Annual Water Quality Report
2023

Norrish Creek Surface Source
New Coanda

Bevan Wellfield - Groundwater
Source

EXECUTIVE SUMMARY

The regional water system serving the municipalities of Abbotsford and Mission delivers drinking water to an approximate population of 160,000, including homes, business, and institutions. The water supply is primarily drawn from Norrish Creek, which is treated by filtration and disinfection. The supply is augmented by secondary sources drawing from Cannell Lake and the Abbotsford-Sumas Aquifer which are treated by disinfection. Finished (i.e., treated) drinking water is conveyed through 95 km of transmission pipe and delivered within Abbotsford and Mission through distribution pipe networks of 850 km and 185 km of total pipe length, respectively. The water system is managed and operated by qualified and certified personnel to ensure that drinking water quality standards consistently meet or exceed applicable requirements.

To comply with the requirements of British Columbia's *Drinking Water Protection Act* and *Drinking Water Protection Regulation*, a rigorous water quality monitoring program is in place. Grab samples of finished water are collected from 55 dedicated sample stations throughout the transmission and distribution network of both municipalities to verify water quality compliance with Provincial regulatory requirements and the Guidelines for Canadian Drinking Water Quality (GCDWQ). Raw water samples from the surface and groundwater sources are also subjected to regular sampling and analysis. In addition to verification monitoring, continuous operational monitoring by online instrumentation is provided for key parameters to ensure that system performance remains within acceptable limits. A summary of verification and operational monitoring during 2023 is as follows:

Surface Water Source (Norrish Creek and Cannell Lake)

- ✓ Results of 33 physical and chemical raw water quality parameters routinely analyzed twice per year for each surface water source. All parameters met the GCDWQ.
- ✓ Continuous online monitoring of chlorine concentration (free and total) and pH of the treated water near the point of chlorine addition at the Cannell Lake and Norrish Creek water treatment plants (WTPs) as well as at the downstream points of ammonia addition (Cannon Pit and Bell Road stations).
- ✓ Continuous online turbidity monitoring of the treated water at Bell Road Ammonia disinfection station.

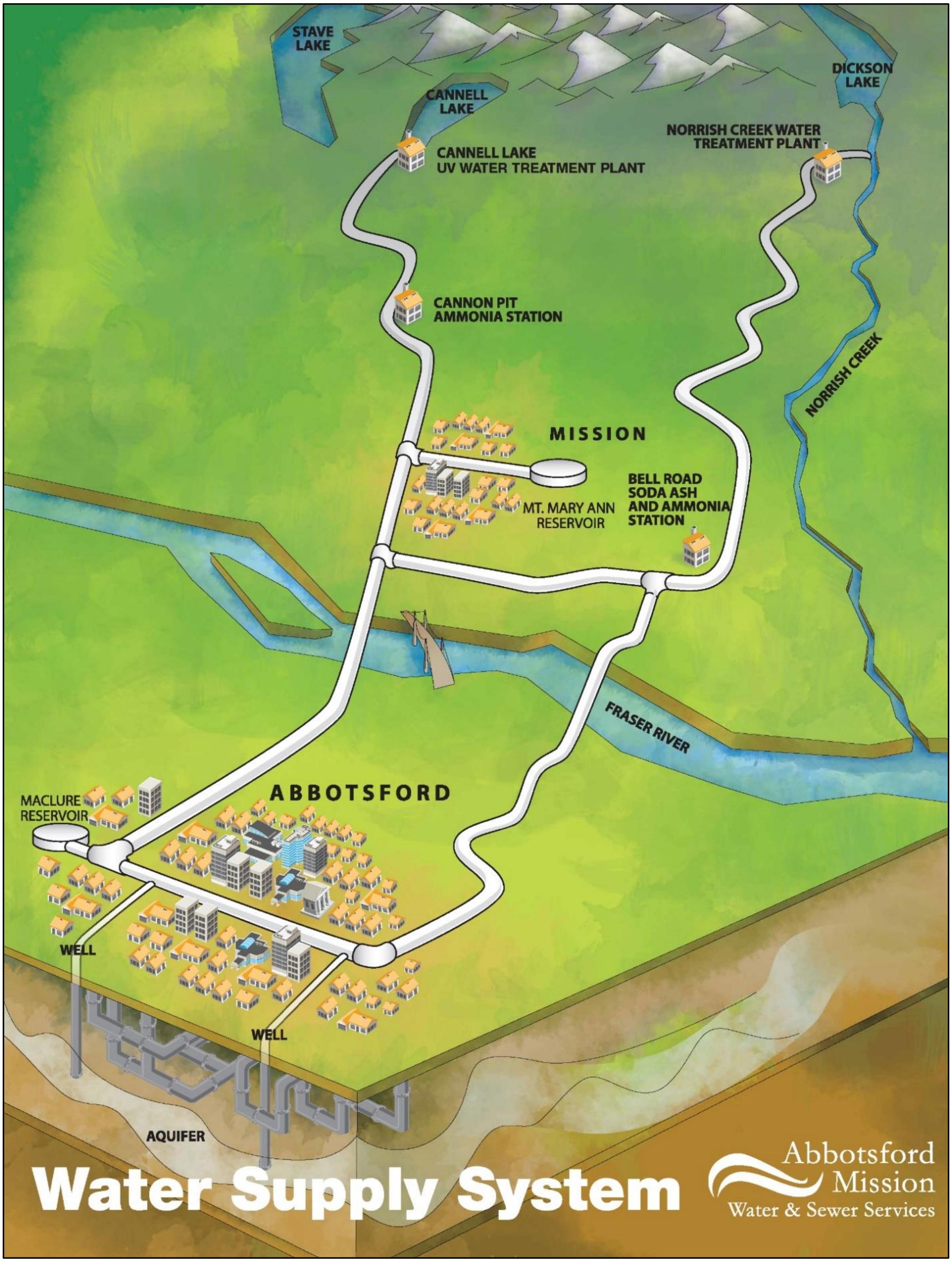
Groundwater Source (11 Active Production Wells)

- ✓ Results of 45 physical and chemical water quality parameters, routinely analyzed monthly for the production wells. All parameters met the GCDWQ, with the exception of manganese concentration for 5 production wells exceeding aesthetic objective (AO) but not exceeding the health-based Maximum Acceptable Concentration (MAC).

- ✓ Of the 105 raw water samples tested from 11 production wells prior to disinfection, 95% yielded negative results for total coliforms and 100% yielded negative for Escherichia coli (E.coli).
- ✓ Annual testing of all production wells for pesticides and herbicides yielded results below the detection limits for all parameters analyzed.

Transmission & Distribution (55 Designated Sample Stations)

- ✓ 2088 routine weekly grab samples of finished water subjected to bacteriological testing, 99.57% yielded negative for total coliforms and all samples tested negative for Escherichia coli., conforming to Provincial regulatory requirements.
- ✓ 2339 routine weekly grab samples of finished water tested for turbidity; results indicate consistently low turbidity.
- ✓ 2339 routine weekly grab samples of finished water tested for residual chlorine; results indicate that under normal operation a measurable residual is consistently maintained throughout the system.
- ✓ Of the 6 grab samples of finished water tested for disinfection by-products (trihalomethanes, haloacetic acids, and N-nitrosodimethlylamine), all results met the applicable limits specified by the GCDWQ.
- ✓ Of 132 grab samples of the finished water tested for metals, all results met the applicable limits specified by the GCDWQ.


STAVE LAKE
CANNELL LAKE
DICKSON LAKE
NORRISH CREEK WATER TREATMENT PLANT
CANNELL LAKE UV WATER TREATMENT PLANT
CANNON PIT AMMONIA STATION
NORRISH CREEK
MISSION
BELL ROAD SODA ASH AND AMMONIA STATION
MT. MARY ANN RESERVOIR
FRASER RIVER
ABBOTSFORD
MACLURE RESERVOIR
WELL
WELL
AQUIFER
Water Supply System
Abbotsford Mission Water & Sewer Services

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1 INTRODUCTION

The City of Abbotsford and the City of Mission jointly own the regional water system (Joint System) that supplies potable water to the two (2) communities. Under agreement, Abbotsford is the appointed Operator tasked with the management and operation of the Joint System. Internally, within each community, the distribution of potable water to customers is the responsibility of the respective municipality and its associated infrastructure (City Systems).

The Joint System and the City Systems are managed and operated by qualified and certified personnel to ensure that the water quality standards are met as per applicable regulation. Water systems, in British Columbia, are regulated through the Drinking Water Protection Act (DWPA) and the Drinking Water Protection Regulation. Both pieces of legislation set out rules, requirements and responsibilities for water systems that provide potable water (i.e., drinking water) to ensure that the water is supplied reliably and is safe to drink at all times.

The DWPA stipulates that the results of the water supplier's monitoring requirements be made public information in the form of an annual report. This Annual Water Quality Report fulfills this requirement for the Joint and City Systems of Abbotsford and Mission and is made available to the public by posting on: https://www.ourwatermatters.ca/water-quality.

The remainder of this report includes a description of the systems (Section 2), an overview of the water sampling and testing program (Section 3), and a summary of system maintenance work completed in 2023 and planned for 2024 (Section 4). Appendices include additional relevant information, including water quality test results (Appendices C through J).

2 DESCRIPTION OF WATER SYSTEMS

2.1 Joint System – Source, Treatment, and Transmission

The Joint System abstracts raw water from the environment, processes it to potable water standards in treatment facilities, and delivers it to the City Systems for distribution via its transmission pipeline and finished water storage facilities, supplying to approximately 160,000 people. The Joint System consists of the following critical infrastructure:

- Norrish Creek intake and water treatment plant facilities
- Dickson Lake Reservoir, including dam and control structure
- Approximately 95 km of large diameter transmission pipeline, including two (2) river crossings
- Two finished water storage facilities, Maclure (Abbotsford), Mount Mary Ann (Mission)
- Two ammonia addition stations at Bell Road (Norrish water) and Cannon Pit (Cannell water)
- Eleven production wells across five (5) wellfields, extracting groundwater from the Abbotsford-Sumas Aquifer, and associated chlorine and ammonia addition facilities

Norrish Creek

The Norrish Creek Watershed, located northeast of Mission, provides the bulk of Abbotsford and Mission's drinking water. Norrish Creek water is filtered by slow sand or ultrafiltration membranes at the Norrish Creek Water Treatment Plant (NCWTP). Filtered water is chlorinated at the plant outlet before entry to the transmission pipeline, flowing 7.5 km to the Bell Road Ammonia Station, where aqueous ammonia is added to form monochloramine as a residual disinfectant that will persist throughout the distribution system.

Norrish Creek Water Treatment Plant

Cannell Lake

Cannell Lake, located north of Mission, supplies water to consumers located in the higher elevations of Mission. It also supplements lower parts of Mission and Abbotsford when demand is high or when the Norrish supply is off-line. Raw Cannell Lake water is conveyed 1 km downstream of the intake to the Cannell Lake Water Treatment Plant (CLWTP) where it is disinfected by ultraviolet light (UV) and chlorine. Water then travels 7 km by transmission pipeline to the Cannons Pit Ammonia Station to form monochloramine before continuing to the distribution system.

Cannell Lake

Groundwater Wells

The Joint System supplements surface water supply with groundwater extracted by several production wells that draw from the Abbotsford-Sumas Aquifer (**Figure 2-2**). Chlorine and ammonia are added to extracted water to form monochloramine and facilitate blending water from different sources. Chlorine and ammonia are added at disinfection stations located at the Bevan, Marshall, Townline, and Farmer wellfields.

Production Well

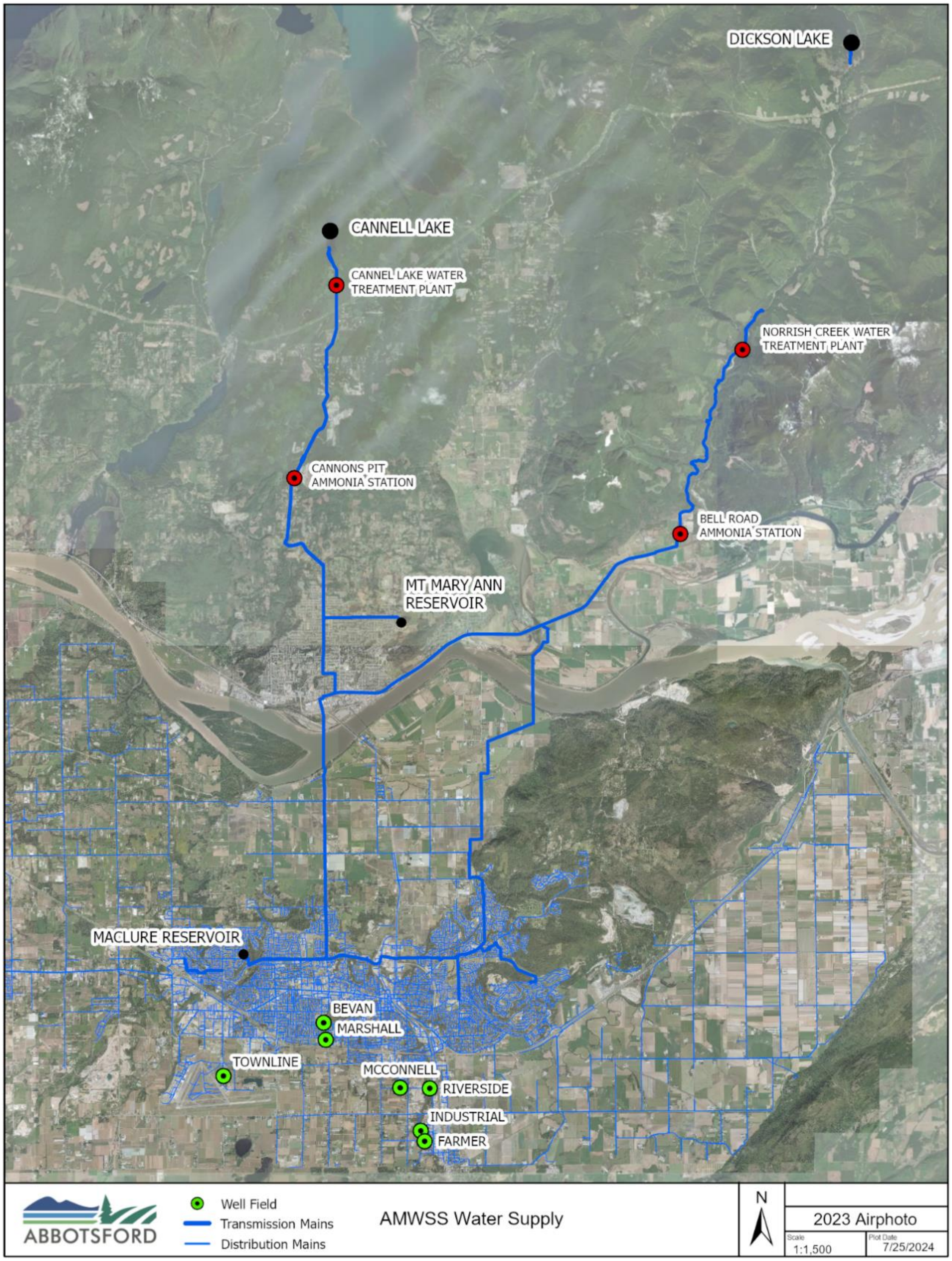
As a transboundary aquifer with an approximate area of 161 km^2, the Abbotsford-Sumas aquifer extends across the Fraser Valley from southern Abbotsford on the Canadian side to northern Whatcom County in Washington State.

The aquifer is classified by the Province of BC as an unconfined aquifer comprising sand and gravel sediments (glaciofluvial outwash), formed towards the end of the last glaciation (Fraser Glaciation). There are areas where the aquifer is confined (e.g., areas where the Bevan and Marshal wellfields are located). The aquifer is considered highly productive.

The Joint System configuration is illustrated is **Figure 2-1**. Groundwater sources supply Abbotsford's City system directly. For surface sources, the transition from Joint to City systems occurs at take-off points consisting of pressure reducing valve (PRV) stations or the outlet of the finished water storage facilities of Maclure (28.6 ML) in Abbotsford and Mount Mary Ann (6.8 ML) in Mission.

During recent years (2019-2023), the annual contribution of the three (3) sources to the volume of water supplied has been 65% (Norrish), 14% (Cannell), and 21% (Aquifer). While the contribution of Norrish tends to be consistent year-round, the contribution from Cannell Lake and the Abbotsford-Sumas Aquifer are seasonally dependent. The contribution from Cannell may decrease to about 10% during summer months and increase to 25% during winter, while that from the aquifer may increase to nearly 30% in the summer months and decrease to less than 10% during the winter.

Figure 2-1: The Joint System serving water to Abbotsford and Mission.



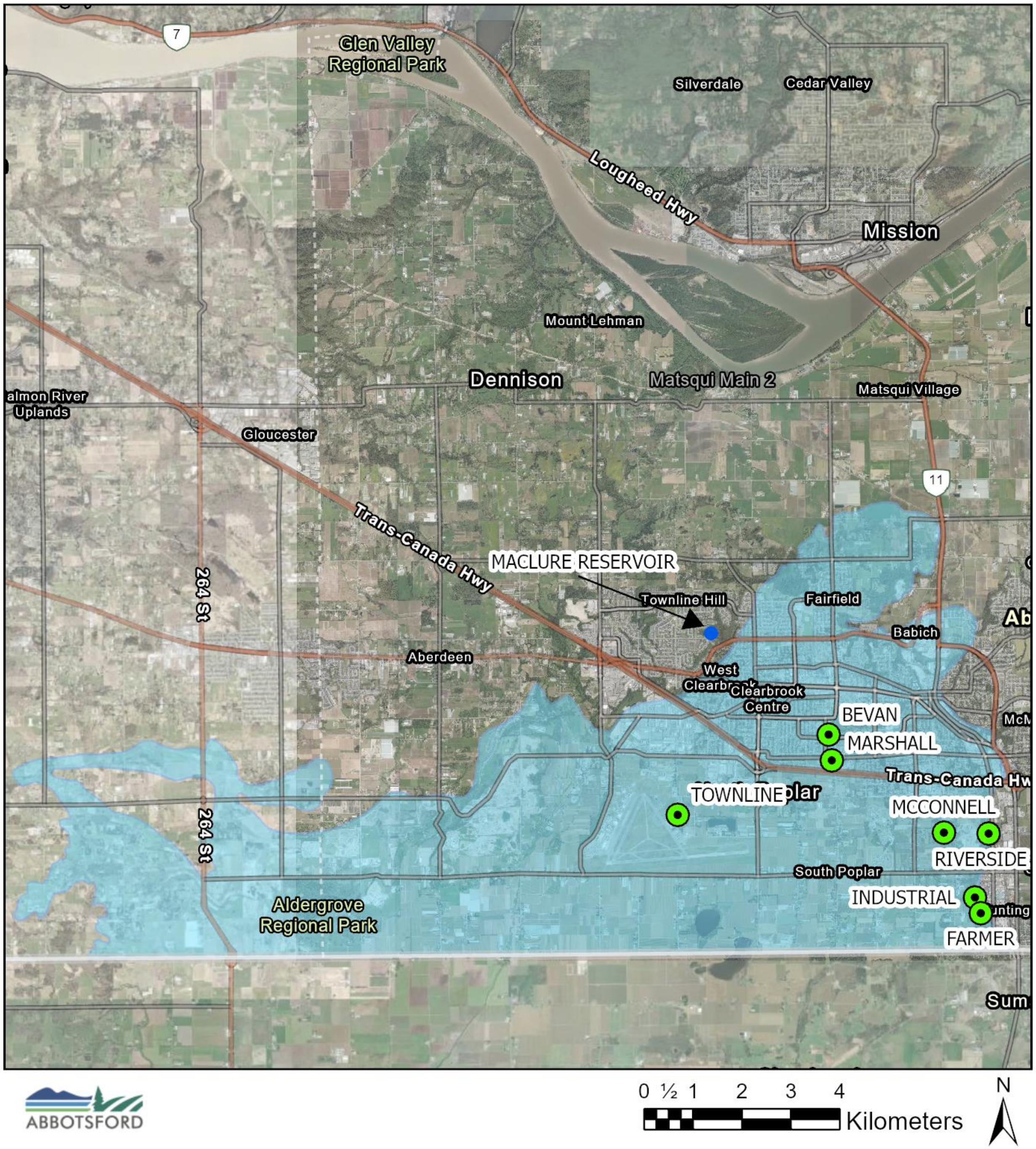


Figure 2-2. The approximate delineation of the Canadian portion of the Abbotsford – Sumas Aquifer (blue shaded area) and the wellfields.

VICARRO PUMP STATION

Completed in 2022, located near the inter section of Wells Gray Avenue and McKinley Drive.

2.3 City Systems – Distribution

The City of Abbotsford water distribution system consists of 25 pressure zones and approximately 850 km of pipe network, including ten (10) finished water storage facilities, 13 pump stations, 27 pressure reducing valve stations, and serves approximately 30,000 residential and non-residential customer connections. **Figure 2-3** show the City of Abbotsford Distribution System.

The City of Mission water distribution system consists of nine (9) pressure zones and approximately 185 km of pipe network, including one (1) booster pump station, 27 pressure reducing valve stations, two (2) pressure sustaining valve stations, and serves approximately 9,500 residential and non-residential customer connections. **Figure 2-4** show the City of Mission Distribution System.

WATER MAIN – 150 MM DIAMETER,

The water main is exposed following the repair of a leak in 2024 (South Fraser Way).

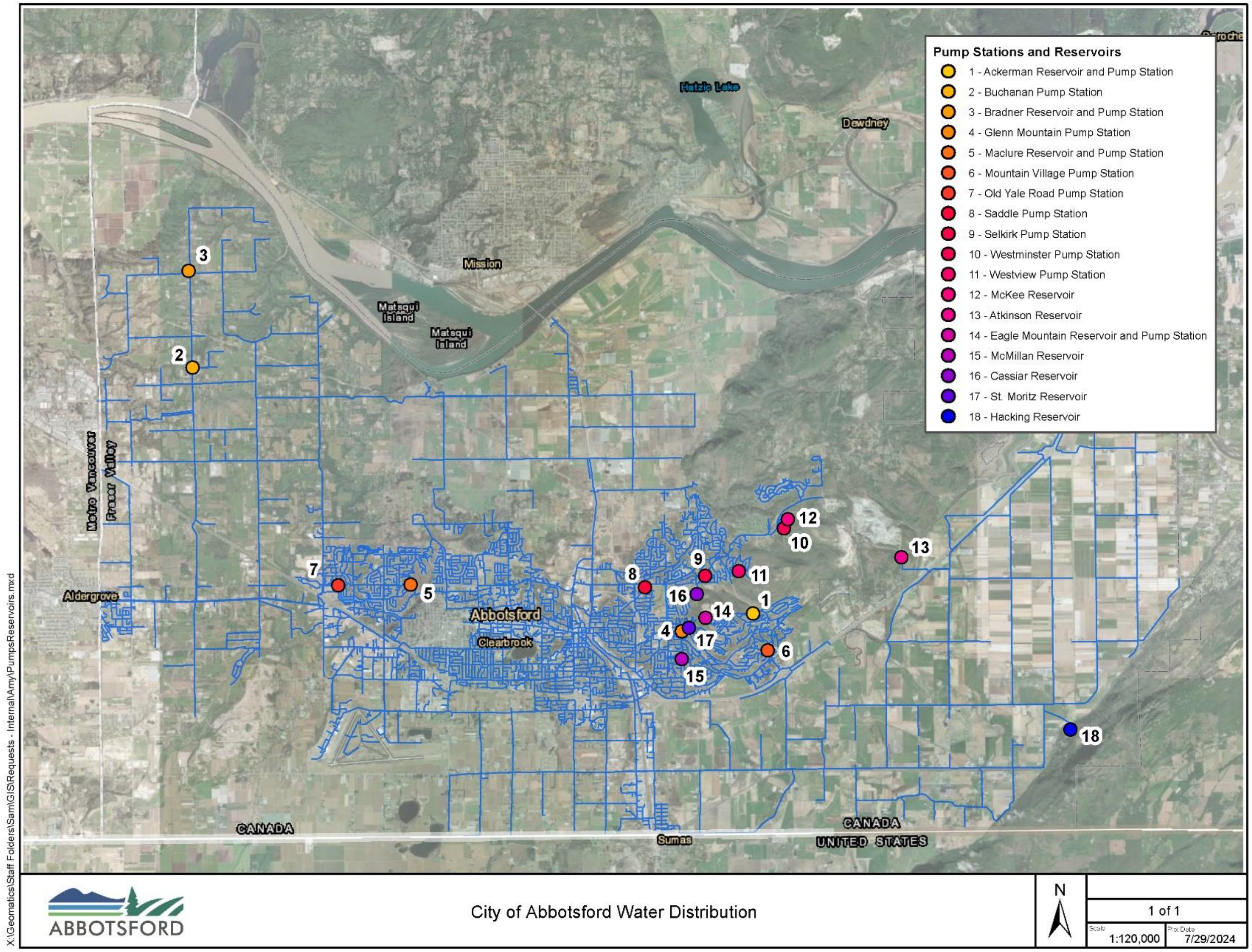


Figure 2-3: City of Abbotsford Water Distribution System

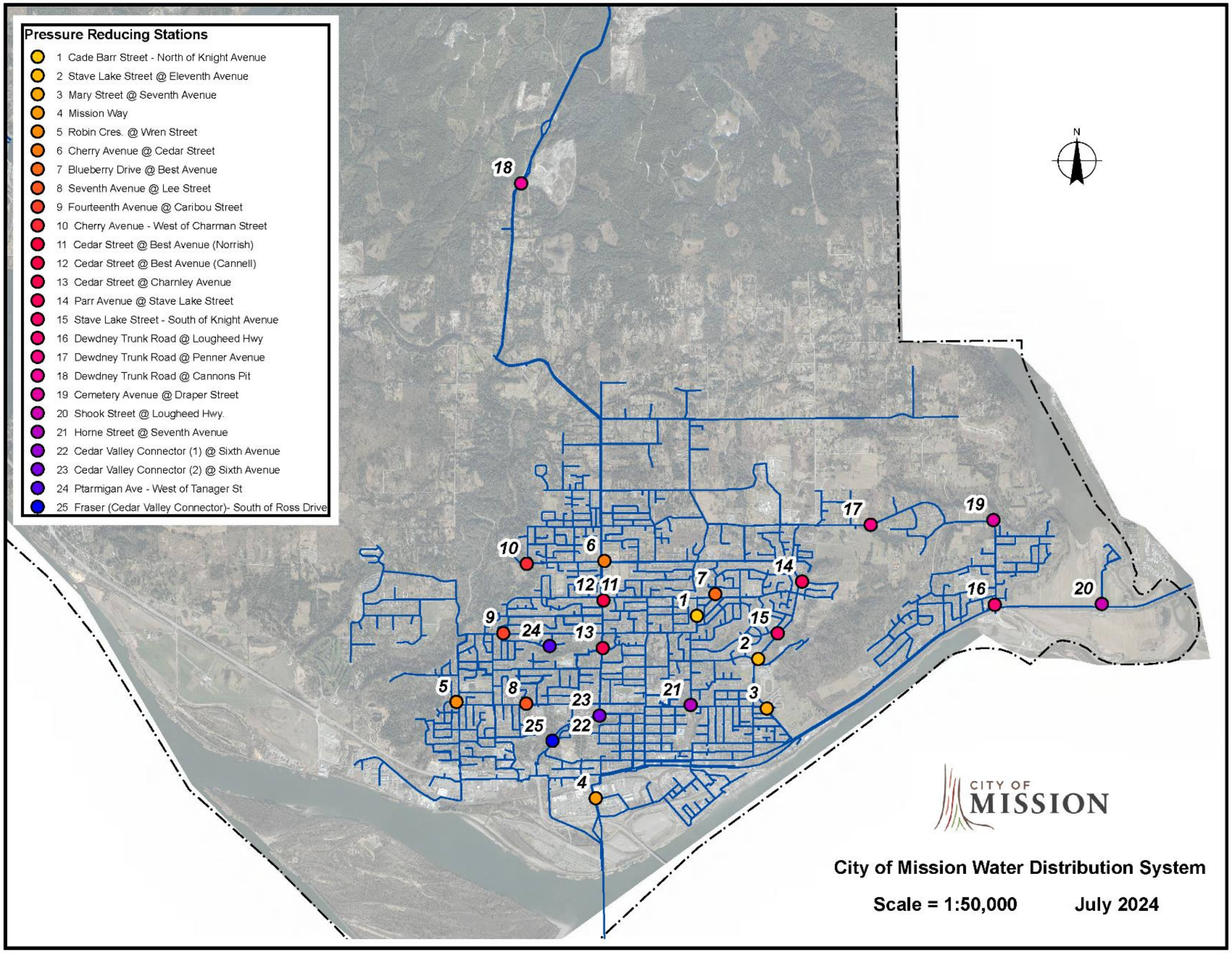


Figure 2-4: City of Mission Water Distribution System.

2.4 Volume of Water Produced by Source

The volumes of water produced by Norrish, Cannell and the production wells for years 2020 to 2023 are summarized in **Table 2.1**.

Table 2-1: Annual Water Production in Megaliters (ML)

Source [1]	2020	2021	2022	2023
	Total	Total	Total	Total
Norrish Creek	16,305	16,530	16,892	16,480
Cannell Lake	3,745	4,575	3,556	2,984
Farmer #1 Well	47	278	1,056	980
Farmer #3 Well	0	145	0	158
Industrial Well "A"	121	183	18	0
Industrial Well "B"	140	259	205	13
Industrial Well "C"	494	468	486	100
Marshall #1 Well	350	360	547	523
Marshall #3 Well	223	1412	1119	1,093
McConnell Well	139	2	0	0
Riverside #1 Well	7	9	1	1
Townline #1 Well	478	0	0	236
Townline #2 Well	552	434	514	573
Bevan #1 Well	487	294	324	600
Bevan #2 Well	439	294	236	1,102
Bevan #3 Well	564	342	430	1,172
Bevan #4 Well	744	464	358	517
Overall Total	**24,843**	**26,050**	**25,742**	**26,532**
Total Surface Water	**20,050**	**21,105**	**20,448**	**19,463**
Total Groundwater	**4,793**	**4,945**	**5,294**	**7,069**

Note: Industrial Well “B” & Riverside #1 were removed from service in February 2023.

3 WATER QUALITY MONITORING PROGRAM

3.1 Overview

The purpose of routine monitoring of water quality is to verify that water delivered to customers complies with the applicable drinking water quality requirements (verification monitoring) and to monitor the system to ensure it is operating within normal limits (operational monitoring). Abbotsford and Mission staff work in their respective roles to monitor drinking water quality according to regulatory requirements and drinking water industry best practice.

Verification monitoring practices are based on the requirements of the Drinking Water Protection Act and Drinking Water Protection Regulation, and consist of discreet grab samples taken at various sampling locations throughout the system, including sources, transmission and distribution systems. Parameters analyzed and associated sampling frequencies are summarized in Table 3-1.

Table 3-1: Verification Water Quality Monitoring

Parameter		Raw Water		Finished Water
		Surface Sources	Wells	
Chemical	**Metals**	Biannually	~Monthly	~Monthly
	Herbicides & Pesticides	-	Annually	-
	Disinfection By-Products	-	-	Biannually
Microbiological	**Total Coliform & *E. coli***	Weekly	Monthly	Weekly

The acceptable limits for chemical parameters in finished water are generally interpreted as the applicable health-based maximum acceptable concentrations (MACs) published by Health Canada in the Guidelines for Canadian Drinking Water Quality (GCDWQ). Acceptable limits for microbiological parameters in finished water are specified in the Drinking Water Protection Regulation. The GCDWQ also provides non-health-based limits of aesthetic objectives (AO).

Analysis of samples for verification monitoring are conducted at certified laboratories and typically require a period of days to weeks to receive results. In addition to verification monitoring, operational monitoring is conducted of parameters that may be analyzed rapidly in the field, typically in seconds to minutes. Operational monitoring is performed either using discrete grab samples using handheld or portable instruments or continuously using automated online instrumentation. Operational monitoring allows to the rapid detection of any deviations from normal operation and the timely use of corrective actions to restore system control or the activation of emergency response procedures. Water quality parameters typically used for operational monitoring include physical parameters (e.g. turbidity, temperature, conductivity, pH, UV transmittance etc.) and chemical parameters (e.g. chlorine residual, ammonia, nitrite).

Appendices C - **H** includes results for relevant water quality results. For additional water quality results and/or questions, please contact the City of Abbotsford Engineering Department (604-864-5514).

Presented water quality results:

- ✓ **Appendix C** – raw water quality (surface water).
- ✓ **Appendix D** – raw water quality (groundwater).
- ✓ **Appendix E** – microbiology (raw groundwater).
- ✓ **Appendix F** – pesticides and herbicides (raw groundwater).
- ✓ **Appendix G** – finished water quality results – metals (distribution system).
- ✓ **Appendix H** – disinfection by-products (DBP) distribution system monitoring (finished water).

3.2 Source Water Quality Monitoring

3.2.1 Surface Water

The quality of raw source water influences the level of treatment required to produce potable water satisfying all applicable standards. Both Norrish Creek and Cannell Lake raw water are tested annually for various physical and chemical parameters. In general, the water quality of the surface sources has remained consistent over the years. For additional water quality reports (2021 and 2022), please visit: Our Water Matters. Cannell Lake raw water monitoring includes additional parameters related to the filtration exemption discussed in Section 3.3.

3.2.2 Groundwater

Raw groundwater quality results for 2023 are provided in **Appendices D - F**. Parameters of note are further discussed below.

Arsenic

Arsenic can be found naturally occurring in both surface water and groundwater sources, with levels generally higher in groundwater. Most provinces and territories across Canada report some areas where arsenic can be detected in drinking water sources. Although levels are generally below the guideline, elevated arsenic concentrations have been found in areas with natural sources.[1] The Maximum Acceptable Concentration (MAC) is currently 10 μg/L, and as low as reasonably achievable (ALARA). Production wells Industrial B and C are the only two (2) wells that have historically contained arsenic that has been at or above the MAC. At present Industrial C is in operation and the observed arsenic concentration, in 2023, were 8.44 and 8.57 μg/L (2 water samples).

Iron

Iron in water is typically mainly attributed to the weathering of rocks and minerals, but can also originate as a consequence of acid mine drainage, landfill leachates, sewage effluents and iron-related industries[2]. Elevated iron can lead to aesthetic issues such as coloured water, objectionable taste, and the staining of plumbing. The GCDWQ currently specifies an aesthetic objective (AO) for iron of 300 μg/L, though recently has proposed lowering the AO to 100 μg/L. The results of analysis of samples collected from the production wells suggest that the raw extracted water meets the current AO.

[1] Health Canada, May 2006. Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Arsenic Retrieved from: http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-arsenic-eau/index-eng.php

[2] Health Canada, December, 1978. Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Iron Retrieved from: http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-iron-fer-eau/index-eng.php

Manganese

Manganese is naturally occurring in most water sources. Moderate levels of manganese may cause plumbing and laundry staining; while high levels of prolonged exposure have been correlated to adverse neurological effects in young children[1]. The GCDWQ specifies an aesthetic guideline (AO) of 20 μg/L for manganese and a health-based MAC of 120 μg/L. In 2023, raw water from five (5) production wells (Farmer 1, Farmer 3, Industrial C, Townline 1 and Townline 2) exceeded the AO but not the MAC, with maximum values ranging from 20.4 μg/L (Townline 2) to 98.6 μg/L (Townline 1).

Nitrate & Nitrite

Nitrate itself is a relatively non-toxic substance. However, bacteria can convert nitrate to nitrite in the environment, in foods and in the human body. Nitrite can then interfere with the ability of red blood cells to carry oxygen to the tissues of the body, producing a condition called methemoglobinemia. It is of greatest concern in infants.

Water naturally contains less than 1 milligram of nitrate-nitrogen[2]; higher levels may indicate anthropogenic influences (but not necessarily exceeding MAC). Selected areas "hotspots" of the Abbotsford-Sumas Aquifer contain elevated levels of nitrate likely due to agricultural activities, thus nitrate and nitrite are monitored at the wells. Results (**Appendix D**) meet the MACs for nitrate and nitrite, of 10 and 1 mg/L, respectively.

Pesticides & Herbicides

Pesticides and herbicides are tested annually in extracted water from select wells. In 2023, all active production wells were tested and no results above the detection limit were reported for any parameter. The parameters tested are listed in **Appendix F**.

[1] Health Canada, May, 2019. Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Manganese Retrieved from: pub-manganese-0212-2019-eng.pdf (canada.ca)

[4] Health Canada, June, 2013. Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Nitrate and Nitrite Retrieved from: https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-nitrate-nitrite/page-2-guidelines-canadian-drinking-water-quality-guideline-technical-document-nitrate-nitrite.html#a2

3.3 Cannel Filtration Exemption Monitoring

In 2005, Fraser Health adopted the Ministry of Health's "Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia". These guidelines generally require filtration for drinking water supplied from surface water sources. However, authorities may exempt such sources from filtration conditional upon compliance with four (4) specific criteria:

1. *Overall inactivation is met using a minimum of two (2) disinfection processes, providing 4-log reduction of viruses and 3-log reduction of Cryptosporidium and Giardia.*
2. *The number of E. coli in raw water does not exceed 20 counts/100 mL (or if E. coli data are not available, less than 100 counts/100mL of Total Coliform) in at least 90% of the weekly samples from the previous six (6) months. The treatment target for all water systems is to contain no detectable E. coli or Fecal Coliform per 100mL. Total Coliform objectives are also zero based on one (1) sample in a 30-day period. For more than one (1) sample in a 30-day period, at least 90% of the samples should have no detectable Total Coliform bacteria per 100 ml and no sample should have more than 10 total coliform bacteria per 100mL.*
3. *Average daily turbidity levels measured at equal intervals (at least every four (4) hours) immediately before the disinfectant is applied are around 1 NTU, but do not exceed 5 NTU for more than two (2) days in a 12-month period.*
4. *A watershed control program is maintained that minimizes the potential for fecal contamination in the source water.*

Fraser Health granted such 'filtration exemption' for Cannell Lake in 2013, under the conditions that: (i) UV-disinfection be added to the treatment process to comply with Criterion #1; (ii) raw water quality continues to satisfy Criteria #2 & #3; and (iii) a watershed control program is maintained as per Criterion #4.

In 2023, the requirements continued to be followed and opportunities for improvements identified:

1. Turbidity of the raw water is continuously monitored (at the WTP - *SCADA*).
2. Weekly raw water E. coli monitoring (at the WTP - *63 samples*).
3. Monthly *Giardia* and *Cryptosporidium* (at the WTP - *9 samples*).
4. Through the watershed control program, the risk of lake fecal contamination is monitored and mitigated or prevented. The program includes: (i) completing weekly visual checks at the lake shore area for any signs of possible watershed contamination (e.g. human trespass); (ii) maintain gated access and signs to prohibit public access (**Figure 3-1**); and (iii) completing an annual helicopter inspection of the watershed.

Figure 3-1: Cannell Lake Watershed Delineation; restrictive access signs are placed at the gate to Cannell Lake.

3.4 Distribution Water Quality Monitoring

3.4.1 Overview

Abbotsford and Mission City distribution systems monitoring of the finished water include weekly testing of E. coli, total coliforms, chlorine residuals, turbidity, temperature and pH at selected sampling locations using dedicated sample stations. These parameters are also monitored along the transmission lines of the Joint System. The list of sample locations used in 2023 are provided in **Table 3-2** (next page).

See Our Water Matters for summaries of the ***2023 water quality results for the weekly water quality monitoring throughout the distribution system at designated sample stations*** (analyzed for total coliforms, *E.coli*, turbidity and total chlorine).

Schedule B of the BC Drinking Water Protection Regulation establishes the minimum frequency of sampling for verification monitoring with bacteriological indicators Total Coliform and E. coli. For water utilities serving a population of 5,000 to 90,000 people, a minimum of one (1) sample per 1000 people served is required. For systems serving more than 90,000 people, a minimum of 90 samples plus one (1) sample for every additional 10,000 persons is required per month. In 2023, 2088 samples of finished water were analysed for bacteriological indicators and thus the minimum sampling requirements were met in 2023.

Table 3-2 Water Distribution Sample Stations

City of Abbotsford Distribution			
W01	35041 Harris Road	E02	310 Arnold Road
W02	3836 Old Clayburn Rd.	E07	6230 Tolmie Road
W03	35944 McKee Rd.	E08	3434 McDermott Road
W04	Bateman Park	E09	36232 Lower Sumas Mountain Road
W05	3315 Gladwin Rd.	E10	36101 Regal Parkway
W06	32961 South Fraser Way	E11	2598 St. Moritz Way
W07	32111 Joyce Ave.	E12	2691 Beck Road
W11	5030 Lefeuvre Rd.	E13	2087 McMillan Road
W13	7942 Bradner Road	E14	2211 Mouldstade Road
W15	3154 Clearbrook Rd.	E15	2215 Orchard Drive
W16	27875 Swensson Rd.	E16	2540 Eagle Mountain Drive
W19	4945 Mt. Lehman Rd.	E17	2720 St. Moritz Way
W21	2059 Peardonville Rd.	E18	36321 Vye Road
W23	3612 Blue Jay Street	E21	34694 5th Avenue
W34	926 Columbia Street	E23	36026 Village Knoll
City of Mission Distribution			
M01	Israel Avenue	M18	Blueberry
M02	Balsam	M19	Ferndale @ Erikson
M03	Penner	M20	DTR & Cedar
M05	Hillcrest	M21	11th & Dunsmuir
M06	Cannell Boster Station	M22	Tunbridge @ DTR
M07	Mary Street @ 4th Avenue	M23	4th @ Alder
M09	Shook Street	M24	Moffat
M10	Miller Crescent	M25	11th & Grand
M16	Best @ Barker	M26	Fennel
M17	TH Booster	M27	McRae & Hurd
Transmission Pipelines			
T01b	Bell Rd. (post-NH3)	T05b	Cannon's Pit 400 (post-NH3)
T03b	Maclure Reservoir	T06b	Cannon's Pit 6400 (post-NH3)
T04	Ainsworth Street		

3.4.2 Total Coliform and E. coli

Schedule A of the BC Drinking Water Protection Regulation specifies standards for the bacteriological quality of potable water in the Province:

- No detectible E. coli per 100 millilitres (mL).
- At least 90 percent (%) of samples have no detectable *total coliform* bacteria per 100mL and no sample has more than 10 *total coliform* bacteria per 100mL.

Total coliforms are a group of bacteria that are naturally found on plants, in soils and water in the environment, as well as in the intestines of humans and warm-blooded animals and in water contaminated with human and animal faeces. Total coliform bacteria generally do not cause human disease, but their presence in a water distribution system may indicate that the system is vulnerable to contamination or is experiencing bacterial re-growth.

E. coli is a member of the total coliform group and is found exclusively in the faeces of humans and other animals. Its presence in water indicates faecal contamination has occurred and suggests the potential presence of infectious bacteria, viruses, and protozoa. The detection of E. coli triggers emergency procedures, immediate notification of health and municipal officials, re-sampling, and a thorough investigation into the possible causes.

In combination, the Joint and City systems tested 2088 finished water samples for bacteriological indicators in 2023 as part of verification monitoring. While all samples returned negative for E coli, detectable levels of total coliforms were observed in nine (9) samples (**Table 3-3**). In all cases subsequent follow up samples were non-detectable for total coliforms. In all cases, the positive detections were well below the acceptability threshold of 10% in any given 30-day period, with approximately 99.57% of all annual samples yielding negative results for total coliforms.

Table 3-3 – Detectable Coliform Results in Weekly Monitoring (Distribution)

Date	Sample Location	Total Coliforms CFU/100 mL
City of Abbotsford Distribution		
07-Feb-23	E21	1
28-Mar-23	W21	1
09-May-23	W01	1
12-Sep-23	E13	1
City of Mission Distribution		
28-Mar-23	M24	4
12-Apr-23	M24	1
05-Dec-23	M21	1
07-Feb-23	M06	2
Transmission Pipelines		
24-Jan-23	T03b	1

3.4.3 Disinfection Residuals

Disinfection is the most important treatment process used to produce potable water, providing a barrier to pathogenic or disease-causing microorganisms that may be present in the source water. Chlorine-based disinfectants are the most widely used disinfecting agents. After chlorine is added to water and has had sufficient time to inactivate microorganisms, any remaining or residual chlorine may persist in the distribution system. A disinfectant residual provides several benefits. While it may provide limited protection against contaminant intrusion and suppression of bacterial growth on internal pipe and storage facility surfaces, its main benefit is as an easily measurable parameter for operational monitoring. Monitoring of a chlorine residual is rapid and can be performed in the field for grab samples or continuously at key locations using online instrumentation. The absence of a measurable disinfectant residual indicates a potential breach in system integrity and allows rapid corrective actions to be taken. As chlorine residuals decay with time, their concentrations may be depleted below measurable levels at the furthest ends of the distribution system or in larger storage facilities. Ammonia may be added to water downstream of the chlorine addition point such that it reacts with the remaining chlorine to form monochloramine, a more persistent disinfectant residual. Monochloramine is the disinfectant residual used in Abbotsford and Mission.

Health Canada's proposed guideline states that "*it is not considered necessary to establish a guideline for chloramines in drinking water based on low toxicity of monochloramine at concentrations found in drinking water, but most Canadian drinking water supplies maintain a chloramine residual below 4 mg/L in the distribution system.*"[1] Monochloramine also decays with time, albeit at a much lower rate relative to chlorine alone. In the Abbotsford Mission water system, chlorine and ammonia are typically dosed produce an initial concentration of 1.5 and 2.5 mg/L, measured as total chlorine with 70% or more typically composed of monochloramine and the remainder consisting largely of other chloramines. Such initial concentrations generally ensure that there are measurable levels of disinfectant at the far reaches of the system.

Of the 1829 water samples taken for total coliform and E. coli analysis in 2023 for verification monitoring, total chlorine and monochloramine were also measured. The weekly results are included in the documents pertaining to the 2023 monthly water quality reports and can be found at Our Water Matters.

3.4.4 Turbidity

Turbidity is a key physical characteristic of water quality of system status due to the ease and sensitivity of its measurement. It is caused by suspended particulates that impede the light passage or clarity of water. While excessive turbidity in drinking water is aesthetically unappealing, the particulates causing the observed turbidity may or may not pose a direct health hazard. The value of turbidity as a water quality parameter is in its use for operational monitoring, including the monitoring of source water conditions, treatment process performance, and distribution system integrity.

[1] Health Canada, January, 2019. Guidelines for Canadian Drinking Water Quality - Chloramines. Retrieved from: https://www.canada.ca/content/dam/hc-sc/documents/programs/consultation-chloramines-drinking-water/chloramines-drinking-water-2018-eng.pdf

A sudden increase in observed turbidity may represents an abnormal condition such as challenging source water quality that could overwhelm treatment barriers, poor or inadequate treatment system performance, or potential distribution system failures resulting in contaminant intrusion. Generally, under normal operation the turbidity of finished water across the system will be consistently below 1.0 NTU.

While operational monitoring of finished water turbidity is performed continuously by online analyzers at the treatment facilities, turbidity is also measured in grab samples taken during routine verification monitoring. The approximately 2000 weekly verification monitoring sample results for turbidity are included with the other measured parameters in the monthly reports available at Our Water Matters.

3.4.5 pH

The finished water pH is measured by online analyzers at the Bell Road and Cannell Lake locations. Additionally, field testing for pH occurs weekly at each distribution system sample location. Average pH is 6.84 and 7.47 for water collected at the designated sample stations for Abbotsford and Mission, respectively.

3.4.6 Metals

In 2023, the Abbotsford and Mission distribution systems were tested approximately monthly for metals to monitor the water quality in the distribution system. **Appendix G** summarizes the results. In 2023, all distribution sampling locations met the GCDWQ requirements.

3.4.7 Disinfection By-Products (DBPs)

Trihalomethanes (THMs) and Haloacetic Acids (HAAs) are by-products of chlorination formed following the addition of chlorine to water and its reaction with naturally occurring organic matter (e.g., decaying leaves and vegetation). The GCDWQ guideline limits are 0.1 mg/L (100 μg/L) for THMs and 0.08 mg/L (80 μg/L) for HAAs based on locational running annual averages of at least quarterly samples taken in the distribution system [1].

The bi-annual samples for THMs and HAAs at taken from sample stations on the transmission main and the outlet to the Maclure finished water storage facility (Joint System). Results are presented in **Appendix H** and all results were well below the guideline limits, predominantly below detection limits.

N-Nitrosodimethlylamine (NDMA) is a by-product often associated with the use of monochloramine. NDMA is considered likely to be carcinogenic to humans. The GCDWQ has established a MAC of 0.00004 mg/L (0.04 μg/L). All results for 2023 were below the detection limit (0.002 μg/L).

[1] Health Canada, July 2008. Guidelines for Canadian Drinking Water. Retrieved from: https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-haloacetic-acids.html

4 SYSTEM MAINTENANCE

4.1 Overview

Between the Joint and City Systems, there are more than 40 staff assigned to engineering, operations management, maintenance, and construction of the water utility system.

To maintain the quality of the water throughout the distribution system, Abbotsford and Mission utilize regular flushing programs. Flushing watermains is an integral part of a comprehensive water management program to prevent bacterial re-growth and stagnation in low circulation areas of the distribution system.

Replacement of aging water pipes in Abbotsford and Mission is ongoing each year. Priority is given to pipes that are made of asbestos cement (AC), ductile iron in known corrosive soil, and those pipes that are approaching the end of their service life or have a history of problems. Abbotsford began using its new smart meters to identify potential leaks in its distribution system in 2010. Mission has developed and implements a leak detection program, which identifies system areas in need of repair, upgrades or replacement.

WATER MAIN FLUSHING THROUGH FIRE HYDRANTS

The first image show flushing as part of a Unidirectional Flushing Program (UDF) and the second images shows regular water main flushing.

4.2 Staff Certification & Training

The BC Environmental Operators Certification Program (EOCP) classifies water systems and certifies operators using ratings levels I through IV. Higher numbers correspond to systems of greater operational complexity and requirements of operators with more advanced training. The required level of operators needed corresponds to the classification of the facility level:

- ✓ The Norrish Water Treatment Plant is classified as **Level IV**
- ✓ The Cannell Lake Water Treatment Plant is classified as **Level III**
- ✓ Transmission system is classified as **Level IV**
- ✓ Abbotsford's water distribution system is classified as **Level IV**
- ✓ Mission's water distribution system is classified as **Level II**

The City of Abbotsford staff maintain and operate the Joint System (sources, water treatment facilities, transmission system) and Abbotsford's City System (distribution system). The City of Mission operates Mission's City System (distribution system).

The Joint System team includes nine (9) operators. Of these, all have completed their water treatment certification including 1 operator with Level IV certification. All 9 operators also have water distribution certification including one (1) with Level IV certification, and 8 with Level II certification.

The Abbotsford Water Distribution department consists of 16 operators and 1 millwright. All operators have Water Distribution Certificates. Three Operators have their Level IV certifications.

The City of Mission water distribution is operated by 11 certified operators, consisting of two (2) operators with Level IV and seven (7) operators with Level II certification.

4.4 Capital Improvements and Operational Highlights for 2023

In 2023, the Joint and City Systems completed the following improvements:

Joint

- Bevan 2 well - lowering of the submersible pump-motor assembly in the well
- Marshall 1 & 3 wells - lowering of the submersible pump-motor assembly in the wells
- Farmer and Bevan disinfection facilities – Conversion from onsite generation to bulk hypochlorite delivery and decommissioning of onsite generation equipment
- Industrial C well - pitless adapter installation and sanitary surface seal construction
- Farmer 3 well – rehabilitation to restore well performance
- Townline 3 well – drilling and construction of new production well
- Best Pump Station - variable frequency drive (VFD) installation and optimization
- Norrish Creek Water Treatment Plant – Ultrafiltration system to slow sand filter interconnect
- Norrish Creek Intake - Coanda Screen Replacement

Abbotsford City

- Vicarro Pump Station - Construction and commissioning of new pump station
- Asbestos Cement Pipe Replacement – Started Phase 1 of the AC water main replacement project to complete replacement of about half of the 4.5 km inventory of AC pipe
- AMI Replacement – Initiated project to replace all 29,000 water meter endpoints, associated network devices, and integration of reading equipment software to customer billing system
- Finished Water Storage - Cleaning of Bradner, Cassiar, and Empress reservoirs
- Decommissioning of Farmer pressure reducing valve (PRV) station
- Distribution System Sampling Stations - Completed 2nd phase of sampling station improvements with installation of 11 new sampling stations

Mission City

- 16 new fire hydrants installed
- 42 km of water main flushed during annual unidirectional flushing program (UDF) February – April 2023
- 39 water quality complaints investigated
- Pressure Zone 2 realignment project

4.5 Works Planned for 2024

Key water system projects and programs scheduled for 2024 include:

Joint

- Well Rehabilitation – Farmer 1, Bevan 3 and Bevan 4 (completed in May / early June)
- Bevan 3 & Bevan 4 - lowering of the submersible pump-motor assembly in the well
- Norrish Creek Water Treatment Plant (WTP) membrane replacement
- Norrish WTP Chlorine Rotameter replacement
- Remote communications for Norrish WTP
- Steel transmission main leak detection
- Dickson Dam Remediation
- Townline wellfield renewal – pump station and well commissioning
- Maclure Watermain ICCP system (*impressed current cathodic protection*)

Abbotsford City

- AC Pipe Replacement – Completion of 1st and 2nd phases of planned replacement of 4.5 km of AC pipe
- AMI Replacement - project completion
- Initiation of a new unidirectional flushing program for routine pipe cleaning
- Decommissioning and removal of the two (2) abandoned storage reservoirs at Ledgeview
- Finished Water Storage – Cleaning of McMillan, St. Mortiz, and McKee reservoirs

Mission City

- Ruskin Community water system – groundwater exploration study
- 14th Ave Utilities Upgrade
- AC Pipe - replacement program – Manson St and Alpine Court
- SCADA system upgrade
- ICI water meter installations
- Fire hydrant servicing and painting program
- Unidirectional Flushing Program – Pressure zone 1
- Valve Maintenance program

4.6 Emergency Response Planning

The City of Abbotsford completed an Emergency Response Procedures Manual in 2009. The Emergency Response Plan (ERP) has been developed to addresses potential hazards such as earthquakes, floods, severe storms, volcanic eruption, and pandemic/staff illnesses. The ERP outlines procedures regarding the effect of hazards, including loss of water supply, loss of power, contamination/turbidity in the water system, or damage to water infrastructure. The ERP may be implemented as:

1. Part of a joint emergency between the City of Abbotsford and the City of Mission, where all engineering resources would be coordinated by the City's Emergency Operations Centre; the ERP is premised on Abbotsford staff taking the lead role on all emergencies related to the Joint System.
2. A stand-alone plan to deal with a water emergency, managed by water utility staff; or
3. In a limited response to a City-wide emergency, involving water utility staff as part of an emergency resource to address a specific situation.

Activation of the ERP occurs when information is received that an emergency exists, either through staff, public, media, or police/fire communications. Staff are directed to determine the location and nature of the event, eliminate the hazard, and ultimately restore normal operation. The ERP contains checklists to prioritize risks and responses, indicators of problems, and restoration plans.

In the unlikely event that **finished drinking water** tests positive for E. coli or evidence suggests potential system contamination has occurred, the City will isolate the affected section of the system if possible to reduce the impact and contact Fraser Health to advise them of the situation. The City and the Medical Health Officer (MHO) of Fraser Health will evaluate the need for a water quality advisory (i.e., Boil Water, Do Not Consume, Do Not Use). If a determination is made that such an advisory must be issued, the City will inform the public. The MHO determines when the advisory can be rescinded.

A summary of the ERPs is available to the public upon request at Abbotsford's Engineering Department Reception (City Hall, 4th floor) and Mission's City Hall Reception.

5 CONCLUSIONS

Results from 2023 water quality monitoring demonstrate that the drinking water supply system serving Abbotsford and Mission is potable under the definition of the Drinking Water Protection Act and Drinking Water Protection Regulation. Abbotsford and Mission engineers and operators continuously pursue water system improvements to provide high-quality potable water to customers. Monitoring and maintenance programs are designed to meet the challenges of distributing water while preserving public health and the environment and meeting all regulatory requirements.

APPENDICES

Appendix A – Message preventing water-borne infections

BRITISH COLUMBIA | HealthLinkBC

Number 56
January 2017

Preventing Water-Borne Infections For People with Weakened Immune Systems

Who is at higher risk from water-borne infections?

People with very weak immune systems who are at higher risk of certain water-borne diseases include those with:

- HIV infection who have a CD4+ count of less than 100 cells/mm^3;
- lymphoma or leukemia (hematological malignancies) who are being actively treated or have been in remission and off treatment for less than 1 year;
- hematopoietic stem cell transplant recipients; and
- people born with diseases that severely affect their immune systems.

Some people with weakened immune systems, such as those with certain types of cancers or taking certain medications, may not be at higher risk of severe water-borne diseases. These people do not need to take extra precautions with their drinking water.

Ask your doctor or nurse practioner how weak your immune system is, and whether you need to take extra precautions.

How can drinking water become contaminated?

Drinking water can contain different organisms, including bacteria, viruses and parasites, which can cause disease. These organisms can exist in the source water, such as lake water, and survive through treatment, or they can enter the water supply in the distribution system.

Well water can be contaminated if the well is located or constructed in a way that the groundwater it draws from is at risk of containing pathogens (germs) such as a shallow well or a well drilled in fractured rock.

Surface water, such as rivers, lakes and streams, can also contain disease-causing organisms from animal feces.

If you have a weak immune system, you should not drink water from surface sources or groundwater at risk of containing pathogens, unless the water has been treated to remove or inactivate at least 99.9 per cent of parasites (protozoa), 99.99 per cent of viruses and all harmful bacteria.

Most community water systems in B.C. have effective treatment, such as disinfection or chlorination, against bacteria and viruses. However, in many cases, treatment may not provide a 99.9 per cent reduction in infectious parasites. Some water systems and many private supplies have no treatment at all. If the water you drink has not been disinfected, please refer to HealthLinkBC File #49b Disinfecting Drinking Water.

How can I further treat disinfected water?

People with very weak immune systems should consult with their doctor or nurse practitioner and may need to take extra precautions with their drinking water.

Boiling: If your water supply has already been disinfected, bring the water to a full boil to inactivate any *Cryptosporidium* parasites - a major concern for people with weakened immune systems. For more information, see [HealthLinkBC File #48 *Cryptosporidium* Infection].

If the water has not already been disinfected, bring the water to a full boil for at least 1 minute. This will kill or inactivate bacteria, viruses and parasites. At elevations over 2,000 meters (6,500 feet), boil water for at least 2 minutes to disinfect it.

Do not drink or use tap water to brush your teeth, rinse your mouth, mix drinks or make ice cubes without boiling it first.

Please note that boiling water will get rid of viruses, bacteria and parasites but not chemicals which may be found in the water.

Reverse Osmosis (RO): RO is effective against all disease-causing organisms and many chemical contaminants. Unless it has a high capacity, it will only produce small amounts of water and waste a large volume. Speak to a water treatment specialist to see if this is the best option for you.

Ultraviolet (UV) Treatment: UV light will kill many disease-causing organisms, and is effective against almost all parasites. UV will not kill some bacterial spores and some viruses, so it should not be used unless the water supply is at least disinfected. UV treatment units should meet NSF Standard #55A.

Filters: Filters do not remove bacteria and viruses and should not be used unless the water supply is disinfected first.

If you plan to install a drinking water filter in your home, you will need a system labeled as Absolute 1 micron or smaller, and labeled as meeting ANSI/NSF International Standard #53 for removal of parasites.

Jug-type filters, such as a Brita®, which sit in a jug and allow water to trickle through, and some tap-mounted and built-in devices are not an appropriate solution. The jug filter models are not effective in removing many disease-causing organisms.

Can I drink bottled water?

Bottled water in B.C. may or may not have been treated. If you have a very weak immune system, check with the bottling company to find out what treatment, if any, it has had. Bottled water that has been properly treated using one of the methods listed above can be used for drinking, brushing teeth, making ice cubes and for recipes where water is used but not boiled, such as cold soups.

For More Information

For more information, including the level of treatment in your local water system, contact your drinking water purveyor or supplier, or the local environmental health officer or drinking water officer. To find your health authority's drinking water contact visit www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/drinking-water-quality/health-authority-contacts.

For more information about water-borne infections and how to safely disinfect your drinking water, see the following HealthLinkBC Files:

- HealthLinkBC File #49a Water-borne Infections in British Columbia
- HealthLinkBC File #49b Disinfecting Drinking Water
- HealthLinkBC File #69b Feeding Your Baby Formula: Safely Making and Storing Formula

Appendix B – Metals in Drinking Water

fraserhealth Better health. Best in health care.

March 3, 2023

Water System Operators

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

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

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

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

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

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

Sincerely,

Blair Choquette
Manager, Drinking Water Program
Health Protection

Appendix C – Raw Water Quality (Surface Water)

Analyte	Units	GCDWQ	Guideline	Cannell Lake (RAW)		Norrish WTP Inlet (RAW)	
				27-Jul-23	26-Oct-23	27-Jul-23	26-Oct-23
Aluminum (total)	µg/L	2900	MAC	9.3	10.8	35.1	34.3
Ammonia (total, as N)	mg/L			<0.015	<0.015	<0.015	<0.015
Antimony (total)	µg/L	6	MAC	<0.50	<0.50	<0.50	<0.50
Arsenic (total)	µg/L	10	MAC	0.10	0.14	0.39	0.26
Barium (total)	µg/L	2000		2.5	2.8	7.2	6.4
Beryllium (total)	µg/L			<0.10	<0.10	<0.10	<0.10
Boron (total)	µg/L	5000		<50	<50	<50	<50
Cadmium (total)	µg/L	7		<0.010	<0.010	<0.010	<0.010
Calcium (total)	mg/L			1.33	1.55	2.72	2.81
Chloride	mg/L	250	AO	<1.0	<1.0	<1.0	<1.0
Chromium (total)	µg/L	50	MAC	<1.0	<1.0	<1.0	<1.0
Cobalt (total)	µg/L			<0.20	<0.20	<0.20	<0.20
Dissolved Inorganic Carbon	mg/L			1.12	1.26	<0.20	0.22
Copper (total)	µg/L	1000/2000	AO / MAC	<1.0	<1.0	2.9	<1.0
Fluoride	mg/L	1500	MAC	<0.050	<0.050	<0.050	<0.050
Hardness (total, as CaCO3)	mg/L			4.02	4.63	8.09	8.38
Iron (total)	µg/L	300	AO	9.6	43.7	12.8	5.3
Lead (total)	µg/L	5	MAC	<0.20	<0.20	<0.20	<0.20
Magnesium (total)	mg/L			0.167	0.183	0.317	0.334
Manganese (total)	µg/L	20 / 120	AO / MAC	2.1	6.7	<1.0	<1.0
Mercury (total)	µg/L	1	MAC	<0.0019	<0.0019	<0.0019	0.0020
Molybdenum (total)	µg/L			<1.0	<1.0	<1.0	<1.0
Nickel (total)	µg/L			<1.0	<1.0	<1.0	<1.0
Nitrate (as N)	mg/L	10	MAC	0.0062	0.0050	0.128	0.159
Nitrite (as N)	mg/L	1	MAC	<0.0020	<0.0020	<0.0020	<0.0020
Potassium (total)	mg/L			0.057	0.060	0.116	0.097
Selenium (total)	µg/L	50	MAC	<0.10	<0.10	<0.10	<0.10
Silicon (total, as Si)	µg/L			1170	1450	2930	3110
Sodium (total)	mg/L	200	AO	0.719	0.775	1.19	1.09
Sulphate	mg/L	500	AO	<1.0	<1.0	1.3	<1.0
Total Organic Carbon	mg/L			0.99	1.3	0.77	1.3
Uranium (total)	µg/L	20	MAC	<0.10	<0.10	<0.10	<0.10
Zinc (total)	µg/L	5000	AO	<5.0	<5.0	<5.0	<5.0

<[value] = below detection limit.
Parameters tested may vary slightly from year to year; this table provides results for those with GCDWQ specified limits and those that are more often of interest to certain customers (e.g. industries with processes sensitive to metal concentrations).
Contact eng-info@abbotsford.ca to inquire regarding any results not listed above.

Appendix D – Raw Water quality – Selected Parameters (Groundwater)

Analyte:		Total Arsenic	Total Iron	Total Manganese	Total Lead	Total Calcium	Chloride	Nitrate (as N)	Nitrite (as N)	Total Sodium	pH	Turbidity	Total Dissolved Solids	Hardness (as CaCO3)
Units		µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	-	NTU	mg/L	mg/L
Guideline Limit (GCDWQ 2022)														
MAC		10.0	n/a	120	5	n/a	n/a	10	1	n/a	n/a	n/a	n/a	n/a
AO		n/a	300	20	n/a	n/a	250	n/a	n/a	200	n/a	n/a	500	n/a
OG		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	7.0 - 10.5	0.1	n/a	n/a
Water source	Sample Size	Values (Raw Water Samples)												
Bevan 1														
Min.	11	0.22	8.1	<1.0	<0.20	22.2	25.0	1.31	<0.0020	7.66	6.71	<0.10	160	74.9
Max.	11	0.34	125.0	3.10	<0.20	28.8	34.0	4.24	<0.0020	9.48	7.52	1.50	210	103
Avg.	11	0.25	38.2	2.10	<0.20	26.9	29.8	2.67	<0.0020	8.32	6.97	0.44	183	95.7
Bevan 2														
Min.	11	0.29	8.4	<1.0	0.40	21.5	27.0	2.13	<0.0020	6.97	6.78	<0.10	130	78.1
Max.	11	0.42	185.0	2.90	0.40	29.5	32.0	3.39	<0.0020	8.22	7.37	1.60	210	107
Avg.	11	0.33	51.2	2.70	0.40	25.9	28.9	2.73	<0.0020	7.62	7.04	0.53	174	93.5
Bevan 3														
Min.	11	0.21	5.1	<1.0	<0.20	22.1	31.0	2.12	<0.0020	7.58	6.75	<0.10	140	78.2
Max.	11	0.26	116.0	2.60	0.46	29.2	38.0	3.45	<0.0020	8.88	7.23	0.62	210	103.0
Avg.	11	0.23	26.9	1.90	0.46	26.4	33.6	2.70	<0.0020	8.27	6.95	0.24	181	93.0
Bevan 4														
Min.	9	0.15	5.5	3.90	<0.20	23.3	32.0	2.74	<0.0020	8.05	6.61	<0.10	160	81.5
Max.	9	0.19	83.4	17.7	<0.20	28.5	39.0	3.39	<0.0020	8.55	**10.6**	2.50	220	91.7
Avg.	9	0.18	30.7	10.3	<0.20	25.1	36.0	3.10	<0.0020	8.34	7.28	1.06	196	86.2
Farmer 1														
Min.	9	0.12	<5.0	**66.1**	<0.20	30.0	11.0	5.44	<0.0020	6.81	6.60	<0.10	140	111
Max.	9	0.17	<5.0	**88.5**	<0.20	36.8	15.0	6.56	<0.0020	7.42	7.69	0.24	230	132
Avg.	9	0.14	<5.0	**79.6**	<0.20	33.3	13.9	5.99	<0.0020	7.04	7.13	0.21	187	120

<[value] = below detection limit.
Selected results are presented; contact eng-info@abbotsford.ca to inquire about other results.

Appendix D – Raw Water quality – Selected Parameters (Groundwater), cont'd

Analyte:		Total Arsenic	Total Iron	Total Manganese	Total Lead	Total Calcium	Chloride	Nitrate (as N)	Nitrite (as N)	Total Sodium	pH	Turbidity	Total Dissolved Solids	Hardness (as CaCO3)
Units		µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	-	NTU	mg/L	mg/L
Guideline Limit (GCDWQ 2022)														
MAC		10.0	n/a	120	5	n/a	n/a	10	1	n/a	n/a	n/a	n/a	n/a
AO		n/a	300	20	n/a	n/a	250	n/a	n/a	200	n/a	n/a	500	n/a
OG		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	7.0 - 10.5	0.1	n/a	n/a
Water source	Sample Size	Values (Raw Water Samples)												
Farmer 3														
Min.	5	0.15	7.5	2.70	<0.20	34.3	9.1	3.41	<0.0020	5.47	6.97	<0.10	210	124
Max.	5	5.53	20.0	**82.1**	<0.20	49.5	15.0	6.25	0.0029	7.17	8.08	0.22	240	162
Avg.	5	4.32	13.6	**23.4**	<0.20	44.7	11.3	4.39	0.0029	5.95	7.69	0.22	225	149
Industrial C														
Min.	2	8.44	<5.0	**59.3**	<0.20	37.5	9.2	1.28	0.104	7.23	7.97	<0.10	110	135
Max.	2	8.57	<5.0	**59.8**	<0.20	43.0	9.8	1.68	0.138	7.76	8.22	<0.10	210	151
Avg.	2	8.51	<5.0	**59.6**	<0.20	40.3	9.5	1.48	0.121	7.50	8.11	<0.10	160	143
Marshall 1														
Min.	10	1.88	<5.0	6.6	<0.20	40.4	24.0	0.0062	<0.0020	16.80	7.71	<0.10	220	138
Max.	10	5.18	15.6	28.8	1.44	46.7	37.0	0.1590	0.0027	20.10	8.34	0.12	260	153
Avg.	10	4.40	15.3	16.3	1.44	44.8	29.0	0.0579	0.0027	18.96	8.01	0.12	236	149
Marshall 3														
Min.	8	0.95	14.8	3.80	<0.20	37.0	27.0	0.15	0.0028	12.4	7.50	0.11	180	129
Max.	8	1.80	14.8	17.4	<0.20	43.2	37.0	0.99	0.0028	16.2	8.1	0.16	240	147
Avg.	8	1.35	14.8	12.2	<0.20	40.2	30.6	0.58	0.0028	13.9	7.8	0.13	210	137
Townline 1														
Min.	6	0.36	8.6	**72.8**	<0.20	22.3	19.0	3.08	<0.0020	6.06	6.38	<0.10	150	76.8
Max.	6	0.50	105	**98.6**	1.03	24.1	22.0	4.66	0.0818	6.98	7.61	0.33	170	80.8
Avg.	6	0.45	31.1	**85.3**	0.56	23.3	20.4	3.89	0.0818	6.64	6.85	0.24	158	79.0
Townline 2														
Min.	9	0.51	5.6	7.2	<0.20	19.1	11.0	3.12	<0.0020	5.41	6.61	<0.10	100	64.2
Max.	9	0.68	46.6	**20.4**	0.41	24.1	18.0	4.53	<0.0020	8.09	7.13	0.47	140	80.4
Avg.	9	0.63	19.5	17.2	0.30	21.5	13.7	3.79	<0.0020	7.02	6.84	0.22	127	72.4

Appendix E – Microbiology (Raw Groundwater)

Analyte:			Total Coliforms	E. coli	Analyte:			Total Coliforms	E. coli	Analyte:			Total Coliforms	E. coli	Analyte:			Total Coliforms	E. coli
Units:			CFU/100mL					CFU/100mL					CFU/100mL					CFU/100mL	
Water source	Sample Date	Raw / Treated	Values		Water source	Sample Date	Raw / Treated	Values		Water source	Sample Date	Raw / Treated	Values		Water source	Sample Date	Raw / Treated	Values	
Bevan 1	19-Jan-23	Raw	0	0	Bevan 4	20-Apr-23	Raw	1.0	0	Industrial C	5-Jan-23	Raw			Townline 1	4-Jul-23	Raw	0	0
Bevan 1	23-Feb-23	Raw	0	0	Bevan 4	1-Jun-23	Raw	0	0	Industrial C	19-Jan-23	Raw	0	0	Townline 1	5-Jul-23	Raw	0	0
Bevan 1	20-Apr-23	Raw	0	0	Bevan 4	29-Jun-23	Raw	0	0	Industrial C	23-Feb-23	Raw	0	0	Townline 1	27-Jul-23	Raw	0	0
Bevan 1	1-Jun-23	Raw	0	0	Bevan 4	27-Jul-23	Raw	0	0						Townline 1	24-Aug-23	Raw	0	0
Bevan 1	29-Jun-23	Raw	0	0	Bevan 4	24-Aug-23	Raw	0	0						Townline 1	5-Oct-23	Raw	0	0
Bevan 1	22-Jul-23	Raw	0	0	Bevan 4	5-Oct-23	Raw	0	0						Townline 1	22-Nov-23	Raw	0	0
Bevan 1	27-Jul-23	Raw	0	0	Bevan 4	19-Oct-23	Raw	0	0						Townline 1	28-Dec-23	Raw	0	0
Bevan 1	24-Aug-23	Raw	0	0	Bevan 4	22-Nov-23	Raw	0	0										
Bevan 1	5-Oct-23	Raw	0	0	Bevan 4	28-Dec-23	Raw	0	0										
Bevan 1	19-Oct-23	Raw	0	0															
Bevan 1	22-Nov-23	Raw	0	0															
Bevan 1	28-Dec-23	Raw	0	0															
Bevan 2	19-Jan-23	Raw	0	0	Farmer 1	19-Jan-23	Raw	0	0	Marshall 1	5-Jan-23	-	-	-	Townline 2	23-Feb-23	Raw	0	0
Bevan 2	23-Feb-23	Raw	0	0	Farmer 1	23-Feb-23	Raw	0	0	Marshall 1	19-Jan-23	Raw	0	0	Townline 2	20-Apr-23	Raw	0	0
Bevan 2	20-Apr-23	Raw	0	0	Farmer 1	10-May-23	Raw	0	0	Marshall 1	23-Feb-23	Raw	0	0	Townline 2	1-Jun-23	Raw	0	0
Bevan 2	1-Jun-23	Raw	0	0	Farmer 1	11-May-23	Raw	0	0	Marshall 1	20-Apr-23	Raw	0	0	Townline 2	29-Jun-23	Raw	0	0
Bevan 2	21-Jun-23	Raw	0	0	Farmer 1	1-Jun-23	Raw	0	0	Marshall 1	1-Jun-23	Raw	0	0	Townline 2	27-Jul-23	Raw	0	0
Bevan 2	22-Jun-23	Raw	0	0	Farmer 1	29-Jun-23	Raw	0	0	Marshall 1	29-Jun-23	Raw	0	0	Townline 2	24-Aug-23	Raw	0	0
Bevan 2	29-Jun-23	Raw	2.0	0	Farmer 1	24-Aug-23	Raw	0	0	Marshall 1	31-Aug-23	Raw	0	0	Townline 2	5-Oct-23	Raw	0	0
Bevan 2	27-Jul-23	Raw	0	0	Farmer 1	19-Oct-23	Raw	0	0	Marshall 1	1-Sep-23	Raw	0	0	Townline 2	22-Nov-23	Raw	0	0
Bevan 2	24-Aug-23	Raw	0	0	Farmer 1	22-Nov-23	Raw	0	0	Marshall 1	5-Sep-23	Raw	0	0	Townline 2	28-Dec-23	Raw	0	0
Bevan 2	5-Oct-23	Raw	0	0	Farmer 1	28-Dec-23		0	0	Marshall 1	5-Oct-23	Raw	0	0					
Bevan 2	19-Oct-23	Raw	0	0						Marshall 1	19-Oct-23	Raw	0	0					
Bevan 2	22-Nov-23	Raw	0	0						Marshall 1	22-Nov-23	Raw	0	0					
Bevan 2	28-Dec-23	Raw	0	0						Marshall 1	28-Dec-23	Raw	0	0					
Bevan 3	19-Jan-23	Raw	0	0	Farmer 3	27-Jul-23	Raw	0	0	Marshall 3	5-Jan-23								
Bevan 3	23-Feb-23	Raw	0	0	Farmer 3	12-Oct-23	Raw	8.0	0	Marshall 3	19-Jan-23	Raw	0	0					
Bevan 3	20-Apr-23	Raw	0	0	Farmer 3	13-Oct-23	Raw	11	0	Marshall 3	23-Feb-23	Raw	0	0					
Bevan 3	1-Jun-23	Raw	0	0	Farmer 3	18-Oct-23	Raw	2.0	0	Marshall 3	20-Apr-23	Raw	0	0					
Bevan 3	29-Jun-23	Raw	0	0	Farmer 3	19-Oct-23	Raw	0	0	Marshall 3	1-Jun-23	Raw	0	0					
Bevan 3	27-Jul-23	Raw	0	0	Farmer 3	19-Oct-23	Raw	0	0	Marshall 3	29-Jun-23	Raw	0	0					
Bevan 3	24-Aug-23	Raw	0	0	Farmer 3	23-Oct-23	Raw	0	0	Marshall 3	27-Jul-23	Raw	0	0					
Bevan 3	5-Oct-23	Raw	0	0	Farmer 3	22-Nov-23	Raw	0	0	Marshall 3	22-Nov-23	Raw	0	0					
Bevan 3	19-Oct-23	Raw	0	0	Farmer 3	28-Dec-23	Raw	0	0	Marshall 3	28-Dec-23	Raw	0	0					
Bevan 3	22-Nov-23	Raw	0	0															
Bevan 3	28-Dec-23	Raw	0	0															

Appendix F – Pesticides and Herbicides (Raw Groundwater)

Parameters Tested (All Results Below Detection Limit)			
2,3,4,6-Tetrachlorophenol	Bromacil	Diphenylamine	Octachlorostyrene
2,4 + 4,4-DDD	Bromophos	Disulfoton	Omethoate
2,4 + 4,4-DDE	Bromophos-ethyl	Endosulfan (total)	Oxychlordane
2,4 + 4,4-DDT	Bromoxynil	Endosulfan I	Parathion
2,4,5-Trichlorophenoxyacetic acid	Butylate	Endosulfan II	Pentachloronitrobenzene
2,4,6-Trichlorophenol	Captan	Endosulfan sulfate	Pentachlorophenol
2,4'-DDT (o,p-DDT)	Carbaryl	Endrin	Permethrin
2,4'-DDT and 4,4'-DDD	Carbofuran	Endrin aldehyde	Phenanthrene
2,4-Dichlorophenol	Carbophenothion - solids	Endrin ketone	Phorate
2,4-Dichlorophenoxyacetic acid	Chlorbenside	EPN	Phosalone
2-Methylnaphthalene	Chlordane (Total)	Eptam	Phosmet
4,4-DDD	Chlorfenson	Ethalfluralin	Phosphamidon E
4,4-DDE	Chlorfenvinphos	Ethion	Phosphamidon Z
4,4'-DDT (pp-DDT)	Chlorfenvinphos (e)	Fenchlorphos	Picloram
4,4-Methoxyclor	Chlormephos	Fenitrothion	Pirimicarb
Acenaphthene	Chlorothalonil	Fensulfothion	Pirimiphos-ethyl
Acenaphthylene	Chlorpropham	Fenthion	Pirimiphos-methyl
a-Chlordane	Chlorpyrifos	Fluoranthene	Polychlorinated Biphenyls
Acridine	Chlorpyrifos-methyl	Fluorene	Procymidone
Alachlor	Chlorthal-dimethyl (Dacthal)	Folpet	Profenofos
Aldicarb	Chlorthiophos	Fonofos	Profluralin
Aldrin	Chrysene	gamma-BHC	Prometryn
Aldrin + dieldrin	Cyanazine	Heptachlor	Pronamide
alpha-BHC	Cyanophos	Heptachlor + Heptachlor epoxide	Propazine
Anthracene	DDT + metabolites	Heptachlor epoxide	Propiconazole
Aroclor 1016	delta-BHC	Hexachlorobenzene	Pyrazophos
Aroclor 1221	Demeton-O	Hexazinone	Pyrene
Aroclor 1232	Demeton-S	Indeno(1,2,3-c,d)pyrene	Quinalphos
Aroclor 1242	Desmetryn	Iodofenphos	Quinoline
Aroclor 1248	Diallate	Iprodione	Simazine
Aroclor 1254	Diallate Z	Isofenphos	Sulfotep
Aroclor 1260	Diazinon	Lindane	Tecnazene
Aspon	Dibenzo(a,h)anthracene	Malaoxon	Terbufos
Atrazine	Dicamba	Malathion	Terbuthylazine

Parameters Tested (All Results Below Detection Limit)			
Atrazine+Metabolites	Dichlobenil	Metalaxyl	Terbutryn
Atrazine-desethyl (DEA)	Dichlofenthion	Methidathion	Tetrachlorvinphos (Stirophos)
Azinphos-ethyl	Dichlofluanid	Methoxychlor	Tetradifon
Azinphos-methyl	Dichloran	Methyl parathion	Tolylfluanid
Bendiocarb	Dichlorvos and Naled	Metolachlor	Total HMW PAH
Benfluralin	Diclofop-methyl	Metribuzin	Total LMW PAH
Benzo(a)anthracene	Dicofol	Mevinphos	Total PAH
Benzo(a)pyrene	Dicrotophos	Mirex	Toxaphene
Benzo(b,j)fluoranthene	Dieldrin	Naphthalene	Triadimefon
Benzo(g,h,i)perylene	Dimethoate	Nitrofen	Triallate
Benzo(k)fluoranthene	Dinoseb	o,p-DDD	Trifluralin
beta-BHC	Dioxathion	o,p-DDE	Vinclozolin

Appendix G – Finished Water Quality Results – Metals (Distribution System)

Abbotsford Distribution

Distribution system: Abbotsford	Units	Analyzed Concentrations				Remark	Guideline Limits		
Analyte (Metal)		Minimum	Maximum	Average	Median		AO	MAC	OG
Aluminum (total)	µg/L	< 3.0	35.3	17.6	19.6		-	0	0
Antimony (total)	µg/L	<0.50	<0.50	-	-		-	0	-
Arsenic (Total)	µg/L	0.12	2.01	0.41	0.305		-	0	-
Barium (Total)	µg/L	3.10	22	6.33	5.75		-	0	-
Beryllium (total)	µg/L	<0.10	<0.10	-	-		-	-	-
Bismuth (total)	µg/L	<1.0	<1.0	-	-		-	-	-
Boron (total)	µg/L	<50	<50	-	-		-	0	-
Cadmium (total)	µg/L	<0.010	0.042	0.018	0.019		-	0	-
Calcium (total)	mg/L	1.32	42.3	9.68	2.95		-	-	-
Chromium (total)	µg/L	<1.0	<1.0	-	-		-	0	-
Cobalt (total)	µg/L	<0.20	<0.20	-	-		-	-	-
Copper (total)	µg/L	<0.50	31.2	5.89	1.915		0	0	-
Iron (total)	µg/L	<5.0	66.4	12.0	8.7		0	-	-
Lead (total)	µg/L	<0.20	0.64	0.32	0.22		-	0	-
Magnesium (total)	mg/L	0.17	9.98	2.10	0.327		-	-	-
Manganese (total)	µg/L	<1.0	52.1	12.4	5.4		0	0	-
Mercury (total)	µg/L	<0.0019	0.0031	0.002	0.0023		-	0	-
Molybdenum (total)	µg/L	<1.0	<1.0	-	-		-	-	-
Nickel (total)	µg/L	<1.0	1.7	*All < 1.0 except one*		W16 - 6/6/2023	-	-	-
Potassium (total)	mg/L	0.054	2.15	0.47	0.119		-	0	-
Selenium (total)	µg/L	<0.10	0.45	0.19	0.16		-	0	-
Silicon (total, as Si)	µg/L	1450	12200	4609	3145		-	-	-
Silver (total)	µg/L	<0.020	0.022	*All < 0.020 except one*		E18 - 6/6/2023	-	-	-
Sodium (total)	mg/L	0.836	14.1	3.64	1.24		0	-	-
Strontium (total)	µg/L	4.10	168	41.2	8.80		0	-	-
Thallium (total)	µg/L	<0.010	<0.010	-	-		-	-	-
Tin (total)	µg/L	<5.0	<5.0	-	-		-	-	-
Titanium (total)	µg/L	<5.0	<5.0	-	-		-	-	-
Uranium (total)	µg/L	<0.10	0.4	0.22	0.21		-	0	-
Vanadium (total)	µg/L	<5.0	<5.0	-	-		-	-	-
Zinc (total)	µg/L	<5.0	<5.0	5.85	5.85		-	0	-
Zirconium (total)	µg/L	<0.10	<0.10	-	-		-	-	-

Note: sample size of each analyte is 93.

Mission Distribution

Distribution system: Mission	Units	Analyzed Concentrations				Remark	Guideline Limits		
Analyte (Metal)		Minimum	Maximum	Average	Median		AO	MAC	OG
Aluminum (total)	µg/L	7.1	46.4	17.23	14.75		-	2900	100
Antimony (total)	µg/L	<0.50	<0.50	-	-		-	6	-
Arsenic (Total)	µg/L	0.1	0.39	0.18	0.13		-	10	-
Barium (Total)	µg/L	2.4	9.8	5.56	5.55		-	2000	-
Beryllium (total)	µg/L	<0.10	<0.10	-	-		-	-	-
Bismuth (total)	µg/L	<1.0	<1.0	-	-		-	-	-
Boron (total)	µg/L	<50	<50	-	-		-	5000	-
Cadmium (total)	µg/L	<0.010	<0.010	-	-		-	7	-
Calcium (total)	mg/L	1.35	3.71	2.12	2.02		-	-	-
Chromium (total)	µg/L	<1.0	2.3	*All <1.0 except one*		M26 18/3/2023	-	50	-
Cobalt (total)	µg/L	<0.20	<0.20	-	-		-	-	-
Copper (total)	µg/L	<0.20	69.70	6.94	1.52	<0.20: M10 27/6	1000	2000	-
Iron (total)	µg/L	<5.0	64.9	19.41	16.15		300	-	-
Lead (total)	µg/L	<0.20	<0.20	-	-		-	5	-
Magnesium (total)	mg/L	0.11	0.32	0.21	0.20		-	-	-
Manganese (total)	µg/L	<1.0	6.3	2.58	2.30		20	120	-
Mercury (total)	µg/L	<0.030	<0.030	-	-		-	1	-
Molybdenum (total)	µg/L	<1.0	2.4	*All <1.0 except one*		M26 14/3/2023	-	-	-
Nickel (total)	µg/L	<1.0	9.7	5.4	5.4		-	-	-
Potassium (total)	mg/L	0.057	0.12	0.086	0.08		-	0	-
Selenium (total)	µg/L	<0.10	<0.10	-	-		-	500	-
Silicon (total, as Si)	µg/L	1140	3000	1980	1995		-	-	-
Silver (total)	µg/L	<0.020	<0.020	-	-		-	-	-
Sodium (total)	mg/L	0.742	6.78	2.87	2.34		200	-	-
Strontium (total)	µg/L	4.7	10.3	6.49	6.2		7000	-	-
Thallium (total)	µg/L	<0.010	<0.010	-	-		-	-	-
Tin (total)	µg/L	<5.0	<5.0	-	-		-	-	-
Titanium (total)	µg/L	<5.0	<5.0	-	-		-	-	-
Uranium (total)	µg/L	<0.10	<0.10	-	-		-	20	-
Vanadium (total)	µg/L	<5.0	<5.0	-	-		-	-	-
Zinc (total)	µg/L	<5.0	<5.0	-	-		-	5000	-
Zirconium (total)	µg/L	<0.10	<0.10	-	-		-	-	-

Note: sample size of each analyte is 38.

Appendix H – Disinfection By-Products (DBP) Distribution System (Finished Water)

Trihalomethanes – THMs

Sample Locations - Transmission Main	Analyte (THMs)	Sample date	Unit	Value	CDWQ Guideline
T01a - Bell Road (pre-NH3)	Bromodichloromethane	09-Mar-23	µg/L	<1.0	16 (MAC)
T01a - Bell Road (pre-NH3)	Bromoform	09-Mar-23	µg/L	<1.0	
T01a - Bell Road (pre-NH3)	Chloroform	09-Mar-23	µg/L	11	100 (MAC)
T01a - Bell Road (pre-NH3)	Dibromochloromethane	09-Mar-23	µg/L	<1.0	
Total THMs				**11**	**100 (MAC)**
T05a - Cannon's Pit 400 (pre-NH3)	Bromodichloromethane	09-Mar-23	µg/L	<1.0	16 (MAC)
T05a - Cannon's Pit 400 (pre-NH3)	Bromoform	09-Mar-23	µg/L	<1.0	
T05a - Cannon's Pit 400 (pre-NH3)	Chloroform	09-Mar-23	µg/L	12	100 (MAC)
T05a - Cannon's Pit 400 (pre-NH3)	Dibromochloromethane	09-Mar-23	µg/L	<1.0	
Total THMs				**12**	**100 (MAC)**
T03b - MacLure Reservoir Cell 1/2 outlet	Bromodichloromethane	09-Mar-23	µg/L	<1.0	16 (MAC)
T03b - MacLure Reservoir Cell 1/2 outlet	Bromoform	09-Mar-23	µg/L	<1.0	
T03b - MacLure Reservoir Cell 1/2 outlet	Chloroform	09-Mar-23	µg/L	5.1	100 (MAC)
T03b - MacLure Reservoir Cell 1/2 outlet	Dibromochloromethane	09-Mar-23	µg/L	<1.0	
Total THMs				**5.1**	**100 (MAC)**
T01a - Bell Road (pre-NH3)	Bromodichloromethane	29-Aug-23	µg/L	<1.0	16 (MAC)
T01a - Bell Road (pre-NH3)	Bromoform	29-Aug-23	µg/L	<1.0	
T01a - Bell Road (pre-NH3)	Chloroform	29-Aug-23	µg/L	17	100 (MAC)
T01a - Bell Road (pre-NH3)	Dibromochloromethane	29-Aug-23	µg/L	<1.0	
Total THMs				**17**	**100 (MAC)**
T05a - Cannon's Pit 400 (pre-NH3)	Bromodichloromethane	29-Aug-23	µg/L	1.5	16 (MAC)
T05a - Cannon's Pit 400 (pre-NH3)	Bromoform	29-Aug-23	µg/L	<1.0	
T05a - Cannon's Pit 400 (pre-NH3)	Chloroform	29-Aug-23	µg/L	27	100 (MAC)
T05a - Cannon's Pit 400 (pre-NH3)	Dibromochloromethane	29-Aug-23	µg/L	<1.0	
Total THMs				**28.5**	**100 (MAC)**
T03b - MacLure Reservoir Cell 1/2 outlet	Bromodichloromethane	29-Aug-23	µg/L	<1.0	16 (MAC)
T03b - MacLure Reservoir Cell 1/2 outlet	Bromoform	29-Aug-23	µg/L	<1.0	
T03b - MacLure Reservoir Cell 1/2 outlet	Chloroform	29-Aug-23	µg/L	9.7	100 (MAC)
T03b - MacLure Reservoir Cell 1/2 outlet	Dibromochloromethane	29-Aug-23	µg/L	<1.0	
Total THMs				**9.7**	**100 (MAC)**

Haloacetic Acids (HAAs)

Sample Locations - Transmission Main	Analyte (HAAs)	Sample date	Unit	Value	CDWQ Guideline
T01a - Bell Road (pre-NH3)	Dibromoacetic acid	9-Mar-23	µg/L	<5.0	
T01a - Bell Road (pre-NH3)	Dichloroacetic acid	9-Mar-23	µg/L	8.9	
T01a - Bell Road (pre-NH3)	Monobromoacetic acid	9-Mar-23	µg/L	<5.0	
T01a - Bell Road (pre-NH3)	Trichloroacetic acid	9-Mar-23	µg/L	9.8	
Total HAAs				**18.7**	**80 (MAC)**
T05a - Cannon's Pit 400 (pre-NH3)	Dibromoacetic acid	9-Mar-23	µg/L	<5.0	
T05a - Cannon's Pit 400 (pre-NH3)	Dichloroacetic acid	9-Mar-23	µg/L	6.6	
T05a - Cannon's Pit 400 (pre-NH3)	Monobromoacetic acid	9-Mar-23	µg/L	<5.0	
T05a - Cannon's Pit 400 (pre-NH3)	Trichloroacetic acid	9-Mar-23	µg/L	12	
Total HAAs				**18.6**	**80 (MAC)**
T03b - MacLure Reservoir Cell 1/2 outlet	Dibromoacetic acid	9-Mar-23	µg/L	<5.0	
T03b - MacLure Reservoir Cell 1/2 outlet	Dichloroacetic acid	9-Mar-23	µg/L	8.1	
T03b - MacLure Reservoir Cell 1/2 outlet	Monobromoacetic acid	9-Mar-23	µg/L	<5.0	
T03b - MacLure Reservoir Cell 1/2 outlet	Trichloroacetic acid	9-Mar-23	µg/L	6.0	
Total HAAs				**14.1**	**80 (MAC)**
T01a - Bell Road (pre-NH3)	Dibromoacetic acid	29-Aug-23	µg/L	<5.0	
T01a - Bell Road (pre-NH3)	Dichloroacetic acid	29-Aug-23	µg/L	<5.0	
T01a - Bell Road (pre-NH3)	Monobromoacetic acid	29-Aug-23	µg/L	<5.0	
T01a - Bell Road (pre-NH3)	Trichloroacetic acid	29-Aug-23	µg/L	<5.0	
Total HAAs				**ND**	**80 (MAC)**
T05a - Cannon's Pit 400 (pre-NH3)	Dibromoacetic acid	29-Aug-23	µg/L	<5.0	
T05a - Cannon's Pit 400 (pre-NH3)	Dichloroacetic acid	29-Aug-23	µg/L	7.2	
T05a - Cannon's Pit 400 (pre-NH3)	Monobromoacetic acid	29-Aug-23	µg/L	<5.0	
T05a - Cannon's Pit 400 (pre-NH3)	Trichloroacetic acid	29-Aug-23	µg/L	11	
Total HAAs				**18.2**	**80 (MAC)**
T03b - MacLure Reservoir Cell 1/2 outlet	Dibromoacetic acid	29-Aug-23	µg/L	<5.0	
T03b - MacLure Reservoir Cell 1/2 outlet	Dichloroacetic acid	29-Aug-23	µg/L	<5.0	
T03b - MacLure Reservoir Cell 1/2 outlet	Monobromoacetic acid	29-Aug-23	µg/L	<5.0	
T03b - MacLure Reservoir Cell 1/2 outlet	Trichloroacetic acid	29-Aug-23	µg/L	<5.0	
Total HAAs				**< 5.0**	**80 (MAC)**

N-Nitrosodimethylamine (µg/L)

Sample Locations - Transmission Main	Analyte	Sample date	Unit	Value	CDWQ Guideline
T01a - Bell Road (pre-NH3)	N-Nitrosodimethylamine (NDMA)	09-Mar-23	µg/L	<0.0019	0.04
T05a - Cannon's Pit 400 (pre-NH3)		09-Mar-23	µg/L	<0.0019	0.04
T03b - MacLure Reservoir Cell 1/2 outlet		09-Mar-23	µg/L	<0.0019	0.04
T01a - Bell Road (pre-NH3)		29-Aug-23	µg/L	<0.002	0.04
T05a - Cannon's Pit 400 (pre-NH3)		29-Aug-23	µg/L	<0.002	0.04
T03b - MacLure Reservoir Cell 1/2 outlet		29-Aug-23	µg/L	<0.002	0.04