Annual Water Quality Report

2018

EXECUTIVE SUMMARY

The City of Abbotsford and District of Mission receive domestic water from the Abbotsford Mission Water & Sewer Commission (AMWSC). The primary source of water is Norrish Creek, supplemented by Cannell Lake and several groundwater wells within the Abbotsford-Sumas Aquifer. The Norrish Creek source is filtered (either by slow sand or ultrafiltration membranes) and chloraminated prior to distribution. Cannell Lake water is treated by ultraviolet (UV) disinfection and chloramination. Chloramination is also practiced at most wells.

During 2018, the Norrish Creek Water Treatment Plant consistently delivered high quality water, within the limits recommended by the Guidelines for Canadian Drinking Water Quality (GCDWQ). Well water also met all health-related GCDWQ requirements. Industrial B had one high result close the Maximum Allowable Concentration (MAC) guideline for arsenic. It produced only 46ML (i.e. < 0.18% of total water supply) in 2018 and when it did operate, its water was blended with that from Industrial C to dilute the arsenic before entering the distribution system. The distribution system is tested on a quarterly basis for arsenic and all results were below the MAC.

Cannell Lake raw water quality was within the requirements. Total Coliforms did exceed 100 counts/100ml in 10 samples, but no E. Coli was detected, therefore the AMWSC remained in compliance with the filtration exemption criteria.

All City of Abbotsford and District of Mission distribution water met the British Columbia Drinking Water Protection Regulation's microbiological criteria. Specifically, there were no positive *E.coli* test results. Out of more than 2,000 samples, *Total Coliforms* were detected in one weekly distribution sample. The site was immediately re-sampled; there were no *Total Coliforms* detected in the resample.

Total Coliforms were detected in the Cannell transmission system during late summer weekly monitoring. As a precaution, samples were taken on a daily basis along this transmission section and at the first two sampling locations in the Mission distribution system during that period. No *Ecoli* were detected in any of the additional sampling and AMWSC staff were in regular contact with Fraser Health to keep them apprised of the situation. Mission distribution site results were all non-detect and by mid-August all transmission results were also non-detect and the additional precautionary sampling schedule ceased.

Table of Contents

1 INTRODUCTION

The British Columbia Drinking Water Protection Act requires that all water suppliers produce an annual water quality report that is reviewed by the local Drinking Water Officer and published for public access. This report has been prepared for the Abbotsford-Mission Water and Sewer Commission (AMWSC) and Ministry of Health for this purpose.

2 WATER SYSTEM DESCRIPTION

Abbotsford & Mission receive domestic water from the Abbotsford Mission Water & Sewer Commission (AMWSC). The AMWSC draws water from three sources, provides treatment, and transmits the treated water to Abbotsford and Mission. The two municipalities distribute the water to consumers directly from transmission pipeline take-off points or through transmission end-point reservoirs. This water supply strategy is illustrated as Figure 2-1.

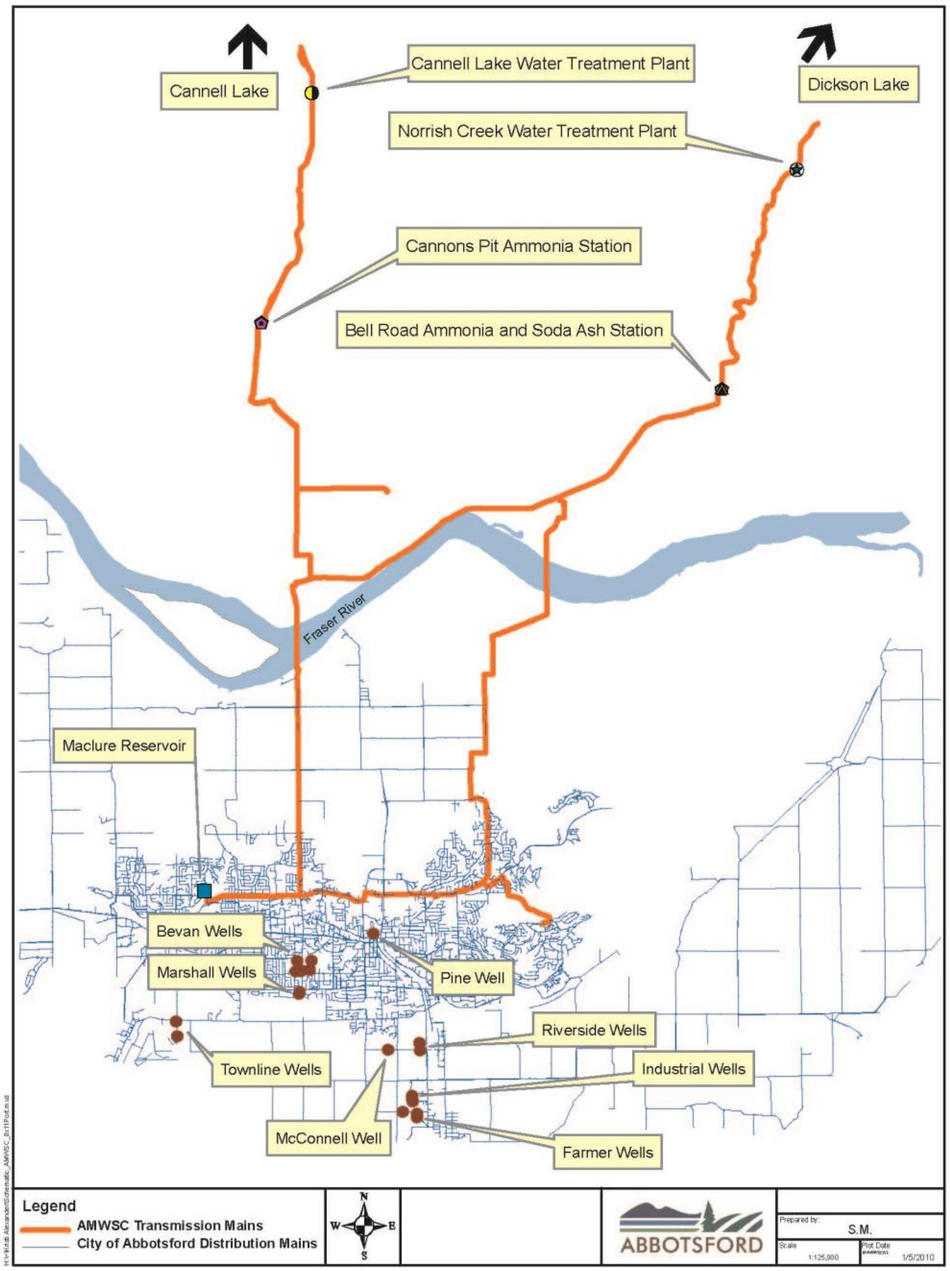


Figure 2-1: AMWSC Water Supply

2.1 Water Sources & Treatment

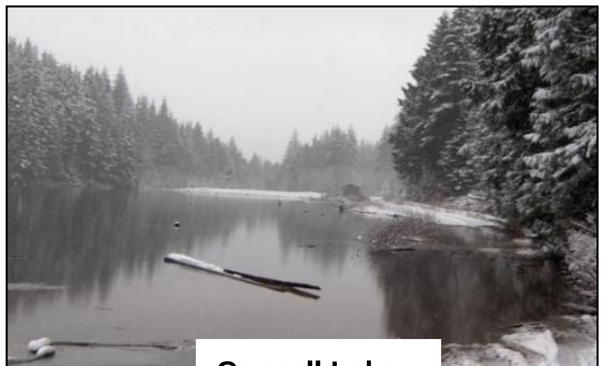
Norrish Creek

Norrish Creek, located northeast of Mission, sources from Dickson Lake and provides the bulk of Abbotsford and Mission's drinking water. Norrish water is filtered by slow sand or ultrafiltration membranes at the Norrish Creek Water Treatment Plant (NCWTP). The water is chlorinated at the plant outlet and then flows 7.5 km to the Bell Road Ammonia & Soda Ash Station, where aqueous ammonia is added to form chloramines for distribution system residual disinfection. Soda ash was not dosed in 2018.

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 supply to Abbotsford when demand is high or when the Norrish supply is off-line. Cannell Lake water is treated by ultraviolet (UV) disinfection and chlorinated 1 km downstream of the intake, then travels 7 km to the Cannon Pit Ammonia Station to form residual chloramines prior to entering the distribution networks.



Cannell Lake

Groundwater Wells

The AMWSC supplements times of high demand with groundwater from the Abbotsford-Sumas aquifer. Most well water is chloraminated prior to distribution.

Groundwater Well Head

Treated water travels through more than 95 km of pipeline from the water sources to Abbotsford and Mission. The water then either enters the municipalities' distribution systems via direct take-off points or after feeding through the Maclure and Mt. Mary Ann Reservoirs. The volumes of water produced by Norrish, Cannell and the wells in 2018 (and the two years prior) are summarized in Table 2.1.

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

Source [1]	2016 Total	2017 Total	2018 Total
Norrish Creek	18,190	17,896	17,302
Cannell Lake	3,437	3,801	3,463
Farmer #1 Well	48	552	763
Farmer #3 Well	109	30	8
Industrial Well "A"	27	2	0
Industrial Well "B"	8	36	46
Industrial Well "C"	293	228	335
Marshall #1 Well	1	1	264
Marshall #3 Well	291	0	0
McConnell Well	85	114	189
Pine Well	34	12	40
Riverside #1 Well	19	16	112
Townline #1 Well	353	386	473
Townline #2 Well	175	170	226
Bevan #1 Well	109	270	360
Bevan #2 Well	201	285	425
Bevan #3 Well	482	272	420
Bevan #4 Well	377	395	550
Overall Total	**24,239**	**24,465**	**24,976**
Total Surface Water	**21,627**	**21,696**	**20,765**
Total Groundwater	**2,612**	**2,769**	**4,211**

1 – The following wells have been removed from the table as of this 2018 report since they have been out of service for more than 5-years and there are no plans to put them back into production: Farmer 2, Marshall 2 & Riverside 2. If any water quality results exist for these inactive wells, such can be obtained by contacting :eng-info@abbotsford.ca

2.2 Distribution System

The Abbotsford distribution system includes 22 pump stations, 10 reservoirs, more than 20 pressure reducing stations (PRVs), and over 850 km of pipelines as shown in Figure 2-2. The Mission distribution system includes 23 PRVs and over 170 km of pipelines as shown in Figure 2-3.

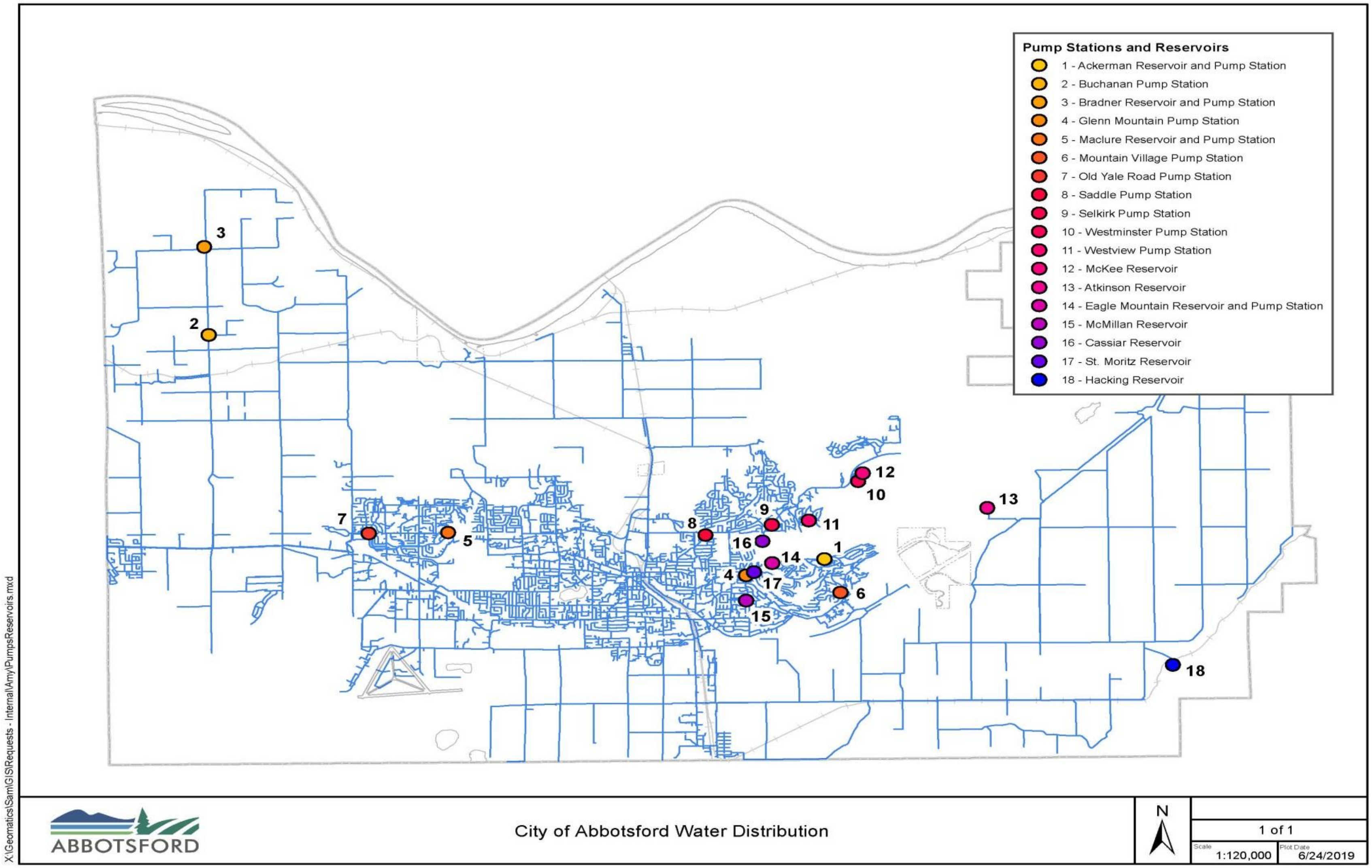


Figure 2-2: City of Abbotsford Water Distribution System

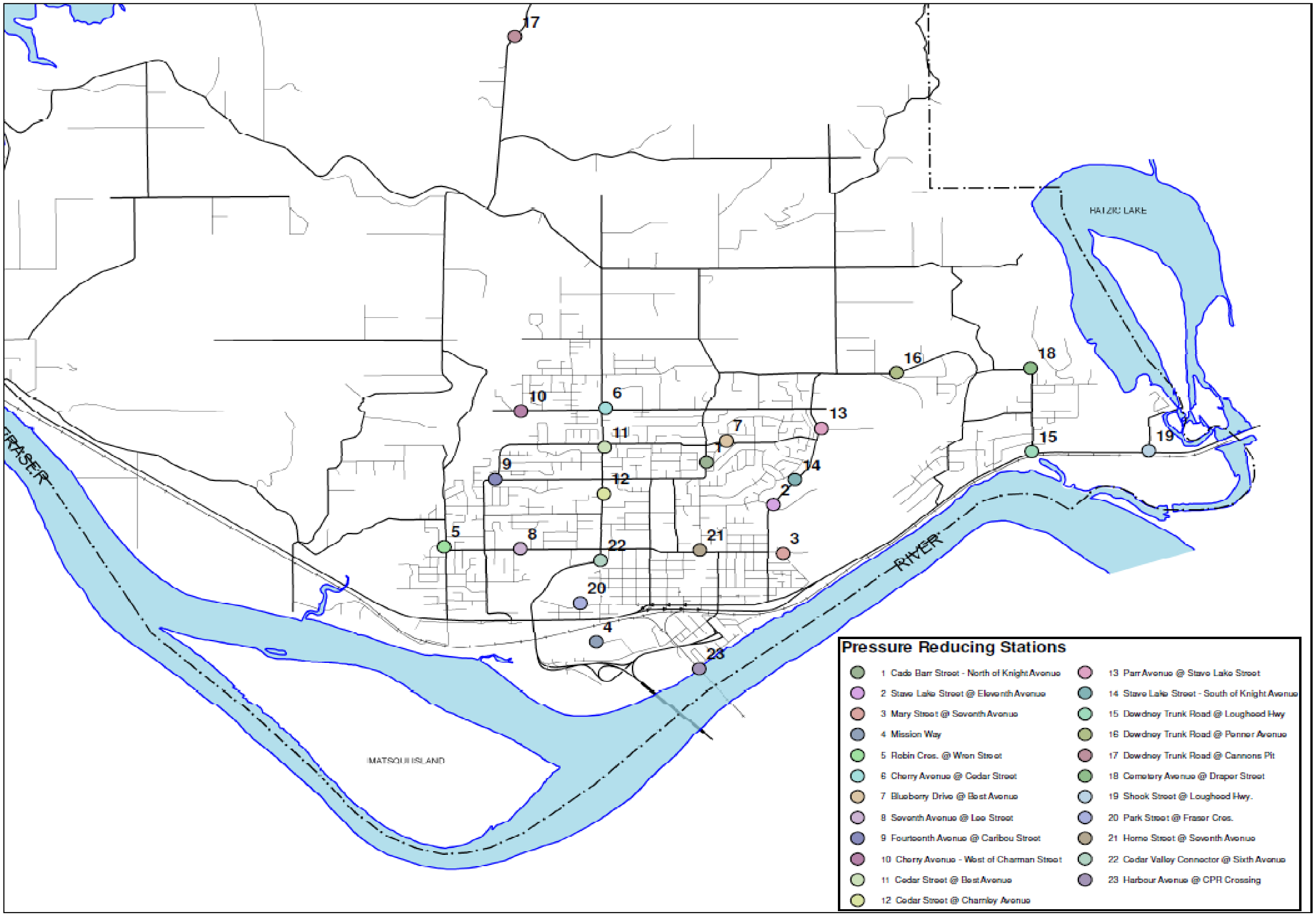


Figure 2-3: District of Mission Water Distribution System

3 WATER SAMPLING AND TESTING PROGRAM

Abbotsford and Mission work together to monitor drinking water quality according to the requirements of the BC Drinking Water Protection Act and Guidelines for Canadian Drinking Water Quality (GCDWQ). The AMWSC monitors source water quality and transmission system water quality to confirm effective water treatment. Mission and Abbotsford monitor their distribution network water quality to ensure that there has been no water quality deterioration during passage through their distribution pipelines. Table 3-1 summarizes the monitoring program and the following sections describe key water quality results from 2018 sampling programs.

Table 3-1: AMWSC, Abbotsford & Mission Water Quality Monitoring Program

Parameters	Raw Surface Water	Raw Well Water	Treated Water	Monitoring Purpose
Potability Scan (1)	Annually (2)	Annually	Quarterly	To characterize source and treated water quality and to track fundamental shifts in quality.
Nitrates & Metals	-	Monthly (3)	-	To proactively screen for aquifer contamination.
Pesticides/Herbicides		Annually		To proactively screen for aquifer contamination.
Various (4)	On-Line	On-Line	On-Line	Data required for effective control of the water treatment processes.
Coliforms	-	-	Weekly (42 locations)	To proactively screen for biological contamination of the distributed water.
Disinfection Monitoring (4)	-	-	Weekly (5) (42 locations)	To ensure that a disinfection residual is maintained through the distribution system.
Disinfection By-Products	-	-	Quarterly (4-5 locations)	To ensure that disinfection by-product levels remain below recommended limits.
Various (6)	-	-	Annually (6)	Proactively screening for pipe deterioration.

(1) Potability scan typically includes: alkalinity, aluminum, antimony, arsenic, barium, boron, bicarbonate, calcium, carbonate, colour, conductivity, hardness, hydroxide, cadmium, chloride, chromium, copper, fluoride, iron, lead, magnesium, manganese, mercury, nitrate/nitrite, pH, potassium, silicon, selenium, sodium, sulphate, turbidity, total dissolved solids, uranium, and zinc. This list may vary slightly year over year.

(2) For Cannell Lake raw water, there are some additional parameters being monitored weekly (e.g. coliforms, colour, pH, UV-absorbance, iron and manganese) and monthly (e.g. organic carbon & protozoa) to manage the treatment process and to comply with filtration exemption.

(3) Monthly metal testing at the wells is not normally part of the water quality monitoring program. This data is being collected under a separate program related to an AMWSC environmental assessment certificate.

(4) There are various on-line water quality instruments throughout the system (e.g. for turbidity, chlorine, pH, and ultraviolet transmittance).

(5) Disinfection monitoring includes analyses of total and free chlorine, along with temperature, turbidity and pH. Alkalinity, ammonia, monochloramine and dichloramine are also monitored at 5 transmission system locations to ensure effective chloramination.

(6) In addition to weekly & quarterly treated water sampling, parameters such as benzo(a)pyrene, asbestos and vinyl chloride are checked annually or bi-annually at select points in the distribution systems to monitor for pipe deterioration.

The GCDWQ sets standards for safe levels of contaminants commonly found in municipal drinking water. However, some people with significantly weakened immune systems may be more vulnerable to contaminants in drinking water than the general population. Immunocompromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and some infants can be particularly at risk from infections. These people are urged to review the HealthLinkBC information sheet attached as Appendix A.

All customers should read Fraser Health's message about flushing taps that have not been used for six hours or longer. Please refer to Appendix B.

3.1 Raw Source Water Quality Monitoring

3.1.1 Surface Water

The quality of raw source water influences the level of treatment required to produce domestic water suitable for consumption. Outside of analytical measurements for managing the water treatment processes, both Norrish Creek and Cannell Lake raw water are tested annually for various physical and chemical characteristics in order to monitor if there are any fundamental changes in quality from year to year. Appendix C contains the results from these analyses for 2016 - 2018. In general, the raw source water quality has remained consistent for the past three years.

Cannell Lake raw water is also monitored weekly and monthly for certain additional parameters, which is further discussed in Section 3.2.

3.1.2 Groundwater

Well water quality results from 2018 are provided in Appendices D through G. Parameters of particular note are further discussed below.

Arsenic

Arsenic can be found 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 supplies. Although levels are generally well below the guideline, elevated arsenic concentrations have been found in areas with natural sources.[1] The Maximum Allowable Concentration (MAC) is 10 μg/L. Industrial B and C are the only two wells that have historically contained arsenic that has been at or above the MAC. In 2018, neither well exceeded the MAC. Industrial B's average arsenic concentration was 8.31 μg/L and the maximum concentration was 9.66 μg/L. Similarly, for Industrial C, the average and maximum concentrations were 7.75 & 8.99 μg/L, respectively. Note that all distribution system results for arsenic were not detectable or below 1μg/L as shown in Appendix I.

[1] Health Canada, December, 1978. 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

Iron

The presence of iron in natural waters can be attributed to the weathering of rocks and minerals, acidic mine water drainage, landfill leachates, sewage effluents and iron-related industries[2]. Elevated iron can lead to aesthetic issues such as coloured water or objectionable taste. Bevan 1 had a maximum result close to the GCDWQ aesthetic guideline of 300 μg/L in 2018. However, the water from Bevan 1 blends with other sources prior to reaching customers and thus its iron concentrations are diluted; there has never been any indication of iron-related aesthetic issues in the distribution system. All distribution results for iron in 2018 were well below the MAC or not detectable as shown in Appendix I.

Manganese

Manganese is a naturally occurring element in most water sources. High levels of manganese may cause fixture and laundry staining. The GCDWQ specifies an aesthetic guideline 20 μg/L for manganese and a new health based MAC of 120 μg/L. Four AMWSC wells (Farmer 1, Industrial B, Industrial C, and Townline #1) regularly produce water with manganese above the aesthetic guideline, but significantly below the MAC. All distribution results for manganese were below the MAC and aesthetic guideline or not detectable as shown in Appendix I.

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[3]; higher levels may indicate contamination. The Abbotsford-Sumas aquifer is known to contain elevated levels of nitrate stemming from the application of agricultural fertilizer to the land above. The AMWSC thus monitors for nitrate and nitrites on a monthly basis in all wells. 2018 results are shown in Appendix E. No wells had nitrates in excess of the 10 mg/L MAC during 2018 and the last ten-years of data suggest a general downward trend in most wells.

Pesticides & Herbicides

Pesticides and herbicides are tested annually in select wells to generally monitor for aquifer contamination. In 2018, 13 wells were tested and all results were non-detect. (The parameters tested are listed in Appendix G).

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[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

[3] BC Water Stewardship Office, May 2007. Nitrate in Groundwater. Retrieved from: http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/library/ground_fact_sheets/pdfs/no3(020715)_fin2.pdf

3.2 Cannell Filtration Exemption Monitoring

In 2005, Fraser Health adopted the "Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia". These standards generally require filtration for drinking water supplied from surface water sources. However, authorities may exclude such sources from filtration assuming compliance with four criteria. 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. The following describes the four filtration exemption criteria and notes how the AMWSC complied with each during 2018.

1. *Overall inactivation is met using a minimum of two disinfection processes, providing 4-log reduction of viruses and 3-log reduction of Cryptosporidium and Giardia.*

   AMWSC Compliance: As of December 2016, Cannell Lake water is treated with 2 disinfection processes: UV-disinfection and chlorination. In 2018, Cannell Lake's raw water was sampled for Cryptosporidium and Giardia 11 times. There were no viable counts in any of the samples.

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/100 mL of Total Coliform) in at least 90% of the weekly samples from the previous six months. The treatment target for all water systems is to contain no detectable E. coli or Fecal Coliform per 100 ml. Total Coliform objectives are also zero based on one sample in a 30-day period. For more than one 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 100 ml.*

   AMWSC Compliance: In 2018, Cannell raw water was tested weekly for coliforms. No *E.coli* were detected. *Total Coliforms* did exceed 100 counts/100ml in 10 samples, but no E. Coli was detected, therefore the AMWSC remained in compliance with Criterion #2.

3. *Average daily turbidity levels measured at equal intervals (at least every four hours) immediately before the disinfectant is applied are around 1 NTU, but do not exceed 5 NTU for more than two days in a 12-month period.*

   AMWSC Compliance: The average daily turbidity reading at Cannell Lake was 0.09 NTU and the highest recorded value was 0.17 NTU.

4. *A watershed control program is maintained that minimizes the potential for fecal contamination in the source water.*

   AMWSC Compliance: Since 2014, the AMWSC has maintained a watershed program plan that monitors and mitigates the risk of lake fecal contamination. This program includes the following key components:

   - Completing weekly visual checks at the lake for any signs of watershed contamination (e.g. human trespass, etc). During 2018, no signs of potential contamination were observed.
   - Maintaining watershed access gates & fences to discourage vehicular entry into the watershed. In 2018, all gates and fences were checked weekly and no sign of forced entry was apparent.

- Completing an annual helicopter inspection of the watershed to identify any changes that may increase contamination risk. In 2018, the helicopter inspection occurred on July 18th. The only noteworthy change was some logging along Cannell Lake access road, but this was outside the watershed boundary and thus poses no risk to the lake.
- Maintaining signs at watershed access points to alert the public that entry is restricted. There are two signs in place for this purpose as shown in the photographs below.
- Maintaining electronic surveillance devices to monitor human entry into the watershed. In December 2016, a camera was installed at the Cannell Lake WTP that monitors entry to the lake access road.

Cannell Lake Sign

Cannell Lake Gate Sign

- In 2019, the AMWSC will be implementing a limnology water quality monitoring program at Cannell Lake that will provide early indication of lake water quality changes and any changes that could arise from disturbances in the watershed, particularly those associated with climate change.

3.3 Distribution Water Quality Monitoring

Abbotsford and Mission's distribution systems are tested weekly for *E.Coli*, *Total Coliforms*, chlorine residuals, turbidity, temperature and pH at 37 locations. The AMWSC analyzes these parameters at a further five locations along the transmission lines. A list of sample location codes are provided in Table 3-2. Maps of Abbotsford and Mission sampling sites are provided as Figure 3-1 and 3-2, respectively.

Table 3-2 Weekly Water Distribution Test Sites

City of Abbotsford Distribution Network	
W1 - 35041 Harris Rd.	**E2 –** Old Yale & Arnold Rd.
W2 - Sandy Hill School	**E3** - 39189 Marion Rd. @ Wellsline Rd.
W3 - 35944 McKee Rd.	**E4** - Campbell Rd. & Tolmie Rd.
W4 - Bateman Park	**E5 -** #3 Rd. @ South Parallel Rd.
W5 - 3315 Gladwin Rd.	**E6** - Cole Rd. Across from 1024
W6 - 32961 South Fraser Way	**E7 -** #1 Rd. @ Tolmie Rd.
W7 - 32111 Joyce Ave.	**E8** - 3434 McDermott Rd.
W8 - King Works Yard	**E9** - Lower Sumas Mtn. Rd.
W9 - 515 Gladwin Rd.	**E10** - 36101 Regal Parkway
W11 - 5030 Lefeuvre Rd.	**E11** - St. Moritz North of Glen Mtn. Dr.
W13 - 7942 Bradner Rd.	**E12** - Beck Rd. @ Larch Park
W14 - Dunach School	**E13** - 2092 McMillan Rd.
W15 - 3154 Clearbrook Rd.	**E14** - Victory Blvd. @ Moulstade Rd.
W16 – 27875 Swensson Rd.	**E15** - 2195 Orchard Dr.
District of Mission Distribution Network	
M1 – Israel Avenue	**M8** – Laminman Avenue
M2 – Balsam Avenue	**M9** – Shook Street
M3 – Penner Avenue	**M10** – Miller Crescent
M5 – Hillcrest Avenue	
M6 – Cannell Booster Station	
M7 – Mary St. @ 4^{th} Avenue	
AMWSC Transmission Pipelines	
Bell Rd.	Cannon Pit 400 & Cannon Pit 600
Ainsworth St.	Maclure Reservoir

Schedule B of the BC Drinking Water Protection Regulation establishes the guideline for water sampling frequency of microbiological contaminants. For water utilities serving more than 90,000 consumers, 90 samples plus 1 sample for every additional 10,000 persons is required per month. Thus, with a serviced population of approximately 165,000, a minimum of 98 samples per month are required. In 2018, the AMSWC, Abbotsford and Mission tested more than 170 samples per month, thereby exceeding requirements.

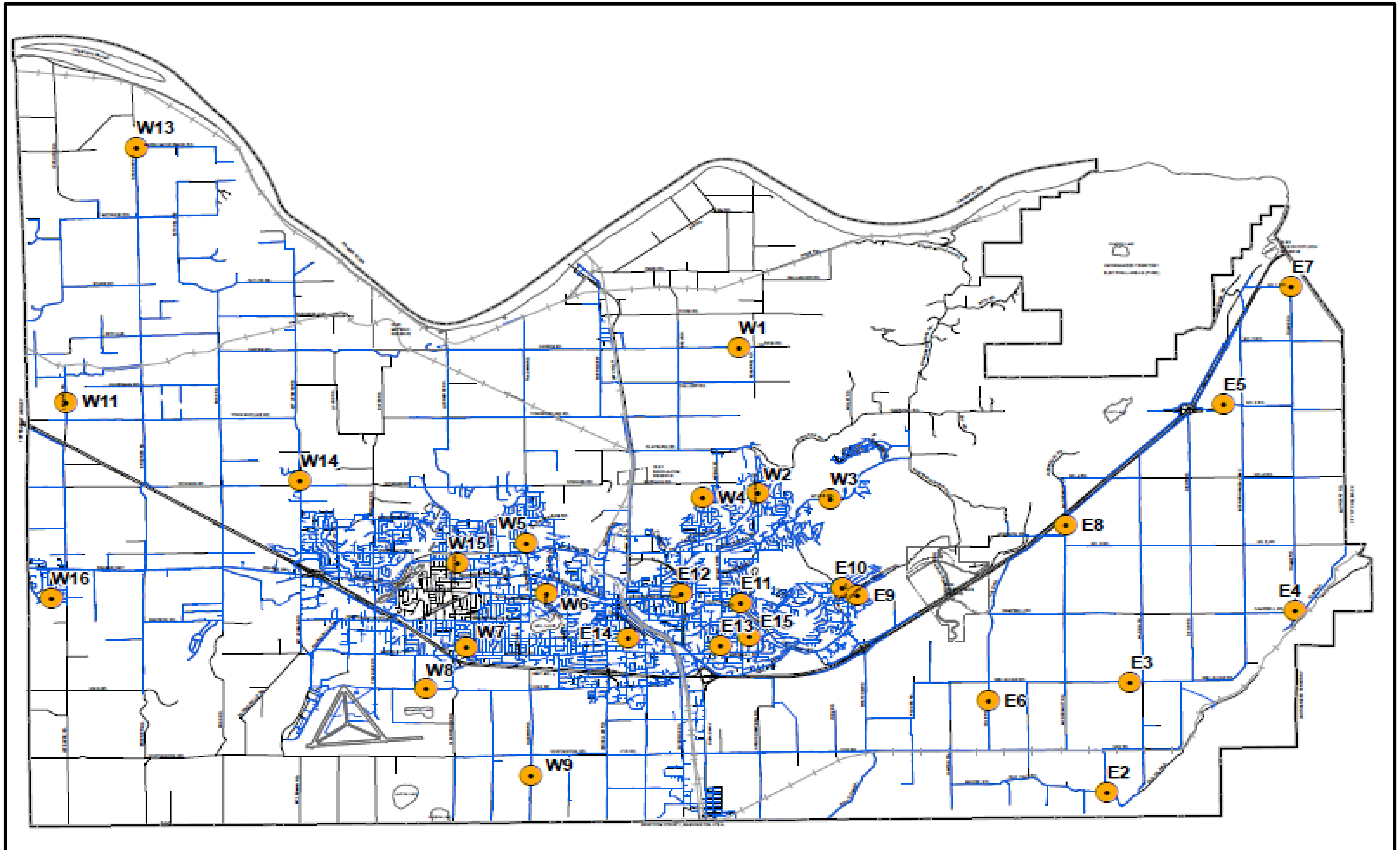

Figure 3-1: Abbotsford Water Distribution Network Sampling Locations

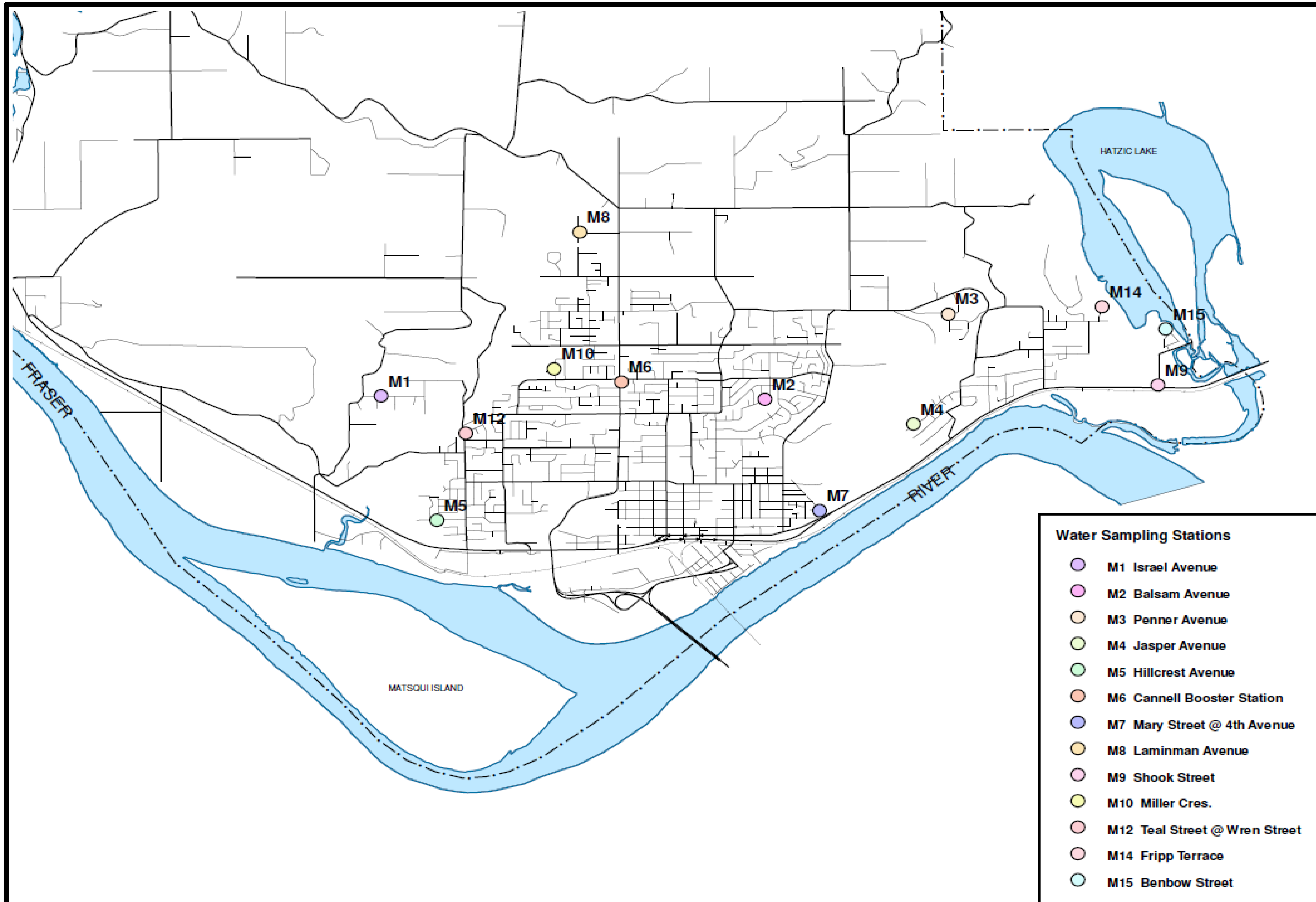

Figure 3-2: Mission Water Distribution Network Sampling Locations

3.3.1 E.Coli and Total Coliform

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

- No sample should be positive for *E.Coli*;
- No more than 10% of the samples in a 30-day period should be positive for *Total Coliform*; and
- No sample should contain more than 10 *Total Coliform* per 100 ml.

Total Coliforms are a group of bacteria that are generally free-living in the environment, but are also present in water contaminated with human and animal faeces. They 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 of the water and possible presence of intestinal disease-causing bacteria, viruses, and protozoa. The detection of *E.Coli* triggers a protocol which involves immediate notification of health and municipal officials, re-sampling and a thorough investigation into the possible causes.

The AMWSC, Abbotsford and Mission tested more than 2000 treated water samples for microbiological parameters in 2018 as shown in Appendix H. *E.Coli* was not found in any sample. *Total Coliforms* were detected in one of the regular weekly distribution samples as listed in Table 3-3. At this site, the location was re-sampled upon receiving the result and no detectable coliforms were found in the follow-up sample. All 2018 monthly reports can be found here: http://www.ourwatermatters.ca/water-quality.

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

Date	Location	Total Coliforms (ct/100 ml)
May 1	M3 - Penner	1

Total Coliforms were detected in the Cannell transmission system during late summer weekly monitoring. As a precaution, samples were taken on a daily basis along this transmission section and at the first two sampling locations in the Mission distribution system during that period. No *Ecoli* were detected in any of the additional sampling and AMWSC staff were in regular contact with Fraser Health to keep them apprised of the situation. Mission distribution site results were all non-detect and by mid-August all transmission results were also non-detect and the additional precautionary sampling schedule ceased. Detailed weekly bacteriological results can be found in the monthly water quality reports here: http://www.ourwatermatters.ca/water-quality.

In addition to the AMWSC and municipal testing, Fraser Health also collected 10 audit samples in Mission and found no *E.Coli* or *Total Coliforms* during 2018.

3.3.2 Disinfection Residuals

Disinfectants are added to potable water supplies to inactivate microorganisms, such as bacteria and viruses, which may be present in the water sources. Chlorine-based chemicals are the most widely used disinfecting agents. The AMWSC uses chloramines for residual disinfection. Chloramination has two distinct advantages over free chlorine: (i) the residual lasts longer, which ensures that disinfection is maintained to the extreme ends of Mission and Abbotsford's large distribution networks, (ii) research suggests that chloramines produce less disinfection by-products than chlorine.

Health Canada describes that the "optimal operational range for chlorine in drinking water is between a detectable level and 3 mg/L."[4]. As the water travels through the distribution system, the concentration of chloramines declines. The AMWSC typically doses chloramines so that the water initially contains a total chlorine residual between 1.0 and 1.5 mg/L. This initial concentration range generally ensures that there are trace amounts of disinfectant at the far reaches of the pipe network.

The AMWSC, Abbotsford and Mission tested more than 2000 samples for total and free chlorine in 2018. (Aside: The difference between the total and free values approximates the total chloramine concentrations). Of these samples, more than 94% of Abbotsford samples and 100% of Mission samples had total chlorine results above 0.2 mg/L. Unless total coliforms begin to appear in the system, periodic low disinfection residuals are not a concern. The maximum total chlorine concentrations detected in the Abbotsford and Mission distribution systems during 2018 were 1.97 mg/L and 1.82 mg/L, respectively. Appendix H provides 2018 total chlorine residual statistics for the system and individual sampling locations.

3.3.3 Turbidity

Turbidity is a principal physical characteristic of water. It is caused by suspended matter or impurities that interfere with the clarity of the water. Excessive turbidity in drinking water is aesthetically unappealing, and may also represent a health concern since it can provide food and shelter for pathogens. Although turbidity is not a direct indicator of health risk, studies show a strong relationship between removal of turbidity and removal of pathogens.

The Guidelines for Canadian Drinking Water Quality (GCDWQ) specify that water filtration systems should target a treated water turbidity of less than 0.1 NTU. However, for slow sand filters, this guideline is relaxed to 1.0 NTU[5]. Since the primary AMWSC source, Norrish Creek, is filtered by a combination of ultrafiltration and slow sand filters, it is expected this source will always provide a treated turbidity well less than 1.0 NTU. Similarly, as discussed earlier, Cannell Lake's natural turbidity is typically well below 1.0 NTU. All AMWSC wells also consistently produce water with very low turbidity. Considering all three sources, Abbotsford and Mission distribution systems should have

[4] Health Canada, June, 2009. Guidelines for Canadian Drinking Water Quality - Chlorine. Retrieved from: https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-chlorine-guideline-technical-document/page-2-guidelines-canadian-drinking-water-quality-chlorine-guideline-technical-document.html#a2

[5] Health Canada, May 2008. Guidelines for Canadian Drinking Water Quality Summary Table. Retrieved from: http://www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/water-eau/sum_guide-res_recom/summary-sommaire-eng.pdf

turbidity consistently below 1.0 NTU. Higher values typically indicate a disturbance in the distribution system (e.g. a main break, etc).

In 2018, no Mission distribution sites had a result above 1.0 NTU and the average turbidity was 0.25 NTU. In Abbotsford, 0.11% of samples exceeded 1.0 NTU and the average turbidity was 0.20 NTU. Appendix H includes more detailed turbidity results.

3.3.4 pH

The AMWSC monitors pH on-line following water treatment of the Norrish Creek and Cannell Lake sources. The average pH at these locations in 2018 was 6.5 and 6.9, respectively. Additionally, field testing for pH occurs weekly at each distribution system sample location. In Abbotsford, the 2018 median pH was 7.5. In Mission, the median pH was 7.4 [6].

3.3.5 Metals Testing

In 2018, the Abbotsford and Mission distribution systems were tested quarterly for metals to monitor for pipe corrosion and variations in treated water quality relative to that at the sources. Appendix I provides maximum and average values for total metals results collected under this program. In 2018, all distribution sampling locations met all the GCDWQ requirements.

3.3.6 Trihalomethanes and Haloacetic Acids

Trihalomethanes (THMs) and Haloacetic Acids (HAAs) are by-products of disinfection, created when chlorine reacts with organic matter dissolved in water. THMs and HAAs are suspected carcinogens and thus a human health concern. The GCDWQ recommend limits of 100 µg/L for Trihalomethanes and 80 µg/L for Haloacetic Acids[7].

The AMWSC tests quarterly for THMs and HAAs at the locations shown in Appendix J tables. All results were well below the recommended limits, with the highest results being 25 and 35 µg/L for total THMs and HAAs, respectively. These excellent results are partly attributed to the low organic content in the source waters. Chloramination also helps to suppress the level of disinfection by-products (i.e. chlorine preferentially bonds with the dosed ammonia rather than the organic matter).

3.3.7 Pipe Deterioration Monitoring

The AMWSC tests for various indicators of pipe degradation on annual or bi-annual intervals at applicable system locations. In 2018, all benzo(a)pyrene and vinyl chloride results were non-detect.

[6] Due to instrument malfunction, weekly pH testing in Mission only occurred in late November and December 2018.

[7] Health Canada, May 2008. Guidelines for Canadian Drinking Water. Retrieved from: http://www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/water-eau/sum_guide-res_recom/summary-sommaire-eng.pdf

4 SYSTEM MAINTENANCE

The AMWSC, City of Abbotsford, and District of Mission have more than 40 staff assigned to engineering, operations management, maintenance, and light 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. Abbotsford & Mission have annual programs to replace aging pipe. Priority is given to pipes that are made of asbestos cement (AC), ductile iron in a known corrosive soil, and those that are approaching the end of their service life or have a history of problems. Abbotsford began using its new smart meters to identify leaks in its distribution system in 2010. Mission has developed a leak detection program which identifies system areas in need of upgrades or replacement.

4.1 Staff Certification & Training

The BC Environmental Operators Certification Program (EOCP) classifies water systems and certifies operators using ratings of I through IV. Higher numbers correspond to greater operational complexity and operators with more advanced training. The BC Drinking Water Protection Act requires that water system owners employ operators with a certification level numerically equivalent to the classification of the water system.

The AMWSC's Norrish Water Treatment Plant is classified as Level III and the transmission system is classified as Level IV. Abbotsford's water distribution system is classified as Level IV and Mission's is Level II. Abbotsford staff maintain and operate the sources, water treatment facilities, transmission system and Abbotsford's distribution system. The District of Mission operates the Mission distribution system.

The AMWSC Water Supply operations team includes 8 Operators. Of these, all have water treatment certificates with the highest being a Level IV Operator. All eight Operators have water distribution certificates; five have level II, two have Level III and one has Level IV.

The Abbotsford Water Distribution department consists of 17 full time Operator positions, of which two were filled by auxiliary staff in 2018 and there were two additional temporary auxiliary staff. Of the 15 Operators, there are two Level IV Water Distribution (WD) Operators, three Level III WD Operators, five Level II WD Operators, and one Level I WD operators. The four auxillary workers had one staff member with an operator in training (OIT) certificate, and one with his multi-utility.

The District of Mission's team includes 8 Certified Operators with water distribution certificates; six have their Level II.

4.2 Water System Events of Note in 2018

Total coliforms were detected in the Cannell Lake transmission system between July 17 and August 13. As a precautionary measure, until August 21, sampling was increased from weekly to daily at multiple transmission and Mission sample locations. No E.Coli was detected in any of these more frequent samples and no total coliforms were detected in the Mission distribution system. The AMWSC was in regular communication with Fraser Health and the District of Mission throughout the period.

4.3 Operational Highlights for 2018

In 2018, the AMWSC, Abbotsford and Mission achieved the following significant works related to water quality:

AMWSC

- Completed its most recent Water Supply Master Plan;
- Began investigative level studies for a future water source;
- Re-sanded 2 of 4 Norrish WTP slow sand filters; and
- Began detailed design of infrastructure replacement and improvements at the Farmer & Marshall wellfields.

Abbotsford

- Cleaned, repaired and made improvements at St. Moritz, McMillan and McKee reservoirs; and
- Some watermain loops added during offsite land development improvements.

Mission

- Annual dead end water main flushing;
- Annual backflow test done on relief valves; and
- Continued with the second year of a unidirectional flushing program, completing 20% of the system annually.

4.4 Works Planned for 2019

Key water system projects related to water quality scheduled for 2019 include the following:

AMWSC

- Update Cannell Lake Watershed Management Plan;
- Continue new source investigative studies;
- Complete re-sanding of the final two Norrish WTP slow sand filters;
- Complete infrastructure replacement & improvements at the Farmer & Marshall Wellfields;
- Complete a high-level system pH study; and
- Complete ‘Groundwater At Risk of Pathogens’ (GARP) screening for each AMWSC well.

Abbotsford
- Reservoir cleaning at Eagle Mountain, Hacking and Atkinson Reservoirs;
- Continue regular dead end flushing program; and
- Develop a system-wide unidirectional flushing program.

Mission
- Continue with the unidirectional flushing program, completing 20% of the system annually.

4.5 Emergency Response

The AMWSC 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 District of Mission, where all engineering resources would be coordinated by the City's Engineering Department Operations Centre; the Plan is premised on Abbotsford staff taking the lead role on all emergencies related to the joint water 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 water service. The ERP contains checklists to prioritize risks and responses, indicators of problems, and restoration plans.

In the event of a positive test for contaminated water, or a case of field evidence indicating that the quality of the water system may be compromised, the City first isolates the affected section of the system to reduce the impact and then contacts Fraser Health to advise them of the situation. The City and the Medical Health Officer (MHO) then evaluate the need for a "Boil Water" or "Stop Water Use" advisory. If such an advisory is to be issued, the City will inform the public. The MHO determines when the advisory can be lifted.

Hard copies of the ERP manual are available for public perusal at Abbotsford's Engineering Department Reception (City Hall, 4th floor) and Mission's City Hall Reception.

5 CONCLUSIONS

Results from 2018 water quality monitoring demonstrate that the City of Abbotsford and District of Mission's drinking water is potable under the definition of the Drinking Water Protection Act & Regulation. AMWSC and municipal water engineers and operators continue to seek water system improvements to consistently provide 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. Working closely with Fraser Health, the public, and the AMWSC, Abbotsford and Mission will continue to provide an aesthetically-pleasing, clean, and safe source of drinking water for all to enjoy.

APPENDICES

APPENDIX A – FRASER HEALTH HEALTHLINK

fraserhealth Better health. Best in health care.

CITY OF ABBOTSFORD
RECEIVED
MAR 23 2010
ENGINEERING DEPT

March 16, 2010

Water Suppliers:

Re: HealthlinkBC File #56 - Persons with Compromised or Weakened Immune systems

In the Ombudsman's Special Report No. 32, June 2008, entitled "Fit to Drink: Challenges in Providing Safe Drinking Water in British Columbia", the Ombudsman recommended that adequate procedures need to be established by Fraser Health to notify people with compromised or weakened immune systems about the potential health risks associated with drinking water.

As part of our ongoing efforts to comply with the Ombudsman's recommendation, we are requesting all water suppliers to include the attached HealthlinkBC File # 56 with their annual report. Please make the report available to all your users. The information can also be found on the following web link:
www.healthlinkbc.ca/healthfiles/pdf/hfile56.pdf

If you have any questions about the above, please contact our office at 604-870-7900 (toll free: 1-866-749-7900) and one of our environmental health officers will gladly assist you.

Sincerely

Marc Zubel

Marc Zubel, P.Eng.
Manager, Drinking Water Program
Health Protection

Enc.

MZ/cs

Public Health Protection
Fraser Health Authority

#207 - 2776 Bourquin Crescent West
Abbotsford BC
V2S 6A4 Canada

Tel (604) 870-7900
Fax (604) 870-7901
www.fraserhealth.ca

HealthLinkBC

Number 56
August 2009

Drinking Water and Those with Weakened Immune Systems

Some people with very weak immune systems may be at higher risk of water-borne infections. This file provides information about how to help prevent water-borne infections.

People who have significantly weakened immune systems and who are at higher risk of certain water-borne diseases include:

- People with HIV infection who have a CD4+ count of < 100 cells/mm^3.
- People with hematological malignancies (lymphoma or leukemia) who are being actively treated or have been in remission and off treatment for less than 1 year.
- Hematopoietic stem cell transplant recipients.
- 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 specialist how weak your immune system is, and whether you need to take extra precautions.

Diseases from drinking water

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 not built properly or if it draws on water from the surface of the ground, such as shallow wells or wells 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 wells potentially contaminated by surface water (for example, dug wells), unless the water has been treated to remove or inactivate at least 99.9% of parasites (protozoa), 99.99% of viruses and 100% of 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% reduction in infectious parasites. Furthermore, some water systems and many private supplies have no treatment at all. If the water you drink has not been disinfected, please refer to HealthLink BC File #49b How to Disinfect Drinking Water.

To further treat drinking water that has been disinfected, consider the methods listed below.

Options for water treatment

Boiling: If your water supply is disinfected you need only bring the water to a full boil to inactivate any *Cryptosporidium* parasites - a major concern for immunocompromised people, as there is no medical treatment for this parasite.

If the water is not yet disinfected, it's recommended you bring water to a full boil for at least one minute as the best way to kill or inactivate bacteria, viruses and parasites.

At elevations over 2,000 meters [6,500 feet], you should boil water for at least two minutes to disinfect it. In this situation, you should not drink or use tap water to brush your teeth, rinse your mouth, mix drinks or make ice cubes without boiling it first.

If you are preparing infant formula, please see HealthLink BC File #69b Formula Feeding Your Baby: Safely Preparing and Storing Formula. Please note that boiling water will get rid of viruses, bacteria and parasites but not chemicals which may be found in the water. For more information, please contact the environmental health officer or drinking water officer at your nearest public health unit.

Filters: 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. These are *not* suitable for removing bacteria and viruses and should *not* be used *unless* the water supply is at least disinfected first.

Jug-type filters, 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.

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 it 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.

Bottled water

If you do not want to drink water from the tap, you may also choose to buy bottled water that has been treated adequately. Most bottled water in B.C. has had RO treatment, but not all has been treated. You should check with the water bottler to find out what treatment it has had. You can still use tap water for cooking as long as you boil it. You can use bottled water treated by reverse osmosis for drinking, brushing teeth, making ice cubes and for recipes where water is used but not boiled such as cold soups or salad dressings.

For more information, including the level of treatment in your local water system, please contact your drinking water purveyor or supplier or the local environmental health officer or drinking water officer. Please also see the following HealthLink BC Files.

#49a Water-borne Diseases in BC

#49b How to Disinfect Drinking Water

BC Centre for Disease Control
AN AGENCY OF THE PROVINCIAL HEALTH SERVICES AUTHORITY

For more HealthLink BC File topics, visit www.HealthLinkBC.ca/healthfiles/index.stm or your local public health unit.

Click on www.HealthLinkBC.ca or call **8-1-1** for non-emergency health information and services in B.C.

For deaf and hearing-impaired assistance, call 7-1-1 in B.C.

Translation services are available in more than 130 languages on request.

APPENDIX B – METALS IN DRINKING WATER

fraserhealth Better health. Best in health care.

February 26, 2016

Water System Operators

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

Fraser Health has recently revised its metals at the tap "Flush" message and we are asking all water systems to please include the following health message with your next annual reports to your users.

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.

Sincerely,

Marc Zubel
Manager, Drinking Water Program
Health Protection

Public Health Protection
Fraser Health Authority

#207 - 2776 Bourquin Crescent West
Abbotsford, BC
V2S 6A4 Canada

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www.fraserhealth.ca

APPENDIX C – ANNUAL RAW WATER SCAN (SURFACE WATER)

Parameter *	Units	GCDWQ[1]	Norrish Creek			Cannell Lake		
			2016 20-Oct	2017 27-Sept	2018 26-Sept	2016 20-Oct	2017 27-Sept	2018 26-Sept
Alkalinity (as $CaCO_3$)	mg/L	-	3.0	8.3	6.5	3.0	6.0	5.3
Aluminum (total)	µg/L	200	181	18	280	12	25	11.4
Antimony (total)	µg/L	6	ND	ND	ND	ND	ND	ND
Arsenic (total)	µg/L	10	ND	ND	0.38	ND	ND	0.13
Barium (total)	µg/L	1000	5.0	7.6	7.5	ND	ND	2.6
Bicarbonate (as HCO_3)	mg/L	-	3.0	8.3	6.5	3.0	6.0	5.3
Boron (total)	µg/L	5000	7.0	16	ND	7.0	8.1	ND
Cadmium (total)	µg/L	5	ND	ND	0.01	ND	ND	ND
Calcium (total)	mg/L	-	2.0	2.6	2.34	1.7	1.5	1.44
Carbonate (as CO_3)	mg/L	-	ND	ND	ND	ND	ND	ND
Chloride	mg/L	≤ 250	0.5	0.6	ND	0.5	0.6	3.86
Chromium (total)	µg/L	50	ND	ND	0.69	ND	ND	ND
Colour (total)	TCU	≤ 15	27	ND	8	ND	ND	ND
Conductivity	microS/cm	-	13	24	18	12	14	26
Copper (total)	µg/L	≤ 1000	2.1	1.4	16.2	8.8	6.2	4.0
Fluoride	mg/L	1.5	ND	ND	ND	ND	ND	ND
Hardness (as $CaCO_3$)	mg/L	-	5.7	8.2	6.93	5.0	4.3	4.22
Iron (total)	µg/L	≤ 300	60	ND	215	40	59	21
Lead (total)	µg/L	10	0.4	ND	2.2	0.7	0.6	ND
Magnesium (total)	mg/L	-	0.2	0.3	0.3	0.2	0.2	0.2
Manganese (total)	µg/L	120	1.8	ND	9.3	6.7	29.3	6.0
Mercury (total)	µg/L	1	ND	ND	ND	ND	ND	ND
Nitrate (as N)	mg/L	10	0.13	0.1	0.16	0.01	ND	0.01
Nitrite (as N)	mg/L	-	ND	ND	ND	ND	ND	ND
pH	-	7 – 10.5	6.53	6.34	6.99	6.51	6.63	6.93
Potassium (total)	µg/L	-	90	ND	97	60	ND	50
Selenium (total)	µg/L	50	ND	ND	ND	ND	ND	ND
Sodium (total)	µg/L	≤ 200000	750	1240	932	830	720	3420
Sulphate	mg/L	≤ 500	ND	1.3	0.71	ND	ND	0.79
Total Dissolved Solids	mg/L	≤ 500	25	ND	26	21	ND	30
Uranium (total)	µg/L	20	0.04	ND	0.05	ND	ND	ND
Zinc (total)	µg/L	≤ 5000	5.0	ND	19	8.0	5.0	ND

ND = not detectable

* 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 about other results.

1 - These are treated water criteria and only shown for comparison to raw water results. (i.e. Water treatment will improve quality before water is sent into distribution system). Black text denotes health-based maximum acceptable concentrations (MAC); light grey text denotes aesthetic objectives (AO).

APPENDIX D – ANNUAL RAW WATER SCAN (WELLS)

(Page 1 of 3)

Parameter *	Units	GCDWQ[1]	Farmer 1			Farmer 3			Industrial A			Industrial B			Industrial C			McConnell		
			2016 Oct 20	2017 Sept 27	**2018 Sept 26**	2016 Oct 20	2017 Sept 27	**2018 Sept 26**	2016 Oct 20	2017 Sept 27	**2018 Sept 26**	2016 Oct 20	2017 Sept 27	**2018 Sept 26**	2016 Oct 20	2017 Sept 27	**2018 Sept 26**	2016 Oct 20	2017 Sept 27	**2018 Sept 26**
Alkalinity (as $CaCO_3$)	mg/L	-	57	64.4	62.4	85	Not Tested	Tested, but results not representative. [5]	155	Not Tested	Not Tested	84	86.9	87.5	95	99.1	92.6	73	76	74.5
Aluminum (total)	µg/L	200	ND	ND	ND	ND			ND			ND	ND	ND	ND	ND	ND	ND	7.0	ND
Antimony (total)	µg/L	6	ND	ND	ND	ND			ND			ND	ND	0.11	ND	ND	0.21	ND	0.22	0.19
Arsenic (total)	µg/L	10	ND	ND	0.16	5.6			ND			6.9	8.3	8.87	8.2	6.14	6.93	ND	2.97	3.99
Barium (total)	µg/L	1000	ND	9.7	12.2	ND			ND			ND	22.0	27.9	ND	29.1	33.4	ND	25.5	27.4
Bicarbonate (as HCO_3)	mg/L	-	57	64.4	62.4	85			155			84	86.9	87.5	95	99.1	92.6	73	76	74.5
Boron (total)	µg/L	5000	ND	27.8	24	ND			ND			ND	27.9	24	ND	11.2	ND	ND	27.1	23
Cadmium (total)	µg/L	5	ND	0.02	0.0134	ND			ND			ND	ND	ND	ND	ND	ND	ND	ND	0.0113
Calcium (total)	mg/L	-	30.4	27.5	31.6	41.6			55.9			29.6	24.2	30	37.2	36.8	40.4	33.3	32.4	34.2
Carbonate (as $CaCO_3$)	mg/L	-	ND	ND	ND	ND			ND			ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloride	mg/L	≤ 250	7.9	9.57	9.84	9.66			9.71			10.7	11.9	11.2	9.85	14.1	13.7	11.5	11.7	11.6
Chromium (total)	µg/L	50	ND	ND	0.37	ND			ND			ND	ND	ND	ND	ND	ND	ND	ND	ND
Colour (Total)	TCU	≤ 15	ND	ND	ND	ND			ND			ND	ND	ND	ND	ND	ND	ND	ND	ND
Conductivity	microS/cm	-	249	263	280	316			447			247	246	258	303	297	310	322	316	322
Copper (total)	µg/L	≤ 1000	6.2	9.62	6.77	5.7			2.2			ND	1.12	0.57	2.8	0.83	0.55	3.6	4.56	4.1
Fluoride	mg/L	1.5	ND	ND	0.03	ND			ND			ND	0.11	0.05	ND	ND	0.03	ND	ND	0.04
Hardness (as $CaCO_3$)	mg/L	-	110	104	113	139			208			101	86	95	134	125	133	116	115	117
Iron (total)	µg/L	≤ 300	ND	ND	ND	ND			ND			ND	24	19	ND	21	17	ND	ND	12
Lead (total)	µg/L	10	ND	0.85	0.55	ND			ND			ND	ND	ND	ND	ND	ND	ND	0.25	0.17
Magnesium (total)	mg/L	-	8.31	8.56	9.1	8.60			16.6			6.59	6.09	6.53	9.99	8.13	8.52	7.91	8.17	7.95
Manganese (total)	µg/L	≤ 120	*28.0*	*41.0*	*59.5* [3]	ND			*20.9*			*42.4*	*35.4*	*43.6* [3]	*55.5*	*52.7*	*57.3* [3]	13.1	12.7	15.9
Mercury (total)	µg/L	1	ND	ND	ND	ND			ND			ND	ND	ND	ND	ND	ND	ND	ND	ND
pH	-	7 – 10.5	7.11	6.90	7.48	7.87			7.92			8.07	7.43	8.23	8.05	7.48	8.22	7.76	7.12	7.99
Potassium (total)	mg/L	-	1.42	1.34	1.52	1.90			2.42			3.15	2.72	3.15	3.47	2.31	2.64	2.50	2.30	2.66
Selenium (total)	µg/L	10	ND	0.61	0.51	ND			ND			ND	ND	ND	ND	ND	ND	ND	1.30	0.48
Silicon (total)	µg/L	-	-	-	7860	-			-			-	-	6750	-	-	7360	-	-	7870
Sodium (total)	mg/L	≤ 200	6.17	6.15	6.56	5.41			7.34			11.8	13.0	12.7	8.12	6.90	6.92	14.4	12.7	16.3
Sulphate	mg/L	≤ 500	28.2	33.4	34.6	50.0			40.4			28.0	27.2	28.5	44.0	44.7	46.4	59.5	54.7	65.9
Total Dissolved Solids	mg/L	≤ 500	160	161	191	190			277			144	781 [4]	158	173	188	207	189	209	206
Turbidity	NTU	-	0.1	ND	0.11	ND			ND			ND	0.16	0.1	ND	ND	0.11	ND	ND	ND
Uranium (total)	µg/L	20	ND	0.02	0.03	ND			1.03			0.42	0.37	0.41	0.92	0.19	0.27	ND	0.15	0.21
Zinc (Total)	µg/L	≤ 5000	ND	25.2	17	ND			ND			ND	ND	3.4	ND	ND	ND	ND	7.3	7.1

ND = not detectable
Not Tested = well pumps were out-of-service, thus sampling could not be completed. Farmer 2 results are not shown since the well has been out-of-service since 2010.
* 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 about other results.
1 -These are treated water criteria and only shown for comparison to raw water results. (i.e. Water treatment will improve quality before water is sent into distribution system). Black text denotes health-based maximum acceptable concentrations (MAC); light grey text denotes aesthetic objectives (AO).
2 - This result is considered an anomaly, likely due to stagnant water as Farmer 3 was not operational in 2018.
3 - Discussed in Section 3.1.2
4 -This result is considered an anomaly, likely due to lab error, since other parameters (.e.g conductivity) would show similar increases relative to previous years if there were an actual change in TDS.
5 - Farmer 3 had been out of service since Jul 2017. It is a well that requires extensive flushing after prolonged outages before water quality normalizes and water is sent to distribution. Its 2018 sampling occurred before quality had normalized.

(Page 2 of 3)

Parameter	Units	GCDWQ	Marshall 1			Marshall 3			Riverside 1			Townline 1			Townline 2		
			2016 Oct 20	**2017 Sept 27**	**2018 Sept 26**	2016 Oct 20	2017 Sept 27	**2018 Sept 26**	2016 Oct 20	2017 Sept 27	**2018 Sept 26**	2016 Oct 20	2017 Sept 27	**2018 Sept 26**	2016 Oct 20	2017 Sept 27	**2018 Sept 26**
Alkalinity (as $CaCO_3$)	mg/L	-	108	121	108	Not Tested	Not Tested	Not Tested	74	78.6	77.3	47	43.5	42	44	54.3	47.1
Aluminum (total)	µg/L	200	ND	6.4	3.1				ND	ND	ND	ND	ND	ND	ND	ND	ND
Antimony (total)	µg/L	6	ND	ND	0.13				ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic (total)	µg/L	10	ND	1.69	1.76				ND	0.55	0.63	ND	ND	0.53	ND	ND	0.41
Barium (total)	µg/L	1000	ND	13.5	14.6				ND	12.8	15.2	ND	17.4	19.2	ND	5.4	6.03
Bicarbonate (as HCO_3)	mg/L	-	108	121	108				74	78.6	77.3	47	43.5	42	44	54.3	47.1
Boron (total)	µg/L	5000	ND	24.5	19				ND	17.0	15	ND	24.8	18	42	32.2	29
Cadmium (total)	µg/L	5	ND	0.02	0.0				ND	0.01	0.01	ND	0.03	0.03	ND	0.02	0.02
Calcium (total)	mg/L	-	40.8	38.9	39.1				32.6	30.8	36.1	24.8	19.1	20.3	23.5	21.1	21.6
Carbonate (as CO_3)	mg/L	-	ND	ND	ND				ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloride	mg/L	≤ 250	30.8	31.8	29.5				19.4	21.3	22.1	10.1	10.6	9.84	6.78	12.9	6.03
Chromium (total)	µg/L	50	ND	ND	ND				ND	0.52	0.5	ND	ND	0.18	ND	ND	0.22
Colour (total)	TCU	≤ 15	ND	ND	ND				ND	ND	ND	ND	ND	ND	ND	ND	ND
Conductivity	microS/cm	-	363	348	350				280	294	301	195	181	185	178	189	178
Copper (total)	µg/L	≤ 1000	3.2	2.59	1.28				15.3	5.47	5.39	16.0	7.05	10.6	11.0	8.37	11.0
Fluoride	mg/L	1.5	ND	ND	0.03				ND	ND	0.024	ND	ND	ND	ND	ND	ND
Hardness (as $CaCO_3$)	mg/L	-	138	133	135				117	116	121	82.4	66.4	68.3	78.1	73.0	70.1
Iron (total)	µg/L	≤ 300	ND	138	42				ND	0.011	ND	ND	ND	17	140	35	145
Lead (total)	µg/L	10	ND	0.58	0.14				ND	ND	0.16	ND	0.33	0.47	ND	0.23	0.40
Magnesium (total)	mg/L	-	8.79	8.69	8.59				8.77	9.50	9.95	5.00	4.52	4.52	4.73	4.92	4.45
Manganese (total)	µg/L	≤ 120	6	10.3	7.02				ND	ND	ND	*91.7*	*71.4*	*77.4* [6]	2.3	0.85	2.06
Mercury (total)	µg/L	1	ND	ND	ND				ND	ND	ND	ND	ND	ND	ND	ND	ND
pH	-	7 – 10.5	7.90	7.40	8.13				7.35	7.19	7.91	6.82	6.63	7.3	6.88	6.77	7.32
Potassium (total)	mg/L	-	2.74	2.44	2.48				1.58	1.49	1.72	2.90	2.72	2.93	1.01	0.99	1.02
Selenium (total)	µg/L	10	ND	ND	ND				ND	ND	0.33	ND	ND	0.15	ND	ND	0.14
Silicon (total)	µg/L	-	-	-	6970				-	-	10700	-	-	9400	-	-	10100
Sodium (total)	mg/L	≤ 200	15.3	15.1	14.9				6.90	7.50	8.11	6.35	6.63	5.97	5.60	6.02	5.74
Sulphate	mg/L	≤ 500	27.8	27.8	28.6				24.2	28.3	29.9	13.7	14.0	13.7	13.7	14.1	13.4
Total Dissolved Solids	mg/L	≤ 500	213	195	218				153	176	203	142	108	136	128	117	124
Turbidity	NTU	20	0.85	0.37	0.23				0.12	ND	ND	ND	0.10	0.13	1.11	0.19	0.93
Uranium (total)	µg/L	20	0.58	0.61	0.61				ND	0.07	0.07	ND	0.02	0.02	ND	0.06	0.03
Zinc (total)	µg/L	≤ 5000	ND	ND	5.7				ND	7.7	6.4	ND	4.9	13.7	ND	7.2	8.8

ND = not detectable
Not Tested = well pumps were out-of-service, thus sampling could not be completed.
6 - Discussed in Section 3.1.2

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Parameter	Units	GCDWQ	Bevan 1			Bevan 2			Bevan 3			Bevan 4			Pine		
			2016 Oct 20	2017 Sept 27	**2018 Sept 26**	2016 Oct 20	2017 Sept 27	**2018 Sept 26**	2016 Oct 20	2017 Sept 27	**2018 Sept 26**	2016 Oct 20	2017 Sept 27	**2018 Sept 26**	2016 Oct 20	2017 Sept 27	**2018 Sept 26**
Alkalinity (as $CaCO_3$)	mg/L	-	46	51.3	46.3	50	65.3	47.8	45	53.3	45.6	40	49.3	42.2	73	73.4	72.1
Aluminum (total)	µg/L	200	ND	35.8	7.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Antimony (total)	µg/L	6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic (total)	µg/L	10	ND	ND	0.27	ND	ND	0.33	ND	ND	0.27	ND	ND	0.24	ND	ND	0.2
Barium (total)	µg/L	1000	ND	ND	5.48	ND	5.5	5.9	ND	5.2	5.42	ND	ND	5.06	ND	13.4	13.9
Bicarbonate (as HCO_3)	mg/L	-	46	51.3	46.3	50	65.3	47.8	45	53.3	45.6	40	49.3	42.2	73	73.4	72.1
Boron (total)	µg/L	5000	ND	21.0	13	ND	11.9	11	ND	12.4	11	ND	12.4	11	ND	37.0	30
Cadmium (total)	µg/L	5	ND	0.02	0.022	ND	0.018	0.019	ND	0.025	0.022	ND	0.026	0.024	ND	0.066	0.06
Calcium (total)	mg/L	-	18.3	20.2	21.1	19.1	19.8	19.5	19.5	19.7	21.2	20.2	18.6	20.9	36.7	29.7	34.7
Carbonate (as CO_3)	mg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloride	mg/L	≤ 250	13.8	19.3	20.6	14.8	14.9	16.4	14.6	19.9	19.6	17.2	17.1	18.9	55.4	49.7	55.5
Chromium (total)	µg/L	50	ND	0.54	0.21	ND	0.54	0.26	ND	ND	0.26	ND	ND	0.24	ND	ND	0.16
Colour (total)	TCU	≤ 15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Conductivity	microS/cm	-	188	210	209	191	201	190	181	204	200	184	183	195	381	338	362
Copper (total)	µg/L	≤ 1000	5.6	3.58	4.97	4.2	3.70	6.69	5.7	9.17	5.25	9.7	38.6	7.74	38.4	40.1	36
Fluoride	mg/L	1.5	ND	ND	0.024	ND	ND	0.026	ND	ND	0.024	ND	ND	0.022	ND	ND	0.02
Hardness (as $CaCO_3$)	mg/L	-	66.8	74.9	74.5	72.1	74.6	71.7	69.3	73.1	72.9	70.2	67.9	70.8	141	119	131
Iron (total)	µg/L	≤ 300	ND	16	31	ND	ND	ND	ND	ND	493 [7]	ND	12	13	ND	65	34
Lead (total)	µg/L	10	ND	ND	0.18	ND	ND	ND	ND	ND	0.25	ND	0.27	0.05	ND	0.61	0.78
Magnesium (total)	mg/L	-	5.09	5.94	6.03	5.43	6.11	5.59	4.97	5.82	5.45	4.81	5.17	5.2	11.9	10.8	9.81
Manganese (total)	µg/L mg/L	≤ 120	ND	0.62	0.78	ND	0.24	0.53	2.1	0.72	1.23	ND	0.22	1.39	*83.1*	*69.4*	38.2[8]
Mercury (total)	µg/L	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
pH	-	7 – 10.5	7.08	6.99	7.66	7.19	7.02	7.70	6.99	6.93	7.62	6.96	6.89	7.5	6.81	6.83	7.41
Potassium (total)	mg/L	-	0.90	0.96	1.07	0.93	0.99	1.02	0.93	0.97	1.02	0.93	0.95	1	1.82	1.72	1.37
Selenium (total)	µg/L	10	ND	ND	0.14	ND	ND	0.19	ND	ND	0.14	ND	ND	0.13	ND	ND	0.06
Silicon (total)	µg/L	-	-	-	11700	-	-	11800	-	-	11200	-	-	11100	-	-	7960
Sodium (total)	mg/L	≤ 200	7.08	7.16	8.16	6.19	6.59	6.79	6.62	7.52	7.59	6.33	7.04	7.55	18.4	20.2	14.7
Sulphate	mg/L	≤ 500	10.2	15.0	10.8	8.9	12.0	9.39	9.5	13.3	10.1	10.3	11.2	11.2	17.0	18.0	17.5
Total Dissolved Solids	mg/L	≤ 500	121	132	148	119	138	136	119	140	142	120	125	139	221	214	235
Turbidity	NTU	20	0.13	0.26	0.45	0.31	ND	ND	0.39	0.1	3.79	0.41	0.65	0.17	0.18	0.39	0.23
Uranium (total)	µg/L	20	ND	ND	0.01	ND	0.04	0.02	ND	ND	0.01	ND	ND	0.01	ND	0.032	0.05
Zinc (total)	µg/L	≤ 5000	ND	4.8	9.3	ND	ND	ND	ND	ND	17.4	ND	ND	7.8	ND	9.6	20.8

ND = not detectable
7- This result is an anomaly likely due to insufficient flushing before sampling.
8 - Discussed in Section 3.1.2

APPENDIX E – MONTHLY WELL MONITORING (NITRATES)

(All results expressed in mg/L as Nitrogen)

Date **	Farmer 1	Farmer 3	Industrial A	Industrial B	Industrial C
10-Jan	1.25 *	-	-	ND	0.02
8-Mar	5.54	-	-	ND	0.05
12-Apr	5.41	-	-	ND	0.40
17-May	6.67	-	-	ND	0.77
7-Jun	6.69	-	-	ND	0.91
12-Jul	6.38	***	-	ND	0.53
9-Aug	5.94	***	-	ND	0.04
6-Sep	6.24	***	-	ND	0.08
11-Oct	6.62	***	-	ND	0.02
8-Nov	-	***	-	ND	1.06
6-Dec	5.91	-	-	ND	0.11

Date	McConnell	Riverside 1	Marshall 1	Townline 1	Townline 2
10-Jan	0.10 *	-	-	1.23 *	0.99 *
8-Mar	1.17	3.54	-	4.75	4
12-Apr	5.34	6.03	-	4.83	3.41
17-May	5.61	3.56	0.10	3.54	5.31
7-Jun	5.73	3.44	0.08	5.36	3.39
12-Jul	5.48	3.41	0.20	5.73	3.41
9-Aug	4.52	2.35	0.18	5.71	3.5
6-Sep	3.47	3.02	0.15	5.4	4.34
11-Oct	0.58	2.94	0.01	5.17	4.74
8-Nov	2.25	2.62	0.03	5.22	5.21
6-Dec	0.45	3.1	0.01	4.49	5.14

Date	Bevan 1	Bevan 2	Bevan 3	Bevan 4	Pine
10-Jan	0.99 *	0.75 *	0.80 *	0.76 *	0.33
8-Mar	3.57	3.04	3.14	3.01	0.19
12-Apr	3.19	2.77	3	2.92	1.18
17-May	3.03	2.63	2.73	2.92	1.5
7-Jun	2.63	2.67	2.82	2.81	1.29
12-Jul	2.61	2.57	2.46	3	1
9-Aug	2.63	2.61	2.18	2.84	1.36
6-Sep	2.43	2.73	2.68	3.02	0.84
11-Oct	3.67	3.12	3.15	3.12	0.49
8-Nov	2.87	2.84	2.9	3.06	1.14
6-Dec	3.53	3.12	3.1	3.12	0.99

ND = not detectable

* January results are suspect as they are significantly lower than typical at almost all the wells.

** No data was collected for the month of February.

*** Farmer 3 had been out of service since Jul 2017. It is a well that requires extensive flushing after prolonged outages before water quality normalizes and water is sent to distribution. All 2018 sampling results occurred before quality had normalized.

APPENDIX F – MONTHLY WELL MONITORING (TOTAL METALS)

Parameter	Units	GCDWQ[1]	Farmer 1		Farmer 3		Industrial B		Industrial C		McConnell		Marshall 1		Townline 1		Townline 2		Pine	
			Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg
Aluminum (total)	µg/L	200	ND	ND	Results not representative.[3]		ND	ND	5.6	0.51	5.2	0.47	5.2	1.9	3.2	0.29	5.2	0.84	5.2	0.89
Antimony (total)	µg/L	6	ND	ND			0.17	0.04	0.66	0.37	0.28	0.10	0.15	0.069	ND	ND	0.18	0.016	ND	ND
Arsenic (total)	µg/L	10	0.15	0.04			9.66	8.31	8.99	7.75	4.70	3.72	1.91	1.80	0.70	0.50	1.32	0.48	0.25	0.08
Barium (total)	µg/L	1000	11.7	4.5			36	27.5	42.6	37.5	31	27.8	14.4	6.7	22	16	7.0	2.2	12.8	4.3
Boron (total)	µg/L	5000	25.6	9.7			28	9.2	15	3.4	25.7	10.6	20	9.5	21	8.8	30	13	35	12
Cadmium (total)	µg/L	5	0.08	0.02			0.06	0.01	0.19	0.03	0.11	0.03	0.03	0.03	0.05	0.04	0.06	0.03	0.12	0.07
Chromium	µg/L	50	0.46	0.08			0.27	0.03	0.14	0.02	0.35	ND	0.17	0.04	0.49	0.09	0.84	0.19	0.22	0.07
Copper (total)	µg/L	≤1000	20.6	10.5			1.8	0.7	2.2	1.0	10.2	6.7	2.1	1.5	25.4	14.6	169	23.9	106	45.1
Fluoride	mg/L	1.5	0.05	0.04			0.07	0.05	0.04	0.03	0.05	0.04	0.04	0.03	0.02	0.01	ND	ND	0.03	0.02
Hardness (as $CaCO_3$)	mg/L	-	120	111			123	101	144	133	134	124	139	133	77.3	72.6	75.7	72.0	138	107
Iron (total)	µg/L	≤300	ND	ND			29	9.2	19	5	26	6.5	166	30.1	182	27.5	-	-	89	29
Lead (total)	µg/L	10	1.21	0.81			ND	ND	ND	ND	0.25	ND	0.59	0.15	0.80	0.47	7.8	0.82	1.21	0.610
Magnesium (total)	mg/L	-	9.45	8.69			8.09	6.80	10.2	9.2	9.69	8.56	8.89	8.40	5.0	4.6	5.05	4.69	11.7	8.64
Manganese (total)	µg/L	≤120	*62.8*[2]	*58.8*[2]			*54.2*[2]	*44.4*[2]	*59.8*[2]	*54.8*[2]	*20.4*[2]	15.7	15.2	9.11	*97.1*[2]	*74.9*[2]	*76.2*[2]	13.5	*67.2*[2]	42.3
Mercury (total)	µg/L	1	0.005	0.001			0.01	0.0009	0.01	.001	0.010	.001	ND	ND	ND	ND	ND	ND	0.01	0.003
Selenium (total)	µg/L	10	0.93	0.55			ND	ND	0.08	0.02	1.11	0.66	0.050	0.007	0.25	0.12	0.26	0.17	0.12	0.06
Uranium (total)	µg/L	20	0.03	0.01			0.93	0.51	0.39	0.06	0.31	0.19	0.64	0.59	0.024	0.010	0.11	0.022	0.05	0.01
Zinc (total)	µg/L	≤ 5000	58.5	35.2			11.7	4.1	3.3	0.3	18.6	11.4	28.1	10.9	45.1	23.2	45.1	18.0	64.7	36.7

Parameter	Units	GCDWQ[1]	Bevan 1		Bevan 2		Bevan 3		Bevan 4	
			Max	Avg	Max	Avg	Max	Avg	Max	Avg
Aluminum (total)	µg/L	200	11.6	2.9	4.6	0.42	ND	ND	ND	ND
Antimony (total)	µg/L	6	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic (total)	µg/L	10	0.27	0.09	0.35	0.11	0.26	0.09	0.24	0.08
Barium (total)	µg/L	1000	5.55	2.38	6.36	2.58	5.35	1.82	5.05	1.73
Boron (total)	µg/L	5000	13.4	5.9	12	5.2	12	5.4	12	5.0
Cadmium (total)	µg/L	5	0.03	0.02	0.02	0.02	0.02	0.02	0.03	0.02
Chromium	µg/L	50	0.37	0.01	0.45	0.12	0.71	0.18	0.49	0.12
Copper (total)	µg/L	≤1000	16.1	8.30	21.3	9.21	14.8	8.45	32.9	18.03
Fluoride	mg/L	1.5	0.028	0.019	0.026	0.022	0.03	0.02	0.02	0.01
Hardness (as $CaCO_3$)	mg/L	-	86.2	78.1	91.5	77.3	83.5	74.8	75	68.6
Iron (total)	µg/L	≤300	292	51.8	24	4.0	144	44.3	151	13.7
Lead (total)	µg/L	10	0.65	0.15	0.09	0.02	0.54	0.066	0.25	0.58
Magnesium (total)	mg/L	-	6.7	6.0	7.49	6.03	6.49	5.60	5.68	4.96
Manganese (total)	mg/L	≤0.12	8.4	2.5	3.28	0.835	3.96	1.41	3.32	1.07
Mercury (total)	µg/L	1	ND	ND	ND	ND	0.01	ND	ND	ND
Selenium (total)	µg/L	10	0.29	0.18	0.22	0.16	0.27	0.16	0.20	0.14
Uranium (total)	µg/L	20	0.02	0.01	0.04	0.009	0.020	0.016	0.010	0.002
Zinc (total)	µg/L	≤ 5000	17.6	8.2	11.3	5.75	14.1	6.99	41.2	15.2

ND = not detectable
* Farmer 3 was not operational in 2018.
1 - These are treated water criteria and only shown for comparison to raw water results. (i.e. Water treatment will improve quality before water is sent into distribution system). Black text denotes health-based maximum acceptable concentrations (MAC); light grey text denotes aesthetic objectives (AO).
2 - Discussed in Section 3.1.2
3 – Farmer 3 had been out of service since Jul 2017. It is a well that requires extensive flushing after prolonged outages before water quality normalizes and water is sent to distribution. All 2018 sampling results occurred before quality had normalized.

APPENDIX G – WELL PESTICIDES & HERBICIDES SCAN

Parameters Tested (all results non-detect)		
1,2,3-Trichlorobenzene	Chlorpyrifos	Metsulfuron-methyl
1,2,4-Trichlorobenzene	cis-chlordane	Mevinphos
1-Methylnaphthalene	Clothianidin	Mirex
2,3,4,5-Tetrachlorophenol	Coumaphos	Myclobutanil
2,3,4,6-Tetrachlorophenol	Cyanazine	Naphthalene
2,3,4-Trichlorophenol	DCPMU	Nitrobenzene
2,3,5,6-Tetrachlorophenol	DDT + metabolites	N-Nitroso-di-n-propylamine
2,3,5-Trichlorophenol	delta-BHC	o,p-DDE
2,4,5-T	Diazinon	op-DDD
2,4,5-TP	Dicamba	op-DDT
2,4,5-Trichlorophenol	Dichlorvos/Naled	Oxychlordane
2,4,6-Trichlorophenol	Diclofop-methyl	p,p'-DDD
2,4-D	Dieldrin	p,p'-DDE
2,4-Dichlorophenol	Dimethoate	p,p'-DDT
2,4-DP	Dinoseb	Parathion
2-Methylnaphthalene	Disulfoton	Parathion-methyl
2-Methylphenol	Diuron	Pentachloronitrobenzene
2-Nitrophenol	Endosulfan 1	Pentachlorophenol
4,6-Dinitro-2-methylphenol	Endosulfan 2	Perylene
4-Nitrophenol	Endosulfan Sulfate	Phenanthrene
5-Nitroacenaphthene	Endrin	Phenol
a-chlordane	Endrin Aldehyde	Phorate
Alachlor	Eptam	Phosalone
Aldicarb	Ethalfluralin	Phosmet
Aldrin	Ethion	Picloram
Aldrin + Dieldrin	Fenitrothion	pp-DDD
alpha-BHC	Fenoxaprop	pp-DDE
alpha-Endosulfan	Fensulfothion	pp-DDT
Ametryn	Fenthion	Prometon
Atrazine	Fludioxonil	Prometryne
Atrazine Desethyl	Fonofos	Propachlor
Atrazine+Metabolites	gamma-BHC (Lindane)	Propanil
Atrazine+N-Dealkylated Metabolites	gamma-hexachlorocyclohexane	Propazine
Atrazine-2-hydroxy	g-chlordane	Propiconazole
Atrazine-desethyl	Heptachlor	Propoxur
Atrazine-desethyl-desisopropyl	Heptachlor Epoxide	Pyraclostrobin
Atrazine-desisopropyl	Hexachlorobenzene	Pyrene
Azinphos methyl	Hexachloroethane	Quizalofop
Azoxystrobin	Imazamethabenz-methyl	Sethoxydim
Bendiocarb	Imidacloprid	Simazine
Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Tebuthiuron
beta-BHC	Indole	Temephos
beta-Endosulfan	Iprodione	Terbufos
Boscalid	Isophorone	Terbutryn
Bromacil	Linuron	Thifensulfuron-methyl
Bromoxynil	Malathion	Tralkoxydim
Captan	MCPA	trans-chlordane
Carbaryl	Mecoprop	trans-Nonachlor
Carbofuran	Metalaxyl	Triallate
Carbophenothion	Methoxychlor	Trifloxystrobin
Carboxin	Methyl Parathion	Trifluralin
Chlorantraniliprole	Metolachlor	Triticonazole
Chlordane	Metribuzin	

Parameters highlighted with blue text are those that have been collected in previous years. Those that are in black are newly recorded this year.

APPENDIX H – WEEKLY DISTRIBUTION SYSTEM MONITORING

System Wide Statistics

Overall

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	2127	1	1.89	1.00	7.02	1.25	0.19
2017	2188	5	2.02	1.04	6.98	1.21	0.20
2018	**2054**	**6**	**1.97**	**1.14**	**7.48**	**1.54**	**0.22**

Transmission

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	255	0	1.66	1.12	6.70	0.91	0.26
2017	260	1	2.02	1.24	6.80	0.94	0.28
2018	**249**	**4**	**1.97**	**1.32**	**7.18**	**0.81**	**0.24**

Abbotsford

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	1404	1	1.49	0.78	7.20	0.63	0.14
2017	1458	2	1.56	0.83	7.01	0.79	0.16
2018	**1347**	**1**	**1.97**	**0.95**	**7.49**	**1.54**	**0.20**

Mission

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	468	0	1.89	1.07	6.70	1.25	0.27
2017	470	2	1.63	1.08	6.82	1.21	0.28
2018	**458**	**1**	**1.82**	**1.16**	**7.35**	**0.83**	**0.25**

Transmission System Sample Locations

Ainsworth

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	52	0	1.66	1.28	6.40	0.53	0.32
2017	51	0	1.60	1.36	6.60	0.70	0.35
2018	**50**	**1**	**1.93**	**1.49**	**7.25**	**0.81**	**0.33**

Cannon 600

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	52	0	1.42	1.08	6.70	0.49	0.31
2017	52	0	2.02	1.19	6.80	0.64	0.33
2018	**51**	**1**	**1.94**	**1.26**	**7.65**	**0.72**	**0.31**

Cannon 400

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	52	0	1.19	0.91	6.70	0.52	0.31
2017	54	0	1.39	1.22	6.80	0.72	0.33
2018	**51**	**2**	**1.97**	**1.38**	**7.23**	**0.59**	**0.31**

Bell Road

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	52	0	1.50	1.15	6.60	0.91	0.22
2017	52	1	1.54	1.28	6.71	0.94	0.18
2018	**51**	**0**	**1.60**	**1.30**	**6.42**	**0.29**	**0.08**

Maclure

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	52	0	1.50	1.15	6.70	0.55	0.15
2017	**50**	**0**	**1.47**	**1.17**	**6.80**	**0.70**	**0.19**
2018	**50**	**0**	**1.40**	**1.17**	**7.12**	**0.52**	**0.18**

Mission Distribution Sample Locations

M1

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	1.31	1.05	7.00	1.11	0.18
2017	54	1	1.35	1.09	7.00	0.72	0.21
2018	**51**	**0**	**1.49**	**1.13**	**7.19**	**0.48**	**0.17**

M2

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	1.31	1.00	6.77	0.76	0.40
2017	52	0	1.29	1.03	6.81	0.67	0.34
2018	**51**	**0**	**1.45**	**1.08**	**7.35**	**0.61**	**0.29**

M3

	# Micro Samples	# with Tot. Col.	Total Cl (mg.L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	1.35	0.97	6.70	0.84	0.39
2017	52	0	1.38	1.04	6.80	1.21	0.37
2018	**51**	**1**	**1.57**	**1.22**	**7.14**	**0.70**	**0.30**

M5

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	1.47	1.07	7.00	0.52	0.16
2017	54	1	1.55	1.12	6.80	0.56	0.23
2018	**51**	**0**	**1.36**	**1.06**	**7.31**	**0.47**	**0.21**

M6

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	1.89	1.05	6.60	0.96	0.42
2017	51	0	1.63	1.15	6.87	0.66	0.34
2018	**50**	**0**	**1.76**	**1.24**	**7.27**	**0.60**	**0.29**

M7

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	1.52	1.20	6.70	0.79	0.18
2017	52	0	1.58	1.19	6.80	0.55	0.20
2018	**51**	**0**	**1.53**	**1.26**	**7.23**	**0.59**	**0.19**

M8

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	1.34	1.06	6.60	0.64	0.30
2017	51	0	1.40	1.13	6.90	0.86	0.35
2018	**51**	**0**	**1.82**	**1.28**	**7.63**	**0.62**	**0.30**

M9

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	1.50	1.26	6.60	0.41	0.17
2017	52	0	1.60	1.26	6.80	0.67	0.20
2018	**51**	**0**	**1.56**	**1.32**	**6.69**	**0.83**	**0.19**

M10

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	1.26	0.94	6.80	1.25	0.25
2017	52	0	1.49	0.87	6.90	0.63	0.28
2018	**51**	**0**	**1.19**	**0.87**	**7.81**	**0.54**	**0.28**

Abbotsford West Distribution Sample Locations

W1

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	52	0	1.23	0.96	6.99	0.36	0.14
2017	54	0	1.36	1.06	7.04	0.40	0.15
2018	**50**	**0**	**1.44**	**1.13**	**7.56**	**0.46**	**0.18**

W2

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	52	0	1.33	1.05	7.10	0.23	0.12
2017	54	0	1.38	1.13	7.09	0.49	0.16
2018	**50**	**0**	**1.58**	**1.22**	**7.55**	**0.74**	**0.20**

W3

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	52	0	1.49	1.12	7.19	0.27	0.12
2017	54	0	1.56	1.17	7.00	0.55	0.16
2018	**50**	**0**	**1.74**	**1.28**	**7.48**	**0.48**	**0.18**

W4

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	52	0	1.31	0.86	6.99	0.28	0.13
2017	54	0	1.35	0.89	6.90	0.48	0.17
2018	**50**	**0**	**1.47**	**0.97**	**7.26**	**0.55**	**0.19**

W5

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	52	0	1.43	1.11	7.09	0.49	0.13
2017	56	1	1.49	1.16	6.97	0.55	0.16
2018	**50**	**0**	**1.81**	**1.33**	**7.45**	**0.72**	**0.21**

W6

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	52	0	1.37	1.07	7.03	0.30	0.13
2017	54	0	1.47	1.09	6.90	0.49	0.16
2018	**50**	**0**	**1.97**	**1.18**	**7.36**	**0.77**	**0.20**

W7

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	52	0	1.15	0.68	6.93	0.54	0.14
2017	54	0	1.31	0.72	6.81	0.42	0.15
2018	**50**	**0**	**1.54**	**0.82**	**7.14**	**0.84**	**0.19**

W8

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	52	0	1.43	0.51	6.97	0.63	0.27
2017	54	0	1.23	0.47	6.85	0.64	0.18
2018	**50**	**0**	**1.17**	**0.56**	**7.15**	**0.80**	**0.22**

W9

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	52	0	1.13	0.43	6.97	0.32	0.13
2017	54	0	0.97	0.50	6.78	0.31	0.14
2018	**50**	**0**	**1.60**	**0.65**	**7.2**	**0.72**	**0.18**

W11

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	52	1	1.22	0.84	7.22	0.37	0.14
2017	54	0	1.34	0.96	7.15	0.70	0.18
2018	**49**	**0**	**1.33**	**1.06**	**7.58**	**1.12**	**0.23**

W13

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	52	0	1.05	0.54	7.24	0.55	0.15
2017	54	0	1.16	0.67	7.15	0.53	0.17
2018	**50**	**0**	**1.21**	**0.75**	**7.59**	**0.35**	**0.20**

W14

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	52	0	0.86	0.42	7.13	0.35	0.14
2017	54	0	1.09	0.64	7.10	0.45	0.17
2018	**50**	**0**	**1.00**	**0.62**	**7.52**	**0.62**	**0.25**

W15

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	52	0	1.43	1.10	7.25	0.59	0.13
2017	54	0	1.44	1.16	7.04	0.67	0.16
2018	**50**	**0**	**1.77**	**1.27**	**7.40**	**1.54**	**0.20**

W16

Year	# Micro Samples	# with Tot. Col.	Total Cl (mg/L) Max	Total Cl (mg/L) Avg	pH Median	Turbidity (NTU) Max	Turbidity (NTU) Avg
2016	52	0	1.21	0.85	7.39	0.29	0.15
2017	54	0	1.33	0.96	7.20	0.79	0.18
2018	**50**	**0**	**1.29**	**0.98**	**7.68**	**0.39**	**0.21**

Abbotsford East Distribution Sample Locations

E2

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	1.21	0.85	7.47	0.28	0.13
2017	53	0	1.25	0.83	7.12	0.46	0.15
2018	**50**	**0**	**1.38**	**0.85**	**7.52**	**0.41**	**0.20**

E3

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	1	1.31	0.79	7.31	0.30	0.14
2017	53	0	1.30	0.77	7.07	0.46	0.17
2018	**50**	**0**	**1.37**	**0.83**	**7.49**	**0.35**	**0.19**

E4

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	1.31	0.76	7.39	0.45	0.14
2017	54	0	1.05	0.50	7.00	0.45	0.17
2018	**50**	**0**	**1.23**	**0.65**	**7.47**	**0.88**	**0.20**

E5

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	0.85	0.44	7.24	0.29	0.13
2017	54	0	0.91	0.34	6.82	0.39	0.16
2018	**49**	**0**	**1.09**	**0.39**	**7.44**	**0.37**	**0.18**

E6

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	0.86	0.37	7.60	0.23	0.13
2017	53	0	1.28	0.85	7.20	0.46	0.17
2018	**50**	**0**	**1.42**	**0.86**	**7.48**	**0.59**	**0.22**

E7

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	1.24	0.74	7.30	0.24	0.13
2017	54	0	0.95	0.28	6.95	0.43	0.16
2018	**50**	**0**	**1.10**	**0.35**	**7.42**	**0.52**	**0.19**

E8

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	0.78	0.30	7.10	0.24	0.14
2017	54	0	0.91	0.46	6.82	0.52	0.16
2018	**50**	**0**	**1.26**	**0.64**	**7.44**	**1.02**	**0.21**

E9

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	1.06	0.52	7.35	0.21	0.12
2017	54	0	1.41	1.02	7.12	0.45	0.16
2018	**50**	**0**	**1.46**	**1.14**	**7.64**	**0.37**	**0.19**

E10

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	1.40	0.91	7.38	0.28	0.13
2017	54	0	1.37	1.08	7.14	0.44	0.15
2018	**50**	**0**	**1.48**	**1.22**	**7.67**	**0.43**	**0.19**

E11

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	1.38	0.98	7.36	0.49	0.13
2017	54	0	1.38	1.12	7.08	0.43	0.15
2018	**49**	**0**	**1.50**	**1.20**	**7.73**	**0.43**	**0.20**

E12

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	1.29	1.03	7.48	0.27	0.13
2017	54	0	1.41	1.18	7.12	0.51	0.17
2018	**50**	**0**	**1.69**	**1.31**	**7.66**	**0.39**	**0.19**

E13

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	1.38	1.13	7.33	0.20	0.12
2017	56	1	1.37	1.13	7.21	0.49	0.16
2018	**50**	**0**	**1.53**	**1.18**	**7.58**	**0.31**	**0.17**

E14

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	1.35	0.97	7.28	0.28	0.13
2017	54	0	1.46	0.97	6.96	0.54	0.17
2018	**50**	**0**	**1.48**	**0.92**	**7.42**	**0.55**	**0.19**

E15

	# Micro Samples	# with Tot. Col.	Total Cl (mg/L)		pH	Turbidity (NTU)	
			Max	Avg	Median	Max	Avg
2016	52	0	1.33	0.87	7.39	0.28	0.13
2017	53	0	1.45	1.03	7.28	0.47	0.16
2018	**50**	**0**	**1.51**	**1.17**	**7.65**	**0.36**	**0.20**

APPENDIX I – QUARTERLY DISTRIBUTION SYSTEM MONITORING (TOTAL METALS)

Abbotsford (page 1 of 2)

Parameter	Units	GCDWQ	W1		W2		W3		W4		W5		W6		W7		W8		W9		W11		W13		W14		W15		W16	
			Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg
Aluminum (total)	µg/L	100	76.10	50.90	65.80	46.10	61.60	44.53	69.70	39.13	54.90	43.73	56.40	43.60	63.80	32.20	45.60	26.67	49.80	26.60	84.00	48.33	43.00	36.83	77.70	45.40	58.70	44.57	72.50	47.67
Antimony (total)	µg/L	6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic (total)	µg/L	10	0.25	0.17	0.26	0.09	0.28	0.09	0.37	0.12	0.29	0.10	0.32	0.11	0.36	0.12	0.47	0.16	0.59	0.20	0.36	0.12	0.22	0.07	0.30	0.10	0.27	0.09	0.31	0.10
Barium (total)	µg/L	1000	5.70	3.68	5.63	3.63	5.59	3.56	8.18	4.04	5.17	3.40	3.21	4.34	91.60	4.34	15.40	6.29	12.80	5.32	11.00	5.34	6.23	4.13	12.50	5.88	5.63	3.71	7.04	4.07
Beryllium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bismuth (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron (total)	µg/L	5000	ND	ND	ND	ND	ND	ND	10.00	3.33	ND	ND	ND	ND	13.00	4.33	24.00	8.00	22.00	7.33	13.00	4.33	ND	ND	11.00	3.67	ND	ND	ND	ND
Cadmium (total)	µg/L	50	ND	ND	ND	ND	ND	ND	0.02	0.01	ND	ND	0.02	0.01	0.02	0.01	0.03	0.01	0.02	0.01	0.01	0.003	0.01	0.002	0.01	0.004	ND	ND	0.01	0.002
Calcium (total)	µg/L	-	2460	2318	2260	2157	2200	2147	1590	6750	2510	2153	2880	2280	22800	9080	22300	9297	23900	9623	9790	4777	3010	2543	7680	4110	2150	2087	5400	3360
Chromium (total)	µg/L	50	0.20	0.11	0.10	0.03	0.11	0.04	0.31	0.14	1.22	0.41	ND	ND	2.40	0.97	0.33	0.16	0.22	0.12	0.21	0.07	ND	ND	0.43	0.18	0.14	0.05	0.16	0.09
Cobalt (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper (total)	µg/L	≤1000	3.22	2.96	1.65	1.03	2.24	1.75	1.61	0.97	1.17	0.72	0.78	0.51	1.64	1.09	374	198.9	2.20	1.05	2.09	1.57	0.76	0.48	2.74	2.08	5.47	4.34	5.11	4.44
Hardness (as $CaCO_3$)	mg/L	-	7.23	6.84	6.76	6.45	6.55	6.42	56.00	22.97	7.76	6.56	9.09	7.01	79.70	30.97	74.50	30.23	81.50	32.22	32.40	15.28	9.09	7.74	25.30	13.14	6.48	6.28	17.40	10.42
Iron (total)	µg/L	≤300	21.00	11.67	18.00	9.33	25.00	12.67	25.00	12.67	20.00	6.67	5.00	9.33	35.00	21.67	34.00	17.00	30.00	14.00	16.00	9.00	26.00	16.00	31.00	17.00	17.00	5.67	20.00	10.67
Lead (total)	µg/L	10	ND	ND	0.07	0.04	0.1	0.06	ND	ND	ND	ND	0.08	0.03	ND	ND	2.39	1.06	ND	ND	0.08	0.05	ND	ND	0.15	0.09	0.13	0.08	0.07	0.04
Lithium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium (total)	mg/L	-	0.27	0.26	0.27	0.26	0.26	0.26	3.94	1.48	0.37	0.29	0.46	0.32	5.52	2.01	4.56	1.70	5.32	2.00	1.92	0.81	0.38	0.34	1.48	0.70	0.27	0.26	0.95	0.49
Manganese (total)	µg/L	≤120	0.7	0.59	0.51	0.30	0.46	0.28	2.03	1.07	0.53	0.25	0.54	0.31	3.46	1.45	45.70	16.17	37.20	14.11	18.30	6.50	3.53	2.77	23.00	9.65	0.60	0.28	8.64	3.21
Mercury (total)	µg/L	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum (total)	µg/L	-	0.30	0.16	0.30	0.18	0.30	0.17	0.22	0.13	0.31	0.18	0.27	0.16	0.19	0.12	0.28	0.17	0.35	0.20	0.27	0.16	0.32	0.20	0.26	0.16	0.28	0.17	0.28	0.18
Nickel (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.90	0.30	ND	ND	ND	ND	ND	ND	1.15	0.38	ND	ND	ND	ND
Phosphorus (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium (total)	µg/L	-	91.00	59.33	91.00	60.00	91.00	58.33	803	301.7	111	64.33	134	73.00	1230	449.7	2220	791.3	2050	735	899	330	123	79	566	221.7	99	62.33	463	187.7
Selenium (total)	µg/L	10	0.09	0.03	0.09	.03	0.07	0.04	0.14	0.09	0.08	0.04	0.06	0.02	0.19	0.09	0.14	0.07	0.15	0.07	0.07	0.05	0.06	0.02	0.06	0.02	0.06	0.04	0.06	0.02
Silicon (total)	µg/L	-	2370	2275	2300	2295	2340	2275	7890	5100	2400	2330	2520	2400	10500	6460	8830	5700	8910	5755	4710	3470	2610	2510	3840	3040	2290	2270	3360	2810
Silver (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium (total)	µg/L	≤200000	907	575	923	606	931	612	600	2295	1080	651	1200	696	8450	3118	9080	3373	9600	3531	3980	1630	1160	730	2930	1288	919	606	2220	1060
Strontium (total)	µg/L	-	7.12	6.72	6.82	6.81	6.89	6.72	83.70	45.49	9.16	7.68	11.30	8.83	121	64.38	148	79	141	75.80	59.60	33.38	9.72	9.46	41.80	24.88	6.90	6.74	30	18.96
Sulfur (total)	µg/L	-	ND	ND	ND	ND	ND	ND	3340	1670	ND	ND	ND	ND	4860	2430	4970	2485	5630	2815	1870	935	ND	ND	1160	580	ND	ND	730	365
Tellurium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Thallium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Thorium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tin (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Titanium (total)	µg/L	-	0.37	0.12	ND	ND	ND	ND	0.34	0.11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33	0.11	ND	ND	0.36	0.12	ND	ND	0.38	0.13
Uranium (total)	µg/L	20	0.03	0.02	0.03	0.02	0.03	0.02	0.05	0.03	0.03	0.02	0.03	0.02	0.05	0.03	0.04	0.03	0.08	0.04	0.04	0.02	0.03	0.02	0.03	0.02	0.03	0.02	0.03	0.02
Vanadium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	0.62	0.21	ND	ND	ND	ND	0.70	0.23	0.62	0.40	0.65	0.22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc (total)	µg/L	≤5000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	33.90	13.23	4.50	1.50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zirconium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = not detectable

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Parameter	Units	GCDWQ	E2		E3		E4		E5		E6		E7		E8		E9		E10		E11		E12		E13		E14		E15	
			Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg
Aluminum (total)	µg/L	100	59.90	41.97	65.10	43.77	42.90	36.10	29.30	26.93	66.20	44.80	33.50	30.83	70.80	44.60	87.20	59.27	72.40	50.97	61.60	43.83	56.70	42.03	57.30	42.63	63.60	34.40	66.90	47.17
Antimony (total)	µg/L	6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic (total)	µg/L	10	0.43	0.27	0.47	0.28	0.68	0.39	0.53	0.33	0.53	0.31	0.56	0.35	0.51	0.29	0.30	0.18	0.30	0.20	0.31	0.20	0.29	0.18	0.32	0.20	0.38	0.22	0.30	0.19
Barium (total)	µg/L	1000	7.44	4.27	6.94	4.15	6.59	3.59	7.78	4.56	8.83	4.75	7.84	4.48	7.06	4.05	5.56	3.65	5.96	3.61	5.85	3.77	5.66	3.63	5.79	3.75	6.82	3.79	5.45	3.52
Beryllium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bismuth (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron (total)	µg/L	5000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	12.00	4.00	ND	ND
Cadmium (total)	µg/L	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02	0.01	ND	ND	ND	ND	ND	ND	ND	ND	0.02	0.01	ND	ND
Calcium (total)	µg/L	-	5050	3223	4480	2947	4760	3460	5810	4087	5480	3393	5690	3850	5310	3367	2230	2137	2320	2170	2270	2220	2220	2093	2530	2290	20100	8093	2470	2317
Chromium (total)	µg/L	50	0.12	0.04	0.29	0.10	0.33	0.16	1.02	0.34	0.28	0.09	0.12	0.04	0.14	0.05	0.27	0.13	0.21	0.07	ND	NDE	0.18	0.09	0.29	0.10	0.21	0.07	0.11	0.04
Cobalt (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper (total)	µg/L	≤1000	3.08	2.52	3.40	2.98	2.68	2.11	1.68	1.42	2.59	1.98	3.26	2.82	2.20	1.83	3.36	2.60	3.08	2.41	1.55	1.35	3.18	2.72	2.51	2.10	2.14	1.30	2.20	1.94
Hardness (as CaCO3)	mg/L	-	16.60	10.13	14.70	9.26	15.50	10.86	19.30	13.10	18.50	10.90	18.90	12.31	17.40	10.59	6.67	6.37	6.92	6.47	6.85	6.62	6.66	6.28	7.48	6.81	70.80	27.76	7.19	6.79
Iron (total)	µg/L	≤300	14	4.67	14	8.33	16	9.67	15	10	22	7.33	24	15.33	19	6.33	19	10.33	18	6	12	4	13	4.33	ND	ND	16	5.33	15	11.67
Lead (total)	µg/L	10	0.1	0.06	0.06	0.02	0.06	0.02	ND	ND	0.06	0.02	ND	ND	0.06	0.02	0.16	0.09	0.09	0.05	0.05	0.02	0.07	0.05	0.07	0.02	0.06	0.04	0.07	0.02
Lithium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium (total)	mg/L	-	0.97	0.50	0.84	0.46	0.89	0.54	1.16	0.70	1.17	0.59	1.14	0.65	1.00	0.53	0.27	0.25	0.28	0.26	0.29	0.26	0.27	0.25	0.28	0.26	5.04	1.85	0.26	0.24
Manganese (total)	µg/L	≤120	8.12	7.05	9.58	7.49	5.35	4.00	10.30	7.22	9.42	7.49	11.30	7.69	8.67	7.21	7.21	2.81	0.43	0.23	0.42	0.26	0.29	0.16	0.38	0.21	1.41	0.65	0.85	0.68
Mercury (total)	µg/L	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum (total)	µg/L	-	0.32	0.19	0.32	0.17	0.29	0.20	0.37	0.24	0.32	0.18	0.32	0.20	0.31	0.17	0.28	0.16	0.28	0.16	0.29	0.18	0.31	0.18	0.30	0.20	0.20	0.13	0.28	0.16
Nickel (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phosphorus (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium (total)	µg/L	-	261.0	121.7	240	113.3	283	145	307	159.7	299	147.3	283	144.3	262	119.7	85.00	54.67	83.00	55.00	93.00	59.67	84.00	55.33	97.00	58.67	977	354.3	90.00	58.67
Selenium (total)	µg/L	10	0.06	0.02	0.06	0.02	0.07	0.02	0.09	0.05	0.08	0.05	0.08	0.04	0.08	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.19	0.08	ND	ND
Silicon (total)	µg/L	-	3160	2735	3010	2610	3210	2910	3200	3060	3400	2850	3100	2880	3270	2690	2420	2305	2510	2325	2550	2435	2500	2405	2490	2490	9710	5980	2430	2430
Silver (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium (total)	µg/L	≤200000	1930	965	1740	886.7	1800	1027	1960	1127	2210	1083	1860	1047	1900	916.7	913	596.3	960	605.3	966	634	941	612	1040	660	7270	2717	940	611.3
Strontium (total)	µg/L	-	18.40	13.15	16.40	11.94	18.20	15.05	22.20	18.15	20.20	14.52	22.20	17.05	20.00	13.54	6.58	6.54	6.79	6.56	6.90	6.73	6.55	6.48	7.88	7.19	97.70	52.15	8.36	8.11
Sulfur (total)	µg/L	-	940	470	690	345	590	295	1190	910	1050	525	1260	630	1010	505	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4200	2100	ND	ND
Tellurium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Thallium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Thorium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tin (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Titanium (total)	µg/L	-	ND	ND	0.35	0.12	ND	ND	ND	ND	0.32	0.11	ND	ND	0.36	0.12	0.37	0.12	0.34	0.11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Uranium (total)	µg/L	20	0.04	0.02	0.04	0.03	0.04	0.03	0.05	0.03	0.04	0.03	0.04	0.03	0.05	0.03	0.04	0.03	0.03	0.02	0.03	0.02	0.03	0.02	0.03	0.02	0.06	0.03	0.03	0.02
Vanadium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.64	0.21	ND	ND
Zinc (total)	µg/L	≤5000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zirconium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = not detectable

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Parameter	Units	GCDWQ	M1		M2		M3		M5		M6		M7		M8		M9		M10		Ainsworth	
			Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg
Aluminum (total)	µg/L	100	38.60	34.80	16.80	11.40	38.50	21.38	43.20	39.15	26.40	12.55	58.90	43.15	38.90	29.20	59.60	44.68	45.30	27.80	18.10	13.80
Antimony (total)	µg/L	6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic (total)	µg/L	10	0.34	0.23	0.15	0.13	0.18	0.15	0.36	0.23	0.16	0.13	0.29	0.22	0.16	0.13	0.32	0.23	0.18	0.15	0.15	0.14
Barium (total)	µg/L	1000	7.63	5.55	12.10	10.54	4.27	3.66	7.44	5.55	14.50	10.53	7.12	5.26	2.01	1.84	6.73	5.33	9.68	8.98	3.34	2.82
Beryllium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bismuth (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron (total)	µg/L	5000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium (total)	µg/L	50	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Calcium (total)	µg/L	-	3310	2703	1480	1400	2070	1800	3670	3008	1380	1353	2750	2125	2270	1970	2690	2043	2360	2053	1370	1303
Chromium (total)	µg/L	50	0.36	0.27	1.01	0.44	0.27	0.15	0.31	0.16	0.63	0.30	0.31	0.16	0.21	0.13	0.12	0.06	0.43	0.22	0.25	0.12
Cobalt (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper (total)	µg/L	≤1000	1.12	0.95	1.42	0.77	1.01	0.48	1.18	0.65	2.69	1.65	2.03	1.72	0.59	0.15	18.50	14.35	1.25	0.47	5.98	4.50
Hardness (as CaCO3)	mg/L	-	9.36	7.65	4.43	4.19	5.70	5.04	10.40	8.36	4.19	4.10	8.23	6.35	6.08	5.33	8.06	6.16	6.46	5.71	4.15	4.00
Iron (total)	µg/L	≤300	17.00	14.00	36.00	27.75	34.00	25.75	33.00	19.00	61.00	46.50	19.00	11.25	19.00	15.50	11.00	2.75	58.00	37.75	16.00	10.50
Lead (total)	µg/L	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.07	0.05	ND	ND	0.05	0.01
Lithium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium (total)	mg/L	-	0.27	0.22	0.18	0.17	0.14	0.13	0.29	0.21	0.18	0.18	0.33	0.25	0.11	0.10	0.33	0.26	0.17	0.14	0.21	0.18
Manganese (total)	µg/L	≤120	1.02	0.44	7.02	4.22	3.00	2.38	0.85	0.43	19.90	7.34	0.63	0.29	2.76	1.90	0.17	0.08	3.37	2.54	4.42	3.28
Mercury (total)	µg/L	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum (total)	µg/L	-	0.41	0.28	0.08	0.07	0.08	0.07	0.38	0.27	0.08	0.06	0.37	0.26	0.08	0.07	0.41	0.27	0.11	0.09	0.08	0.07
Nickel (total)	µg/L	-	ND	ND	1.10	0.28	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phosphorus (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium (total)	µg/L	-	110	61.25	ND	ND	51.00	12.75	114	62.00	55.00	13.75	100	57.75	ND	ND	97.00	62.50	54.00	13.50	86.00	21.50
Selenium (total)	µg/L	10	0.08	0.02	0.14	0.04	0.14	0.03	0.16	0.04	0.16	0.04	0.13	0.03	0.07	0.02	0.09	0.02	0.05	0.01	0.09	0.02
Silicon (total)	µg/L	-	2640	2405	1350	1315	1360	1343	2710	2425	1400	1308	2640	2278	1490	1420	2660	2300	1650	1450	1400	1315
Silver (total)	µg/L	-	ND	ND	0.01	ND	0.03	0.01	0.01	ND	0.03	0.01	0.01	ND	0.29	0.07	0.03	0.01	0.01	ND	ND	ND
Sodium (total)	µg/L	≤200000	1260	1039	3130	2755	3470	2848	1260	953	3280	2825	1210	901	2910	2720	1190	927	2970	2575	3300	2980
Strontium (total)	µg/L	-	9.50	7.33	4.79	4.69	6.35	5.87	9.19	7.50	4.88	4.77	7.80	6.02	6.54	6.12	7.70	5.99	7.23	6.17	4.70	4.53
Sulfur (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tellurium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Thallium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Thorium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tin (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.15	0.04	ND	ND	ND	ND	ND	ND
Titanium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	0.48	0.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Uranium (total)	µg/L	20	0.03	0.02	ND	ND	ND	ND	0.03	0.02	ND	ND	0.03	0.02	ND	ND	0.03	0.02	ND	ND	ND	ND
Vanadium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	0.55	0.14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc (total)	µg/L	≤5000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zirconium (total)	µg/L	-	ND	ND	ND	ND	ND	ND	ND	ND	0.07	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = not detectable

APPENDIX J – QUARTERLY DISTRIBUTION SYSTEM MONITORING (DBPS)

Trihalomethanes (μg/L)

Date	Location	A Chloroform	B Bromoform	C Bromodichloro-methane	D Dibromochloro-methane	Total (A + B + C + D)
22-Mar-18	Maclure Reservoir	12.7	ND	ND	ND	**12.7**
	E4	ND	ND	ND	ND	**ND**
	W9	ND	ND	ND	ND	**ND**
	W11	12.3	ND	ND	ND	**12.3**
	M7	12.9	ND	ND	ND	**12.9**
21-Jun-18	Maclure Reservoir	23.7	ND	ND	ND	**23.7**
	E4	18.9	ND	ND	ND	**18.9**
	W9	ND	ND	ND	ND	**ND**
	W11	13	ND	ND	ND	**13**
	M7	23.9	ND	ND	ND	**23.9**
20-Sept-18	Maclure Reservoir	22.6	ND	ND	ND	**22.6**
	E4	23.6	ND	ND	ND	**23.6**
	W9	22.1	ND	ND	ND	**22.1**
	W11	25.2	ND	ND	ND	**25.2**
	M7	18.5	ND	ND	ND	**18.5**
13-Dec-18	Maclure Reservoir	23.7	ND	ND	ND	**23.7**
	E4	17.6	ND	ND	ND	**17.6**
	W9	ND	ND	ND	ND	**ND**
	W11	18.7	ND	ND	ND	**18.7**
	M7	23	ND	ND	ND	**23**

Haloacetic Acids (μg/L)

Date	Location	A Monobromo-acetic acid	B Dibromo-acetic acid	C Monochloro-acetic acid	D Dichloro-acetic acid	E Trichloro acetic acid	Total (A + B + C + D + E)
22-Mar-18	Cannons Pit 400	ND	ND	ND	10.1	6.8	**16.9**
	Cannons Pit 600	ND	ND	ND	10.1	6.8	**16.9**
	Shook	ND	ND	ND	12.3	6	**18.3**
	Maclure Reservoir	ND	ND	ND	13	5.7	**18.7**
21-Jun-18	Cannons Pit 400	ND	ND	ND	12.8	6.7	**19.5**
	Cannons Pit 600	ND	ND	ND	13.9	10.7	**24.6**
	Shook	ND	ND	ND	21.9	13	**34.9**
	Maclure Reservoir	ND	ND	ND	22.2	12.4	**34.6**
20-Sept-18	Cannons Pit 400	ND	ND	ND	8.1	10.2	**18.3**
	Cannons Pit 600	ND	ND	ND	11.1	18	**29.1**
	Shook	ND	ND	ND	10.9	8.8	**19.7**
	Maclure Reservoir	ND	ND	ND	15.7	10.9	**26.6**
13-Dec-18	Cannons Pit 400	ND	ND	ND	6.8	7	**13.8**
	Cannons Pit 600	ND	ND	ND	8.2	9.2	**17.4**
	Shook	ND	ND	ND	13.6	10	**23.6**
	Maclure Reservoir	ND	ND	ND	12.2	7.6	**19.8**

ND = not detectable