Fernwood and Highland Water Service

2021 Annual Report

CRD | Drinking Water

INTRODUCTION

This report provides a summary of the Fernwood and Highland Water Service for 2021. It includes a description of the service, summary of the water supply, demand and production, drinking water quality, operations highlights, capital project updates and financial report.

SERVICE DESCRIPTION

In 2010 the Highland and Fernwood water services merged to construct new water treatment plant to operate as a single water system. Both former water services hold legacy budgets to repay existing debt and outstanding capital works. The service obtains its drinking water from St. Mary Lake, which lies within an uncontrolled multi-use watershed. The Capital Regional District (CRD) holds five licenses to divert a total of up to 230,000 m^3 per year and store up to 30,800 m^3. St. Mary Lake is subject to seasonal water quality changes and is affected by periodic algae blooms.

The Highland service was first developed in the 1970's under the name Vesuvius Holdings and was converted to the Highland Water System in 1978. It then became a CRD service in 2004. The Fernwood service was created in the 1970's by a private developer and was converted to the Fernwood Improvement Water District in 1984. It then became a Capital Regional District (CRD) service in 1989. The Fernwood and Highland Water Service (Figure 1) is comprised of 333 parcels of land with 321 of those parcels connected to the service.

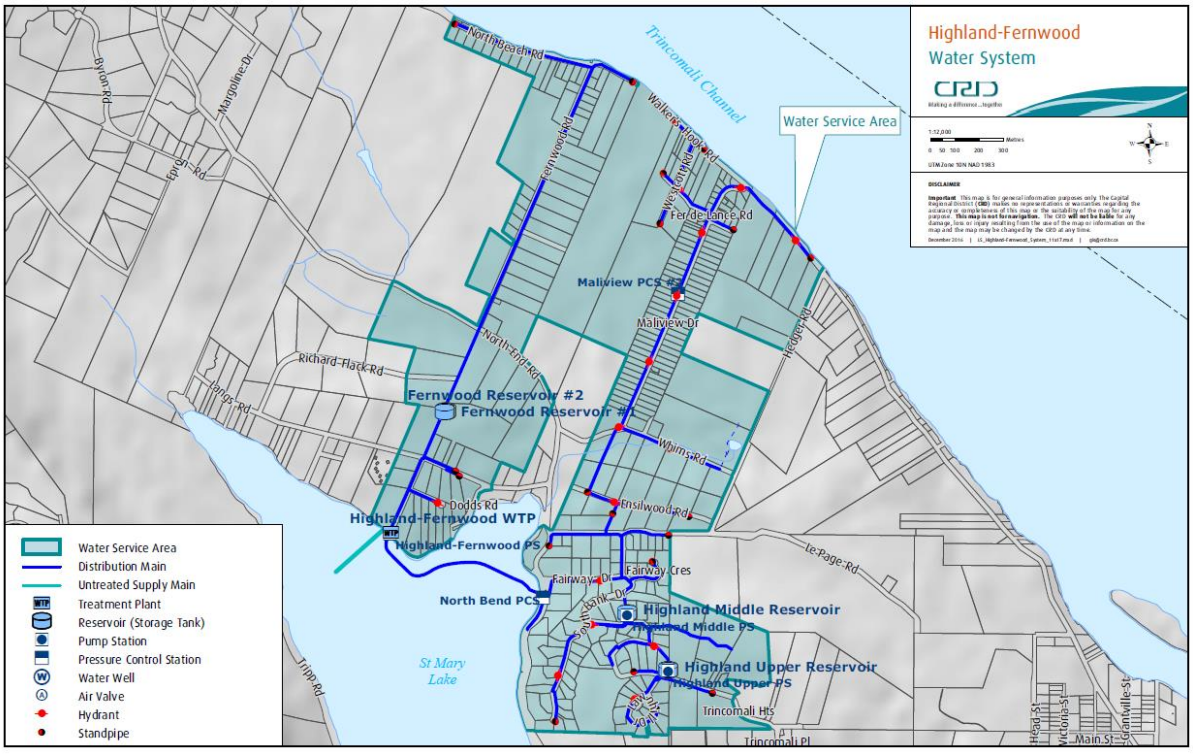

Figure 1: Fernwood and Highland Water Service

The Fernwood and Highland water system is primarily comprised of:

- a water treatment plant (WTP) that draws water from St. Mary Lake and treats it at a location on Maycock Road, adjacent to the lake. The water is treated using a rapid mix system, flocculation, dissolved air floatation (DAF) and filters, ultraviolet disinfection, then chlorination prior to being pumped, via the distribution system to two different reservoirs. The WTP design flow rate is 11.3 l/sec (150 Igpm);
- one raw water pump station on Maycock Road, adjacent to the lake. (flow rate of two pumps running is 4.6 l/sec (60 Igpm);
- approximately 12,000 m of water distribution pipe;
- 4 water reservoirs – one 180 m^3 (40,000 Ig) on the Highland system, one 91 m^3 (20,000 Ig) on the Highland system, one 45 m^3 (10,000 Ig) on the Fernwood system and, one 91 m^3 (20,000 Ig) on the Fernwood system;
- 2 water system booster pumps:
  - One located at the Highlands Middle Reservoir
  - One located at the Highlands Upper Reservoir
- fire hydrants, standpipes, and gate valves;
- water service connections complete with water meters;
- 2 pressure reducing valve stations - one on North End Road and one on Maliview Drive.

WATER PRODUCTION AND DEMAND

Referring to Figure 2, 689,637 cubic meters (m^3) of water was extracted (water production) from St. Marys Lake in 2021; a 12% decrease from the previous year and a 16% decrease from the five year rolling average. Water demand (customer water billing) for the service totalled 52,834 m^3 of water; a 6% increase from the previous year and a 5% increase from the five year rolling average. Given that water production has dropped from the previous year and the water demand has increased is a direct result of identifying and correcting water system leaks.

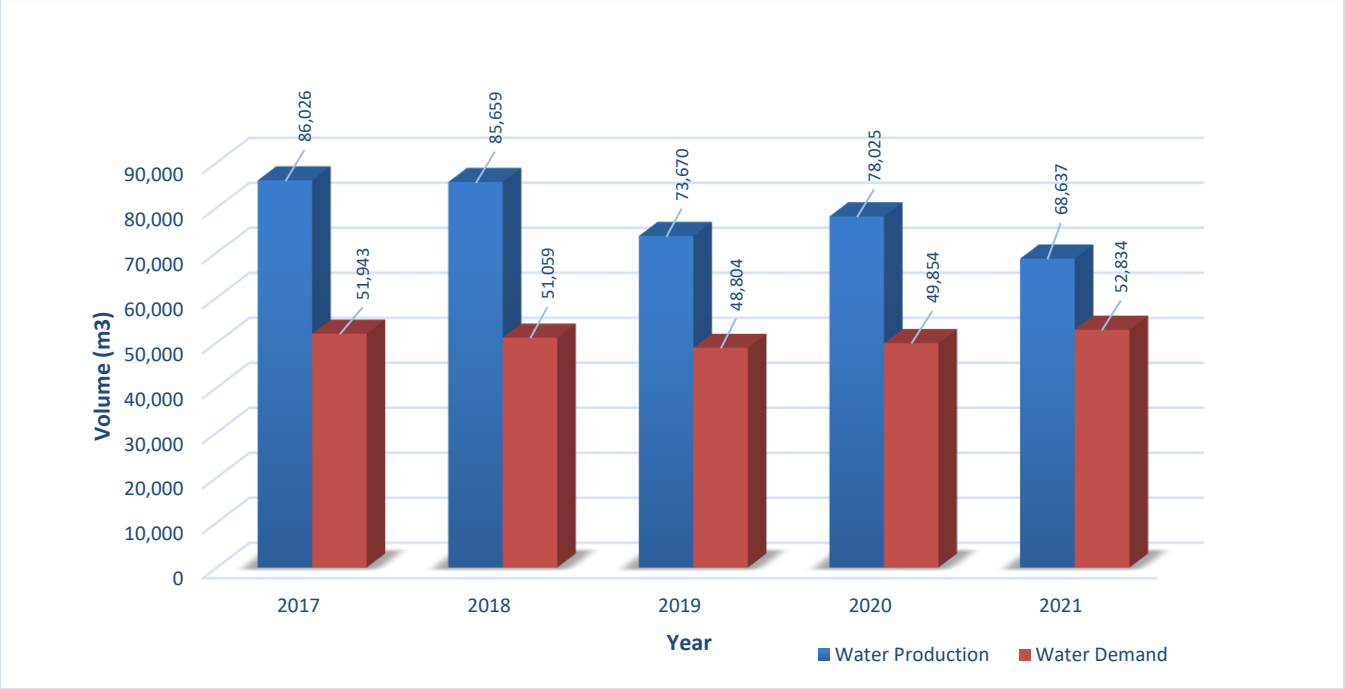

Figure 2: Fernwood and Highland Water Service Annual Water Production and Demand

Water production by month for the past five years is shown in Figure 3. As with most water systems, water consumption follows a typical diurnal pattern where the monthly total flow peaks during the summer months. The 2021 monthly flow information, for the most part, is indicative of this diurnal pattern. However, for prior years it can be seen that the monthly flow trending does not follow this pattern and is indicative of water system leaks that influence and skew monthly production data.

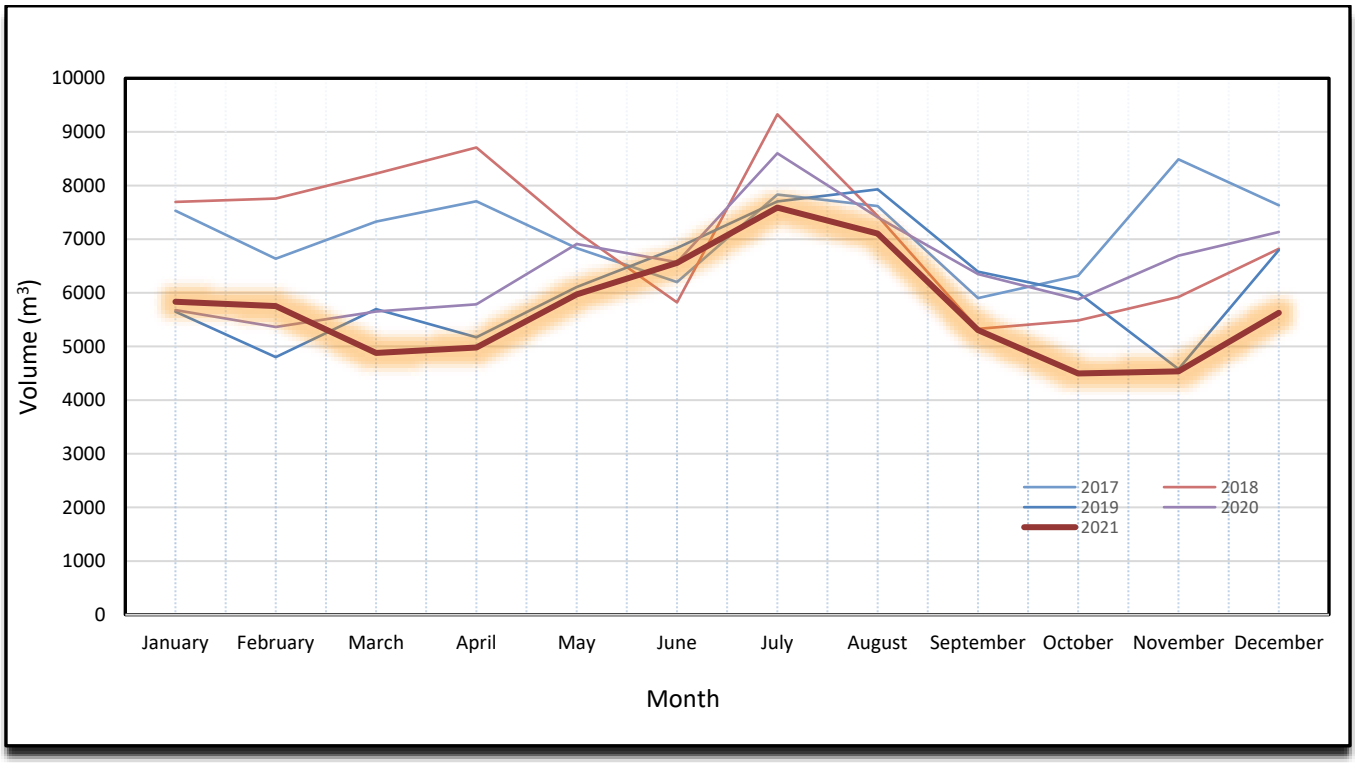

Figure 3: Fernwood and Highland Water Service Monthly Water Production

The Fernwood and Highland Water System is fully metered, and water meters are read quarterly. Water meters are manually read on a quarterly basis and the data enables water production and consumption to be compared in order to estimate leakage losses in the distribution system. The difference between water produced and water demand (total metered consumption) is called non-revenue water and includes distribution leaks, meter error, and unmetered uses such as fire hydrant usage, distribution system maintenance, and process water for the treatment plant. Non-revenue water is approximately 23%. Water loss is estimated to be approximately 19% which is considered low for a small water system such as Fernwood and Highland. It is important to note that non-revenue water for the previous year was 36%.

WATER QUALITY

In 2021, the analytical results (biological, chemical and physical parameters) of water samples collected from the Highland/Fernwood Water Systems indicated that the drinking water supplied to the customers was generally of good quality. Both, the Highland and the Fernwood distribution systems had challenges with water main breaks in 2021 that led to two partial Boil Water Advisories (BWA) in the Highland system (June 9 – 12 and August 20 – 23), and one BWA in the Fernwood system (September 17-19). Also, St. Mary Lake experienced smaller cyanobacteria blooms on and off during the spring, and then a strong cyanobacteria bloom from mid May through to the end of the year. Various species of potentially toxin producing cyanobacteria were responsible for these blooms but all samples taken from the intake of the Highland/Fernwood Water System tested negative for microcystin, a cyanotoxin frequently associated with such blooms. During this event, the Highland/Fernwood water treatment plant was able to produce safe and good quality drinking water. A water main flushing program in both distribution systems in 2021

was successful in removing accumulated pipe sediments which have led to frequent turbidity exceedances in the distribution systems in the past.

The data below provides a summary of the water quality characteristics in 2021:

Raw Water:

- The raw water exhibited typically low concentrations of total coliform and *E.coli* bacteria throughout the cold weather periods, but much higher spikes during the summer.
- No parasitic *Cryptosporidium* oocysts or *Giardia* cysts were detected in 2021.
- The analyses of raw water samples indicated low concentrations of iron and but elevated concentrations of manganese in the fall (November).
- The raw water was slightly hard (median hardness 38.3 mg/L $CaCO_3$).
- The raw water turbidity (cloudiness) was near 1 NTU during most months, but well over 1 NTU between July and August. Highest raw water turbidity was registered in July with 4.1 NTU. This was as a result of the strong cyanobacteria bloom during that time.
- A median annual total organic carbon (TOC) concentration of 3.20 mg/L confirms the mesotrophic (semi-productive) to eutrophic (productive) status of St. Mary Lake.
- Cyanobacteria blooms of various species occurred almost all year long in St Mary Lake. Despite the blooms of potentially toxin producing cyanobacteria species, no cyanotoxins (microcystin) were detected in the raw water entering the treatment plant in 2021.

Treated Water:

- The treated water was safe to drink outside the periods with a BWA; no indicator bacteria were detected in any Fernwood Distribution System sample throughout the year. The Highland System had one total coliform positive result on January 12 in one sampling location. An immediate resample from this location tested negative for indicator bacteria; an actual water contamination was therefore not confirmed.
- The treated water turbidity was typically well below the turbidity limit of 1.0 NTU throughout the year in most parts of the system. However, a few standpipes in the Highland system occasionally registered elevated turbidity. These low flow locations need to be flushed regularly to remove accumulated pipe sediments.
- The levels of regulated disinfection by-products trihalomethanes (THM) and haloacetic acids (HAA) were well below the limits in the GCDWQ (100 µg/L and 80 µg/L respectively) across the Fernwood and the Highland Distribution System.
- The treated water total organic carbon concentration (TOC) in both distribution systems was similar to 2020 but lower than in previous years, ranging from 1.3 to 2.0 mg/L in the Fernwood Distribution System, and 1.3 to 2.1 mg/L in the Highland Distribution System. There is currently no guideline in the GCDWQ for TOC levels, however the USEPA suggests a treated water TOC concentration of < 2 mg/L as confirmation of effective treatment and disinfection by-product control.
- Iron and/or manganese concentrations, which can lead to water discolouration if present in elevated concentrations, have been below the aesthetic guideline limits throughout both distribution systems.

Table 1, 2 and 3 below provide a summary of the 2021 raw and treated water test results.

Water Quality data collected from these two distribution systems can be reviewed on the following CRD website: https://www.crd.bc.ca/about/data/drinking-water-quality-reports

OPERATIONAL HIGHLIGHTS

The following is a summary of the major operational issues that were addressed by CRD Integrated Water Services staff:

- Water system leak repairs:
  - 200 Maliview Drive (resulted in a boil water advisory)
  - 214 Maliview Drive (resulted in a boil water advisory)
  - 210 Langs Road (resulted in a boil water advisory)
- Water system service line leak repairs:
  - 147 Maliveiw Drive
  - 249 Maliview Drive
  - 2344 Trincomali Heights
  - 287 Southbank Road
  - 208 Fairway Crescent
- Water Treatment Plant corrective maintenance
  - Air saturator compressor replacement
  - Backwash tank level transducer replacement
  - Water backflow preventer repairs
  - Ultra Violet light (UV) automatic wiper system repairs

CAPITAL IMPROVEMENTS

Fernwood and Highland Water Capital Projects

The following is a summary of the major capital improvements including year ending spending for 2021:

Water Intake Assessment (CE.677.7500): Fernwood water intake has not been performing as it should. Investigation and design of a new intake was commenced by a consultant engaged by the CRD.

Project	Spending
Budget	$20,000
Project Management	($2,706)
Designs	($11,172)
Balance Remaining	**$6,122**

Safe Work Procedures (CE.699.4501): The work scope includes reviewing and developing safe work procedures for operational and maintenance tasks.

Project	Spending
Budget	$17,000
Project Management	($444)
Contract	($3,386)
Balance Remaining	**$13,170**

Waste Pump Design and Construction (CE.707.7500): The control panel and pump for the DAF waste pump at the Fernwood and Highland water treatment plant requires replacement. Investigation and design of a new waste pump will be completed by a consultant engaged by the CRD.

Project	Spending
Budget	$80,000
Project Management	($4,896)
Designs	($14,247)
Construction	
Balance Remaining	**$60,857**

Highland Upper Reservoir (CE.360.4655): The Highland Upper Reservoir requires replacement. Investigation and design of a new reservoir is in progress by a consultant engaged by the CRD.

Project	Spending
Budget	$50,000
Project Management	($6,736)
Designs	($19,503)
Balance Remaining	**$23,761**

Power Generation Equipment - Design (CE.735.4501): Preliminary and detailed design for back-up power generation for the service.

Project	Spending
Budget	$24,000
Project Management	($2,206)
Designs	($21,500)
Balance Remaining	**$23,706**

2021 FINANCIAL REPORT

Please refer to the attached 2021 Statement of Operations and Reserve Balances.

Revenue includes parcel taxes (Transfers from Government), fixed user fees (User Charges), water Sales (Sale-Water), interest on savings (Interest earnings), a transfer from the Operating Reserve Fund, and miscellaneous revenue such as late payment charges (Other revenue).

Expenses includes all costs of providing the service. General Government Services includes budget preparation, financial management, utility billing and risk management services. CRD Labour and Operating Costs includes CRD staff time as well as the costs of equipment, tools and vehicles. Debt servicing costs are interest and principal payments on long term debt. Other Expenses includes all other costs to administer and operate the water system, including insurance, supplies, water testing and electricity.

The difference between Revenue and Expenses is reported as Net revenue (expenses). Any transfers to or from capital or reserve funds for the service (Transfers to Own Funds) are deducted from this amount and it is then added to any surplus or deficit carry forward from the prior year, yielding an Accumulated surplus (or deficit) that is carried forward to the following year.

As of December 31, 2021, the accumulated deficit was $44,133 for Highland/Fernwood Water Service. In alignment with Local Government Act Section 374 (11), if actual expenditures exceed actual revenues, any deficiency must be included in the next year's financial plan. The financial plan approved by CRD Board on March 16, 2022 incorporated this deficit.

WATER SYSTEM PROBLEMS - WHO TO CALL:

To report any event or to leave a message regarding the Highland/Fernwood Water System, call either:

CRD water system *emergency* call centre: **1-855-822-4426 (toll free)**
1-250-474-9630 (toll)

CRD water system *general enquiries* (toll free): **1-800-663-4425**

When phoning with respect to an emergency, please specify to the operator, the service area in which the emergency has occurred.

Submitted by:	Matthew McCrank, MSc., P.Eng, Senior Manager, Wastewater Infrastructure Operations
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Concurrence	Robert Lapham, MCIP, RPP, Chief Administrative Officer

Attachment:

2021 Statement of Operations and Reserve Balances

Highland/Fernwood Water

Highland Water (Debt Service)

Fernwood Water (Debt Service)

For questions related to this Annual Report please email saltspring@crd.bc.ca

Table 1: 2021 Summary of Raw Water Test Results, Highland / Fernwood Water System									
PARAMETER		**2021 ANALYTICAL RESULTS**				**CANADIAN GUIDELINES**	**2011 - 2020 RESULTS**		
Parameter Name	Units of Measure	Annual Median	Samples Analyzed	Range Minimum	Range Maximum	≤ = Less than or equal to	Median	Samples Analyzed	Range Minimum-Maximum
ND means Not Detected by analytical method used									
Physical/Biological Parameters									
Carbon, Total Organic	mg/L as C	**3.20**	3	2.90	4.80		4.04	20	2.80 - 5.67
Chlorophyll	ug/L	**6.3**	14	1.29	17.50		8.51	35	0.85 - 22.2
Colour, True	TCU	**6.0**	16	3.0	8		6.80	78	3.0 - 25.0
Hardness as $CaCO_3$	mg/L	**38.3**	4	37.3	38.9	No Guideline Required	39.1	24	28.1 - 46.1
pH	pH units	**7.6**	1	7.6	7.6	7.0 - 10.5 AO	7.77	22	7.18 - 8.90
Turbidity	NTU	**1.45**	18	0.60	4.10		1.40	204	0.10 - 27.1
Water Temperature	°C	**15.0**	38	6.0	25.0	15°C AO	14.3	74	5.0 - 24.6
Microbial Parameters									
Indicator Bacteria									
Coliform, Total	CFU/100 mL	**120**	19	13	42		47	154	ND - 6000
E. coli	CFU/100 mL	**ND**	19	ND	180		ND	155	ND - 12
Hetero. Plate Count, 7 day	CFU/1 mL	Last analyzed in 2013							
Algal Toxins									
Microcystin (Abraxis)	ug/L	**ND**	39	ND	ND	1.5	ND	91	ND
Cryptosporidium, Total oocysts	oocysts/100 L	**ND**	2	ND	ND	Zero detection desirable	ND	20	ND - 1.92
Giardia, Total cysts	cysts/100 L	**ND**	2	ND	ND	Zero detection desirable	ND	20	ND - 1.20
Metals									
Aluminum	ug/L as Al	**10.8**	4	ND	19.5	2900 MAC / 100 OG	9	25	ND
Antimony	ug/L as Sb	**ND**	4	ND	ND	6 MAC	ND	25	ND
Arsenic	ug/L as As	**0.44**	4	0.32	0.66	10 MAC	ND	25	0.34 - 0.85
Barium	ug/L as Ba	**12.9**	4	11.8	13.9	100 MAC	11.70	25	ND - 15.1
Beryllium	ug/L as Be	**ND**	4	ND	ND		ND	25	ND
Bismuth	ug/L as Bi	**ND**	4	ND	ND		ND	21	ND
Boron	ug/L as B	**ND**	4	ND	51.0	5000 MAC	ND	25	43 - 343
Cadmium	ug/L as Cd	**ND**	4	ND	ND	5 MAC	ND	25	ND
Calcium	mg/L as Ca	**9.82**	4	9.61	10.3	No Guideline Required	10.2	25	7.85 - 12.3
Chromium	ug/L as Cr	**ND**	4	ND	ND	50 MAC	ND	25	ND
Cobalt	ug/L as Co	**ND**	4	ND	ND		ND	25	ND
Copper	ug/L as Cu	**1.06**	4	0.83	2.08	2000 MAC / ≤ 1000 AO	1.30	25	ND
Iron	ug/L as Fe	**17.3**	4	9.6	84.6	≤ 300 AO	23.1	25	0.1 - 176
Lead	ug/L as Pb	**ND**	4	ND	ND	5 MAC	ND	25	ND
Lithium	ug/L as Li	**7.85**	4	7.2	8.8		8.40	9	7.50 - 11.5
Magnesium	mg/L as Mg	**3.26**	4	3.23	3.41	No Guideline Required	3.33	25	1.09 - 4.47
Manganese	ug/L as Mn	**13.80**	4	11.8	63.6	120 MAC / ≤ 20 AO	20.5	25	ND - 85.8
Molybdenum	ug/L as Mo	**ND**	4	ND	ND		ND	25	ND
Nickel	ug/L as Ni	**ND**	4	ND	1.1		ND	25	ND
Potassium	mg/L as K	**0.83**	4	0.73	0.88		0.81	25	0.31 - 1.62
Selenium	ug/L as Se	**ND**	4	ND	ND	50 MAC	ND	25	ND
Silicon	ug/L as Si	**816**	4	515	1760		1620	25	345 - 9530
Silver	ug/L as Ag	**ND**	4	ND	ND	No Guideline Required	ND	25	ND
Sodium	mg/L as Na	**19.4**	4	18.9	20.9	≤ 200 AO	19.7	25	ND - 87.3
Strontium	ug/L as Sr	**96.9**	4	93.9	102	7000 MAC	94.5	25	36.7 - 116
Sulphur	mg/L as S	**4.50**	4	4.4	4.9		4.7	21	ND - 8.70
Tin	ug/L as Sn	**ND**	4	ND	ND		ND	25	ND
Titanium	ug/L as Ti	**ND**	4	ND	ND		ND	25	ND
Thallium	ug/L as Tl	**ND**	4	ND	ND		ND	21	ND
Uranium	ug/L as U	**ND**	4	ND	ND	20 MAC	ND	21	ND
Vanadium	ug/L as V	**ND**	4	ND	ND		ND	25	ND
Zinc	ug/L as Zn	**ND**	4	ND	ND	≤ 5000 AO	ND	24	1.98 - 136
Zirconium	ug/L as Zr	**ND**	4	ND	ND		ND	21	ND

Table 2: 2021 Summary of Treated Water Test Results, Fernwood Distribution System									
PARAMETER		**2021 ANALYTICAL RESULTS**				**CANADIAN GUIDELINES**	**2011 - 2020 RESULTS**		
Parameter Name	Units of Measure	Annual Median	Samples Analyzed	Range Min.	Range Max.	≤ = Less than or equal to	Median	Samples Analyzed	Range Min.-Max.
ND means Not Detected by analytical method used									
Physical Parameters									
Hardness as $CaCO_3$	mg/L	**39.8**	8	37.2	44.6		40.6	27	35.1 - 49.1
Carbon, Total Organic	mg/L as C	**1.60**	3	1.30	2.00		2.00	30	ND - 9.28
Colour, True	TCU	**6.0**	16.0	3.0	8.0		1.51	1	1.51 - 1.51
pH	pH units	**7.3**	1	7.3	7.3		7.80	2	7.5 - 8.1
Turbidity	NTU	**0.15**	18	ND	0.5	1 MAC and ≤ 5 AO	0.57	199	ND - 10.5
Water Temperature	°C	**14.0**	60	7.0	22.0	15°C AO	13	204	0.0 - 20.5
Microbial Parameters									
Indicator Bacteria									
Coliform, Total	CFU/100 mL	**ND**	62	ND	ND	0 MAC	ND	257	ND - 5
E. coli	CFU/100 mL	**ND**	62	ND	ND	0 MAC	ND	257	ND
Hetero. Plate Count, 7 day	CFU/1 mL	Not tested in 2021				No Guideline Required	ND	73	ND - 800
Algal Toxins									
Microcystin (Abraxis)	ug/L	Not tested in 2021				1.5	ND	40	ND
Anatoxin A	ug/L	Last analyzed in 2013					ND	4	ND
Cylindrospermopsin	ug/L	Last analyzed in 2013					ND	4	ND
Microcystin-RR	ug/L	Last analyzed in 2013					ND	2	ND
Microcystin-YR	ug/L	Last analyzed in 2013					ND	4	ND
Microcystin-LR	ug/L	Last analyzed in 2013				1.5 MAC	ND	4	ND
Microcystin-LA	ug/L	Last analyzed in 2013					ND	2	ND
Nodularin	ug/L	Last analyzed in 2013					ND	4	ND
Disinfectants									
Disinfectants									
Chlorine, Free Residual	mg/L as Cl2	**1.22**	139	0.45	2.2	No Guideline Required	1.06	1024	0.20 - 3.30
Chlorine, Total Residual	mg/L as Cl_2	**1.90**	25	1.39	2.2	No Guideline Required	1.25	1009	0.18 - 4.0
Disinfection By-Products									
Trihalomethanes (THMs)									
Bromodichloromethane	ug/L	**14.5**	4	9.3	20		13	32	6.94 - 28.4
Bromoform	ug/L	**ND**	4	ND	ND		ND	32	ND
Chloroform	ug/L	**27.5**	4	15.0	45.0		23	31	12.7 - 115.0
Chlorodibromomethane	ug/L	**6.25**	4	3.7	8.1		4.75	32	2.19 - 32.1
Total Trihalomethanes	ug/L	**48**	4	28.0	73	100 MAC	42	31	23 - 145
Haloacetic Acids (HAAs)									
HAA5	ug/L	**18.0**	4	16.0	26.0	80 MAC	10.7	6	ND - 22.2
Metals									
Aluminum	ug/L as Al	**7.3**	8	3.9	15.7	2900 MAC / 100 OG	12.8	27	4.1 - 389
Antimony	ug/L as Sb	**ND**	8	ND	ND	6 MAC	ND	27	ND
Arsenic	ug/L as As	**0.3**	8	0.2	0.4	10 MAC	0.31	27	0.20 - 0.76
Barium	ug/L as Ba	**12.2**	8	10.8	12.6	100 MAC	12.0	27	9.9 - 16.4
Beryllium	ug/L as Be	**ND**	8	ND	ND		ND	27	ND
Bismuth	ug/L as Bi	**ND**	8	ND	ND		ND	27	ND
Boron	ug/L as B	**ND**	8	ND	51.0	5000 MAC	ND	27	ND - 53.0
Cadmium	ug/L as Cd	**ND**	8	ND	ND	5 MAC	ND	27	ND - 0.02
Calcium	mg/L as Ca	**10.8**	8	9.7	12.7	No Guideline Required	10.9	27	8.90 - 15.3
Chromium	ug/L as Cr	**ND**	8	ND	ND	50 MAC	ND	27	ND
Cobalt	ug/L as Co	**ND**	8	ND	ND		ND	27	ND - 0.23
Copper	ug/L as Cu	**5.48**	8	3.5	83.2	2000 MAC / ≤ 1000 AO	4.83	27	1.5 - 75.9
Iron	ug/L as Fe	**32.6**	8	24.2	84.8	≤ 300 AO	57.0	27	19.6 - 770
Lead	ug/L as Pb	**0.49**	8	ND	1.92	5 MAC	0.56	31	ND - 78.1
Lithium	ug/L as Li	**7.8**	8	7.2	8.6		8.1	3	7.7 - 11.7
Magnesium	mg/L as Mg	**3.14**	8	2.9	3.4	No Guideline Required	3.05	27	2.52 - 3.57
Manganese	ug/L as Mn	**1.3**	8	ND	3.0	120 MAC / ≤ 20 AO	5.9	27	ND - 150.0
Molybdenum	ug/L as Mo	**ND**	8	ND	ND		ND	27	ND
Nickel	ug/L as Ni	**ND**	8	ND	ND		ND	27	ND
Potassium	mg/L as K	**0.8**	8	0.7	0.9		0.78	27	0.70 - 0.87
Selenium	ug/L as Se	**ND**	8	ND	ND	50 MAC	ND	27	ND
Silicon	ug/L as Si	**1130**	8	664	1780		1480	27	405 - 3700
Silver	ug/L as Ag	**ND**	8	ND	ND	No Guideline Required	ND	27	ND
Sodium	mg/L as Na	**22**	8	21.3	23.0	≤ 200 AO	22.6	27	19.8 - 25.2
Strontium	ug/L as Sr	**98.1**	8	92.9	104.0	7000 MAC	96.0	27	87.1 - 106
Sulphur	mg/L as S	**4.3**	8	3.7	5.4		4.8	27	3.80 - 5.40
Tin	ug/L as Sn	**ND**	8	ND	ND		ND	27	ND
Titanium	ug/L as Ti	**ND**	8	ND	ND		ND	27	ND
Thallium	ug/L as Th	**ND**	8	ND	ND		ND	27	ND - 0.04
Uranium	ug/L as U	**ND**	8	ND	ND	20 MAC	ND	27	ND
Vanadium	ug/L as V	**ND**	8	ND	ND		ND	27	ND
Zinc	ug/L as Zn	**19.5**	8	9.8	53.9	≤ 5000 AO	18.5	27	5.60 - 76.2
Zirconium	ug/L as Zr	**ND**	8	ND	ND		ND	27	ND

Table 3: 2021 Summary of Treated Water Test Results, Highland Distribution System									
PARAMETER		2021 ANALYTICAL RESULTS				CANADIAN GUIDELINES	2011 - 2020 RESULTS		
Parameter Name	Units of Measure	Annual Median	Samples Analyzed	Range Min.	Range Max.	≤ = Less than or equal to	Median	Samples Analyzed	Range Min.-Max.
ND means Not Detected by analytical method used									
Physical Parameters									
Hardness as $CaCO_3$	mg/L	**42.2**	8	36.7	52.7		43	34	34.1 - 54.9
Carbon, Total Organic	mg/L as C	**1.4**	9	1.30	2.10		1.9	72	ND - 19.7
Colour, True	TCU	**ND**	48	ND	ND		1.95	2	1.80 - 2.10
pH	pH units	7.2	2	7.2	7.2		7.0	19	6.55 - 8.1
Turbidity	NTU	**ND**	54	ND	2.9	1 MAC and ≤ 5 AO	0.38	511	ND - 37.8
Water Temperature	°C	**13.0**	188	6.0	26.0	15°C AO	13.0	555	4.0 - 24.5
Microbial Parameters									
Indicator Bacteria									
Coliform, Total	CFU/100 mL	**ND**	175	ND	12	0 MAC	ND	1111	ND - 106
E. coli	CFU/100 mL	**ND**	175	ND	ND	0 MAC	ND	1110	ND - 1
Hetero. Plate Count 7 day	CFU/1 mL	Not tested in 2021				No Guideline Required	30	58	ND - 310
Algal Toxins									
Microcystin (Abraxis)	ug/L	Not tested in 2021				1.5	ND	41	ND
Anatoxin A	ug/L	Last analyzed in 2013					ND	85	ND
Cylindrospermopsin	ug/L	Last analyzed in 2013					ND	85	ND
Microcystin-RR	ug/L	Last analyzed in 2013					ND	84	ND
Microcystin-YR	ug/L	Last analyzed in 2013					ND	85	ND - 0.58
Microcystin-LR	ug/L	Last analyzed in 2013				1.5 MAC	ND	85	ND - 0.51
Microcystin-LA	ug/L	Last analyzed in 2013					ND	28	ND
Nodularin	ug/L	Last analyzed in 2013					ND	85	ND
Disinfectants									
Disinfectants									
Chlorine, Free Residual	mg/L as Cl2	**1.15**	198	0.20	2.20	No Guideline Required	1.11	3819	ND - 5.30
Chlorine, Total Residual	mg/L as Cl_2	**1.89**	29	0.84	2.20	No Guideline Required	1.29	3795	0.02 - 9.10
Disinfection By-Products									
Trihalomethanes (THMs)									
Bromodichloromethane	ug/L	**16.0**	8	12.0	19.0		16.0	59	ND - 31.9
Bromoform	ug/L	**ND**	8	ND	ND		ND	66	ND - 4.20
Chloroform	ug/L	**31.0**	8	20.0	49.0		29.0	69	6.41 - 127.0
Chlorodibromomethane	ug/L	**6.35**	8	4.6	8.3		5.7	67	ND - 31.7
Total Trihalomethanes	ug/L	**53.0**	8	36.0	75.0	100 MAC	52.2	64	14.6 - 161.0
Haloacetic Acids (HAAs)									
HAA5	ug/L	**22.0**	8	19.0	30.0	80 MAC	18.2	12	9.21 - 37.7
Metals									
Aluminum	ug/L as Al	**11.7**	8	8.6	28.4	2900 MAC / 100 OG	15.75	34	4.50 - 58.8
Antimony	ug/L as Sb	**ND**	8	ND	ND	6 MAC	ND	34	ND
Arsenic	ug/L as As	**0.28**	8	0.2	0.39	10 MAC	0.29	34	0.20 - 0.51
Barium	ug/L as Ba	**11.7**	8	10.0	12.7	100 MAC	11.65	34	6.7 - 14.6
Beryllium	ug/L as Be	**ND**	8	ND	ND		ND	34	ND
Bismuth	ug/L as Bi	**ND**	8	ND	ND		ND	34	ND
Boron	ug/L as B	**ND**	8	ND	51.0	5000 MAC	ND	34	ND - 53.0
Cadmium	ug/L as Cd	**ND**	8	ND	ND	5 MAC	ND	34	ND
Calcium	mg/L as Ca	**12.6**	8	9.3	18.5	No Guideline Required	13.1	34	8.57 - 19.1
Chromium	ug/L as Cr	**ND**	8	ND	ND	50 MAC	ND	26	ND
Cobalt	ug/L as Co	**ND**	8	ND	ND		ND	34	ND
Copper	ug/L as Cu	**1.54**	8	0.6	2.7	2000 MAC / ≤ 1000 AO	4.64	34	2.02 - 19.5
Iron	ug/L as Fe	**27.5**	8	ND	123.0	≤ 300 AO	58.9	34	ND - 591.0
Lead	ug/L as Pb	**ND**	8	ND	0.3	5 MAC	0.31	34	ND - 3.62
Lithium	ug/L as Li	**7.6**	8	7.0	8.4		7.75	4	7.30 - 8.1
Magnesium	mg/L as Mg	**2.55**	8	1.6	3.3	No Guideline Required	2.7	34	0.95 - 3.70
Manganese	ug/L as Mn	**1.45**	8	ND	6.5	120 MAC / ≤ 20 AO	2.95	34	ND - 57.9
Molybdenum	ug/L as Mo	**ND**	8	ND	ND		ND	34	ND
Nickel	ug/L as Ni	**ND**	8	ND	ND		ND	34	ND
Potassium	mg/L as K	**0.76**	8	0.7	0.86		0.79	34	0.70 - 0.90
Selenium	ug/L as Se	**ND**	8	ND	ND	50 MAC	ND	34	ND
Silicon	ug/L as Si	**1285**	8	460	1970		1660	34	322 - 3490
Silver	ug/L as Ag	**ND**	8	ND	ND	No Guideline Required	ND	34	ND
Sodium	mg/L as Na	**21.6**	8	20.6	23.1	≤ 200 AO	22.45	34	19.3 - 25.4
Strontium	ug/L as Sr	**98.8**	8	91.6	114	7000 MAC	100.0	34	87.0 - 115.0
Sulphur	mg/L as S	**4.35**	8	3.4	4.7		4.85	34	3.80 - 5.90
Tin	ug/L as Sn	**ND**	8	ND	ND		ND	34	ND
Titanium	ug/L as Ti	**ND**	8	ND	ND		ND	34	ND
Thallium	ug/L as Th	**ND**	8	ND	ND		ND	34	ND
Uranium	ug/L as U	**ND**	8	ND	ND	20 MAC	ND	34	ND
Vanadium	ug/L as V	**ND**	8	ND	ND		ND	34	ND
Zinc	ug/L as Zn	**ND**	8	ND	13.1	≤ 5000 AO	12.2	34	ND - 42.1
Zirconium	ug/L as Zn	**ND**	8	ND	ND		ND	34	ND