

CITY OF NORTH BATTLEFORD 2020 ANNUAL DRINKING WATER QUALITY REPORT



WTP #1



FEH WTP

CITY OF NORTH BATTLEFORD

DRINKING WATER QUALITY

2020 ANNUAL REPORT

CITY OF NORTH BATTLEFORD

DEPARTMENT OF CITY OPERATIONS

2020

Executive Summary

This report provides a summary of the Drinking Water Quality of the water produced by the City of North Battleford and the results of the Distribution System monitoring.

The highlights of 2020 were as follows:

- A total of 352 samples were submitted as part of the routine monitoring of the distribution system. None of the routine samples tested positive for total coliforms. All routine samples were within the recommended chlorine residual guidelines set by the WSA.
- The annual average for samples submitted for Trihalomethanes and Haloacetic Acids was below the Maximum Acceptable Concentration.
- The online turbidity analyzers for Water Treatment Plant #1 ranged from 0.02 NTU to 0.17 NTU, meeting the guideline of less than 1.0 NTU for 95% of readings.
- The turbidity for the F.E. Holliday Treatment Plant filters ranged from 0.05 to 0.30 NTU for Filter #1, 0.05 to 0.30 NTU for Filter #2, 0.02 to 0.17 NTU for Filter #3, and 0.02 to 0.21 NTU for Filter #4. All filters were below the NTU guidelines of less than 0.3 NTU for 95% of readings and at no time exceeded the Absolute Maximum of 1.0 NTU.
- Monthly free chlorine readings were above the minimum guideline of 0.2 mg/L entering the distribution system. The monthly readings ranged from 0.63 mg/L to 1.95 mg/L at Water Treatment Plant #1 and 0.32 mg/L to 1.95mg/L at the F.E Holliday Treatment Plant.
- The highest iron reading recorded was 0.09 mg/L at Water Treatment Plant #1 which was below the aesthetic guidelines of 0.3 mg/L.
- The highest manganese reading recorded was 0.06 mg/L at Water Treatment Plant #1 which is slightly above the aesthetic guidelines of 0.05 mg/L.
- During 2020, the COVID-19 pandemic negatively influenced the City's water consumption, mainly due to numerous commercial and industrial businesses restricting operational hours and/or patron numbers, in some cases, shutting down completely for an extended period. In 2020 the City produced 1.55 million m³ compared to 1.67 million m³ in 2019.
- Water Treatment Plant #1 produced 1.5 million m³, while the F.E Holliday Treatment Plant produced 0.05 million m³. Combined, the Water Treatment Plants produced just over 1.55 million m³. The F.E. Holliday Treatment Plant is considered a peaking plant and is mainly operated as needed. Due to staff shortages and low overall demand the plant was only operated to manage peak water demands, maintain clearwell water chlorine levels, and control clearwell water age and solids contact unit sludge age.

In conclusion, the City of North Battleford water treatment plants provided potable water that met the Water Security Agency guidelines.

Safe Drinking Water Policy

POLICY STATEMENT

The City of North Battleford Council and Administration are committed to providing the community with good quality and safe drinking water throughout the City distribution system.

KEY INDICATORS

Good and safe drinking water quality will be demonstrated by:

- Water that is free of pathogenic organisms and any harmful concentrations of chemicals or other substances as may be identified in provincial drinking water requirements, guidelines, objectives, or recommendations.
- Water that is adequately disinfected.
- Water that is aesthetically acceptable.

PRIORITY MEASURES

The following essential measures are undertaken to ensure the provision of good and safe drinking water:

- Protection of Water Sources and Watersheds within the City's Jurisdiction and Influence.
- Quality Control, Quality Assurance and Continuous Improvement Programs.
- Water Treatment, Transmission and Distribution System Maintenance and Renewal.
- Staff Training, Certification and Ongoing Learning.
- Regular and Timely Reporting to City Council.
- Water Quality Monitoring with Public Accountability for Verifying Quality Results.

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Introduction

The City of North Battleford Annual Drinking Water Report is designed to provide information to the public, government organizations, and internal management. Data that is presented in this report is collected from the water treatment plants and distribution system within the City of North Battleford.

Background

The City of North Battleford water supply system is comprised of two water treatment facilities, three reservoirs, one booster station, approximately 120 kilometres of water main, 580 fire hydrants and thousands of valves.

Approximately 5,500 residential, commercial, industrial and institutional customers utilize the North Battleford distribution system.

Between January 1, 2020, and December 31, 2020, the City of North Battleford water treatment plants produced approximately 1.55 million m³ of water. Tables and graphs showing water production per month, can be viewed in the results section of the report.

Water Treatment Plants

The City of North Battleford water treatment Facilities consists of two water treatment plants: Water Treatment Plant #1 (WTP #1) and F.E. Holliday Water Treatment Plant (FEH WTP). The WTPs utilize two sources of water to meet the customer demand.

Water Treatment Plant #1 (Figure 1) is currently designated as a Class 2 Water Treatment Facility. The plant draws water from a well field located in the River Valley southwest of the city. The water treatment process at WTP #1 consists of 'Train A' which utilizes four pressure filters and 'Train B' which utilizes two open filters. All six filters use greensand media to aid in the removal of manganese and iron. Chlorine gas is the main pre and post filtration disinfection method used at this plant. A liquid form of chlorine is used in pre-treatment when pre-chlorine residuals drop below an acceptable level during an upset condition. The 'Train B' expansion officially came online in September 2012.

In 2016, four new production wells were installed at WTP #1. The four new production wells began operating in the fall of 2016 after the Husky Energy oil spill which caused the City of North Battleford to shut down operations at FEH WTP. The new production wells increased the production capability of WTP #1 to offset lost production from FEH WTP. Husky Energy provided the funding for the four production wells and the included associated costs. The current treatment capacity of WTP #1 has increased from 180 m³/hr to approximately 320 m³/hr. The well field limits the production capability of this plant.



Figure 1. Water Treatment Plant #1



Figure 2. F.E. Holliday Water Treatment Plant

FEH WTP (Figure 2) is designated as a Class 3 Water Treatment Facility. The plant takes raw water directly from the North Saskatchewan River. Water is drawn from the river, sand is removed, and then the water is treated for inorganic and organic constituents and filtered. Chlorine gas is used as the primary disinfectant with ultraviolet energy (UV) providing additional disinfection. The production capability of this plant is affected by the turbidity of the North Saskatchewan River.

The untreated and treated water is monitored and tested daily at each WTP when operating to ensure that the finished product meets the standards set by the Water Security Agency (WSA). A summary of plant operations for each WTP can be found in the results section of this report.

Distribution System

The City of North Battleford has over 120 km of water mains. These mains are a combination of asbestos concrete, cast iron, PVC, HDPE, copper, and steel. In 2020, there were 12 water main leaks detected and repaired. Work was done on 83 hydrants (19 complete rebuilds, 23 repairs, 9 replacements and 32 thaws).

In 2019, the City of North Battleford installed pressure monitoring devices in 16 locations throughout the distribution system. These locations included: City Hall, Don Ross Center, Cuplex (Field House), Airport Terminal Building, John Paul II Collegiate High School, Lakeland Vet Clinic, Scott Campbell Dodge, Bready School, St. Mary School, Killdeer Signature Condo, City of North Battleford Parks Shop, Don Jerry's Bulk Foods, Civic Center, WWTP, and two at the pressure sustaining station at Douglas Avenue (one for pressure zone 1 and one for pressure zone 2). The pressure in the City's distribution system must be greater than 20 psi at all times. If any part of the water distribution system pressure drops below 20 psi that part of the distribution system is considered depressurized, and is vulnerable to contamination. If the system is considered depressurized, a drinking water advisory is issued to the affected section of the system while corrective actions are performed.

Water in the distribution system is regularly tested at seven monitoring locations per week throughout the City. A map showing the division of the City into 12 sampling zones can be found in **Appendix A**. Each monitoring location is sampled weekly or every other week. The Permit to Operate a Waterworks, set out by the WSA, requires three samples are taken per week for a total of 156 per year. In 2020, a total of 352 routine monitoring

samples were submitted. Each sample is tested for coliforms, free chlorine, total chlorine, and turbidity.

'Other' samples are collected when there are new services, complaints about taste or odour, following water main repairs or after any construction activity where water distribution quality may be affected. In 2020, a total of 177 'other' samples were submitted. These are not considered 'routine' samples but do undergo the same tests. A summary of 'routine' and 'other' sampling can be found in the results section.

Tested Parameters

The City of North Battleford performs testing as required by the Permit to Operate a Waterworks and as directed by the WSA. Additional testing may be done at the discretion of the City in advance of proposed changes to Drinking Water Quality Guidelines to determine the effect of potential changes in the treatment processes. Tested parameters may or may not be subject to a guideline limit. These limits can be health-based, Maximum Acceptable Concentration (MAC), interim Maximum Acceptable Concentration (iMAC), or based on Aesthetic Objectives (AO) such as taste or odor. These limits may be expressed as milligrams per litre (mg/L), micrograms per litre ($\mu\text{g/L}$), or counts per millilitre or litre (0 cts/100mL or 0 cts/100L). Each tested parameter is outlined in greater detail below. The results for these tested parameters can be found in the results section of this report.

Coliform Bacteria, Total

Total coliform bacteria are used as an operational tool to determine how well the drinking water treatment system is operating. Total coliforms include a variety of naturally occurring bacteria in water, soil, and vegetation as well as human and animal feces. The majority of these bacteria are harmless. The presence of total coliform bacteria indicates that the system is vulnerable to contamination and that additional actions need to be taken. Any exceedances should be investigated. Testing is used to ensure water quality meets permitted criteria. The guideline for the presence/absence of Total Coliforms is a health objective, and as such is expressed as a MAC. The WSA limit for total coliform bacteria is 0 cts/100mL of a sample.

Escherichia coli, (E. coli)

E. coli is used as an indicator of the microbiological safety of drinking water. If it is detected, other pathogens may also be present. The presence of E. coli in water indicates recent fecal pollution from animal and/or human sources and the potential presence of microorganisms capable of causing gastrointestinal illnesses. E. coli is not reported when total coliform is not detected. The limit set by the WSA for drinking water is 0 cts/100 mL, which is also a MAC.

Chlorine

Chlorine is an oxidizing agent that is commonly used as a disinfectant. When chlorine is added to water, it reacts to form two disinfectants known as "free residual chlorine" and "combined residual chlorine." The WSA has placed a limit of not less than 0.2 mg/L of free residual chlorine in the water entering the distribution system from the water treatment plants. Additionally, a minimum of 0.10 mg/L of free residual chlorine or 0.50 mg/L of total residual chlorine (free plus combined) must be maintained continuously throughout the distribution system.

As per the permit to operate, the City must test free residual in the water entering the distribution system continuously or at least once per hour. The WTPs use on-line analytical instruments to monitor the free chlorine. Also, water is tested for free and total chlorine at least once daily at WTP #1 and hourly at WTP #2 while the plant is in operation. These tests are used to confirm that the online instruments are operating properly.

Turbidity

Turbidity is an assessment of water clarity, and a measure of suspended inorganic and organic particles in the water. Turbidity can be caused by sediment, particles of dirt, clay, silt, air bubbles, vegetation, plankton, and other microscopic organisms suspended in the water. Turbid water may protect microorganisms from disinfection or prevent the removal of naturally occurring particles that the treatment process wants to control or eliminate.

As per the permit to operate, the limit for turbidity leaving WTP #1 is to be less than 1.0 NTU in 95% of readings and the limit leaving the filters at FEH WTP is to be less than 0.3 NTU in 95% of readings and never more than 1.0 NTU off each filter. The WSA does not provide a limit for the turbidity within the distribution system. However, the City has implemented practices to maintain turbidity levels below 5.0 NTU in the distribution system.

Iron

Iron is an inorganic element and one of the most abundant metals in the earth's crust. Small quantities of iron are naturally found in many groundwater sources. An AO of less than 0.3 mg/L is used to minimize iron staining of laundry and plumbing fixtures, and to reduce undesirable tastes in consumption.

Manganese

Manganese is a naturally occurring inorganic element from the erosion and weathering of rocks and minerals. Water naturally contains small amounts of manganese; the guideline limit is based on taste and staining of laundry and plumbing fixtures. The AO for manganese in drinking water is less than 0.05 mg/L.

Additional Testing

Additional water quality parameters are tested as set out in the Permit to Operate a Waterworks as directed by the WSA or at the discretion of the City of North Battleford.

General Chemical

A general water quality analysis is done semi-annually on the treated water from WTP #1 and quarterly from FEH WTP. Some of the parameters tested have guideline limits while others do not. The presence of some parameters may interfere with the removal of health-related parameters (such as bacteria). They may affect the treatment system's effectiveness and may be indicators of the overall water quality. Since 2013, general chemical analysis has been completed on the source waters for the WTP's to track changes in water quality that could affect the treatment processes.

Chemical Health and Toxicity

Trace elements in North Battleford's water are monitored annually. These elements can be naturally occurring or the result of leaching, runoff, or spills. Some parameters are subject to a MAC while others are subject to an AO.

Trihalomethanes/Haloacetic Acids

Trihalomethanes (THMs) and Haloacetic Acids (HAAs) are organic compounds formed in drinking water as a by-product of chlorine disinfection. THMs and HAAs may be linked to cancer or other health problems. The MAC of total THMs is 100 µg/L (0.1 mg/L) and total HAAs is 80 µg/L (0.08mg/L) based on an annual average of quarterly tests.

Pesticides

The City of North Battleford tests for pesticides in the treated water once every two years. Pesticides can enter source water (usually surface water) as a result of leaching and runoff from agricultural or other uses. Limits on pesticide concentrations are health-based and subject to a MAC. Pesticides were not tested in 2020.

Organics

The City of North Battleford tests for organics in the treated water once every two years. Organics, usually petroleum products, can enter source water through a variety of means. Limits on organics are mainly health-based and subject to a MAC. A few are subject to an AO. Organics were not tested in 2020.

Cryptosporidium and Giardia

Cryptosporidium and Giardia are pathogens commonly found in surface water. They are associated with gastrointestinal upset. They can cause nausea, vomiting and diarrhoea. Cryptosporidium oocysts and Giardia cysts are found in human and animal wastes, which sometimes wash into rivers and lakes.

The minimum treatment process goal is a 3 log (99.9%) reduction or inactivation of Cryptosporidium oocysts and Giardia cysts. The combination of physical removal (filtration) and the use of an ultraviolet treatment system allows FEH WTP to reach this goal. As part of the October 1st, 2017 operating permit, the City of North Battleford was only required to test for these during periods of upset or under the direction of the WSA. The amended December 5, 2018 permit changed sampling to semi-annually for raw water entering FEH WTP and under upset conditions for treated water at FEH WTP.

Microcystin

Microcystins are tested in the treated water at FEH WTP by the City of North Battleford once a month from June to October (a total of 5 samples are collected). Microcystins are toxins produced by blue-green algae. Blue-green algae are commonly found in surface water when conditions are favourable for growth and the formation of algal blooms. The toxins are released when the algae die and may continue to be present in the water for weeks to months.

Most microcystins are liver toxins, but they are also a skin, eye and throat irritant. Blue-green algal blooms can occur with adequate levels of phosphorous and nitrogen, a temperature range of 5 to 30 degrees Celsius and pH between 6 and 9. Most blooms will occur in late summer and early fall.

The MAC for total microcystins is 1.5 µg/L.

Results

The summary of the sampling results at each of the WTPs, as well as the results for the tested parameters, are discussed below. Refer to **Appendix B** for detailed tables showing the sampling data.

WTP #1 Summary

The treated water leaving WTP #1 was tested for five parameters (turbidity, free chlorine, total chlorine, iron, and manganese) daily and met the guidelines set out by the WSA.

The monthly turbidity readings ranged from 0.02 NTU to 0.17 NTU. The highest reading of 0.17 NTU is below the limit of 1.0 NTU set out by the WSA. The monthly free chlorine readings from the on-line analyzer ranged from 0.63 to 1.95 mg/L. The low limit set by WSA is not less than 0.2 mg/L for the water leaving the plant.

Iron readings ranged from 0.00 mg/L to 0.09 mg/L. The AO for Iron is 0.3 mg/L.

Manganese readings ranged from 0.00 mg/L to 0.06 mg/L. The AO for Manganese is 0.05 mg/L. While the highest reading of 0.06 mg/L is above the AO, the average readings for manganese was 0.02 mg/L.

A summary of the results for WTP #1 can be found in **Table 1B, Appendix B**.

FEH WTP (WTP #2) Summary

The treated water leaving FEH WTP was tested daily for turbidity and free chlorine and met the guidelines set out by the WSA. Turbidity was tested leaving the filters and clear well, while the free chlorine was tested leaving the clear well.

The turbidity leaving the four filters ranged from 0.05 NTU – 0.30 NTU for Filter #1, 0.05 – 0.30 NTU for Filter #2, 0.02 – 0.17 NTU for Filter #3, and 0.02 – 0.21 NTU for Filter #4. The highest turbidity reading recorded from the filters was 0.30 NTU (several months) while the lowest reading was 0.02 NTU (several months). The turbidity for Filters #1 and #2 occasionally spiked following long filter down-time periods. These spikes were believed to be associated with accumulated precipitates in the filter underdrain system and piping during the downtime periods and not a filter breakthrough event. WSA was inform of all events related to these turbidity spike events.

The free chlorine readings recorded entering the distribution system ranged from 0.32 mg/L to 1.95 mg/L. The highest chlorine reading recorded was 1.95 mg/L (June) while the lowest was 0.32 mg/L (June).

The results can be found in **Table 2B, Appendix B**.

Routine Sampling

In 2020, a total of 352 samples were submitted to an accredited laboratory for analysis as part of the routine monitoring required by the WSA. None of the routine samples tested positive for coliforms/E.coli. Free and total chlorine residuals and turbidity were measured in each routine sample. All samples were within applicable guidelines. A total of 177 'other' samples were submitted for testing as a result of new services, complaints, water main breaks or any other construction activity which had the potential to impact the distribution water. Total coliforms were detected in one sample. The follow up sample was within applicable guidelines Free and total chlorine residuals and turbidity were measured at each location. Two samples were below applicable guidelines. These samples were taken as part of "Filter Maintenance" at FEH WTP, this water did not enter the distribution system and WSA was notified.

General Chemical

Two samples of the treated water from WTP#1 and four from FEH WTP (WTP #2) were submitted to an accredited laboratory for analysis for General Chemical analysis in 2020.

The parameters tested met all aesthetic and health objectives. The results are shown in **Tables 4B and 5B, Appendix B.**

Chemical Health with Cyanide and Mercury

One sample of the treated water from each WTP was submitted for Chemical Health with Cyanide and Mercury in 2020. The parameters tested were either within guidelines or below detection limits. The results are shown in **Table 6B, Appendix B.**

THMs

Samples were collected quarterly from two locations (eight samples in total) within the distribution system and were submitted to an accredited laboratory for analysis for THMs in 2020. The total THM concentrations ranged from 43.1 µg/L to 69.7 µg/L. All samples tested below the MAC of 100 µg/L. The results are shown in **Table 7B and 8B, Appendix B.**

HAAs

Samples were collected quarterly from two locations (eight samples in total) within the distribution system and were submitted to an accredited laboratory for HAAs analysis in 2020. The total HAA concentrations ranged from 22.0 µg/L to 39.0 µg/L. All samples tested below the MAC of 80 µg/L. The results are shown in **Table 7B and 8B, Appendix B.**

Cryptosporidium and Giardia

Two samples of the raw water from FEH WTP (WTP #2) were submitted to an accredited laboratory for Cryptosporidium and Giardia analysis in June and November of 2020. No Cryptosporidium oocysts were detected in either of the sample results, while 20 Giardia cysts/100L were detected in the November sample results. The results are shown in **Table 9B, Appendix B.**

Pesticides

No sampling for Pesticides was conducted in 2020. Samples are taken bi-annually.

Organics

No sampling for Organics was conducted in 2020. Samples are taken bi-annually.

Water Production

In 2020, just over 1.55 million m³ of potable water was produced by the two Water Treatment Plants. WTP #1 produced 1.5 million m³, while 0.05 million m³ of potable

water was produced by the FEH WTP. The F.E. Holliday Treatment Plant is considered a peaking plant and is mainly operated as needed. Due to staff shortages and low overall demand the plant was only operated to manage peak water demands, maintain clearwell water chlorine levels, and control clearwell water age and solids contact unit sludge age.

Combined, the monthly amount of water produced by the WTPs ranged from a low of 108,767m³ (November) to a high of 156,145m³ (August) which can be seen in **Table 1C, Appendix C**. The average daily production was 4,171 m³. The peak average daily production was 5037m³ in August, and the lowest average daily production was 3626m³ in November. The production amounts for both WTPs along with the combined monthly total can be seen in **Table 1C, Appendix C**.

During 2020, the COVID-19 pandemic negatively influenced the City's water consumption, mainly due to numerous commercial and industrial businesses restricting operational hours and/or patron numbers, in some cases, shutting down completely for an extended period. In 2020 the City produced 1.55 million m³ compared to 1.67 million m³ in 2019.

Conclusion

In conclusion, the North Battleford water treatment plants were able to provide potable water that met the WSA guidelines as set out in the Permit to Operate. For the distribution system in the City of North Battleford, chlorine levels exceeded the minimum level outlined by the WSA.

Acknowledgement

The City Operations Department of the City of North Battleford prepared this report. The dedication and commitment of civic staff in providing safe water during 2020 is acknowledged.

Also acknowledged is the ongoing assistance of the WSA.

For more information, please contact:

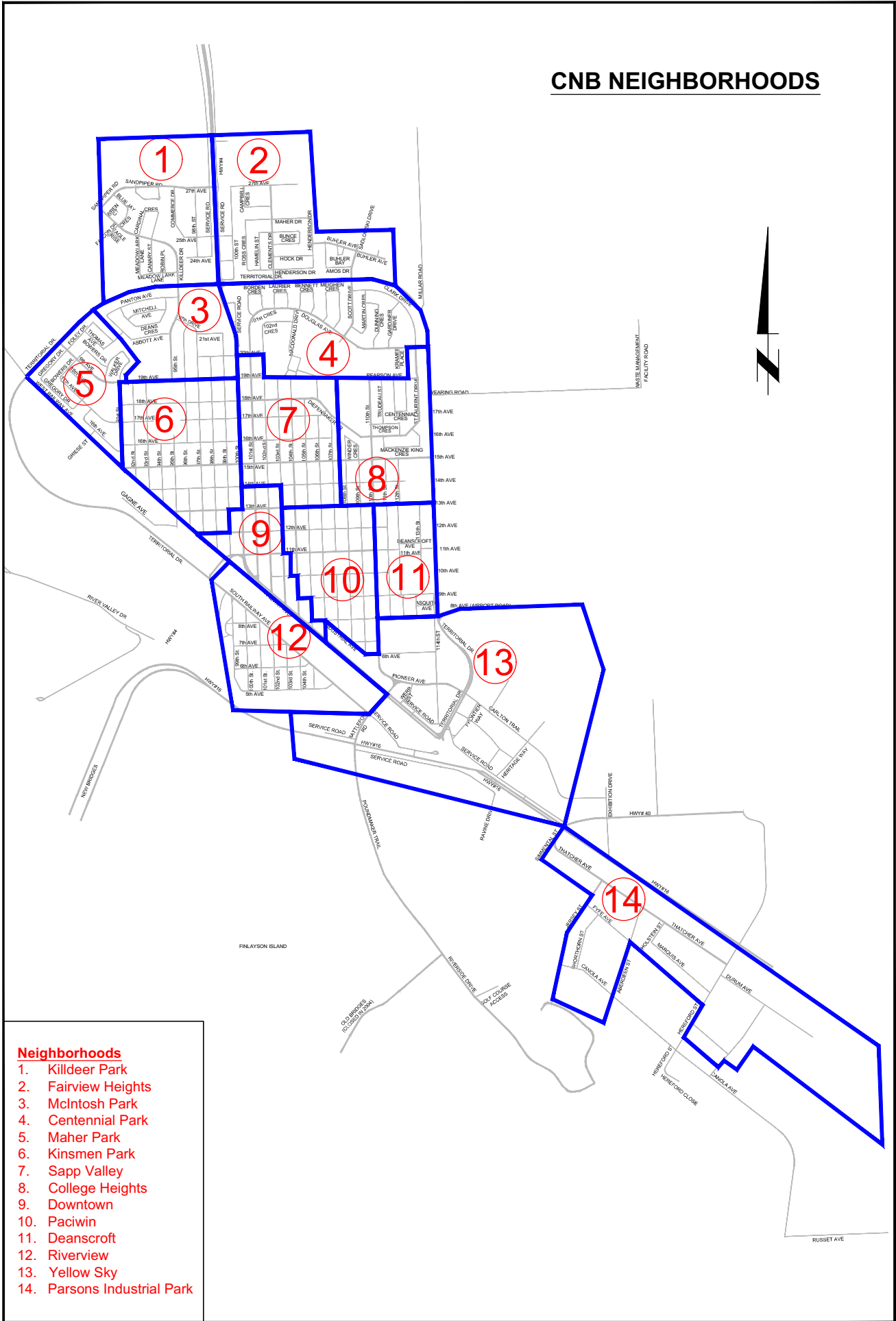
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*City of North Battleford
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Appendix A: Map of Sampling Zones*

CNB NEIGHBORHOODS



- Neighborhoods**
1. Killdeer Park
 2. Fairview Heights
 3. McIntosh Park
 4. Centennial Park
 5. Maher Park
 6. Kinsmen Park
 7. Sapp Valley
 8. College Heights
 9. Downtown
 10. Paciwinn
 11. Deanscroft
 12. Riverview
 13. Yellow Sky
 14. Parsons Industrial Park

*City of North Battleford
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Appendix B: Results Tables*

WTP #1 Summary									
Month	Train		CHLORINE			TURBIDITY		IRON mg/L	MANGANESE mg/L
			Free (Lab) mg/L	Free (Wall) mg/L	Total mg/L	NTU (Lab)	NTU (Wall)		
January	A	Average	1.21	1.20	1.46	0.18	0.11	0.03	0.02
		Max	1.51	1.43	1.77	0.27	0.12	0.06	0.04
		Min	0.97	0.97	1.12	0.14	0.10	0.00	0.00
	B	Average	1.19	1.21	1.44	0.18	0.08	0.03	0.02
		Max	1.59	1.44	1.81	0.23	0.10	0.06	0.03
		Min	0.98	0.99	1.13	0.12	0.07	0.00	0.00
February	A	Average	1.27	1.33	1.48	0.16	0.09	0.02	0.01
		Max	1.57	1.74	1.82	0.19	0.11	0.05	0.02
		Min	0.98	1.10	1.08	0.11	0.08	0.00	0.00
	B	Average	1.23	1.25	1.49	0.15	0.08	0.02	0.01
		Max	1.42	1.53	1.72	0.17	0.11	0.08	0.02
		Min	0.88	0.95	1.10	0.11	0.07	0.00	0.00
March	A	Average	1.20	1.23	1.43	0.14	0.07	0.01	0.02
		Max	1.43	1.46	1.76	0.17	0.09	0.05	0.03
		Min	0.76	0.99	1.05	0.11	0.06	0.00	0.00
	B	Average	1.21	1.21	1.47	0.14	0.07	0.01	0.02
		Max	1.50	1.43	1.83	0.18	0.09	0.09	0.03
		Min	0.92	0.95	1.14	0.10	0.07	0.00	0.01
April	A	Average	1.32	1.29	1.60	0.11	0.07	0.02	0.02
		Max	1.57	1.48	1.90	0.14	0.09	0.05	0.03
		Min	1.09	1.02	1.29	0.08	0.05	0.00	0.01
	B	Average	1.58	1.31	1.29	0.12	0.07	0.01	0.02
		Max	1.88	1.55	1.52	0.20	0.09	0.04	0.03
		Min	1.21	1.01	1.01	0.08	0.06	0.00	0.01
May	A	Average	1.49	1.25	1.24	0.08	0.07	0.01	0.02
		Max	1.75	1.67	1.62	0.14	0.09	0.03	0.03
		Min	1.18	1.01	1.02	0.06	0.06	0.00	0.01
	B	Average	1.51	1.30	1.31	0.08	0.05	0.01	0.02
		Max	1.80	1.59	1.61	0.12	0.06	0.02	0.03
		Min	1.10	0.94	0.90	0.06	0.02	0.00	0.01
June	A	Average	1.31	1.29	1.52	0.10	0.06	0.01	0.02
		Max	1.76	1.95	2.05	0.12	0.07	0.03	0.03
		Min	0.95	0.93	1.11	0.08	0.04	0.00	0.01
	B	Average	1.31	1.31	1.50	0.09	0.04	0.01	0.03
		Max	1.57	1.59	1.86	0.10	0.05	0.04	0.02
		Min	1.04	0.95	1.16	0.08	0.03	0.00	0.01

WTP #1 Summary Continued									
Month	Train		CHLORINE			TURBIDITY		IRON mg/L	MANGANESE mg/L
			Free (Lab) mg/L	Free (Wall) mg/L	Total mg/L	NTU (Lab)	NTU (Wall)		
July	A	Average	1.31	1.31	1.54	0.10	0.06	0.01	0.02
		Max	1.66	1.75	3.02	0.11	0.08	0.04	0.03
		Min	1.01	0.99	0.76	0.09	0.04	0.00	0.01
	B	Average	1.34	1.22	1.60	0.09	0.04	0.01	0.02
		Max	1.67	1.75	2.80	0.10	0.06	0.04	0.03
		Min	1.08	0.73	1.18	0.07	0.03	0.00	0.01
August	A	Average	1.17	1.13	1.41	0.09	0.04	0.01	0.02
		Max	1.44	1.46	1.84	0.11	0.05	0.05	0.03
		Min	1.00	0.97	1.08	0.06	0.04	0.00	0.01
	B	Average	1.22	1.10	1.46	0.09	0.03	0.01	0.02
		Max	1.50	1.51	1.97	0.12	0.04	0.04	0.04
		Min	0.95	0.86	1.19	0.07	0.03	0.00	0.01
September	A	Average	1.05	1.04	1.26	0.09	0.04	0.02	0.02
		Max	1.31	1.28	1.51	0.11	0.06	0.04	0.04
		Min	0.92	0.88	0.98	0.06	0.03	0.00	0.01
	B	Average	1.07	1.03	1.29	0.10	0.04	0.01	0.02
		Max	1.28	1.25	1.56	0.11	0.05	0.06	0.04
		Min	0.91	0.84	0.94	0.08	0.04	0.00	0.01
October	A	Average	1.06	1.06	1.43	0.09	0.04	0.01	0.02
		Max	1.53	1.54	1.88	0.10	0.05	0.07	0.04
		Min	0.83	0.82	0.98	0.07	0.04	0.00	0.00
	B	Average	1.08	1.08	1.43	0.11	0.03	0.02	0.02
		Max	1.61	1.62	1.71	0.14	0.04	0.05	0.06
		Min	0.85	0.80	1.05	0.10	0.03	0.00	0.00
November	A	Average	0.99	1.00	1.39	0.11	0.04	0.02	0.02
		Max	1.15	1.13	1.69	0.19	0.05	0.06	0.03
		Min	0.86	0.85	1.02	0.05	0.03	0.00	0.01
	B	Average	1.02	1.04	1.46	0.07	0.04	0.01	0.02
		Max	1.16	1.21	1.84	0.11	0.05	0.04	0.03
		Min	0.85	0.63	1.05	0.02	0.03	0.00	0.01
December	A	Average	1.03	1.02	1.49	0.07	0.07	0.01	0.03
		Max	1.17	1.16	1.65	0.09	0.17	0.04	0.02
		Min	0.91	0.94	1.28	0.06	0.04	0.00	0.01
	B	Average	1.13	1.20	1.53	0.07	0.04	0.01	0.02
		Max	1.63	1.41	1.73	0.08	0.04	0.07	0.04
		Min	0.90	0.98	1.07	0.07	0.03	0.00	0.01

FEH WTP Summary										
Date	Raw Water		Filter Effluent - Turbidities (NTU)				Clearwell One		Clearwell Two	
	RATE (m3/hr)	TURBIDITY (NTU)	Filter 1 TURB	Filter 2 TURB	Filter 3 TURB	Filter 4 TURB	Turb (NTU)	Free Cl	Turb (NTU)	Free Cl
January										
Average	119	4.42	0.17	0.12	0.03	0.03	0.20	1.16	0.14	0.91
Max	151	6.10	0.25	0.19	0.05	0.04	0.46	1.41	0.44	1.40
Min	90	3.50	0.14	0.08	0.02	0.02	0.04	0.92	0.02	0.60
February										
Average	115	4.17	0.18	0.18	0.03	0.03	0.06	0.86	0.06	0.84
Max	191	4.68	0.30	0.30	0.03	0.03	0.13	1.10	0.12	1.15
Min	83	3.63	0.09	0.07	0.03	0.03	0.03	0.61	0.02	0.48
March										
Average	104	3.56	0.15	0.13	0.04	0.03	0.07	1.06	0.05	1.05
Max	137	4.58	0.20	0.19	0.05	0.04	0.14	1.38	0.22	1.23
Min	68	2.84	0.06	0.06	0.03	0.03	0.05	0.90	0.01	0.81
April										
Average	115	180.37	0.14	0.10	0.05	0.03	0.06	1.00	0.03	0.91
Max	162	948.00	0.28	0.18	0.05	0.03	0.10	1.35	0.05	1.20
Min	90	2.66	0.05	0.07	0.05	0.03	0.04	0.50	0.01	0.50
May										
Average	191	266.00	-	-	0.05	0.06	0.20	1.00	0.13	0.79
Max	338	1100.00	-	-	0.17	0.21	0.37	1.82	0.21	1.17
Min	54	65.00	-	-	0.03	0.03	0.05	0.47	0.01	0.50
June										
Average	131	131.22	-	-	-	-	0.24	1.06	0.21	0.90
Max	149	148.54	-	-	-	-	0.33	1.95	0.22	1.35
Min	67	66.71	-	-	-	-	0.00	0.62	0.21	0.54
July										
Average	110.14	114.80	-	-	0.08	0.07	0.30	1.00	0.26	0.93
Max	174.36	324.00	-	-	0.11	0.09	0.40	1.91	0.37	1.34
Min	15.43	65.00	-	-	0.04	0.04	0.15	0.32	0.07	0.46
August										
Average	151	26.55	-	-	0.06	0.07	0.17	1.15	0.10	0.89
Max	176	64.80	-	-	0.11	0.13	0.32	1.61	0.19	1.40
Min	129	13.20	-	-	0.04	0.04	0.05	0.61	0.02	0.52
September										
Average	140	8.14	-	-	0.07	0.06	0.13	0.88	0.09	0.92
Max	157	11.50	-	-	0.12	0.12	0.25	1.29	0.12	1.61
Min	106	5.95	-	-	0.03	0.03	0.00	0.52	0.03	0.57
October										
Average	167	5.67	-	-	0.04	0.04	0.19	1.12	0.09	1.15
Max	267	9.50	-	-	0.07	0.10	0.41	1.80	0.22	1.54
Min	107	4.08	-	-	0.03	0.02	0.04	0.70	0.02	0.68

FEH WTP Summary Continued										
November										
Average	145	3.35	0.12	0.11	0.03	0.03	0.10	0.98	0.04	0.91
Max	205	5.39	0.16	0.14	0.04	0.05	0.18	1.40	0.08	1.15
Min	52	2.15	0.06	0.05	0.02	0.02	0.05	0.72	0.02	0.73
December										
Average	133	4.38	0.14	0.12	0.05	0.05	0.23	0.91	0.15	1.01
Max	353	5.77	0.20	0.19	0.10	0.09	0.38	1.31	0.18	1.29
Min	3	3.50	0.07	0.06	0.03	0.03	0.12	0.54	0.08	0.72

Routine and Other Sampling						
LOCATION	SAMPLES	BACTERIOLOGICAL # of Positive Samples			CHLORINE # of Samples Below Guidelines	TURBIDITY
	# of Samples Collected	>200 Background Colonies	Total Coliform (MPN/100 mL)	E. Coli (MPN/100 mL)	Total < 0.5 mg/L Free < 0.1 mg/L	Average (NTU)
Killdeer Park	26	0	0	0	0	0.14
Fairview Heights	28	0	0	0	0	0.18
North Commercial (Fairview Heights)	54	0	0	0	0	0.20
Maier Park	6	0	0	0	0	0.12
McIntosh Park	26	0	0	0	0	0.12
Downtown	29	0	0	0	0	0.20
College Heights	24	0	0	0	0	0.18
Yellow Sky	50	0	0	0	0	0.17
Riverview	52	0	0	0	0	0.16
Parsons Industrial Park	57	0	0	0	0	0.43
Other ¹	177	0	1	0	2	0.43
Total Routine Samples	352	0	0	0	0	0.19
Total Other Samples²	177	0	1	0	2	0.43

¹ These samples are not part of the routine sampling

² All Other "Samples Below Guidelines" for Chlorine were taken at the City's WTP #1 during filter maintenance.

² The one sample taken with positive Total Coliform results was taken during filter maintenance at WTP #1, the resample at the same location was negative for Total Coliforms.

Note:

In cases where the Free and Total Chlorine falls below the guidelines set out by the Water Security Agency, the lines are flushed and chlorine retested.

Table 4 - General Chemical for WTP #1				
Parameter	Units	17-Mar	13-Oct	AO
		Results	Results	
Bicarbonate	mg/L	251	276	
Calcium	mg/L	68	85	
Carbonate	mg/L	<1	<1	
Chloride	mg/L	19	24	250
Hydroxide	mg/L	<1	<1	
Magnesium	mg/L	22	28	200
pH	pH Units	8	8.01	6.5-9.0
Potassium	mg/L	2.0	2.5	
Sodium	mg/L	30	42	300
E.C.	uS/cm	630	757	
Sulphate	mg/L	110	160	500
Sum of Ions	mg/L	502	618	
Total Alkalinity	mg/L	206	226	500
Total Hardness	mg/L	260	327	800
Nitrate	mg/L	<0.04	0.18	
Fluoride	mg/L	0.11	0.11	1.5
TDS	mg/L	416	487	1500

Table 4 - General Chemical for FEH WTP#2						
Parameter	Units	17-Mar	June**	29-Jul	13-Oct	AO
		Results	Results	Results	Results	
Bicarbonate	mg/L	184		149	166	
Calcium	mg/L	49		53	48	
Carbonate	mg/L	<1		<1	<1	
Chloride	mg/L	19		60	28	250
Hydroxide	mg/L	<1		<1	<1	
Magnesium	mg/L	15		18	18	200
pH	pH Units	8.07		7.57	7.94	6.5-9.0
Potassium	mg/L	1.5		4.8	2.8	
Sodium	mg/L	13		19	15	300
E.C.	uS/cm	432		515	454	
Sulfate	mg/L	53		54	61	500
Sum of Ions	mg/L	337		359	339	
Total Alkalinity	mg/L	151		122	136	500
Total Hardness	mg/L	184		206	194	800
Nitrate	mg/L	2.20		1.00	0.63	45*
Fluoride	mg/L	0.1		0.03	0.06	1.5
TDS	mg/L	280		294	232	1500

*MAC based on Nitrate as NO₃

**FEH WTP #2 Sample for June not taken due to plant not running.

Table 6 - Chemical Health + Cyanide and Mercury						
Parameter	Units	WTP#1	WTP#2	MAC (mg/L)	iMAC (mg/L)	AO (mg/L)
		13-Oct	13-Oct			
Aluminum	mg/L	0.001	0.032			
Arsenic	ug/L	0.2	0.2	0.01	0.025	
Barium	mg/L	0.098	0.049	1		
Boron	mg/L	0.03	0.02		5	
Cadmium	mg/L	<0.00001	0.00001	0.005		
Chromium	mg/L	<0.0005	<0.0005	0.05		
Copper	mg/L	<0.0002	0.0007			
Iron	mg/L	0.0049	0.0059			0.3
Lead	mg/L	<0.0001	<0.0001	0.01		
Manganese	mg/L	0.0011	0.0072			0.05
Selenium	mg/L	<0.0001	0.0002	0.01		
Uranium	ug/L	0.2	<0.1	0.02		
Zinc	mg/L	<0.0005	0.0006			5
Cyanide	ug/L	1	2	0.2		
Mercury	ng/L	1	4	0.001		

Table 7 - Trihalomethanes							
Location	Date	iMAC (ug/L)	Total THMs (ug/L)	Bromoform (ug/L)	Dibromo chloromethane (ug/L)	Dichloro bromomethane (ug/L)	Chloroform (ug/L)
Riverview	15-Jan-20		63.5	<2	<1	7.5	56.0
	6-Apr-20		43.1	<2	<1	6.1	37.0
	22-Jul-20		49.1	<2	1.0	7.1	41.0
	5-Oct-20		60.0	<2	1.0	9.0	50.0
Downtown	15-Jan-20		69.7	<2	1.0	8.7	60.0
	6-Apr-20		43.8	<2	<1	5.8	38.0
	22-Jul-20		61.0	<2	1.0	9.0	51.0
	5-Oct-20		58.7	<2	1.0	8.7	49
Average		<100	56.1	<2	1.0	7.7	47.8
Max			69.7		1.0	9.0	60.0
Min			43.1		1.0	5.8	37.0

Table 8 - Halo Acedic Acids									
Location	Date	iMAC (ug/L)	Total HAAs (ug/L)	Monochloroacetic acid (ug/L)	Monobromoacetic acid (ug/L)	Dichloroacetic acid (ug/L)	Trichloroacetic acid (ug/L)	Dibromoacetic acid (ug/L)	Bromochloroacetic acid (ug/L)
Riverview	15-Jan-20		39.0	<10	<2	14.0	25.0	<3	<3
	6-Apr-20		30.0	<10	<2	12.0	18.0	<3	<3
	22-Jul-20		25.0	<10	<2	10.0	15.0	<3	<3
	5-Oct-20		35.0	<10	<2	11.0	21.0	<3	3.0
Downtown	15-Jan-20		38.0	<10	<2	13.0	25.0	<3	<3
	6-Apr-20		26.0	<10	<2	9.0	17.0	<3	<3
	22-Jul-20		22.0	<10	<2	7.0	15.0	<3	<3
	5-Oct-20		34.0	<10	<2	14.0	20.0	<3	<3
Average		<80	31.1	<5	<2	11.3	19.5	<1	3.0
Max			39.0	<5	<2	14.0	25.0	<1	3.0
Min			22.0	<5	<2	7.0	15.0	<1	3.0

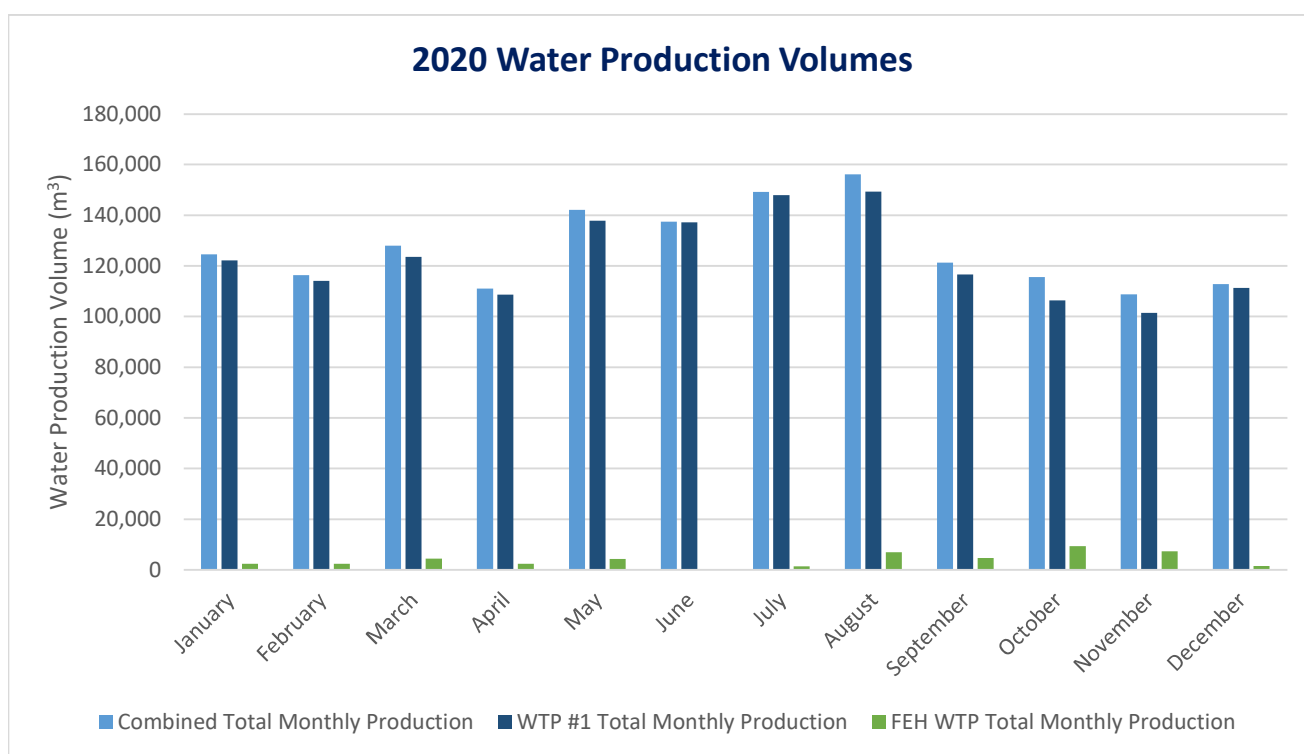
Crypto and Giardia			
Parameter	Units	Results	Results
		23-Jun-20	24-Nov-20
Volume Filtered	L	11.5	20
Giardia cysts	cysts/100L	0.0	20
Cryptosporidium oocysts	oocysts/100L	0.0	0.0
Risk Factor			

Risk of Surface Water Contamination

- 20+ high risk
- 10-19 moderate risk
- 0-9 low risk

City of North Battleford
Drinking Water Quality
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Appendix C: Water Production Volumes

Table 1C - Water Production Volumes						
Month	WTP #1		FEH WTP		Combined	
	Total (m ³)	Average Daily Production (m ³)	Total (m ³)	Average Daily Production (m ³)	Total Monthly Production (m ³)	Average Daily Production (m ³)
January	122,137	3,940	2,416	78	124,553	4,018
February	114,006	4,072	2,342	84	116,348	4,155
March	123,548	3,985	4,353	140	127,901	4,126
April	108,590	3,620	2,400	80	110,990	3,700
May	137,856	4,447	4,250	137	142,106	4,584
June	137,236	4,575	187	6	137,423	4,581
July	147,886	4,771	1,348	43	149,234	4,814
August	149,251	4,815	6,894	222	156,145	5,037
September	116,617	3,887	4,692	156	121,309	4,044
October	106,299	3,429	9,346	301	115,645	3,730
November	101,446	3,382	7,321	244	108,767	3,626
December	111,311	3,591	1,516	49	112,827	3,640
Yearly Total	1,476,183	4,043	47,065	129	1,523,248	4,171



*City of North Battleford
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Appendix D: Glossary*

Glossary

AO – Aesthetic Objective and is based on taste, odour, or staining

BOD – Biochemical Oxygen Demand is the amount of dissolved oxygen needed by aerobic organisms in water to break down organic material present.

BTEX – Benzene, Toluene, Ethylbenzene, and Xylene are volatile organic compounds typically found in petroleum products such as gasoline and diesel.

EC – is a measure of water's ability to conduct electricity, The higher the concentration of dissolved ions, the higher the conductivity. It is most often measured in $\mu\text{S}/\text{cm}$ – microSiemens per centimetre.

E. coli – is the only member of the total coliform group of bacteria that is found only in the intestines of mammals. The presence of E. coli in water indicates recent fecal contamination and may indicate the possible presence of disease-causing pathogens

FEH WTP – F.E. Holliday Water Treatment Plant

iMAC – Interim Maximum Acceptable Limit and is health based

MAC - Maximum Acceptable Limit and is health based

Microcystins – are toxins produced by blue-green algae (cyanobacteria).

mg/L – milligrams per litre

NTU – Nephelometric Turbidity Unit is based on the amount of light that is scattered by particles

OG – Operational Guidelines and is based on operational considerations (for example the water treatment process used)

Pathogen – is a disease causing microorganism such as a virus or bacterium.

pH – is a measure of how acidic or basic a solution is. It ranges from 0 to 14. A pH of 7 is neutral. A pH less than 7 is acidic while a pH greater than 7 is basic.

S.E. – Saskatchewan Ministry of the Environment is the department that oversees solid waste disposal

WSA – The Water Security Agency was created on October 1, 2012. The former Saskatchewan Watershed Authority is now part of this new provincial water organization. This agency regulates and monitors waterworks and wastewaterworks.

THMs – Trihalomethanes are disinfection by-products that form when chlorine is added to water that contains natural organic matter.

TKN – Total Kjeldahl nitrogen is the sum of organic nitrogen, ammonia, and ammonium.

Total Coliforms – are a group of bacteria commonly found in the environment. They are not likely to cause illness, but their presence indicates the water supply may be vulnerable to contamination by more harmful microorganisms.

Total P – Total Phosphorus is a measure of all the forms of phosphorus in a sample

TSS – Total Suspended Solids includes all particles suspended in water which will not pass through a filter.

Turbidity – is a measure of relative clarity of a liquid. Guidelines for turbidity are a safeguard against pathogens in drinking water.

VSS – Volatile Suspended Solids is the portion of Total Suspended Solids that can be ignited and is made up of organic material.

WSA – The Water Security Agency was created on October 1, 2012. The former Saskatchewan Watershed Authority is now part of this new provincial water organization.

WTP – Water Treatment Plant

WTP #1- Water Treatment Plant #1, this is the groundwater plant

WTP #2 – Water Treatment Plant #2, also officially known as F.E.Holliday Water Treatment Plant, this is the surface water plant

µg/L – micrograms per litre; this is 1000 times smaller than a milligram (0.001mg/L)