

NORTH BATTLEFORD

DRINKING WATER QUALITY

2017 ANNUAL REPORT



**North
Battleford**

Executive Summary

This report provides an analysis of the Drinking Water Quality of the water produced in the City of North Battleford and the results of the Monitoring of the Distribution System.

The highlights of 2017 were as follows:

- A total of 370 samples were submitted as part of the routine monitoring of the distribution system. One of the routine samples tested positive for total coliforms. E.Coli was not detected in the positive sample. A repeat sample was collected, and the results were negative. All other samples tested negative for total coliforms and E. Coli. All samples were above minimum guidelines for chlorine residuals.
- The annual average for samples submitted for Trihalomethanes was below the Maximum Acceptable Concentration.
- The average monthly turbidity for Water Treatment Plant #1 ranged from 0.03 NTU to 0.09 NTU, meeting the guideline of less than 1.0 NTU for 95% of readings.
- The average monthly turbidity for the F.E Holliday Treatment Plant filters ranged from 0.024 to 0.071 NTU for filter #1, 0.030 to 0.071 NTU for filter #2, 0.038 to 0.075 NTU for filter #3, and 0.036 to 0.078 NTU for filter #4. These were below the guideline of less than 0.3 NTU for 95% of readings.
- Monthly free chlorine readings were above the minimum guideline of 0.2 mg/L entering the distribution system. The monthly average readings ranged from 1.08 mg/L to 1.44 mg/L at Water Treatment Plant #1 and 0.73 mg/L to 1.34 mg/L at the F.E Holliday Treatment Plant.
- The highest iron reading recorded was 0.26 mg/L at Water Treatment Plant #1 which was below the aesthetic guidelines of 0.3 mg/L.
- The highest manganese reading recorded was 0.09 mg/L at Water Treatment Plant #1 which was above the aesthetic guidelines of 0.05 mg/L.
- The 2016 Husky Energy Oil Spill continued to affect the water treatment operations for the City of North Battleford in 2017. To further summarize:
 - The City of North Battleford continued to use the GE pre-treatment system at F.E Holiday Treatment Plant to remove hydrocarbons in the raw water from the North Saskatchewan River. The GE pre-treatment system reduced the production capability of F.E Holiday Treatment Plant from 360 m³/hr to 180 m³/hr. The GE pre-treatment system was decommissioned in September 2017.
 - The temporary water line providing treated water from the Town of Battleford was recommissioned in April of 2017. The temporary water line was recommissioned to offset the lost production from F.E Holiday Treatment Plant. The temporary water line was decommissioned in September 2017.
 - The City of North Battleford continues to monitor hydrocarbons in the raw water from the North Saskatchewan River at F.E Holiday Treatment Plant using on-line analytical instruments that were installed in the fall of 2016.
 - A total of 14 sets of samples were submitted from the raw and treated water at F.E Holiday Treatment plant for hydrocarbon testing. All samples were either within applicable guidelines or below detection limits.

- Water Treatment Plant #1 produced 1,481,205.7 m³, while the F.E Holliday Treatment Plant and Town of Battleford Line produced 430,709.2 m³. Combined, the Water Treatment Plants produced over 1.82 million m³.

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

CITY OF NORTH BATTLEFORD

DRINKING WATER QUALITY

2017 ANNUAL REPORT

CITY OF NORTH BATTLEFORD

DEPARTMENT OF UTILITY SERVICES

2017

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.

Contents

Introduction	1
Background.....	1
Water Treatment Plants	1
Distribution System	2
Tested Parameters.....	3
Results	6
WTP #1 Summary	6
FEH WTP (WTP #2) Summary.....	7
Routine Sampling	8
General Chemical.....	8
Health and Toxicity with Cyanide and Mercury	8
THMs	8
Halo Acetic Acids	8
Cryptosporidium and Giardia	9
Pesticides.....	9
Organics.....	9
Water Production	9
Conclusion	10
Acknowledgment.....	10

APPENDICES

- Appendix A: Map of Sample Zones
- Appendix B: Results Tables
- Appendix C: Water Production Volumes
- Appendix D: Glossary

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 represented 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 many thousands of valves.

Approximately 4,600 residential, commercial, industrial and institutional customers utilize the North Battleford distribution system.

Between January 1, 2017, and December 31, 2017, the City of North Battleford water treatment plants produced over 1.82 million m³ of water. Tables, along with a graph showing water production per month, can be viewed in the results section of the report.

Water Treatment Plants

The City of North Battleford waterworks 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 demand of residents.

Water Treatment Plant #1 (Figure 1) is currently designated as a Level 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 in 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 disinfection method used at this plant. A liquid form of chlorine is used in pre-treatment. 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 some of the lost production from FEH WTP. Husky Energy provided the funding for the four production wells and the associated costs included. With the 2012 expansion and the addition of the four new production wells, the 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 Level 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.

In 2017, the City of North Battleford continued to receive treated water from the Town of Battleford, by means of a temporary water line, due to the Husky Energy oil spill in 2016. In addition to receiving treated water from the Town of Battleford, the City continued to pre-treat the raw water at FEH WTP with the GE pre-treatment system for the removal of hydrocarbons. Both the Town of Battleford temporary water line and GE pre-treatment system were decommissioned in September of 2017 after the Water Security Agency (WSA), and the City of North Battleford had received and reviewed the 'North Saskatchewan River Sediment Sampling Report' performed by Husky Energy. The City of North Battleford will continue to monitor for hydrocarbons in the source water at FEH WTP by means of on-line analytical instruments that were installed in the fall of 2016.

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 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 2017, there were 19 water main leaks detected and repaired. Work was done on 166 hydrants (150 complete rebuilds, 9 repairs, 4 replacements and 3 thaws).

In 2017, the City of North Battleford installed pressure monitoring devices in 6 locations throughout the distribution system. An additional 10 locations will have pressure monitoring devices installed in 2018. The pressure in the City's distribution system must be greater than 20 psi at all times. In any circumstance that the pressure drops below 20 psi in the distribution system, the system is considered depressurized, vulnerable to contamination, and a drinking water advisory is issued to the affected section of the system while corrective action is 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 biweekly. The Permit to Operate a Waterworks set out by the WSA only requires 3 samples be taken per week. In 2017, a total of 370 routine monitoring samples were submitted. Each sample is submitted for coliform testing and is also tested for 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. They 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 (µg/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 levels. 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, free and total chlorine are tested 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 used to assess the clarity of water. It is 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.

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

Trihalomethanes (THMs) are organic compounds formed in drinking water as a by-product of chlorine disinfection. THMs may be linked to cancer or other health problems. The MAC of total THMs is 100 µg/L (0.1 mg/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 tested in 2017.

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 tested in 2017.

Due to the Husky Energy oil spill, the City of North Battleford tested for BTEX, PAHs, and F1-F4 Hydrocarbons in the water entering FEH WTP and the treated water on a biweekly (June to October) and monthly (November to May) basis in 2017. These

parameters were also continuously monitored by on-line analytical instruments which were installed at FEH WTP in the fall of 2016.

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 WTP #2 to reach this goal. As part of the current operating permit, City of North Battleford is only required to test for these during periods of upset or under the direction of the WSA.

Microcystin

Microcystins are tested in the raw 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 average for turbidity from the on-line analyzer ranged from 0.03 NTU (April, Train A) to 0.09 NTU (August, Train A). The highest reading was 0.15 NTU (July, Train

A) while the lowest reading was 0.02 NTU (several readings). The highest reading of 0.15 NTU is below the limit of 1 NTU set out by the WSA.

The average monthly free chlorine reading from the on-line analyzer ranged from 1.08 mg/L (November, Train A) to 1.44 mg/L (January, Train A). The highest free chlorine reading recorded was 3.71 mg/L (January, Train A) while the lowest free chlorine reading was 0.65 mg/L (August, Train B).

Average iron readings ranged from 0.03 mg/L (several readings) to 0.05 mg/L (several readings). The highest reading recorded was 0.26 mg/L (September, Train B) while the lowest reading was below detection limits (several readings).

Average manganese readings ranged from 0.02 mg/L (several readings) to 0.04 mg/L (July, Train A). The highest reading recorded was 0.09 mg/L (May, Train B) and the lowest reading for manganese recorded was below detection limits (several readings). While the highest reading of 0.09 mg/L is above the AO, the average readings for manganese remained below the AO of 0.05 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 average turbidity leaving the four filters ranged from 0.024 – 0.071 NTU for filter #1, 0.030– 0.071 NTU for filter #2, 0.038 – 0.075 NTU for filter #3, and 0.036 – 0.078 NTU for filter #4. The highest turbidity reading recorded from the filters was 0.193 NTU (December, filter #2) while the lowest reading was 0.286 NTU (May, filter #2). The highest readings were below the limit set out by WSA. Filter #3 and filter #4 did not operate from January 1st to May 8th. Filter #1 and filter #2 did not operate from June 1st to September 12th.

Average free chlorine readings recorded entering the distribution system ranged from 0.73 mg/L to 1.34 mg/L. The highest chlorine reading recorded was 4.74 mg/L (November) while the lowest was 0.42 mg/L (October and November).

In April of 2017, the temporary water line from the Town of Battleford was recommissioned to provide treated water to the City of North Battleford. Two sets of water samples were collected from 4 locations along the temporary line after super chlorination and flushing was performed (2 locations in the Town of Battleford and 2 locations in North Battleford; 2 sets at each location). Before the water line was put into service, each set of samples were tested for total coliforms and E. Coli. Once the results for each set of samples showed zero coliforms and zero E. Coli, the line was put into service. The line was put into service on April 21st after all tested parameters were within guidelines. The temporary water line was decommissioned in September of 2017.

The results can be found in **Table 2B, Appendix B**. These results include the water from the Town of Battleford.

Routine Sampling

In 2017, a total of 370 samples were submitted as part of the routine monitoring required by the WSA. Of these samples, 1 came back positive for total coliforms. E. Coli was not detected in the positive sample. A repeat sample was collected, and the results were negative. 3 routine samples sent to an accredited laboratory were tested for total coliforms and E. Coli using an incorrect dilution method. The WSA was notified of the incorrect method and the results showed no detection of total coliforms or E. Coli. Free and total chlorine residuals and turbidity were measured in each routine sample. All were within applicable guidelines.

A total of 337 '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 4 locations. None of these samples tested positive for E. coli. Repeat samples were collected at all 4 locations. These follow-up samples were within applicable guidelines. Free and total chlorine residuals and turbidity were measured at each location. All were within applicable guidelines. Refer to **Table 3B, Appendix B** for the routine monitoring of the distribution system results as well as the results of 'other' sampling.

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 General Chemical Analysis in 2017. The parameters tested met all aesthetic and health objectives. The results are shown in **Tables 4B and 5B, Appendix B**.

Health and Toxicity with Cyanide and Mercury

One sample of the treated water from each WTP was submitted for Health and Toxicity with Cyanide and Mercury in 2017. 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 2 locations (8 samples in total) within the distribution system and were submitted for THMs in 2017. The total THM concentrations ranged from 39.2 µg/L to 70.0 µg/L. All samples tested below the MAC of 100 µg/L. The results are shown in **Table 7B and 8B, Appendix B**.

Halo Acetic Acids

Samples were collected quarterly from 2 locations (8 samples in total) within the distribution system and were submitted for HAAs in 2017. The total HAA concentrations ranged from 8.0 µg/L to 38.0 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

No sampling was conducted for Cryptosporidium and Giardia in 2017. Sampling is done under upset conditions or the direction of the WSA.

Pesticides

One sample of the treated water from each WTP was submitted for Pesticides analysis in 2017. All tested parameters were below detection limits. The results can be found in **Table 9B, Appendix B.**

Organics

One sample of the treated water from each WTP was submitted for Organics analysis in 2017. All tested parameters were below detection limits. The results can be found in **Table 10B, Appendix B.**

Monthly (January to April) and biweekly (May to September) samples of the treated and raw water from FE WTP (WTP #2) were submitted for hydrocarbon analysis in 2017. The hydrocarbon monitoring program concluded in October 2017. The parameters tested were either within guidelines or below detection limits. The results can be found in **Table 11B, Appendix B.**

Water Production

In 2017, over 1.82 million m³ of potable water was produced by the two Water Treatment Plants. WTP #1 produced over 1.48 million m³, while just over 0.43 million m³ of potable water was produced by either the FEH WTP or from the Town of Battleford water line into the clear wells at FEH WTP.

Combined, the monthly amount of water produced by the WTPs ranged from a low of 111,536.5 m³ (December) to a high of 206,669.6 m³ (July) which can be seen in Figure 3. The average daily production was 5,006.8 m³. The peak amount produced by both WTPs was 8,641.0 m³ on July 5th. The lowest amount produced by both WTPs was 2,878.3 m³ on January 16th. The production amounts for both WTPs along with the combined monthly total can be seen in **Table 1C, Appendix C.**

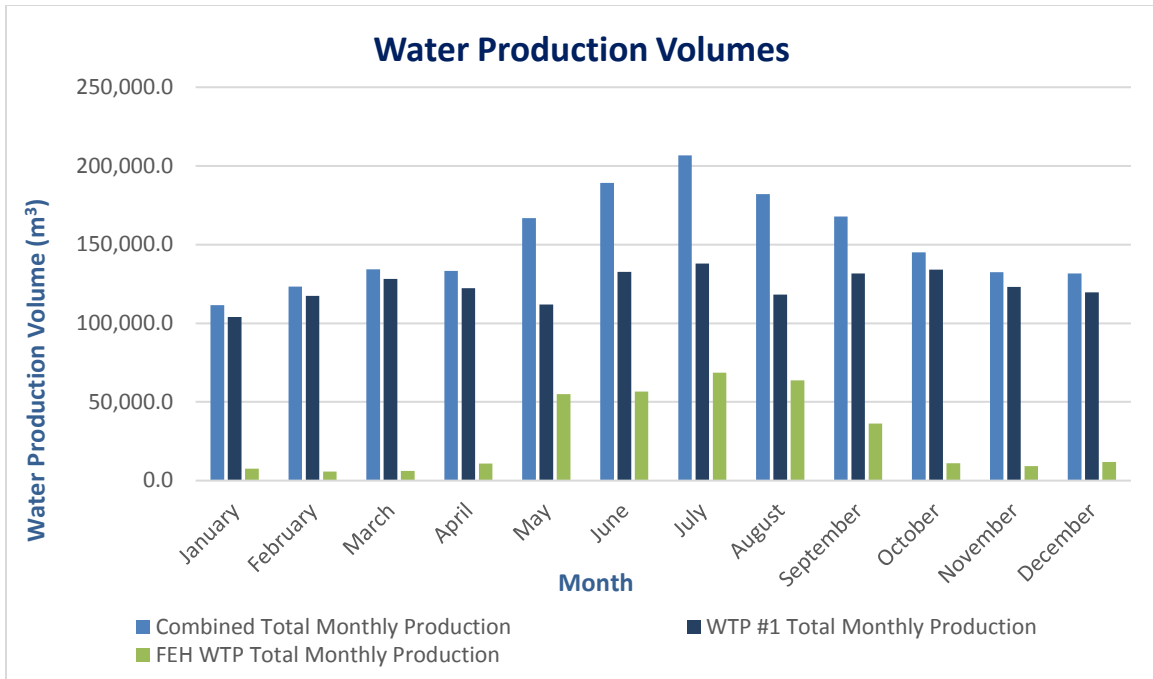


Figure 1. Monthly Production Volumes

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.

The City of North Battleford will collect one set of hydrocarbon samples from the raw and treated water at FEH WTP during spring runoff in 2018, as per the amended October 1st, 2017, Permit to Operate.

Acknowledgement

The Utility Services Department of the City of North Battleford prepared this report. The dedication and commitment of civic staff in providing safe water during 2017 is acknowledged.

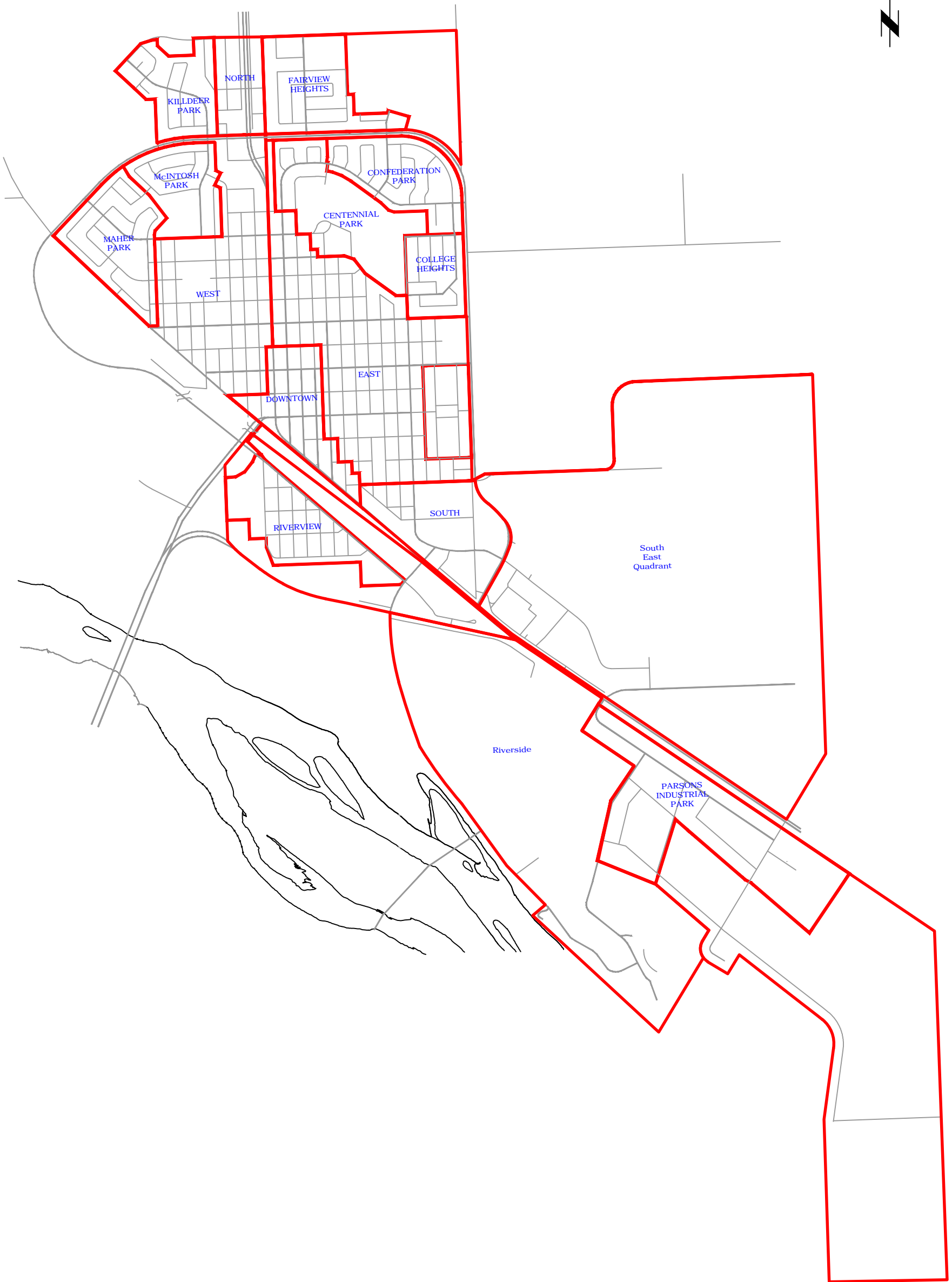
Also acknowledged is the ongoing assistance of the WSA.


For more information, please contact:

City of North Battleford

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*City of North Battleford
Drinking Water Quality
2017 Report
Appendix A: Map of Sampling Zones*



 North Battleford Public Works & Utilities	DATE REVISED	BY	DESIGNED BY:	DATE: April 19, 2013	SCALE: 1:30,000	PAGE: 1 / 1
			CHECKED BY:	PROJECT: SAMPLE ZONES WATER DISTRIBUTION		
			JOB NO.:			

*City of North Battleford
Drinking Water Quality
2017 Report
Appendix B: Results Tables*

Table 1B - 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	1.46	1.44	1.77	0.15	0.05	0.03	0.02
		Max	3.38	3.71	4.10	0.21	0.10	0.07	0.04
		Min	0.77	0.85	0.91	0.09	0.03	0.00	0.01
	B	Average	1.31	1.34	1.59	0.13	0.07	0.03	0.02
		Max	1.90	2.04	2.10	0.18	0.12	0.09	0.03
		Min	0.84	0.99	1.09	0.08	0.05	0.00	0.00
February	A	Average	1.26	1.31	1.52	0.20	0.04	0.04	0.02
		Max	1.49	1.48	1.78	0.35	0.09	0.12	0.05
		Min	0.95	1.03	1.06	0.09	0.02	0.00	0.01
	B	Average	1.18	1.27	1.37	0.20	0.07	0.05	0.02
		Max	1.55	1.50	1.71	0.29	0.12	0.11	0.04
		Min	0.82	0.95	0.88	0.09	0.03	0.00	0.01
March	A	Average	1.44	1.20	1.23	0.19	0.04	0.04	0.02
		Max	2.00	1.57	1.54	0.28	0.06	0.08	0.04
		Min	1.18	0.94	1.03	0.14	0.02	0.01	0.01
	B	Average	1.46	1.20	1.19	0.24	0.07	0.04	0.02
		Max	1.84	1.48	1.44	0.42	0.10	0.10	0.04
		Min	1.12	1.01	1.04	0.09	0.05	0.01	0.01
April	A	Average	1.17	1.23	1.45	0.14	0.03	0.03	0.02
		Max	1.56	1.67	2.09	0.24	0.11	0.07	0.03
		Min	0.81	1.01	1.07	0.09	0.02	0.00	0.01
	B	Average	1.14	1.13	1.39	0.17	0.07	0.04	0.02
		Max	1.67	1.51	2.11	0.25	0.09	0.14	0.07
		Min	0.84	0.90	1.02	0.12	0.05	0.00	0.01
May	A	Average	1.24	1.32	1.58	0.24	0.05	0.04	0.02
		Max	1.65	1.69	2.18	0.35	0.10	0.19	0.04
		Min	0.82	0.96	1.07	0.18	0.03	0.00	0.00
	B	Average	1.15	1.16	1.51	0.20	0.07	0.05	0.02
		Max	1.69	1.65	2.17	0.25	0.09	0.22	0.09
		Min	0.53	0.73	0.99	0.14	0.05	0.00	0.00
June	A	Average	1.32	1.35	1.65	0.19	0.08	0.04	0.02
		Max	1.62	1.56	1.99	0.23	0.11	0.09	0.04
		Min	0.69	0.90	0.94	0.16	0.06	0.00	0.00
	B	Average	1.27	1.29	1.52	0.17	0.07	0.04	0.02
		Max	1.63	1.62	1.86	0.20	0.08	0.10	0.04
		Min	0.82	0.94	1.03	0.13	0.05	0.00	0.00

Table 1B - 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	1.23	1.28	1.49	0.36	0.07	0.05	0.04
		Max	1.45	1.52	2.18	0.59	0.15	0.21	0.05
		Min	0.86	0.97	1.04	0.15	0.05	0.00	0.01
	B	Average	1.15	1.24	1.41	0.36	0.07	0.04	0.02
		Max	1.49	1.55	1.75	0.60	0.11	0.11	0.04
		Min	0.72	0.97	0.99	0.11	0.06	0.00	0.01
August	A	Average	1.14	1.15	1.43	0.19	0.09	0.04	0.03
		Max	1.62	1.70	1.96	0.23	0.11	0.09	0.06
		Min	0.87	0.91	0.97	0.15	0.07	0.00	0.01
	B	Average	1.11	1.14	1.38	0.20	0.08	0.05	0.02
		Max	1.60	1.75	1.97	0.25	0.09	0.10	0.04
		Min	0.39	0.65	0.79	0.14	0.07	0.00	0.01
September	A	Average	1.32	1.32	1.58	0.33	0.08	0.05	0.02
		Max	1.84	1.80	2.17	0.43	0.09	0.12	0.05
		Min	0.75	0.76	1.05	0.26	0.04	0.00	0.00
	B	Average	1.21	1.16	1.47	0.26	0.08	0.05	0.02
		Max	1.66	1.51	1.92	0.29	0.11	0.26	0.07
		Min	0.75	0.80	1.02	0.22	0.07	0.00	0.01
October	A	Average	1.14	1.16	1.40	0.19	0.07	0.05	0.02
		Max	1.39	1.55	1.80	0.24	0.08	0.14	0.04
		Min	0.87	0.88	1.08	0.13	0.05	0.01	0.00
	B	Average	1.11	1.11	1.35	0.16	0.06	0.04	0.02
		Max	1.44	1.31	1.67	0.19	0.07	0.13	0.04
		Min	0.81	0.93	0.94	0.13	0.06	0.00	0.00
November	A	Average	1.09	1.08	1.32	0.25	0.05	0.05	0.02
		Max	1.36	1.30	1.65	0.49	0.06	0.14	0.04
		Min	0.84	0.84	0.99	0.12	0.03	0.01	0.00
	B	Average	1.10	1.09	1.33	0.22	0.06	0.05	0.02
		Max	1.69	1.61	1.79	0.37	0.06	0.09	0.03
		Min	0.74	0.79	0.91	0.10	0.05	0.00	0.00
December	A	Average	1.12	1.26	1.39	0.24	0.06	0.05	0.02
		Max	1.37	1.53	1.77	0.35	0.10	0.11	0.04
		Min	0.71	0.94	1.03	0.16	0.04	0.00	0.01
	B	Average	1.13	1.16	1.38	0.22	0.06	0.04	0.02
		Max	1.35	1.52	1.64	0.40	0.08	0.08	0.03
		Min	0.91	0.75	1.07	0.12	0.05	0.00	0.00

Table 2B - FEH WTP Summary										
Date	Raw Water		Filter Effluent - Turbidities (NTU)				Clearwell Turbidities (NTU)		Clearwell Free Cl2 (mg/L)	
	RATE (m3/hr)	TURBIDITY (NTU)	No. 1 1720 D	No. 2 1720 D	No. 3 1720 D	No.4 1720 D	1/2 1720 D	3/4 1720 D	1/2 Cl 17	3/4 Cl 17
January										
Average	111.59	7.12	0.026	0.030	-	-	0.059	0.094	0.99	1.13
Max	184.80	15.90	0.071	0.050	-	-	0.154	0.164	1.46	2.07
Min	47.85	3.02	0.020	0.025	-	-	0.015	0.009	0.71	0.69
February										
Average	98.31	3.54	0.024	0.037	-	-	0.048	0.087	1.07	1.09
Max	138.32	7.79	0.030	0.044	-	-	0.124	0.160	1.31	1.40
Min	58.43	1.31	0.020	0.029	-	-	0.012	0.022	0.74	0.68
March										
Average	129.84	4.65	0.026	0.037	-	-	0.034	0.044	0.97	0.96
Max	209.46	6.80	0.035	0.058	-	-	0.076	0.082	1.52	1.50
Min	61.67	3.10	0.022	0.032	-	-	0.014	0.008	0.61	0.57
April										
Average	106.47	35.47	0.036	0.044	-	-	0.076	0.083	1.14	0.94
Max	155.17	110.00	0.124	0.074	-	-	0.182	0.304	2.20	1.45
Min	40.97	4.00	0.019	0.033	-	-	0.019	0.013	0.48	0.57
May										
Average	177.01	34.88	0.056	0.056	0.038	0.038	0.029	0.027	1.11	1.06
Max	256.37	52.00	0.140	0.286	0.064	0.064	0.169	0.131	3.71	1.51
Min	100.94	18.70	0.040	0.039	0.031	0.031	0.009	0.013	0.73	0.82
June										
Average	155.66	74.87	-	-	0.044	0.056	0.086	0.051	0.95	1.04
Max	263.38	164.00	-	-	0.060	0.072	0.306	0.244	1.29	1.23
Min	77.79	36.20	-	-	0.036	0.048	0.032	0.013	0.73	0.84
July										
Average	195.43	18.50	-	-	0.051	0.050	0.274	0.219	1.00	1.09
Max	367.71	61.80	-	-	0.103	0.087	1.681	0.660	1.37	1.42
Min	63.41	6.53	-	-	0.029	0.027	0.020	0.030	0.71	0.74
August										
Average	155.65	6.57	-	-	0.049	0.043	0.034	0.028	1.06	1.12
Max	266.77	8.86	-	-	0.065	0.050	0.101	0.083	2.13	1.42
Min	81.12	3.38	-	-	0.041	0.039	0.018	0.019	0.68	0.79
September										
Average	193.95	6.59	0.064	0.065	0.058	0.063	0.071	0.058	1.27	1.34
Max	422.86	12.90	0.076	0.078	0.075	0.080	0.225	0.185	4.43	3.98
Min	53.46	4.49	0.041	0.045	0.042	0.042	0.020	0.024	0.66	0.66
October										
Average	183.17	6.34	0.071	0.071	0.075	0.078	0.051	0.048	1.06	0.73
Max	365.03	18.80	0.086	0.108	0.099	0.103	0.077	0.108	1.44	1.07
Min	81.79	3.78	0.056	0.044	0.064	0.066	0.031	0.021	0.66	0.42

Table 2B - FEH WTP Summary Continued										
November										
Average	205.21	3.48	0.074	0.065	0.069	0.073	0.051	0.038	1.00	0.88
Max	366.74	6.70	0.129	0.140	0.111	0.126	0.127	0.085	4.74	2.98
Min	43.73	2.35	0.047	0.043	0.035	0.041	0.021	0.018	0.38	0.42
December										
Average	225.54	3.65	0.054	0.052	0.039	0.047	0.028	0.027	1.31	0.85
Max	325.42	4.88	0.125	0.066	0.069	0.068	0.064	0.062	2.29	1.35
Min	115.05	2.93	0.040	0.038	0.025	0.038	0.009	0.007	0.84	0.53

- No turbidity value recorded. Filter non operational/non producing.

Clearwell turbidity and chlorine from April 21st to September 15th is a combination of FEH WTP treated water and Town of Battleford treated water.

TABLE 3B
Routine and 'Other' Sampling

Table 3B - 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)
North	25	0	0	0	0	0.20
Fairview Heights	24	0	0	0	0	0.22
Kildeer Park	52	0	0	0	0	0.21
Maher/McIntosh Park	26	0	0	0	0	0.18
West	26	0	0	0	0	0.19
Downtown	25	0	0	0	0	0.26
East	27	0	1	0	0	0.20
South	26	0	0	0	0	0.19
Southeast	25	0	0	0	0	0.17
River View	52	0	0	0	0	0.24
Riverside	10	0	0	0	0	0.29
Parsons Industrial Park	52	0	0	0	0	0.29
Other ¹	337	0	4	0	0	0.48
Total Routine Samples	370	0	1	0	0	0.22
Total Other Samples	337	0	4	0	0	0.48

¹ These samples are not part of the routine sampling

² In cases where a sample comes back positive for Total Coliforms or E. Coli, samples are submitted 24 hours apart until 2 consecutive samples come back negative

*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 4B - General Chemical for WTP #1				
Parameter	Units	13-Mar	20-Nov	AO
		Results	Results	
Bicarbonate	mg/L	246	232	
Calcium	mg/L	87	71	
Carbonate	mg/L	<1	<1	
Chloride	mg/L	20	21	250
Hydroxide	mg/L	<1	<1	
Magnesium	mg/L	30	24	200
pH	pH Units	7.79	8.22	6.5-9.0
Potassium	mg/L	2.2	2.1	
Sodium	mg/L	37	31	300
E.C.	uS/cm	731	652	
Sulphate	mg/L	160	140	500
Sum of Ions	mg/L	582	521	
Total Alkalinity	mg/L	202	190	500
Total Hardness	mg/L	340	276	800
Nitrate	mg/L	<0.04	<0.04	
Fluoride	mg/L	0.11	0.15	1.5
TDS	mg/L	500	429	1500

Table 5B - General Chemical for FEH WTP						
Parameter	Units	13-Mar	12-Jun	5-Sep	20-Nov	AO
		Results	Results	Results	Results	
Bicarbonate	mg/L	170	210	142	220	
Calcium	mg/L	60	56	42	55	
Carbonate	mg/L	<1	<1	<1	<1	
Chloride	mg/L	26	21	19	18	250
Hydroxide	mg/L	<1	<1	<1	<1	
Magnesium	mg/L	18	19	16	19	200
pH	pH Units	7.78	7.96	7.59	8.28	6.5-9.0
Potassium	mg/L	3	3.4	1.2	1.9	
Sodium	mg/L	16	17	11	15	300
E.C.	uS/cm	484	502	388	480	
Sulfate	mg/L	74	69	57	65	500
Sum of Ions	mg/L	370	396	288	396	
Total Alkalinity	mg/L	139	172	116	180	500
Total Hardness	mg/L	224	218	170	215	800
Nitrate	mg/L	3.2	0.87	0.12	2.0	45*
Fluoride	mg/L	0.11	0.13	0.11	0.13	1.5
TDS	mg/L	301	298	230	305	1500

*MAC based on Nitrate as NO₃

Table 6B - Chemical Health + Cyanide and Mercury						
Parameter	Units	WTP#1	WTP#2	MAC (mg/L)	iMAC (mg/L)	AO (mg/L)
		18-Sep	18-Sep			
Aluminum	mg/L	0.0008	0.14*			
Arsenic	mg/L	0.000002	0.000002	0.01		
Barium	mg/L	0.079	0.058	1		
Boron	mg/L	0.04	0.02		5	
Cadmium	mg/L	<0.00001	<0.00001	0.005		
Chromium	mg/L	<0.0005	<0.0005	0.05		
Copper	mg/L	0.0005	0.0004			
Iron	mg/L	0.0095	<0.0005			0.3
Lead	mg/L	<0.0001	<0.0001	0.01		
Manganese	mg/L	0.0022	0.0023			0.05
Selenium	mg/L	<0.0001	0.0002	0.01		
Uranium	mg/L	0.2	0.4	0.02		
Zinc	mg/L	<0.0005	<0.0005			5
Cyanide	mg/L	<0.000001	<0.000001	0.2		
Mercury	mg/L	<0.000000001	<0.000000001	0.001		

*Second set of Chemical Health taken on Oct 18. Aluminum - 0.042 mg/L.

Table 7B - 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	27-Jan-17		58.4	<2	2.4	11.0	45
	17-Apr-17		41.6	<2	1.0	7.6	33
	19-Jul-17		39.2	<2	1.0	6.2	32
	25-Oct-17		59.2	<2	1.0	9.2	49
Downtown	27-Jan-17		49.7	<2	2.1	9.6	38
	17-Apr-17		50.1	<2	2.0	9.1	39
	19-Jul-17		45.1	<2	1.0	7.1	37
	25-Oct-17		70.0	<2	2.0	11.0	57
Average		<100	51.7	<2	1.6	8.9	41
Max			70.0	<2	2.4	11.0	57
Min			39.2	<2	1.0	6.2	32

Table 8B - 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	27-Jan-17		37.0	<5	2	19	16	<0.5	1.7
	17-Apr-17		16.0	<5	2	3	11	<1	2.0
	19-Jul-17		28.0	<5	<2	14	12	2.0	3.0
	25-Oct-17		34.0	<5	<2	13	20	1.0	2.0
Downtown	27-Jan-17		31.0	<5	2	16	13	<0.5	1.3
	17-Apr-17		8.0	<5	<1	2	6	<1	<1
	19-Jul-17		32.0	<5	<2	15	15	2.0	3.0
	25-Oct-17		38.0	<5	<2	15	22	1.0	3.0
Average		<80	28.0	<5	<2	12.1	14	<2	2
Max			38.0	<5	2.0	19.0	22.0	2.0	3.0
Min			8.0	<5	<1	2.0	6	<0.5	<1

Table 9B - Pesticides					
Parameter	Units	WTP#1	WTP#2	MAC (mg/L)	iMAC (mg/L)
		10-Oct	10-Oct		
Atrazine	µg/L	<0.2	<0.2		0.005
Bromoxynil(Buctril)	µg/L	<1	<1		0.005
Carbofuran	µg/L	<0.2	<0.2	0.09	
Chlorpyrifos(Lorsban)	µg/L	<0.2	<0.2	0.09	
Dicamba(Banvel)	µg/L	<1	<1	0.12	
2,4 D	µg/L	<1	<1		0.1
Diclofop-methyl(HoeGrass)	µg/L	<1	<1	0.009	
Dimethoate(Cygon)	µg/L	<2	<2		0.02
Malathion	µg/L	<0.2	<0.2	0.19	
Pentachlorophenol(PCP)	µg/L	<2	<2	0.06	
Picloram(Tordon)	µg/L	<1	<1		0.19
Trifluralin(Treflan)	µg/L	<0.2	<0.2		0.045

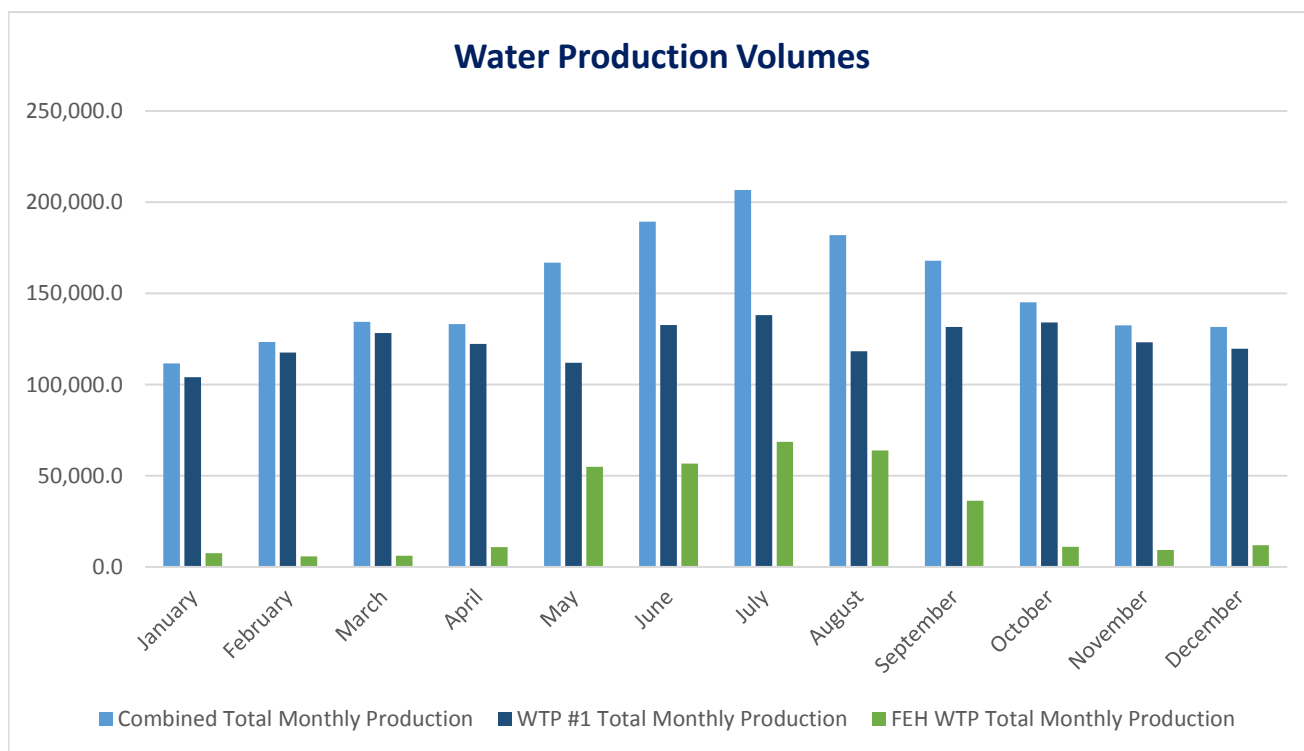
Table 10B - Organics						
Parameter	Units	WTP#1	WTP#2	MAC (mg/L)	iMAC (mg/L)	AO (mg/L)
		10-Oct	10-Oct			
BTEX						
Benzene	µg/L	<0.2	<0.2	0.005		
Toluene	µg/L	<0.2	<0.2	0.060		0.024
Ethylbenzene	µg/L	<0.2	<0.2	0.140		0.0016
Xylenes	µg/L	<0.2	<0.2	0.090		
Organochlorides						
Benzo(a)pyrene	µg/L	<0.01	<0.01	0.00001		
Carbon tetrachloride	µg/L	<2	<2	0.005		
Dichlorobenzene, 1,2	µg/L	<0.5	<0.5	0.2		
Dichlorobenzene, 1,4	µg/L	<0.5	<0.5	0.005		
Dichloroethane, 1,2	µg/L	<0.5	<0.5		0.005	
Dichloroethylene, 1,1	µg/L	<0.5	<0.5	0.014		
Dichloromethane	µg/L	<0.5	<0.5	0.05		
Dichlorophenol, 2,4	µg/L	<2	<2	0.9		
Monochlorobenzene	µg/L	<0.5	<0.5	0.08		
Tetrachlorophenol, 2,3,4,6	µg/L	<2	<2	0.1		
Trichloroethylene	µg/L	<0.5	<0.5	0.05		
Trichlorophenol, 2,4,6	µg/L	<2	<2	0.005		
Vinyl Chloride	µg/L	<0.5	<0.5	0.002		

Table 11B - Hydrocarbon Monitoring - Treated Water																	
Parameter	Units	24-Jan	21-Feb	28-Mar	14-Apr	11-May	26-May	12-Jun	26-Jun	13-Jul	24-Jul	2-Aug	21-Aug	5-Sep	27-Sep	MAC (mg/L)	AO (mg/L)
BTEX																	
Benzene	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.005	
Ethylbenzene	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.140	0.0016
m+p-Xylene	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
o-Xylene	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
Total Xylene	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.090	
Toluene	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.060	0.024
PAHs																	
2-Methylnapthalene	ug/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.020	
Benzo(a)pyrene	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.00001	
Napthalene	ug/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.090	
Pyrene	ug/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.120	
Hydrocarbons F1-F4																	
F1 (C6-C10)	ug/L	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50		
F2 (C10-C16)	ug/L	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500		
F3 (C16-C34)	ug/L	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	0.120	
F4 (C34-C50)	ug/L	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500		
Table 11B - Hydrocarbon Monitoring - Raw Water																	
Parameter	Units	24-Jan	21-Feb	28-Mar	14-Apr	11-May	26-May	12-Jun	26-Jun	13-Jul	24-Jul	2-Aug	21-Aug	5-Sep	27-Sep	MAC (mg/L)	AO (mg/L)
BTEX																	
Benzene	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.005	
Ethylbenzene	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.140	0.0016
m+p-Xylene	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
o-Xylene	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
Total Xylene	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.090	
Toluene	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.060	0.024
PAHs																	
2-Methylnapthalene	ug/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.020	
Benzo(a)pyrene	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.00001	
Napthalene	ug/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.090	
Pyrene	ug/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.120	
Hydrocarbons F1-F4																	
F1 (C6-C10)	ug/L	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50		
F2 (C10-C16)	ug/L	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500		
F3 (C16-C34)	ug/L	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	0.120	
F4 (C34-C50)	ug/L	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500		

October 1st, 2017: Permit to operate waterworks no longer requires Biweekly or Monthly Hydrocarbon sampling. Next required sample to be collected in Spring of 2018.

*City of North Battleford
Drinking Water Quality
2017 Report
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	103,959.4	3,353.5	7,577.1	244.4	111,536.5	3,598.0
February	117,494.3	4,196.2	5,759.7	205.7	123,254.0	4,401.9
March	128,184.0	4,272.8	6,183.6	199.5	134,367.6	4,472.3
April	122,364.8	3,947.3	10,835.8	361.2	133,200.5	4,308.5
May	111,846.0	3,607.9	54,915.2	1,771.5	166,761.2	5,379.4
June	132,627.3	4,420.9	56,611.9	1,887.1	189,239.1	6,308.0
July	138,042.0	4,453.0	68,627.6	2,213.8	206,669.6	6,666.8
August	118,207.0	3,813.1	63,786.8	2,050.7	181,993.8	5,863.8
September	131,573.5	4,385.8	36,285.6	1,209.5	167,859.1	5,595.3
October	134,100.5	4,325.8	11,024.3	355.6	145,124.8	4,681.4
November	123,161.0	4,105.4	9,285.4	309.5	132,446.4	4,414.9
December	119,646.0	3,859.5	11,957.0	385.7	131,603.0	4,245.2
Yearly Total	1,481,205.7	4,058.1	430,709.2	932.9	1,824,055.7	4,997.4



*City of North Battleford
Drinking Water Quality
2017 Report
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)