CITY OF NORTH BATTLEFORD

DRINKING WATER QUALITY

2018 ANNUAL REPORT

CITY OF NORTH BATTLEFORD

DEPARTMENT OF CITY OPERATIONS

2018

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 2018 were as follows:

- A total of 376 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 above 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 average monthly turbidity for Water Treatment Plant #1 ranged from 0.04 NTU to 0.08 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 0.110 to 1.302 NTU for filter #1, 0.078 to 1.133 NTU for filter #2, 0.027 to 0.104 NTU for filter #3, and 0.035 to 0.098 NTU for filter #4. Filters #1 & #2 were above the 0.3 NTU guidelines. This was most likely due to the plant not operating, while the high turbidity data was still being recorded by the historian. Filters #3 and #4 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 0.71 mg/L to 1.38 mg/L at Water Treatment Plant #1 and 0.86 mg/L to 1.29 mg/L at the F.E Holliday Treatment Plant.
- The highest iron reading recorded was 0.27 mg/L at Water Treatment Plant #1 which was below the aesthetic guidelines of 0.3 mg/L.
- The highest manganese reading recorded was 0.07 mg/L at Water Treatment Plant #1 which was above the aesthetic guidelines of 0.05 mg/L.
- Water Treatment Plant #1 produced 1.64 million m^3, while the F.E Holliday Treatment Plant produced 0.197 million m^3. Combined, the Water Treatment Plants produced just under 1.84 million m^3.

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 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, 2018, and December 31, 2018, the City of North Battleford water treatment plants produced just under 1.84 million m^3 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 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 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 m^3/hr to approximately 320 m^3/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.

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 2018, there were 9 water main leaks detected and repaired. Work was done on 153 hydrants (113 complete rebuilds, 22 repairs, 8 replacements and 10 thaws).

In 2018, the City of North Battleford installed pressure monitoring devices in 8 locations throughout the distribution system. These new locations included: City Hall, Don Ross, Cuplex (Field House), Airport Terminal Building, John Paul II, Lakeland Vet Clinic, Scott Campbell Dodge, and the WWTP. 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. At this point, 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, only requires 3 samples be taken per week for a total of 156 per year. In 2018, a total of 376 routine monitoring samples were submitted. Each sample is tested for coliform, 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.

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 ug/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 2018.

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 2018.

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, City of North Battleford is 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 and under upset conditions.

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 0.04 NTU (several months) to 0.08 NTU (October, Train A). The highest reading was 0.13 NTU (October, Train A) while the lowest reading was 0.02 NTU (July, Train B). The highest reading of 0.13 NTU is below the limit of 1.0 NTU set out by the WSA.

The average monthly free chlorine reading from the on-line analyzer ranged from 0.71 mg/L (November, Train A) to 1.38 mg/L (April, Train A). The highest free chlorine reading recorded was 2.10 mg/L (September, Train A) while the lowest free chlorine reading was 0.52 mg/L (November, Train A).

Average iron readings ranged from 0.03 mg/L (July, Train A) to 0.06 mg/L (several readings). The highest reading recorded was 0.27 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 0.03 mg/L (several readings). The highest reading recorded was 0.07 mg/L (several readings) and the lowest reading for manganese recorded was below detection limits (several readings). While the highest reading of 0.07 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 0.110 – 1.302 NTU for filter #1, 0.078– 1.133 NTU for filter #2, 0.027 – 0.104 NTU for filter #3, and 0.035 – 0.098 NTU for filter #4. The highest turbidity reading recorded from the filters was 4.222 NTU (June, filter #2) while the lowest reading was 0.001 NTU (February, filter #2). The average readings in filters #1 and #2 were above the limit set out by WSA of 0.3 NTU for a large portion of May, June, July, and August. This was most likely due to the plant not operating for extended periods of time, while the high turbidity data was still being recorded by the historian. Final effluent turbidity leaving the clear wells was below the required 0.3 NTU limit.

Average free chlorine readings recorded entering the distribution system ranged from 0.86 mg/L to 1.29 mg/L. The highest chlorine reading recorded was 3.85 mg/L (December) while the lowest was 0.35 mg/L (May).

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

Routine Sampling

In 2018, a total of 376 samples were submitted 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 were within applicable guidelines.

A total of 324 ‘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 2018. 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 2018. 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 2018. The total THM concentrations ranged from 36.1 µg/L to 56.6 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 2 locations (8 samples in total) within the distribution system and were submitted for HAAs in 2018. The total HAA concentrations ranged from 13.0 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

No sampling was conducted for Cryptosporidium and Giardia in 2018. Sampling is done under upset conditions or under the direction of the WSA.

Pesticides

No sampling for pesticides was conducted in 2018. Samples are taken bi-annually.

Organics

No sampling for organics was conducted in 2018. Samples are taken bi-annually.

Water Production

In 2018, just under 1.84 million m^3 of potable water was produced by the two Water Treatment Plants. WTP #1 produced over 1.64 million m^3, while 0.197 million m^3 of potable water was produced by the FEH WTP.

Combined, the monthly amount of water produced by the WTPs ranged from a low of 117,232.1 m^3 (December) to a high of 202,003.3 m^3 (June) which can be seen in **Figure 3**. The average daily production was 5,038.9 m^3. The peak amount produced by both WTPs was 8,833.9 m^3 on May 8th. The lowest amount produced by both WTPs was 1,283.7 m^3 on December 4th. The production amounts for both WTPs along with the combined monthly total can be seen in **Table 1C**, **Appendix C**.

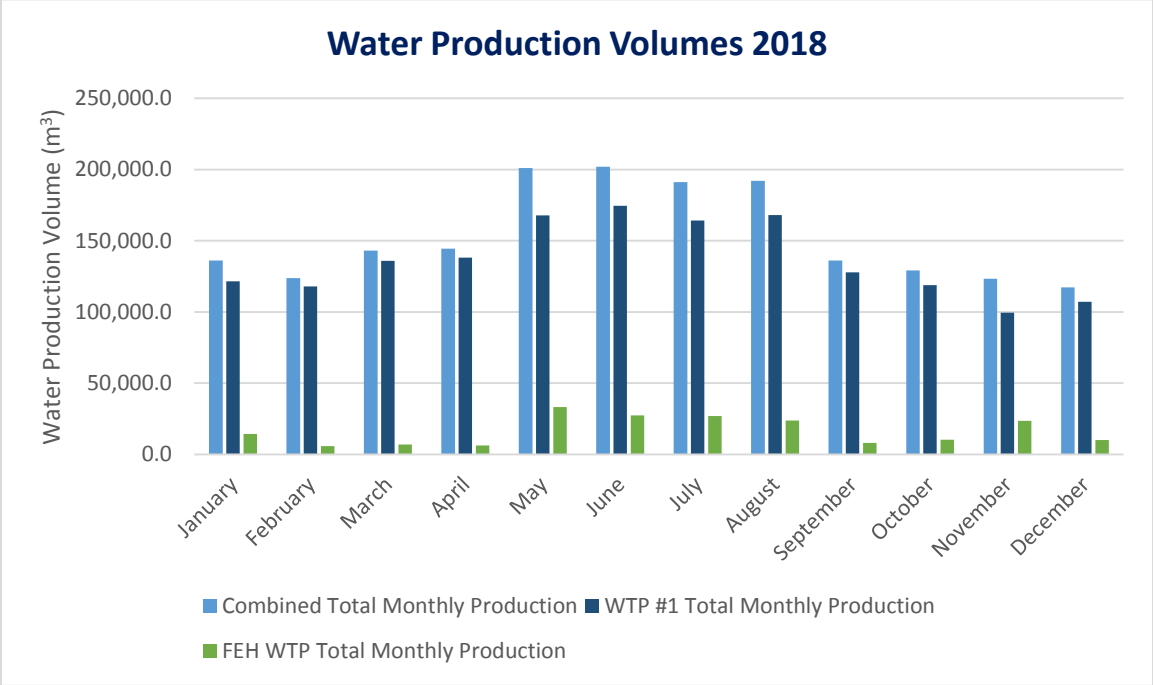

Figure 3. Monthly Production Volumes for 2018.

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 no longer be collecting hydrocarbon samples from the raw and treated water at FEH WTP in 2019, as per the amended December 5th, 2018, Permit to Operate.

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 2018 is acknowledged.

Also acknowledged is the ongoing assistance of the WSA.

For more information, please contact:

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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	113.47	3.35	0.244	0.159	0.034	0.051	0.041	0.033	1.05	0.94
Max	599.24	6.20	0.572	0.336	0.045	0.067	0.123	0.166	2.32	2.90
Min	10.80	2.26	0.044	0.048	0.028	0.044	0.014	0.010	0.57	0.36
February										
Average	65.21	4.15	0.251	0.116	0.027	0.037	0.069	0.074	0.98	0.91
Max	274.08	5.14	0.572	0.255	0.044	0.049	0.183	0.135	1.22	1.12
Min	10.48	3.26	0.045	0.001	0.021	0.026	0.012	0.010	0.54	0.68
March										
Average	58.95	3.68	0.110	0.078	0.047	0.060	0.109	0.065	0.97	0.87
Max	208.19	5.77	0.196	0.145	0.095	0.113	0.340	0.206	1.26	1.26
Min	10.78	2.74	0.040	0.037	0.022	0.034	0.010	0.002	0.52	0.59
April										
Average	92.14	8.61	0.378	0.178	0.040	0.056	0.092	0.082	0.98	1.20
Max	493.47	34.20	1.098	0.398	0.147	0.158	0.147	0.158	1.41	1.46
Min	10.89	2.09	0.062	0.052	0.023	0.039	0.014	0.012	0.51	0.86
May										
Average	246.12	84.53	1.135	0.840	0.081	0.089	0.101	0.062	0.93	0.98
Max	648.54	288.00	2.738	2.683	0.251	0.238	0.305	0.219	1.40	2.12
Min	6.41	24.70	0.031	0.042	0.038	0.048	0.013	0.006	0.35	0.43
June										
Average	189.33	51.71	1.302	1.133	0.073	0.088	0.138	0.048	1.01	0.97
Max	467.77	510.00	2.939	4.222	0.151	0.189	0.436	0.145	1.40	1.33
Min	0.00	14.30	0.266	0.159	0.046	0.046	0.037	0.012	0.47	0.52
July										
Average	222.22	31.39	0.827	0.535	0.104	0.098	0.083	0.047	0.98	0.89
Max	635.49	92.70	2.245	1.564	0.262	0.234	0.131	0.114	1.89	1.49
Min	0.00	9.04	0.211	0.146	0.044	0.048	0.042	0.012	0.39	0.46
August										
Average	203.98	10.13	0.54	0.38	0.065	0.081	0.068	0.041	0.89	0.86
Max	590.82	19.70	1.13	1.01	0.203	0.191	0.313	0.377	1.33	1.10
Min	0.00	5.68	0.20	0.11	0.032	0.045	0.004	0.002	0.61	0.61
September										
Average	65.32	5.64	0.292	0.222	0.033	0.043	0.031	0.043	0.93	1.00
Max	248.91	8.40	0.593	0.477	0.054	0.061	0.095	0.297	1.36	1.28
Min	0.00	0.56	0.121	0.081	0.026	0.035	0.002	0.001	0.66	0.78
October										
Average	98.99	6.25	0.352	0.197	0.038	0.045	0.044	0.039	1.02	0.97
Max	279.34	9.73	0.808	0.678	0.073	0.074	0.095	0.076	1.39	1.34
Min	0.00	4.69	0.124	0.063	0.031	0.037	0.024	0.006	0.68	0.63

FEH WTP Summary Continued										
November										
Average	232.23	4.57	0.179	0.109	0.033	0.035	0.058	0.012	0.96	0.95
Max	546.43	9.40	0.464	0.228	0.109	0.110	0.340	0.078	1.19	1.28
Min	0.00	2.53	0.112	0.061	0.023	0.025	0.021	0.002	0.74	0.69
December										
Average	103.27	4.48	0.305	0.209	0.03	0.04	0.046	0.030	0.88	1.29
Max	395.21	5.53	1.644	0.484	0.06	0.05	0.100	0.082	1.55	3.85
Min	0.00	3.55	0.111	0.073	0.02	0.03	0.024	0.007	0.69	0.96

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	25	0	0	0	0	0.24
North Commercial (Killdeer Park)	43	0	0	0	0	0.26
Fairview Heights	25	0	0	0	0	0.25
North Commercial (Fairview Heights)	9	0	0	0	0	0.22
Maher Park	26	0	0	0	0	0.17
West (McIntosh Park)	26	0	0	0	0	0.19
Downtown	24	0	0	0	0	0.41
East (College Heights)	26	0	0	0	0	0.21
South (Yellow Sky)	26	0	0	0	0	0.23
South East (Yellow Sky)	25	0	0	0	0	0.18
Riverview	52	0	0	0	0	0.31
Riverside	17	0	0	0	0	0.45
Parsons Industrial Park	52	0	0	0	0	0.25
Other[1]	324	0	6	0	2	0.33
Total Routine Samples	**376**	**0**	**0**	**0**	**0**	**0.26**
Total Other Samples	**324**	**0**	**6**	**0**	**2**	**0.33**

[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, 2 samples are submitted 15 minutes 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.

**1 "Other" DWA sample for 2018 was taken Jan 4, 2019 and added to December 2018 count

Table 4 - General Chemical for WTP #1				
Parameter	Units	6-Mar	11-Dec	AO
		Results	Results	
Bicarbonate	mg/L	235	271	
Calcuim	mg/L	71	83	
Carbonate	mg/L	5	<1	
Chloride	mg/L	21	22	250
Hydroxide	mg/L	<1	<1	
Magnesium	mg/L	24	27	200
pH	pH Units	8.42	7.94	6.5-9.0
Potassium	mg/L	2.0	2.3	
Sodium	mg/L	30	38	300
E.C.	uS/cm	688	742	
Sulphate	mg/L	140	150	500
Sum of Ions	mg/L	528	593	
Total Alkalinity	mg/L	201	222	500
Total Hardness	mg/L	276	318	800
Nitrate	mg/L	0.06	0.1	
Fluoride	mg/L	0.10	0.15	1.5
TDS	mg/L	416	484	1500

Table 4 - General Chemical for FEH WTP						
Parameter	Units	6-Mar	12-Jun	29-Aug	11-Dec	AO
		Results	Results	Results	Results	
Bicarbonate	mg/L	166	160	139	171	
Calcuim	mg/L	51	44	43	51	
Carbonate	mg/L	1	<1	2	<1	
Chloride	mg/L	17	27	20	19	250
Hydroxide	mg/L	<1	<1	<1	<1	
Magnesium	mg/L	16	18	14	16	200
pH	pH Units	8.34	8.26	8.41	7.98	6.5-9.0
Potassium	mg/L	1.6	3.9	1.2	1.6	
Sodium	mg/L	9.5	18	6.9	13	300
E.C.	uS/cm	436	478	353	432	
Sulfate	mg/L	61	72	48	57	500
Sum of Ions	mg/L	326	343	274	593	
Total Alkalinity	mg/L	138	131	118	140	500
Total Hardness	mg/L	193	184	165	193	800
Nitrate	mg/L	3.0	<0.04	0.21	1.5	45*
Fluoride	mg/L	0.09	0.11	0.1	0.13	1.5
TDS	mg/L	247	284	214	258	1500

*MAC based on Nitrate as NO_3

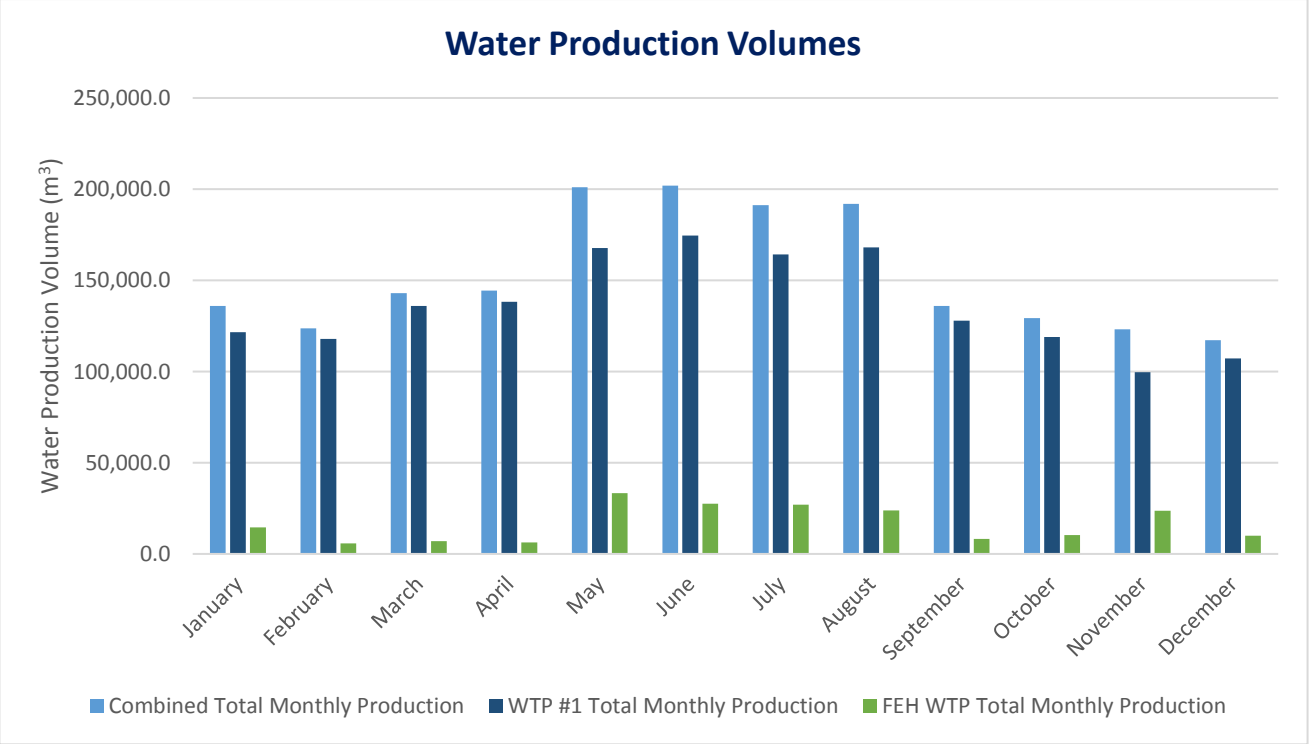
Table 6 - Chemical Health + Cyanide and Mercury						
Parameter	Units	WTP#1 10-Oct	WTP#2 10-Oct	MAC (mg/L)	iMAC (mg/L)	AO (mg/L)
Aluminum	mg/L	0.0023	0.027			
Arsenic	ug/L	0.2	<0.1	0.01	0.025	
Barium	mg/L	0.085	0.048	1		
Boron	mg/L	0.05	0.02		5	
Cadmium	mg/L	<0.00001	0.00001	0.005		
Chromium	mg/L	<0.0005	<0.0005	0.05		
Copper	mg/L	0.065	0.001			
Iron	mg/L	0.016	0.005			0.3
Lead	mg/L	0.0002	<0.0001	0.01		
Manganese	mg/L	0.0035	0.0043			0.05
Selenium	mg/L	<0.0001	0.0002	0.01		
Uranium	ug/L	0.2	<0.1	0.02		
Zinc	mg/L	0.0069	0.0007			5
Cyanide	ug/L	<1	<1	0.2		
Mercury	ng/L	<1	<1	0.001		

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

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	17-Jan-18		42.8	<2	1.0	6.8	35
	25-Apr-18		38.7	<2	1.0	6.7	31
	30-Jul-18		46.0	<2	2.0	10.0	34
	17-Oct-18		54.1	<2	2.0	9.1	43
Downtown	17-Jan-18		42.2	<2	1.0	7.2	34
	25-Apr-18		36.1	<2	1.0	6.1	29
	30-Jul-18		37.6	<2	2.0	8.6	27
	17-Oct-18		56.6	<2	2.0	9.6	45
Average		<100	44.3	<2	1.5	8.0	34.8
Max			56.6		2.0	10.0	45.0
Min			36.1		1.0	6.1	27.0

Table 8 - Halo Acedic Acids									
Location	Date	iMAC (ug/L)	Total HAAs (ug/L)	Monochloroacetic acid (ug/L)	Monobromoacedic acid (ug/L)	Dichloroacedic acid (ug/L)	Trichloroacedic acid (ug/L)	Dibromoacedic acid (ug/L)	Bromochloroacedic acid (ug/L)
Riverview	17-Jan-18		20.0	<5	<2	8	12	<1	1.0
	25-Apr-18		21.0	<5	<2	9	12	<1	2.0
	30-Jul-18		16.0	<5	<2	4	12	<1	1.0
	17-Oct-18		39.0	<5	<2	16	23	<1	2.0
Downtown	17-Jan-18		22.0	<5	<2	10	12	<1	2.0
	25-Apr-18		22.0	<5	<2	9	13	<1	2.0
	30-Jul-18		13.0	<5	<2	5	8	<1	2.0
	17-Oct-18		35.0	<5	<2	14	21	<1	2.0
Average		<80	23.5	<5	<2	9.4	14.1	<1	1.8
Max			39.0	<5	<2	16.0	23.0	<1	2.0
Min			13.0	<5	<2	4.0	8.0	<1	1.0

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	121,571.0	3,921.6	14,481.6	467.1	136,052.6	4,388.8
February	117,965.0	4,213.0	5,760.4	205.7	123,725.4	4,418.8
March	135,982.0	4,386.5	7,036.7	227.0	143,018.7	4,613.5
April	138,189.0	4,606.3	6,272.4	209.1	144,461.4	4,815.4
May	167,732.0	5,410.7	33,350.4	1,111.7	201,082.4	6,486.5
June	174,515.0	5,817.2	27,488.3	916.3	202,003.3	6,733.4
July	164,221.5	5,297.5	26,936.2	868.9	191,157.7	6,166.4
August	168,049.5	5,421.0	23,886.8	770.5	191,936.3	6,191.5
September	127,868.5	4,262.3	8,173.4	272.4	136,041.9	4,534.7
October	118,875.0	3,834.7	10,394.6	335.3	129,269.6	4,170.0
November	99,624.0	3,320.8	23,586.4	786.2	123,210.4	4,107.0
December	107,159.5	3,456.8	10,072.6	324.9	117,232.1	3,781.7
Yearly Total	**1,641,752.0**	**4,498.0**	**197,440.0**	**540.9**	**1,839,192.0**	**5,038.9**



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 µS/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 Kjedahl 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)