

CITY OF NORTH BATTLEFORD  
WASTEWATER TREATMENT PLANT  
2023 REPORT



March 2024



## **Executive Summary**

This report provides an overview of the 2023 Wastewater Treatment Plant (WWTP) operations for the City of North Battleford (CNB).

A summary of the results are as follows:

- The Wastewater Treatment Plant treated over 1.7 million m<sup>3</sup> of domestic wastewater in 2023.
- All required accredited 3<sup>rd</sup> Party permit samples results were below the Permit to Operate a Sewage Works (PTO) except for seven permit exceedances for bi-weekly grab effluent (treated sewage) samples.
  - There were six permit exceedances for E.coli single sample of over 400 organisms/100 ml between April and June, and there was one permit exceedance for E.coli monthly geometric mean greater than 200 organisms/100 ml for the month of May.
    - These permit exceedances were related to a new force main coming into operation. The Water Security Agency (WSA) was notified each time a permit exceedance occurred.
- Since the start of LysteGro fertilizer at the WWTP, 42,820 m<sup>3</sup> of bio-fertilizer has been produced and transferred to the storage lagoon. In 2023, 3,636 m<sup>3</sup> bio-fertilizer was land applied.
- Effluent (treated sewage) passed all acute lethality testing on rainbow trout allowing for continued reduction from quarterly to annually in the frequency of acute lethality testing.

In conclusion, operations at the CNB WWTP proceeded smoothly. The WWTP was able to meet most of the guidelines set forth by the WSA.

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## **Introduction**

The City of North Battleford (CNB) owns and operates a Wastewater Treatment Plant (WWTP). The goal of the North Battleford Wastewater Treatment Plant is to treat the cities sewage and produce effluent (treated sewage) that meets or exceeds the Permit to Operate a Sewage Works (PTO) as set by the Water Security Agency (WSA). Data represented within this annual report is taken from operations, sampling, and data collection from the CNB WWTP. The PTO can be found in Appendix A.

## **Background**

The WWTP began operating in 2006 and is a Level 4 plant. The plant is located in the south-east of the City. Effluent is discharged to the North Saskatchewan River, downstream of the F.E. Holliday Water Treatment Plant. The plant is designed to treat an average flow of 7,320 m<sup>3</sup>/day, a maximum flow of 7,617 m<sup>3</sup>/day and a peak flow of 11,950 m<sup>3</sup>/day.

## **Quality Assurance/Quality Control (QA/QC)**

QA/QC involves a duplicate/standard program. WWTP staff conduct daily/weekly *in-house* tests on sewage effluent (treated sewage). The parameters tested include total ammonia, total suspended solids (TSS), biochemical oxygen demand (BOD), carbonaceous biochemical oxygen demand (cBOD), and phosphorous. These *in-house* tests results are compared to the PTO accredited 3rd Party laboratory test results.

Although sewage influent (raw sewage) sampling is not part of the PTO requirements, WWTP staff conduct *in-house* testing of sewage influent. The results of the parameters tested assist with effectively treating the sewage influent to meet the sewage effluent limits set by the WSA.

## **Tested Parameters**

### **Monthly/Quarterly Data**

The following parameters are tested daily or weekly but reported as a monthly or quarterly average since the limits set out by WSA are based on a calendar monthly or quarterly arithmetic average. The exception to this is coliforms which is based on a monthly geometric average. The data is collected and reported from January 1 to December 31 of 2023.

Each of the following parameters are tested for on the basis that each affects the final quality of river water and may be detrimental to aquatic life if higher than the permitted limit.

## **Ammonia - Total**

Ammonia as N ( $\text{NH}_3\text{-N}$ ) is an inorganic, dissolved form of nitrogen that can be found in water and is the preferred form of nitrogen for algae and plant growth. Discharge of effluent high in ammonia to receiving waters (i.e. rivers) may result in oxygen-depleted conditions. Total ammonia refers to two chemical species which are in equilibrium in water. They are  $\text{NH}_4^+$  (ionized) and  $\text{NH}_3$  (un-ionized). Tests for ammonia measure total ammonia. A composite effluent *in-house* sample is tested daily, and accredited 3<sup>rd</sup> Party samples are tested bi-weekly. A composite influent (raw sewage) *in-house* sample is tested every Wednesday and Thursday and while not regulated to do so is accredited 3<sup>rd</sup> Party tested bi-weekly. A *in-house* grab sample of the influent is tested daily. The composite effluent is regulated for ammonia. WSA limits for ammonia as N are 7 mg/L (October – May) and 3 mg/L (June – September).

## **Un-ionized Ammonia**

The toxicity of ammonia is primarily attributed to the un-ionized form ( $\text{NH}_3$ ) as opposed to the ionized form. In general, the un-ionized ammonia is highly toxic to fish and other aquatic life. Toxicity increases as pH and temperature increase. Accredited 3<sup>rd</sup> Party bi-weekly testing for un-ionized ammonia in the effluent composite sample is a requirement for the PTO. The limit is 1.24 mg/L at 15°C.

## **Total Phosphate**

Like nitrogen, phosphorus is essential for the growth of plants and animals. Influent (composite) and effluent (grab) sampling for total phosphate are conducted twice a week *in-house*. Effluent composite samples are required to be tested by an accredited 3<sup>rd</sup> Party bi-weekly. CNB samples phosphorus weekly.

## **Coliforms**

### *Total Coliform*

Coliforms can be found in water, soil, and on vegetation. They are divided into fecal and nonfecal coliforms. Samples are analyzed for the presence of the coliform group of bacteria which serve as indicator organisms for other pathogens. Coliforms are generally not pathogenic but are usually present when pathogens are present. There is no limit for total coliforms. An effluent grab sample is required to be tested by an accredited 3<sup>rd</sup> Party bi-weekly. CNB samples total coliforms weekly.

### *E. coli/Fecal Coliforms*

Escherichia Coli (also known as E.coli) is a fecal coliform. Their presence indicates the potential presence of microorganisms capable of causing gastrointestinal illnesses. Influent is treated to minimize the number of fecal coliforms released into the environment. E. coli/Fecal coliforms are not to exceed a monthly geometric mean

density of 200 organisms per 100 mL and not to exceed a single sample maximum of 400 organisms per 100 mL. An effluent grab sample is required to be tested by an accredited 3rd Party bi-weekly. CNB samples E.coli weekly.

## **pH**

pH tests are performed to determine if the wastewater effluent is acidic or basic. The pH scale ranges from 0 to 14 with substances less than 7.0 being acidic while pH greater than 7.0 is considered basic or alkaline. A pH of 7.0 is considered neutral. A pH range of 6.5 to 9.0 has been set as the guideline for the Protection of Aquatic Life. Effluent grab samples are tested *in-house* daily. Effluent composite samples are tested bi-weekly by an accredited 3rd Party at 15°C +/- 1°C.

## **Temperature**

Daily temperature samples are collected from the effluent stream. Temperature ranges from 6.7° C in the winter to 18.3° C in the summer.

## **Turbidity**

Turbidity is used to assess the clarity of water. It is a measure of suspended inorganic and organic particles in the water. Effluent turbidity is tested *in-house* once per day using a grab sample. Effluent turbidity stays consistent. WSA has set no limit for effluent turbidity. An online turbidimeter installed inside the UV channel continuously monitors turbidity.

## **BOD**

Biochemical oxygen demand (BOD) is a chemical process used for determining how fast organisms use up oxygen in a body of water. WSA does not regulate BOD testing in the influent and effluent. CNB performs weekly *in-house* influent and effluent BOD tests. Bi-weekly influent tests by an accredited 3rd Party are taken for BOD.

## **cBOD**

Carbonaceous biochemical oxygen demand (cBOD) measures the amount of oxygen consumed by organisms in decomposing the organic portion of waste. Weekly effluent composite *in-house* and bi-weekly accredited 3rd Party samples are taken for this test. WSA requires that cBOD values for effluent do not exceed a quarterly arithmetic mean of 25 mg/L.

## **Suspended Solids**

### *TSS*

Total suspended solids (TSS) are a measure of suspended particles in a fluid. The TSS test measures both the active bacterial mass and the inert material in the sample.

Influent and effluent TSS are tested *in-house* twice weekly. Effluent and influent are tested *by an* accredited 3rd Party bi-weekly. Influent TSS values are tested for internal use but are not required by WSA. WSA requires that effluent TSS does not exceed a quarterly arithmetic mean of 25 mg/L. Influent TSS values are not required by WSA.

## VSS

Volatile suspended solids (VSS) test measures the mass of the organic solids compared to the mass of the combined organic and inorganic solids. Most of the VSS component will be active microorganisms in the effluent. Sampling for VSS is not a permit requirement, however VSS for influent and effluent is sampled twice weekly *in-house* to monitor the efficiency of the WWTP.

## River Analysis

River samples are taken monthly from locations upstream and downstream of the WWTP outfall and tested by an accredited 3<sup>rd</sup> Party. The upstream samples provide background or normal conditions that the downstream or post treatment samples are compared to. Differences in analytical results may indicate chemical or biological changes from the release of effluent into the river. The upstream sample is taken from the intake at the F.E. Holliday Water Treatment Plant, while the downstream sample is taken at an irrigation site 1.7km south east of the outfall.

## Major Ions Scan plus TDS and Conductivity

Increased concentrations of ions, TDS, and conductivity can cause harm to aquatic organisms. A of composite effluent sample is taken semi annually and tested by an accredited 3rd Party.

## Trace Metal Sampling

Trace metals in large quantities can be detrimental to aquatic life. Trace metals such as lead, mercury, and cadmium are considered toxic metals and exposure to these metals over time can cause serious illness. One composite sewage effluent sample is taken annually and tested by an accredited 3rd Party.

## Acute Lethality

Acute lethality refers to the ability of a substance to cause harm to an organism during a relatively short period of time. A grab effluent sample is collected quarterly and sent for testing by an accredited 3rd Party using rainbow trout to determine if it is lethal. The sampling frequency is reduced from quarterly to annually when four consecutive quarterly tests are passed.

## **Groundwater Well Monitoring**

The groundwater underlying the WWTP is sampled annually between September and October at 12 piezometer locations and is tested by an accredited 3rd Party. The condition of each monitoring well is noted and groundwater samples are collected. The groundwater samples are sampled for total coliforms, E.coli., specific conductivity, and chloride, while field monitoring of the piezometer provides the depth to water, pH, and temperature.

## **Biosolids Monitoring**

All sample results, the product label, and the Product Management Yearly Report for biosolids can be found in Appendix E

Biosolids, also known as sewage sludge, is a semi-solid or liquid residue generated during treatment of domestic sewage in treatment works. It consists mainly of water (90 to 99%) and settleable solids. The solids, that are mostly organics, are removed during primary, secondary, or advanced wastewater treatment processes. The biosolids generated by the WWTP are converted to a registered bio-fertilizer product.

## **Biosolids Volume Produced**

In 2023, all biosolids were converted into bio-fertilizer product. Since the start of LysteGro fertilizer at the WWTP, 42,820 m<sup>3</sup> of bio-fertilizer has been produced and transferred to the storage lagoon. In 2023, 3,636 m<sup>3</sup> bio-fertilizer was land applied.

## **Biosolids Analysis**

WSA does not regulate biosolids in the PTO. One biosolid sample is submitted for sampling monthly for metals, mercury, Total-P, Total-N, moisture, fecal coliforms + Salmonella, and total organic carbon (TOC) by an accredited 3rd Party. The biosolid is tested to ensure all the regulatory requirements set out by the Canadian Food Inspection Agency (CFIA) for a registered fertilizer product are met.

## **PTO Regulated Sample Results**

### **Treated Wastewater Effluent Discharge to Environment**

All sample results for effluent discharge to environment can be found in Appendix B.

### **Flows**

As part of a requirement in the PTO, the volume of effluent discharged to the environment is monitored and recorded. The WWTP continuously monitors and records all influent entering and all effluent leaving the plant. In 2023, the WWTP treated over 1.7 million m<sup>3</sup> of domestic wastewater. The monthly flows ranged from 114,591.6 m<sup>3</sup>



(February) to 174,067.9 m<sup>3</sup> (March). The lowest average daily flow was 4,092.6 m<sup>3</sup> (February), and the highest was 5,117.0 m<sup>3</sup> (June). Flow data for 2023 can be found in Tables 1.

In 2023, 5,237.9 m<sup>3</sup> of leachate was pumped from the WMF landfill pit to the WWTP to be treated.

### **Bi-Weekly Effluent Composite and Grab Samples**

The required test parameters and limits can be found in Appendix A.

As shown in Table 2, 25 composite Group 4 Panel effluent samples were taken in 2023. Results for all tested parameters were below permit limits.

As shown in Table 3, 51 grab total coliform and E.coli effluent samples were taken in 2023. Six permit exceedances for E.coli single sample of over 400 organisms/100 ml occurred for the months of April, May, and June. There was one permit exceedance for E.coli monthly geometric mean greater than 200 organisms/100 ml for the month of May. These permit exceedances were related to a new force main coming into operation. WSA was notified each time a permit exceedance occurred.

### **Quarterly Effluent Grab Samples**

The required test parameters and limits can be found in Appendix A. The results show that the effluent had no impact on the test organism's mortality rate at all effluent concentrations, including 100% effluent. The results can be found in Table 4.

### **Semi-Annual Effluent Composite Samples**

The required test parameters and results limits can be found in Appendix A. The test parameters do not have regulated limits. Results can be found in Table 5.

### **Annual Effluent Composite Sample**

The required test parameters and limits can be found in Appendix A. The test parameters do not have regulated limits. Results can be found in Table 6.

## **Receiving Environment Upstream and Downstream locations**

All sample results for receiving environment upstream and downstream can be found in Appendix C.

### **Monthly River Samples**

The required test parameters and limits can be found in Appendix A.

Results can be found in Table 1. The downstream sample location is not accessible during winter months. No samples were taken in the month of January, the current PTO came into effect on January 23, 2023, and in the previous PTO river samples were taken quarterly. The required test parameters and limits can be found in Appendix A. Results can be found in Table 1.

## **Groundwater Monitoring Wells (GMMW)**

All sample results for effluent discharge to environment can be found in Appendix D.

### **Annual GMMW Samples**

Out of the twelve piezometers at the WWTP, eleven were field tested and sampled. GMMW MW14\_06 was dry. The results from the groundwater well monitoring describe the state of each well and the condition of the groundwater. The results were consistent with historical data and did not demonstrate any anomalous results. Results can be found in Table 1.

## **Conclusion**

The WWTP experienced permit exceedances from conditions experienced with the commissioning of the new force main. E.coli exceedances were reported in the months of April through June. All other permit samples were within WSA limits.

In 2023 a newly completed sewage force main and lift station were commissioned. The lift station is located in the area of the historic Sewage Treatment Plant just west of Riverview and the force main transports approximately 60% of the City sewage from Riverview to the WWTP. The introduction of the force main resulted in aerobic sewage turning into anaerobic sewage believed to be the cause of the WWTP E.coli exceedances. The operation of the force main also resulted in high concentrations of H<sub>2</sub>S gas within the WWTP and along the force main. As a result of the H<sub>2</sub>S gas the force mains operating status was changed from regular to intermittent operation with regular flushing.

A summary of the results are as follows:

- The Wastewater Treatment Plant treated over 1.7 million m<sup>3</sup> of domestic wastewater in 2023.
- All required *off-site* permit samples results were below the Permit to Operate a Sewage Works (PTO) except for seven permit exceedances for bi-weekly grab effluent (treated sewage) samples.
  - There were six permit exceedances for E.coli single sample of over 400 organisms/100 ml between April and June, and there was one permit exceedance for E.coli monthly geometric mean greater than 200 organisms/100 ml for the month of May.

- WSA was notified each time a permit exceedance occurred.
- Since the start of LysteGro fertilizer at the WWTP, 42,820 m<sup>3</sup> of bio-fertilizer has been produced and transferred to the storage lagoon. In 2023, 3,636 m<sup>3</sup> bio-fertilizer was land applied.
- Effluent (treated sewage) passed all acute lethality testing on rainbow trout allowing for continued reduction from quarterly to annually in the frequency of acute lethality testing.

In general, the results reported by the accredited lab(s) were comparable with the results reported by the WWTP.

Northland Power Energy Center has continued to take effluent to be used in their power process.

Looking towards the future, the major capital projects that have been identified in the 2024 budget include:

- A new septage receiving station was installed on the main sewer trunk just north of the plant in 2021 and will be commissioned in 2024.
- Evaluation of the H<sub>2</sub>S gas and the development of engineering solutions to reduce the H<sub>2</sub>S concentrations.
  - Stop the aerobic sewage in the force main from turning into anaerobic sewage that results in high H<sub>2</sub>S concentrations.
- UPAR construction of new sewer mains throughout the distribution system will continue.

## **ACKNOWLEDGEMENTS**

The Department of Utility Services of the City of North Battleford prepared this report. The dedication and commitment of civic staff in providing regulated wastewater during 2023 is acknowledged.

Also acknowledged is the ongoing assistance of the WSA.

For more information, please contact:

City of North Battleford

Department of Utility Services  
 Box 460  
 North Battleford, SK  
 S9A 2Y6  
 Phone: (306) 445-1700

*City of North Battleford  
Wastewater Treatment Plant  
2023 Report  
Appendix A: Permit to Operate a Sewage  
Works – North Battleford*



Science and Licensing Division

# Permit to Operate a Sewage Works

Altered pursuant to section 28(1)(h) of *The Environmental Management and Protection Act, 2010*

Page: 1 of 8

Permit No.: 00050936-07-01

File: 21050-50/WWW/OP/North Battleford

ISSUED TO **The City of North Battleford (the permittee)** the person/entity responsible for the sewage works consisting of a **Class 4** wastewater treatment facility and a **Class 2** wastewater collection facility, located in City of North Battleford and at the sewage treatment works located at Northeast  $\frac{1}{4}$  of Section 22, in Township 43, in Range 16, West of the 3<sup>rd</sup> Meridian; the Northwest  $\frac{1}{4}$  of Section 22, in Township 43, in Range 16 West of the 3<sup>rd</sup> Meridian, which provides sewage collection and treatment to the City of North Battleford in the Province of Saskatchewan.

PURSUANT to section 28(1)(h) of *The Environmental Management and Protection Act, 2010*, the Permit to Operate a Sewage Works No. 00050936-07-00 issued to the permittee on 1<sup>st</sup> day of May, 2021, whose sewage works is located at Northeast  $\frac{1}{4}$  of Section 22, in Township 43, in Range 16, West of the 3<sup>rd</sup> Meridian; the Northwest  $\frac{1}{4}$  of Section 22, in Township 43, in Range 16 West of the 3<sup>rd</sup> Meridian, in the Province of Saskatchewan, and which operation involves the discharge of effluent into the North Saskatchewan River at LSD 2 Section 22 in Township 43, in Range 16, West of the 3<sup>rd</sup> Meridian in the Province of Saskatchewan, is hereby altered and amended, subject to the terms and conditions attached to this permit.

This permit takes effect on the **23<sup>rd</sup> day of January, 2023.**

This permit expires on the **1<sup>st</sup> day of May, 2024.** unless cancelled or suspended before that date.

Issued

A handwritten signature in black ink, appearing to read "Bruce Dahl".

Bruce Dahl, B. Sc.\*  
Environment Officer  
Water Security Agency

\* This digital signature affixed to the permit is legally binding and is considered a sufficient electronic signature as required under *The Electronic Information and Documents Act, 2000*. The original copy is retained by the Water Security Agency and shall be considered the official record.

## **Terms and Conditions**

### **Section One: Definitions**

- 1.1 All words and phrases have the same definitions as set out in *The Environmental Management and Protection Act, 2010*, or *The Waterworks and Sewage Works Regulations*, as the case may be.
- 1.2 In this permit:
  - (a) "Act" means *The Environmental Management and Protection Act, 2010*;
  - (b) "Accredited laboratory" means a laboratory that is accredited under the International Organization for Standardization standard ISO/IEC 17025:2005 entitled *General requirements for the competence of testing and calibration laboratories*, as amended from time to time, by an accrediting body that is a signatory to the *International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement* or a laboratory that is accredited under the *Environment Quality Act*, R.S.Q., c. Q-2, as amended from time to time, by an accredited body that is recognized in accordance with the *Environment Quality Act*;
  - (c) "Adverse effect" has the same meaning as defined in the *Act*;
  - (d) "Regulations" means *The Waterworks and Sewage Works Regulations*;
  - (e) "Science and Licensing Division" means the Science and Licensing Division of the Water Security Agency;
  - (f) "Environment" has the same meaning as defined in the *Act*; and
  - (g) "Environment officer" has the same meaning as defined in the *Act*.

### **Section Two: Operation**

- 2.1 The permittee shall comply with the *Act* and the *Regulations*, and the terms and conditions of this permit.
- 2.2 In the event of an inconsistency between the *Act* and this permit, or the *Regulations* and this permit, the more stringent requirement shall apply.
- 2.3 The permittee shall not extend or alter the sewage works without approval from the Science and Licensing Division.
- 2.4 The permittee shall ensure that the operation, repair and maintenance of the sewage works is under the direction of an operator who holds at least the corresponding certificate for the classification of the sewage works as set out in the Saskatchewan Water and Wastewater Works Operator Certification Standards, December 2016.
- 2.5 The permittee shall continuously disinfect the treated effluent prior to discharge to the receiving environment.
- 2.6 The permittee shall dispose of all biosolids generated by the sewage works at a Saskatchewan Ministry of Environment approved waste disposal grounds or other location that is permitted to accept biosolids.
- 2.7 In the event of an upset or bypass condition, the permittee shall ensure all downstream water users that may be adversely impacted by the sewage works discharge are notified.
- 2.8 Pursuant to section 8 of the *Act*, no person shall discharge or allow the discharge of a substance into the environment in an amount, concentration or level or at a rate of release that may cause or is causing an adverse effect unless otherwise expressly authorized pursuant to this permit.
- 2.9 The permittee shall maintain an emergency response plan that is satisfactory to the minister and shall update the plan from time to time to incorporate changes to the sewage works equipment, operational procedures, chemical use, upset/bypass conditions, or any other matter or thing that could affect the quality of the effluent produced by the sewage treatment works and may adversely affect the environment. The permittee shall:
  - (a) provide a copy of the plan to any employee, agent or contractor performing work or service in relation to the sewage works; and,
  - (b) inform the certified operator(s), mentioned in 2.4, of the contents of the emergency response plan.

### **Section Three: Sampling, Monitoring and Effluent Quality**

- 3.1 The permittee shall cause samples to be taken from the sewage works and receiving environment and tested for the parameters listed in Appendix A, at the locations, times and frequency set out in Appendix A.
- 3.2 The permittee shall ensure that the effluent quality results for those samples required by 3.1 do not exceed the limits set out in Appendix B for the chemical parameters listed in Appendix B.
- 3.3 The permittee shall take samples in accordance with the instructions provided by the institution or laboratory that provides the sampling bottles or containers
- 3.4 Subject to 3.5, the permittee shall have all effluent and receiving environment samples analyzed by an accredited laboratory.
- 3.5 The permittee may perform on-site effluent and receiving environment sample analyses for parameters indicated in the monitoring schedule as "field test" or "on-site test".

#### **Section Four: Recordkeeping**

- 4.1 The permittee shall cause operational records or logs to be maintained, including information respecting:
- (a) tests conducted and the information to be collected as required by this permit;
  - (b) site inspections, maintenance work and any failure of treatment components;
  - (c) types, dosages and total amount of chemicals or other substances added to sewage;
  - (d) dates and volumes of sewage effluent discharges;
  - (e) locations from which samples for any tests are taken;
  - (f) the results of any tests conducted on the samples taken pursuant to 3.1;
  - (g) records of public complaints including complaints over impacts from suspected seepage from the facility and/or complaints over impacts resulting from discharge practices.
- 4.2 The permittee shall cause the operational records or logs mentioned in 4.1 to be recorded and maintained in the following manner:
- (a) operational records or logs must be made in chronological order, with the dates, times and testing locations clearly indicated;
  - (b) entries in an operational record or log must only be made by the permittee, which includes, by definition, any principal or agent of a permittee;
  - (c) any person making an entry in an operational record or log must do so in a manner that allows the person to be unambiguously identified as the maker of the entry;
  - (d) operational records or logs must be maintained on a daily basis and retained for at least five years;
  - (e) any anomalies or instances of missing entries in an operational record or log must be accompanied by explanatory notes;
  - (f) operational records or logs must only contain data or information that is actually observed or produced;
  - (g) operational records or logs must not contain default values generated manually or by automated means; and
  - (h) operational records or logs maintained pursuant to clause (d) must be made available promptly on request of the Water Security Agency.
- 4.3 The permittee shall review the records and logs mentioned in 4.1 on a monthly basis to ensure that the operating parameters are being achieved and that the limits set out in Appendix B are not exceeded.
- 4.4 The permittee shall report the findings to the minister as soon as is reasonably practicable after each review required by 4.3, should the review of the records and logs indicate that the operating parameters have not been achieved and effluent quality limits have been exceeded.

#### **Section Five: Reporting**

- 5.1 The permittee shall submit the results of water sampling analyses performed in accordance with this permit to the Science and Licensing Division, within 7 days following completion of the sampling analyses.
- 5.2 The permittee shall direct the laboratory performing its water sampling analyses to submit the results within the timeframes mentioned in 5.1. The results must be provided directly to the Science and Licensing Division, in a format compatible with the EPB 383 Water Security Agency and Ministry of Environment - Environmental Management System (SEEMS) Lab-Operator (LAB-OPR) Data File Format, in addition to submitting the written results to the permittee.
- 5.3 The permittee shall report to the minister any known or anticipated upset condition, bypass condition or events at or affecting the sewage works that could adversely affect the quality of effluent produced by the sewage works.
- 5.4 The permittee shall immediately report to the minister any instance where:
- (a) effluent disinfection equipment fails;
  - (b) the level of effluent disinfection identified in Appendix B is not achieved or is not anticipated to be achieved;
  - (c) any other parameter level identified in Appendix B is not achieved or is not anticipated to be achieved; and
  - (d) there is a retirement, suspension, resignation, scheduled absence or termination of employment of any certified sewage works collection or sewage works treatment operator, or any anticipated retirement, suspension, resignation or termination that results in the sewage works not being under the direction of a certified operator.
- 5.5 The permittee shall instruct its employees, agents and contractors performing work or service in relation to the sewage works of their obligation, under section 13(2) of the *Regulations*, to report to the minister any instance described in 5.4 and any known or anticipated upset condition, bypass condition or events at or affecting a sewage works that could adversely affect the quality of effluent discharged into the environment.
- 5.6 The permittee shall, as soon as reasonably practical, report any of the events mentioned in 5.3 or 5.4 to the minister.
- 5.7 The permittee shall submit an annual operating report to the Water Security Agency by March 31<sup>st</sup> of the following year of operation, which shall include all monitoring data as required by condition 3.1 and all record keeping information as required by condition 4.1 of this permit.

### **Section Six: Inspection**

- 6.1 An environment officer may enter the sewage works at any time to conduct an inspection to ensure that the permittee is complying with this permit, the *Act* or the *Regulations*.
- 6.2 Upon the request of an environment officer, the permittee shall immediately provide any books, records, logs, graphs, papers, documents, or data, including any computer, digital or electronic records, logs, graphs, files or data maintained with respect to the sewage works.

### **Section Seven: General**

- 7.1 A copy of this permit shall be posted in a conspicuous place at the sewage works or administration office.
- 7.2 The permittee shall provide each operator of the sewage works with a copy of this permit and the *Regulations*.
- 7.3 The minister may cancel, alter or suspend this permit for the reasons and in the manner set out in the *Act*.
- 7.4 The permittee shall apply for renewal/alteration of this permit at least 60 days prior to its expiry.
- 7.5 In the event of any inconsistency between a previously issued Permit to Operate a Sewage Works, and the terms and conditions of this Permit to Operate a Sewage Works, the terms and conditions of this permit prevail.
- 7.6 This permit does not replace or supersede any approvals, licenses or authorizations that may be required due to municipal, provincial or federal legislation. The permittee shall maintain in force any and all such approvals, licenses or authorizations that may be required.
- 7.7 Where any notice or reporting is required to be given by the permittee, it shall be provided to:

Water Security Agency  
Bruce Dahl B. Sc.  
10-3904 Millar Ave  
Telephone: 306-230-3184  
Fax: 306-933-6820  
Email: bruce.dahl@wsask.ca

After hours, weekends and holidays, the Water Security Agency can be contacted by calling the Upset Report Line at 1.844.536.9494.



**Appendix A**

**Permit to Operate a Sewage Works  
Monitoring Schedule  
Permit No.: 00050936-07-01**

Location	Station Number	Frequency	Type of Sample	Parameter(s)
1. Treated Wastewater Effluent Discharge to Environment	SK05EG0281	Daily	Volume of influent or effluent discharged at final discharge point <sup>1</sup>	
		Bi-weekly (at least seven days after any other sample)	24-hour Composite	<b>Group 4 Panel</b> 5-day Carbonaceous Biochemical Oxygen Demand Chloride pH at 15°C ± 1°C Total Suspended Solids Total Phosphorous Total Nitrogen Total Ammonia Nitrogen Total Kjeldahl Nitrogen Calculated Un-ionized Ammonia <sup>2</sup>
			Grab	Total Coliform Bacteria <i>Escherichia coli</i> Temperature ( <i>field test</i> ) pH ( <i>field test</i> )
		Quarterly <sup>3,4</sup> (at least 60 days after any other sample)	Grab	Acute Lethality <sup>5</sup>
		Semi-annually (at least four months after any other sample)	24-hour Composite	<b>Major Ions Scan plus TDS and Conductivity</b> Alkalinity, Total Bicarbonate Calcium Carbonate Conductivity at 25°C Magnesium Nitrate – N Potassium Sodium Sulphate Total Dissolved Solids Total Hardness

		Annually (at least six months after any other sample)	24-hour composite	<u>Trace Metals</u> Aluminum Arsenic Antimony Barium Beryllium Boron Cadmium Chromium Cobalt Copper Iron Lead Manganese Mercury Molybdenum Nickel Selenium Silver Strontium Thallium Tin Titanium Uranium Vanadium Zinc
2. Receiving Environment Upstream and Downstream locations	SK05EG0089  and  SK05GD0093	Monthly (at least 21 days after any other sample)	Grab	<u>Group 4 Panel plus TDS and Conductivity</u> 5-day Carbonaceous Biochemical Oxygen Demand Chloride Conductivity at 25°C pH at 15°C ± 1°C Total Suspended Solids Total Phosphorous Total Nitrogen Total Ammonia Nitrogen Total Dissolved Solids Total Kjeldahl Nitrogen Calculated Un-ionized Ammonia <sup>6</sup> Total Coliform Bacteria <i>Escherichia coli</i> Temperature ( <i>field test</i> ) pH ( <i>field test</i> )
			Grab	<u>Major Ions Scan</u> Alkalinity, Total Bicarbonate Calcium Carbonate Magnesium Nitrate – N Potassium Sodium Sulphate Total Hardness

<b>3. Monitoring Wells</b>	SK050EG0176 MW 14-01 SK050EG0278 MW 14-02  SK050EG0347 MW 14-03  SK050EG0351 MW 14-04  SK050EG0352 MW 14-05  SK050EG0353 MW 14-06  SK050EG0354 MW 14-07  SK050EG0355 MW 14-08  SK050EG0356 MW 14-09  SK050EG0357 MW 14-10  SK050EG0358 MW 14-11  SK050EG0359 MW 14-12	Once per year (October)	Grab  (Following the purging of at least two volumes of water from the well if possible or the stabilization of pH and conductivity)	<b>Group 1 Panel</b> Conductivity at 25°C Chloride Nitrate – N Total Coliform Bacteria <i>Escherichia Coli</i>
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<sup>1</sup> The permittee shall calibrate or conduct calibration verification of the flow monitoring equipment at least once in every calendar year and at least five months after a previous calibration. The monitoring equipment must be able to determine the volume or rate of flow with a margin of error of ±15%.

<sup>2</sup> The un-ionized portion of total ammonia (NH<sub>3</sub>) in the treated effluent shall be calculated using the formula:

$$\text{Total Ammonia Nitrogen} \times 1 \div (1 + 10^{9.56 - \text{pH}})$$

- where pH is the pH of the effluent adjusted to 15°C ± 1°C

<sup>3</sup> If a treated wastewater effluent sample is determined to be acutely lethal, the permittee must collect a grab sample of treated wastewater effluent twice per month but at least seven days after any previous sample and conduct the acute lethality test on each of the samples. The permittee shall continue to sample twice per month until such time as three consecutive samples are found not to be acutely lethal. Once three consecutive samples are found not to be acutely lethal, the permittee shall revert back to quarterly acute lethality testing.

<sup>4</sup> Following the collection of 4 consecutive quarterly samples, that have been collected and analyzed and found not to be acutely lethal, the acute lethality sampling and testing requirement may be reduced to yearly (one per calendar year but at least 6 months after any other sample). Should an acute lethality test fail, the permittee shall revert to sampling as per the frequency in footnote 3.

<sup>5</sup> The accredited laboratory must adhere to the following biological test methods:

Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout  
(Reference Method EPS 1/RM/13 Second Edition)

Procedure for pH Stabilization During the Testing of Acute Lethality of Wastewater Effluent to Rainbow Trout  
(Reference Method EPS 1/RM/50)

<sup>6</sup> The un-ionized portion of total ammonia (NH<sub>3</sub>) in the receiving waters shall be calculated using the formula:

$$\text{Total Ammonia Nitrogen} \times 1 \div (1 + 10^{\text{pKa} - \text{pH}})$$

- where pKa is 0.09018 + 2729.92/T

- where T is the ambient receiving water temperature in degrees Kelvin

- where pH is the pH of the receiving water

**Appendix B**

**Permit to Operate a Sewage Works  
Permit Limits  
Permit No.: 00050936-07-01**

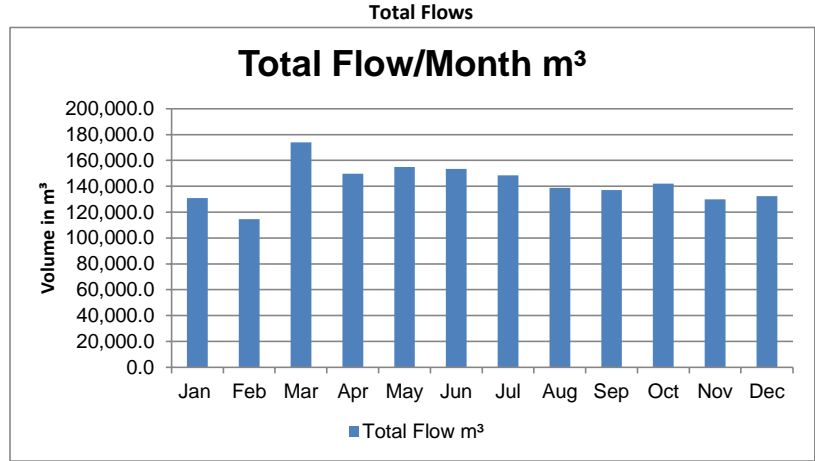
<b>Location</b>	<b>Parameter</b>	<b>Limit</b>
<b>Final Treated Wastewater Effluent</b>	5-day Carbonaceous Biochemical Oxygen Demand	Shall not exceed a quarterly arithmetic mean of 25 milligrams per litre.
	Total Suspended Solids	Shall not exceed a quarterly arithmetic mean of 25 milligrams per litre.
	Un-ionized Ammonia - N	Shall not exceed 1.24 milligrams per litre at 15°C ± 1°C.
	Total Chlorine Residual	Shall not exceed 0.02 milligrams per litre.
	Acute Lethality (pH-stabilized)	Shall be non-lethal to 50% or more of test organisms at 100% effluent concentration.
	<i>Escherichia coli</i>	Shall not exceed a monthly geometric mean of 200 organisms per 100 millilitres and shall not exceed a single sample maximum of 400 organisms per 100 millilitres.
	Total Ammonia Nitrogen (October 1 <sup>st</sup> to May 31 <sup>st</sup> )	Shall not exceed a monthly arithmetic mean of 7 milligrams per litre
	Total Ammonia Nitrogen (June 1 <sup>st</sup> to September 30 <sup>th</sup> )	Shall not exceed a monthly arithmetic mean of 3 milligrams per litre

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*City of North Battleford  
Wastewater Treatment Plant  
2023 Report  
Appendix B: Regulated Results Tables – Effluent  
Discharge to Environment*

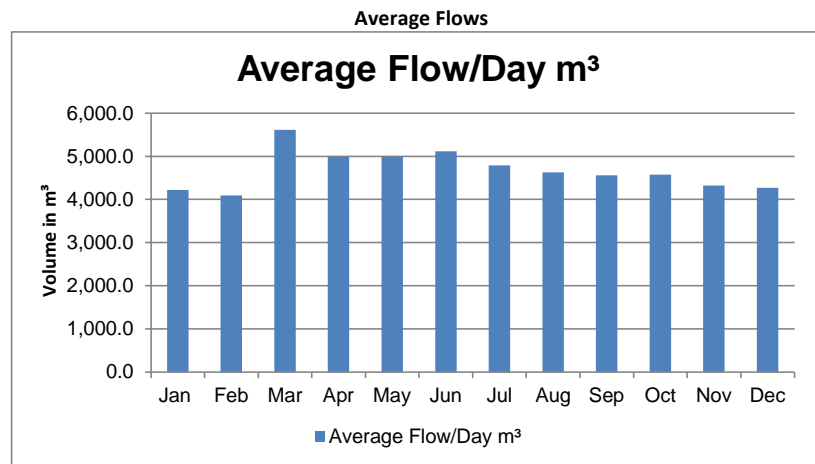
Total Flows

Month	Total Flow m <sup>3</sup>
Jan	130,842.1
Feb	114,591.6
Mar	174,067.9
Apr	149,697.2
May	154,771.5
Jun	153,510.9
Jul	148,509.4
Aug	138,697.4
Sep	137,043.2
Oct	142,052.6
Nov	129,905.5
Dec	132,403.7
<b>Total</b>	<b>1,706,093.0</b>



Average Flows

Month	Average Flow/Day m <sup>3</sup>
Jan	4,220.7
Feb	4,092.6
Mar	5,615.1
Apr	4,989.9
May	4,992.6
Jun	5,117.0
Jul	4,790.6
Aug	4,628.8
Sep	4,562.3
Oct	4,575.9
Nov	4,324.2
Dec	4,272.1
<b>Average</b>	<b>4,685.7</b>



Date	cBOD	Chloride	ph	TSS	Total Phosphorous	Total Nitrogen	Total Ammonia Nitrogen	Total Kjeldahl Nitrogen	Calculated Un-ionized Ammonia
	mg/L	mg/L	pH Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
24-Jan	<3	138	7.68	5	0.79	24	0.10	2.4	<0.01
9-Feb	5.00	255	7.80	8	1.10	23	0.13	2.4	<0.01
22-Feb	5.00	199	7.82	8	0.99	26	0.15	2.9	<0.01
7-Mar	5.00	200	7.75	10	1.20	24	0.20	3.1	<0.01
21-Mar	4.00	240	7.70	6	0.72	22	0.18	2.4	<0.01
5-Apr	<3	233	7.86	8	0.60	21	0.18	2.9	<0.01
18-Apr	6.00	201	7.73	8	1.10	21	0.62	3.0	<0.01
3-May	4.00	218	7.80	8	1.30	22	0.47	3.0	<0.01
16-May	7.00	212	7.68	11	1.90	20	1.80	4.5	0.02
30-May	4.00	199	7.95	19	0.92	24	12.00	15.0	0.28
14-Jun	4.00	205	7.77	6	0.98	23	1.40	3.6	0.02
26-Jun	3.00	202	7.84	7	2.00	21	0.68	3.4	0.01
11-Jul	4.00	209	7.86	6	0.84	20	0.24	3.1	<0.01
25-Jul	4.00	199	7.81	9	0.84	25	0.20	2.7	<0.01
9-Aug	3.00	211	7.90	8	0.64	25	0.13	2.4	<0.01
22-Aug	3.00	202	7.90	4	0.56	23	0.10	2.0	<0.01
5-Sep	<3	185	7.85	4	0.83	24	0.10	1.7	<0.01
21-Sep	<3	215	7.85	7	1.00	27	0.10	2.1	<0.01
4-Oct	3.00	178	7.90	7	1.10	25	0.14	2.2	<0.01
17-Oct	<3	183	7.67	3	0.97	23	0.14	2.0	<0.01
31-Oct	3.00	191	7.76	3	0.42	28	0.14	2.0	<0.01
15-Nov	<3	192	7.94	7	0.56	27	0.11	2.4	<0.01
29-Nov	3.00	212	7.87	11	1.30	29	0.18	3.0	<0.01
13-Dec	<3	202	7.93	8	0.64	32	0.16	2.6	<0.01
28-Dec	2.00	206	7.52	5	0.19	24	0.11	<1	<0.01

Bi-Weekly Lab Results - Total Coliform/E.Coli  
Sewage Effluent Discharge to Environment (Grab)

Date	Total Coliform	E.Coli	E. Coli Limit - Monthly Geometric <200/100mL Single Sample <400/100mL	
			E.Coli Monthly Geometric Mean	E.Coli Single Sample
<b>January</b>				
4-Jan	60	5		<400
12-Jan	300	40		<400
17-Jan	47	6		<400
24-Jan	290	22		<400
<b>Geo-Mean</b>	<b>125.15</b>	<b>12.75</b>	<200	
<b>February</b>				
1-Feb	310	41		<400
15-Feb	550	85		<400
22-Feb	240	34		<400
<b>Geo-Mean</b>	<b>344.60</b>	<b>49.12</b>	<200	
<b>March</b>				
1-Mar	110	11		<400
7-Mar	240	56		<400
15-Mar	260	40		<400
21-Mar	68	28		<400
29-Mar	140	10		<400
<b>Geo-Mean</b>	<b>145.56</b>	<b>23.32</b>	<200	
<b>April</b>				
5-Apr	240	35		<400
18-Apr	520	63		<400
26-Apr	1000	<b>690</b>		<400
<b>Geo-Mean</b>	<b>499.73</b>	<b>115.01</b>	<200	
<b>May</b>				
3-May	1500	<b>440</b>		<400
9-May	3200	<b>1000</b>		<400
16-May	1200	<b>890</b>		<400
16-May	1200	<b>780</b>		<400
24-May	2200	310		<400
30-May	1300	390		<400
<b>Geo-Mean</b>	<b>1644.35</b>	<b>577.07</b>	<200	
<b>June</b>				
7-Jun	550	24		<400
14-Jun	350	30		<400
21-Jun	17000	<b>980</b>		<400
26-Jun	390	73		<400
<b>Geo-Mean</b>	<b>1062.88</b>	<b>84.72</b>	<200	



Bi-Weekly Lab Results - Total Coliform/E.Coli  
Sewage Effluent Discharge to Environment (Grab)

Date	Total Coliform	E.Coli	E. Coli Limit - Monthly Geometric <200/100mL Single Sample <400/100mL	
			E.Coli Monthly Geometric Mean	E.Coli Single Sample
<b>July</b>				
5-Jul	31	5		<400
11-Jul	1900	380		<400
19-Jul	110	5		<400
25-Jul	1100	93		<400
<b>Geo-Mean</b>	<b>290.55</b>	<b>30.66</b>	<200	
<b>August</b>				
2-Aug	180	12		<400
9-Aug	1000	35		<400
16-Aug	140	11		<400
22-Aug	350	20		
30-Aug	110	22		<400
<b>Geo-Mean</b>	<b>249.67</b>	<b>18.26</b>	<200	
<b>September</b>				
5-Sep	2400	120		<400
13-Sep	550	16		<400
21-Sep	730	50		<400
27-Sep	77	10		<400
<b>Geo-Mean</b>	<b>521.91</b>	<b>31.30</b>	<200	
<b>October</b>				
4-Oct	280	43		<400
11-Oct	170	14		<400
17-Oct	120	32		<400
23-Oct	54	11		<400
31-Oct	260	15		<400
<b>Geo-Mean</b>	<b>132.52</b>	<b>21.46</b>	<200	
<b>November</b>				
8-Nov	290	22		<400
15-Nov	24	4		<400
22-Nov	100	15		<400
29-Nov	66	8		<400
<b>Geo-Mean</b>	<b>82.33</b>	<b>10.14</b>	<200	
<b>December</b>				
6-Dec	250	20		<400
13-Dec	1000	72		<400
20-Dec	210	20		<400
28-Dec	24	3		<400
<b>Geo-Mean</b>	<b>188.41</b>	<b>17.14</b>	<200	

Quarterly Lab Results - Acute Lethality  
Sewage Effluent Discharge to Environment (Grab)

Acute Lethality							
Parameter	Species	Unit	Results				Limit
			28-Feb	27-Jun	27-Sep	12-Dec	
Acute Lethality (96 hr LC <sub>50</sub> - survival)	Trout	%	>100	>100	>100	>100	>50

## Sewage Effluent Discharge to Environment (Composite)

Parameter	Units	Date	
		18-Apr	22-Aug
Total Alkalinity	mg/L	194	186
Bicarbonate	ug/L	237	227
Calcium	mg/L	100	105
Carbonate	mg/L	<1	<1
Conductivity (at 25°C)	uS/cm	1720	1710
Magnesium	mg/L	45	50
Nitrate	mg/L	79	100
Potassium	mg/L	15	16
Sodium	mg/L	176	178
Sulphate	mg/L	290	310
Total Dissolved Solids	mg/L	1080	1120
Total Hardness	mg/L	434	467

## Sewage Effluent Discharge to Environment (Composite)

Parameter	Units	Date
		23-Aug
Aluminum	mg/L	0.0059
Arsenic	ug/L	0.6
Antimony	mg/L	0.0005
Barium	mg/L	0.066
Beryllium	mg/L	<0.0001
Boron	mg/L	0.24
Cadmium	mg/L	0.00003
Chromium	mg/L	0.0006
Cobalt	mg/L	0.0004
Copper	mg/L	0.0098
Iron	mg/L	0.1
Lead	mg/L	0.0007
Manganese	mg/L	0.065
Mercury	ng/L	2
Molybdenum	ng/L	0.0017
Nickel	mg/L	0.0018
Selenium	mg/L	0.0007
Silver	mg/L	<0.00005
Strontium	ug/L	0.77
Thallium	mg/L	<0.0002
Tin	mg/L	0.0002
Titanium	mg/L	0.0006
Uranium	ug/L	4
Vanadium	mg/L	0.0002
Zinc	mg/L	0.049

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*City of North Battleford  
Wastewater Treatment Plant  
2023 Report  
Appendix C: Regulated Results Tables – Receiving  
Environment Upstream and Downstream locations*

Month		January		February		March		April	
Parameter	Units	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
cBOD	mg/L	Not Accessible	Not Accessible	<3	Not Accessible	<3	Not Accessible	<3	Not Accessible
Chloride	mg/L	Not Accessible	Not Accessible	8	Not Accessible	8	Not Accessible	8	Not Accessible
Specific Conductivity	uS/cm	Not Accessible	Not Accessible	429	Not Accessible	456	Not Accessible	358	Not Accessible
pH at 15°C	pH Units	Not Accessible	Not Accessible	7.86	Not Accessible	7.9	Not Accessible	8.2	Not Accessible
TSS	mg/L	Not Accessible	Not Accessible	4	Not Accessible	2	Not Accessible	125	Not Accessible
Total-P	mg/L	Not Accessible	Not Accessible	<0.01	Not Accessible	0.01	Not Accessible	0.07	Not Accessible
Total-N	mg/L	Not Accessible	Not Accessible	0.73	Not Accessible	0.66	Not Accessible	0.57	Not Accessible
Ammonia as N	mg/L	Not Accessible	Not Accessible	0.1	Not Accessible	0.54	Not Accessible	0.11	Not Accessible
TDS	mg/L	Not Accessible	Not Accessible	261	Not Accessible	274	Not Accessible	221	Not Accessible
TKN	mg/L	Not Accessible	Not Accessible	0.22	Not Accessible	0.12	Not Accessible	0.51	Not Accessible
Un-ionized Ammonia	mg/L	Not Accessible	Not Accessible	<0.01	Not Accessible	<0.01	Not Accessible	<0.01	Not Accessible
Total Coliforms	ct/100mL	Not Accessible	Not Accessible	110	Not Accessible	74	Not Accessible	140	Not Accessible
E.coli	ct/100mL	Not Accessible	Not Accessible	21	Not Accessible	22	Not Accessible	3	Not Accessible
Temp (field test)	C°	Not Accessible	Not Accessible	5.7	Not Accessible	1.6	Not Accessible	6.1	Not Accessible
ph (field test)	pH Units	Not Accessible	Not Accessible	7.75	Not Accessible	7.86	Not Accessible	7.25	Not Accessible
Total Alkalinity	mg/L	Not Accessible	Not Accessible	146	Not Accessible	152	Not Accessible	120	Not Accessible
Bicarbonate	mg/L	Not Accessible	Not Accessible	178	Not Accessible	185	Not Accessible	146	Not Accessible
Calcium	mg/L	Not Accessible	Not Accessible	52	Not Accessible	56	Not Accessible	39	Not Accessible
Carbonate	mg/L	Not Accessible	Not Accessible	<1	Not Accessible	<1	Not Accessible	<1	Not Accessible
Magnesium	mg/L	Not Accessible	Not Accessible	16	Not Accessible	17	Not Accessible	14	Not Accessible
Nitrate-N	mg/L	Not Accessible	Not Accessible	0.51	Not Accessible	0.54	Not Accessible	0.06	Not Accessible
Potassium	mg/L	Not Accessible	Not Accessible	1.4	Not Accessible	1.5	Not Accessible	2.1	Not Accessible
Sodium	mg/L	Not Accessible	Not Accessible	13	Not Accessible	12	Not Accessible	13	Not Accessible
Sulphate	mg/L	Not Accessible	Not Accessible	61	Not Accessible	69	Not Accessible	55	Not Accessible
Total Hardness	mg/L	Not Accessible	Not Accessible	195	Not Accessible	210	Not Accessible	155	Not Accessible

Notes:

\* E.coli is not reported (NR) when Total Coliform is not detected

Month		May		June		July		August	
Parameter	Units	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
cBOD	mg/L	<3	<3	<3	<3	3	<3	<3	<3
Chloride	mg/L	5	6	2.8	3.1	3	4	8	9
Specific Conductivity	uS/cm	383	397	289	296	338	347	376	386
pH at 15°C	pH Units	8.68	8.71	8.12	8.08	8.6	8.61	8.51	8.56
TSS	mg/L	18	17	365	356	25	25	16	9
Total-P	mg/L	<0.02	<0.02	0.26	0.26	<0.02	0.03	<0.02	<0.02
Total-N	mg/L	0.35	0.56	1.00	0.97	0.33	0.53	0.2	0.27
Ammonia as N	mg/L	0.03	0.04	0.04	0.03	0.04	0.05	0.01	0.03
TDS	mg/L	238	271	209	207	186	211	239	238
TKN	mg/L	0.35	0.4	1	0.97	0.33	0.38	0.2	0.25
Un-ionized Ammonia	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Coliforms	ct/100mL	52	68	720	5500	1500	4600	1600	1700
E.coli	ct/100mL	4	3	29	36	2	6	60	140
Temp (field test)	C°	16.3	14	20.3	20	23.6	21.4	18	19.9
ph (field test)	pH Units	8.91	8.75	8.08	7.91	8.75	8.59	8.61	8.74
Total Alkalinity	mg/L	134	134	114	114	131	131	123	125
Bicarbonate	mg/L	156	156	139	139	155	155	150	152
Calcium	mg/L	48	48	39	38	44	44	44	45
Carbonate	mg/L	4	4	<1	<1	2	2	<1	<1
Magnesium	mg/L	16	16	11	11	13	13	14	14
Nitrate-N	mg/L	<0.01	0.16	<0.01	<0.01	<0.01	0.15	<0.01	0.02
Potassium	mg/L	1.6	1.7	1.7	1.8	1.2	1.3	1.5	1.6
Sodium	mg/L	12	13	7	7.02	7.5	8.5	12	13
Sulphate	mg/L	58	60	38	37	46	48	56	58
Total Hardness	mg/L	185	185	142	140	163	163	167	170

Notes:

\* E.coli is not reported (NR) when Total Coliform is not detected

Month	Parameter	Units	September		October		November		December*	
			Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
	cBOD	mg/L	<3	<3	<3	<3	<3	Not Accessible	<3	Not Accessible
	Chloride	mg/L	4	5	6	8	5	Not Accessible	6	Not Accessible
	Specific Conductivity	uS/cm	381	391	414	423	396	Not Accessible	407	Not Accessible
	pH at 15°C	pH Units	8.51	8.52	8.42	8.4	8.26	Not Accessible	8.12	Not Accessible
	TSS	mg/L	12	10	4	5	1	Not Accessible	5	Not Accessible
	Total-P	mg/L	0.01	0.01	0.01	0.01	0.01	Not Accessible	<0.01	Not Accessible
	Total-N	mg/L	0.23	0.40	0.45	0.72	0.53	Not Accessible	0.63	Not Accessible
	Ammonia as N	mg/L	<0.01	0.02	0.02	0.03	0.03	Not Accessible	0.44	Not Accessible
	TDS	mg/L	212	222	247	251	231	Not Accessible	266	Not Accessible
	TKN	mg/L	0.23	0.24	0.25	0.28	0.17	Not Accessible	0.19	Not Accessible
	Un-ionized Ammonia	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	Not Accessible	<0.01	Not Accessible
	Total Coliforms	ct/100mL	200	390	77	99	170	Not Accessible	9	Not Accessible
	E.coli	ct/100mL	9	15	8	3	7	Not Accessible	<1	Not Accessible
	Temp (field test)	C°	14.3	12.1	11.3	7.9	5	Not Accessible	3.1	Not Accessible
	ph (field test)	pH Units	7.79	8.23	7.68	8.24	7.42	Not Accessible	7.03	Not Accessible
	Total Alkalinity	mg/L	137	138	137	138	139	Not Accessible	139	Not Accessible
	Bicarbonate	mg/L	162	163	167	168	170	Not Accessible	170	Not Accessible
	Calcium	mg/L	46	46	46	48	49	Not Accessible	50	Not Accessible
	Carbonate	mg/L	2	2	<1	<1	<1	Not Accessible	<1	Not Accessible
	Magnesium	mg/L	14	14	16	17	15	Not Accessible	15	Not Accessible
	Nitrate-N	mg/L	<0.01	0.16	0.2	0.44	0.36	Not Accessible	0.44	Not Accessible
	Potassium	mg/L	1.3	1.4	2	2	1.3	Not Accessible	1.2	Not Accessible
	Sodium	mg/L	8.6	9.4	13	14	9.7	Not Accessible	9	Not Accessible
	Sulphate	mg/L	53	54	62	66	56	Not Accessible	59	Not Accessible
	Total Hardness	mg/L	172	172	180	190	184	Not Accessible	186	Not Accessible

Notes:

E.coli is not reported (NR) when Total Coliform is not detected

\*December Upstream sample taken January 2, 2024. WSA approval was notified of late sample date.



---

*City of North Battleford  
Wastewater Treatment Plant  
2023 Report  
Appendix D: Regulated Results Tables – Ground  
Water Monitoring Wells*

TABLE 5C - Annual Groundwater Well Monitoring at WWTP - October 17-19, 2023

Lab Parameter	Units	Piezometer					
		MW14_01	MW14_02	MW14_03	MW14_04	MW14_05	MW14_06
Total Coliforms	MPN/100mL	<1	<1	<1	<1	<1	n/a
E.coli	MPN/100mL	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	n/a
Specific Conductivity	uS/cm	4920	993	5000	1660	7790	n/a
Chloride	mg/L	68	7	98	19	957	n/a
Nitrate - N	mg/L	1.1	21.0	3.8	100.0	54.0	n/a
Field Parameter	Units	Piezometer					
		MW14_01	MW14_02	MW14_03	MW14_04	MW14_05	MW14_06
Specific Conductivity	uS/cm	3180	664	3330	1098	5160	n/a
pH	pH units	7.47	7.75	7.72	7.59	7.30	n/a
Temperature	°C	7.1	7.8	7.8	7.7	8.3	n/a
Depth to Water	m	3.24	5.19	6.00	6.42	6.21	n/a
Depth to Well Bottom	m	4.26	6.96	7.00	8.25	6.83	n/a
Volume of Water in Well	L	2.00	3.48	1.96	3.60	1.22	n/a
Volume Purged	L	6.0 Dry	7.5 Dry	4.5 Dry	7.5 Dry	3.5 Dry	n/a
Condition of Well	n/a	Good	Good	Good	Good	Good	Good
<b>Notes</b>	n/a	Replaced lock	Replaced lock	Replaced lock	Replaced lock	Replaced lock	Replaced lock

Lab Parameter	Units	Piezometer					
		MW14_07	MW14_08	MW14_09	MW14_10	MW14_11	MW14_12
Total Coliforms	MPN/100mL	<1	<1	1	<1	<1	<1
E.coli	MPN/100mL	Not Reported	Not Reported	<1	Not Reported	Not Reported	Not Reported
Specific Conductivity	uS/cm	895	2750	9190	9200	13000	1880
Chloride	mg/L	17	21	2490	2270	3110	2250
Nitrate - N	mg/L	120	2	84	150	1400	28
Field Parameter	Units	Piezometer					
		MW14_01	MW14_02	MW14_03	MW14_04	MW14_05	MW14_06
Specific Conductivity	uS/cm	622	1808	6160	6230	8780	5660
pH	pH units	8.24	7.56	7.03	7.17	7.39	7.07
Temperature	°C	9.3	7.7	9.0	9.6	9.3	8.7
Depth to Water	m	5.16	5.15	7.50	5.88	5.96	6.41
Depth to Well Bottom	m	6.60	8.20	8.60	8.28	6.96	6.97
Volume of Water in Well	L	2.82	5.98	2.16	4.71	1.96	1.01
Volume Purged	L	8.5	11.5 Dry	4 Dry	14.5	2.5 Dry	2.5 Dry
Condition of Well	n/a	Good	Good	Good	Good	Good	Good
<b>Notes</b>	n/a	Replaced lock	Replaced lock	Replaced lock	Replaced lock	Replaced lock	Replaced lock

n/a - Not Applicable

Notes:

E. coli is not reported when Total Coliform is not detected.

October 17, 2023 - Water was purged from from all wells.

October 18 & 19, 2023 - Water samples were collected from all wells.

*City of North Battleford  
Wastewater Treatment Plant  
2023 Report  
Appendix E: Biosolids Results Table/Yearly Report*

Parameter	Units	Results			
		January	February	March	April
<b><u>Inorganic</u></b>					
Phosphorus	mg/kg	21000	19000	860	17000
Nitrate as N	mg/kg	<5	<5	<5	<5
Nitrite as N	mg/kg	<0.50	1.4	<0.50	1.1
Ammonia as N	µg/g	140	110	71	77
Total Organic Carbon	%	*230000mg/kg	38	38	26
Total Kjeldahl Nitrogen	mg/kg	84000	74000	79000	68000
Moisture	%	91	91	92	90
<b><u>Metals</u></b>					
Aluminum	µg/g	1700	2200	5200	3500
Antimony	µg/g	1.4	1.4	0.75	1.4
Arsenic	µg/g	2.3	2.5	2.6	3.7
Barium	µg/g	140	140	86	140
Beryllium	µg/g	<0.20	<0.20	0.27	<0.20
Boron	µg/g	43	51	5.4	60
Cadmium	µg/g	0.45	0.43	0.13	0.4
Calcium	µg/g	13000	13000	65000	14000
Chromium	µg/g	11	13	16	15
Cobalt	µg/g	2.4	2.5	5.2	2.9
Copper	µg/g	820	760	14	670
Iron	µg/g	5000	6000	13000	8300
Lead	µg/g	12	9.2	68	11
Magnesium	µg/g	6400	6700	17000	7300
Manganese	µg/g	310	240	340	170
Mercury	µg/g	0.31	0.28	0.1	0.46
Molybdenum	µg/g	5.8	6.7	1.2	7.4
Nickel	µg/g	11	12	11	13
Potassium	µg/g	59000	61000	1100	4600
Selenium	µg/g	2.9	2.6	<0.50	2.1
Silver	µg/g	0.66	0.62	<0.20	0.75
Strontium	µg/g	80	78	120	65
Thallium	µg/g	0.055	0.06	0.14	0.1
Tin	µg/g	14	14	3.4	11
Uranium	µg/g	6.4	6	0.5	4.7
Vanadium	µg/g	<5.0	6.7	20	10
Zinc	µg/g	250	220	56	220
<b><u>Microbiology</u></b>					
Fecal Coliforms	MPN/g	<2	<2	<2	<2
Salmonella spp.	MPN/25g	<1	<1	<1	<1

\*Test results reported as mg/kg instead of as a % for January due to test results not arriving within hold time.

Parameter	Units	Results			
		May	June	July	August
<b><u>Inorganic</u></b>					
Phosphorus	mg/kg	15000	18000	19000	25000
Nitrate as N	mg/kg	<5	<5	<5	<5
Nitrite as N	mg/kg	0.66	<0.50	1.6	0.56
Ammonia as N	mg/kg	770	390	250	550
Total Organic Carbon	%	34	*260000mg/kg	1.4	37
Total Kjeldahl Nitrogen	mg/kg	51000	62000	50000	45000
Moisture	%	90	90	92	92
<b><u>Metals</u></b>					
Aluminum	µg/g	2200	2100	2500	2600
Antimony	µg/g	1.1	1.1	1.3	1.3
Arsenic	µg/g	2.3	2.4	2.9	2.6
Barium	µg/g	110	130	150	140
Beryllium	µg/g	<0.20	<0.20	<0.20	<0.20
Boron	µg/g	67	76	110	90
Cadmium	µg/g	0.37	0.53	0.80	0.49
Calcium	µg/g	14000	15000	16000	14000
Chromium	µg/g	12	12	13	12
Cobalt	µg/g	1.8	1.9	2.4	2.1
Copper	µg/g	630	710	830	950
Iron	µg/g	5700	5300	7000	5300
Lead	µg/g	8.9	9.3	260	11
Magnesium	µg/g	6600	6800	7800	8200
Manganese	µg/g	92	80	89	100
Mercury	µg/g	0.46	0.35	0.38	0.43
Molybdenum	µg/g	6.7	7.8	9.7	9.7
Nickel	µg/g	10	10	13	12
Potassium	µg/g	41000	48000	5600	61000
Selenium	µg/g	2.6	4.8	5.7	6
Silver	µg/g	0.7	0.81	0.89	0.9
Strontium	µg/g	63	67	73	80
Thallium	µg/g	0.054	0.06	0.085	0.071
Tin	µg/g	11	11	29	5.4
Uranium	µg/g	4.7	5.1	7.7	11
Vanadium	µg/g	6.9	6.1	7.6	6.5
Zinc	µg/g	220	320	380	340
<b><u>Microbiology</u></b>					
Fecal Coliforms	MPN/g	<2	<2	<2	<2
Salmonella spp.	MPN/25g	<1	<1	<1	<1

\*Test results reported as mg/kg instead of as a % for June due to test results not arriving within hold time.

Parameter	Units	Results			
<b>Inorganic</b>		September	October	November	December
Phosphorus	mg/kg	22000	19000	21000	20000
Nitrate as N	mg/kg	<5	<5	<5	<5
Nitrite as N	mg/kg	1.4	0.75	0.8	<0.50
Ammonia as N	mg/kg	120	870	390	1200
Total Organic Carbon	%	40	32	38	33
Total Kjeldahl Nitrogen	mg/kg	74000	34000	65000	61000
Moisture	%	92	91	91	91
<b>Metals</b>					
Aluminum	µg/g	2800	2400	2400	2300
Antimony	µg/g	1.2	1.0	1.3	1.2
Arsenic	µg/g	2.8	3.3	2.3	2.3
Barium	µg/g	170	140	170	170
Beryllium	µg/g	<0.20	<0.20	<0.20	<0.20
Boron	µg/g	76	48	30	23
Cadmium	µg/g	0.57	0.44	0.44	0.38
Calcium	µg/g	16000	15000	14000	13000
Chromium	µg/g	14	13	14	0.38
Cobalt	µg/g	2.4	2.6	2.7	2.5
Copper	µg/g	930	730	900	790
Iron	µg/g	5500	5800	6000	5400
Lead	µg/g	12	11	12	8.9
Magnesium	µg/g	7900	7400	7700	7000
Manganese	µg/g	240	330	420	410
Mercury	µg/g	0.5	0.49	0.40	0.38
Molybdenum	µg/g	10	8.1	7.2	5.9
Nickel	µg/g	15	12	12	11
Potassium	µg/g	63000	61000	56000	55000
Selenium	µg/g	5.6	4.2	3.8	3.3
Silver	µg/g	0.91	0.99	0.8	0.71
Strontium	µg/g	91	89	100	93
Thallium	µg/g	0.082	0.063	0.062	0.062
Tin	µg/g	5	15.0	15	11
Uranium	µg/g	11	10	12	9.5
Vanadium	µg/g	7.3	6.1	6.2	6.3
Zinc	µg/g	310	260	260	220
<b>Microbiology</b>					
Fecal Coliforms	MPN/g	<2	<2	<2	<2
Salmonella spp.	MPN/25g	<1	<1	<1	<1



# City of North Battleford 2023 LysteGro Application Summary

Marketing and Management of  
LysteGro Produced at the North  
Battleford Wastewater Treatment  
Plant

January, 2024

**Lystek**   
Nothing wasted.  
Everything to gain.



# City of North Battleford

## 2023 LysteGro Application Summary

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**Appendix C** – Maps of Land Application Sites

**Appendix D** – Bills of Sale for Fertilizer Product Sold to Farmers

**Appendix E** – Photos of Land Application

**Appendix F** – Lystek Best Management Practises



## 1 INTRODUCTION

In 2019, Lystek International Inc. entered into a 3- year agreement for the marketing and management of LysteGro fertilizer produced at the North Battleford Wastewater Treatment Plant (WWTP) located at 1 Canola Ave, North Battleford, SK. As per the agreement and subsequent amendment extending the agreement, Lystek is responsible for all aspects of the marketing and application of LysteGro fertilizer produced at the facility from 2019-2023.

**In 2023, the City of North Battleford recycled 3,636 m<sup>3</sup> of biosolids to agricultural land.**

LysteGro is a valuable fertilizer for crop production, and is valued by farmers in the region. LysteGro has a good concentration of nitrogen (N), phosphorus (P) and potassium (K), micronutrients such as sulfur (S) and calcium (Ca), as well as organic matter. There is an increasing recognition by the agricultural community of the value of organic amendments such as LysteGro in building soil health and long-term improvements in yield. Third party trials in Ontario have shown that farmers can completely replace their commercial fertilizer with LysteGro and achieve comparable or higher corn yields.

In 2023, 3,636 cubic metres (m<sup>3</sup>) of LysteGro was hauled from North Battleford WWTP and directly injected into approximately 200 acres (ac).

This report is a summary of the City of North Battleford's 2023 LysteGro application program. It will provide more information about the product, volumes hauled and applied and details of the application.

## 2 PRODUCT CHARACTERIZATION AND VALUE SUMMARY

### 2.1 LYSTEGRO FERTILIZER LABEL

The material produced at the North Battleford WWTP with the Lystek-patented technology is a regulated fertilizer product through the Canadian Food Inspection Agency (CFIA), as shown in [Appendix A](#). As such, the material is applied as a fertilizer, where the rate of application is based on soil characteristics and crop requirements. The requirements of the product characteristics under the Federal *Fertilizers Act* include:

- Reduced pathogen content (Fecal Coliforms <1,000 MPN/gram, Salmonella Absence/25 grams)
- Dioxin & furan analysis and meeting regulatory limits
- Guaranteed minimum nutrient analysis (NPK)
- Analysis of 11 Regulated Metals and application rate maximums based on concentrations

According to the product label, the fertilizer has a minimum guaranteed analysis of 3-3-3% on a dry weight basis for Total N, Total Available Phosphoric Acid (P<sub>2</sub>O<sub>5</sub>), and Soluble Potash (K<sub>2</sub>O), respectively. However, based on the mean of 12 samples collected monthly during the 2023 production period, the actual analysis of the material is 6-4-4. A product analysis is



available in [Appendix B](#). The actual product analysis rather than the fertilizer label is always provided to the farmer, and used by Lystek’s Certified Crop Advisors when making application rate recommendations.

## 2.2 VALUE OF LYSTEGRO FERTILIZER

The **Ontario Farm Monitoring Project** is an effort by the University of Guelph to gather information about the cost of farm inputs (fertilizer, pesticides, fuel) in Ontario. As no such publication could be found for Saskatchewan, the pricing for Ontario will be used to evaluate the equivalent fertilizer value of LysteGro compared to commercial fertilizer: Urea (primary source of N), mono-ammonium phosphate (MAP) (primary source of P) and Muriate of Potash (primary source of K). Based on their most current 2023 surveys average fertilizer prices, the equivalent value of LysteGro product produced at the North Battleford WWTP is \$103.82 /1,000 imperial gallons (imp gal) based on total N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O and \$56.94 /1,000 imp gal based on predicted availability of nutrients in the first growing season.

Recycling nutrients from the WWTP back to farm fields provides local farmers with benefits in the form of reduced costs for fertilizer and improving their overall soil fertility. The price charged to customers in 2023 was \$17.50/1,000 imp gal. This price is the same price as the previous year. The price remaining the same was related to a softening of prices in the commercial granular fertilizer market and continued stress in sourcing a suitable local application contractor. Time continues to be allocated in sourcing a suitable local application contractor.

## 3 VOLUMES REMOVED AND APPLICATION SITES

### 3.1 FERTILIZER VOLUMES

[Table 3-1](#) and outlines the LysteGro hauling and land application volumes from the North Battleford WWTP for 2023. In total, 3,636 m<sup>3</sup> of LysteGro was hauled and applied. Further details of each application are described below.

**Table 3-1 Land application events from North Battleford WWTP in 2023**

Hauling Date (from plant)	Farmer	Interim Storage	Volume (m <sup>3</sup> )	Land App dates	Acres	App Rate (imp gal./ac)
September 11 – 17, 2023	Ryan Charabin	NO	3,636	Same as hauling	200	4,000

### 3.2 HAULING SUMMARIES & APPLICATION SITES

There was one hauling event from the North Battleford WWTP in 2023. Maps showing the location of the application site are available in [Appendix C](#). Bills of sale for LysteGro fertilizer



sold to the end customer are in [Appendix D](#). Between September 11 - 17, approximately 3,636 m<sup>3</sup> was hauled from the North Battleford WWTP to land farmed by Ryan Charabin east of the WWTP on East Hill Road.

### 3.3 DISTANCE FROM WWTP TO SITES

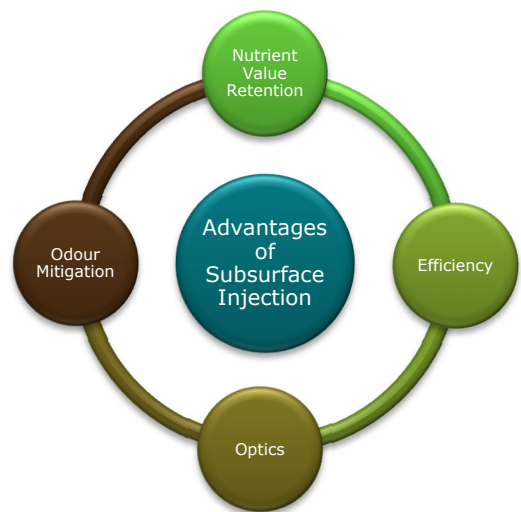
Lystek's focus is on fertilizer program efficiency and delivering fertilizer to the farm customer when it is most beneficial for their program. Reducing hauling distance increases efficiency of the program and reduces greenhouse gas emissions. In 2023, the application site was 5 km from the WWTP, eliminating the need for hauling distant hauling.

## 4 THE LYTEK PRODUCT MANAGEMENT APPROACH

### 4.1 APPLICATION METHOD

All material was sub-surface injected using a tanker-mounted injection system. The benefits of subsurface injection are summarized in Figure 4-1. The injection equipment is designed to ensure all material is applied below the soil surface, causing minimal disturbance, reducing odours, improving optics and maximizing the nutrient value of the product.

Ammonia-nitrogen (NH<sub>4</sub>-N) will be lost to the atmosphere if it is top-spread, therefore subsurface injection allows for higher retention of nitrogen, and greater value for the farmer. The application equipment is able to apply the material evenly throughout the application area through a combination of hydraulics, controlling the pumping rate and vehicle speed.



**Figure 4-1. Advantages of subsurface injection.**

### 4.2 BEST MANAGEMENT PRACTISES

In addition to ensuring that all LysteGro is subsurface injected rather than top spread, Lystek employs additional voluntary best management practises (BMPs) for application of the fertilizer product. Product Management staff at Lystek are all professional agrolologists, with experience and commitment to nutrient management principles and environmental stewardship. These BMPs are clearly communicated to all land application contractors that we work with and monitored by Lystek staff oversight. The voluntary BMPs include no application of material to frozen or snow covered soil, minimum depth to groundwater and bedrock, and setbacks from waterways and dwellings.

Lystek's full voluntary best management practises are included in [Appendix E](#).

### 4.3 PROFESSIONAL SERVICES

Lystek product management staff are certified crop advisors and/or professional agronomists committed to serving the needs of our agricultural customers, while practising environmental



stewardship. Along with ensuring regulatory compliance for the use of LysteGro and overseeing all hauling/land application activities, we are active in the Canadian agricultural and biosolids industries. We participated in several major research projects in 2023, including:

- Actively contributed to university and government research projects:
  - Continued into the 5<sup>th</sup> year of a wheat yield study with UC Davis in Fairfield, California
  - A corn yield study with UC Davis in Fairfield, California

## 5 APPLICATION RATE DETERMINATION

Application rates for LysteGro fertilizer are based on a number of factors including soil characteristics and crop plans. LysteGro is used as a fertilizer, with the additional benefit of providing organic matter to the soil, so application is based primarily on nutrient concentration, while also taking into account metal additions to soils.

### 5.1 NUTRIENT MANAGEMENT

Application rates of LysteGro fertilizer are primarily dependant upon crop nutrient requirements and pre-existing soil nutrient concentrations. The average application rate in 2023 was 4,000 imp gal/ac.

Land used for cash cropping with limited addition of organic amendments (manure, compost, biosolids, etc) will often see a depletion in P, K and organic matter. In addition, depending on parent material and soil characteristics, secondary and micronutrients can also be deficient in soils that are intensively cropped. Farmers often apply large amounts of P and K fertilizers to overcome deficiencies in the current crop year as well as build up the supply of P and K in the soil for future years. LysteGro applied at the appropriate rates to fields will provide adequate nutrition for the next crop, while also increasing concentrations of organic matter, macro and micronutrients, providing multi-year value to the customer.

**The City of North Battleford recycled:**

- **20 tonnes of Nitrogen**
- **13 tonnes of P<sub>2</sub>O<sub>5</sub>**

**to local farmland as a result of their LysteGro program in 2022.**

### 5.2 HEAVY METALS

Heavy metals generally refer to the 11 regulated metals which are monitored for their inputs to agricultural soils. The addition of heavy metals to the soil through fertilizers and amendments is regulated under either the provincial ***Land Application of Municipal Sewage Sludge Guidelines (EPB 296)***, or the federal ***Fertilizers Act***, depending on the material. LysteGro is a fertilizer regulated by the CFIA, and therefore falls under the ***Fertilizers Act***. The federal ***Fertilizers Act*** limits metal addition to soils by assigning maximum annual application rates based on metal concentrations of the fertilizer. Therefore, the metal concentrations also play a role in determining the application rate for LysteGro. Maximum annual application rates for North Battleford LysteGro for CFIA based on 2023 analysis was 4,203.03 imp gal/ac. This application rate is based on the nutrient which is closest to its 45-year maximum addition to soils based on annual applications (Copper).



The application rate used in 2023 was 4,000 imp gal/ac. In addition, LysteGro application is rotated each year to ensure that the same piece of land does not receive LysteGro in subsequent years meaning the 2023 application rate is far below compared to the 45-year addition referenced application rate. Field rotation is not a regulatory requirement but is in line with best practises for the industry.

## 6 SUMMARY

The 2023 application season was successful, as the North Battleford LysteGro was applied responsibly as a fertilizer. The Lystek application program managed 3,636 m<sup>3</sup> of product and was completed as a fertilizer program, based on agronomics and best management practices.

To date, the City of North Battleford has produced 42,820 m<sup>3</sup> of LysteGro fertilizer from its biosolids. We look forward to continuing to work in partnership with the City to divert valuable nutrients from landfill and return them back to the soil in an environmentally responsible manner as part of a circular economy.



## **APPENDICES**



## **APPENDIX A**

### **CFIA Fertilizer Label**

## LYSTEGRO 3-3-3

<b>Guaranteed minimum analysis (dry weight basis)</b>	<b>Analyse minimale garantie</b>
Total nitrogen (N) 3%	Azote total (N) 3%
Available phosphoric acid (P <sub>2</sub> O <sub>5</sub> ) 3%	Acide phosphorique assimilable (P <sub>2</sub> O <sub>5</sub> ) 3%
Total phosphoric acid 3%	Acide phosphorique total 3%
Soluble potash (K <sub>2</sub> O) 3%	Potasse soluble (K <sub>2</sub> O) 3%
Organic Matter 45%	Matière organique 45%
Maximum Moisture 92%	Humidité maximale 92%
Active ingredient derived from municipal biosolids.	Matières actives dérivées des biosolides municipaux.
Lot #:1-2023 Net Weight: 40,000 kg	No. de lot: 1-2023 Poids net: 40,000 kg
Manufactured By: The City of North Battleford Wastewater Treatment Plant 1 Canola Avenue North Battleford, SK, S9A 2Y6	Fabriqué par: The City of North Battleford Wastewater Treatment Plant 1, Canola Avenue North Battleford (Saskatchewan), S9A 2Y6
<b>Directions for use:</b> Maximum annual application rates for LysteGro fertilizer should not exceed 4 dry tonnes per hectare.	<b>Mode d'emploi:</b> La dose maximale annuelle d'application d'engrais de LysteGro ne devrait pas dépasser 4 tonnes sèches par hectare.
User should seek the advice of a county agricultural representative or professional agricultural consultant. This product should be used based on soil and/or tissue analysis and incorporated following application.	L'utilisateur devrait demander conseil à un représentant agricole du comté ou un consultant agricole professionnel. Ce produit devrait être utilisé basé sur une analyse de sol et/ou de tissus et incorporé suivant l'application.
Not to be applied to land during the production of ready-to-eat crops that may come in contact with the soil. When applied to pastureland, do not allow animals to graze for at least one month from the date of application. When applied to land on which forage crops are grown, do not harvest crop for at least one month from the date of application.	Ne pas appliquer à la terre pendant la production de cultures prêtes à manger qui peuvent entrer en contact avec le sol. Lorsque appliqué sur les pâturages, ne pas laisser les animaux paître pendant au moins un mois à partir de la date d'application. Lorsque appliqué sur les terres fourragères, ne pas récolter de cultures pendant au moins un mois à partir de la date d'application.
Keep out of reach of children Read label before use.	Tenir hors de la portée des enfants. Lire l'étiquette avant d'utiliser.
Protective eyewear and gloves recommended. <b>If on skin:</b> wash with water and soap. <b>If in eyes:</b> flush with water thoroughly. If irritation persists, seek medical advice.	Il est conseillé de porter des lunettes et des gants de protection. <b>En cas de contact avec la peau :</b> Laver avec de l'eau et du savon. <b>En cas de contact avec les yeux :</b> Rincer à fond avec de l'eau. Si l'irritation persiste, consultez un médecin.

## **APPENDIX B**

### **Fertilizer Composition**



### North Battleford - LysteGro Fertilizer Composition

	LysteGro Average <sup>a</sup>	Maximum Acceptable Concentration <sup>b</sup>	Units
Organic Matter Content	3.05		% on a wet weight basis
Total Organic Carbon	5.24		% on a wet weight basis
<b>Total Nutrient Content</b>			
Total Nitrogen (TKN)	6.24		% on a dry weight basis
Total Available Nitrogen (Ammonium + Nitrate)	0.03		% on a dry weight basis
Total Organic Nitrogen	6.20		% on a dry weight basis
Total Phosphorus (elemental)	1.79		% on a dry weight basis
Total Phosphorus (P <sub>2</sub> O <sub>5</sub> )	4.10		% on a dry weight basis
Total Potassium (elemental)	5.03		% on a dry weight basis
Total Potassium (K <sub>2</sub> O)	6.06		% on a dry weight basis
<b>Metals Regulated by WSA</b>			
Arsenic	2.70	75	mg/kg
Cadmium	0.46	20	mg/kg
Cobalt	2.63	150	mg/kg
Chromium	13.18	1,060	mg/kg
Copper	793.00	760	mg/kg
Mercury	0.38	5	mg/kg
Molybdenum	7.30	20	mg/kg
Nickel	11.91	180	mg/kg
Lead	38.58	500	mg/kg
Selenium	4.03	14	mg/kg
Zinc	257.82	1,850	mg/kg
<b>Relevant Macro and Micro Nutrients</b>			
Calcium	16.92		lbs/1,000 gallons
Copper	0.71		lbs/1,000 gallons
Iron	5.90		lbs/1,000 gallons
Magnesium	7.27		lbs/1,000 gallons
Sulphur	5.71		lbs/1,000 gallons
Zinc	0.23		lbs/1,000 gallons
<b>Total and Available Nutrients (during 1st growing season) - Imperial</b>			
Total Nitrogen	55.55		lbs/1,000 gallons
Total Available Nitrogen <sup>c</sup>	22.41		lbs/1,000 gallons
Total Phosphorus (P <sub>2</sub> O <sub>5</sub> )	36.48		lbs/1,000 gallons
Total Available Phosphorus (P <sub>2</sub> O <sub>5</sub> ) <sup>d</sup>	14.59		lbs/1,000 gallons
Total Potassium (K <sub>2</sub> O)	53.96		lbs/1,000 gallons
Total Available Potassium (K <sub>2</sub> O) <sup>e</sup>	48.56		lbs/1,000 gallons
<b>Pathogens</b>			
Fecal coliform	<2 <sup>f</sup>		MPN/g(mL)
Salmonella spp.	Absent <sup>f</sup>		P-A/25g(mL)

<sup>a</sup> Values represent the mean of samples collected on a monthly basis throughout January - November 2023

<sup>b</sup> As per WSA Land Application of Municipal Sewage Sludge Guidelines

<sup>c</sup> The sum of Ammonium + Nitrate + assume 30% mineralization of Organic Nitrogen during first growing season

<sup>d</sup> Assume 40 % availability of Phosphorus during first growing season

<sup>e</sup> Assume 90% availability of Potassium during first growing season

<sup>f</sup> Results were consistent for all sampling events

## **APPENDIX C**

### **Maps of Land Application Sites**

2023 North Battleford  
LysteGro Application  
Ryan Charabin - E Hill Road



Sept 2023 Application  
200 ac  
3.636 m3

150 ac

50 ac

North Battleford WWTP

Yellow Road Hwy



## **APPENDIX D**

### **Bills of Sale for Fertilizer sold to Farmers**

## **APPENDIX E**

### **Photos of Land Application**







## **APPENDIX F**

### **Lystek Best Management Practices**

## **LysteGro – Application and Setback Guidelines**

### ***Application Method***

LysteGro must be **sub-surface injected**.

Sub-surface injection is defined as the placement of nutrients to 10 – 30 cm below the soil surface in the crop root zone using equipment specifically designed for that purpose, when the applied material is retained by the soil.

### **Application – Ground Condition**

LysteGro cannot be applied to Frozen or Snow-covered soil.

“Frozen”, when used in reference to soil, means that a layer of soil with an average minimum depth of five centimetres, located within the top 15 centimetres of the soil, is consolidated by the presence of frozen moisture;

“snow-covered”, when used in reference to soil, means that there is a layer of snow with an average minimum depth of five centimetres.

### **Depth to Groundwater**

There must be at least 30 cm of unsaturated soil at the surface of the land at the time of application.

### **Depth to Bedrock**

There must be at least 1 m separation distance from ground surface to bedrock.

### **Set-backs**

- **100 m** from municipal wells for all applied nutrients
  - 30 m from any other well
- No application is permitted within **25 m** of a dwelling
- No application is permitted within **50 m** of a residential area or commercial, community or institutional use.
- **3 to 20 m** from the bank of surface water (as defined by the Nutrient Management Act, 2002). This setback depends on a

number of factors such as the slope near the watercourse and whether there is a presence of a vegetated buffer strip along water body. i.e. If no buffer strip, a setback on the higher end (**20 m**) will be the course of action.

For LysteGro application, the following setbacks are to be adhered to:

- **100 m** distance buffer from municipal wells
- **30 m** distance buffer for all other wells
- **50 m** distance buffer from residential, commercial, community or institutional areas
- **25 m** distance buffer from house dwellings
- For surface water without a vegetated buffer strip, a **20 m** distance buffer from top of bank will be used
- For surface water with a vegetated buffer strip a **10 m** distance buffer from top of bank will be used

Note: This document is a summary of Guidelines which all companies applying LysteGro originating from the Southgate Organic Materials Recovery Centre or other Lystek managed programs as an agricultural fertilizer must adhere to, unless otherwise approved by a qualified Lystek representative. The above noted criteria are Guidelines voluntarily enforced by Lystek International Inc. and Lystek International Inc. as Best Management Practices.

I, \_\_\_\_\_ have read and understood this document and will adhere to the practices described herein related to my work on behalf of Lystek International Corp. Should I have any questions about them, I will inquire with a Lystek representative.

Date: \_\_\_\_\_

Signature: \_\_\_\_\_

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*City of North Battleford  
Wastewater Treatment Plant  
2023 Report  
Appendix F: Glossary*

## Glossary

**Ammonia** – Ammonia as N ( $\text{NH}_3\text{-N}$ ) – Ammonia as N is an inorganic, dissolved form of nitrogen that can be found in water and is the preferred form for algae and plant growth. The term ammonia refers to two chemical species which are in equilibrium in water. They are  $\text{NH}_4^+$  (ionized) and  $\text{NH}_3$  (un-ionized). Tests for ammonia usually measure total ammonia.

**Biosolids** – also known as sewage sludge, is a solid, semi-solid, or liquid residue generated during treatment of domestic sewage in a treatment works. It consists mainly of water (90 to 99%) and settleable solids. The solids are mostly organics that are removed during primary, secondary or advanced wastewater treatment processes.

**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.

**CBOD** – Carbonaceous Biochemical Demand measures the amount of oxygen consumed by living organisms (bacteria) in decomposing the organic waste.

**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

**MAC** - Maximum Acceptable Limit and is health based

**mg/l** – milligrams per litre

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

**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

**SWSA** – The Saskatchewan 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 wastewater works.

**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.

**Un-ionized Ammonia** –  $\text{NH}_3$  is the un-ionized form of ammonia. It is the toxic form of ammonia. In general, the un-ionized ammonia is highly toxic to fish and other aquatic life. Toxicity increases as pH and temperature increase.

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

**WMF** – Waste Management Facility

**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.

**WWTP** – Wastewater Treatment Plant