

**Lagoon Operation & Maintenance
Manual
Charter Community of Déline, NT**

Draft



Stantec

April 10, 2013

Sign-off Sheet



Stantec

This document entitled Lagoon Operation & Maintenance Manual Charter Community of Déline, NT was prepared by Stantec Consulting Ltd. for the account of the Charter Community of Déline. The material in it reflects Stantec's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Stantec Consulting Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Prepared by _____
(signature)

Reviewed by _____
(signature)

Table of Contents

| | |
|---|------------|
| 1.0 INTRODUCTION | 1.1 |
| 1.1 INFORMATION OF THE LICENSEE | 1.1 |
| 1.2 LIST OF RESPONSIBLE PERSONNEL | 1.1 |
| 1.3 ROLE OF THE PLAN | 1.1 |
| 1.1 COMMUNITY INFORMATION | 1.1 |
| 1.2 FACILITY INFORMATION..... | 1.2 |
| 1.3 EMERGENCY PLANNING & CONTACT | 1.2 |

| | |
|---|------------|
| 2.0 LAGOON FUNDAMENTALS | 2.3 |
| 2.1 CHECKING THE SYSTEM..... | 2.3 |
| 2.2 FREEBOARD | 2.3 |
| 2.3 RUNOFF AND DRAINAGE CONTROL..... | 2.3 |
| 2.4 TREATMENT OF CONTAMINATED DRAINAGE | 2.4 |
| 2.5 COLOUR | 2.4 |
| 2.6 PH..... | 2.4 |
| 2.7 BERM MAINTENANCE | 2.5 |
| 2.8 INLET STRUCTURES – TRUCK DISCHARGE | 2.6 |
| 2.8.1 Point Problems | 2.6 |
| 2.8.2 Erosion | 2.6 |
| 2.9 OUTLET STRUCTURES..... | 2.6 |
| 2.10 ODOUR, VEGETATION, AND INSECT PROBLEMS | 2.7 |
| 2.10.1 Odour Problems | 2.7 |
| 2.10.2 Vegetation Control..... | 2.7 |
| 2.10.3 Insects | 2.8 |
| 2.11 FLOATING MATERIAL REMOVAL | 2.8 |
| 2.12 WINDBLOWN DEBRIS, FENCING, AND SIGNS | 2.8 |
| 2.13 SLUDGE MANAGEMENT..... | 2.9 |
| 2.13.1 Sludge Survey | 2.9 |
| 2.13.2 Sludge Removal & Frequency..... | 2.9 |
| 2.13.3 Sludge Disposal..... | 2.10 |
| 2.13.4 Health & Safety Considerations..... | 2.10 |
| 2.14 OPTIMIZATION OF EFFLUENT QUALITY | 2.10 |
| 2.15 QUALITY ASSURANCE/QUALITY CONTROL PLAN | 2.10 |
| 2.16 RECORD KEEPING | 2.11 |

| | |
|---|-------------|
| 3.0 OPERATIONAL INSTRUCTIONS | 3.12 |
| 3.1 FLOATING MATERIAL REMOVAL | 3.12 |
| 3.2 SLUDGE SURVEY | 3.12 |
| 3.3 CELL DRAINAGE | 3.13 |
| 3.4 WATER/WASTEWATER SAMPLING | 3.13 |

| | |
|--------------------------------------|-------------|
| 4.0 O & M CHECKLIST | 4.14 |
|--------------------------------------|-------------|

| | | |
|-----|-------------------|------|
| 4.1 | DAILY | 4.14 |
| 4.2 | WEEKLY | 4.14 |
| 4.3 | MONTHLY | 4.14 |
| 4.4 | AS REQUIRED | 4.14 |

LIST OF TABLES

| | |
|--|------|
| Table 2.1: Lagoon Colour Identification | 2.4 |
| Table 2.2: Effluent Quality Requirements | 2.11 |
| Table 3.1: SP-1 Characteristics | 3.13 |
| Table 3.2: SP-2 Characteristics | 3.13 |

LIST OF APPENDICES

| | | |
|-------------------|---------------------------------------|------------|
| APPENDIX A | DRAWINGS..... | A.1 |
| APPENDIX B | CURRENT WATER LICENCE..... | B.2 |
| APPENDIX C | INAC SAMPLING GUIDE | C.3 |
| APPENDIX D | SITE INSPECTION TEMPLATE | D.4 |

DRAFT

Executive Summary

DRAFT

1.0 Introduction

1.1 INFORMATION OF THE LICENSEE

Charter Community of Déline (Déline)
PO Box 2
Déline, NT
X0E 1G1

1.2 LIST OF RESPONSIBLE PERSONNEL

| | |
|-------------------------------------|----------------------------------|
| Senior Administrative Officer (SAO) | (867) 589-4800 |
| Hamlet Foreman | (867) 589-4800 or (867) 589-3718 |
| Sanitation Lead | (867) 589-3718 |

1.3 ROLE OF THE PLAN

This Plan consists of Operation and Maintenance Procedures for the Sewage Disposal Facility. The Plan is developed to ensure the operation and maintenance of the Déline Lagoon meets the mandatory requirements as per the Water Licence S12L3-006 issued by the Sahtu Land and Water Board (SLWB). The SLWB's mandate is to regulate the use of land and waters and the disposal of waste to provide for the conservation, development and utilization of land and water resources. The Plan is developed to manage the waste generated at the Déline Lagoon in such a way that adverse impacts to public health & safety and the environment are minimized.

Therefore, all aspects of the lagoon facilities operation and maintenance must not be contravention of the requirements stated by the SLWB current Water Licence: **S12L3-006** attached in **Appendix B** for reference.

1.1 COMMUNITY INFORMATION

The Charter Community of Déline is located on the north shore of Great Bear Lake in the Sahtu region of the Northwest Territories as follows:

| | | | |
|------------|-----------------|-------------------|----------------------------|
| (Lat/Long) | 65° 11' North | 123° 26' West | |
| (UTM) | Easting 480192m | Northing 7229422m | (Map sheet number O96G-03) |

The Community is located within the Norman Range ecoregion, which extends from Fort Good Hope on the east side of the Mackenzie River to Willowlake River south of Great Bear Lake. It is marked by cool summers and long, very cold winters. The ecoregion is classified as having a low subarctic ecoclimate. Vegetation is dominated by open stands of black spruce with an

understory of dwarf birch, Labrador tea, lichen, and moss. The surface of the ecoregion is covered with steeply sloping to undulating glacial drift, colluvium, and organic deposits in the form of polygonal peat plateaus. Turbic and Organic Cryosols, as well as Eutric Brunisols, are the dominant soils. Permafrost is extensive and discontinuous with low to medium ice content, and is characterized by sparse ice wedges.

Annual precipitation in the Community averages 166 millimetres of rainfall and 153 millimetres of snowfall, resulting in an annual total of approximately 291 millimetres of equivalent precipitation, resented as rain. The mean high and low annual temperatures are -0.7 °C and -10.4 °C. The wind is typically from the northwest and has an annual average speed of 11 kilometres per hour.

The Northwest Territories Bureau of Statistics estimated the current population of the community of Déline at 552 people in 2011. Domestic solid waste is collected five days a week (Monday through Friday) by the Community and disposed of at the municipal solid waste disposal facilities.

Location of the Community's waste disposal facilities are shown in drawings found in **Appendix A** of this Plan.

1.2 FACILITY INFORMATION

Wastewater from the Community is hauled by truck for discharge into the single celled anaerobic lagoon system; the volume of the lagoon is 20,000 m³. The effluent flows into a low lying area making its way overland through various wetlands until eventually discharging to Great Bear Lake approximately 4.5 km away.

The time the effluent is exposed to biological remediation in the wetlands depends on the amount and frequency of rainfall, the heat and humidity of the air and the winter temperatures. Wetlands treatment is a web of complex physical and biological processes. Sedimentation, absorption of pollutants in the surface soils, nutrient uptake by plants, and the oxidation of compounds by micro-organisms are some of the processes which effect the treatment. There are no chemicals used in the sewage treatment process.

1.3 EMERGENCY PLANNING & CONTACT

In the event of accidental/unauthorized discharge of waste occurs or if such a discharge is foreseeable, the Spill Contingency Plan for the Charter Community of Déline shall be employed.

1. The first contact shall be to the Hamlet Foreman (867) 589-3718;
2. The incident shall be reported to the 24-Hour Spill Report at (867) 920-8130; and
3. A report regarding the incident shall be submitted to the INAC Inspector within 30 days of reporting the incident.

2.0 Lagoon Fundamentals

Continuous discharge lagoons such as the exfiltration lagoon in Déline are operated using the fill and continuous discharge method. The lagoon is discharged at a semi-constant rate with the use of a coarse rip-rap section of berm.

2.1 CHECKING THE SYSTEM

Once a day during the summer, a walk around inspection of the lagoon should be undertaken to see if anything is obviously wrong. During the winter, a weekly inspection will normally be sufficient. Action needs to be taken immediately if major problems such as significant erosion are apparent. A *Site Inspection Template* is attached in **Appendix D**; this form is to be completed upon each weekly, monthly, and annual site inspection visit undertaken by Déline Employees.

Once a week, all the major components of a lagoon system should be checked to see if they are operating properly. If they are not, a repair work order should be generated and the repairs made immediately. Repairs to lagoon systems cannot wait once needed, as the consequences of a failure are very expensive.

The lagoon itself has five main areas to inspect:

- Inlet structures - truck discharge area and inlet;
- Berms;
- Outfall structures; and
- Colour of the liquid.

2.2 FREEBOARD

The lagoon has been designed to have a minimum of 1.0 metre of freeboard, which is the distance between the water surface and the top of the berm, when the lagoon is full. This is to protect the berm from erosion and over topping.

2.3 RUNOFF AND DRAINAGE CONTROL

The cell berms are gradually sloped away to take any accumulated precipitation to a ditch leading into the wetlands surrounding the site. The vacuum truck dumping station is constructed of granular materials and drains into the sewage cells. Precipitation that falls on the dumping station which could be contaminated by any spilled sewage is drained down a steel chute into the cell and is processed through the lagoon system.

2.4 TREATMENT OF CONTAMINATED DRAINAGE

Drainage contaminated by effluent will be contained using temporary dykes/berms and pumped or trucked to the lagoon area as per the *Guideline for Industrial Waste Discharges in the NWT*¹.

2.5 COLOUR

The colour of a lagoon is an indicator of how well it is working. If the lagoon is operating well, it is usually bright green. If the contents of the lagoons are any other colour than green, there may be something wrong. The Hamlet Foreman should be contacted to determine the problem, and an engineer should be contacted to assess the condition of the lagoon.

Table 2.1: Lagoon Colour Identification

| Colour | Lagoon Health | Comments |
|----------------------------|---------------|---|
| Green | Great | Good treatment conditions; high pH and dissolved oxygen |
| Dull Green – Yellow | Not Good | pH and dissolved oxygen generally dropping |
| Tan – Brown | Questionable | Dissolved oxygen levels and pH may be dropping, may also indicate physical issues with the lagoon or collection system |
| Grey – Black | Bad | Possibly fully anaerobic conditions (no dissolved oxygen); so the lagoon is not treating wastewater well. Odours most likely present. |

2.6 PH

The intensity of acidity or alkalinity in a solution is numerically expressed by the pH. A pH value of 7.0 is neutral, decreasing values become more intensely acidic, increasing values become more intensely alkaline.

pH measurements are valuable because pH is one of the environmental factors that affect the activity and health of the microorganisms. Sudden changes, or abnormal values, indicate that the process has been upset in some way, usually from a toxic waste. Once the lagoon is completely thawed, pH measurements should be taken monthly during effluent sampling.

¹ http://www.enr.gov.nt.ca/_live/documents/content/industrial_waste_guidelines.pdf

2.7 BERM MAINTENANCE

There are four main functions of the lagoon berms:

1. to form part of a storage container for retention of the wastewater for treatment;
2. to provide access to all parts of the lagoon;
3. to allow variation in level due to volume changes; and
4. to provide a system for flow rate control.

The objective of berm inspection is to make sure that leakage is not occurring. Wastewater leakages through the berms mean that problems are occurring that need to be addressed immediately. The two major concerns are excessive growth of vegetation, which may hide developing problems, and erosion. Erosion of dikes can be caused by wave action and surface runoff. The problems can be aggravated by animal burrows.

Regular monitoring and maintenance are required to control berm erosion. The most frequent areas are:

1. around the exfiltration discharge structure,
2. at corners,
3. along banks down wind,
4. areas with insufficient vegetative cover, and
5. areas with insufficient berm compaction.

Wind-induced water erosion is usually more serious for the larger lagoons, particularly for surface areas over 5 hectares. The Déline Lagoon is much smaller (<2hectares), and therefore wind induced erosion is not a primary concern. If it is found that excessive erosion is occurring, rip-rap can be placed to reduce its effects.

Another method of berm protection uses grass or other vegetative cover. Vegetation may not be present directly following construction of the lagoon, however once vegetation begins to occur it is important that regular cutting of grass or vegetative cover is carried out. A well maintained berm is less likely to be the target for burrowing animals.

Surface runoff is prevented from entering the lagoon through sloping of the berms and interceptor ditches at the bottom of the outer berm slope. The ditches must be properly maintained to prevent the blockage of drainage.

The berms and drainage ditches should be visually checked once a day; this should be recorded weekly as shown in the **Appendix D** – Site Inspection Template.

2.8 INLET STRUCTURES – TRUCK DISCHARGE

2.8.1 Point Problems

At the discharge point, the major problems occur as a result of spillage, snow accumulation, waste build-up at the discharge point, and wastewater freezing.

Snow accumulation at this location can be dealt with by clearing periodically. This should occur each time the access road is cleared.

At the same time, spillage from the truck, during discharge, should be removed and disposed to the lagoon. Because this material is frequently frozen and therefore more difficult to remove than snow, care must be exercised to prevent damage at the discharge location.

Any snow or ice contaminated with wastewater should be directly disposed of in the lagoon.

2.8.2 Erosion

Typically erosion problems at the truck discharge point are a common occurrence. The Déline Lagoon truck discharge point consists of a steel chute with rip-rap and therefore erosion should not be a concern.

2.9 OUTLET STRUCTURES

Two types of outlet structures exist at the Déline Lagoon:

1. Exfiltration outlet structure; and
2. Emergency overflow section.

The exfiltration outlet structure is constructed of large rip-rap material (100mm – 200mm in diameter) and is designed to allow continuous discharge of the wastewater during summer/fall periods when ice has melted. As the ice melts, wastewater is allowed to flow through the berm and into the wetland and discharge to Great Bear Lake.

An emergency overflow section is designed to allow for wastewater to discharge from the lagoon before berms can overtop and/or fail. The overflow section consists of large rip-rap material and allows wastewater to flow through and over the outlet. Maintenance inspections should be routinely made to detect any settling, blockage or damage. The overflow section should be kept open and well maintained.

The sewage lagoon system is designed to minimize any short-circuiting of the wastewater. The inlet is located directly opposite the outlets, maximizing the effective use of the designed cell volume.

2.10 ODOUR, VEGETATION, AND INSECT PROBLEMS

2.10.1 Odour Problems

Under normal operating conditions, the lagoon will not cause serious odour problems. However, at certain times significant odours may occur.

The most troublesome odour conditions occur:

1. During the period immediately following ice break-up; this problem will normally be of short duration. It is also likely to occur annually.
2. At the end of an extensive period of cloud cover (in spring to fall when there is no ice cover), resulting in reduced sunlight and therefore reduced algae activity and low oxygen production. The problem will decrease as sunlight returns or ice-cover forms.
3. Extensive floating sludge mats. In this case, floating scum, septic sludge and algae mats need to be broken up and dispersed using manual mechanical means such as a rake.

2.10.2 Vegetation Control

Plants around the outside slope of the lagoon berm can have a good effect. The maintenance problems must be handled routinely. Small-size vegetation on the outside slopes of the berms is beneficial, whereas large weeds and shrubs can cause root-related problems and must be removed.

Riprap protection should not be covered with vegetation as the vegetation will be difficult and dangerous to control. Similarly, vegetation should not be allowed to grow on the inside slope of the lagoon berms.

A number of surface weeds can develop in lagoons. The problem with these weeds is that they block out the sunlight which is needed by algae to produce oxygen. A second problem is that when the floating plants die, they begin to decompose, using up oxygen which is needed by the bacteria and lowering the dissolved oxygen.

Duckweed is one of the most common of the problem weeds. It is a three-leaved plant. It develops long hair-like roots which harden in the water. It varies in colour from light green during normal growth to brownish yellow in its death phase.

The ways to control surface weeds are to skim them off the lagoon (often difficult and requires repeating). The removed weeds should be taken to the landfill and buried, where possible, to prevent odour and insect problems.

General guidelines for regular vegetation control are to:

1. Remove all shrubs from the lagoon area;
2. Allow, plant or maintain shallow-dense rooted, perennial grasses such as Perennial Ryegrass, on the outside slopes of the berms; and
3. Cut grass regularly during warm weather. Mowing equipment should have a low centre of gravity to minimize the potential of overturning the tractor when mowing along the berm slopes.

2.10.3 Insects

Flies and mosquitoes create the most common insect problems. Most mosquitoes breed in sheltered, calm water containing vegetation and floating materials to which the female can attach the eggs. The egg clusters are fragile and easily damaged by turbulent action caused by wind and currents. Poor weed control and the accumulation of scum layer will make insect problems worse.

Puddles of water outside the lagoon will also harbour insects. Berm maintenance and the filling of potholes and puddles will reduce the opportunity for insect reproduction.

2.11 FLOATING MATERIAL REMOVAL

The Déline Lagoon is fenced to prevent any windblown garbage from entering the facility. Debris observed on the surface of the cell is to be removed at the first opportunity.

2.12 WINDBLOWN DEBRIS, FENCING, AND SIGNS

As previously mentioned, the Déline Lagoon is entirely fenced to prevent any windblown garbage from entering the facility. The fencing should be examined for problems with posts or accumulation of wind-blown material. Posts which have been affected by settlement, frost heave or unstable soils should be reinstalled. Wind-blown material should be removed as quickly as possible to reduce the lateral load on the fence and maintain the appearance of the site.

As per the Water Licence requirement B.5, warning signs are to be installed on the fence at regular intervals, usually 30 to 40 m apart. Lost or damaged signs should be replaced.

2.13 SLUDGE MANAGEMENT

General sludge management activities are required very infrequently. Anywhere from 10 to 15 years may pass between sludge clean-out activities for a short detention lagoon cell such as the Déline Lagoon.

Sludge volumes are to be measured and recorded every 2-5 years to determine when actual sludge removal should occur. Refer to the following sections regarding sludge removal frequency and procedures.

2.13.1 Sludge Survey

A sludge survey involves two steps: locating the top of the sludge layer and measuring its thickness at several locations in a lagoon. Refer to **Section 3.2** of this document for an example procedure.

The sludge survey should be conducted from a boat on the lagoon. Special care should be taken when going onto the lagoon in a boat. For safety reasons, at least three people should be present: two in the boat and one on the lagoon bank. The extra person(s) on shore may be needed as a rescuer(s), should anything go awry. The extra person on the boat assists with getting in and out of the boat and anchoring the boat at the measurement locations. Also, it is more efficient if one person in the boat uses the measuring instruments and the other records the data. Flat-bottom or johnboats are preferred over canoes or V-bottom boats, as they are more stable. All persons working within the inner slopes of the lagoon, and especially those in the boat, should wear appropriate flotation devices.

The sludge layer is generally a "mobile" fluid, but it may form peaks and valleys within the lagoon. Small lagoons, such as the Déline Lagoon, seem to have more variation in sludge layer thickness. For this reason, at least 8 depth measurements should be taken for the primary cell and 12 for the secondary cell of the lagoon. The locations for measurements should be determined by a uniform grid, if possible. Avoid measuring over the slope of the lagoon embankments. All measurements from the various locations on the grid should be averaged to produce an average sludge layer thickness use to calculate the volume of sludge.

2.13.2 Sludge Removal & Frequency

When a sludge survey determines that excessive sludge has accumulated in any one of the cells, sludge removal should be completed. In the case where more than 1/3 of the designed water storage depth is accumulated sludge, the sludge should be planned to be removed.

After draining or pumping of the last amount of free water, the solids can be removed using an excavator, do not try to remove the bottom 250mm of sludge. Refer to the facility drawings to determine lagoon elevations.

Care must be taken to prevent damage to the berm surfaces during this method of cleaning. It is important to have a skilled operator doing this work to reduce surface damage.

2.13.3 Sludge Disposal

Removed sewage sludge will be allowed to accumulate, treat naturally, and dewater in a future specified location. This location and its characteristics will be chosen with approvals from the SLWB. During the winter, freezing will encourage consolidation of the sludge and, upon thawing, further dewatering. When required, the accumulated dry sludge may be added to the berms of the lagoon to add to the soil biomass. Any liquid accumulating with the removed sewage sludge will be pumped back into the sewage lagoon.

2.13.4 Health & Safety Considerations

Prior to undertaking any sludge survey, removal or disposal, operators should be well aware of safety and health considerations. All operations conducted at the lagoon facility shall adhere to the applicable Workers Safety and Compensation Commission policies and legislations².

A minimum of two people shall be on site when working in and around wastewater filled lagoon cells. Safety belts and lanyards shall be used when a worker is required to work on the sloped surfaces of the lagoon cells. Proper flotation devices shall be on site to prevent drowning in the event that someone falls in.

Raw untreated sludge may contain pathogens harmful to human health. When working with raw untreated sludge, proper clothing shall be worn to eliminate skin contact such as gloves and appropriate boots. Immediately upon completion of work, the hands and face of those working with the sludge should be washed with soapy warm water to prevent any contamination.

2.14 OPTIMIZATION OF EFFLUENT QUALITY

Grey water arriving by vacuum truck is sucked up through a high velocity hose, injected into a tank, hauled at least 5 km and sprayed into the lagoon. Some tissue survives this treatment but is broken down by the aerobic action in the primary lagoon cell. Further, the wetland and discharge route further consumes any remaining organics, producing an effluent that meets the Water Licence requirements.

2.15 QUALITY ASSURANCE/QUALITY CONTROL PLAN

The SNP sampling is completed in accordance with Indian and Northern Affairs Canada's (now Aboriginal Affairs and Northern Development Canada) QA and QC Guidelines for Use by Class A Licensees in Meeting Surveillance Network Program Requirements and for Submission of a QA/QC Plan, 1996; see **Appendix C** for a copy of this guideline.

² <http://www.wcb.nt.ca/YourWSCC/Resources/Pages/Legislation.aspx>

The purpose of taking samples is threefold: one, to test how well the lagoon is working; two, to see if the effluent meets the regulatory requirements, three, to adhere to the requirements stated in the governing Water License.

There are six important parts to the process of sampling:

1. taking the sample at the time called for;
2. using the correct sample container;
3. taking the sample from the correct location;
4. careful and correct labelling of the sample container;
5. using proper sampling procedures; and
6. shipping the sample in proper containers so it arrives on time at the laboratory for testing.

Sample analysis will be conducted by Taiga Environmental Laboratory, accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL) as a testing laboratory for specific test registered with CAEAL. Routine methods of sampling and analysis are based on recognized procedures such as Standard Methods for the Examination of Water and Wastewater APHA, AWWA, WEF, Environmental Canada, USEPA.

The sampling instructions outlined in **Section 3.4** should be used for sampling the lagoon effluents. As per the Water Licence requirement D.2, effluent from the lagoon shall meet the following effluent quality requirements at SP-2 (location shown in the attached drawings found in **Appendix A**).

Table 2.2: Effluent Quality Requirements

| Parameter | Maximum Average Concentration |
|------------------------|-------------------------------|
| Faecal Coliform (FC) | 10,000 FC per 100 ml |
| BOD ₅ | 80 mg/L |
| Total Suspended Solids | 100 mg/L |

2.16 RECORD KEEPING

Records of all inspections, preventive maintenance, repairs, and operational procedures should be meticulously kept. The records should be kept for the lifetime of the facility.

A *Site Inspection Template* is provided for record keeping in **Appendix D**. Copies of these reports should be kept in an organized and convenient location.

3.0 Operational Instructions

3.1 FLOATING MATERIAL REMOVAL

In the event that debris or vegetation is observed on the surface of any cell, it is to be removed at the first opportunity using a skimming device. Algae growth on the surface of the lagoon does not need to be removed.

3.2 SLUDGE SURVEY

The basic sludge survey approach is to measure the depth from the liquid surface to the top of the sludge layer, and then measure the depth from the liquid surface to the lagoon bottom (soil contact); calculate the difference to obtain the thickness of the sludge layer.

A disk-on-rope can be used for detecting the top of the sludge layer using a disk or plate that sinks through the liquid and settles on the sludge. When used carefully, this method generally agrees within 1 inch with infrared detectors. A PVC disk 1/4-inch thick and about 8 to 12 inches in diameter or of square shape (specific gravity = 1.4) has shown results consistent with the infrared detectors. The size (area) of the disk should make little difference because the pressure exerted on the sludge is constant per unit area. Disks of Lexan (specific gravity = 1.2) give similar results. Materials that are heavier than PVC could exert more pressure and penetrate the sludge.

The wire, rope, or string by which the infrared detectors or disks are lowered into the lagoon should be marked using metric measurements of 10cm. This line should not be elastic because stretching will cause variations in readings. The disk should be lowered slowly to keep it from swaying off vertical line. Holes should be drilled in the disk to allow liquid to pass through and reduce swaying. The rope or string can be attached to the disk at the center or at 2 to 4 symmetrically placed locations to keep the disk more stable. The depth to the sludge layer should be measured with the disk before using a pole to measure depth to the lagoon bottom because the pole may disturb the sludge layer.

1. Gather the necessary people and equipment: boat, life jackets, paddles, map or sketch of lagoon, clipboard and pencils, sludge detection device such as a disk-on-rope with interval markings to determine the top of the sludge layer, and a solid rod or pole with interval markings to determine the depth to the lagoon bottom. A small johnboat is recommended. There should be two people in the boat and one on the bank.
2. Measure sludge at a minimum of 8 points per cell. Set up a uniform grid on a lagoon sketch to show the location of each point.
3. Measure the depth from the surface of the liquid to the top of the sludge. Record this depth. Insert a pole vertically at the same location until the lagoon bottom (soil contact)

is felt. Record this depth. The sludge thickness is the difference between the two readings.

4. Proceed to all other sample points, and record measurements similarly.
5. To determine the average sludge layer thickness in the lagoon, add all sludge layer thickness determinations and divide by the number of readings taken. This average, along with the difference from the top of berm to the water level in each cell should be recorded.

3.3 CELL DRAINAGE

In the event that maintenance such as sludge removal is required for one of the cells, the cell must be fully drained. If this is required, notification will be sent to the SLWB and authorization for a full decant will be requested.

3.4 WATER/WASTEWATER SAMPLING

The following SNP Station Numbers shall be sampled monthly during periods of flow and analyzed for the following parameters. Locations of the SNP Stations are shown in the drawings attached in **Appendix A**.

Table 3.1: SP-1 Characteristics

| | | |
|--|--|--|
| SNP ID: To Be Set | Description: <i>At the lagoon site where effluent from the lagoon discharges to the swampland.</i> | |
| UTM Coordinates: <i>TO BE DETERMINED</i> | Rationale: <i>To document water quality prior to discharge into the wetland sewage treatment system</i> | |
| <ul style="list-style-type: none"> • Suspended Solids | <ul style="list-style-type: none"> • BOD₅ | <ul style="list-style-type: none"> • Faecal Coliform (FC) |

Table 3.2: SP-2 Characteristics

| | | |
|--|--|--|
| SNP ID: To Be Set | Description: <i>Swampland effluent approximately 2000 meters downstream of the wastewater discharge route.</i> | |
| UTM Coordinates: <i>TO BE DETERMINED</i> | Rationale: <i>Site compliance to monitor final effluent quality before dispersing and eventually discharging into Great Bear Lake</i> | |
| <ul style="list-style-type: none"> • Suspended Solids | <ul style="list-style-type: none"> • BOD₅ | <ul style="list-style-type: none"> • Faecal Coliform (FC) |

1. Information on sampling of effluents and receiving waters is in the Indian and Northern Affairs Canada's QA and QC Guidelines for Use by Class A Licensees in Meeting Surveillance Network Program Requirements and for Submission of a QA/QC Plan, 1996; a copy of this guideline is attached in **Appendix C** for reference.
2. Follow all quality control and quality assurance procedures required by the laboratory conducting the analysis.

4.0 O & M Checklist

4.1 DAILY

1. Walk around inspection.
2. Check for colour during open water season. If the water is a very dark black, contact the Hamlet Foreman (see **Section 2.5**).
3. Check berms, drainage ditches for damage caused by animals, vegetation, or any type of erosion. If damage is observed, repair the problem immediately to eliminate further damage and expenses.
4. Verify a 1-meter freeboard is maintained at all times at all berms. Contact the Hamlet Foreman if considerable different elevations exist as this may be an indication that settlement is occurring or discharge structures are not operating correctly.

4.2 WEEKLY

1. Inspect major components – outlet and truck discharge structures and berms. If erosion, settlement, or blockage is observed, repair problems immediately to eliminate further damage and expenses.

4.3 MONTHLY

1. Inspect fencing, gates, locks, and signs; repair as required.
2. Visual inspection of sludge lagoon area to ensure run-off or seepage is not occurring.
3. Sample effluent and record pH/colour as required by Water Licence (see **Section 3.4**).
4. Remove excess floating debris and any vegetation. (see **Section 3.1**)

4.4 AS REQUIRED

1. Determine sludge levels in lagoon cells (see **Section 3.2**) and remove as required.
2. Clear drainage ditches and culverts of excess snow/ice and repair any damages from erosion.

Appendix A Drawings

DRAFT

Stantec

**LAGOON OPERATION & MAINTENANCE MANUAL
CHARTER COMMUNITY OF DÉLINE, NT**

Appendix B: Current Water Licence

April 10, 2013

Appendix B Current Water Licence

DRAFT



SAHTU Land and Water Board Water Licence

Pursuant to the *Mackenzie Valley Resource Management Act*, the *Northwest Territories Waters Act* and Regulations, and the SAHTU Land and Water Board, hereinafter referred to as the Board, hereby grants to

The Charter Community of Deline

(Licencee)

of

**P.O. Box 180
Deline, Northwest Territories
X0E 0G0**

(Mailing Address)

hereinafter called the Licencee, the right to alter, divert or otherwise use water subject to the restrictions and conditions contained in the *Mackenzie Valley Resource Management Act*, the *Northwest Territories Waters Act* and Regulations made thereunder and subject to and in accordance with the conditions specified in this licence.

| | |
|---------------------------|---|
| Licence Number | <u>S12L3-006</u> |
| Licence Type | <u>"B"</u> |
| Location | <u>65° 11' N Latitude, 123° 26' W Longitude Deline, Northwest Territories</u> |
| Purpose | <u>To Use Water For Municipal Purposes And To Dispose Of Municipal Wastes</u> |
| Effective Date of Licence | <u>December 5, 2012</u> |
| Expiry Date of Licence | <u>December 4, 2017</u> |

This Licence issued and recorded at Fort Good Hope includes and is subject to the annexed conditions.

SAHTU Land and Water Board



Witness



Chairman

**This Licence and conditions shall be kept on site.
If you have any questions please call the SAHTU Land & Water Board at
(867) 598-2413**

SAHTU LAND AND WATER BOARD

LICENSEE: Charter Community of Deline
LICENCE NUMBER: S12L3-006
EFFECTIVE DATE OF LICENCE ISSUANCE: December 5, 2012

TERMS AND CONDITIONS

PART A: SCOPE AND DEFINITIONS

1. Scope

- a) This Licence allows for the use water and disposal of waste for municipal purposes at the hamlet of Deline, Northwest Territories.
Latitude – 65° 11', North, Longitude – 123° 26', West
- b) This Licence is issued subject to the conditions contained herein with respect to the taking of water and the depositing of waste of any type in any waters or in any place under any conditions where such waste or any other waste that results from the deposits of such waste may enter any waters. Whenever new Regulations are made or existing regulations are amended by the Governor in Council under the *Northwest Territories Waters Act*, or other statutes imposing more stringent conditions relating to the quantity or type of waste that may be so deposited or under which any such waste may be so deposited, this Licence shall be deemed, upon promulgation of such regulations, to be automatically amended to conform with such regulations.
- c) Compliance with the terms and conditions of this Licence does not absolve the Licensee from responsibility for compliance with the requirements of all applicable federal, territorial and municipal legislation.

2. Definitions

In this Licence: S12L3-006

“Act” means the *Mackenzie Valley Resource Management Act* and/or *Northwest Territories Waters Act*.

“Analyst” means an Analyst designated by the Minister under Section 35(1) of the *Northwest Territories Waters Act*.

“Closure and Reclamation” means returning a developed site to a self-sustaining natural state as much as feasible.

“Spill Contingency Planning” means a plan to establish a state of readiness which will enable prompt and effective response to possible spill or system failure.

“Freeboard” means the vertical distance between water line and crest on a dam or dyke’s upstream slope.

“Inspector” means an Inspector designated by the Minister under Section 35(1) of the *Northwest Territories Waters Act*.

“Licensee” means the holder of this Licence.

“Minister” means the Minister of Aboriginal Affairs and Northern Development Canada.

“Modification” means an alteration to a physical work that introduces a new structure or eliminates an existing structure and does not alter the purpose or function of the work, but does not include an expansion.

“Pumpout Sewage” means all toilet wastes an/or greywater collected by means of a vacuum truck for disposal at an approved facility.

“Regulations” means regulations proclaimed pursuant to Section 33 of the *Northwest Territories Waters Act*.

“Sewage” means all toilet wastes and greywater.

“Surveillance Network Program” means a set of sampling requirements with attached criteria that need to be assessed and complied with as part of the Licence.

“Waste” means waste as defined by Section 2 of the *Northwest Territories Waters Act*.

“Waters” means any inland water, whether in a liquid or frozen state, on or below the surface of the land in the Northwest Territories.

PART B: GENERAL CONDITIONS

1. The Licensee shall file an Annual Report with the Sahtu Land and Water Board not later than March 31st of the year following the calendar year reported which shall contain the following information:
 - a) the monthly and annual quantities in cubic metres of fresh water obtained from all sources;
 - b) the monthly and annual quantities in cubic metres of all sewage discharged to the sewage lagoons;
 - c) a summary of the monthly and annual quantities of hazardous waste stored on site and transported off site;

- d) a summary of modifications and/or major maintenance work carried out on the Water Supply and Waste Disposal Facilities, including all associated structures;
 - e) tabular summaries of all data generated under the "Surveillance Network Program" and a copy of original lab results in an appendix;
 - f) a list of spills and unauthorized discharges;
 - g) a summary of any closure and reclamation work completed during the year and an outline of any work anticipated for the next year;
 - h) a summary of any studies requested by the Sahtu Land and Water Board that relate to waste disposal, water use or reclamation, and a brief description of any future studies planned;
 - i) any revisions to the approved Spill Contingency Plan;
 - j) any revisions to approved Closure and Reclamation Plans;
 - k) the monthly and annual quantities of sludge removed from the sewage lagoons;
 - l) updates or revisions to the approved Operation and Maintenance Plans;
 - m) an outline of any spill training and communications exercises carried out; and
 - n) any other details on water use or waste disposal requested by the Sahtu Land and Water Board by November 1st of the year being reported.
2. The Licensee shall comply with the "Surveillance Network Program" annexed to this Licence, and any amendment to the said "Surveillance Network Program" as may be made from time to time, pursuant to the conditions of this Licence.
 3. The "Surveillance Network Program" and compliance dates specified in the Licence may be modified at the discretion of the Sahtu Land and Water Board.
 4. Meters, devices or other such methods used for measuring the volumes of water used shall be installed, operated and maintained by the Licensee to the satisfaction of an Inspector.
 5. The Licensee shall, within 60 days of issuance of this Licence, post the necessary signs, where possible, to identify the stations of the "Surveillance Network Program", and post signs in the appropriate areas to inform the public of Water Supply and Waste Disposal Facilities. All postings shall be located and maintained to the satisfaction of an Inspector.
 6. The Licensee shall immediately report to the 24 Hour Spill Report Line (867-920-8130) any spills of waste, which are reported to or observed by the Licensee,

within the municipal boundaries or in the areas of the water supply or Waste Disposal Facilities.

7. The Licensee shall ensure a copy of this Licence is maintained at the municipal office at all times.
8. The Licensee shall submit to the Sahtu Land and Water Board for approval a map or drawing indicating the locations of all "Surveillance Network Program" sampling stations, with associated GPS coordinates.

PART C: CONDITIONS APPLYING TO WATER USE

1. The Licensee shall obtain all water for municipal purposes from Great Bear Lake by using the intake structures and associated piping as described in Water Licence Application dated October 3, 2012, or as otherwise approved by the Sahtu Land and Water Board.
2. The Licensee may obtain water from an alternate water supply for use on an emergency basis upon approval from the Sahtu Land and Water Board, when it is not possible to obtain water from the source stated in Part C, Item 1.
3. The annual quantity of water used for all purposes shall not exceed 30,000 cubic metres.
4. The water intake hose used on the water pumps shall be equipped with a screen of a mesh size of 2.54 mm, sufficient to ensure no entrainment of fish, as per Fisheries and Oceans Canada requirements.

PART D: CONDITIONS APPLYING TO WASTE DISPOSAL

1. The Licensee shall direct all pumpout Sewage to the Sewage Disposal Facilities or as otherwise approved by the Sahtu Land and Water Board.
2. All sewage effluent discharged from the Sewage Disposal Facilities at "Surveillance Network Program" Station Number 0555-2 shall meet the following effluent quality standards:

| PARAMETER | MAX. CONCENTRATION |
|------------------------------|-----------------------------|
| Fecal Coliforms | <10 ⁴ CFU/100 ml |
| BOD ₅ | 80 mg/L |
| Total Suspended Solids (TSS) | 100 mg/L |

3. No other sewage effluent can be discharged, unless approved by the Sahtu Land and Water Board.
4. Discharge of sludge from the sewage lagoons requires prior approval from the Sahtu Land and Water Board.

5. A minimum of 1.0 metre freeboard shall be maintained at both of the cells of the sewage lagoons.
6. The Licensee shall advise an Inspector and the Sahtu Land and Water Board at least ten days prior to initiating the decant of the sewage lagoon.
7. In the event that the lagoon requires decanting at any time during the term of this Licence, the liquid effluent from the lagoon shall be decanted to the area described in the Water Licence Application dated October 3, 2012.
8. Decanting may be carried out as required with approval by the Sahtu Land and Water Board
9. The sewage lagoon shall be maintained and operated in such a manner as to prevent structural failure.
10. The Licensee shall maintain the Sewage Disposal Facilities to the satisfaction of an Inspector.
11. The Licensee shall dispose of all solid wastes at the Solid Waste Disposal Facilities or as otherwise approved by the Sahtu Land and Water Board.
12. The Licensee shall maintain the Solid Waste Disposal Facilities to the satisfaction of an Inspector.
13. The Licensee shall burn only clean combustible garbage.
14. Contaminated soils and snow shall be treated as hazardous waste and disposed of in accordance with the Guideline for General Management of Hazardous Waste in the NWT.
15. The Licensee shall develop a hazardous waste management plan as a component of the Operation and Maintenance Plan for the Solid Waste Disposal Facility following the Guide to Developing a Community Based Hazardous Waste Management Plan to be approved by the Sahtu Land and Water Board.

PART E: CONDITIONS APPLYING TO MODIFICATIONS

1. The Licensee may, without written approval from the Sahtu Land and Water Board, carry out modifications to the water supply and Waste Disposal Facilities provided that such modifications are consistent with the terms of this Licence and the following requirements are met:
 - a) the Licensee has notified the Sahtu Land and Water Board in writing of such proposed modifications at least 90 days prior to beginning the modifications;
 - b) such modifications do not place the Licensee in contravention of either the Licence or the *Act*;

- c) the Sahtu Land and Water Board has not, during the 90 days following notification of the proposed modifications, informed the Licensee that review of the proposal will require more than 90 days; and
 - d) the Sahtu Land and Water Board has not rejected the proposed modifications.
- 2. Modifications for which all of the conditions referred to in Part E, Item 1 have not been met may be carried out only with written approval from the Sahtu Land and Water Board.
- 3. The Licensee shall provide to the Sahtu Land and Water Board as-built plans and drawings of the modifications referred to in Part E, Item 1 within 90 days of completion of the modifications.

PART F: CONDITIONS APPLYING TO CONTINGENCY PLANNING

- 1. The Licensee shall review the Spill Contingency Plan annually and modify the Plan as necessary to reflect changes in operation and technology. Any proposed modifications shall be submitted to the Sahtu Land and Water Board for approval.
- 2. If, during the period of this Licence, an unauthorized discharge of waste occurs, or if such a discharge is foreseeable, the Licensee shall:
 - a) employ the appropriate Spill Contingency Plan;
 - b) report the incident immediately via the 24 Hour NT-NU Spill Report Line. Currently the number is (867) 920-8130 or email spills@gov.nt.ca; and
 - c) submit to an Inspector and the Sahtu Land and Water Board, a detailed report on each occurrence not later than 30 days after initially reporting the event.

PART G: CONDITIONS APPLYING TO CLOSURE AND RECLAMATION

- 1. The Licensee shall submit to the Sahtu Land and Waters Board for approval a Closure and Reclamation Plan at least six months prior to closure of any water and/or waste disposal facilities. The Plan shall include, but not be limited to:
 - a) contaminated site remediation;
 - b) leachate prevention;
 - c) an implementation schedule;
 - d) maps delineating all disturbed areas, borrow material locations, and site facilities;

- e) consideration of altered drainage patterns;
 - f) type and source of cover materials;
 - g) future area use; and
 - h) hazardous wastes.
 - i) the potential for groundwater contamination;
 - j) any facility that is part of the Charter Community of Deline's Water Licence.
2. The Licensee shall implement the Plan specified in Part G, Item 1 as and when approved by the Sahtu Land and Water Board.
 3. Notwithstanding the time schedule referred to in the Closure and Reclamation Plan, the Licensee shall endeavour to carry out progressive restoration of areas which are abandoned prior to closure of operations.
 4. The Licensee shall complete the restoration work within the time schedule specified in the Plan, or as subsequently revised and approved by the Sahtu Land and Water Board.
 5. Upon implementation of the Closure and Reclamation Plan, the Licensee shall provide to the Sahtu Land and Water Board updates of all closure and reclamation activities by March 31st of each year.
 6. Compliance with the Closure and Reclamation Plan specified in this Licence does not limit the legal liability of the Licensee, other than liability arising from provisions of the *Act* and its regulations.

PART H: CONDITIONS APPLYING TO CONSTRUCTION

1. Prior to any new construction related to the Water Supply Facilities or Waste Disposal Facilities, other than as contemplated in an approved Spill Contingency Plan, the Licensee shall submit to the Sahtu Land and Water Board a rationale and design drawings.
2. Prior to construction of any dams, dykes, or structures intended to contain, withhold, divert or retain water or wastes other than as contemplated in the Spill Contingency Plan, the Licensee shall submit to the Sahtu Land and Water Board a rationale and design drawings.
3. As-built drawings of any new construction shall be stamped by a qualified engineer registered in the Northwest Territories and submitted to the Sahtu Land and Water Board within 90 days of construction completion.
4. Any fill materials used in the construction of any structures must be clean and free of contaminants.


PART I: CONDITIONS APPLYING TO OPERATION AND MAINTENANCE

1. At the request of the Sahtu Land and Water Board, or no later than 30 days after the commissioning of any new facility, the Licensee shall submit to the Sahtu Land and Water Board for approval a revised Operation and Maintenance Plan for the Sewage and Solid Waste Facility, and Water Intake Facility. The plan shall include, but not be limited to the following:
 - a) controlling effluent discharge quality;
 - b) runoff and drainage control within and around the facility, and restoration of erosion;
 - c) treatment of contaminated drainage;
 - d) prevention of windblown debris;
 - e) managing hazardous waste;
 - f) segregation of domestic, metal and recyclable waste materials;
 - g) method and frequency of site maintenance, including burning where permitted; and,
 - h) training methods and reporting requirements.
2. The Licensee shall implement the plan specified in Part I, Item 1 as and when approved by the Sahtu Land and Water Board.

SAHTU LAND AND WATER BOARD



Witness



Chairman

SAHTU LAND AND WATER BOARD

LICENSEE: Charter Community of Deline
LICENCE NUMBER: S12L3-006
EFFECTIVE DATE OF LICENCE ISSUANCE: December 5, 2012

SURVEILLANCE NETWORK PROGRAM

A. Location of Surveillance Stations

| <u>Station Number</u> | <u>Status</u> | <u>Description</u> |
|-----------------------|---------------|--|
| 0555-1 | Active | Raw water supply from Great Bear Lake at the pumphouse. |
| 0555-2 | Active | Effluent at point of discharge from the secondary sewage lagoon. |
| 0555-3 | Active | Effluent at point of entry of seepage from the sewage lagoon at Airplane Lake. |
| 0555-4 | Active | Runoff from the solid waste disposal site. |

B. Sampling and Analysis Requirements

1. Effluent at Station Number 0555-2 shall be sampled at the beginning, and every three days thereafter during periods of decant, and shall not exceed criteria as per Part D (2) of the License:

Fecal Coliforms
Total Suspended Solids
BOD₅

All analyses shall be performed in a laboratory approved by the Analyst

2. Water at Station Number 0555-3 shall be sampled at the request of an Inspector.

3. Station No. 0555-4 shall be sampled monthly during periods of flow and analyzed for the following parameters:

| | |
|----------------------|-----------------|
| pH | Sodium |
| Suspended Solids | Total Phosphate |
| Magnesium | Sulphate |
| Potassium | Total Arsenic |
| Fecal Coliform | Total Lead |
| BOD ₅ | Total Nickel |
| Total Organic Carbon | Total Chromium |
| Nitrate and Nitrogen | Total Cadmium |
| Ammonia Nitrogen | Total Iron |
| Oil and Grease | Total Mercury |
| Total Phenols | Total Zinc |
| Conductivity | Total Copper |
| Calcium | |

4. More frequent sampling or additional sampling locations may be required at the request of an Inspector.
5. All sampling, sample preservation and analyses shall be conducted in accordance with methods prescribed in the current edition of "Standard Methods for the Examination of Water and Wastewater", or by such other methods approved by an Analyst.
6. All analyses shall be performed in a laboratory accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL) for the specific analyses to be performed or as approved by an Analyst.

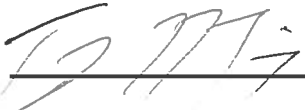
C. Flow and Volume Measurement Requirements

1. The monthly and annual quantities of raw water pumped from Surveillance Network Program Station Number 0555-1 shall be measured and recorded in cubic metres.
2. The monthly and annual quantities of wastes discharged to the primary sewage lagoon shall be recorded.
3. The monthly and annual quantities of effluent decanted from the primary sewage lagoon to the secondary sewage lagoon shall be recorded.
4. The monthly and annual quantities of effluent discharged from the secondary sewage lagoon shall be recorded.
5. The monthly and annual quantities of sewage solids removed from the sewage disposal facility shall be measured and recorded.

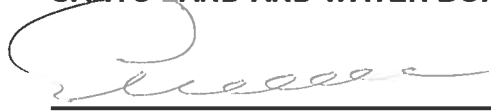
D. Reports

1. The Licensee shall, unless otherwise requested by an Inspector, include all of the data and information required by the "Surveillance Network Program" in the Licensee's Annual Report, which shall be submitted to the Sahtu Land and Water Board on or before March 31st of the year following the calendar year being reported.

SAHTU LAND AND WATER BOARD



Witness



Chairman



**SAHTU Land & Water Board
REASONS FOR DECISION
Issued Pursuant to Section 121 of
The Mackenzie Valley Resource Management Act
and Section 26 of
The Northwest Territories Waters Act**

Water Licence Number: S12L3-006 (Type "B")

This is the decision of the SAHTU Land & Water Board with respect to an application for a Water Licence dated October 3, 2012, made by:

**The Charter Community of Deline
P.O. Box 180
Deline, Northwest Territories
X0E 0G0**

for: The use of water for municipal purposes and the disposal of municipal wastes located within the municipal boundaries of the Charter Community of Deline, Northwest Territories.

With respect to this application, notice was given in accordance with Sections 63 & 64 of the *Mackenzie Valley Resource Management Act* and Section 23 of the *Northwest Territories Waters Act*. There was no Public Hearing held in association with this application.

DECISION

After having been satisfied that the project had been screened pursuant to the *Mackenzie Valley Resource Management Act*, and that any potential adverse environmental effects were insignificant or mitigable with known technology, and as such the application could proceed through the regulatory process and after reviewing the submission of the Applicant and after reviewing the written comments received by the Board; the Board, having due regard to the facts and circumstances, the merits of the submissions made to it, and to the purpose, scope and intent of the *Mackenzie Valley Resource Management Act* and the *Northwest Territories Waters Act* and Regulations made thereunder has determined that:


Water Licence S12L3-006 be issued subject to the terms and conditions contained therein.

The Board's reasons for this decision are as follows:

1. This Licence is in the public interest and essential to the socio-economic well being of the community.
2. Conducting the undertaking in compliance with the terms and conditions imposed by the Licence will minimize any disturbance to the natural conditions of surrounding water bodies.
3. The use of water proposed by the Licensee is of a nature contemplated by the *Mackenzie Valley Resource Management Act*, and the *Northwest Territories Waters Act*.
4. The five year term of the Licence is in recognition of the future work on new municipal facilities in the Charter Community of Deline.

Water Licence S12L3-006 contains provisions that the Board feels necessary to ensure and monitor compliance with the *Mackenzie Valley Resource Management Act* and the *Northwest Territories Waters Act* and the Regulations made thereunder and to provide appropriate safeguards in respect of the Applicant's use of the waters affected by the Licence. The Board will provide any referenced material or documents and/or reasons for decision for any specific clause or clauses contained within the application if requested to do so in writing.

SIGNED this day of 5th day of December, 2012 on behalf of the SAHTU Land & Water Board.


Larry Wallace (Chairman)
SAHTU Land & Water Board

Appendix C INAC Sampling Guide

DRAFT

QUALITY ASSURANCE (QA) AND QUALITY CONTROL (QC)

GUIDELINES

**FOR USE BY CLASS "A" LICENSEES
IN MEETING SNP REQUIREMENTS**

AND FOR SUBMISSION OF A QA/QC PLAN

JULY 1996

**DEPARTMENT OF INDIAN AND NORTHERN AFFAIRS CANADA
WATER RESOURCES DIVISION
AND THE
NORTHWEST TERRITORIES WATER BOARD**

Table of Contents

| | | |
|------------|--|----|
| 1.0 | Introduction and Definitions | 1 |
| 2.0 | Field Sampling..... | 1 |
| 2.1 | Sample Collection..... | 1 |
| 2.1.1 | Location | 1 |
| 2.1.2 | Sampling Equipment | 2 |
| 2.1.3 | Sampling Methods | 3 |
| 2.2 | Sample Handling..... | 4 |
| 2.2.1 | Preservation | 4 |
| 2.2.2 | Sample Identification..... | 5 |
| 2.2.3 | Transportation..... | 5 |
| 3.0 | Lab Analysis | 6 |
| 3.1 | Outside Laboratories | 6 |
| 3.1.1 | Lab Accreditation | 6 |
| 3.1.2 | Detection Limits..... | 6 |
| 3.1.3 | Methodology | 6 |
| 3.2 | In-House Laboratories..... | 6 |
| 3.2.1 | Identification of Analytical Laboratory/Detection Limits | 7 |
| 3.2.2 | For Overall Analytical Methods, Precision and Accuracy | 7 |
| 3.2.3 | Accuracy Requirements | 7 |
| 3.2.4 | Precision Requirements | 8 |
| 3.2.5 | Methodology | 8 |
| 4.0 | Reporting Requirements | 9 |
| 4.1 | General Submissions | 9 |
| 4.2 | Outside Laboratories..... | 9 |
| 4.3 | In-House Laboratories | 9 |
| Appendixes | | |
| | Appendix 1 | 11 |
| | Table 1 - Summary of Preservation Requirements | |
| | Appendix 2 | 12 |
| | References | |

1.0 Introduction and Definitions

In order to assist Licensees in completing their Quality Assurance and Quality Control (QA/QC) Plan, the following guidelines are provided, which indicates the minimum information that should be included.

These Guidelines are divided into three sections:

- 1) Field Sampling
- 2) Lab Analysis
- 3) Reporting Requirements

It is recognized that there may be different interpretations as to what is covered by "Quality Assurance/Control" due to the fact that certain Licensees have their own laboratories, while others only use commercial laboratories. For licence purposes, "Quality Assurance" and "Quality Control" refer to the following:

Quality Assurance: is the system of activities designed to better ensure that quality control is done effectively; while

Quality Control: is the use of established procedures to achieve standards of measurement for the three principal components of quality: precision, accuracy and reliability.

2.0 Field Sampling

2.1 Sample Collection

2.1.1 Location

A QA/QC plan must identify the locations of all sampling stations and the markers used to identify the stations. If the Surveillance Network Program (SNP) of the Water Licence does not specify sampling locations, locations should be chosen with help from an Inspector.

Buoys and landmarks identify sampling stations in tailings ponds and lakes, while sign post positioning usually marks stream sample stations. Stations should be used repeatedly, with the same personnel and techniques to reduce operational error. The use of Global Positioning System (GPS) to identify Latitude and Longitude for sampling stations is recommended.

2.1.2 Sampling Equipment

The Plan must include a detailed section on the equipment used for sampling, the rationale behind the choices of equipment, and descriptions of how the equipment is maintained and calibrated. Equipment and bottles should be selected so that they do not contaminate or otherwise alter the concentrations of parameters of interest.

Sampling devices, sample bottles and filtration devices should be constructed of non-metallic material. Most samples are now collected in containers constructed of high density polyethylene plastic. However, there are some exceptions, when testing for oil and grease or phenols glass containers are to be used. When conducting a fish bioassay, plastic drums are used while hydrocarbon based containers are not to be used for the collection of organic samples.

This section should also identify whether new or used bottles are used for each sample analysis. New bottles are preferred,

but sample containers may be used repeatedly with proper handling measures.

If old bottles are used, a detailed description should be included, noting how they are maintained, stored and cleaned. Usually, this will closely resemble the product manufacturer's instructions. An example of how bottles should be cleaned is outlined below:

- Rinse well with hot tap water for one minute or more.
- Empty bottle and add 30% HNO₃ to approximately 1/3 container capacity. Shake well for three to four minutes.
- Rinse vigorously with hot tap water for two minutes.
- Rinse thoroughly three times with tap water and three times with distilled water.
- Store with 0.2% HNO₃ for a minimum of one week.
- Rinse again with distilled water at least three times.

Bottles that are to be used for bacteria testing should be acid washed or autoclaved if possible.

Note: Additional information on bottle washing is also available from Water Resources Division.

2.1.3 Sampling Methods

This Section will include details on methods for sample collection and the equipment that is to be used for each station.

In lakes and ponds, regular sample bottles are used the majority of the time, but Van Dorn samples are often utilized. The sample or the sample bottle is usually lowered to mid

depth and washed three times before collecting the sample on the fourth submersion. Approximately 2% of the sample container capacity should remain to provide for mixing, preservative addition and thermal expansion.

Stream water sampling is usually done by plunging a sample bottle toward the current and allowing it to fill. Once again, the bottle should be rinsed three times before filling and room should be left for preservative addition and mixing.

A glass bottle should be used when sampling for oil and grease with the sample being collected during the first submersion and not rinsed three times first.

This section should also describe how often field blanks and replicate samples will be collected. Field blanks are samples of distilled/deionized water that are to be treated in exactly the same manner as the other samples. Blanks should therefore be taken to the field and handled and preserved as part of the sample program. They indicate when a sample may be contaminated and are indicative of general sample integrity. Replicate samples (duplicates and triplicates) are two or three samples collected from the same station at the same time. They help to ensure sample precision at the laboratory.

2.2 Sample Handling

2.2.1 Preservation

After collection, most samples must be preserved in order to prevent chemical or biochemical changes to the sample. The QA/QC plan must describe how samples from each station are to be preserved.

Preservation is generally done by the addition of certain chemicals into the bottle immediately after the sample is collected. **Table 1** is a general guide to preservatives and their appropriate concentrations. The QA/QC plan should contain more detailed information on the concentrations and amount of preservatives that will be used.

2.2.2 Sample Identification

The plan should include a description of the system used to identify samples. The system must provide positive sample identification and ensure that the identification is maintained. It is advisable to keep a logbook of samples that have already been delivered.

The identification can be maintained by marking the bottle itself or a label, with a water resistant, non-smear felt pen. The information should be clear to persons uninvolved in the sampling and may include such details as company name, sample area, SNP number, time and date.

2.2.3 Transportation

The section on transportation will describe how sample integrity will be ensured from the time of collection to completion of delivery. Delivery to the lab should be done as soon as possible after the samples have been collected.

Usually, samples are sealed and stored upright in a box with other samples to provide a snug, immobile storage space during transfer. Any samples that require refrigeration for preservation should be kept cool during transport.

3.0 Lab Analysis

Because certain Class "A" Licensees have their own analytical laboratory and others rely on commercial laboratories, this section of the Guidelines is divided accordingly.

3.1 Outside Laboratories

3.1.1 Lab Accreditation

The Licensee will identify in the plan the name of the commercial laboratory that will be conducting the analyses. A letter must be provided from the commercial lab indicating that they are accredited to conduct analyses on each of the required sampling parameters. Ideally, the lab should be accredited by the Canadian Associated for Environmental Analytical Laboratories (C.A.E.A.L.) and should provide a certificate stating parameters for which they are accredited.

3.1.2 Detection Limits

Detection limits for the commercial lab should be identified for all parameters and should be reported when any SNP data is submitted.

3.1.3 Methodology

Descriptions should be included for any methods of analysis used that are not outlined in "Standard Methods for the Examination of Water and Wastewater".

3.2 In House Laboratories

3.2.1 Identification of Analytical Laboratory/Detection Limits

Licensees using in-house labs shall identify their detection limits for all parameters and report them when any SNP data is submitted. The Licensee shall also identify the commercial lab they use to check for quality control.

3.2.2 For Overall Analytical Methods, Precision and Accuracy

The plan must describe how the Licensee will ensure precision and accuracy in their analytical methods. This includes what action will be taken if any sample results are found to be outside the appropriate ranges.

All analyses should be conducted in accordance with methods prescribed in the current edition of "Standard Methods for the Examination of Water and Wastewater" or by other approved methods. In addition, the lab should analyze standard reference material for each parameter measured. For each parameter (group) to be measured, a complete description of the sampling procedure must be documented and adhered to.

If any sample results are outside the appropriate QA/QC ranges, attempts should be made to correct the problem and the sample shall be immediately re-analyzed. If any analysis indicates a violation of a licence condition, an Inspector shall be notified of the violation, any corrective action taken, and the results of retests.

3.2.3 Accuracy Requirements

The plan should document how the Licensee will go about ensuring accuracy in the laboratory. Accuracy is the measurement of how closely a value approximates a

standard, or true value. The Licensee should identify the frequency at which certified or reference standards will be analyzed during each sampling period.

3.2.4 Precision Requirements

Precision is a measure of the closeness or repeatability of a set of values. This section will describe how and when replicate samples are taken to ensure lab precision. It is recommended that the Licensee take triplicates at one SNP station during each sampling period. If daily sampling is required at only one station, a duplicate sample should be taken each time, with a triplicate sample taken one a week.

3.2.5 Methodology

Descriptions should be included of any methods of analysis that are not taken from "Standard Methods for the Examination of Waste and Wastewater." Standard methods should be referenced.

4.0 Reporting Requirements

4.1 General Submission

The QA/QC plan will contain a section outlining what information will be reported in the monthly SNP reports. Any control charts or graphs which display the precision and accuracy of the methods used to analyze the samples should be submitted with the report. This includes warning and control limits used to determine acceptability of the data.

4.2 Outside Laboratories

The Licensee shall outline the number of replicate samples that will be collected and submitted with each SNP report. It is recommended that one set of duplicates or triplicates from an assigned SNP site, as well as the results from field blanks, be submitted with each required SNP report. This would serve as an internal/external check for the Licensee and the commercial lab.

4.3 In-House Laboratories

The Licensee shall outline the number of results from replicate samples that will be included with each required SNP report. It is recommended that two duplicate sets be collected per month at an assigned SNP site, with one set being sent to a commercial lab while the other is to be analyzed by the Licensee's lab. Analytical results from both labs should be submitted with each required SNP report. This would serve as an external check for the lab. Any results from a commercial lab should be presented on the lab's letterhead.

**FOR FURTHER INFORMATION, CONTACT THE WATER
RESOURCES DIVISION AT:**

**Box 1500
Yellowknife, NWT
X1A 2R3
(867) 669-2654 Phone
(867) 669-2716 Fax**

Appendix 1**Table 1: General Summary of Special Sampling or Handling Techniques**

| Determination | Container | Minimum Sample Size (ml) | Preservation | Maximum Storage Recommended |
|----------------------|---|---------------------------------|---|------------------------------------|
| BOD | Sterile polyethylene | 1000 | Refrigerate 4°C | 24 hours |
| Conductivity | Polyethylene | 500 | Refrigerate 4°C | 28 days |
| Total Cyanide | Polyethylene | 500 | Add NaOH to raise pH>12 refrigerate in dark | 24 hours |
| Hardness | Polyethylene | 100 | Add Conc. HNO ₃ to lower pH<2 OR (*) unpreserved | 6 months |
| Metals, General | Polyethylene | 250 | For dissolved metals filter immediately, add Conc. HNO ₃ to pH<2 | 6 months |
| Mercury | Glass (rinsed with 1 + 1 HNO ₃) | 500 | Add Conc. HNO ₃ or pH<2 or H ₂ SO ₄ + 1 ml of 5% K ₂ Cr ₂ O ₇ , refrigerate 4°C | 28 days |
| Nitrogen: | | | | |
| Ammonia | Polyethylene | 500 | Analyze as soon as possible or add H ₂ SO ₄ to pH<2, refrigerate OR (*) unpreserved | 7 days |
| Nitrate | Polyethylene | 100 | Analyze as soon as possible or refrigerate | 48 hours |
| Oil and Grease | Glass or wide-mouth calibrated | 1000 | Add H ₂ SO ₄ to pH<2, refrigerate | 28 days |
| pH | Polyethylene | -- | Analyze immediately | 2 hours |
| Suspended Solids | Polyethylene | -- | Refrigerate | 7 days |
| Temperature | Polyethylene | -- | Analyze immediately | 0 |
| Turbidity | Polyethylene | -- | Analyze same day; store in dark up to 24 hours, refrigerate | 24 hours |
| Bacteria | Polyethylene (sterilized) | -- | None: Keep cool | 6 - 48 hours |

(*) Unpreserved = check with lab that will be analyzing the samples

Appendix 2

References:

Gilbert, Andrew (1993). "Echo Bay Mines Ltd. Environmental Laboratory Quality Assurance Plan".

Soniassy, R. (1980). "A Guide for the Collection of Water and Effluent Samples"; pp 1-16;
INAC

"Standard Methods for the Examination of Water and Wastewater" (1989); AHPA, AWWA and WPCF, 17th edition.

Water Resources Division, Indian and Northern Affairs Canada (1990). "Generic Quality Assurance (QA) Plan Guidelines for Use by the Licensees in Meeting SNP Requirements for Submission of a QA Plan"; INAC.

Stantec

**LAGOON OPERATION & MAINTENANCE MANUAL
CHARTER COMMUNITY OF DÉLINE, NT**

Appendix D: Site Inspection Template

April 10, 2013

Appendix D Site Inspection Template

DRAFT



Déline – Sewage Lagoon Area Monitoring & Maintenance Checklist

Created April 2013
Version 1.0

A) Weekly Inspection:

- | | | |
|---|-----------------------------|------------------------------|
| 1. Visual inspection of berms | <input type="checkbox"/> No | <input type="checkbox"/> Yes |
| 2. Visual inspection of accompanying drainage ditches | <input type="checkbox"/> No | <input type="checkbox"/> Yes |
| 3. Visual inspection of truck discharge structures | <input type="checkbox"/> No | <input type="checkbox"/> Yes |
| 4. Visual inspection of outlet structures | <input type="checkbox"/> No | <input type="checkbox"/> Yes |
| 5. Verify lagoon water levels & 1-meter freeboard | <input type="checkbox"/> No | <input type="checkbox"/> Yes |
| 6. Colour of lagoon: _____ | <input type="checkbox"/> No | <input type="checkbox"/> Yes |

Concerns:

Concerns: _____

B) Monthly Inspection:

- | | | |
|--|-----------------------------|------------------------------|
| 1. Visual inspection of fence, gates, locks, and signs | <input type="checkbox"/> No | <input type="checkbox"/> Yes |
| 2. Sample and record effluents during periods of flow | <input type="checkbox"/> No | <input type="checkbox"/> Yes |
| 3. Remove floating debris and vegetation | <input type="checkbox"/> No | <input type="checkbox"/> Yes |

Concerns:

Concerns: _____

C) Annual Inspection:

- | | | |
|---|-----------------------------|------------------------------|
| 1. Complete a sludge survey (as required) | <input type="checkbox"/> No | <input type="checkbox"/> Yes |
| 2. Clear drainage ditches and culverts & repair as necessary | <input type="checkbox"/> No | <input type="checkbox"/> Yes |
| 3. Assess berms and site for erosion / slumping & repair as necessary | <input type="checkbox"/> No | <input type="checkbox"/> Yes |

Concerns:

Concerns: _____

Signature of Inspector: _____
Name of Inspector: _____

Weekly Monthly Annually
Date of Inspection: _____