Sewage Lagoon Operation & Maintenance Manual
Déline Got'ine Government, NT

February 20, 2018

Sign-off Sheet

This document entitled Sewage Lagoon Operation & Maintenance Manual Déline Got'ine Government, NT was prepared by Stantec Consulting Ltd. Originally for the account of the Charter Community of Déline and updated for the Déline Got'ine Government . 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 _____ November 18, 2013
(signature)

Reviewed by _____ November 18, 2013
(signature)

Table of Contents

LIST OF TABLES

LIST OF APPENDICES

Executive Summary

The following Operation and Maintenance Manual for the Wastewater Lagoon Facility was developed by Stantec on behalf of the Charter Community of Déline. The Manual has been updated for the Déline Got'ine Government (DGG).

Wastewater from the community is hauled by truck for discharge into a double-celled anaerobic lagoon system; the volume of the lagoon is 19,944 m^3. The effluent flows from the cells into a low lying area making its way overland through various wetlands until eventually discharging to Great Bear Lake approximately 4.5 km away.

Wetland treatment is a combination of complex physical and biological processes. Sedimentation, absorption of pollutants in the surface soils, nutrient uptake by plants, and the oxidation of compounds by microorganisms are some of the processes, which affect the treatment. There are no chemicals used in the sewage treatment process.

This Plan consists of the operation and maintenance procedures for the Sewage Lagoon Disposal Facility. The Plan is developed to ensure the operation and maintenance of the Déline Sewage Lagoon meets the mandatory requirements as per the Water Licence, S12L3-006, issued by the Sahtu Land and Water Board (SLWB).

An operation and maintenance checklist has been provided in this manual and should be followed. The inspections and maintenance that takes place at the wastewater lagoon facility should be recorded; a site inspection template has been included in **Appendix D** to record such information.

1.0 Introduction

1.1 INFORMATION OF THE LICENSEE

Déline Got'ine Government (Community)
PO Box 156
Déline, NT
X0E 0G0

1.2 LIST OF RESPONSIBLE PERSONNEL

Director of Local Services	(867) 589-5586
Local Services Foreman	(867) 589-5575

1.3 ROLE OF THE PLAN

This Plan consists of the operation and maintenance procedures for the Sewage Lagoon Disposal Facility. The Plan is developed to ensure the operation and maintenance of the Déline Sewage 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 Sewage Lagoon in such a way that adverse impacts to public health and safety, and to the environment are minimized.

Therefore, all aspects of the sewage 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

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

(Lat/Long)	65º 11' North	123º 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 and 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 averages 166 millimetres of rainfall and 153 millimetres of snowfall, resulting in an annual total equivalent precipitation of approximately 291 millimetres represented 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 498 people in 2018.

Domestic solid waste is collected five days a week (Monday through Friday) by the DGG and disposed of at the municipal solid waste disposal facilities.

The 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 a double-celled anaerobic lagoon system; the volume of the lagoon is 19,944 m^3. The effluent flows from the cells 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. Wetland treatment is a combination of complex physical and biological processes. Sedimentation, absorption of pollutants in the surface soils, nutrient uptake by plants, and the oxidation of compounds by microorganisms are some of the processes, which affect the treatment. There are no chemicals used in the sewage treatment process.

1.3 EMERGENCY PLANNING & CONTACT

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

1. The first contact shall be to the Local Services Foreman (867) 589-5575;
2. The incident shall be reported to the 24-Hour Spill Report Hotline at (867) 920-8130; and
3. A report regarding the incident shall be submitted to the Inspector within 30 days of reporting the incident.

2.0 Sewage Lagoon Fundamentals

Continuous discharge lagoons such as the exfiltration sewage 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 observe 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 DGG employees. If issues are observed during a daily inspection, these should be included on the site inspection template as well.

Once a week, all the major components of the sewage 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. Once identified, repairs to lagoon systems cannot wait, as the consequences of failure can be very costly.

The sewage lagoon itself has four main areas to inspect:

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

2.2 FREEBOARD

The sewage 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 outside cell berms are gradually sloped away, at a 3:1 slope, to take any accumulated precipitation to ditches leading perimeter the wetlands surrounding the site. The sewage truck discharge station is constructed of granular materials and drains into the first sewage cells. Precipitation that falls on the discharge area which could be contaminated by any spilled sewage is drained down a steel chute, or down the inside cell berm (which is sloped 3:1), 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 the liquid in 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 then green, there may be something wrong. The Local Services 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; neutral pH and high 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 are 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 (0 to 7) become more intensely acidic, increasing (7 to 14) 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

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

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.

2.7 BERM MAINTENANCE

There are three 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; and
3. to provide a system for flow rate control.

The objective of berm inspection is to make sure that failure does not result from undue leakage. Wastewater leakages through the berms mean that problems are occurring that need to be addressed immediately. The two major concerns, and visual evidence of potential berm issues, are excessive growth of vegetation, which may hide developing problems, and erosion. Erosion of dikes can be caused by wave action, on the inside of the lagoon cells, and surface runoff on the inside or outside of the lagoon cells. 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, (located in the southeast corner of cell 2)
2. at all corners,
3. along inside 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 large lagoons, particularly with surface areas over 5 hectares. The Déline Lagoon is much smaller (<2 hectares), 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 establish, 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 on a regular basis. 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 truck discharge points, 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 the snow periodically. This should occur each time the access road is cleared.

When it occurs, 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 points are a common occurrence. The Déline Lagoon truck discharge points consist of two steel chutes with rip-rap and therefore erosion should not be a major 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 riprap portion and into the wetland with final 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 (between 200mm and 300mm in diameter) 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 inlets are located 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 experience or 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 are good and necessary. Small-size vegetation on the outside slopes of the berms are beneficial, however large weeds and shrubs can cause deep root-related problems and must be removed. Proper maintenance on the outside slopes, including regular cutting and removal, must be addressed on a routine basis.

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 to produce oxygen. A second problem is that when 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. The slopes are constructed at a 3:1 ratio.

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, and taken to the landfill.

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 and at the identified Surveillance Network Program points. All lost or damaged signs must be replaced.

2.13 SLUDGE MANAGEMENT

Sludge is the non-liquid portion of waste that accumulates on the bottom of lagoon cells. General sludge management activities are required very infrequently. Anywhere from 10 to 15 years may pass between sludge clean-out activities for a small detention lagoon cell system, such as the Déline Lagoon.

Sludge volumes are to be measured and recorded every 2 to 5 years to determine when actual sludge removal is required. 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 the sludge 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 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 free water, the solids can be removed using an excavator. To protect the bottom of the lagoon, 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 the potential for 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 exterior 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 legislations[2].

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 pathogens, nutrients, organics, and inorganics in the wastewater 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

[2] http://www.wcb.nt.ca/YourWSCC/Resources/Pages/Legislation.aspx

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.

The purpose of taking samples is threefold: one, to measure, determine, or quantify how well the lagoon is working; two, to determine if the effluent meets the regulatory requirements; and three, to adhere to the requirements stated in the governing Water Licence.

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 tests 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 information outlined in **Section 3.3** 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 0555-5 (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 22mm (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 personnel and equipment, including the following: 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 a minimum of 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 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: *0555-4 (SP-1)*	**Description**: *At the lagoon site where effluent from the lagoon discharges to the swampland.*	
UTM Coordinates: *7233815.9m N 480098.4m E*	**Rational**: *To document water quality prior to discharge into the wetland sewage treatment system*	
• Total Suspended Solids	• BOD_5	• Fecal Coliform (FC)

Table 3.2: SP-2 Characteristics

SNP ID: *0555-5 (SP-2)*	**Description:** *Swampland effluent approximately 1000 meters downstream of the wastewater discharge route.*	
UTM Coordinates: *7233302.6m N 479500.9m E*	**Rationale**: *Site compliance to monitor final effluent quality before dispersing and eventually discharging into Great Bear Lake*	
• Total Suspended Solids	• BOD_5	• Fecal 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. A copy of the laboratory sampling requirements will be included in **Appendix E** of this manual.

4.0 O & M Checklist

4.1 DAILY

1. Walk around the lagoon site, and conduct a visual inspection.

2. Determine the colour of liquid in the lagoon cells 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 3.3**).

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 sludge as required.

2. Clear drainage ditches and culverts of excess snow/ice and repair any damage from erosion.

Appendix A Drawings

Appendix B Current Water Licence

Appendix C INAC Sampling Guide

Appendix D Site Inspection Template

Appendix E Laboratory Sampling Requirements