Land and Water Boards of the Mackenzie Valley

Guidelines for Municipal Sludge Management for Passive Sewage Treatment Systems in the Northwest Territories

December 2022

Table of Contents

Figures

Tables

Appendices

Definitions

TERM	DEFINITION
deposit of waste	As defined in section 1 of the MVRMA: a deposit of waste in any waters in the Mackenzie Valley or in any other place under conditions in which the waste, or any other waste that results from the deposit of that waste, may enter any waters in the Mackenzie Valley.
discharge	A direct or indirect deposit or release of any water or wastewater to water in the receiving environment.
effluent	A wastewater discharge.
freeboard	The vertical distance between the water or wastewater line and the lowest elevation of the effective water or wastewater containment crest on the upstream slope of a containment structure.
greywater	All liquid waste from showers, baths, sinks, kitchens, and domestic washing facilities, but does not include toilet waste.
receiving environment	The natural environment[1] that, directly or indirectly, receives any waste from a project.[2]
sewage	All toilet wastes and greywater.
sewage disposal facilities or sewage treatment facilities	The area(s) and structures designated to contain and treat sewage.
sludge	The residual, semi-solid material that is produced as a by-product during treatment of sewage.
toilet wastes	All human excreta and associated products, not including greywater.
waste	As defined in section 1 of the *Waters Act* and section 51 of the MVRMA.[3]
wastewater	Any water that is generated by undertaking activities or originates on-site, and which contains waste, and may include, but is not limited to, runoff, seepage, sewage, and effluent.
water	As defined in section 1 of the Waters Act: water under the administration and control of the Commissioner, whether in a liquid or frozen state, on or below the surface of land.

[1] "environment" is defined in section 2 of the MVRMA as: the components of the Earth and includes
(a) land, water and air, including all layers of the atmosphere;
(b) all organic and inorganic matter and living organisms; and
(c) the interacting natural systems that include components referred to in paragraphs (a) and (b).

[2] Where a project is located in a previously disturbed area, a licence and/or permit may include a project-specific definition of 'receiving environment.'

[3] "waste" is defined as:
(a) any substance that, if added to water, would degrade or alter or form part of a process of degradation or alteration of the quality of the water to an extent that is detrimental to its use by people or by any animal, fish or plant, or
(b) water that contains a substance in such a quantity or concentration, or that has been so treated, processed or changed, by heat or other means, that it would, if added to any other water, degrade or alter or form part of a process of degradation or alteration of the quality of that water to the extent described in paragraph (a), and, without limiting the generality of the foregoing, includes
(c) any substance or water that, for the purposes of the Canada Water Act, is deemed to be waste,
(d) any substance or class of substances prescribed by regulations made under subparagraph 63(1)(b)(i),
(e) water that contains any substance or class of substances in a quantity or concentration that is equal to or greater than a quantity or concentration prescribed in respect of that substance or class of substances by regulations made under subparagraph 63(1)(b)(ii), and
(f) water that has been subjected to a treatment, process or change prescribed by regulations made under subparagraph 63(1)(b)(iii).

1.0 What is the Purpose of these Guidelines?

1.1 Purpose

The purpose of this document is to provide recommendations and outline expectations for municipal staff regarding the monitoring and management of sewage sludge in the Northwest Territories (NWT).

1.2 Authority

The Land and Water Boards' (LWBs') authorities are granted under the MVRMA and the Waters Act and their regulations.

1.3 Policy Development

The Guidelines were developed by a working group consisting of LWB staff, and staff from the Departments of Environment and Climate Change, and Municipal and Community Affairs, Government of the Northwest Territories.

1.4 Application

This Policy will be applied by all the LWBs operating under the MVRMA including the:

- Mackenzie Valley Land and Water Board
- Gwich'in Land and Water Board
- Sahtu Land and Water Board
- Wek'èezhìi Land and Water Board

2.0 What is Sludge?

2.1 Passive Sewage Treatment Systems

Most sewage treatment systems (also called sewage disposal facilities) in the NWT use passive treatment in lagoon cells or retention ponds before discharging effluent[4] to the receiving environment. In passive treatment systems, sewage is typically pumped or trucked to natural or engineered lagoons, where it is retained for treatment before being discharged to the receiving environment. To treat sewage, it generally needs to be kept in the lagoon for a particular length of time. Treatment occurs through several processes:

a) the removal of solids by settling or filtration;
b) the biodegradation of organic matter by microorganisms (i.e. bacteria); and
c) the ultraviolet disinfection of harmful microorganisms by sunlight.

2.2 Sludge Accumulation in Passive Sewage Treatment Systems

Lagoons are generally operated in one of two ways: periodic discharge (Figure 1) or continual discharge (Figure 2).

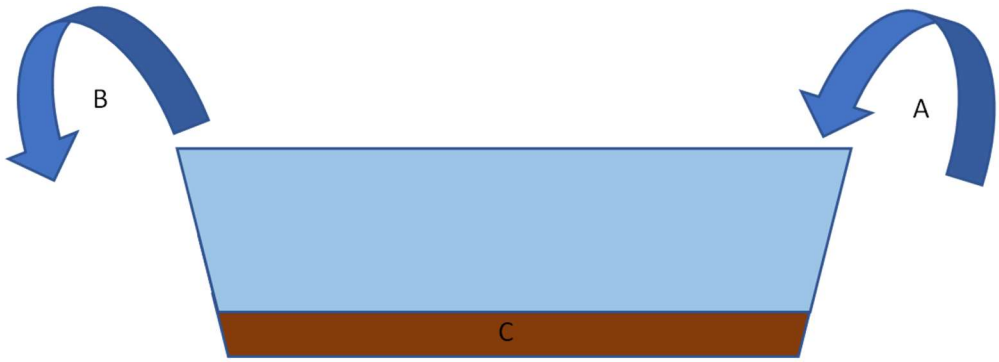

Figure 1 - Lagoon with Periodic Discharge. Sewage is pumped or piped into the lagoon (A) and retained until the lagoon is fully decanted, or emptied of liquids (B). Sludge (C) generally accumulates on the bottom surface of the lagoon in these systems.

[4] The discharge of effluent from a lagoon/sewage treatment system is considered a deposit of waste by the *Waters Act*.

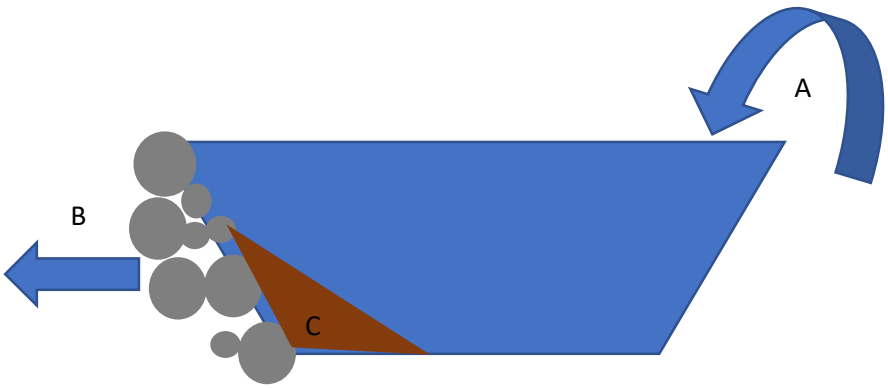

Figure 2 - Lagoon with Continual Discharge. Sewage is pumped or piped into the lagoon (A) and continuously flows out (B) of the system. This discharge can take place through a pipe, cobble berm, or other outlet structure. Some continually flowing systems discharge into the ground through an "exfiltration" pit. Sludge (C) can accumulate in continually flowing systems.

Sewage treatment systems are typically designed to allow a certain volume of sludge to build up within the lagoon (Figure 1 and Figure 2). However, it is important to maintain enough operational volume in the lagoon above the sludge level so that the sewage can be treated effectively. Lagoons also need to maintain a minimum freeboard (the distance between the lagoon surface and the top of the berm) so that there isn't a risk of the lagoon overflowing. Therefore, as sewage is put in the lagoon, at some point the maximum sludge volume is reached. The accumulated sludge should then be removed in order to maintain a minimum operational volume for effective sewage treatment in the lagoon (Figure 3). Sludge volume and accumulation need to be monitored periodically to ensure that sewage treatment is not compromised by sludge depth.

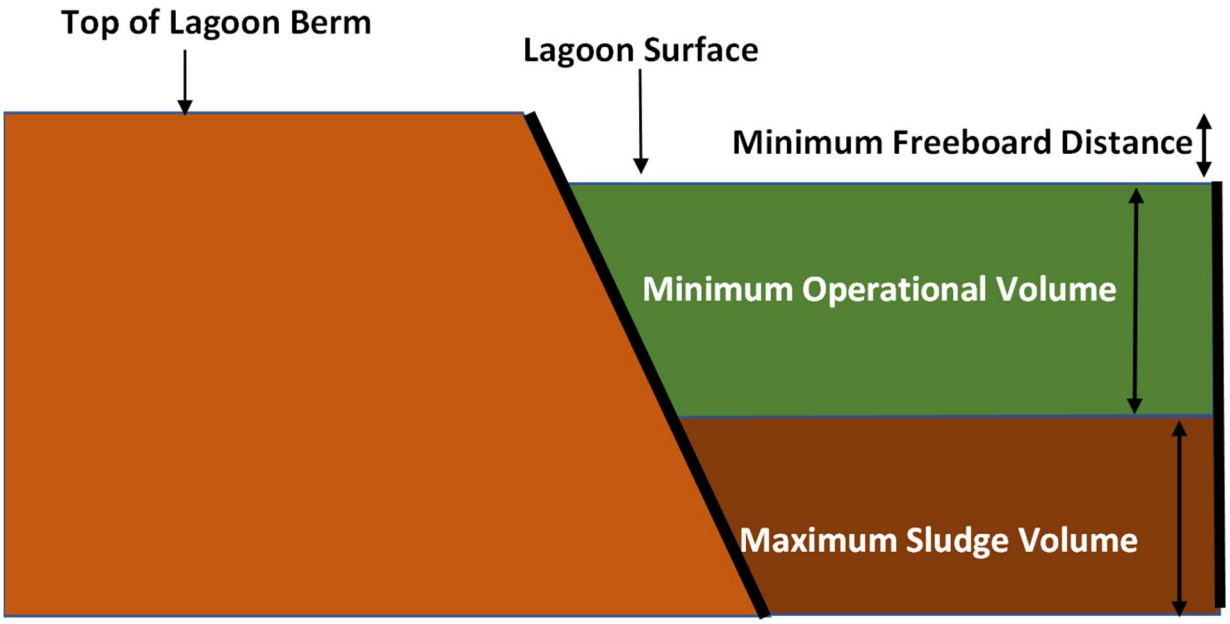

Figure 3 - Maximum Sludge Storage Volume. Lagoons typically have thresholds for accumulated sludge so that an operational volume of sewage and freeboard can be maintained.

2.3 Sludge Management

Sludge is a concentrated form of sewage, and by definition, a waste. It contains high levels of solids, microorganisms, organic matter, nutrients, and possibly other constituents like metals and emerging contaminants such as pharmaceuticals. Therefore, sludge needs to be properly managed. Before sludge is removed from a sewage treatment system, a municipality must have a plan to manage, and either to re-use or dispose of, the sludge properly. This document provides guidance on how to develop a sludge management plan.

3.0 How is the Monitoring and Management of Sludge Regulated in the NWT?

In the NWT, a water licence is required for the deposit of municipal waste above certain thresholds (in accordance with the Waters Regulations). Most municipalities in the NWT have a water licence, issued by their regional Land and Water Board in the Mackenzie Valley or by the Inuvialuit Water Board (Board) in the Inuvialuit Settlement Region. Water licences generally include conditions on how sewage, including sludge, must be managed and disposed of. The sewage treatment system (or sewage disposal facilities) is typically defined as an engineered structure in a water licence, requiring specific design and construction conditions. Once a water licence is issued to a community, a Water Resource Officer (Inspector) with the Department of Environment and Climate Change (ECC), Government of the Northwest Territories (GNWT) is responsible for ensuring the community complies with the conditions of a water licence. In this section, the specific water licence requirements relating to sludge management are discussed.

3.1 Operation and Maintenance Plan and Annual Reporting

Municipal water licences generally require that sewage disposal facilities have up-to-date operation and maintenance (O&M) plans that reflect current practices. These plans are generally publicly reviewed, and considered for approval by the Board. Typically, a municipality's methods for monitoring sludge are included in an O&M plan.

Municipal water licences also require communities to submit an annual report for all activities included in the licence, including sludge monitoring and management. Results of sludge monitoring activities, any noted or significant trends in sludge accumulation, as well as any plans for sludge management should be included in annual reports.

3.2 Sludge Management Plan

A municipality will need to start planning to manage sludge a minimum of one year prior to proposing to remove the sludge from the lagoon for treatment, possible re-use, and/or disposal. At that time, a sludge management plan must be submitted to their respective Board for approval. Planning and designing for sludge removal and talking with Board staff should start well before the submission of the sludge management plan to make sure all required information is included. Ample time is required for Board staff to check the plan for completeness prior to posting it for a public review. Once comments from reviewers are received, the municipality has the opportunity to respond to any public review comments prior to Board staff bringing the plan to the Board for approval. Based on reviewer comments and the Board's decision, the plan may need to be revised and possibly be publicly reviewed again.

Table 1 includes the typical requirements for a sludge management plan.

Table 1 - Sludge Management Plan Requirements

ITEM	SLUDGE MANAGEMENT PLAN REQUIREMENT
Project Schedule	• Describe the predicted timeline for sludge removal, treatment, and re-use or disposal.

Removal Method	• Describe how the sludge will be removed, including:
	  ○ equipment mobilized;
	  ○ staging areas used; and
	  ○ methods for ensuring the receiving environment will not be impacted by the activity.

Management	• Describe the method(s) being proposed for the management of sludge, including how the surrounding environment will be protected. • Depending on the water licence, a design and construction plan may have to be submitted for public review and Board approval prior to construction. • Design and as-built drawings may need to be submitted pre- and post-construction. • Characterize the quality of sludge prior to disposal or end-use, for the parameters listed in Section 5.3. If a community proposes an end-use for sludge that requires meeting a more stringent quality criteria, sludge quality should be characterized before planning treatment, in order to assess the treatability and level of treatment required for the sludge.
End-Use	• Propose the intended end use(s) of the sludge, and the criteria by which the sludge will be deemed appropriate for re-use or disposal. • Include sampling methods for analyzing sludge quality.
Contingencies	• Include any contingencies put in place if the proposed methods for management do not go as planned.

4.0 How is Sludge Monitored?

Monitoring sludge depth in municipal sewage treatment systems is important to help communities:

a) understand how well a sewage treatment system is working; and
b) plan for any future management, treatment, re-use, and disposal of sludge.

As discussed in Section 2.0, most sewage treatment systems in the NWT are designed to filter or settle out sewage waste solids as part of the sewage waste treatment process (Figure 1 and Figure 2), so sludge accumulates over time. Most systems are designed to allow sludge to build up and can continue operating for a number of years without sludge accumulation impacting operations or sewage treatment. However, after a period of time, sludge may build up to a level where there is not enough volume for proper treatment to occur (Figure 3).

Figure 4 shows how a municipality can use sludge monitoring as one tool to assess whether the sewage treatment system is properly treating sewage. Sludge accumulation can be determined by directly measuring sludge depth, volume, and/or accumulation. If there isn't enough operational room for sewage treatment, poor effluent quality may result. Another tool to measure the impact of sludge accumulation is assessing the treatment efficacy through testing the effluent quality of the sewage treatment system (see Section 4.3). If either sludge or effluent monitoring indicates that sludge depth is becoming problematic, a sludge management plan must be developed.

The frequency of monitoring should be chosen depending on how well the treatment system is performing and how fast sludge is accumulating.

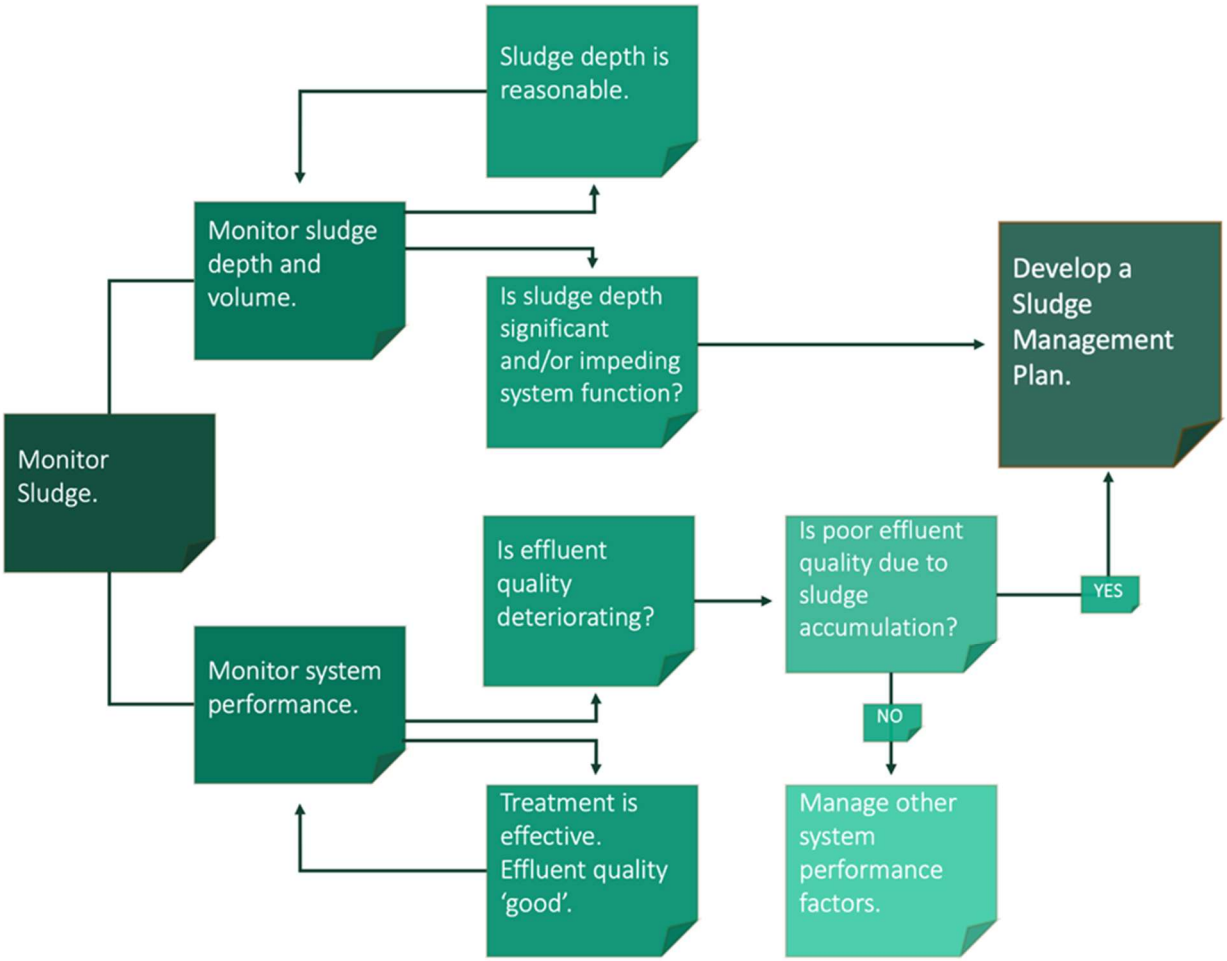

Figure 4 - Decision Making Matrix for Monitoring Sludge and Assessing Sewage Treatment.

4.1 Sludge Depth Monitoring

In sewage treatment systems that are designed to settle out solids and accumulate sludge, sludge depth should be monitored on a regular basis. Periodically monitoring the depth of sludge enables a municipality to understand several aspects of the treatment system, including:

a) how quickly sludge is accumulating over time;
b) how much volume is available for retention and treatment of sewage above the sludge layer; and
c) how soon sludge may have to be removed.

There are different ways to monitor sludge depth, depending on access to the sewage treatment system, the configuration of the system, and the training staff have received. Some of the options for sludge depth monitoring include, but are not limited to, the following:

4.1.1 Sludge Judge

The Sludge Judge® (Figure 5) is a common and inexpensive way to monitor sludge depth and volume. It consists of a long clear PVC pipe with a flap foot valve on the bottom. When it is lowered into a lagoon cell, the foot valve causes the liquid level inside the pipe to drop relative to the water level outside the

pipe, allowing the depth from the water level to the sludge blanket to be recorded. Sludge depth can be alternatively measured by pushing the sludge judge to the bottom of the lagoon floor, which then shows the depth of sludge within the pipe. A detailed description of how to use the Sludge Judge® for depth and volume measurements is included in Appendix B.

Figure 5 - Sludge Judge®.
Source: https://www.wateronline.com/doc/sludge-judge-0001

4.1.2 Secchi Disk

A Secchi disk (Figure 6) is a black-and-white-coloured disk on a rope that is usually used to monitor water clarity. However, it can be used to monitor the distance between the water surface and the top layer of sludge by lowering the disk until it meets resistance at the top of the sludge blanket. This or any other weighted disk on a rope can be used to assess a very approximate measurement between the water surface and the top of the sludge blanket.

Figure 6 - Secchi Disc.
Source: https://magnoliafisheries.com/secchi-disk-explained/

4.1.3 Infrared Sensors

Several types of infrared sensors for sludge depth monitoring exist, like the Sludge Gun® shown in Figure 7. These sensors are used to calculate the distance between the water surface and the top layer of sludge. These instruments can be expensive and can also be less accurate when the lagoon contains a high concentration of solids.

Figure 7 - Sludge Gun®.
Source: https://sludgecontrols.com/our-products/portable-sludge-level-detector/

4.1.4 Sonar

Some communities have used fish/depth-finder technologies for determining sludge depths. These consist of wireless sonar devices, controlled from a smartphone or tablet. This type of device (Figure 8) allows various sludge-depth profiles to be created for a lagoon system from the safety of the shore. From a health and safety perspective, these are the best option for sludge measurements, as they don't require staff to boat on the lagoon.

Figure 8 - Wireless Sonar Depth Finder.
Source: https://store.vexilar.com/sonarphone-w-transducer-t-pod-phone-not-included.html

4.2 Sludge Accumulation Monitoring in Filtration or Flowing Systems

Some municipal sewage treatment systems continually filter sewage through an exfiltration trench or berm (Figure 2). These systems should be visually monitored to ensure that sludge is not plugging the trench/berm and that liquid sewage is still able to flow. If the trench/berms are periodically bare during operations, these systems should be sprayed down to loosen the sludge, or if a very thick blanket develops, sludge may have to be removed mechanically and then managed.

4.3 Water Quality Monitoring

Monitoring effluent quality from a sewage treatment system may provide information on how well the system is treating sewage, and therefore whether the sludge needs to be managed. Most municipal water licences in the NWT include a Surveillance Network Program (SNP) that requires the community to sample, monitor and report on the quality of effluent from the sewage treatment system. If enough sludge builds up, the quality of sewage effluent may show a significant decline (i.e., have higher concentrations of solids and/or organic matter than usual) for two reasons: Either (1) the system does not have enough volume and/or retention time to physically and biologically treat sewage, or (2) a continual-discharge location is blocked by sludge.

Figure 4 shows that sludge accumulation may not be the only reason for poor treatment performance; sludge should only be managed when it is confirmed to have accumulated to (or will soon accumulate to) a problematic level that affects treatment.

4.4 Health and Safety

While it is important to monitor sewage treatment and sludge, the health and safety of municipal staff should be prioritized. Less intrusive (i.e., on-shore) monitoring options should be prioritized, favouring remote monitoring, whenever possible.

Staff should take these health and safety precautions before conducting any monitoring of a sewage treatment system:

- Have up-to-date immunizations that are recommended for working near domestic sewage;
- Wear proper personal protection equipment (PPE – see Figure 9) while monitoring is conducted, including but not limited to full-body protection from biological and chemical hazards (i.e. boot covers, full suit, gloves, face, eye and mouth protection);
- Dispose of PPE properly, and clean clothing thoroughly post-monitoring; and
- Clean equipment after using.

Figure 9 - Personal Protective Equipment (PPE) for Working near Sewage.
Source: https://www.broadbentinc.com/employee-health-safety-highest-priority-broadbent

5.0 How is Sludge Managed and Treated?

5.1 Planning for Sludge Management

Figure 4 illustrates how a municipality may reach a point where they should start to plan to remove and possibly treat sludge.

Figure 10 illustrates the planning, regulation, and implementation of a sludge management plan. As discussed in Section 3.0, municipalities should communicate early and often with their respective Board staff and Inspector to ensure that they make all necessary considerations related to the options for sludge removal, sludge treatment, and sludge re-use. All aspects of the sludge management plan must be approved by the respective regional Board in advance of the scheduled work.

Once removed from a sewage treatment system, sludge must be properly managed and treated (if required).

5.2 Sludge Management

The NWT does not have specific requirements for how sludge must be managed and there are a variety of ways this can be done. In a sludge management plan, a municipality may propose a method to manage sludge that is suitable for its site-specific location. In the NWT, sludge is generally managed by dewatering the sludge and disposing of the dried material, such as using the material as landfill cover. However, sludge may also need to be further treated (i.e., decrease the concentrations of certain parameters) if the municipality wants to use the material in a more stringent way (i.e., agricultural). Regardless of the final disposal or end-use, sludge must always be managed and treated in a way that ensures the surrounding environment (i.e., the quality of surface water and/or groundwater nearby) will not be adversely affected, and is approved by their regional Board.

Environment and Climate Change Canada (ECCC) has two publications related to the management of municipal sludge: the *Canada Wide Approach for the Management of Wastewater Biosolids* and the *Guidance Document for the Beneficial Use of Municipal Biosolids, Municipal Sludge and Treated Septage*. These documents detail several methods for treating sludge; however, most of the treatment methods in the document are not appropriate for passive sewage systems in cold regions.

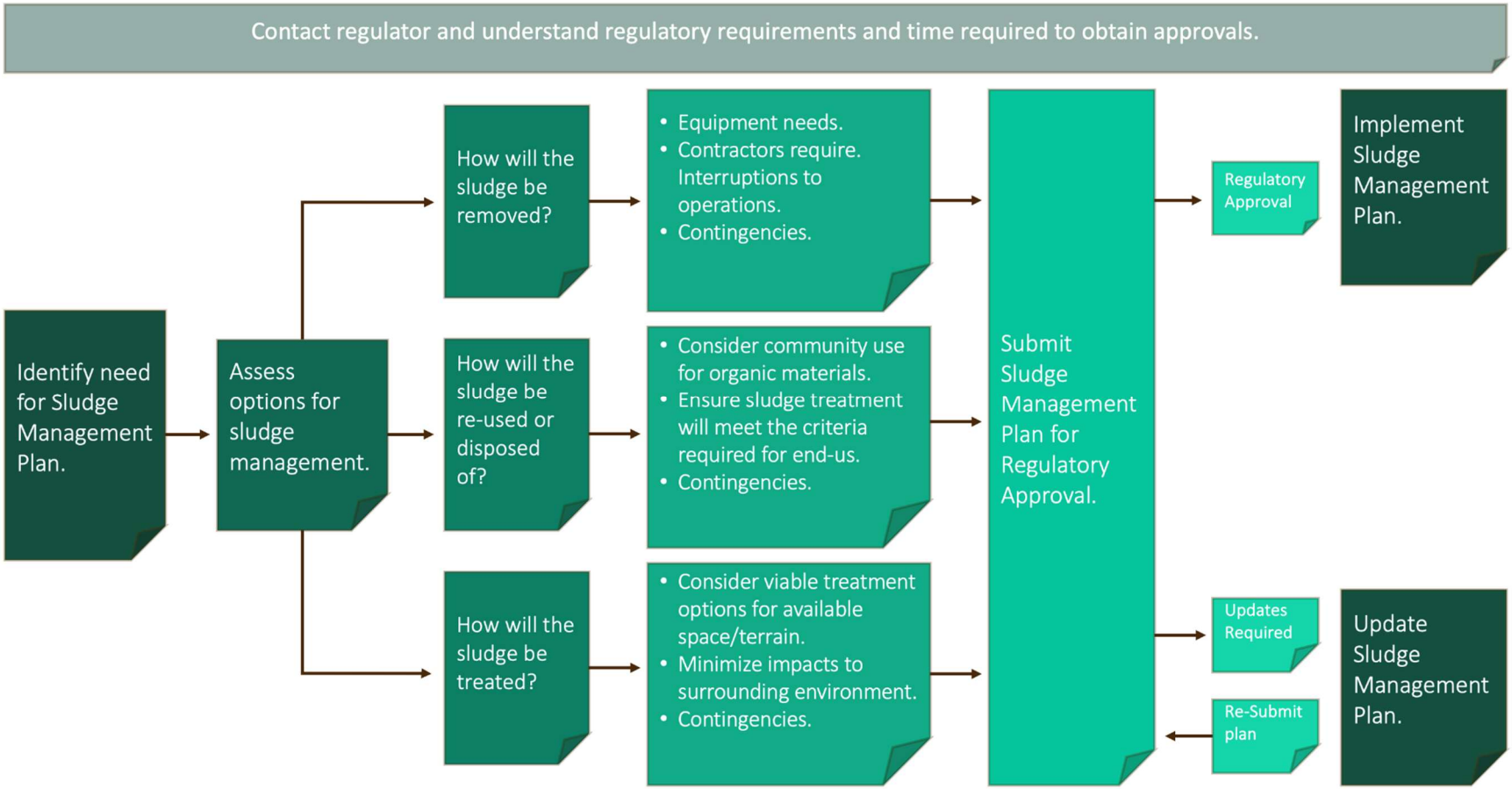

Figure 10 - Development of a Sludge Management Plan.

5.2.1 Dewatering Sludge

One of the primary goals of sludge management is to dewater or dry the sludge. This can be accomplished using various methods such as drying beds or pits, or using drying or separating technology, such as Geotubes®. Ideally, removing water from the sludge should happen in an area adjacent to the sewage treatment system, so that any water draining from the sludge runs back to the main lagoon system. This is because the water contains components that could impact the surrounding environment.

5.2.2 Treating Sludge

If a community chooses to treat sludge beyond dewatering, the level and method of treatment will depend on how the municipality intends to re-use or dispose of the sludge. In some cases, sludge might simply be removed from the lagoon, dewatered as discussed in 5.2.1, and then disposed of. In other cases, a community might identify a use for sludge, such as landfill cover, in which case it must be treated to meet certain quality criteria.

If the community wishes to use the sludge in a way that requires meeting more stringent end-use criteria (i.e., agricultural use), a more advanced treatment method may have to be used, such as composting or landfarming. Like with de-watering, treatment must also ensure that the surrounding environment is not adversely impacted. Communities who want to re-use sludge may wish to explore and propose emerging technologies for treating sludge to certain standards.

5.3 Sludge Re-Use

Although communities usually have to remove sludge to improve the performance of sewage treatment systems (as per Section 2), the resulting sludge can actually be a commodity for the community. Treated and/or dewatered sludge may be a useful resource for a community, because it can be used as organic material or land cover. A municipality can propose to re-use treated sludge for a variety of applications that suit their needs and meet applicable regulations. Generally, and depending on the final use, re-used sludge should meet:

- The remediation criteria in the Government of the Northwest Territories' (GNWT) Environmental Guideline for Contaminated Site Remediation; and
- The criteria for Fecal coliforms and Salmonella in the Canadian Council of Ministers of the Environment (CCME) Guidelines for Compost Quality.

The GNWT Environmental Guideline for Contaminated Site Remediation includes the criteria that numerous parameters must meet, for a variety of end-uses. For example, sludge used in an industrial application (i.e., landfill cover) would have to meet less stringent criteria than if it were to be used on an agricultural area. The proposed end-use and associated criteria must be approved in a sludge management plan if they are not included in the conditions of a water licence.

Sludge analysis should include, but not be limited to the following parameters, depending on the end-use:

- Petroleum hydrocarbons F1-F4;
- Ammonia + ammonium;
- Fecal coliform;
- E. coli;
- Salmonella;
- Mercury;
- Total metals;
- Nitrate; and
- Total Kjeldahl nitrogen.

Additional analyses may be required, depending on site-specific conditions in a municipality. If treated sludge does not meet the criteria that are specified in an approved sludge management plan or conditions of a water licence, it must be further treated until criteria are met. Otherwise, sludge must be disposed of as specified by regional regulators.

Appendix A: Resources for Municipal Sludge Management

Canada-Wide Approach for the Management of Wastewater Biosolids
https://ccme.ca/en/res/biosolids_cw_approach_e.pdf

Guidance Document for the Beneficial Use of Municipal Biosolids, Municipal Sludge and Treated Septage
https://publications.gc.ca/collections/collection_2013/ccme/En108-4-56-2012-eng.pdf

Sonar Sludge-Depth Measurement
www.aquaclear.com

Waters Act
https://www.justice.gov.nt.ca/en/files/legislation/waters/waters.a.pdf

Government of the Northwest Territories' Environmental Guideline for Contaminated Site Remediation
https://www.enr.gov.nt.ca/sites/enr/files/guidelines/siteremediation.pdf

Canadian Council of Ministers of the Environment Guidelines for Compost Quality
https://ccme.ca/en/res/compostgdlns_1340_e.pdf

Appendix B: Instructions for Using a Sludge Judge®

A Sludge Judge® or sludge measuring tube is a long, clear plastic tube with measurement markings and a check valve on the bottom, as described in Section 4.0 of the document.

Measurement Layout:

Sludge depth measurements should be taken in a grid format and should be taken in the same locations during each sampling event. The bottom surface area of the lagoon must be estimated. Then, the number of required sludge depth sampling locations can be determined, based on the figure below, i.e., with approximate 70-foot spacings. It is recommended that the sampling locations are marked with survey flags on the shore, or by distinct landmarks.

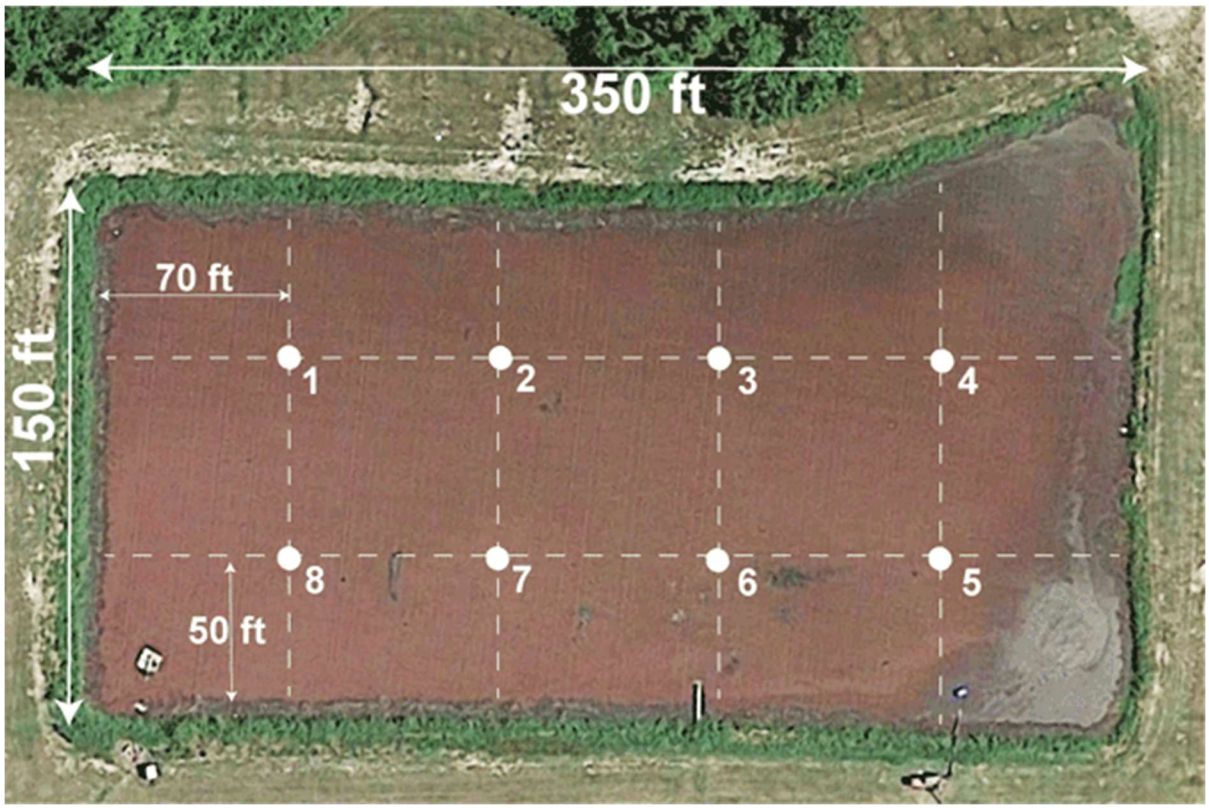

Figure 11 - Sludge Monitoring Grid.

Source: https://content.ces.ncsu.edu/sludge-survey-methods-for-anaerobic-lagoons

Health and Safety:

To prepare for sludge depth measuring, you will need:

- A boat (a flat-bottom boat is more stable than a canoe or V-bottom boat);
- Appropriate and functional personal floatation devices (PFDs) for each sampling team member;
- Sludge Judge, sludge measuring tube, or a similar measuring device (ensure that the check valve is operating properly);

- A solid, long rod or pole with measured increment markings beginning at zero to measure total depth from top of water level to bottom of the lagoon (note: the Sludge Judge could also be used for this purpose);
- Appropriate Personal Protective Equipment (PPE) which includes but is not limited to latex or nitrile gloves, CSA certified rubber boots, coveralls, safety goggles, etc.; and
- Notebook and pen to record measurements for each sampling location.

A team of three people should work to take measurements, and all must be wearing functional PFDs and appropriate PPE:

- There must be at least one person on the shore of the sewage lagoon at all times with a throwable flotation device that is connected to a line, in case personnel in the boat need a rescue. Also, this person should have a charged cellphone with signal reception to request emergency assistance if required. (See A, **Error! Reference source not found.**);
- The second person is in the boat, to anchor the boat and record depth measurements (See B, Figure 12); and
- The third person is also in the boat to use the Sludge Judge and measuring rod to take measurements (See C, Figure 12).

Conducting Measurements:

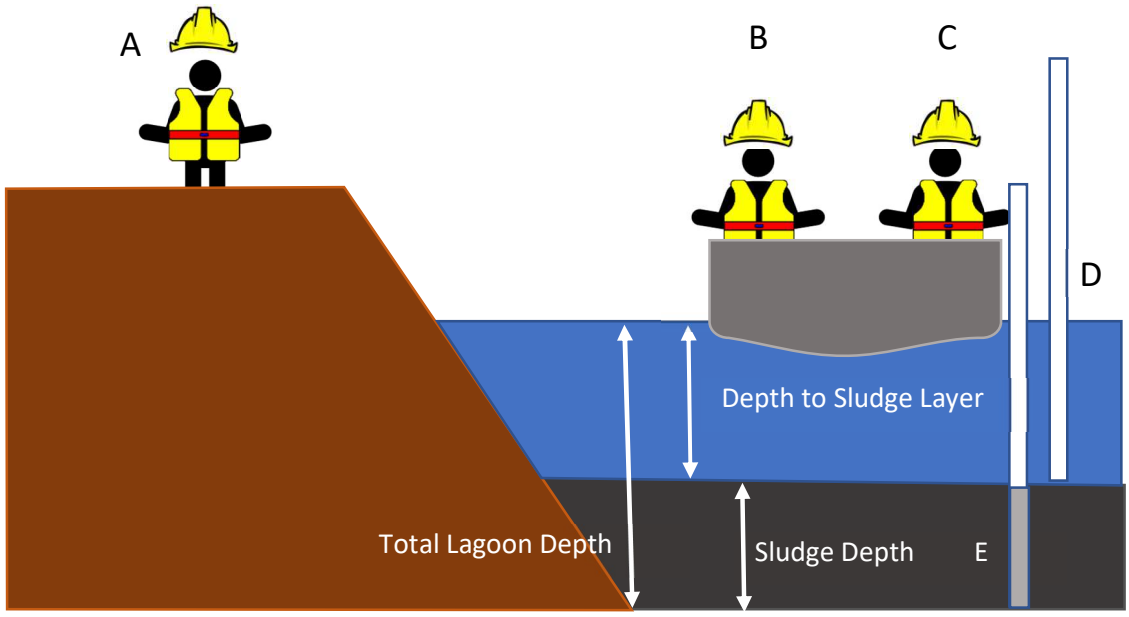

Figure 13 - Conducting Sludge Measurements with a Sludge Measuring Tube.

To take accurate depth measurements, follow these instructions:

1. Proceed to the first sampling location. Ensure that locations are properly documented – i.e., by flagging tape or landmarks onshore, GPS, etc.
2. Lower the sludge measurement tube into the sewage lagoon slowly without moving the tube up and down. Carefully observe the liquid level in the measurement tube as it is lowered, when the tube has reached the sludge layer, the liquid level inside the tube will drop slightly below the liquid level outside the tube (See D, Figure 12).
3. Pull on the rope of the sludge measurement tube to secure the check valve and remove the tube from the sewage lagoon.
4. Using the increment markings on the sludge measurement tube, record the depth from the surface of the liquid to the top of the sludge layer. Note that there should be 1 to 2 inches of sludge at the bottom of the tube which ensures that the sludge layer has been reached.
5. Insert the pole vertically at the same location. The marked increments at the end of the pole that is inserted into the lagoon should begin at zero. Push the pole through the sludge layer until the bottom of the sewage lagoon is reached and record this depth (See E, Figure 12).
6. Subtract the depth of the liquid layer from the total depth of the sewage lagoon. This is the thickness of the sludge layer.
7. Repeat Steps 2 through 6 for the remainder of the sampling locations.

If no solid, long rod or pole is available for Step 5, the sludge measurement tube may be used. However, it should be noted that this alternative method is not as accurate.

1. Insert the sludge measurement tube vertically at the same location.
2. Once the bottom of the sewage lagoon is reached, pull on the rope of the sludge measurement tube to secure the check valve and remove the tube from the sewage lagoon.
3. The distance from the bottom of the tube to the top of the sludge is the sludge layer thickness.
4. Record this measurement.

Weather Conditions:

Sludge depth measurements should be taken during optimal weather conditions during the summer, after the lagoon has completely thawed. A calm day with stable weather conditions (wind, rain, etc.) will help with the process.

Record Keeping:

Records should be kept of all measurements for reference. An example form is provided on the following page.

Lagoon I.D.:			
Completed by:			
Date:			
Weather Conditions:			
Equipment Used/Notes:			
	Name	Signature	Date
(A)	(B)	(C)	(C) minus (B)
Grid Point No.	Distance from Liquid Surface to Top of Sludge	Distance from Liquid Surface to Lagoon Bottom (Soil)	Thickness of Sludge Layer
	(cm)	(cm)	(cm)
1			
2			
3			
4			
5			
6			
7			
8			
9			