City of Iqaluit

Sludge Management

Operation and Maintenance

FINAL

2006 05 18

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1.0 INTRODUCTION

The proper operation and maintenance of the City of Iqaluit's sanitary sewage sludge management facility are important components of its overall municipal waste management system. The inappropriate operation and maintenance (O&M) of the sludge facility may cause the sewage sludge management site to become a source of potential public health hazards and adverse environmental impacts.

1.1 Objective of Iqaluit's Sanitary Sewage Sludge Management Facility

The primary objective of the facility is to apply appropriate technologies and procedures to treat and dispose of Iqaluit's municipal sanitary sewage sludge in a manner to minimize the potential public health and environmental hazards from the site, and acceptable to the Nunavut Water Board (NWB). The application of appropriate technology depends upon the geology, terrain and climate of the area, as well as the technical and financial capabilities of this City. In the case of the City of Iqaluit the appropriate technology is a "freeze thaw dewatering method followed by composting."

The following general requirements to minimize the potential public health and environmental hazards are addressed in this O&M manual:

1. transportation planning from WWTP to sludge management area
2. site organization;
3. site drainage;
4. application of freeze / thaw and drying technologies; and,
5. application of composting technologies.

1.2 Sewage Sludge Treatment Facility Site Description

The City of Iqaluit's sludge management facility is being developed on its landfill site (West 40), south of existing WWTP (See Figure 1.). This provides easy access for the transport of sludge from the WWTP to the sludge management facility. The facility is being organized to accommodate Phase 1 of the WWTP development (approximately 1.8 cubic metres of sludge per day), with an area for future expansion to accommodate Phase 2 of the WWTP development (approximately 3.5 cubic metres of sludge per day) (See Figures 2 and 3). The schedule for Phase 2 of the WWTP development remains unknown at this time.

1.3 Sewage Sludge Management Facility Process Descriptions

The sewage sludge treatment process that best describes the Iqaluit's sludge management is a freeze-thaw dewatering, and drying method followed by composting.

A freeze/thaw and drying process followed by composting may provide an appropriate process consistent with the cold climate of Iqaluit. The particular climate "attributes" of Iqaluit are:

1. Extreme winter cold, with a record low of -46°C in February, 1967.
2. Moderate summer warm, with a record high of +26°C in July, 2001.
3. Limited moisture, with an average rainfall of 200 mm per year.

Freezing and thawing, as an efficient method of sewage sludge conditioning, has been used for many years in cold climates. An important aspect of this process is that the separation of sludge particles and water is generally irreversible. The final separation is achieved when the "released" water drains away from the solids after thawing, leaving a porous sludge with solids content of 20 to 30%.

Following this dewatering and drying process, composting may provide stabilization and destruction of pathogens. The composting process will require the addition of bulking materials such as wood chips and cardboard pieces.

The timeline for freeze-thaw-composting may be a two-year cycle. Freezing would occur in a period from September to May; thawing would occur from May to June; and composting would occur in the period of June to September. A "maturing" phase in the composting would occur in the period of September to May. The total process would occupy a 20 month period from start to finish.

1.4 Information Sources

The preparation of this O&M manual is based upon the following information sources:

1. City of Iqaluit Water License NWB3IQA9900 Application for Renewal, December 22, 2003.
2. Guidelines for the Planning, Design, Operation and Maintenance of Wastewater Sewage Lagoons in the Northwest Territories - Volume I: Planning and Design / Volume II: Operation and Maintenance, Department of Municipal and Community Affairs, and Government of the Northwest Territories, 1988.
3. Planning Report. Sewage Sludge Management Plan - City of Iqaluit. December, 2005.

2.0 SLUDGE MANGEMENT FACILTY OPERATIONAL REQUIREMENTS

The City of Iqaluit's sludge management facility operational requirements will be those activities that must be done on a regular basis (daily, weekly, monthly or yearly).

The operation of the facility has been divided into five types of activities:

1. Normal Operation (daily)

2. Safety (daily)
3. Checking (weekly/monthly)
4. Sampling and Record Keeping (weekly/monthly/yearly)
5. Review (yearly).

2.1 Normal Operation of Sludge Management Facility

2.1.2 Transportation of Sewage Sludge from WWTP

The sewage sludge is transported from the WWTP to the sludge management area approximately once per day using a specially designed trailer (See Figure 4). The sludge is automatically deposited in the trailer through a channel as it sits below the primary filtration system (See Figure 4).

The transportation route follows the access road to from the end of the airport, through the light industrial area, and through the tank farm area (See Figure 5).

During the transportation of the sludge, the trailer tarp must always cover the box of the trailer and the driving speed must be limited to 30 kilometres per hour

2.1.3 Deposition of Sewage Sludge into Management Area

The sludge is deposited from the sludge trailer onto the freeze/thaw and drying beds at the sludge management area of the landfill. (See Figure 6). The freeze/thaw and drawing beds area oriented to provide access between rows of beds (See Figure 7). The sludge will be deposited in piles up to 50 centimetres high.

No accumulation of snow in the bed should be permitted because it insulates the sludge and reduces the rate of freezing. Observations should also be made of the sludge surface.

An entry should be recorded every day/week on the Daily/Weekly Operation Observations Record to either indicate that the operation is normal, or that something abnormal was observed and corrective steps had to be taken.

2.1.4 Windrow Composting

During the period of early summer to early fall (June, July, August, and September), composting of the sewage sludge may be undertaken on the sludge which is sufficiently dry to allow the mixing with shredded wood and cardboard material (See Figure 8). The shredded wood and cardboard will be obtained from the stockpile on the landfill site (See Figure 9). The mixing will be completed with the bucket attachment to a loader (Allu Bucket). The mixing ratio will be approximately 1 part sludge to 2 parts shredded material; this ratio may be adjusted a process experience is obtained.

2.1.5 Site Drainage System

Runoff from the sludge management area will enter the on-site drainage system (See Figure 10), which ultimately flows into drainage collection system for the landfill site and the storage pond. Runoff from the sludge management area will undergo an initial filtration by flowing though the 150 mm thick sludge pad.

2.2 Safety of Freeze/Thaw and Drying Bed

The operator must ensure that all aspects of sanitary sewage sludge management are conducted safely, as stated in this O&M manual.

General public and unimportant access to the facilty should be prevented to ensure no contamination or infection of the public from pathogenic microorganisms in the sludge should occur.

After work, before eating, and at other convenient times, wash your hands thoroughly.

Caution should be used when working with sewage sludge. If you get in direct contact with the sludge, wash promptly with soap and water. Treat all cuts and skin abrasions immediately to prevent any infection.

All those working on the sewage sludge facility should keep normal preventative health care vaccinations up to date. Check with a physician as to the recommended inoculations (usually includes typhoid and paratyphoid).

2.3 Inspections

On a biweekly basis (summer months and monthly basis in the winter) all main components of the sludge management system should be inspected. The purpose of the inspections is to spot things that may lead to problems later and to record the conditions of the date checked.

Sewage Sludge Site Condition: The inspection of the sludge management system should be conducted to check the condition of the site security (perimeter fence) and the condition of facility. The conditions should be recorded accordingly.

Drainage System: The drain system and surrounding area should be examined for blockages or other operational problems.

Sludge Level: The sludge level should be observed and recorded on weekly basis.

2.4 Sampling

The purpose of taking samples and carrying out tests on them is to obtain information on how well the sewage sludge treatment process is performing.

There are six important parts to the process of sampling. These are:

1. taking the sample at the time called for;
2. using a properly cleaned container for the sample to be taken;
3. careful collection of the sample from the correct location and doing any necessary field tests called for at that time;
4. careful and correct labeling of the sample container and filling out a record sheet;
5. use of proper testing procedures, where tests can be performed on site; and
6. shipping of the sample in proper containers and expeditiously so that it arrives on time for the testing.

Sample Frequency: Two Samples should be taken on a monthly basis during the summer months. These samples must be sent to an accredited laboratory for the analysis.

Sample Parameters: Samples will be taken and analyzed for moisture content, and fecal coliforms.

Sample Locations: Samples are normally required to be taken at the sewage sludge bed centre. Occasionally, other samples may be collected as required by the conditions of the Water License.

Sample Collection: Normally, you will be required to collect all of the samples at the specified location above in supplied containers; this type of sampling is referred to as a grab sample as it is collected at one time from a specific location. The grab samples are collected by filling the sample container using a small shovel.

Sample Containers: The sample containers can affect the sample test results. The type of material it is made of and the way it was cleaned are the most important factors. Most sewage sludge samples are collected in plastic containers that have been well washed and rinsed.

Sample Reporting: An annual report on the sample parameters will be submitted to the NWB.

2.5 Record Keeping and Reporting

Record keeping and reporting is necessary to have information on what has happened. The use of accurate record reports is very important for the City, and the NWB.

The records and reports must be detailed enough to allow evaluation of performance and to track the development of problems. The records and reports also give a good check on completed tasks, and those left to complete. The records and reports for the City of Iqaluit include:

1. Daily Activities and Weekly Inspections prepared by the City staff;
2. Annual Sampling Report prepared by sample testing laboratory; and
3. Annual Water Licence Report prepared by the City staff.

2.6 Review

A compilation of the sludge management operations and sampling will be prepared once a year as a summary of the operation and performance for the purpose of submitting an annual report to the NWB and for the purpose of an operation management review by the City administration.

3.0 SLUDGE TREATMENT FACILTY MAINTENANCE REQUIREMENTS

3.1 Facility Structures

The drainage system enables sludge management system to function properly. In addition, the bed surrounding requires attention to make sure that the facility operates properly and does not experience or cause any damage, blockage or erosion.

Surface runoff must be prevented from entering the bed through diversion ditches around the bed's perimeter berm. The ditches must be properly maintained to prevent blockage of drainage.

3.2 Odour Problems

Under normal operating (below freezing temperature) conditions, the sludge management facility will not have any significant odour problems. However, at certain times, severe odours may occur. The sludge management facility is located at a significant distance from the nearest house; therefore, odour problem would not normally be a concern.

3.3 Fencing and Signs

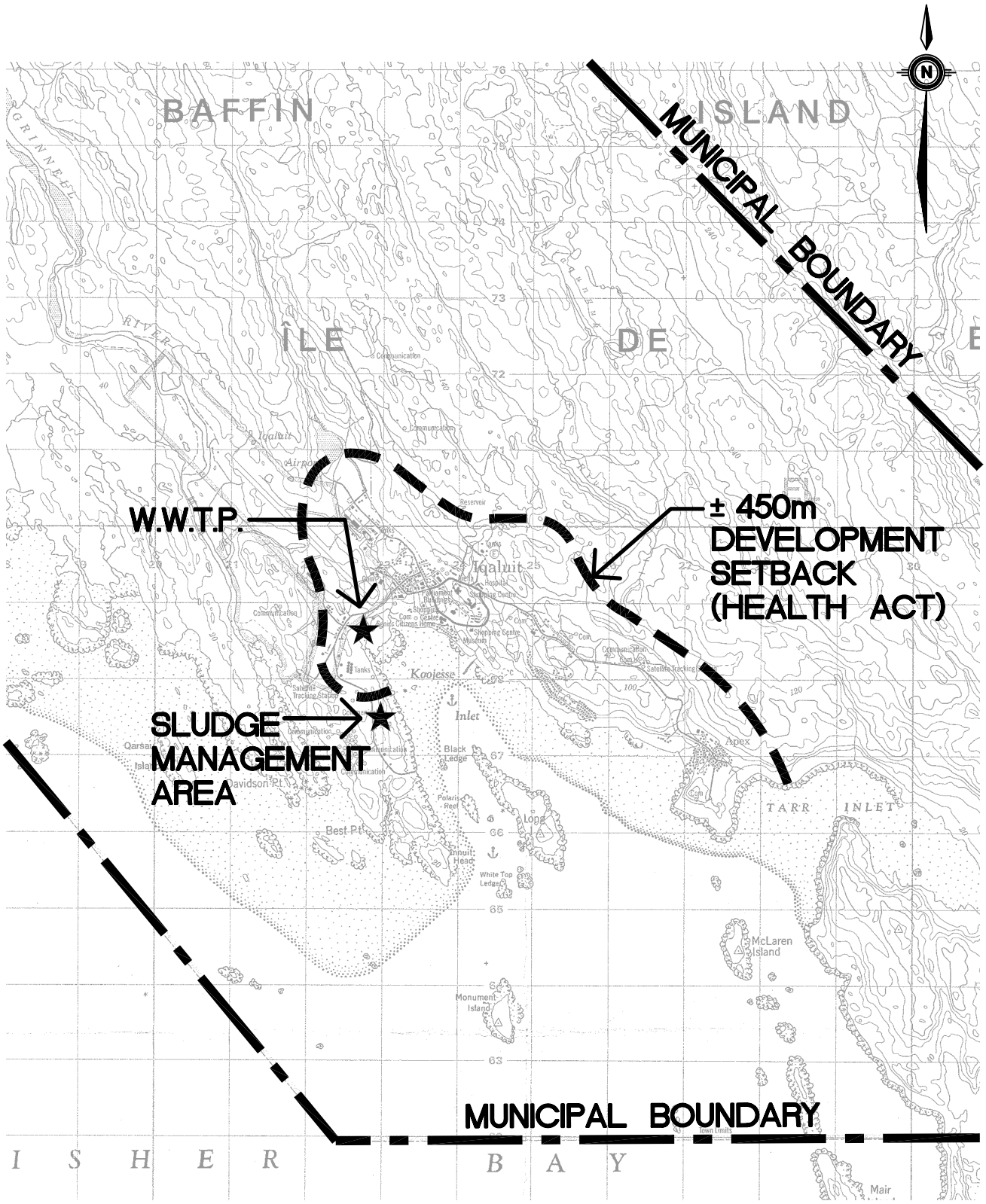
Bilingual warning signs are normally installed at regular intervals around the facility. Lost or damaged signs should be replaced.

3.4 Maintenance of Access Road

The access road is an all weather road. Maintenance takes three basic forms: road shaping and smoothing, roadway filling and snow removal. These activities follow normal community procedures.

3.5 Surface Runoff Management

Drainage ditches and culverts near the sludge management facility should be inspected during the early summer months, to ensure that they are not blocked by ice. Any blockages should be cleared immediately to avoid surface runoff from entering the sludge management facility.



REFERENCE: PUBLIC HEALTH GUIDELINES

Date: MAY 18, 2006

0 1 2 3km

Scale

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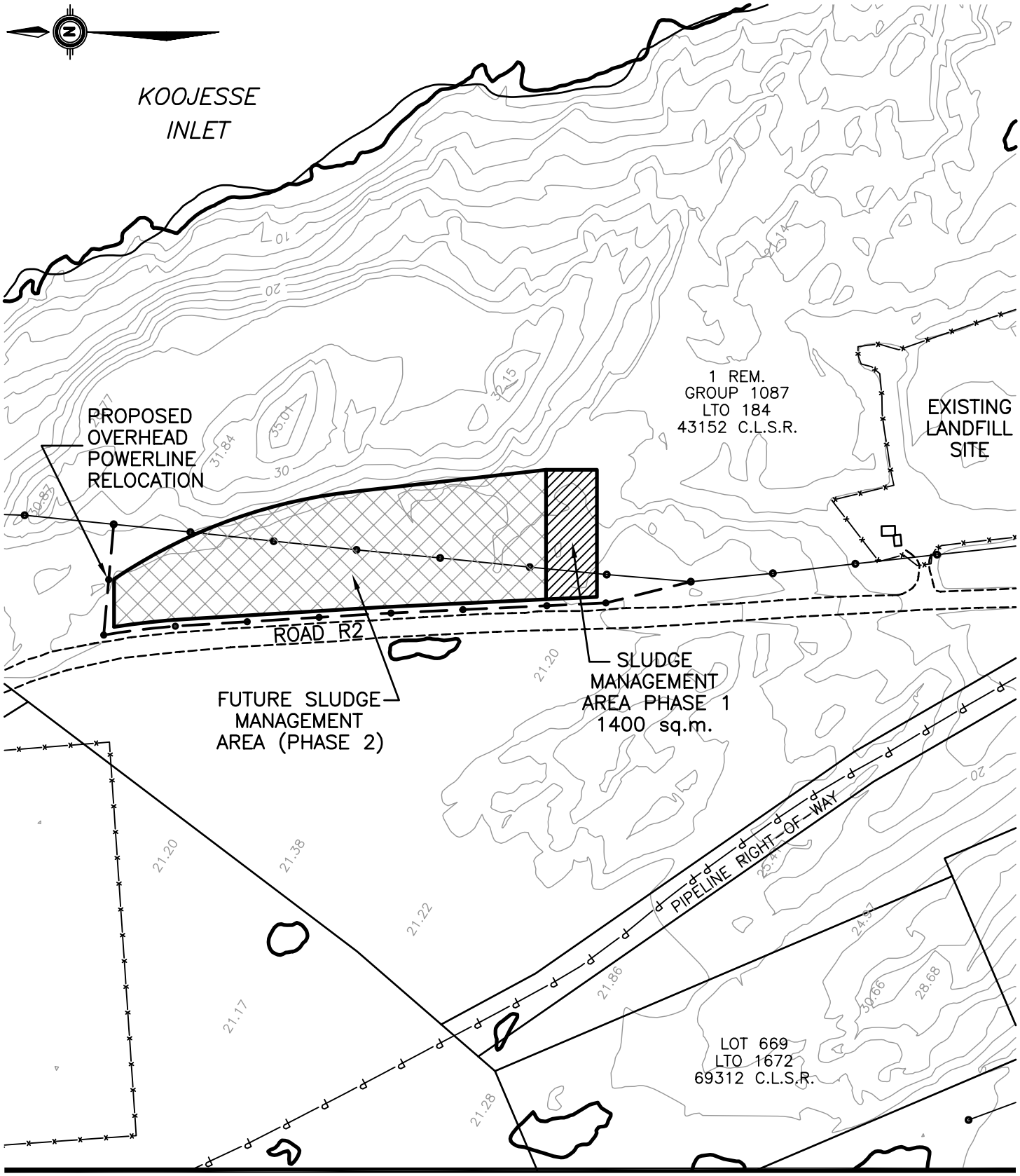
City of Iqaluit - Sludge Management
OPERATION and MAINTENANCE LOCATION PLAN
Figure 1



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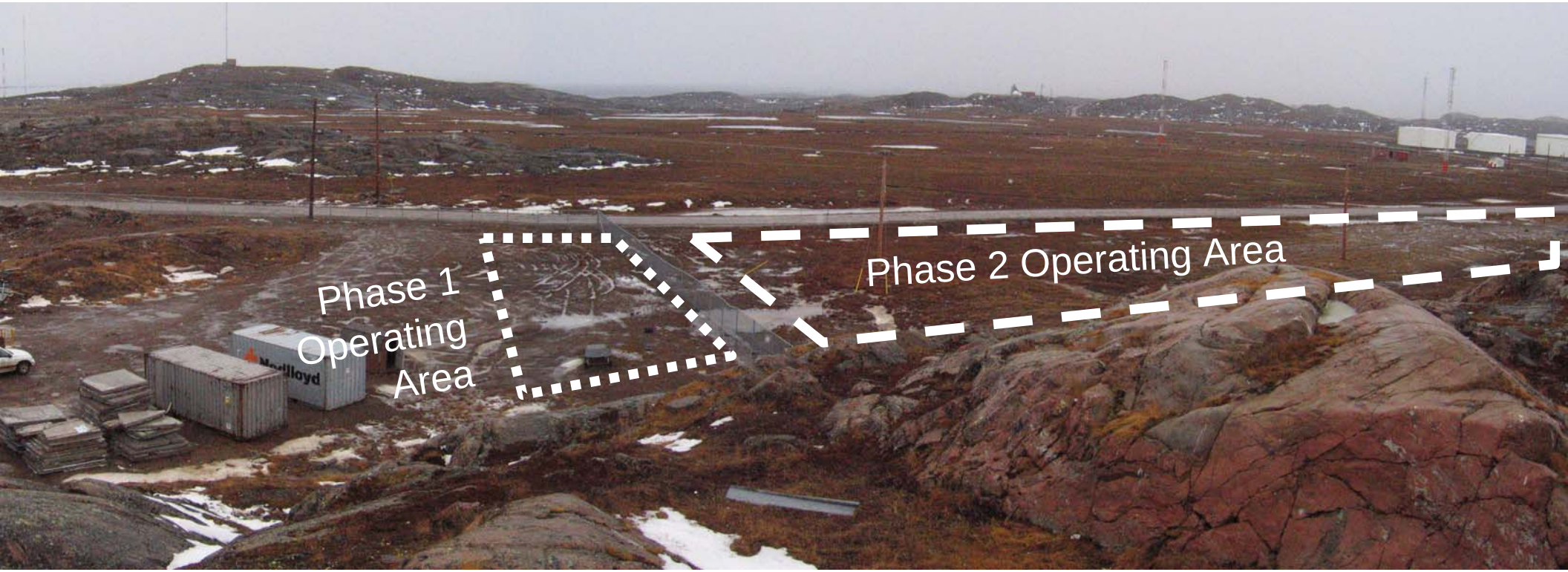
Cadd File:86905_O&M FIGURE 02.dwg\Plot Scale: 1:2.5(A4)

City of Iqaluit - Sludge Management

OPERATION and MAINTENANCE SITE ORGANIZATION

Figure 2



Iqaluit Sludge Management
Operation and Maintenance
Site Organization

Figure 3

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Sewage sludge transportation trailer – note rollout cover at front of trailer

Sewage sludge from primary filter depositing into discharge channel.

Sewage sludge transportation trailer positioned below discharge channel – note access door at front of trailer.

Iqaluit Sludge Management Operation and Maintenance Transfer Equipment

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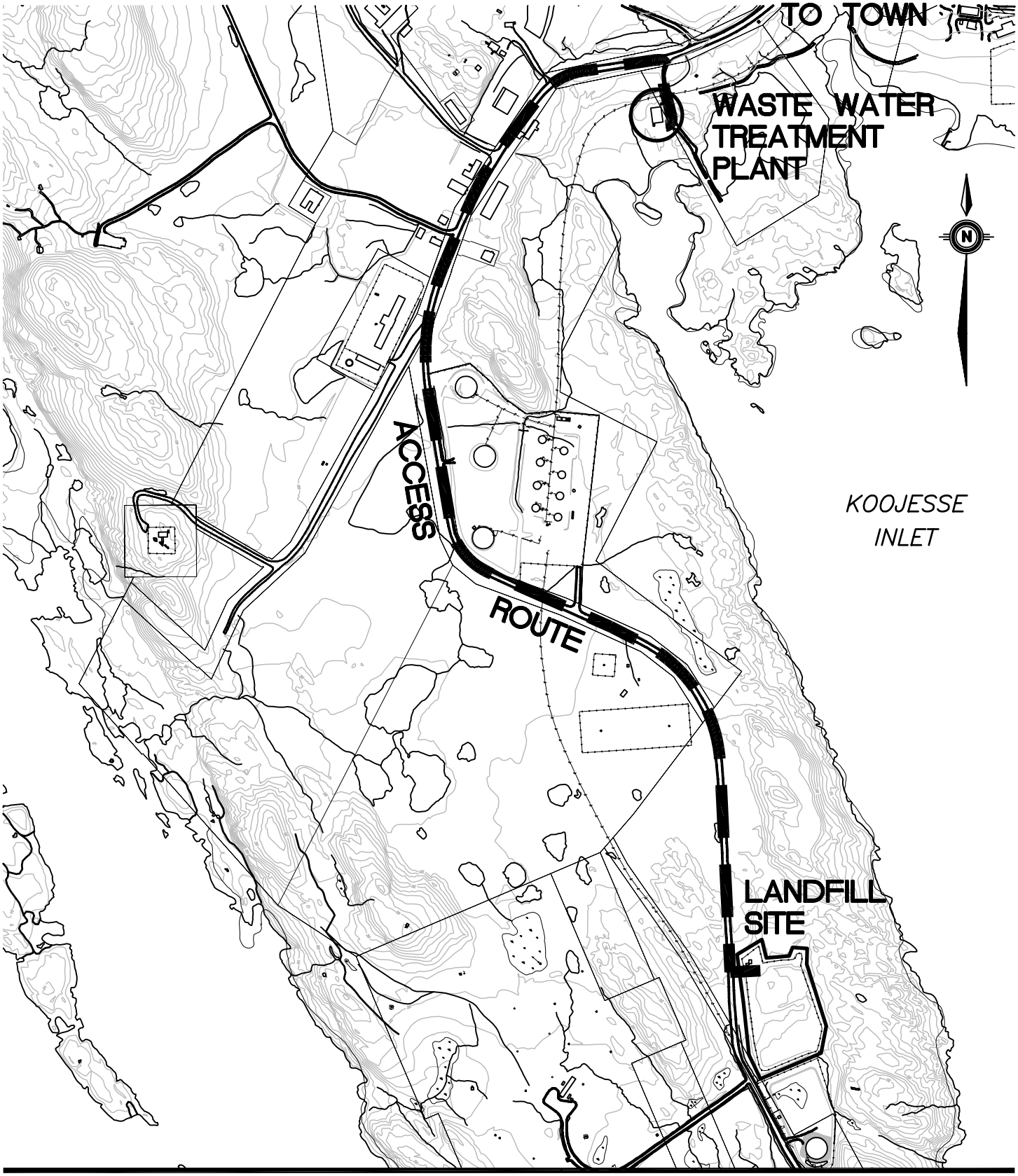
Figure 4



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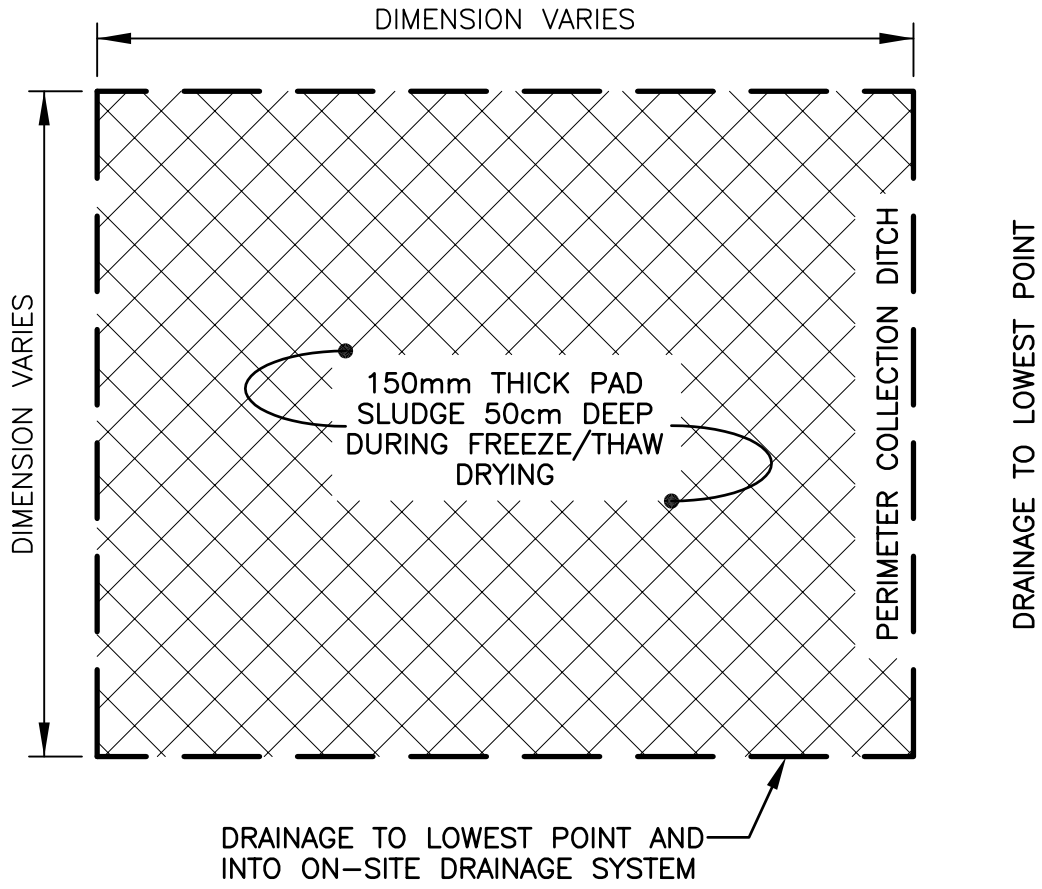
City of Iqaluit - Sludge Management

OPERATION and MAINTENANCE TRANSPORTATION ROUTE

Figure 5



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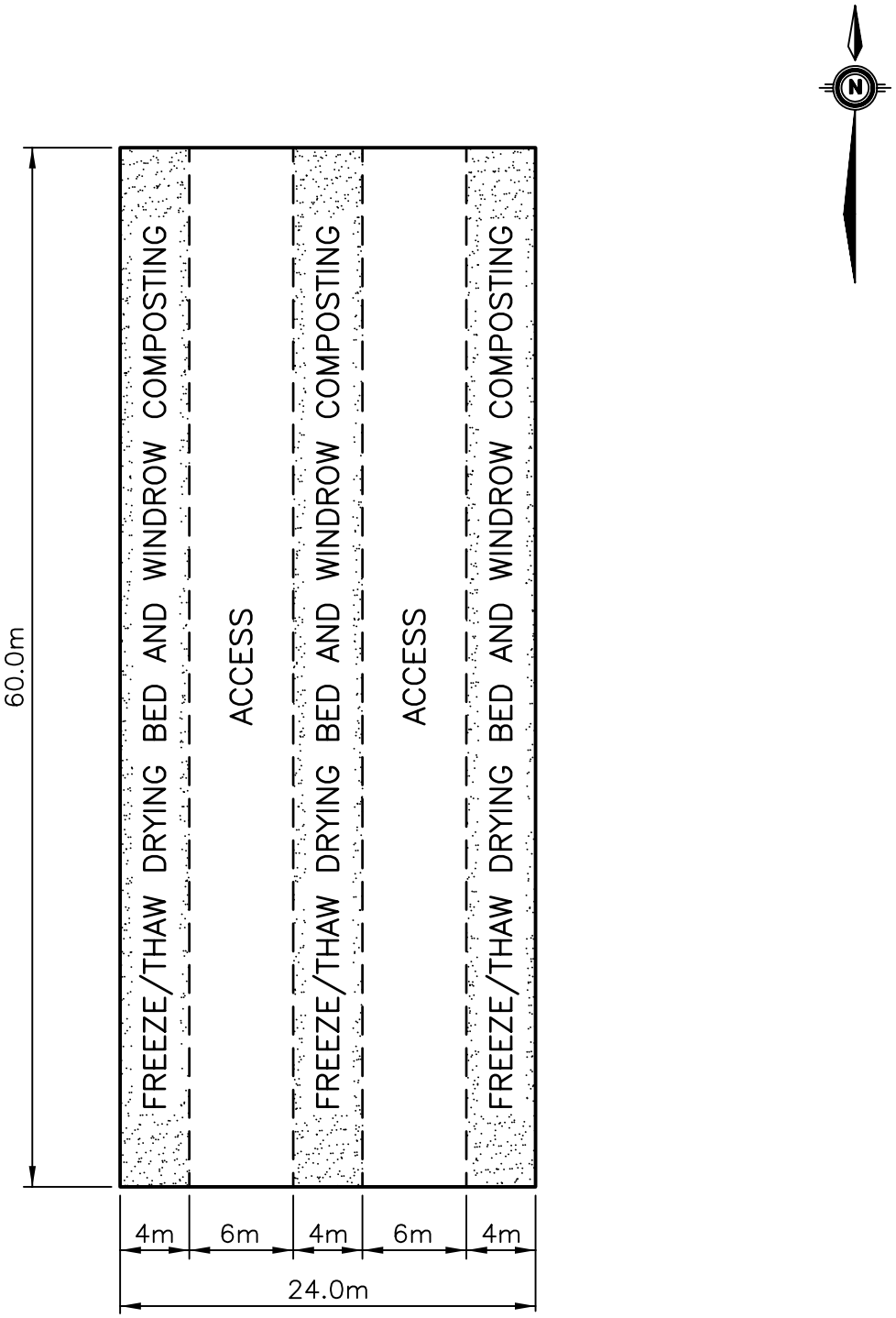
City of Iqaluit - Sludge Management

OPERATION and MAINTENANCE
FREEZE / THAW DRYING BED

Figure 6



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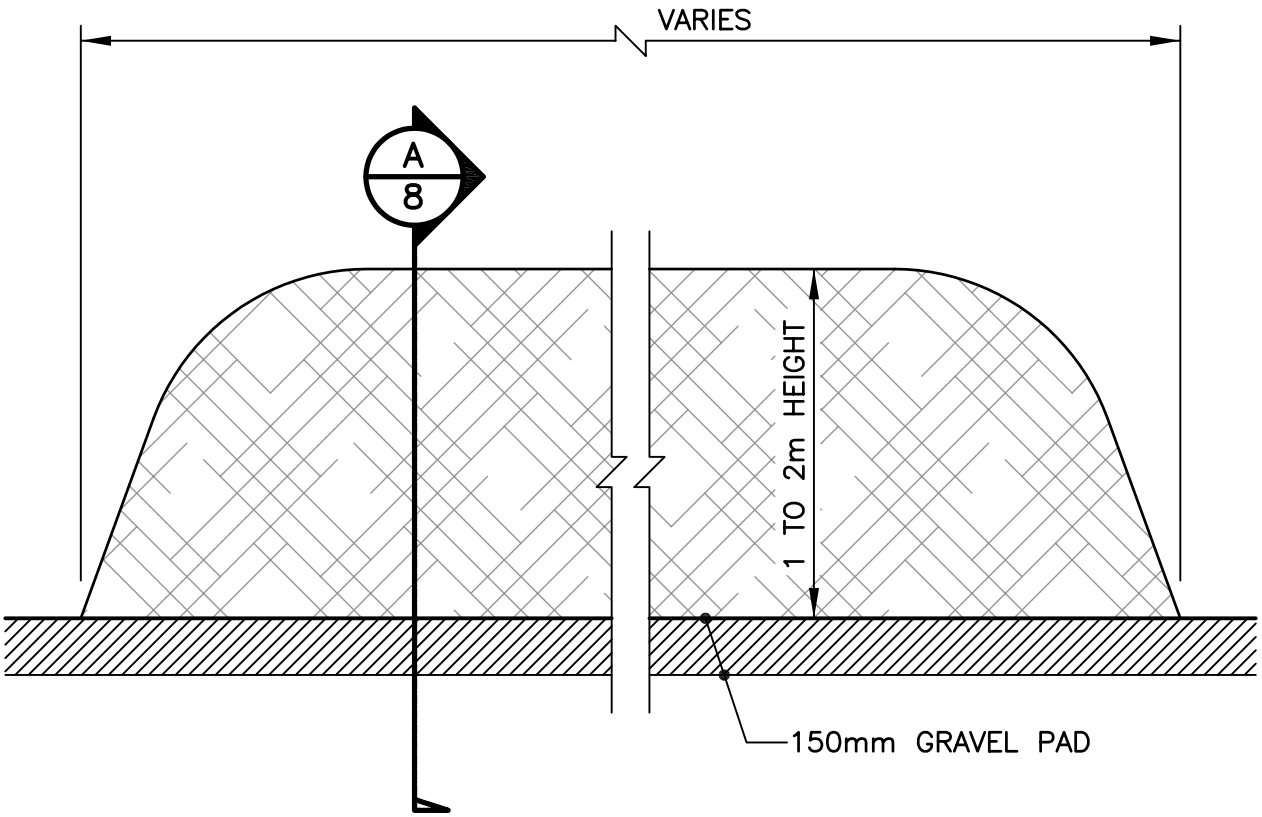
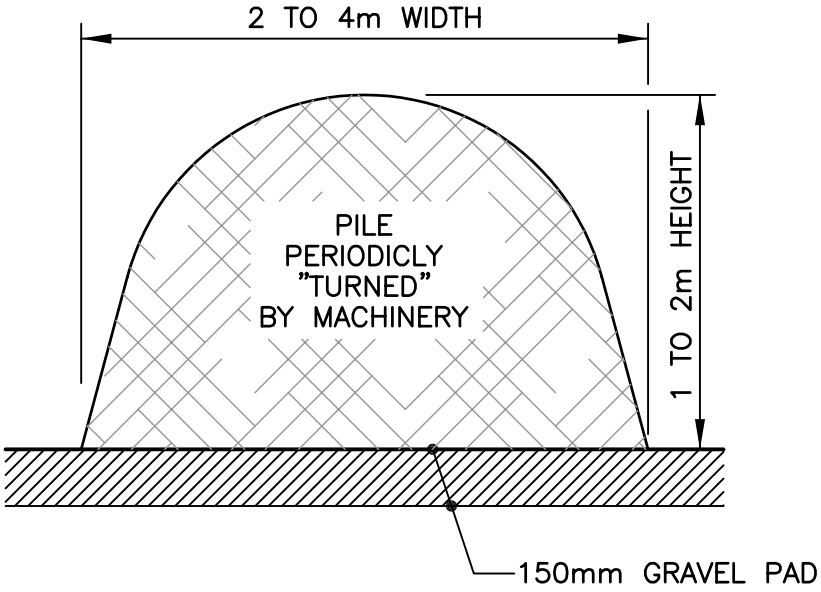
City of Iqaluit - Sludge Management

OPERATION and MAINTENANCE SITE UTILIZATION

Figure 7





SECTION A/8

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City of Iqaluit - Sludge Management

OPERATION and MAINTENANCE
WINDROW COMPOSTING

Figure 8

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Cadd File:86905_O&M FIGURE 08.dwg\Plot Scale: 1:1(A4)

Equipment used to process wood waste and cardboard to create shred material.

Stockpile of shred material for use in landfill operations and sewage sludge composting.

Front end loader with <u>proposed</u> bucket for mixing dried sludge and shred material for composting process.

Iqaluit Sludge Management
Operation and Maintenance
Site Equipment and Materials

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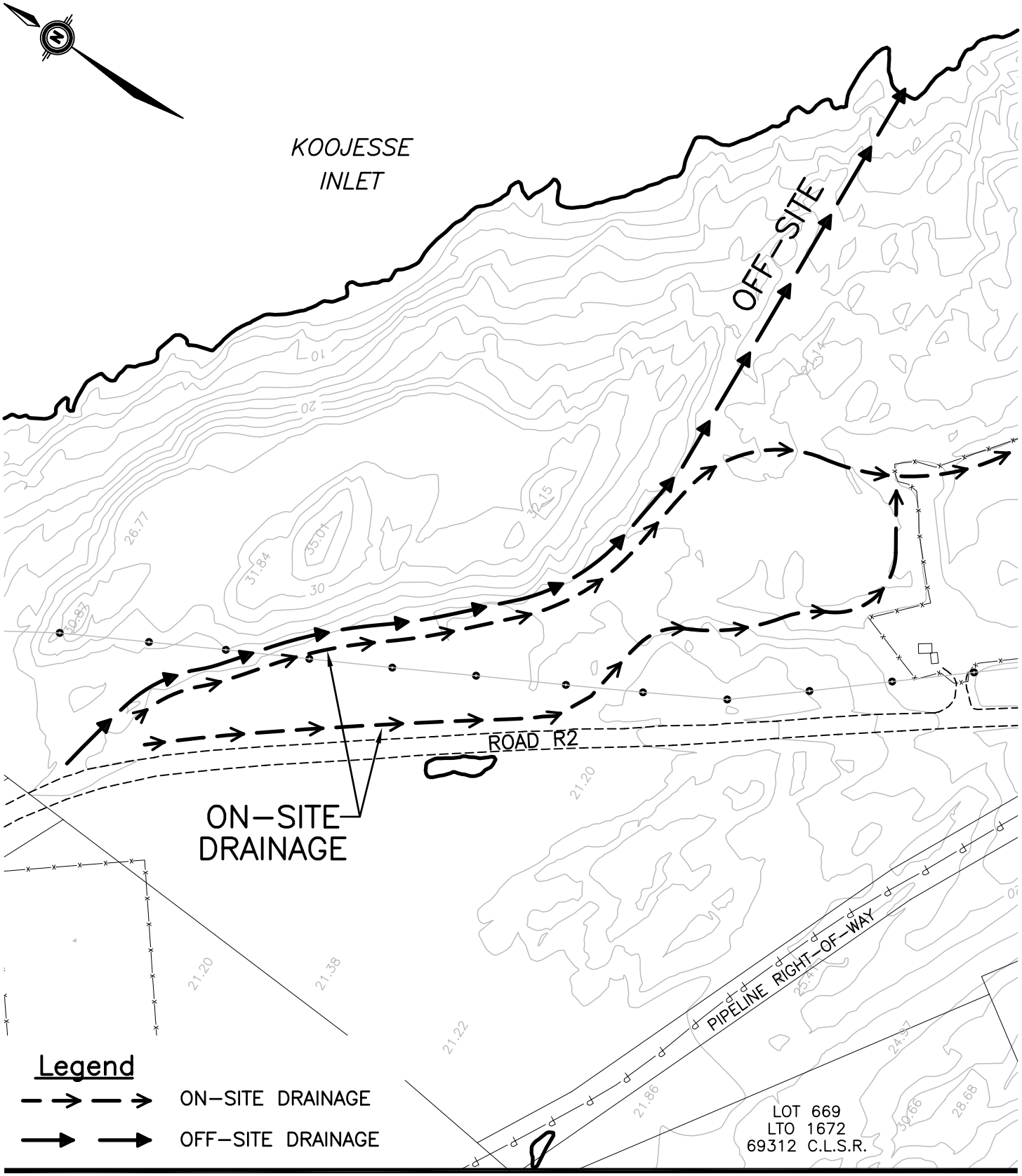
Figure 9



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Cadd File:86905_O&M FIGURE 10.dwg\Plot Scale: 1:2.5(A4)

City of Iqaluit - Sludge Management

OPERATION and MAINTENANCE SITE DRAINAGE

Figure 10