SNAP LAKE MINE

Waste Management Plan V.4

March 2019
## REVISIONS HISTORY

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Notes/Revisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste Management Plan</td>
<td>December 2014</td>
<td>n/a</td>
</tr>
<tr>
<td>Extended Care and Maintenance Water</td>
<td>April 2016</td>
<td>All Sections: The Extended Care and Maintenance Waste Management Plan has been updated to reflect the proposed flooded condition at Snap Lake Mine and update organizational structures. This is considered an addendum to the previously provided Waste Management Plan.</td>
</tr>
<tr>
<td>Management Plan V. 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extended Care and Maintenance Water</td>
<td>July 2016</td>
<td>Updated to address the interim MVLWB approval of June 22, 2016. Other revisions detailed within the ‘Table of Revisions included in the Plan.</td>
</tr>
<tr>
<td>Management Plan V.1.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extended Care and Maintenance Water</td>
<td>December 2017</td>
<td>Section 1.3, page 6: Statement regarding use of old sewage treatment plant versus new plant, which had filter issues. Section 2.4, page 13 (Table I): Oily rags were listed as an incinerated item, however, they are actually backhauled. Section 2.4 page 12: References to explosives were removed Section 3.0, page 19: “Bulk Sample Pit” was added to the options list for on-site domestic waste disposal. Section 3.1, page 20: Statement regarding 2014 stack testing was provided. Section 3.1, page 20: The statement “weight and burn temperatures are automatically recorded on the incinerator Programmable Logic Controller” was added Section 3.3, page 21: Bulk Sample Pit use Section 3.5, page 25: Land farm decommissioning Section 4.0, page 27: Movement Document/Manifest information was updated. Section 5.1, page 29: TP3 Section 6.0, page 30: Water treatment capacity volume was revised Section 6.1, page 32: Potable Water Treatment Plant Section 9.3, page 36: Fuel capacity volume was updated</td>
</tr>
<tr>
<td>Management Plan V.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extended Care and Maintenance Water</td>
<td>March 2018</td>
<td>Section 5.0, page 29:Sewage treatment updated verbiage Section 5.1, page 30: STP3 added Section 6.0, page 32: Water Treatment Plant updated verbiage Section 6.1, page 32: Potable Water Treatment Plant removed</td>
</tr>
<tr>
<td>Management Plan V.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Version 4</td>
<td>March 2019</td>
<td>All Sections: Plan has been updated to align with the Final Closure Plan and water licence application package</td>
</tr>
</tbody>
</table>
TABLE OF CONTENTS

REVISIONS HISTORY................................................................................................................................. I

ACRONYMS AND ABBREVIATIONS................................................................................................................ V

1. INTRODUCTION........................................................................................................................................ 1-1
   1.1 Background ........................................................................................................................................... 1-1
   1.2 Environmental Management Policy ................................................................................................. 1-1
   1.3 Objectives and Scope .......................................................................................................................... 1-5
   1.4 Land Fill Status .................................................................................................................................... 1-6
   1.5 Waste Management Strategy Closure ............................................................................................... 1-7

2. DESCRIPTION, IDENTIFICATION, CLASSIFICATION, AND STORAGE OF WASTE .................. 2-1
   2.1 Introduction .......................................................................................................................................... 2-1
   2.2 Description .......................................................................................................................................... 2-1
   2.3 Identification ....................................................................................................................................... 2-2
   2.4 Classification of Waste Streams and Hazardous Materials ............................................................. 2-4
   2.5 Storage of Wastes .............................................................................................................................. 2-5
      2.5.1 Waste Management Area ............................................................................................................. 2-6
   2.6 Protective Clothing and Equipment for Hazardous Materials ......................................................... 2-6
   2.7 Emergency Measures ......................................................................................................................... 2-6

3. ON-SITE DISPOSAL ................................................................................................................................. 3-1
   3.1 Incineration .......................................................................................................................................... 3-1
   3.2 Burn Pit ............................................................................................................................................... 3-2
   3.3 Bulk Sample Pit ................................................................................................................................... 3-3
   3.4 Landfill ................................................................................................................................................ 3-3
   3.5 Hazardous Waste Containment Facility Area and Area B (Former Tankfarm When Available) ......... 3-3
      3.5.1 Waste Management – Hydrocarbon Impacted Materials .............................................................. 3-3
      3.5.2 Operation of Waste Area A ........................................................................................................... 3-6
      3.5.3 Operation of Waste Area B (Tank Farm) ....................................................................................... 3-6
         3.5.3.1 Segregation of Annual Hydrocarbon Waste Material – Batches – If Waste Area B Constructed during Extended Care and Maintenance .......... 3-6
         3.5.3.2 Disposal of Oversize Rock ....................................................................................................... 3-7
         3.5.3.3 Procedure for Placement in the HWCFs ............................................................................... 3-7
      3.5.4 Water Management ....................................................................................................................... 3-9

4. OFF-SITE DISPOSAL ............................................................................................................................... 4-1

5. SEWAGE TREATMENT ........................................................................................................................... 5-1
   5.1 STP3 .................................................................................................................................................... 5-1
6. WATER TREATMENT ........................................................................................................... 6-1
7. MONITORING, MITIGATION, AND REVIEW ................................................................. 7-1
8. TRANSPORTATION PLAN ............................................................................................... 8-1
   8.1 Introduction .................................................................................................................... 8-1
   8.2 Contractor Requirements ............................................................................................. 8-1
9. PETROLEUM, OILS, AND LUBRICANTS ....................................................................... 9-1
   9.1 Introduction .................................................................................................................. 9-1
   9.2 Types and Quantities .................................................................................................... 9-1
   9.3 Design and Location of POL Storage Facilities ........................................................... 9-1
   9.4 Inspection and Monitoring ........................................................................................... 9-1
   9.5 Records Keeping .......................................................................................................... 9-1
   9.6 Training of Personnel .................................................................................................. 9-2
10. EXPLOSIVES .................................................................................................................. 10-1
    10.1 Introduction ............................................................................................................... 10-1
    10.2 Types and Quantities ................................................................................................ 10-1
    10.3 Design and Location of Storage Facilities ................................................................ 10-1
    10.4 Inspection and Monitoring ....................................................................................... 10-2
    10.5 Training of Personnel ............................................................................................... 10-2
11. REFERENCES .................................................................................................................. 11-1

List of Figures

Figure 1-1  Location of the Snap Lake Mine, Northwest Territories ........................................ 1-2
Figure 1-2  Snap Lake Mine: General Site Plan .................................................................... 1-3
Figure 3-1  North Pile Final Closure Design ........................................................................ 3-4
Figure 3-2  Hydrocarbon Impacted Material Workflow ......................................................... 3-8
Figure 5-1  Sewage Process Flow Diagram ......................................................................... 5-2

List of Tables

Table 2-1  Anticipated Waste Types, Management Strategies and Methodologies .................. 2-3
Table 2-2  Maximum Volumes of Hazardous Materials Stored at the Mine ............................ 2-5
Table 3-1  Hydrocarbon Impacted Material Waste Management at Snap Lake Mine .............. 3-5
Table 3-2  Operation Equipment Requirements for Waste Management Areas .................... 3-6
Table 4-1  Off-site Disposal, Recycled and Reused Items ..................................................... 4-1
Table 5-1  Sewage Treatment Plant Specifications ................................................................ 5-1
ACRONYMS AND ABBREVIATIONS

AN  Ammonium Nitrate
ANFO  Ammonium Nitrate Fuel Oil
BMP  Best Management Practices
CCME  Canadian Council of Ministers of the Environment
De Beers  De Beers Canada Inc.
EMS  Environmental Management System
GNWT  Government of the Northwest Territories
MVLWB  Mackenzie Valley Land and Water Board
NFCC  National Fire Code of Canada
PAG  Potentially Acid Generating
PK  Processed Kimberlite
PPE  Personal Protective Equipment
POL  Petroleum, Oils and Lubricants
SDS  Safety Data Sheet
SHE  Safety, Health and Environment
SHE OP  Safety, Health and Environment Operating Procedure
SNP  Surveillance Network Program
STP  Sewage Treatment Plant
TDG  Transportation of Dangerous Goods
WHMIS  Workplace Hazardous Materials Information System
WMP  Water Management Pond
WTP  Water Treatment Plant
1. INTRODUCTION

1.1 Background

De Beers Canada Inc. (De Beers) owns and operates the Snap Lake Mine located approximately 220 kilometers (km) northeast of Yellowknife, Northwest Territories, 30 km south of MacKay Lake, and 100 km south of Lac de Gras where the Diavik Diamond Mine, and the Dominion Diamond Mine are located (Figure 1-1). An Environmental Assessment Report (EAR) for the Mine (De Beers 2002) was submitted to the Mackenzie Valley Environmental Impact Review Board (MVEIRB) in February 2002. The Mine received approval from the Minister of Indian and Northern Affairs in October 2003, based on MVEIRB (2003). Final regulatory approvals for construction and operation of the Mine were granted in May 2004 and construction began in April 2005. The Mine reached full production in 2008 and was expected to continue operations for approximately 20 years. However, on December 4, 2015, De Beers announced that it would be suspending operations at Snap Lake Mine, and that the Mine would be placed under “care and maintenance”. An Extended Care and Maintenance Plan was submitted to the Mackenzie Valley Land and Water Board (MVLWB) in April 2016 (De Beers 2016). In December 2017, following an on-going evaluation of the Mine, De Beers announced the Mine would enter into final closure.

This Waste Management Plan is an update to previously prepared plans and has been modified for final closure.

1.2 Environmental Management Policy

De Beers is committed to the goal of sustainable development. This approach requires a balance between the protection of human health and the natural environment with the need for economic growth. To meet this goal of sustainable development, De Beers looks to maintain safe and efficient transportation, storage, handling, and use of all hazardous materials including but not limited to hydrocarbon products, ammonium nitrate and associated explosive materials. Diligence in the application of technically proven and economically feasible environmental protection measures will be exercised throughout exploration, mining, processing, and decommissioning activities, to meet the requirements of legislation and to ensure the adoption of Best Management Practices (BMP). De Beers’ policy is to:

- assess, plan, construct, and operate its facilities in compliance with all applicable legislation;
- provide for the protection of the environment, employees, and the public;
- foster research directed at expanding scientific knowledge of the impact of the industry’s activities on the environment, of environment/economy linkages, and of improved treatment technologies;
- work proactively with government and the public in the development of equitable, cost effective, and realistic laws for the protection of the environment; and
- enhance communications and understanding with government, employees, and the public.

De Beers’ Environmental Management Policy also states that the company will “protect the environment through the wise use of resources and prevention of adverse environmental impacts, including pollution prevention”. The general site plan for the Snap Lake Mine is shown in Figure 1-2.
Figure 1-1  Location of the Snap Lake Mine, Northwest Territories
Snap Lake Mine

Figure 1-2 Snap Lake Mine: General Site Plan
The primary focus of the wise use of resources is the conservation of raw materials. This is the “Reduce” component of the “Reduce, Reuse, Recycle” philosophy. The monetary and environmental costs to replenish raw materials by air and/or ice road to a remote location such as the Snap Lake Mine are significant and it is recognized that the physical replacement and consumption of raw materials depletes natural resources. Moreover, a small reduction in the consumption of raw materials may have far reaching benefits environmentally. Each person at the mine has the responsibility to be an active participant in reducing waste generation at source.

The secondary focus is the proper disposal of waste. This includes the implementation of “reuse and recycle” which minimizes waste. It also includes final disposal in the appropriate facility.

1.3 Objectives and Scope

The collection, storage, transportation, and disposal of all wastes generated during care and maintenance and final closure of Snap Lake will be conducted in a safe, efficient, and environmentally compliant manner. De Beers recognizes the importance of achieving these goals and outlines their commitment in the preparation of this Plan.

The overall goal for this Plan is to create a framework for the proper handling and disposal of waste, the minimization of potentially adverse impacts on the environment, and compliance with the Mine’s Water License and other regulatory guidelines for waste management. To meet this overall goal, the Plan has been developed to address the following four specific objectives:

- to describe domestic wastes generated at the mine site;
- to establish the principles of hazardous materials management;
- to outline practices and procedures for the collection, storage, transport, and disposal of those wastes; and
- to present monitoring and mitigation procedures for domestic wastes.

The Plan also outlines procedures that promote reduction, recovery, reuse, and recycling of waste streams. The storage handling, treatment and disposal of mine waste water is included in the Water Management Plan. The handling, deposition, and logging of mine waste, including potentially acid generating rock (PAG) and processed kimberlite (PK) are covered in the North Pile Management Plan.

As a minimum standard of acceptability, the Plan will be compliant with the Snap Lake Mine EMS, environmental laws and appropriate sections of the following Acts and associated Regulations, and Guidelines:

- Canadian Environmental Protection Act;
- Department of Indian Affairs and Northern Development Act;
- Environmental Protection Act;
- Fisheries Act;
- Hazardous Products Act;
• Northwest Territories Waters Act;
• Transportation of Dangerous Goods Act;
• Territorial Environmental Health Act;
• Territorial Lands Act;
• Territorial Public Health Act;
• NWT Guidelines for General Management of Hazardous Waste; and
• NWT Guidelines for the Management of Waste Batteries.

Compliance will be monitored using the following mechanisms:

• On site compliance monitoring;
• Inspections;
• Environmental audits (internal and external);
• Communication with regulatory authorities (federal, provincial, regional, and municipal); and
• Communication with other De Beers facilities.

The Plan gives consideration to the following as discussed in the Board waste management hierarchy:

• reducing volumes of waste through established plans and procedures;
• reducing waste disposal costs;
• prevention and reduction of adverse impacts on the environment including wildlife and fish, and their respective habitats;
• the health and safety of site personnel and visitors;
• the environmental integrity of soil and water;
• maximizing the efficient use of resources; and
• ensuring due diligence by contractors, vendors, and management.

As part of the overall continuous improvement process for the mine site, De Beers have established Safety, Health, and Environment Operational Procedures (SHEOPs) integrated within the De Beers EMS system. These operational procedures are reviewed on a regular basis and updates are completed as required on an ongoing basis.

1.4 Land Fill Status

The landfill will be operated in areas designated within the North Pile footprint. As per the design provided with the Final Closure and Reclamation Plan, landfill waste material will be placed in the North Pile. The feasibility design concept restricts placement of landfill waste material in the East Cell to within Cell 2, Cell 5, and the existing landfill Cell 1. This reduction of footprint requires excavation of the deposited PK material in Cell 2 and Cell 5 to gain the required storage capacity for landfill waste material placement.
The excavated PK material would be placed in Cell 3 and Cell 4. The landfill waste material to be placed in Cell 1, Cell 2, and Cell 5 is anticipated to be mostly demolition waste from site decommissioning.

As per the design of the facility and the existing site permits, a minimum non-acid generating cover thickness of 2 m will be placed over deposited landfill waste material. Similar to the deposited PK cover profile, the profile will include 300 mm of erosion protection as the uppermost layer of the cover. The remaining 1.7 m of the required 2 m thickness will be non-acid generating material. The specific composition of this 1.7 m profile will be defined based on material availability and the conditions once the landfill material has been placed. If fine PK is used to cover the landfilled waste, a minimum 150 mm layer of transition material will be required above the fine PK.

1.5 Waste Management Strategy Closure

As the mine is located in a remote site, quantities of materials are transported and stored on-site to ensure availability of supplies during the periods when winter road access is not available. To address this volume of waste, the waste management strategy for operations will continue to focus on reducing the amount of material consumed wherever possible. These measures include the following:

- use of bulk containers for items used in large quantities (i.e., lube oil, cooking oil, beverages);
- tire recycling (where opportunities exist);
- use of waste oil for heat generation (waste oil burners in place in selected site facilities);
- selection of environmentally friendly packaging where possible;
- appropriate separation of waste for on-site and off-site disposal;
- effective and efficient disposal of waste on-site;
- appropriate storage of waste awaiting removal from site; and
- transportation of waste to an appropriate off-site facility for reuse, recycling, or disposal.
2. DESCRIPTION, IDENTIFICATION, CLASSIFICATION, AND STORAGE OF WASTE

Waste as defined in the Water Licence means any substance defined as waste by section 2 of the Northwest Territories Water Act, which states:

“waste” means

(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 33(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 33(1)(b)(ii), and

(f) water that has been subjected to a treatment, process or change prescribed by regulations made under subparagraph 33(1)(b)(iii)

Mine waste and water are discussed in the North Pile Management Plan and the Water Management Plan.

2.1 Introduction

The management of waste requires that safety and proper techniques must be considered during transportation, handling, storage, distribution, use, and final disposal.

All hazardous materials will be labelled and classified according to Transportation of Dangerous Goods (TDG) and WHMIS regulations. Specific instructions for the storage and handling of hazardous materials are outlined in the Snap Lake Mine Operating Procedure, SHE OP 0026A Storage and Handling of Hazardous Materials. This operating procedure forms part of the Snap Lake Mine Environmental Management System (EMS).

2.2 Description

The two forms of waste generated at Snap Lake for the purposes of this Plan are domestic waste and hazardous waste. Waste related to mine operations such as slurry and paste from the Process Plant,
seepage from the North Pile, and discharge from the Water Treatment Plant (WTP) are covered in detail, under separate cover, in the North Pile Management Plan and Water Management Plan.

Domestic waste at the mine site is considered as the waste generated from day to day operations, and is separated into two streams:

- solid domestic waste; and
- organic waste.

Waste streams incorporate the type of waste, treatment or disposal strategy, site handling methodology, and primary responsibility, as shown in Table 2-1.

Hazardous wastes and hazardous recyclable materials are defined as those with properties such as flammability, corrosiveness, or inherent toxicity. These wastes and materials can pose a variety of risks, from skin damage on contact to the contamination of ground water, surface water, and soil as a result of leaching into the environment.

Hazardous wastes and recyclables come from many sources, including material left over from industrial activities such as oil refining, chemical manufacturing and metal processing. Even some everyday household products such as used batteries, computers and other electronic equipment, cleansers, paints, and pesticides may be hazardous when improperly discarded or recycled.

2.3 Identification

All personnel who may come into contact with or manage hazardous materials will be trained in proper procedures. Any employees working with acids, oils, fuel, radioactive materials, or other hazardous substances must be trained on the procedure for the storage, handling, and disposal of these products, and their containers, and be made aware of the consequences of not conforming to relevant procedures. All materials are labelled by Workplace Hazardous Materials Information System (WHMIS) categories and labels.

Specific procedures for training employees in environmental safety are included in the EMS system procedure; Training and Awareness.

Responsibility for waste disposal varies depending on the waste type. All domestic and hazardous wastes are segregated, packaged, and stored in appropriate containers by Site Services personnel. Waste containers will be appropriately labelled and hazardous waste signs posted at the storage, transfer, and disposal facilities. It is the responsibility of Site Services to transport the containerized waste to the Waste Management Area. Shipments off-site will be the responsibility of the Logistics Department including compliant legislative documentation.
<table>
<thead>
<tr>
<th>Waste Type</th>
<th>Treatment or Disposal Strategy</th>
<th>Site Handling Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Domestic Waste</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food</td>
<td>Collect and store inside incinerator building until ready for incineration</td>
<td>Incineration at campsite incinators</td>
</tr>
<tr>
<td>Food Contaminated Plastics, Tin Cans, Glass</td>
<td>Collect and store in secure containers</td>
<td>Off-site disposal or within the landfill</td>
</tr>
<tr>
<td>General Camp Waste</td>
<td>Separate according to waste type</td>
<td>Recycle / Incinerate / Landfill as appropriate</td>
</tr>
<tr>
<td>Non-recyclable Plastics</td>
<td>Store in approved bins / containers</td>
<td>Landfill</td>
</tr>
<tr>
<td>Paper / Cardboard</td>
<td>Recycle and / or blend with kitchen wastes</td>
<td>Incinerate</td>
</tr>
<tr>
<td>Glass</td>
<td>Cleaned and stored in approved bins</td>
<td>Landfill</td>
</tr>
<tr>
<td>Recyclable Beverage Containers</td>
<td>Collect and store in containers until ready for backhaul on winter road</td>
<td>Recycle</td>
</tr>
<tr>
<td>Bio-hazardous Waste</td>
<td>Collect and store until ready for incineration</td>
<td>Incinerate</td>
</tr>
<tr>
<td>Sewage Sludge</td>
<td>Dewater and landfill</td>
<td>Dewater sludge in Sewage Treatment Plant (STP), bag, load in transfer bin, deposit and bury in landfill</td>
</tr>
<tr>
<td><strong>Hazardous Waste</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oily Rags</td>
<td>Collect and store for backhaul on winter road</td>
<td>Off-site disposal at an accredited facility approved to accept such waste</td>
</tr>
<tr>
<td>Waste Glycol</td>
<td>Collect and store for backhaul on winter road</td>
<td>Off-site disposal</td>
</tr>
<tr>
<td>Used Oil Filters</td>
<td>Collect and store for backhaul on winter road</td>
<td>Off-site disposal</td>
</tr>
<tr>
<td>Diesel/Glycol Impacted Water</td>
<td>Collect and store for backhaul on winter road</td>
<td>Off-site disposal</td>
</tr>
<tr>
<td>Waste Flammable Liquid (Waste Jet B, Gasoline, Diesel)</td>
<td>Collect and store for backhaul on winter road</td>
<td>Off-site disposal</td>
</tr>
<tr>
<td>Waste Aerosol Containers</td>
<td>Collect and store in lined crates for backhaul on winter road</td>
<td>Off-site disposal</td>
</tr>
<tr>
<td>Batteries</td>
<td>Collect and store in lined crates for backhaul on winter road</td>
<td>Off-site disposal</td>
</tr>
<tr>
<td>Hydrocarbon Impacted Soil</td>
<td>Collect and store within the Hazardous Waste Containment Facility for ex-situ remediation or backhaul on winter road</td>
<td>On-site ex-situ remediation or off-site disposal</td>
</tr>
</tbody>
</table>
2.4 Classification of Waste Streams and Hazardous Materials

Due to the remote location and logistics of the Snap Lake mine site, considerable volumes of materials are transported and stored on-site to ensure availability of supplies when the winter road is not accessible. The majority of hazardous materials that will be used during mining can be grouped into the following three site categories:

- Petroleum, Oils and Lubricants (POLs);
- Explosives; and
- Other Hazardous Chemicals.

Lists of hazardous materials have been updated as of 2018 for the final closure and reclamation plan. These lists are approximate, and will be subject to change in light of care and maintenance and closure activities. Miscellaneous materials are those that are used in small volumes and/or not regularly stocked on site.

Hazardous materials are classified according to the Transportation of Dangerous Goods Act and Regulations. All of the substances that fall under these regulations will be labelled to inform personnel as to their toxicity and to comply with governmental regulations. Safety Data Sheets are available on-line at http://ccinfoweb.ccohs.ca/msds/search.html for all hazardous materials located onsite and are available at various computer terminals located across site. No paper copies of the Sheets are used on site to prevent non-conformance with the Environmental Management System. Hazardous materials will be grouped according to TDG categories by the Site Supervisor. Specific categories of hazardous materials that may be present on-site include:

- Class 1 Explosives (e.g., caps, ANFO, Emulsion, stick powder)
- Class 2 Compressed gases (acetylene, oxygen, propane tanks)
- Class 3 Flammable liquids (e.g., gasoline, diesel)
- Class 4 Flammable solids (e.g., calcium carbide)
- Class 5 Oxidizers (e.g., peroxide)
- Class 6 Poisonous and infectious substances (e.g., cyanide, pesticides)
- Class 7 Radioactive material (e.g., nuclear density gauges)
- Class 8 Corrosive material (e.g., caustic soda, acids)
- Class 9 Miscellaneous hazardous materials (e.g., PCBs, asbestos)

De Beers requires that all contractors and suppliers comply with Federal and Territorial TDG and WHMIS regulations for the storage, handling, and transportation of hazardous waste. For example, the shipper/receiver must ensure that the carrier or transporter has the proper placards and labelling. The shipper/receiver must also ensure that handling and storage of dangerous goods comply with TDG requirements. Labelling of containers must comply with WHMIS standards.
2.5 Storage of Wastes

At the mine site, hazardous materials will be stored in various locations associated with their intended use to minimize site transport and handling requirements. All hazardous, non-combustible and contaminated waste materials will be temporarily stored in the lined berm of the Waste Management Area inclusive of the Hazardous Waste Containment Facilities (HWCF) Area A and Area B (Former Tankfarm after demolition). All waste will be contained in sealed, steel, or plastic drums and shipped off-site for disposal or recycling or in the case of hydrocarbon impacted material, bulk deposited within the waste management area. Hazardous waste storage locations can be found in Table 2-2.

Table 2-2 Maximum Volumes of Hazardous Materials Stored at the Mine

<table>
<thead>
<tr>
<th>Material</th>
<th>Approximate Amount</th>
<th>Storage Location</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Petroleum, Oils and Lubricants</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diesel fuel</td>
<td>12,000,000 litres</td>
<td>Tank Farm</td>
</tr>
<tr>
<td>Gasoline</td>
<td>2,500 litres</td>
<td>Adjacent Environment Shop</td>
</tr>
<tr>
<td>Gear Oils and Lubricants</td>
<td>150,000 litres</td>
<td>Laydown Area 1</td>
</tr>
<tr>
<td></td>
<td>150,000 litres</td>
<td>Services Complex</td>
</tr>
<tr>
<td>Jet-A Fuel</td>
<td>31,000 litres</td>
<td>Waste Management Area</td>
</tr>
<tr>
<td><strong>Other Hazardous Materials</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windshield Washer Fluid</td>
<td>9,500 litres</td>
<td>Warehouse</td>
</tr>
<tr>
<td></td>
<td>500 litres</td>
<td>Services Complex</td>
</tr>
<tr>
<td>Ethylene Glycol</td>
<td>4270 litres</td>
<td>Lube Shop</td>
</tr>
<tr>
<td></td>
<td>16,176 litres</td>
<td>Powerhouse</td>
</tr>
<tr>
<td></td>
<td>3300 litres</td>
<td>Laydown Area 1</td>
</tr>
<tr>
<td>Propylene Glycol</td>
<td>Only what is used in current system circulation</td>
<td>None stored</td>
</tr>
<tr>
<td>Propane</td>
<td>95 (20 lbs)</td>
<td>Laydown Area 1</td>
</tr>
<tr>
<td></td>
<td>20 (100 lbs)</td>
<td></td>
</tr>
<tr>
<td>Acetylene</td>
<td>30 bottles</td>
<td>Laydown Area 1</td>
</tr>
<tr>
<td>Oxygen</td>
<td>60 bottles</td>
<td>Laydown Area 1</td>
</tr>
<tr>
<td>Paint</td>
<td>500 litres</td>
<td>Laydown Area 1</td>
</tr>
<tr>
<td>Solvents</td>
<td>500 litres</td>
<td>Laydown Area 1</td>
</tr>
<tr>
<td>Sulphuric Acid (Batteries)</td>
<td>0 litres (batteries are sealed)</td>
<td>Laydown Area 1</td>
</tr>
<tr>
<td>Sulphuric Acid (water treatment)</td>
<td>109,000 litres</td>
<td>Outside Utilities Bldg.</td>
</tr>
<tr>
<td>Lime</td>
<td>18,360 kg</td>
<td>Sewage Treatment Plant #2</td>
</tr>
<tr>
<td>Sodium Hypochlorite (12%)</td>
<td>500 litres</td>
<td>Potable Water Plant</td>
</tr>
<tr>
<td>Cement</td>
<td>20,000 tonnes</td>
<td>Laydown Area 1</td>
</tr>
<tr>
<td>Material</td>
<td>Approximate Amount</td>
<td>Storage Location</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Concrete Additives</td>
<td>2,000 litres</td>
<td>Laydown Area 1</td>
</tr>
<tr>
<td>Curing Compounds</td>
<td>100 litres</td>
<td>Laydown Area 1</td>
</tr>
<tr>
<td>Flocculants</td>
<td>10 tonnes</td>
<td>Process Plant</td>
</tr>
<tr>
<td></td>
<td>10 tonnes</td>
<td>Water Treatment Plant</td>
</tr>
<tr>
<td>Ferric Sulphate</td>
<td>17,000 kg</td>
<td>Water Treatment Plant</td>
</tr>
<tr>
<td>Ferrosilicon</td>
<td>500 tonnes</td>
<td>Process Plant</td>
</tr>
<tr>
<td>Alum</td>
<td>2,000 litres</td>
<td>Laydown Area 1</td>
</tr>
</tbody>
</table>

These storage locations and facilities will follow all the protocols mentioned in this Waste Management Plan. All containers used to store hazardous materials will be closed and sealed when not in use. All storage facilities will be in compliance with the GNWT legislation and the National Fire Code of Canada (NFCC). All storage tanks will be regularly inspected and maintained as per regulatory requirements. Storage facilities will be clearly identified with proper labelling as storage facilities for hazardous materials. They will also be well ventilated in order to prevent the build-up of toxic fumes or dust, which could harm both the personnel present and the environment. The facilities will be secured and only authorized personnel will have access to the area.

2.5.1 Waste Management Area

The waste management area is the primary location for waste storage. Located in the waste management area are two incinerators, the lined and bermed area for hydrocarbon and hazardous wastes storage (HWCF Areas A and Area B Tankfarm), wooden crates containing recyclable materials such as aluminium cans and copper wire, a burn pit, and totes and bins containing other items stored until they can be backhauled off site.

2.6 Protective Clothing and Equipment for Hazardous Materials

It is of the utmost importance that personnel are aware of waste products they are handling and wear appropriate personal protective equipment (PPE) as outlined by WHMIS and TDG regulations and the Snap Lake Mine Operating Procedures. Appropriate protective equipment and clothing, spill kits, and SDS will be available to personnel responsible for the transportation, handling, storage, distribution, use, and disposal of hazardous materials. These safety items will be available in every vehicle that transports these goods, and in all facilities that store and handle hazardous materials.

2.7 Emergency Measures

The Snap Lake Mine Spill Contingency Plan has been prepared in accordance with the MVLWB’s “Guidelines for Contingency Planning”. The plan outlines the response organization, reporting responsibilities, and procedures for spills. It provides specific information about site facilities, response plans, and the training of response teams.
3. ON-SITE DISPOSAL

The overall waste management philosophy, under De Beers’ environmental policy, is based on the following principles:

- Health and safety all of site employees and visitors is paramount.
- The “Three R” principles (Reduce, Reuse and Recycle) will be implemented.
- Treatment, disposal and management of waste will be performed on site to the maximum practical and economic extent in order to minimize the volume of waste shipped off site.
- The generation of wastes that may attract wildlife or the interaction between humans and wildlife will be minimized.
- Measures will be implemented to reduce waste generation at the source and minimize wildlife attractants.
- A materials procurement policy will stipulate which types of materials are prohibited on site, due to known unacceptable waste products, and will require that products with minimal waste generation be given priority over alternatives where economic and practical.
- Waste management principles and procedures will form a fundamental component of personnel site orientation and education. This program will be enforced by site management personnel, through regular site inspections and auditing.

Efforts will focus on recycling and reuse where possible. Waste oil will be used as an alternate fuel source to offset diesel oil consumption for heating some of the ancillary buildings.

Options for on-site domestic waste disposal are limited to:

- incineration;
- burn pit;
- bulk sample pit;
- landfill; and
- Hazardous Waste Containment Facilities.

3.1 Incineration

De Beers uses two Ketek incinerators (model CY-100-CA) for incineration at Snap Lake Mine.

The Ketek incinerators are capable of meeting the conditions of the Land Use Permit, under section 26(1)(i), item 54, which states “The Permittee shall select a unit that is capable of meeting an emission concentration limit of dioxans and furans of 80 pg TEQ/m³.”
Furthermore, the unit is guaranteed to be capable of meeting the NWT emission regulations and CCME guidelines. The following items are incinerated on site:

- food waste (i.e. some food containers, napkins, and wrappings);
- paper and cardboard;
- general camp and office wastes (cleaning rags, used office supplies, etc.); and
- first aid station waste.

Food waste or food-contaminated wastes are a prime wildlife attractant. It is critical that such wastes are accurately identified, sorted, and directly incinerated. The kitchen and dining room are the main sources of food waste. However, all wastes in offices are treated as food-contaminated waste and collected for direct incineration. Lunchroom waste from facilities located around the site are collected and transferred to the incinerator.

To reduce the potential for attracting wildlife, waste is placed in containers such as sealed sea cans. Incineration occurs daily to minimize long term storage of waste.

A composite sample of the incinerator ash is collected and sent to a laboratory on a quarterly basis (during periods of operation) and tested for metals, heavy metals, and various organic compounds; with the removed ash land filled at the on-site land fill area within the North Pile, as per the Guidelines for the Management and Operation of Landfill in the Northwest Territories.

The incinerator units have been designed and were purchased with the stipulation that if the units are maintained and operated in accordance with the vendor’s procedures the units will be operated in compliance with environmental standards, including the air quality emissions requirements.

Stack testing of the incinerators for dioxin, furans and mercury emissions was conducted in 2014 to confirm whether the incinerators were capable of meeting Canada-Wide Standards for dioxin, furans and mercury emissions. Results were reported to Environment Canada, the Snap Lake Environmental Monitoring Agency, and the Government of the Northwest Territories. While De Beers did not achieve the CWS standards for dioxins and furans, through consultation with Environment Canada and the GNWT De Beers’ continuous improvement and adaptive management measures have been demonstrated to promote successful operation of the equipment to-date.

The incinerators are periodically inspected by the equipment manufacturer’s representatives to ensure the units are operating optimally, and that recommended maintenance requirements are met.

### 3.2 Burn Pit

The burn pit is located in the Waste Management Area adjacent to the North Pile drainage system. No food wastes or other potential animal attractants are placed in the burn pit. The only materials permitted for disposal include untreated timber and cardboard as per the GNWT position paper on open burning.
3.3 Bulk Sample Pit

The bulk sample pit was approved to be used as a disposal area for shotcrete and concrete for the life of mine by the GNWT Inspector in 2014. The material placed in the bulk sample pit is to be inert and requires a non-PAG material cover after disposal to avoid windblown debris.

3.4 Landfill

As part of the Final Closure Plan the team generated estimates of total inert waste volume generated from the demolition works by using a bottom-up approach. This was based on the calculated waste volume for each building and its content, as well as the volumes calculated for the various laydown/debris piles and other infrastructure (pipelines, power poles, etc.) throughout the site (Figure 3-1).

The contractor team were on-site between September 19-21, 2018 to collect a significant amount of additional data on the current conditions and refine its estimates further.

These estimates were validated by comparison with actual waste volumes measured from past projects with similar buildings and facilities/contents. These volumetric calculations and comparisons with past projects are based on many years of experience and data collection (volume waste/m² based on industry/building type). The detailed volume estimate by building is presented in the Final Closure and Reclamation Plan. It is noted that the total estimated volume of compacted material is approximately 95,000 m³ and with at least an additional 25% of daily cover required to limit the spread of litter during waste placement, this would relate to a landfill airspace volume of approximately 120,000 m³ to 130,000 m³.

The management of the wastes at the landfill location will occur at the same time as the demolition and/or inert waste removals occur. This will involve the effort for a crew at the landfill to unload and compact the waste material, and to apply a daily cover when required to limit the spread of airborne debris and litter. Most of the inert waste will be processed and consolidated where the demolition is occurring to reduce the trucking volume. However, for certain buildings such as the ATCO trailers and offices, these will be raised and loaded onto the step deck trailers so that they can be hauled and consolidated at the landfill, thereby reducing the spread of litter and lighter materials. Non-potential acid generating (non-PAG) processed kimberlite host material, available within 500 m of the active waste face, will be used as daily cover. Additional environmental protection measures (e.g. snow fencing) would be considered should monitoring indicate it to be necessary. At the completion of the waste placement in the landfill, a cover will be constructed consistent with the North Pile design included with the FCRP.

3.5 Hazardous Waste Containment Facility Area and Area B (Former Tankfarm When Available)

3.5.1 Waste Management – Hydrocarbon Impacted Materials

The practices that are used for the management of hydrocarbon impacted material at the Snap Lake Mine are listed in Table 3-1.
Figure 3-1 North Pile Final Closure Design
### Table 3-1 Hydrocarbon Impacted Material Waste Management at Snap Lake Mine

<table>
<thead>
<tr>
<th>Waste Category</th>
<th>Material</th>
<th>Storage Area (primary = 1°, secondary = 2°)</th>
<th>Handling Methods</th>
<th>Disposal Methods</th>
</tr>
</thead>
</table>
| Contaminated Soil, Water, and Snow    | Contaminated soil               | • Storage and/or Treatment in Waste Area B (lined with sump)  
• 1° containment                                                                                     | • Placed in lined containment area;  
• Ex-situ treatment (Landfarming, chemical amendments, soil stabilization or low temperature thermal desorption); or  
• Shipped Off-site in containers meeting TDG standards.                                                                                                       | Shipped off-site to an approved Waste Receiver or remediated on-site. Soil meeting appropriate criteria will be used on site as authorized. |
|                                       |                                 | • Water collected from within containment berms  
• Contaminated snow and Ice                                                                           |                                                                                           |                                                                                                                                                                                                               |
|                                       |                                 | • Oil:water separator  
• 2° containment                                                                                     | Contaminated snow and ice is taken to the Snow Storage Tank, from there it is pumped to the oil:water separator, then tested against effluent quality criteria before discharged. Rain water or freshet melt collected within containment berms will also be treated and discharged. |                                                                                                                                                                                                               |
|                                       |                                 |                                                                                                         |                                                                                           |                                                                                                                                                                                                               |
|                                       |                                 |                                                                                                         | • Treated water that meets effluent quality criteria is no longer considered hazardous waste and can be discharged to an approved location or the WMP.  
• Collected oils are transferred to storage drums and stored at the Waste Management Area, before transfer off-site for further treatment or disposal. |                                                                                                                                                                                                               |
|                                       |                                 |                                                                                                         |                                                                                           |                                                                                                                                                                                                               |
| Contaminated rock not suitable remediation or bulk transport off-site. | Rock will temporarily be stored in the Waste Management Areas and then placed directly within the North Pile Interior Berms | Rock will be excavated using mining equipment and transported to the Interior Berms of the North Pile via haul truck or other suitable vehicle |                                                                                                                                                                                                               | Contaminated rock will be placed within the North Pile and covered process kimberlite to prevent migration potential due to water infiltration. |
3.5.2 Operation of Waste Area A

Within Waste Area A hazardous materials will be stored in various locations associated with their intended use to minimize site transport and handling requirements. All hazardous, non-combustible and contaminated waste materials will be temporarily stored in the lined berms of the Waste Management Area (Area A) bulk deposited (impacted soil) and/or contained in sealed, steel, or plastic drums and shipped off-site for disposal or recycling.

3.5.3 Operation of Waste Area B (Tank Farm)

In light of the closure of the mine, the Waste Area B will be within a tankfarm lined area once demolition is complete. This section has been included in this version of the plan as previously approved by the MVLWB. Potentially impacted hydrocarbon material originating from the Landfarm decommissioning or other areas of the mine over the life of the project, will be contained in Area B. De Beers intends to operate Area B as described in the following sections.

Impacted soil from mine operations will be sent to Areas A and B. Impacted soils will be either removed from Site to an approved waste management receiver, or remediated on-site using an ex-situ remedial technology (chemical amendments and or landfarming). Once remediated to an acceptable level, they will be considered clean fill and can be reused on-site.

3.5.3.1 Segregation of Annual Hydrocarbon Waste Material – Batches – If Waste Area B Constructed during Extended Care and Maintenance

Impacted soil encountered during the decommissioning and demolition of the mine will be placed within Area B. The soil accumulated will be treated together as one “batch”. Once placed in the waste area no additional soil will be added to it.

Over subsequent years, a new batch will be created (one for each operating year). It may be necessary to designate several areas within the waste area to allow sufficient time for each batch to completely remediate or be transferred off-site to an approved waste receiver. The batches will be separated by markers indicating the maximum height for the soil, and the year the soil batch was created. The On-site Technician will direct orange snow fencing to be laid down to indicate the batch area for the year, and to protect the liner from inadvertantly being damaged. The equipment requirements for the Waste Management Areas are described in Table 3-2.

<table>
<thead>
<tr>
<th>Work objective</th>
<th>Equipment requirements</th>
<th>Frequency of use</th>
</tr>
</thead>
</table>
| Easily visible indication of annual treatment piles | • Large stakes labeled with spill event (or equivalent)  
• Orange snow fencing to be used for the marking of sorted piles | Annual labeling of the new treatment piles in the spring of each year. |
<p>| Aeration/ Chemical Amendment                        | Small dozer, or equivalent to be used for the routine turning/treatment. | When ground is unfrozen |</p>
<table>
<thead>
<tr>
<th>Work objective</th>
<th>Equipment requirements</th>
<th>Frequency of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil/water separation</td>
<td>Oil water separator</td>
<td>After large summer rain events and with spring melt water</td>
</tr>
<tr>
<td>Waste water transport</td>
<td>Water tank truck and pump</td>
<td>After large summer rain events and with spring melt water</td>
</tr>
<tr>
<td>Oversize material separation</td>
<td>Grizzly solids screening</td>
<td>Every time waste material is added to the WMA or Area B</td>
</tr>
</tbody>
</table>

### 3.5.3.2 Disposal of Oversize Rock

Oversize rock is any material over 3” in diameter or long dimension. The On-site Technician will designate an area for this material within Area B for the temporary storage of oversize material contaminated with petroleum hydrocarbons. The oversized material will be used for construction within the interior structures of the North Pile located greater than 30 m from the high water mark.

### 3.5.3.3 Procedure for Placement in the HWCFs

**a. Soil Arrives at Facility**

Impacted soils will be brought to the waste area from various locations in the Snap Lake Project area (initially from the Landfarm). Before the soil is placed, it must be screened to separate the soil from any oversize material (>3” diameter) that might be in the soil. Soil and oversize material are treated differently, so they must be separated.

**b. Separate Soil from Oversize Material**

The Operator shall separate the soil from the oversize material as follows:

- A front-end loader will be used to load the soil onto a screen to separate the oversize from <3” material.
- Once the soil and the oversize rock are separated, the material will be moved to the designated areas. The oversize rock will be used for the interior construction of the North Pile at a distance >30 m from the high water mark.

**c. Hydrocarbon Impacted Material Workflow**

After the soil has been screened and the oversize removed, the soil can be placed in the Waste Area (Figure 3-2).

**d. Final Soil Guideline Choice**

Remediation of soil in Areas A or B will have been considered a success when CCME and Canada Wide Standards for Agricultural (Wildland) Coarse Grained criteria or an alternative satisfactory to the GNWT Inspector are achieved for Petroleum Hydrocarbons.
Figure 3-2  Hydrocarbon Impacted Material Workflow

Hydrocarbon Impacted Material Identified

Soil or Gravel

Place in Hazardous Waste Facility (Bulk Placement or place in containment for off-site disposal)

Smaller grain <3" diameter

Locate Batch Area for current year and place within Waste Area Maintaining 1 m freeboard above berms

Remediate Soil using Ex-situ Technology or Remove off-site to an approved waste receiver

Oversized Rocks and Large Grain Crush > 3"

Temporarily Place within Waste Area

Use for construction of interior berms of North Pile

Snow or Ice

Place in appropriate storage container treat on-site using oil/water separator or transport to a waste receiver.
e. Monitoring Specific to Hydrocarbon Impacted Soil

*Environmental Monitoring*

Waste Management facilities are within the current monitoring network at Snap Lake Mine. Soil samples will be representative of the batch and will be sampled at a frequency that is representative of the contamination and is satisfactory to the inspector prior to re-use on Site.

f. Remedial Options for Hydrocarbon Impacted Material

Options for Remediation may include the following:

- Contaminated soil transferred off-site to an approved waste facility;
- In-situ biological or chemical amendments (i.e., bioremediation);
- Ex-situ Chemical Amendments (i.e., Chemical Oxidation);
- Landfarming (Bio-remediation);
- Soil Solidification/Stabilization (Low Temperature Asphalt/Concrete); and
- Low Temperature Thermal Desorption.

De Beers primary method for disposal of hydrocarbon impacted material is to transfer the material off-site to an approved waste receiver. For any remediation conducted at the Snap Lake Mine, De Beers soil must achieve remedial criteria as defined in the Section 3.5.5 part d, and must be sampled at a frequency satisfactory to the GNWT Inspector as identified in Section 9.

3.5.4 Water Management

Any seepage produced from the landfill and Hazardous Waste Containment Facilities will be directed to catchment in the sumps of the North Pile, as per design. The water quality of the sumps is analyzed as per the Surveillance Network Program (SNP) of Water Licence MV2011L2-0004.
4. OFF-SITE DISPOSAL

A recycling program for plastic and aluminum beverage containers was implemented in 2006. Beverage containers are collected from recycling bins located throughout the site buildings and stored in a sea can or crates for off-site disposal via the winter road or backhauled by air when possible. These items are then provided to interested charitable organizations within the Northwest Territories to return to Yellowknife’s Bottle Depot.

Table 4-1 lists the items that are shipped off-site for disposal and those shipped off-site for recycling and items reused on site. Except for the beverage containers, all items are recycled or disposed of by KBL Environmental Ltd, a registered Receiver of Hazardous Waste with the Government of the Northwest Territories. The ultimate disposal of hazardous waste is confirmed through the use of hazardous waste movement documents as prescribed in the Guideline for the General Management of Hazardous Waste in the Northwest Territories.

### Table 4-1 Off-site Disposal, Recycled and Reused Items

<table>
<thead>
<tr>
<th>Off-site Disposal</th>
<th>Recycle</th>
<th>Reused</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemicals – glycol, calcium hydroxide, etc.</td>
<td>Tires</td>
<td>Tires for protection of equipment</td>
</tr>
<tr>
<td>Empty fuel drums</td>
<td>Steel (structural, non-insulated piping)</td>
<td>Waste oil in furnaces</td>
</tr>
<tr>
<td>Dry alkaline batteries and lead acid batteries</td>
<td>Empty totes (1,000 litre oil / chemical)</td>
<td>Wasted shotcrete for construction</td>
</tr>
<tr>
<td>Hydraulic hose</td>
<td>Wire - copper and aluminum</td>
<td>Gear oil is reused in gearboxes on fixed equipment</td>
</tr>
<tr>
<td>Fluorescent light ballasts</td>
<td>Wood</td>
<td>Wood</td>
</tr>
<tr>
<td>Crushed and drained oil/fuel filters, oily rags</td>
<td>Beverage containers (water and pop)</td>
<td>Totes</td>
</tr>
<tr>
<td>Contaminated water (oil)</td>
<td>Water from WTP to Process Plant</td>
<td>Flammable liquids (Jet B, gasoline, solvents) ERT Training</td>
</tr>
<tr>
<td>Contaminated vent tubing (oily)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kitchen grease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil &amp; grease pails containers / vent tubing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A procedure exists for the documentation of all materials movement, which describes the steps required to track environmentally hazardous waste from the generator to final disposal. The procedure includes the personnel responsible for tracking and submitting the paperwork to regulators.

The Environment Protection Service of the GNWT monitors movement of hazardous waste through use of a tracking document called a Movement Document/Manifest. The Movement Document/Manifest form must accompany all regulated (hazardous) waste in transit regardless of the means of transport (air or road).
5. SEWAGE TREATMENT

This plant is an Activated Sludge Treatment plant with one C,9 external membrane designed for a maximum capacity of 135 cubic meters per day. The plant with one membrane required the installation of automatic pre-filters, one membrane feed pump, one membrane circulation pump. The modular design allows the plant to be relocated as necessary.

At the final stage of the process, liquid that meets discharge criteria set out in the De Beers Water License MV2011L2-0004 is pumped to the Water Management Pond or Influent Storage Ponds and onwards to the Water Treatment Plant where it is re-processed prior to being released as effluent to Snap Lake.

The sewage treatment plants include phosphorus removal as part of an overall water management strategy to meet the total phosphorus loading limit set out in the Water License. Management of sewage treatment is linked with the Aquatic Effects Monitoring Plan (Golder 2019), which evaluates the effects of nutrient releases from the mine on productivity in Snap Lake.

The operational parameters are listed below in Table 5-1.

Table 5-1  Sewage Treatment Plant Specifications

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Daily Permeate Flow</td>
<td>135 m$^3$/day</td>
</tr>
<tr>
<td>Maximum Operating Temperature</td>
<td>30° C</td>
</tr>
<tr>
<td>Minimum Operating Temperature</td>
<td>4° C</td>
</tr>
<tr>
<td>Bioreactor TSS - Minimum</td>
<td>3,000 mg/L (ppm)</td>
</tr>
<tr>
<td>Bioreactor TSS – Optimal Operational Range</td>
<td>10,000 mg/L (ppm)</td>
</tr>
<tr>
<td>Membrane Inlet Pressure</td>
<td>448,175 – 517,125 pa</td>
</tr>
<tr>
<td>Membrane Outlet Pressure</td>
<td>68,950 – 103,425 pa</td>
</tr>
<tr>
<td>Maximum Membrane Inlet Pressure</td>
<td>482,650 pa</td>
</tr>
<tr>
<td>Minimum Concentrate Flow Rate Per Train</td>
<td>120 m$^3$/hr</td>
</tr>
<tr>
<td>Permeate Flow Rate Per Train</td>
<td>6.1 m$^3$/hr</td>
</tr>
</tbody>
</table>

Solids produced during sewage treatment are caked, which is basically reducing the water content of the sludge, and pressed in the filter press to remove additional water. Dewatered solids are bagged and sent to the land fill but can be incinerated if necessary.

5.1 STP3

Due to the reduction in personnel during Care and Maintenance, a smaller Wastewater treatment plant (STP3) was installed and commissioned in 2018. The current process flow diagram is shown in Figure 5-1. The STP3 uses treatment with Chlorine only, utilizing an average of 25 L per month. This plant will be utilized into Closure and then demolished as part of the final closure plan.
Figure 5-1  Sewage Process Flow Diagram

- B-dorm accommodations
- Sewage pit (between B & A-dorm)
- Wastewater treatment plant (Serves complex washbay)

- Grey water directed to WMP through the Process Plant
- Removal of grey water directly from wastewater treatment plant to WMP via truck

De Beers Group
6. WATER TREATMENT

Water collected in ditches and sumps from around the site, including from the North Pile is directed to the Water Management Pond for storage. Water from the Water Management Pond can then either be a) discharged to Snap Lake after filtration in the modular treatment plant, and discharged without further treatment via the existing diffuser discharge line (if it meets EQCs), b) directed to the Water Treatment Plant to be treated so it can meet EQCs for discharge or c) discharged directly to the underground if it does not meet the surface water EQCs.

At this time, De Beers anticipates that during freshet the water in the water management pond may meet EQCs without treatment, however water will be directed to the water treatment system regardless, prior to discharge. Water directed to the Water Treatment Plant will largely be treated as it was during Operations.

Due to surface water quality concentrations encountered in 2017, an additional treatment module was designed and procured to specifically treat the water quality expected during Extended Care and Maintenance. This additional module uses microfiltration and Reverse Osmosis (RO) and is an add-on to the current water treatment system. It will be used to treat water for discharge to Snap Lake as required. The high TDS water that cannot be released to Snap Lake will be directed to the underground. The additional treatment option ensures that the daily flow rate to the underground is low enough to prevent overtopping. Therefore, the RO unit provides additional contingency to the operation.

Upon transitioning to the final closure layout for Snap Lake, De Beers will construct a passive water management system that directs water flow from the North Pile into a passive treatment system that will achieve the closure EQCs. Details of this system are provided in the Water Management Plan and the passive water management design.
7. MONITORING, MITIGATION, AND REVIEW

Compliance with all environmental laws, regulations, and guidelines, as well as the Snap Lake Mine EMS, will be monitored using the following mechanisms:

- environmental inspections;
- environmental audits (internal and external);
- communication with regulatory authorities (federal, territorial); and
- communication with De Beers Corporate Legal Department and other De Beers facilities.

To control waste substances from entering the aquatic environment, a number of spill mitigation techniques related to handling of wastes have been implemented. Complete descriptions of spill and containment procedures can be found in the Snap Lake Mine Spill Contingency Plan.

The following list describes general practices when handling wastes:

- use of spill mats;
- replacement of leaking, corroded or otherwise deteriorated containers;
- careful unloading or loading wastes to minimize losses;
- checks of storage containers for leaks, proper labels, and lids that are on tight;
- use of plastic tarps to cover waste piles; and
- installation of runoff berms.

As part of De Beers’ EMS, waste audits are carried out on site and some of the past recommendations have identified a number of improvements for the handling and disposal of waste and personal safety as it relates to wildlife conservation:

- conduct regular audits of all food and non-food solid waste streams, and use information to modify plans, procedures, and protocols;
- conduct external audits to review success of activities;
- fabricate a burner unit to improve disposal of large volumes of cardboard and wood wastes generated;
- implement a standardized colour-code for various waste streams; and
- avoid storage of waste for incineration to reduce the potential for attracting wildlife. Incineration should be performed as dictated, by waste volumes generated.

The suggestions made through the auditing process were considered and where practical, are implemented.
8. TRANSPORTATION PLAN

8.1 Introduction

The transportation of hazardous materials to the Snap Lake Mine site will be conducted either by winter ice road or by air. The winter ice road will be the major transportation route for bulk materials. Hazardous materials will require special handling and specific documentation to comply with GNWT and Highway Department regulations.

De Beers and their contractors will ensure that the transporters of hazardous materials are aware of their legal responsibilities. De Beers is currently a member of the Tibbitt to Contwoyto Winter Road Joint Venture and will adhere to the Tibbitt to Contwoyto Joint Venture Spill and Emergency Response Plan, and to the Rules of the Road Manual.

8.2 Contractor Requirements

Materials to be shipped to the mine site will be received by a De Beers contractor. When possible, the material will be stored indoors in a secure area. Once transported to the site, the originator of the requisition will perform the final material receipt confirmation.

All TDG and WHMIS labelled materials must have accompanying MSDS. The MSDS information is communicated between the contractor and De Beers Logistics department.

If materials are spilled while receiving, the receiver will be the first responder and contact the SHE Department and/or Materials Management to initiate the Spill Contingency Plan. A review of the MSDS for the spilled material will determine what personal protective equipment and other precautions may be required. The receiver will ensure spill kits are present at the unloading area in case a spill occurs.
9. **PETROLEUM, OILS, AND LUBRICANTS**

9.1 **Introduction**

The mine closure activities will use large amounts of Petroleum, Oils and Lubricants (POLs). These products are transported, stored, handled, and used in compliance with the appropriate legislation and with best management practices. POLs are transported to site during the winter road season this has been scaled accordingly due to reduced power requirements in light of extended care and maintenance and mine closure.

9.2 **Types and Quantities**

The types and quantities of POLs to be stored and used are summarized in Table 2-2.

9.3 **Design and Location of POL Storage Facilities**

All single-walled fuel storage tanks are contained within a perimeter berm lined with high-density polyethylene (HDPE) geo-membrane. The berm has been designed as required by the NFCC, API-650, and NWT Public Works and Services design standards.

The berms provide secondary containment for all fuel storage tanks and the capacity of the secondary containment has the equivalent to the volume of 110% of the largest tank, as per the NFCC.

Currently, Snap Lake Mine has three 12 million litre main tanks, one 10 million litre tank, and 19 small tanks (between 330,000 to 500,000 L) with a total carrying capacity of 52,998,800 L. Snap Lake Mine fuel consumption was originally forecasted to increase from 42,795,512 L in 2014 to 52,567,314 L by 2027. Only a portion of the tanks will be used and staged for the closure sequence of the mine.

9.4 **Inspection and Monitoring**

De Beers is responsible for formal inspection of fuel storage, dispensing pumps, and pipelines. Visual Inspections of all tanks and associated pipelines are conducted weekly or more frequently if deemed necessary. The inspection frequency will be determined by the legislation in place at that time and by Best Management Practices (BMP). De Beers will explore ways to remotely monitor the fuel storage systems (camera’s, level transducers, etc.) throughout closure to reduce on-site inspection requirements.

Any release of hazardous materials will be reported immediately and appropriate measures will be taken to remediate the situation. Details of reporting protocol, procedures, and remedial measures are specified in the Snap Lake Mine **Spill Contingency Plan**.

9.5 **Records Keeping**

Specific procedures for documentation of activities related to the EMS and to Safety and Health are included in the EMS system procedures under SHEOP’s.
Inventory control and reconciliation records are kept on site in an acceptable manner and format and maintained for a period of one year. They are then archived and stored on site for examination or reference if required.

9.6  Training of Personnel

WHMIS training is provided to all personnel working on-site. The Emergency Response Team will be trained in the following fields, regardless of previous training and experience: transporting, handling, and transferring petroleum products; emergency response; and WHMIS.
10. EXPLOSIVES

10.1 Introduction

During Closure, there will be explosives manufacture and use in landforming and materials movement. Explosives and other hazardous materials stored in magazines will be constantly monitored for spills, excessive humidity, stability of storage facilities and access of humans or wildlife to storage facilities. De Beers will continue to destroy mixed explosives that cannot be shipped from Snap Lake Mine as approved by the WSCC and the Chief Inspector of Mines.

This section discusses explosives management with respect to the potential environmental hazards of each of the constituent components making up the explosive mixtures, and outlines how to maintain personnel safety and training while working with these constituents.

The transportation, storage, or use of explosives or their constituents could result in hazardous situations or adverse environmental impacts. Procedures to prevent such an outcome are outlined in this section. These measures will ensure that the utmost safety and environmental responsibility will be maintained during the closure of the Snap Lake Mine.

10.2 Types and Quantities

The most common explosive that is used is Emulsion (a mixture of ammonium nitrate prill, sodium nitrate prill), an oil phase (typically vegetable oil based), and a solution phase (water).

10.3 Design and Location of Storage Facilities

The Bulk AN Storage Facility has been designed and constructed of suitable building foundation and base slab for support of the building and designated loads within the building. The foundation and base slab system includes an embedded membrane for the secondary containment of nitrates and corrosion reduction. The facility meets the following standards:

- National Fire Code of Canada 2005 (NFCC)
- National Building Code of Canada 2005 (NBCC)
- NFPA 490 Code for the Storage of Ammonium Nitrate
- NWT Fire Marshal
- ANSI American National Standards Institute
- ASME American Society of Mechanical Engineers
- CEMA Conveyor Equipment Manufacturers Association
- CSA Canadian Standards Association – Canadian Electrical Code
- MSHA Mine Safety and Health Administration
- OSHA Occupational Safety and Health Administration
- Workers’ Compensation Act of Northwest Territories
The design of the interior of the building includes two concrete walled storage areas, one for the storage of bulk ammonium nitrate and the second for the storage of bagged sodium nitrate. The total combined storage capacity is 2400 mega tonnes.

The materials handling system consists of three screw conveyors for the purpose of moving the bulk ammonium nitrate. The building houses an exhaust fan and filtering system to provide adequate ventilation for equipment contained within the building; a cathodic protection system to reduce corrosion from exposure to the ammonium nitrate and surface treatment for limiting penetration of ammonium nitrate and sodium nitrate.

10.4 Inspection and Monitoring

Explosives are strictly regulated and only qualified and certified personnel will be employed in the handling of explosives. Periodic audits of all working areas and roads used to transport the explosives will be conducted by SHE personnel to ensure proper handling procedures are used.

Any release of hazardous materials will be reported immediately and appropriate measures will be taken to remediate the situation. Details of reporting protocol, procedures, and remedial measures are specified in the Snap Lake Mine Spill Contingency Plan.

10.5 Training of Personnel

WHMIS training is provided to all personnel working on-site. The Emergency Response Team will be trained in the following fields, regardless of previous training and experience: transporting, handling, and transferring petroleum products; emergency response; and WHMIS.
11. REFERENCES


