

# **HIGH LAKE PROJECT**

## **Project Description Supporting Regulatory Applications**

September 18, 2006



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Appendix A. Summary of Design Mitigation Measures

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**Abbreviations**

AN	Ammonium nitrate
ANFO	Ammonium nitrate and fuel oil (diesel)
API	American Petroleum Institute
ARD	Acidic rock drainage
BOD	Biological oxygen demand
CCME	Canadian Council of Ministers of the Environment
CEPA	Canadian Environmental Protection Agency
DFO	Department of Fisheries and Oceans
DWT	Dead Weight Tonnage
FO	Fuel oil (diesel)
GPS	Global positioning system
LHD	Load-haul-dump
NAG	Non acid generating
NSR	Net Smelter Return
NIRB	Nunavut Impact Review Board
NTCL	Northern Transportation Company Limited (NTCL)
NT	Northwest Territories
NU	Nunavut
PAG	Potentially acid generating
PMF	Probable maximum flood
PMP	Probable maximum precipitation
ppm	parts per million
SOP	Standard operating procedure
tpd	tonnes per day
tpy	tonnes per year
TSS	Total suspended solids
VMS	Volcanogenic Massive Sulphide

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**Units**

ft	feet
ha	hectares
kg	kilograms
km	kilometres
km/hr	kilometres per hour
kW	kilowatt
L	litres
L/d	litres per day
L/hr	litres per hour
m	metres
mm	millimetres
mL	millilitres
M	million
ML	million litres
MW	Megawatt
Mm <sup>3</sup>	million meters cubed
Mt	million tonnes
m <sup>3</sup>	cubic metres
m <sup>3</sup> /s	cubic metres per second
m/s	metres per second
mg/L	milligrams per litre
tonnes/m <sup>3</sup>	tonnes per cubic metre

# 1. Introduction

## 1.1 Wolfden Resources Inc. Development Philosophy

Wolfden Resources Inc. released a “Strategic Plan for the High Lake Mine Project” in November 2003 that provided a broad overview and approach that would be used through all phases of the mine development at High Lake. This plan summarizes Wolfden’s vision for the High Lake Project as:

*Wolfden Resources Inc.’s vision is to develop the High Lake Project as an economically viable mining project for the benefit of its shareholders and the residents of Nunavut, in a manner that respects the environmental and socio-economic conditions in Nunavut.*

Wolfden Resources Inc.’s corporate values are based on:

- **Respect** - Consideration for the residents of Nunavut affected by the Project and all parties that will be involved in the Project in regard to their views and issues.
- **Openness** - Conducting the affairs of Wolfden Resources Inc. in an open and transparent manner such that others can see the decisions that have been made and the timely sharing of information with due consideration to confidentiality and proprietary interests where required.
- **Professionalism** - Meeting the highest standards in all business dealings and earning confidence through the manner in which work is conducted according to mining industry best practices, mining association guidelines and regulatory requirements.
- **Integrity** - At all times, in all situations, through the entire process.
- **Trust** - Active building of relationships with the affected residents of Nunavut and government organizations, including boards and Inuit Organizations, through all stages of the Project

The Board of Directors of Wolfden Resources Inc. have established a corporate environmental policy that guides the actions of the firm and is followed and promoted by employees and contractors hired by the firm. This policy is considered to be a part of the overall corporate governance policy. It will be regularly monitored for compliance with the appropriate performance reviews to ensure effective implementation.

## 1.2 Need for and Purpose of the Project

The Government of Nunavut has identified minerals development as a key area for economic development for the Territory in the *Nunavut Economic Development Strategy*. It is also recognized that “Nunavummiut need strong community and territorial economies to attain the goal all societies seek: a

## Project Description Supporting Regulatory Applications

high and sustainable quality of life”. This strategy also commits to at least four operating mines in Nunavut by 2013.

This vision of building a strong mining future for Nunavut is also supported in a joint federal and territorial *Northern Strategy* that makes the “advancement of large-scale projects such as pipelines and mines as a key objective to meet the goal of “Establishing Strong Foundations for Economic Development”.

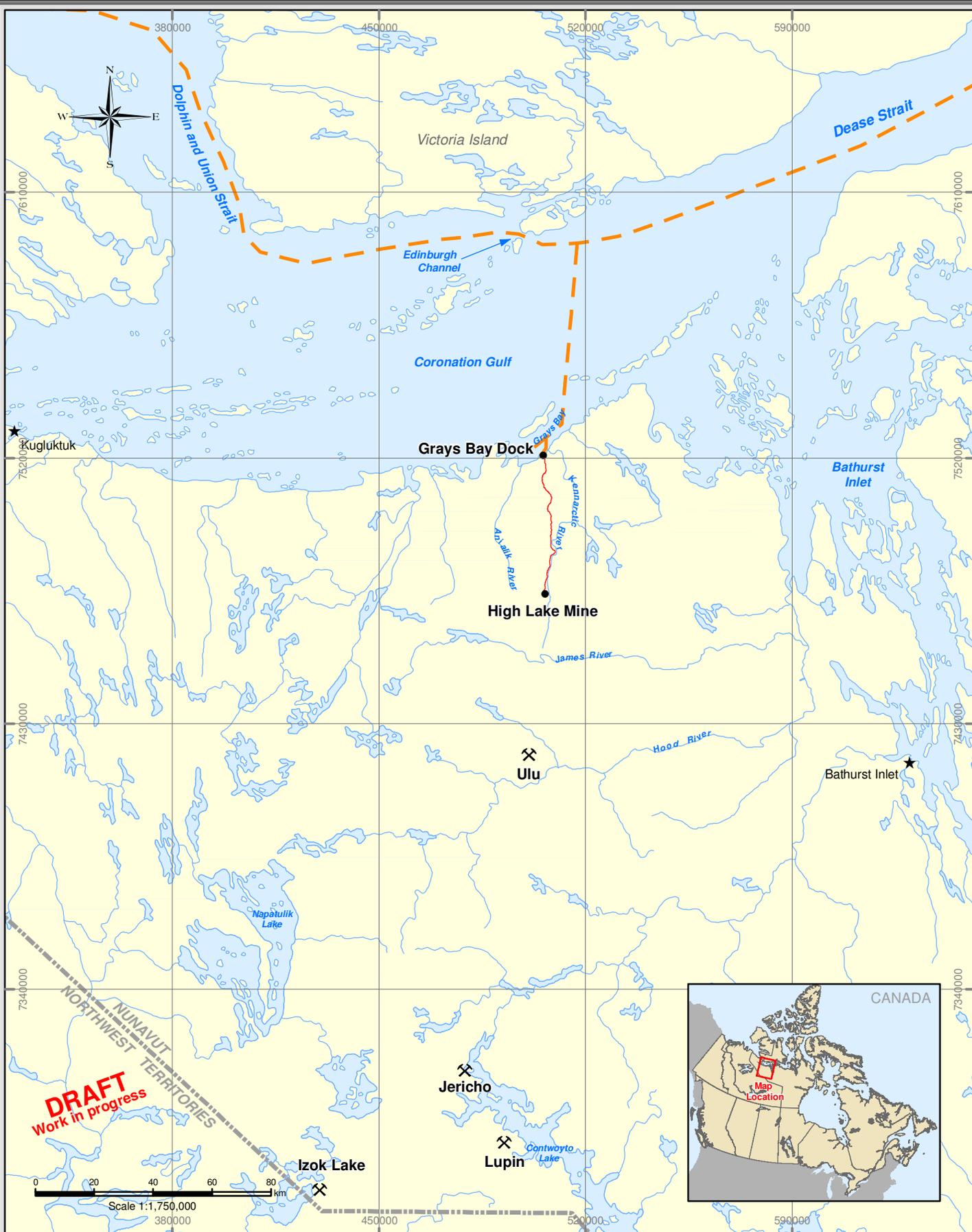
Wolfden Resources Inc.’s long term vision for minerals resource development in Nunavut and the proposed High Lake Project clearly supports the vision of a strong economic future for all Nunavummiut. However, Wolfden Resources Inc. has not lost sight of Nunavummiut core values. In all aspects of the High Lake Project, Wolfden Resources Inc. has strived to protect the land, water and wildlife through its environmental and socio-economic baseline programs including important recommendations of the elders that were made through Inuit Qaujimajatuqangit (IQ) discussions.

*The purpose of the High Lake Project is to mine and process ore from three deposits and ship metal concentrates to world markets in a manner that yields a positive economic return on investment for Wolfden Resources Inc. shareholders and Nunavummiut. Wolfden intends to carry out the entire operation so that the environment is protected and socio-economic benefits to the region are maximized*

### 1.3 Project Overview and Schedule

The proposed High Lake mine development site is situated within approximately 50 km of the Arctic coast in the Coronation Gulf area and is a polymetallic deposit of base metal and precious metal deposits including copper, zinc, gold and silver (Figure PD.1).

Wolden Resources Inc. acquired the High Lake property in 2000 and has successfully carried out exploration programs designed to expand the mineral reserves. Since 2000, Wolfden has invested some \$90 million on the High Lake Project and continues to demonstrate a commitment to investment in Nunavut by expanding both the mineral resource asset base, as well as mining related infrastructure. Three significant mineralized zones at High Lake have been defined and in-ground resources have been calculated. There is also high potential for the discovery of new additional resources in the area around the High Lake property. An ongoing exploration program at High Lake is serviced by a tent camp of about 35 to 50 people with aviation support for supplies, personnel and general cargo requirements.



Legend	
<b>Proposed Project Components</b>	<b>Existing Sites</b>
● Project Site	★ Community
— Access Road	⌵ Mine or Prospect
- - - Approximate Shipping Route	
<b>Boundaries</b>	<b>Hydrological Features</b>
--- Territorial	— Watercourse
	■ Waterbody

  
**WOLF DEN Resources Inc.**  
 High Lake Project  
*Project Description*  
**Project Location**

References:  
 Base data 1:2,000,000; Penn State University, University Libraries, Pattee Maproom.  
 Project components provided by Gartner Lee Limited, Communities, and index map compiled from ESRI.  
 Mine sites provided by Wolf Den Resources.  
 Projection: UTM Zone 12 NAD 83  
 Revision: 1  
 Date: September 18, 2006

## Project Description Supporting Regulatory Applications

To continue with the ongoing exploration program and to improve overall camp facilities, including overall health and safety, Wolfden Resources Inc. has submitted applications for re-licensing their exploration activities at High Lake starting in 2007. These applications included construction of an airstrip at Sand Lake, located approximately 12 km north of High Lake, replacement of the existing aging camp at High Lake, and related mobilization activities. The Nunavut Impact Review Board (NIRB) has screened and approved the application for the relicensing work. Wolfden Resources Inc. is now in the process of obtaining the regulatory permits and licenses needed to start construction of the relicensing work. For the exclusive purposes of describing the High Lake Project in this document, it is assumed that the facilities planned for the exploration relicensing described above are in place (e.g., Sand Lake airstrip, improved High Lake exploration camp and construction camp at Sand Lake).

The long term objective of the High Lake Project is to construct the additional infrastructure (e.g., processing facility, disposal facility for mine tailings) necessary to mine and process the defined mineral resource. As part of the overall mine plan, a dock facility will be constructed at Grays Bay to service the operations of the High Lake mine. Ocean-going vessels will be loaded with metal concentrate for transport to markets and will be off-loaded with supplies and equipment necessary for the mining operation at High Lake. An all-season mine road extending from High Lake to Grays Bay will also be required for transporting metal concentrate from the mine to the dock and for the transport of supplies to support the mining operation. A winter road between the High Lake and Grays Bay will be required during the construction phase of this Project.

An overview schedule for the construction, operation, and closure and reclamation phases of the Project is provided in Table PD.1, which can be summarized as follows:

- Construction: anticipated to begin in 2008 and last two years;
- Operation: anticipated to begin in 2010 and last 14 years; and
- Closure and Reclamation: anticipated to begin in 2024 and last about 3 years.

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Project Description Supporting Regulatory Applications

Table PD.1 Overview of Project Schedule

Project Activity	Year*	Construction		Operation												Closure & Reclamation			
		- 2	- 1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<b>High Lake Mine Site</b>																			
Construction of mine site facilities		█	█																
Open pit mining of AB Zone			█	█	█	█													
Open pit mining of D Zone					█	█	█												
Underground mining of West Zone						█	█	█	█	█	█	█	█	█	█	█	█		
Underground mining of AB Zone							█	█	█										
Underground mining of D Zone							█	█	█	█	█	█	█						
Processing of High Lake ore				█	█	█	█	█	█	█	█	█	█	█	█	█	█		
AB Zone Pit closure														█	█				
High Lake mine site closure																	█	█	█
<b>Grays Bay Dock</b>																			
Deliver/store equipment		█																	
Construction of dock facilities		█	█	█															
Closure of Grays Bay dock																			█
Shipping to Grays Bay dock		█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
<b>Roads</b>																			
Dock to High Lake winter road		█	█																
Dock-HL all-season road construction		█	█																
Dock-HL all-season road operation				█	█	█	█	█	█	█	█	█	█	█	█	█	█		
Closure of all-season road																		█	█

\* Year minus (-) 2 = 2008; Year minus (-) 1 = 2009; Year 1 = 2010; Year 2 = 2011 etc.

-  Construction activity
-  Operation activity
-  Closure and Reclamation activity

## 1.4 Integrating Mitigation into Project Design

From the initial design stages of the High Lake Project, significant efforts have been made to maximize the integration of mitigation measures into the design of the Project. The engineering and environmental teams worked closely together in designing the Project, through an interactive process. These design mitigation measures are summarized in Appendix A.

The following principles were used in guiding the design of the High Lake Project:

### **Minimize Project disturbance footprint by:**

- minimizing the number of drainage areas affected by the Project infrastructure, buildings and activities; and
- minimizing disturbance outside of the High Lake drainage area.

### **Minimize resource consumption through operational efficiency by:**

- reducing fresh water consumption through process design and internal recycling;
- conserving energy and thereby reducing fuel consumption through recycling of waste heat for use in processing; and
- implementing long term waste management solutions.

### **Implement best mine management and design practices by:**

- reducing effects of drainage basin drawdown or flooding on spawning habitat;
- protecting aquatic habitat using best practices in design and construction of all structures in marine and fresh waters;
- carrying out any required water treatment at or close to source;
- avoidance of archaeological resources where possible;
- incorporating elders' recommendations into the design and monitoring of the Project, where feasible;
- incorporating best design practices for northern climates and permafrost conditions;
- minimizing the loss and emission of concentrate dust;
- implementing progressive mine reclamation strategies including restoring land surfaces to conditions compatible with pre-existing conditions;
- restoring surface water flows to pre-mining conditions to the maximum extent possible;
- minimizing the need for long term pit lakes;
- maximizing underground mine backfilling, thereby minimizing permanent surface storage of potentially reactive mine rock; and
- minimizing disturbance to wildlife during construction and operations phases, with emphasis on sensitive periods of the year.

## Project Description Supporting Regulatory Applications

## 1.5 Project Disturbance Footprint

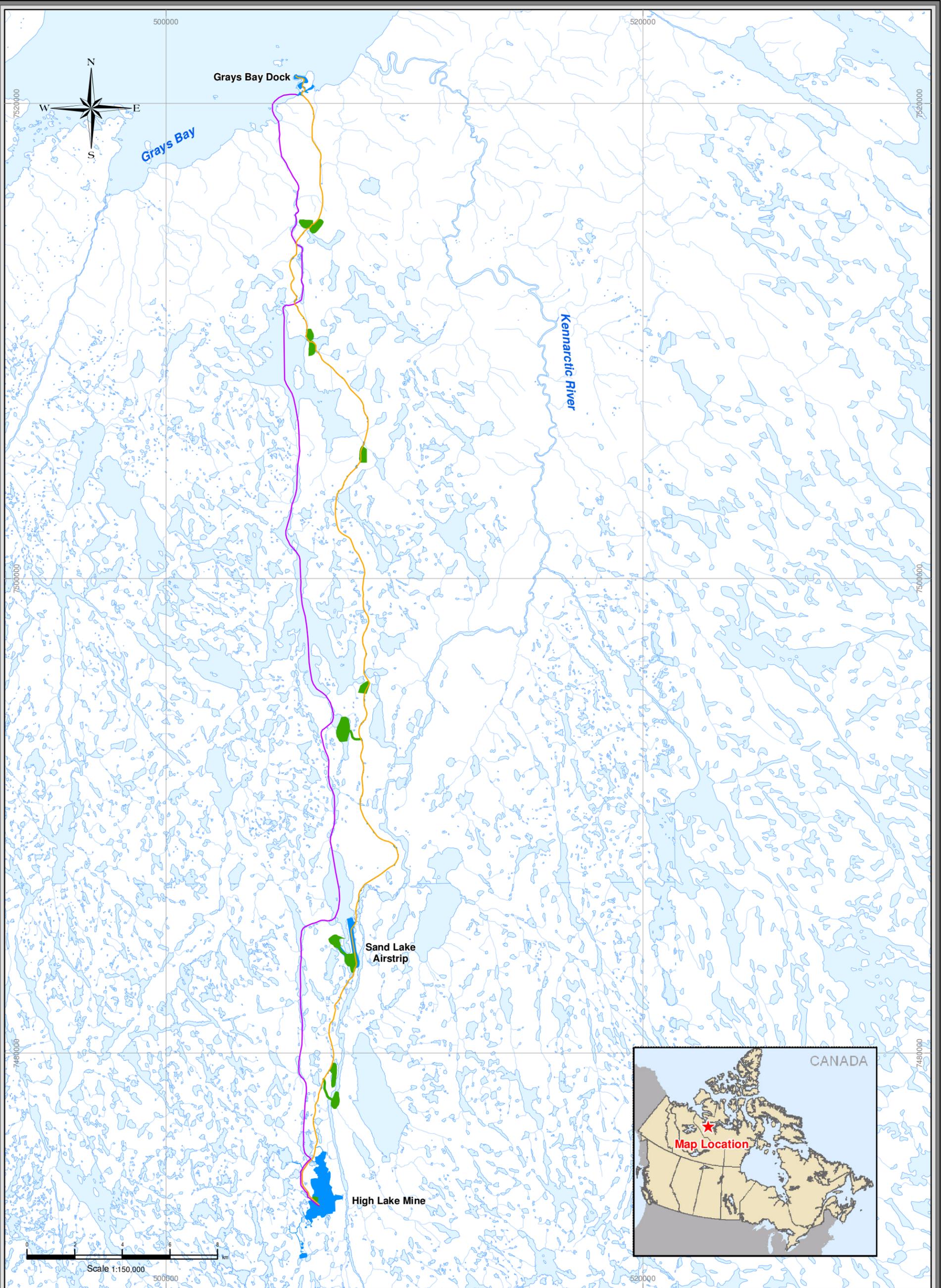
In the design of the High Lake Project, Wolfden Resources Inc. has strived to minimize the overall area of disturbance as a result of the Project, as discussed above. Figure PD.2 shows the combined Project disturbance footprint for the Grays Bay dock, High Lake mine site, Sand Lake airstrip, the roads and borrow sources. The area of the disturbance footprint for each of these project components is further broken down and presented in Table PD.2.

The Project disturbance footprint areas are based on the aerial extent of the proposed infrastructure developments. A conservative approach was taken in calculating the Project disturbance footprint:

- Pockets of land that will be surrounded by infrastructure and facilities at the dock and the mine site were included in the disturbance footprint calculations, to account for potential pedestrian movements and potential lay-down areas between the infrastructure and facilities;
- Although the winter road will be constructed to be 20 to 30 m wide, an average width of 90 m was used for the purposes of calculating the footprint to account for potential annual variability in the winter road alignment;
- In calculating the disturbance footprint for the all-season road an average road width of 22 m was used, to account for cut/fill areas, ditches, construction staging areas, and turnouts.
- The facilities developed during the exploration relicencing phase have been included in the Project disturbance footprint. These largely include the Sand Lake airstrip and associated camp facilities, borrow sources near Sand Lake, the 12 km road between Sand Lake and High Lake, and the improved camp facilities at High Lake.

**Table PD.2 Overview of Project Disturbance Footprint**

<b>Location</b>	<b>Figure Number</b>	<b>Disturbance Footprint Area (ha)</b>
Grays Bay dock	PD.9	25
Sand Lake airstrip and facilities	PD.7	90
High Lake mine site	PD.3a	240
All-season road (with passing lanes)	PD.10	119
Winter road	PD.10	491
Borrow sources	PD.2	114
<b>Total</b>		<b>1,079</b>



Legend	
<b>Project Disturbance</b>	<b>Hydrological Features</b>
Facility Footprint	Waterbody
Potential Borrow Source	Watercourse
Road for Borrow Source	
Winter Road	
All-Season Road	



*Project Description*

## High Lake Project Footprint

References:  
 Disturbance footprint defined by Gartner Lee in June, 2006 based on proposed site facility drawings supplied by Wardrop Engineering in Jan-June, 2006.  
 National Topographic Database (NTDB) compiled by the government of Canada, Natural Resources Canada (NRCAN) at 1:50,000.  
 Proposed quarry locations from hand drawn sketches by Andrew Mitchell, of Wolfden Resources Spring, 2006.

Projection: UTM Zone 12 NAD 83  
 Revision: 1  
 Date: September 18, 2006

Gartner Lee	Figure: PD. 2
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## 1.6 Structure of Project Description

The major components of the High Lake Project, which include the High Lake mine site, Grays Bay dock, the winter road, the all-season road, and mobilization and shipping are described in detail in Sections 2 to 6. For each Project component, the physical aspects are first described, followed by a description of the construction activities, the operation activities and the closure and reclamation concepts.

The social and economic aspects of the High Lake Project are described in Sections 7 to 10 under the following headings: Human Resources, Project Costs, Contracting and Procurement, and Community Outreach.

Several management plans and technical supporting documents related to the Project Description are currently being developed by Wolfden Resources Inc. These management plans and supporting documents will be contained in Volumes 8 and 9 of the *High Lake Project Proposal* to be submitted to NIRB in late October.

The following management plans are referenced through-out this document, and will be found in Volume 8 of the *High Lake Project Proposal*:

- Wildlife Mitigation and Monitoring Plan;
- Emergency Response and Contingency Plan;
- Access and Traffic Management Plan;
- Water Management Plan;
- Borrow Management Plan;
- Shipping Management Plan;
- Preliminary Reclamation and Closure Plan;
- Human Resources Management Plan; and
- Heritage Resource Protection Plan.

Volume 9 of the *High Lake Project Proposal* will contain a series of technical supporting documents. In relation to the enclosed Project Description, the technical supporting documents will provide additional information on geochemical characterization, geotechnical investigations, tailings disposal and containment facility, road studies, and permafrost conditions.

## 2. High Lake Mine Site

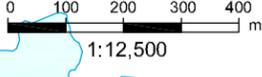
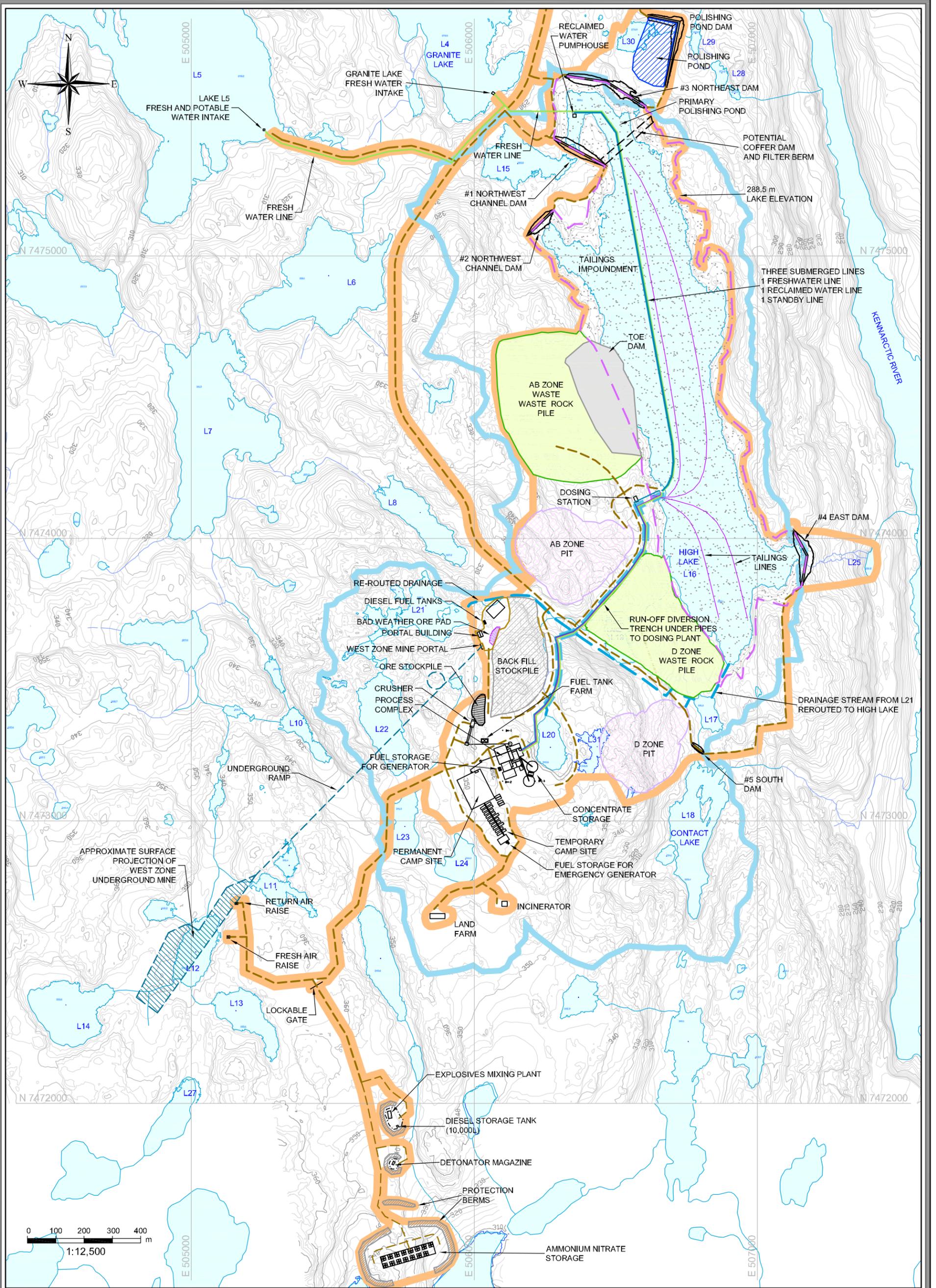
### 2.1 Overview of High Lake Mine Site

The High Lake Volcanogenic Massive Sulphide (VMS) deposit is hosted within the High Lake greenstone belt in the northern part of the Slave structural province. Basement gneisses are overlain by sedimentary and volcanic rocks. The High Lake greenstone belt extends 140 km from the Coronation Gulf coast southward, ranging from 5 km to 30 km in width, and is intruded by northwesterly trending diabase dykes. The High Lake VMS deposits are within the felsic volcanic sequence with the B and D zones at or near the contact with granodiorite intrusion. Each ore is distinctly different, although all copper mineralization in each ore type is in the form of chalcopyrite. No secondary minerals were detected. The West Zone comprises three lenses, the largest being about 275 m long, extending about 900 m down dip, and up to 40 m thick. The AB Zone comprises 12 separate lenses of mineralization, the largest of which is 150 m long, extends 360 m down dip, and is up to 80 m wide. The D zone comprises four separate lenses of mineralization, the largest being about 150 m long, dipping down 320 m and up to 35 m thick.

Three mineral deposits containing concentrations of copper, zinc, gold and silver have been investigated at the High Lake mine site. Preliminary mine plans indicate that two of the deposits, the AB Zone and the D Zone, can be mined most efficiently by open pit excavation initially, followed by underground mining accessed from the bottom of each pit. The third deposit, the West Zone, will be mined entirely underground. The location and general arrangement of all facilities at the High Lake mine site is provided in Figure PD.3a and Figure PD.3b.

The High Lake Project has been designed to minimize the overall Project disturbance footprint. To the extent practical, the mine site infrastructure has been sited within the High Lake drainage area (Figure PD.3a). A discussion of the drainage areas used at the mine site will be found in Volume 5, Section 1 (Hydrology) of the *High Lake Project Proposal*.

The mine site will have a disturbance footprint of 240 ha. A summary of the disturbance footprint of the major facilities is provided in Table PD.3. Table PD.4 presents the proposed schedule for installation of the High Lake mine site facilities.



**Legend:**

	Facility Footprint
	Proposed Tailings Line
	Re-routed Drainage
	Run-off Diversion Trench
	Proposed Road
	Proposed Fresh Water Line
	Proposed Reclaimed Water Line for Mill
	High Lake Drainage Area
	Fence
	Tailings Impoundment



**High Lake Project**

Project Description

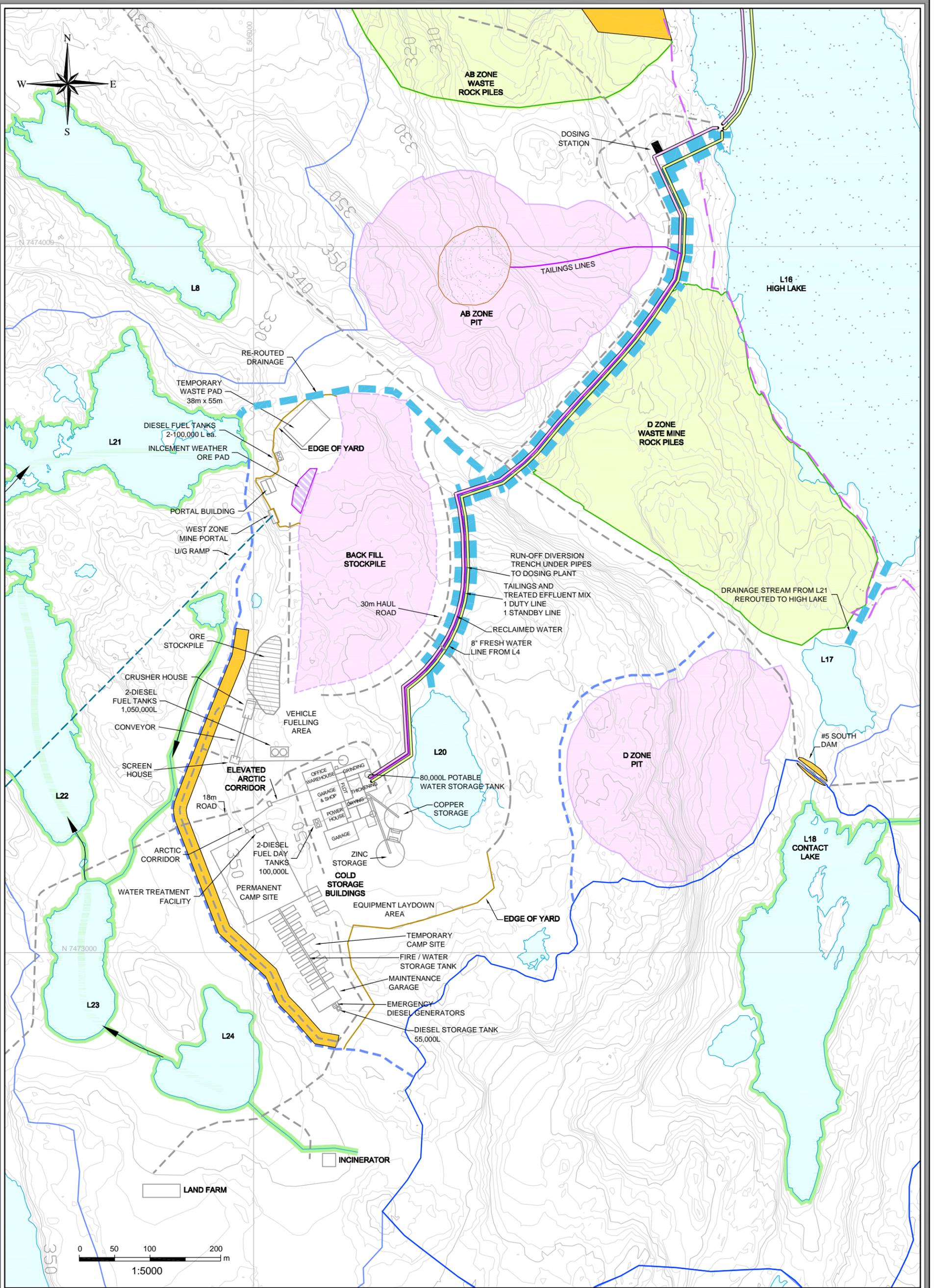
**High Lake Mine**

**References:**  
 Wardrop Engineering drawings:  
 0551310100-DWG-G0012 rev C dated 06.05.18  
 0551310100-DWG-G0013 rev K dated 06.07.21  
 0551310100-DWG-G0014 rev C dated 06.01.19  
 0551310100-DWG-G0016 rev B dated 06.05.15  
 0551310100-DWG-G0022 rev B dated 06.02.08  
 0551310100-DWG-G0023 rev A dated 06.05.18

Projection: UTM Zone 12 NAD 83  
 Revision: 1  
 Date: September 18, 2006

Prepared By: PW  
 Reviewed By: AK

Gartner Lee Figure: **PD. 3a**



**Legend:**

- Clean Water Pathway
- Run-off Diversion Trench
- Proposed Road
- Proposed Tailings Line
- Proposed Fresh Water Line
- Proposed Reclaimed Water Line For Mill
- Catchment Boundaries
- Artificial Catchment Boundaries Created By Mine Facilities
- Water Management Structures (road Or Dam)

Note: Facilities shown would be present in Year 8



**High Lake Project**

*Project Description*

**High Lake Mine - Detail**

**References:**  
 Wardrop Engineering drawings:  
 0551310100-DWG-G0012 rev C dated 06.05.18  
 0551310100-DWG-G0013 rev K dated 06.07.21  
 0551310100-DWG-G0014 rev C dated 06.01.19  
 0551310100-DWG-G0016 rev B dated 06.05.15  
 0551310100-DWG-G0022 rev B dated 06.02.08  
 0551310100-DWG-G0023 rev A dated 06.05.18

Projection: UTM Zone 12 NAD 83      Prepared By: PW  
 Revision: 1      Reviewed By: AK  
 Date: Sept 18, 2006



Figure:  
**PD. 3b**

## Project Description Supporting Regulatory Applications

**Table PD.3 High Lake Mine Site Major Facilities Disturbance Footprint**

Facility	Approximate Disturbance Footprint <sup>1</sup> (ha)
AB Zone open pit	13
D Zone open pit	10
West Zone underground mine	no surface disturbance
Processing facility	3
AB Zone waste rock pile <sup>2</sup>	24
D Zone waste rock pile <sup>2</sup>	14
West Zone backfill storage	8
Tailings impoundment	90 ha
Notes:	
1. Total area to be disturbed at High Lake mine site is 240 ha.	
2. Waste rock piles will also be used for landfilling and capping non-combustible solid waste materials	

**Table PD.4 High Lake Mine Site Facility Installation Schedule**

Schedule	Component
Year minus 2	Convert existing camp to 140-person capacity
	Water supply system upgrade
	Wastewater treatment – expanded as camp capacity increases
	Fuel storage facilities
	Power generation and transmission facilities
	Explosives storage and manufacture facilities
	Civil works for buildings and machinery foundations and concrete slabs
Years minus 1 and 2	Building structures (including sheeting in)
	Flotation circuit installation
	Jaw and cone crushers on foundations (including installation of tarpaulins to cover over for winter)
	Diesel generators, air compressors, pumps and associated equipment
	Grinding circuit
	Thickening and dewatering circuits
Year minus 1	Permanent 240-person camp at High Lake
	Electrical equipment, instruments and cables
	Piping and pumps
	Conveyors and associated equipment
	Mill commissioning and process optimization
Operation (timing uncertain)	Upgrades to Sand Lake airstrip
	Addition to processing facility for zinc concentration

## Project Description Supporting Regulatory Applications

The total quantity of mineralized resource is estimated as:

- AB and D Zones: 8 Mt
- West Zone: 12.1 Mt
- Total: 20.1 Mt

The quantity that can be mined feasibly will be based on the ongoing economic balance of revenue versus extraction costs. Pre-feasibility studies have included preliminary mine planning to determine cost-effective mining methods, layouts and sequences. Pre-feasibility reserve estimates of the most economic mining quantities are shown in Table PD.5.

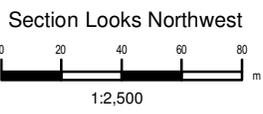
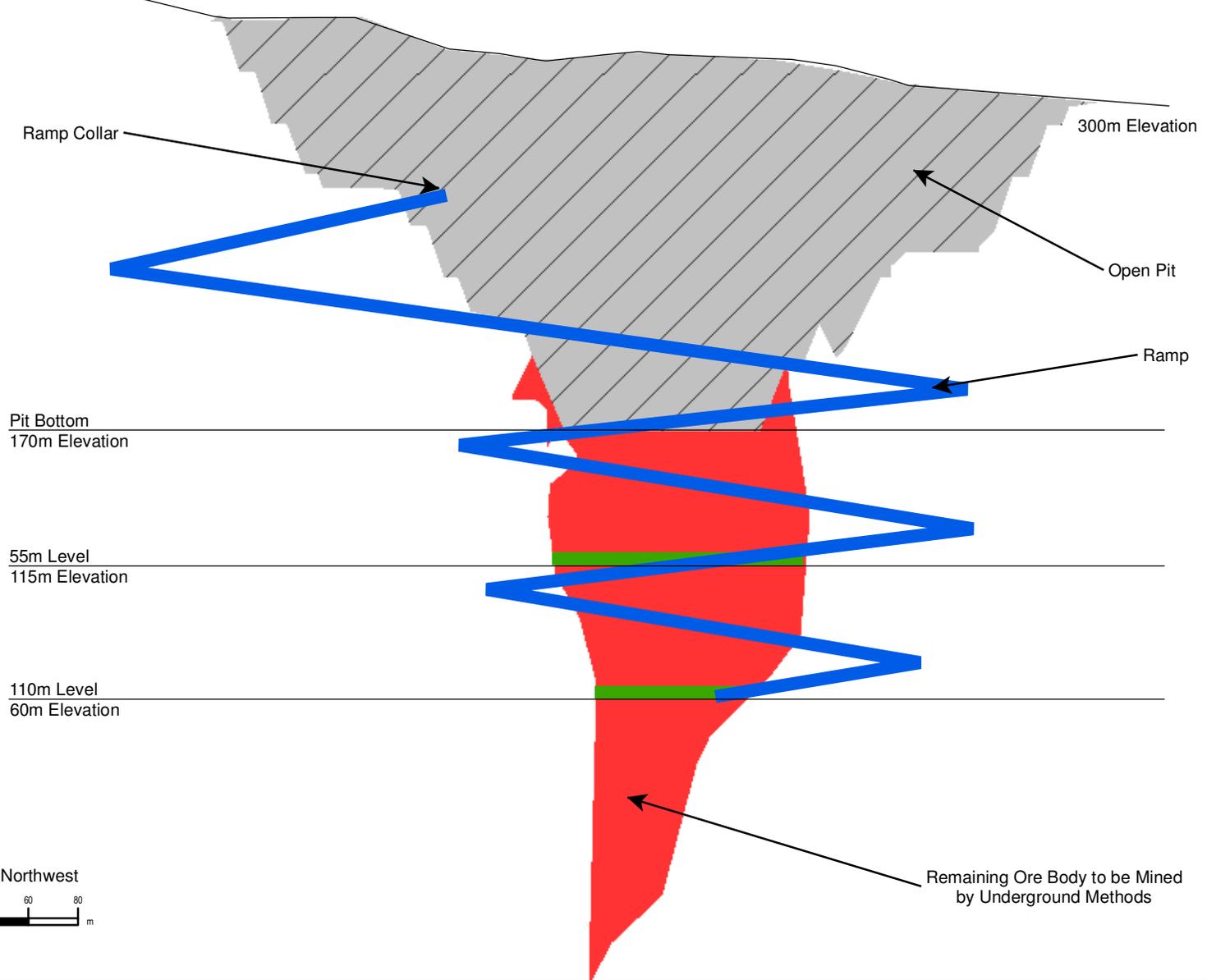
**Table PD.5 Pre-feasibility Reserve Estimates**

Mine Pit/Zone	Pre-feasibility Mining Quantity Estimates	
	Ore (Mt)	Waste Rock (Mt)
AB Open Pit	3.1	14.4
D Open Pit	1.3	9.8
West Zone Underground	11.5	0.92
AB Underground	0.635	0.12
D Underground	1.68	0.09
<b>Total</b>	<b>18.2</b>	<b>25.3</b>

Pre-development excavation of waste mine rock will take place at the AB Zone open pit prior to initial mining of ore. During pre-development, some ore will be mined and stockpiled to commission the processing facility. Underground development work for the West Zone underground mine will occur following the main project construction period. Figure PD.4, Figure PD.5 and Figure PD.6 show conceptual cross-sections through the AB, D and West Zone deposits, respectively.

The open pits will be mined using conventional drilling and blasting techniques, with ore and waste rock removal using mechanical excavators and trucks. The underground mining method for all three zones consists of a long hole open stope technique with a combination of longitudinal and transverse stope configurations. Over the 14-year operational life of the Project, the combined open pit and underground mine production rate is expected to be 4,000 tpd of ore in Year 2 to Year 10, with lower quantities in the first year and final four years. The combined copper and zinc concentrate production rate is expected to be up to 140,000 tpy, including the following:

- total of 23,400,000 ounces of silver over the life of the Project, produced (off-site) mostly with the copper concentrates; and
- approximately 410,000 ounces of gold over the life of the Project, produced (off-site) with the copper concentrate.



**Legend**

-  Open Pit
-  Underground



**WOLFDEN**  
Resources Inc.  
High Lake Project  
Project Description

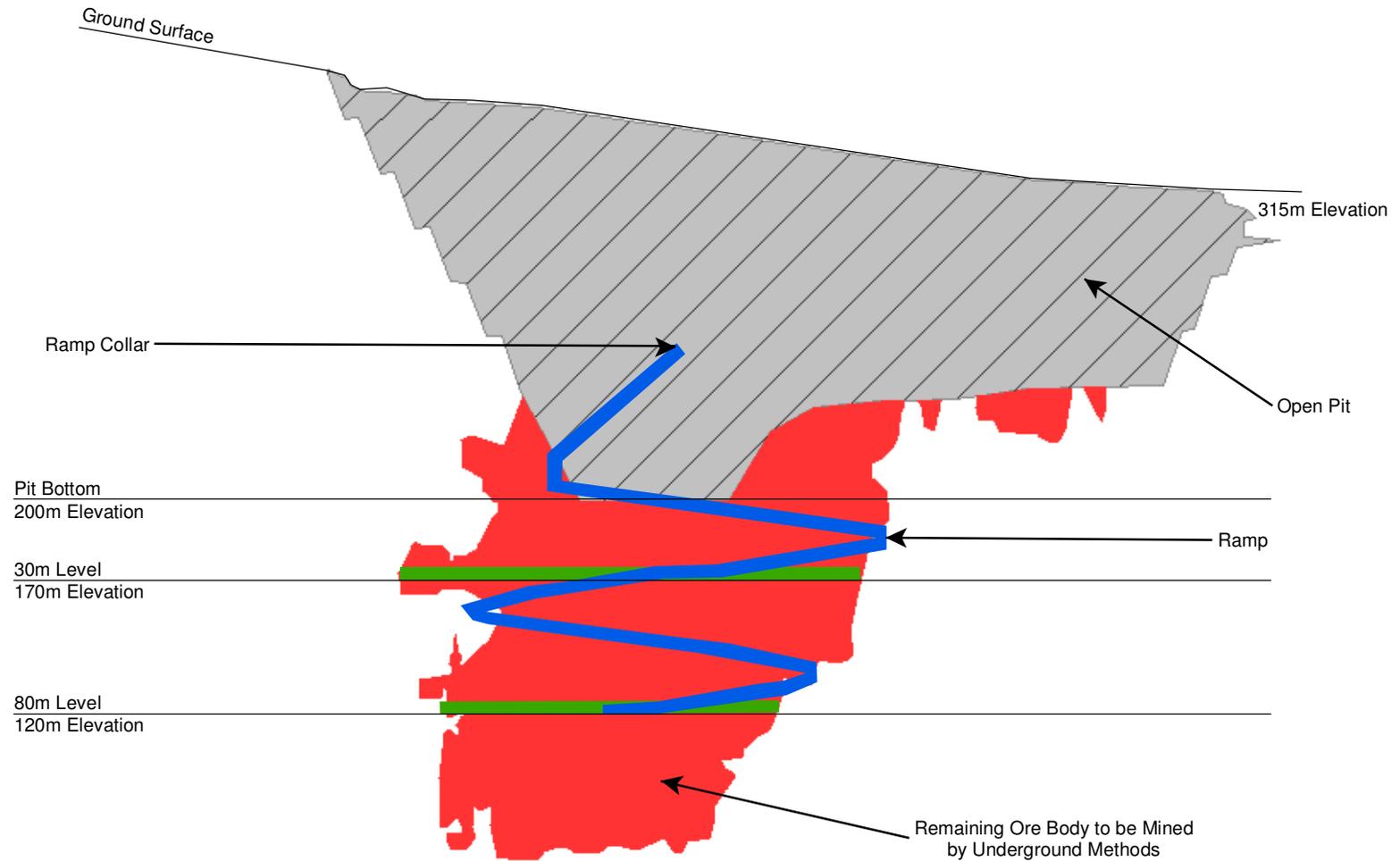
**Cross-Section through AB Zone Deposit**

References:  
Traced from a drawing by Wardrop Engineering Inc.  
0651310104-DWG-R0005 Rev B  
Dated 06 01 22

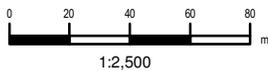
Projection: Not Applicable  
Revision: 1  
Date: September 18, 2006

 **Gartner Lee**

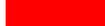
Figure: **PD. 4**



Section Looks Northwest



Legend

-  Open Pit
-  Underground



High Lake Project

Project Description

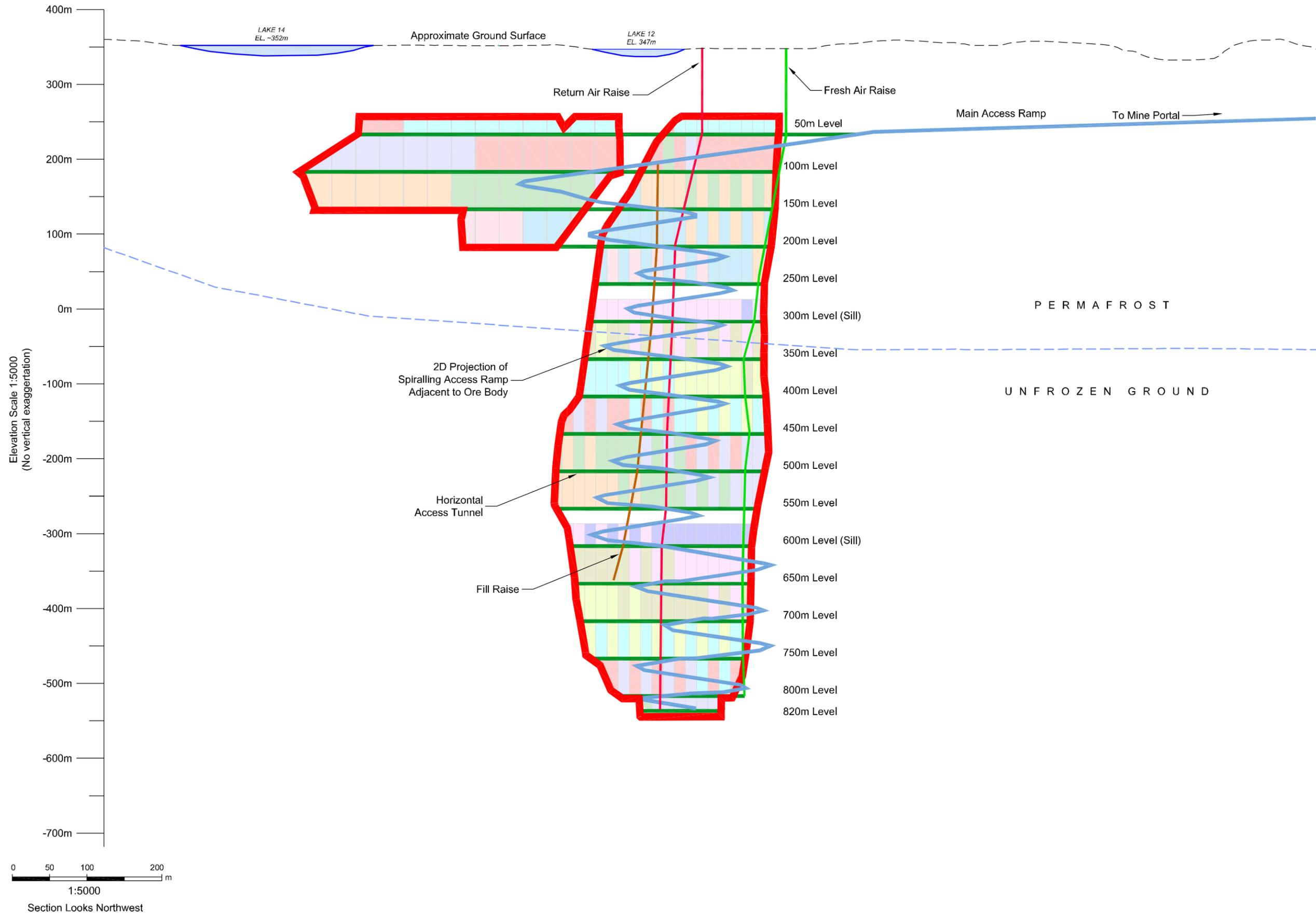
Cross-Section through D Zone Deposit

References:  
Traced from a drawing by Wardrop Engineering Inc.  
0651310104-DWG-R0004 Rev B  
Dated 06 01 22  
Projection: Not applicable  
Revision: 1  
Date: September 18, 2006



Figure: PD. 5

# Conceptual Cross Section Through West Zone Deposit



- Legend:**
- Access Ramp
  - Horizontal Access Tunnels
  - - - Approximate Permafrost Boundary
  - - - Approximate Surface Datum
  - Ore Body

**Mine Development Plan**

Year 1 to 3 - Development Work

- Year 4
- Year 5
- Year 6
- Year 7
- Year 8
- Year 9
- Year 10
- Year 11
- Year 12
- Year 13
- Year 14

**References:**  
DRAWING BY WARDROP ENGINEERING INC.  
0651310104-DWG-R0003 rev E  
DATED 060118

Prepared By: PW/MP  
Reviewed By: AK  
Projection: None  
Revision: 1  
Date: September 18, 2006

## Project Description Supporting Regulatory Applications

The chemical characteristics of the tailings require that they be submerged for disposal. This will allow for long term saturation, inhibit oxidation and preclude acid generation and metal leaching. They will be disposed of as a conventional slurried tailings deposited to the High Lake tailings impoundment and covered with water. Once mining in the AB and D Zones has been completed, additional tailings storage will be obtained from deposition in the AB Zone and D Zone pits.

An overall summary of estimates for the annual quantity of ore and waste rock that will be excavated from the High Lake mining zones and the annual quantity of concentrate and waste tailings produced throughout the life of the Project is provided in Table PD.6. Further materials balance details are found in Table PD.7.

Process water supply will be obtained by a combination of the following:

- recycling in the processing facility using a thickener: 4,300 m<sup>3</sup>/d;
- pumping reclaimed water from the primary polishing pond in the tailings impoundment: 3,100 m<sup>3</sup>/d;
- fresh water for process make-up from Lake L4: up to 1,300 m<sup>3</sup>/d;
- fresh water for process make-up (and potable water) from Lake L5: up to 1,000 m<sup>3</sup>/d; and
- possibly by pumping from the open pits after any major storm events.

On average, 4,400 m<sup>3</sup>/d of water will be discharged with the tailings from the processing facility to High Lake during operations. The Water Management Plan will be presented in Volume 8 of the *High Lake Project Proposal*.

Further details regarding the proposed facilities, construction and operation activities and closure and reclamation concepts for the High Lake mine site are provided below. The primary mining and processing facilities are described in Section 2.2 and the secondary supporting facilities such as power generation, water supply and accommodation are described in Section 2.3. Construction and operation activities are described in Sections 2.4 and 2.5, respectively. Closure and reclamation concepts are described in Section 2.6. A Preliminary Closure and Reclamation Plan will be presented in Volume 8 of the *High Lake Project Proposal*.

## Project Description Supporting Regulatory Applications

**Table PD.6 High Lake Project Materials Balance Summary**

Process Material	Approximate Life-of-Project Quantity (tonnes × 1,000)
<b>Mined ore</b>	
Open pit mining	4,322
Underground mining	13,830
<b>Total</b>	<b>18,152</b>
<b>Total concentrate production</b>	<b>1,797</b>
<b>Total tailings production</b>	<b>16,355</b>
<b>Waste rock production</b>	
Open pit mining	24,166
Underground mining	1,135
<b>Total</b>	<b>25,301</b>
<b>Waste rock used for underground backfill</b>	<b>7,200</b>
<b>Waste rock stored in permanent surface rock piles</b>	
AB Zone waste rock pile	14,410
D Zone waste rock pile	3,613
<b>Total</b>	<b>18,023</b>
<b>Tailings storage volume</b>	<b>(m<sup>3</sup> × 1,000)<sup>1</sup></b>
High Lake tailings impoundment	7,000
AB Zone pit	3,539
D Zone pit	1,487
<b>Total</b>	<b>12,026</b>

<sup>1</sup> Based on an assumed average settled density of 1.36 tonnes/m<sup>3</sup>

## 2.2 High Lake Mine Site Primary Facilities Description

### 2.2.1 Open Pit Mining – AB and D Zones

The open pits mines will be developed first due to their lower initial operating costs and the shorter time needed to develop the ore for production. The AB Zone open pit will be mined first because this zone contains higher-grade (copper) ore. The deposit is also large enough to mine at the target production rate of 4,000 tpd to provide a supply of ore to the mill at full capacity. Pre-stripping of the AB Zone open pit will start in Year minus 1, which will provide a 180,000 tonne stockpile of ore for mill commissioning. The AB Zone open pit mining will continue until Year 3.

HIGH LAKE PROJECT

Project Description Supporting Regulatory Applications

Table PD.7 High Lake Project Waste Rock, Ore, Concentrate and Tailings Balance

Operational Year	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	TOTAL
<b>Mining of Ore (tonnes*1000)</b>															<b>tonnes*1000</b>
Ore mined open pit, AB Zone	1,109	1,440	521	-											3,071
Ore mined open pit, D Zone	-	-	804	447											1,251
Annual total open pit ore mined	1,109	1,440	1,325	447	<b>NO FURTHER OPEN PIT MINING</b>										4,322
Ore mined underground West Zone			115	555	903	1,038	1,229	1,224	1,177	1,219	1,194	1,224	1,224	415	11,518
Ore mined underground AB Zone				438	198										636
Ore mined underground D Zone					339	402	211	216	263	221	25				1,676
Annual total underground ore mined			115	993	1,440	1,440	1,440	1,440	1,440	1,440	1,219	1,224	1,224	415	13,830
Total annual ore mined	1,109	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,219	1,224	1,224	415	18,151
<b>Processing (tonnes*1000)</b>															
Annual concentrate produced	129	131	145	153	153	133	137	129	134	140	121	125	125	42	1,797
Daily Concentrate Production, tpd	359	363	404	424	426	370	379	358	371	388	337	346	346	117	
Annual tailings production	980	1,309	1,295	1,287	1,287	1,307	1,304	1,311	1,306	1,300	1,097	1,099	1,099	373	16,355
Daily Tailings Production Rate, tpd	2,723	3,637	3,596	3,576	3,574	3,630	3,621	3,642	3,629	3,611	3,048	3,054	3,054	1,036	
<b>Mining of waste rock (tonnes) note a</b>															
Waste mined, AB Pit	8,251	5,533	627	-											14,410
Waste mined, D Pit	-	3,107	6,407	241											9,756
Annual total open pit waste rock mined	8,251	8,640	7,034	241	<b>NO FURTHER OPEN PIT MINING</b>										24,166
Waste mined underground West Zone			77	189	231	226	190	11	-						924
Waste mined underground AB Zone				121											121
Waste mined underground D Zone				89											89
Cumulative AB Surface Rock Pile	8,251	13,783	14,410	14,410	<b>REMAINS UNCHANGED FOR THE REMAINDER OF MINE OPERATIONS</b>										14,410
Annual underground waste rock mined	-	77	310	321	226	190	11	-	-	-	-	-	-	-	1,135
<b>Backfilling Underground (tonnes*1000)</b>															
Cumulative underground Waste Mined			77	387	708	934	1,124	1,135	1,135	1,135	1,135	1,135	1,135	1,135	
Backfill Placed underground West Zone					292	474	545	645	643	618	640	627	643	643	218
Backfill Placed underground A/B Zone						104	230	<b>BACKFILL AB OPEN PIT WITH TAILINGS STARTS IN YEAR 7</b>							334
Backfill Placed underground D Zone											880	<b>BACKFILL D OPEN PIT WITH TAILINGS STARTS MID YR 12</b>			880
Annual underground backfilling				292	578	775	645	643	618	640	1,507	643	643	218	7,200
Cumulative D surface rock dump waste after backfilling - note c			3,107	9,824	10,095	9,743	9,158	8,524	7,881	7,263	6,623	5,116	4,474	3,831	3,613
<b>TAILINGS PRODUCTION</b>															
Cumulative total tailings (tonnes*1000)	980	2,289	3,584	4,871	6,158	7,465	8,768	10,079	11,386	12,686	13,783	14,882	15,982	16,355	16,355
<b>ANNUAL TAILINGS STORAGE VOLUME (cubic metres*1000)- Note b</b>															<b>1000 m<sup>3</sup></b>
High Lake	721	963	952	947	946	961				300	807	404			7,000
AB pit							958	964	961	656					3,539
D pit											404	808	274		1,487

Notes:

- Continuous operations 360 days per year approximately
- a. SG of Waste (Insitu) 2.84
- b. Density of HL tailings settled 1.36 t/m<sup>3</sup>
- c. Density of Waste placed underground 1.89 t/m<sup>3</sup>

## Project Description Supporting Regulatory Applications

The D Zone open pit operations will start in Year 2, providing time to pre-strip the waste above the D Zone ore, which will be mined in Years 3 and 4. Table PD.1 provides an overview of the Project schedule, including operations at all mining zones. The extent of open pit mining of the AB and D Zones is illustrated in Figure PD.4 and Figure PD.5, respectively.

### 2.2.2 Underground Mining – West, AB and D Zones

The West Zone ore body is too narrow to mine by open pit methods and will be mined entirely by underground methods. Compared to the AB and D Zones, the West Zone resource is long and narrow and extends 500 m deeper underground (Figure PD.6).

The main underground access ramp for the West Zone will be constructed in Year 2 of operation. It will be driven from the portal, approximately 350 m north of the processing facility (Figure PD.3a and Figure PD.3b) to a depth of approximately 110 m below surface for a total distance of 1,100 m. In the ramp construction 77,000 tonnes of waste rock will be brought to surface and placed in the backfill stockpile.

Beginning in Year 3, the ramp will be continued downwards adjacent to the orebody in a “figure of eight” configuration and access drifts will be established off the ramp to the ore zone at 50 m vertical intervals. The deposit will be fully developed to the 750 m level (Figure PD.6), over a period of six years. A vent raise and fan house accessed by a single lane surface access road will be constructed beginning in the first quarter of Year 3, following the mine development and access ramp excavation. Installation of the main fans begins in the last quarter of Year 3.

Mine production in the West Zone will begin at the end of Year 3 at a production rate of about 1,500 tpd to be increased to approximately 3,400 tpd between Years 7 to 13, tapering off in the final year of production. Approximately 11.5 Mt of ore will be mined in the West Zone.

Ore resources in the AB and D Zone that are not mined by open pit mining will be mined using the same underground techniques as in the West Zone (Figure PD.4 and Figure PD.5). Underground mining in the AB Zone will occur in Years 4 and 5, and in the D Zone in Years 5 through 11. Production from the AB and D Zone underground mines will be critical to supplement ore production from the West Zone. The minimum and maximum production rates in the AB and D Zones will be between 600 and 1,200 tpd over seven years for the total underground resource of 2.3 Mt in the combined AB and D Zones.

The plan for the AB and D underground mines does not require the placement of backfill for stability. The waste rock generated from the underground operation in these zones will be managed by placing the rock into the mined-out stopes.

### 2.2.3 Mineral Processing Facility

Ore will be concentrated at the High Lake mineral processing facility (Figure PD.3a and Figure PD.3b). The concentration process uses conventional flotation circuits to separate the zinc and copper. These processes take advantage of differing affinities to air bubbles under controlled chemical conditions resulting from the addition of small amounts of chemicals or reagents.

The AB Zone ore primarily contains copper and will be processed through the copper flotation circuit. The D Zone and West Zone ores contain economical quantities of zinc, copper, gold and silver, and will be processed through both the copper and zinc flotation circuits.

The mineral processing facility has been sited in the southwest part of the High Lake drainage area, adjacent to the AB Zone and D Zone, to minimize haul distance and for ease of access to the West Zone underground mine portal (Figure PD.3a and Figure PD.3b).

The processing facility consists of:

- ore stockpile area (maximum capacity 10,000 tonnes);
- crusher building;
- screen building;
- two 55 m long belt conveyors between the crusher building and the screen building and one 150 m long belt conveyor between the screen building and the mill;
- main mill building which contains:
  - rod mill and ball mill;
  - zinc and copper floatation circuits;
  - zinc and copper concentrate thickeners, dryers and temporary concentrate;
  - storage facilities;
  - tailings thickener and disposal system;
  - office/warehouse;
  - garage;
  - workshop;
  - power house; and
- two concentrate storage buildings (one each for zinc and copper concentrates).

Building and machinery foundations will be constructed from reinforced concrete. Large, heavy foundations will be placed directly on bedrock. Floors will be concrete slabs placed on engineered fill which will include insulation and drainage where required to protect permafrost.

## Project Description Supporting Regulatory Applications

## 2.2.4 Power Generation

The total power requirement at the High Lake mine site will be 10,500 kW, provided by seven diesel electrical units:

- three 1,500 kW units;
- two 2,100 kW units; and
- two new 2,500 kW units.

These units will be located in the power house in the processing facility. Additional generation capacity of about 1,200 kW will be located in the accommodation complex in the event of a failure of the main system. Power distribution will be provided on surface by protected cabling.

## 2.2.5 High Lake Mine Site Roads and Utilities

All mine site roads are identified on Figure PD.3a. The mine haul roads will have a total width of 30 m, including drainage ditches and 1.3 m high safety berms. This road allowance allows for safe two-way traffic of 100 tonne capacity trucks. All other site roads will have an 18 m road allowance. The roads will be constructed using non acid generating (NAG) waste rock.

Permanent pole-mounted exterior lighting will be provided around the processing facility, and accommodation buildings, the West Zone portal and the primary crusher. Exterior lighting will be provided on buildings at the explosives storage and manufacturing areas, the water intakes at Lake L4 and Lake L5, the north end of the tailings impoundment and on the West Zone air intake and exhaust housings. Lighting may be installed along the mine haul roads. Mobile lighting units will be used within the open pits.

All water and sewage lines will be enclosed, insulated and protected from traffic and winter conditions.

## 2.2.6 Underground Mine Ventilation

The key characteristics of the underground mine ventilation systems are summarized in Table PD.8. Mine exhaust and fresh air intakes within the West Zone ore body will use steeply inclined return air and fresh air raise shafts (Figure PD.6). Additional ventilation will be provided via the main access ramp and portal. The AB and D Zone underground mines will be ventilated via the entry portal at the bottom of the open pits. Fans located at the portals will draw exhaust air from the bottom of the AB and D Zone underground mines. Fresh air will be delivered to the underground workings via raises and through the access ramps.

## Project Description Supporting Regulatory Applications

**Table PD.8 Summary of Underground Mine Ventilation Equipment**

<b>West Zone</b>				
<b>Type of Equipment</b>	<b>Mine Exhaust Raise</b>	<b>Mine Exhaust Portal</b>	<b>Mine (Fresh Air) Escapeway</b>	<b>Mine Fresh Air Raise</b>
Number of Units	1	1	1	1
Stack Size	3.5 m x 3.5 m	5.0 m x 5.5 m	3.5 m x 3.5 m	3.5 m x 3.5 m
Exit Velocity	10.4 m/s	1.7 m/s	0.4 m/s	10.4 m/s
<b>AB and D Zones</b>				
Type of Equipment	Mine Exhaust Fan (in pit, at portal)			
Number of Units (for each zone)	1			
Stack Diameter	1.95 m			
Exit Velocity	19.2 m/s			

### 2.2.7 Ore and Waste Rock Storage Sites

The proposed waste rock and ore storage sites are found on Figure PD.3a and Figure PD.3b.

The AB Zone waste rock pile has a capacity of approximately 14.4 Mt (6.7 Mm<sup>3</sup> based on a density of 2.14 tonnes/m<sup>3</sup>) and all waste rock from the AB Zone will be stored here. A seepage cut-off dam (toe dam) will be constructed across the western bay of High Lake beneath the eastern toe of the AB Zone waste rock pile (Figure PD.3a and Figure PD.3b) to prevent the flow of water and heat across the foundation and to promote the progressive freezing of the waste rock pile. The seepage cut-off dam is comprised of two parallel rockfill embankments with tailings placed between them. Water from the bay will be pumped into the main body of High Lake. The lake bed will be exposed to ambient air temperature allowing the base of the rock pile to begin freezing. No other foundation preparation is expected to be required as the area is predominantly underlain by bedrock.

The D Zone waste rock pile has an operational capacity of approximately 12 Mt (5.6 Mm<sup>3</sup>). Approximately 3.6 Mt (1.7 Mm<sup>3</sup>) will be permanently stored here and the remaining material from this zone will be used for backfill in the West Zone underground mine. The D Zone waste rock pile will extend across Lake L19 (non-fish bearing). During operation, stream flow into Lake L19 will be diverted either along the south side of the main haul road to the D Zone pit and then by culvert and ditching to Lake L17, or by a diversion channel around the south side of the AB open pit to the High Lake impoundment. A proportion of the PAG waste material generated from the D Zone pit will be placed temporarily in the D Zone rock pile pending use during the life of the Project as backfill in the west Zone underground mine.

Both waste rock piles have been designed and will be operated to encapsulate PAG rock within a thick layer of NAG rock so that the PAG material progressively freezes due to the aggradation of permafrost.

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The thickness of the NAG rock will be sufficient to insulate the PAG rock from the seasonal freeze-thaw cycle. Surface runoff from the mine waste piles will be directed towards the High Lake tailings impoundment.

The backfill stockpile adjacent to the West Zone underground mine portal has a capacity of approximately 1.5 Mt (700,000 m<sup>3</sup>) and will be completely depleted by the end of mining operations. A smaller 8,000 tonne capacity pad will be located adjacent to the portal for temporary storage of waste mine rock during poor weather.

The primary ore storage pad (10,000 tonnes) will be located at the southwest corner of the backfill stockpile, adjacent to the processing facility. A 3,000 tonne capacity pad will be located adjacent to the West Zone underground mine portal for temporary ore storage during inclement weather. Mine rock produced from the West Zone underground mine that cannot be used underground directly will be temporarily stored adjacent to the portal, or at the D Zone waste rock pile.

## 2.2.8 Tailings Impoundment

An estimated 16.4 M dry tonnes of tailings will be produced during the life of the Project, requiring a total storage volume of up to approximately 12 Mm<sup>3</sup>, based on a conservatively assumed settled dry density of 1.36 tonnes/m<sup>3</sup>. The tailings impoundment has been designed to maintain a flooded water cover over the tailings in perpetuity. Tailings will be deposited subaqueously in the High Lake impoundment and kept submerged to inhibit oxidation and the associated risk of acid rock drainage (ARD) and metal leaching. Two 150 mm diameter high density polyethylene pipelines will convey tailings to a central point on the west side of High Lake, from which a floating pipeline will be established to distribute tailings evenly across the lake floor (Figure PD.3a). One pipeline will serve as a backup.

Once mining in the AB Zone and D Zone is complete, additional storage capacity will be obtained, by flooding the underground workings in these zones and storing the tailings as follows:

- The AB Zone pit will be available for tailings storage between approximately Years 7 to 10 of mine operation. During this period, the AB Zone pit will receive 100% of the tailings stream and will be filled. Once the pit has been filled, excess water will be drained and tailings will be capped with NAG waste rock.
- The D Zone pit will receive approximately 50% of the tailings from Year 12 of mine operation and 100% of the tailings from Years 13 and 14. This will fill the pit to approximately 75% of its capacity with tailings.

Further details regarding reclamation of the open pits is provided in Section 2.6.1. A Preliminary Closure and Reclamation Plan will also be presented in Volume 8 of the *High Lake Project Proposal*.

## Project Description Supporting Regulatory Applications

The anticipated availability of tailings storage volumes is shown in Table PD.9.

**Table PD.9 Summary of Tailings Storage Locations and Volumes**

Tailings Storage Location	Approximate Storage Capacity	Expected Use of Storage Capacity	Expected Availability
AB Zone open pit	5.0 Mt / 3.7 Mm <sup>3</sup>	4.8 Mt / 3.5 Mm <sup>3</sup>	Years 7 to 10
D Zone open pit	2.9 Mt / 2.1 Mm <sup>3</sup> <sup>(a)</sup>	2.0 Mt / 1.5 Mm <sup>3</sup>	Years 12 to 14
High Lake tailings impoundment	12 Mt / 8.5 Mm <sup>3</sup> <sup>(b)</sup>	9.5 Mt / 7.0 Mm <sup>3</sup>	Years 1 to 14
Total	19.9 Mt / 14.3 Mm <sup>3</sup>	16.3 Mt / 12 Mm <sup>3</sup>	

<sup>(a)</sup> Storage capacity will only be available if economical reserves in the D Zone can be mined out in time.

<sup>(b)</sup> In case D pit is not available in time for tailings storage, this includes a 1.6 Mm<sup>3</sup> increase from High Lake's existing capacity of 6.9 Mm<sup>3</sup> through the construction of perimeter dams (see Section 2.2.9, Water Management Structures).

## 2.2.9 Water Management Structures

The water management structures in the High Lake impoundment have been designed to maintain a flooded water cover over the tailings in perpetuity. The current capacity of High Lake is estimated at 6.9 Mm<sup>3</sup> based on a surface elevation of 286 m. Four dams along the perimeter of the tailing impoundment (Figure PD.3a) will raise the storage level by 3 m to elevation 286 m. An additional 2 m will be added for flood and wave action events and a permanent water cover of approximately 2.5 m will cover the tailings. The final elevation of the dam crests will be 290.5 m.

The four dams required for tailings containment in High Lake (Dams #1 to #4, Figure PD.3a) will be rockfill embankments, with an upstream sloping geomembrane liner for water retention. The liner will fold back under the centreline of the crest and tie into intact bedrock via a key trench cut-off. This liner/bedrock connection is located under the crest in order to keep the foundation beneath the dam frozen. Additional measures to reduce seepage that may be incorporated in the dam designs include double-liners, thermosiphons, and seepage interception and collection wells.

Various synthetic liner materials will be considered in more detail during the next engineering design phase, and will be installed using appropriate processes. Rockfill used for dam construction will be of a 600 mm maximum particle size. Sand and bentonite clay will be used to bed and seal the liners so that they are integral with the in-situ bedrock mass. The liners will be supported on and protected by processed filter and bedding granular materials and rip rap materials will be placed on the upstream face to protect the liner and cover material against wave and ice action. The objective of this design is to minimize seepage under the dams. If talik zones are found in the foundation, some seepage would be expected. No taliks are indicated by the currently available subsurface information. If taliks are

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encountered, winter foundation preparation and/or thermosyphons (passive heat exchangers) will be installed into the dam section to cut-off potential seepage pathways. The proposed dams will serve to prevent uncontrolled release of water from the High Lake drainage area to the Kennarctic River or to the adjacent Lake L15 (Figure PD.3a).

The width of the crest will be a minimum of 6 m and will be determined during detailed engineering. The side slopes of the dams will be between 2 horizontal (H):1 vertical (V) and 3H:1V, assuming that foundations are intact competent bedrock. The flatter slope would be required if the liner is positioned parallel to the upstream slope. Otherwise, 2H:1V will be used. This takes into account site seismicity and achieves long term safety factor requirements.

A fifth dam (Dam #5) will be required in order to divert the outflow of L18 (Contact Lake) from L17 towards the Kennarctic River. In addition this dam will serve to prevent any seepage flows between Lake L17 and Lake L18 and preclude any passage of fish from L18. A low dam and seepage cut-off, similar to those proposed for the High Lake tailings impoundment is proposed between Lakes L17 and L18, as shown on Figure PD.3a and Figure PD.3b.

Instrumentation, including thermistors, piezometers, monitoring wells and deformation sensors will be installed in the dams to verify performance.

The overall objective of the proposed discharge scenario is to meet water quality guidelines in the Kennarctic River. The north end of High Lake will act as the primary polishing pond (Figure PD.3a). It will be subdivided from the main body of the impoundment structure by a filter berm that will retain solids but allow water to pass through. A second polishing pond will be constructed adjacent to Lake L30 (Figure PD.3a). Water will first be decanted from the main body of the tailings impoundment into the primary polishing pond, then into the second polishing pond. Water meeting discharge criteria, will be released into the Kennarctic River basin during the open water season.

If water does not meet the discharge criteria, contingency plans include treatment in the polishing pond through the use of reagents to promote removal of metals and by increasing retention time in the main tailings impoundment and placement in mined-out pits.

There is no planned discharge from the High Lake tailings impoundment during the first 2 years of operations, when the naturally occurring elevated levels of metals in High Lake result in concentrations above allowable discharge limits. During this time, if required to ensure that any seepage from the facility meets discharge limits, water can be pretreated in the basins established by the construction cofferdams.

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Site runoff will be treated at a lime dosing station located adjacent to the eastern rim of the AB Zone open pit (Figure PD.3a and Figure PD.3b). This includes water from the following sources:

- surface runoff from the processing facility area;
- water pumped from the AB Zone open pit;
- water pumped from the D Zone open pit;
- springs intercepted between the AB pit and AB waste rock pile; and
- excess supernatant water in High Lake requiring treatment.

Drainage from Lake L21 and drainage collected from the processing facility area will be conveyed to High Lake either by a channel constructed parallel to the haul road around the south side of the AB open pit, or by a channel along the side of the haul road to the D open pit to Lake L17 and then to High Lake. Site runoff may be routed through Lake L17 in the later stages of mining. A lime dosing station would be established if necessary.

Lake L15, at the northwest end of High Lake, receives runoff from a small drainage area which under natural conditions drains into High Lake. Any excess accumulations of water in L15 will need to be rerouted north towards Lake L4. It is proposed to allow drainage of Lake L15 to enter Lake L4 via a rock drain. The use of a rock drain will provide for the drainage of water but precludes any passage of fish between Lake L15 and Lake L4. The rock drain will be buried beneath the main access road from High Lake to the Grays Bay dock facility.

A preliminary Water Management Plan will be presented in Volume 8 of the *High Lake Project Proposal*.

## 2.3 High Lake Mine Site Secondary Facilities Description

### 2.3.1 Camp Accommodation, Offices and Maintenance Buildings

The peak construction workforce will be about 440 people, which will occur for only a few months. Typically the construction workforce will be between 350 and 400 people. At the start of construction, a temporary camp will be used, which will include: 1) modifying the existing 70-person camp to accommodate 140 people; and 2) relocating the 40-person existing camp at Sand Lake to the High Lake mine site, increasing total occupancy to 180 people. To accommodate the construction crew, rooms will be temporarily converted to double occupancy increasing the accommodation capacity up to 320 people.

The permanent camp for operation will be erected early in the construction period. Completion of this accommodation facility will coincide with the period of maximum demand for construction accommodation (Year minus 1). The permanent camp will be a multilevel hard shell modular complex,

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which will house 250 people in single rooms with individual washroom facilities during the operational phase of the Project. Additional accommodation required during the first four years of mining when open pit mining takes place will be provided by the temporary construction camp located immediately south of the permanent camp. The locations of the temporary and permanent camps are found on Figure PD.3a and Figure PD.3b.

The main processing facility will include space for offices, warehousing, diesel generators, and a mine equipment maintenance garage. An equipment lay-down area and cold storage buildings will be located south of the main processing facility.

A three bay mining equipment maintenance garage will be constructed south of the permanent camp (Figure PD.3b). It will have a concrete floor, with sumps for collection of spilled fuel and lubricants. Underground maintenance facilities may also be established as part of the West Zone underground mine workings to reduce equipment movements.

Heat conservation was an important consideration in siting buildings at the mine site. The permanent camp will be located adjacent to the industrial facilities and linked by a fully enclosed arctic corridor to facilitate movement of personnel and sharing of power, heat, water and sewage infrastructure. This will also enhance safety by limiting the personnel's exposure to wildlife and inclement weather.

### 2.3.2 Water Supply and Wastewater Management

Sources of process water are: water recycled from the processing facility, water reclaimed from the primary polishing pond, and fresh water pumped from Lake L5 and Lake L4. Approximately 85% of the process water needs will be met by recycled and reclaimed water. About 1,400 m<sup>3</sup>/d of fresh water will be withdrawn from Lake L5 and Lake L4. This includes 100 m<sup>3</sup>/d for domestic use, which will be obtained only from Lake L5.

Pump houses for the Lake L4 and Lake L5 water supply will be installed at the southern end of each lake. A water line will also be installed and routed within the High Lake drainage area to the processing facility. Water will be extracted to meet the federal department of Fisheries and Oceans Canada (DFO) requirements. The water intake structures will be designed and built in accordance with DFO's *Fresh water Intake End-of-Pipe Fish Screen Guideline* (1995).

Sewage from the camp and from other process and maintenance facilities will be conveyed in heat traced insulated pipes to a pre-packaged wastewater treatment plant located in the processing facility. A Rotating Biological Contactor sewage treatment system or a similar system will be used. The treated effluent will be discharged into Lake L20 during the construction period. During operation, treated effluent will be

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discharged into the mine tailings system. The design flows and loadings of untreated sewage are as follows:

Average day flow	80,000 L/d
Peak day flow	120,000 L/d
Peak hour Flow	13,400 L/hr
Average day BOD	300 mg/L
Average day TSS	300 mg/L

Treated discharges will meet the Nunavut Water Board's *Guideline for Discharge of Domestic Wastewater in Nunavut* (2000) as follows:

BOD <sub>5</sub>	<40 mg/L
TSS	<60 mg/L
Faecal coliforms	<10,000 / 100 mL
PH	6 to 9
Oil and grease	<5 mg/L

The collection system will consist of heat-traced insulated piping. Portions of the piping may be placed on elevated cribbing to allow for surface water drainage or in culverts to allow unobstructed flow of traffic.

The excess biomass (sludge) produced in treating the domestic wastewater will be aerobically digested, stored in sludge thickening/storage cells located at the wastewater treatment plant and then landfilled within the waste rock piles.

### 2.3.3 Solid Waste Management Facilities

#### Incinerator

The existing incinerator will be used to incinerate combustible inert solids throughout the life of the Project. The incinerator design capacity will accommodate the maximum peak waste streams generated during construction. To minimize waste handling activities, it will be installed near the processing facility and camps (Figure PD.3a and Figure PD.3b). The building will be heated with waste heat from the incinerator. During operations, power will be supplied from the processing facility. The incinerator building will be located within an electric-fenced area to deter wildlife.

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The following types of material will be incinerated:

Organic Waste (such as kitchen waste)	Domestic waste
Wood	Light plastics (bags, thin plastics)
Paper	Rags contaminated with hydrocarbons
Cardboard	Engine waste oil (used as incinerator fuel)
Oil filters	Cooking waste oil (used as incinerator fuel)
Air filters	

### Landfill

Non-combustible materials will be landfilled within the AB Zone and D Zone waste rock piles (Figure PD.3a and Figure PD.3b). During the construction phase, non-combustible materials will be stored within the AB Zone waste rock pile and landfilled as mine rock becomes available to cover it.

The following items will be designated as landfill waste and buried within the surface waste rock piles:

Wood	Vehicle lights
Iron products	Fibreglass
Plumbing piping (copper, steel, etc.)	Styrofoam boards
Electrical wiring	Insulation
Compressed gas containers	Plaster and plaster boards
Rubber products	Hydraulic rubber hoses
Tires	Rock resin
Heavy plastics (pails, etc.)	Ash produced from incinerator
Plexiglass	Soils that have been remediated in the land farm
Glass	

### Landfarm

A lined landfarm facility will be built during the construction phase approximately 300 m west of the incinerator (Figure PD.3a and Figure PD.3b). It will be used as a treatment facility for hydrocarbon-contaminated material and operated during summer months.

### 2.3.4 High Lake Mine Site Fuel Storage

Fuel will be stored at three locations at the High Lake mine site. The main tank farm will be located between the West Zone ore stock pile and the processing facility (Figure PD.3b). It will consist of two 1,050,000 L capacity diesel fuel tanks plus required containers of gasoline and lubricants, all within a

## Project Description Supporting Regulatory Applications

bermed area with minimum spill storage capacity of 1,160,000 L. The vehicle fuelling area will be located at the north side of the bermed tank area, and will be lined and graded to contain any spillage.

The fuel storage for the generators at the processing facility power house will be located alongside the west wall of the power house (Figure PD.3b) and will consist of two 100,000 L tanks. The tanks will be located within a 110,000 L capacity bermed and lined area.

Emergency diesel generators and a 55,000 L diesel storage tank will be located immediately to the south of the maintenance garage (Figure PD.3b). The diesel storage tank will be located within a 61,000 L capacity bermed and lined area.

All fuel used for the High Lake Project will have a low sulphur content (15 ppm).

The tank farm and fuel storage areas will incorporate a security system including appropriate levels of illumination and fencing. Electrical grounding of the site will include piping systems and grounding of tanks. Spill control and other safety measures incorporated into the design of the fuel-oil storage compound will conform with Part IV of the National Fire Code of Canada 1990, the American Petroleum Institute (API) Standard 650, and the Canadian Electrical Code and will include the following:

- The tanks will be equipped with automatic level controls and alarms, overflow connection, access stairs, manhole access, floating suction, vents and any other tank appurtenances as may be required.
- The fuel storage tanks and containers will be located within a bermed area, with minimum spill storage capacity of 100% of the largest tank capacity plus 10% of the aggregate capacity of the other tanks within the tank farm.
- The vehicle fuelling area will be adjacent to the fuel storage area and will be bermed and graded to contain any spillage.
- The bermed areas will be sealed using polymer geosynthetic liners to prevent release of any spilled substances through exfiltration. A protective covering of sand will be applied on top of these liners.
- Liquids collected at the containments will be pumped to an oil/water separator. The separated oil will be incinerated and the water will be discharged to the High Lake tailings impoundment.
- The compound will be inspected at least weekly.

A preliminary Emergency Response and Contingency Plan, which includes a spill contingency plan, will be presented in Volume 8 of the *High Lake Project Proposal*.

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### 2.3.5 Explosives Storage

Annual explosive requirements have been estimated as follows:

- surface mining: 2,500,000 kg of ammonium nitrate;
- underground mining: 430,000 kg of ammonium nitrate; and
- detonators: 23,000 units.

Explosives use at the mine site will consist primarily of ANFO, which is produced by mixing ammonium nitrate (AN) prills with fuel oil (FO) or kerosene at a typical ratio of 94% ammonium nitrate and 6% fuel oil by weight. ANFO possesses a low sensitivity to detonation and requires the use of a blasting cap or high strength booster to set it off. It will typically burn rather than explode when directly exposed to fire.

If excessively wet conditions are encountered in the underground mining operations, emulsion based explosives may be required and these will be purchased in pre-packaged sticks.

The explosives storage and manufacturing facility is located approximately 1.5 km south of the processing facility (Figure PD.3a). It has been sited in consultation with federal department of Natural Resources Canada, Explosives Regulatory Division and to meet the set back requirements of the federal *Explosive Act* and Explosives Regulations.

All explosives-related structures will be located within a barricaded and fenced area as shown on Figure PD.3a. This facility will consist of the following:

- An explosives mixing plant consisting of a 10,000 L dual-walled fuel oil holding tank and a metering/mixing system to mix the ANFO in the specified ratio. The ANFO is discharged to 25 kg capacity tote bags for transfer to the mining sites.
- A detonator magazine, located between the explosives mixing plant and ammonium nitrate storage, at a distance of 155 m from the explosives mixing plant.
- An ammonium nitrate tote bag storage area with 3,000 tonne capacity, located 300 m south of the detonator magazine.

A preliminary Emergency Response and Contingency Plan will be contained in Volume 8 of the *High Lake Project Proposal*.

### 2.3.6 Sand Lake Airstrip

The Sand Lake airstrip will be operated as a private facility to service the High Lake Project and will be available for emergency use. It is located approximately 12 km north of the High Lake mine site at the

## Project Description Supporting Regulatory Applications

southern end of Sand Lake (Figure PD.7). The Sand Lake airstrip, is assumed to be in place for the purposes of describing the High Lake Project (see Section 1.3):

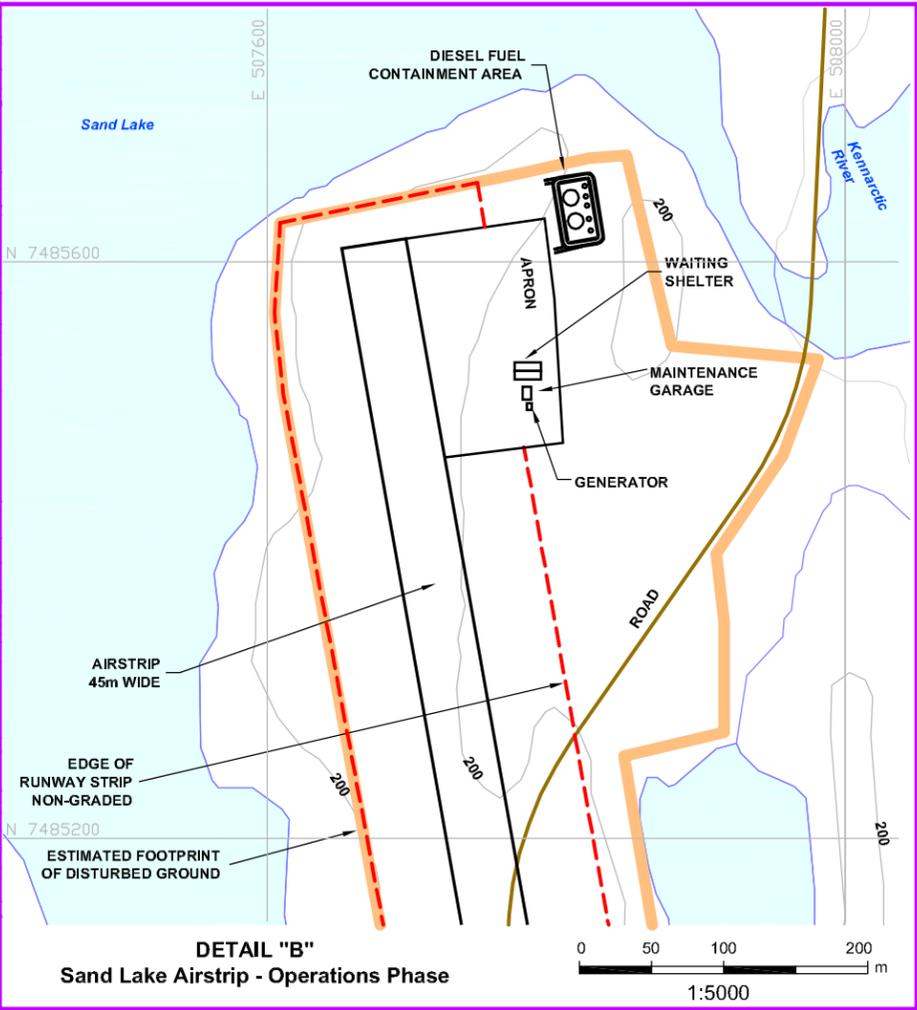
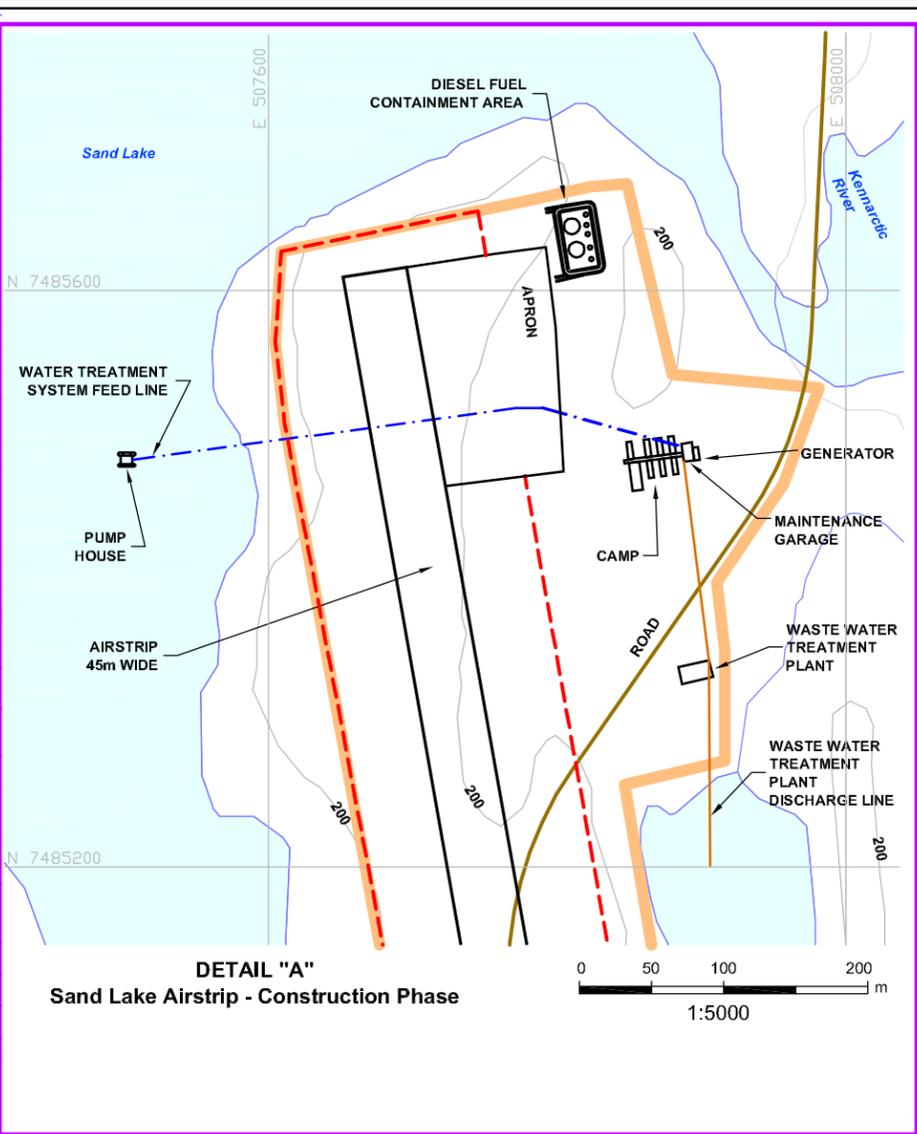
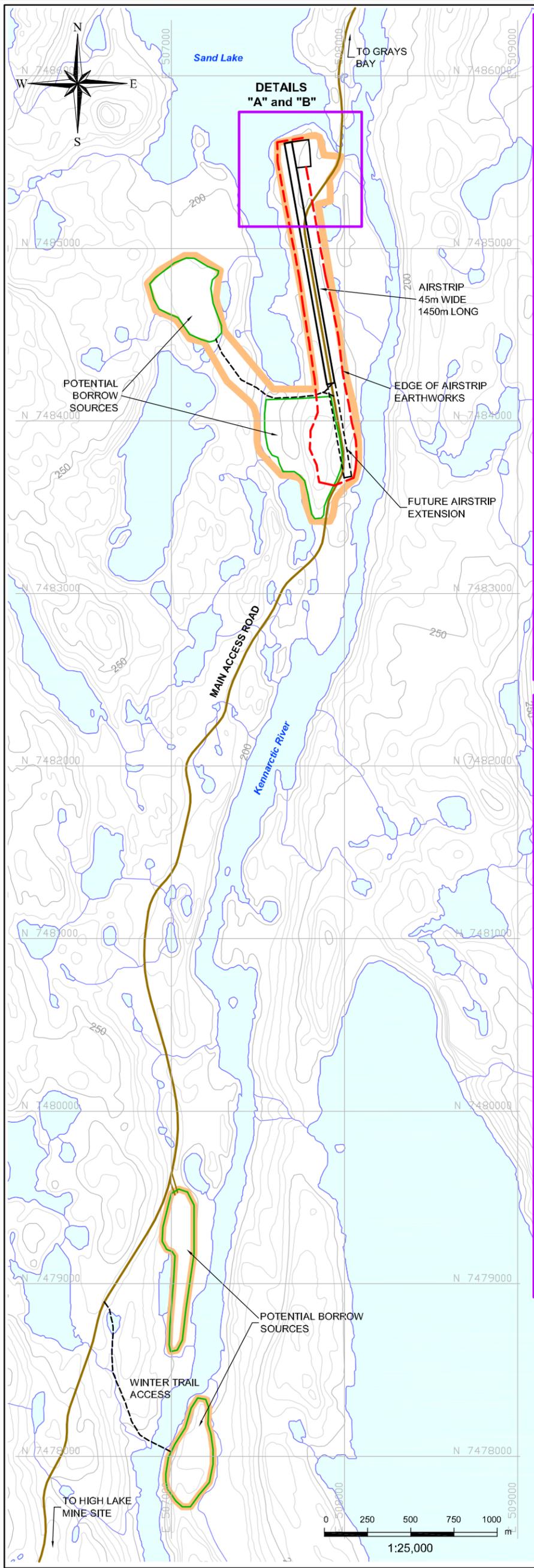
The Sand Lake airstrip, which is assumed to be in place for the purposes of describing the High Lake Project, consists of:

- a 1,450 m long by 45 m wide airstrip and a parking and loading area at the north end;
- a temporary 40 person construction camp including a water treatment system;
- 500,000 L fuel storage/vehicle fuelling facility (diesel fuel containment area) located adjacent to the northeast corner of the airstrip apron (parking and loading area);
- two 250 kW diesel generators;
- a fresh water intake pump house located on a barge on Sand Lake; and
- a maintenance garage located east of the construction camp.

Upgrades and changes to the Sand Lake airstrip to be undertaken during development of the High Lake Project includes (Figure PD.7):

- runway extension to a total length of 2,000 m at some time during the life of the Project;
- development of a waiting shelter in the south-east part of the apron;
- decommissioning the temporary Sand Lake construction camp and relocation to the High Lake mine site after the all-season access road between the Grays Bay dock and mine site is complete (Year minus 1 or Year minus 2);
- relocation of the waste water treatment plant to High Lake at the end of the construction phase; and
- expansion of the fuel storage/vehicle fuelling facility to 1.4 ML, consisting of the following:
  - one 100,000 L tank for Jet A fuel;
  - one 50,000 L tank for Jet B fuel;
  - two 500,000 L tanks for diesel fuel; and
  - a small quantity of gasoline and oil containers.

De-icing fluid will also be stored within the fuel containment berms. The design of the fuel storage facility will incorporate the same spill control and safety measures as the main tank farm at the High Lake mine site (Section 2.3.4).



**Legend:**

	Disturbance Footprint
	Contours (10 m)
	Watercourse
	Waterbody



**High Lake Project**  
Project Description

**Sand Lake Detailed Layout**

**References:**  
Wardrop Engineering drawings:  
0551310100-DWG-B0003 rev E dated 06.03.21  
0551310100-DWG-G0025 rev B dated 06.06.29  
0551310100-DWG-G0010 rev G dated 06.03.15  
National Topographic Database (NTDB) compiled by the government of Canada, Natural Resources Canada (NRCan) at 1:50,000.

Projection: UTM Zone 12 NAD 83  
Revision: 1  
Date: September 18, 2006

Prepared By: PW  
Reviewed By: AK

	Gartner Lee	Figure: <b>PD. 7</b>
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## 2.4 High Lake Mine Site Construction Activities

### 2.4.1 Earth Moving (Blasting, Excavation, Drilling, Grading and Backfilling)

The terrain at the mine site is almost entirely underlain by bedrock at or near the surface. No major geotechnical constraints for construction have been identified. Site preparation for the mine site facilities, roads and dams will require stripping of vegetation and surficial soils, loose boulders and frost shattered rock outcrops to expose intact bedrock. Excavations may extend to greater depths in some locations to remove ice-rich soil or rock. Seepage cut-off trenches for the impoundment structures will be excavated to competent bedrock. Drilling and blasting will likely be required. Waste materials will be placed either the AB Zone or D Zone waste rock pile.

Preliminary excavation and fill quantity estimates for construction of the impoundment dams are:

- 80,000 m<sup>3</sup> foundation excavation; and
- 220,000 m<sup>3</sup> total fill.

Conventional drilling and blasting techniques will be used for excavation of ore and waste rock in the AB Zone open pit to provide ore feed for commissioning of the processing facility. Waste rock and ore will be removed from excavations by mechanical excavators and trucks. Water will be used as needed for dust suppression during earthmoving activities. The annual quantities of materials to be excavated from the AB and D Zone open pits are provided in Table PD.7.

### 2.4.2 Borrow Sources

Non acid generating pre-development mine waste rock will be used to prepare access roads, impoundment structures and other fill platform. Quarrying of the NAG rock will begin in Year minus 2 and continue through construction of surface facilities. Excavated bedrock from building, road and impoundment structure sites will also be used for site preparation. Where necessary, a portable crusher will be used to prepare the material.

Sand and gravel will also be sourced from several potential borrow sources located near the Sand Lake airstrip, the High Lake mine site, and along the High Lake to Grays Bay all-season road (Figure PD.2). Borrow sources will be refined in the detailed engineering phase of the Project. A preliminary Borrow Management Plan will be presented in Volume 8 of the *High Lake Project Proposal*.

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### 2.4.3 Drainage Management

Runoff from the main portion of the site, e.g., waste rock piles, processing facility, office and accommodation area, will be contained within the High Lake drainage area to protect fish and fish habitat in the upper High Lake drainage area. Runoff from the processing facility, camp and ore stockpile areas will be directed away from Lake L21, Lake L22, and Lake L23 and routed towards High Lake. A dam will be constructed between Lake L17 and Lake L18 to divert Lake L18's clean drainage away from the High Lake impoundment directly into the Kennarctic River. In addition, this dam will prevent seepage to Lake L18 and preclude fish passage from Lake 18 to Lake 17. Throughout construction, erosion and sediment control measures (e.g., silt fence, flow checks in ditches, erosion control blankets and/or seeding and mulch on exposed earth slopes), will be used where required to protect adjacent water bodies.

All temporary and permanent storage sites for excavated materials will be managed to contain sediment and runoff. With the exception of portions of access roads, runoff from all construction areas for the primary facilities will be directed towards High Lake, which will serve as a sediment collection pond. In addition, intermediate small depressions may be used to temporarily hold surface runoff and collect construction related sediment.

Runoff from the eastern tailings dam, the explosives storage and manufacturing complex, the water supply intakes access roads, and the West Zone ventilation houses will be allowed to drain naturally.

During construction of the tailings impoundment dams, it will be necessary to dewater the foundation areas by using temporary cofferdams. Water pumped from the dam sites will be added to the main body of High Lake.

A preliminary Water Management Plan will be presented in Volume 8 of the *High Lake Project Proposal*.

### 2.4.4 Explosives Manufacture

Explosives storage has been discussed in Section 2.3.5. During construction, pre-mixed explosives will likely be used and they will be stored in magazines placed within the future ANFO storage impoundment (Figure PD.3a).

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**2.4.5 Transportation**

All materials and construction equipment will be transported to the mine site by a combination of sea and surface transportation (winter and all-season road) or by aircraft. All personnel will travel to site by aircraft landing at the Sand Lake airstrip. A winter airstrip may be at the mine site on High Lake.

Table PD.10 outlines the proposed schedule and routing of equipment and materials to High Lake.

**Table PD.10 Proposed Schedule and Routing of Construction Equipment and Materials to High Lake**

Schedule	Method and Route of Delivery	Equipment and Materials
Upon receipt of permits, Year minus 1	Winter or All-season road from Grays Bay	New and used materials and equipment: Portable crusher, cement, forming materials, reinforcing steel, new construction equipment, cement plant, screen and mill feed bin, structural steel and siding for mill, warehouse, garage, diesel generators, concentrate storage sheds, air compressors, vacuum pumps, grinding, flotation, thickening and dewatering circuits, electrical equipment, instrumentation and cables, piping and pumps, conveyors
	Airlift to High Lake mine site	Portable concrete plant
Years minus 1 and 2	All-season road from Grays Bay	New mill equipment and permanent camp
Year minus 1	All-season or winter road from Grays Bay	New crusher, screen and mill feed bin
	All-season road from Grays Bay	Mill chemicals, reagents etc.

Issues related to access, traffic, safety and wildlife will be addressed in management plans. A preliminary Access and Traffic Management Plan and a preliminary Wildlife Mitigation and Monitoring Plan will be included in Volume 8 of the *High Lake Project Proposal*.

An example of traffic and aircraft protocols includes:

- Traffic will be directed to halt operations when wildlife is observed close to or on the roads, and wildlife will be given the right-of-way.
- All vehicles will be restricted to designated roads and prepared work areas within the designed disturbance footprint .

## Project Description Supporting Regulatory Applications

- Where logistically feasible, aircraft will maintain flying altitudes of:
  - 300 m (approximately 1,000 ft) during all Project related flights;
  - 610 m (approximately 2,000 ft) when flying over areas of nesting migratory birds or known raptor nesting areas during nesting season;
  - 1,100 (approximately 3,600 ft) when flying over areas of breeding bird concentrations.
- Aircraft will not approach closer than approximately 1,500 m from a raptor nest, waterfowl nesting area or caribou water crossings when any of these sites are active.
- Caribou will be herded off aircraft landing areas prior to aircraft landings and takeoffs.

#### **2.4.6 Snow Clearing**

Snow clearing within the High Lake mine site will be undertaken as needed during construction. Stockpiles of cleared snow will be placed within the High Lake drainage area. Snow coming into contact with industrial activity will be directed to the area around Lake L20 (Figure PD.3a) where it can be managed. Snow along general access roads will only come into contact with NAG material and will be ploughed off to the roadsides.

#### **2.4.7 Solid Waste Management**

The solid waste management facilities are described in Section 2.3.3. Waste generated at the surface facilities will be sorted and stored in standard trash bins located indoors. The trash bins will be located at various refuse collection areas throughout the camp where they will be emptied and the waste delivered to the incinerator by truck daily. Refuse collection areas will consist of multiple bins for different types of waste. Each bin will be clearly marked for incineration or landfilling. Incineration will take place several times daily.

#### **2.4.8 Water Management and Use**

Water withdrawals during the construction period will be required for the following:

- concrete manufacturing;
- potable water supply (approximately 250 L per person per day);
- dust control;
- hydrostatic testing of fuel tanks; and
- fresh water for processing facility commissioning.

## Project Description Supporting Regulatory Applications

During construction, water will be sourced from the nearest practical water body, which is not fish-bearing, within the High Lake drainage area. Alternatively, the water supply system planned for operations on Lakes L4 and L5 can be installed early in the construction phase and utilized for construction supply. All DFO water withdrawal protocols will be met for water withdrawal.

The construction workforce will require approximately 100 m<sup>3</sup>/d of potable water. A detailed schedule of water use is not yet finalized. It is not expected to be as high as the 1,400 m<sup>3</sup>/d water demand during operation.

## 2.5 High Lake Mine Site Operations Activities

### 2.5.1 Mining (Blasting, Excavation, Drilling, Grading and Backfilling)

#### Open Pit Excavation

The depths of the open pits below average ground surface are estimated at approximately 150 m for the AB Zone open pit and 130 m for the D Zone open pit (Figure PD.4 and Figure PD.5).

Based on preliminary geotechnical analysis of geological structures, the quality of the rock mass and permafrost conditions, a 70° bench face angle, with catch berms at 20 m vertical intervals, has been selected for both open pits. The width of the catch berms will vary from 4 m to 7 m, resulting in an overall pit wall angle of 57°. Internal haul roads traversing the pit walls will result in a flatter overall wall angle of 30 to 55°.

Open pit mining will involve drilling and blasting. Typically, a diamond pattern of blast holes will be created and filled with explosives. The explosives will be detonated in a carefully timed sequence for maximum efficiency and to avoid flyrock over the adjacent site. The pit walls will be benched as the layers are blasted to be able to catch and store falling rock near its source and to avoid risk of damage or injury where active mining is taking place below.

The frequency of blasting will depend on many factors including weather, drill availability, blast crew efficiency, blasted muck inventory and plant throughput requirements. It is expected to vary between daily and every third day. The expected average consumption of ANFO will be 0.8 kg for every banked cubic metre of ore or waste. The blast hole spacing is expected to be a typical 5 m by 5 m equilateral pattern.

Dust and sediment from the open pits and waste rock storage areas will be controlled by progressive reclamation and capping.

## Project Description Supporting Regulatory Applications

**Underground Mine Excavation**

Figure PD.4, Figure PD.5 and Figure PD.6 provide conceptual cross-sections of the AB Zone, D Zone and West Zone mine deposits respectively. The underground mining method consists of a long hole open stope technique with a combination of longitudinal and transverse stope configurations. The ore will be brought to surface and stockpiled temporarily before processing. Blasting for underground mining is expected to be daily.

***AB Zone and D Zone Underground Mines***

Decline ramps will be driven from the lower open pit benches to access the orebody. As the ramp is driven to the bottom of the zones, levels will be developed at approximately 30 m to 60 m depth intervals (Figure PD.4 and Figure PD.5).

***West Zone Underground Mine***

The main and internal ramp system to access the West Zone ore body will consist of excavations 5 m wide by 5 m high. The West Zone mine portal is located immediately to the west of the main backfill stockpile (Figure PD.3a and Figure PD.3b). All ore will be brought to surface by haul trucks. In the early years of operation, waste rock will be brought to surface for temporary storage. Subsequently, all waste rock excavated underground will be used directly for backfilling mined out stopes. Additional waste rock from the D Zone open pit will also be used for backfill.

An inclement weather ore pad is located adjacent to the portal for the West Zone (Figure PD.3a and Figure PD.3b) and will be used in whiteout conditions when the transport of ore to the processing facility is considered unsafe. This temporary ore storage pad provides two days worth of capacity.

Mine rock generated underground and used directly will not be crushed. The total waste rock tonnage generated from the West Zone development will be approximately 900,000 tonnes, of which 100% will be used for backfill. Backfill requirements will also include the use of 6 Mt of waste rock generated from the D Zone open pit operation. Cement may be used for backfill consolidation to sustain the planned production rate for approximately 40% of the backfill requirements.

Mine rock produced from the West Zone underground mine that cannot be used underground directly will be brought to surface by underground mine haulage vehicles and stored temporarily in the temporary waste pad or placed directly in the main backfill stockpile (Figure PD.3a and Figure PD.3b). Material from both of these piles will be crushed and conditioned for use as underground backfill. Conditioning of the backfill includes thawing to allow the cement to hydrate and consolidate the waste in the stopes. The crushed waste will be warmed by immersion in a heated water bath. Energy to thaw the backfill will come from waste heat given off by the diesel generators.

## Project Description Supporting Regulatory Applications

A detailed summary of estimates for backfill requirements and quantities of ore, waste rock and tailings production at the High Lake mine site is provided in (Table PD.7).

## 2.5.2 Drainage Management

Sources of water inflows into the High Lake tailings impoundment will include:

- catchment runoff;
- mine rock pile and haul road runoff and seepage;
- tailings slurry processing facility area, roads and buildings;
- water from open pit and underground mine dewatering; and
- sewage treatment plant effluent.

The AB Zone and D Zone open pits and underground mines are expected to be within the inferred zone of permafrost, which is estimated to be in excess of 400 m thick, therefore relatively minor groundwater discharge from the open pit walls is anticipated. The surface catchment areas contributing to the open pits are small and it is expected that no surface diversions will be required.

The West Zone underground mine will penetrate beneath the base of permafrost and tests have indicated that hydraulic conductivity is low. It is expected that mine inflow generally will be less than 700 m<sup>3</sup>/d, based on the results of 2005 and 2006 field packer testing. Groundwater inflow also may occur where underground access ramps and workings intersect taliks beneath lakes. Inflows will be controlled by grouting, if necessary, or by avoidance of the taliks. Depending on its quality, water pumped from the underground mine from below the base of the permafrost may be treated prior to discharge into the tailings pipeline.

The open pits will be dewatered using sumps and pumps. Typically, all pit drainage water will be collected for treatment if necessary, or may be used for process water supply. The presence of pit water is likely to be intermittent, resulting from direct precipitation during summer storms or spring snowmelt.

All runoff from the waste rock storage areas will be directed to the tailings impoundment where, if necessary, it will be treated prior to discharge to High Lake. Only minor re-routings of surface water diversions around the mine rock piles will be required as upstream catchments are relatively small.

Tailings from the processing facility will be thickened to remove some water for process use, and discharged to High Lake by a slurry pipeline. Water from dewatering the West Zone underground mine will be added to this flow, as will effluent from the sewage treatment plant.

A preliminary Water Management Plan will be included in Volume 8 of the *High Lake Project Proposal*.

### 2.5.3 Explosives Manufacture

Explosives storage is discussed in Section 2.3.5.

#### Underground Explosives

ANFO to be used underground will be mixed on surface at the explosives mixing plant (Figure PD.3a). The ANFO manufacturing process begins by discharging ammonium nitrate prills from a tote bag into a feed hopper. The ammonium nitrate is subsequently fed into a mixing auger where it is mixed with a metered quantity of fuel to produce the final desired mixture. All of the ANFO produced for underground use will be packaged in 25 kg tote bags, transported underground and stored in powder magazines. If excessively wet conditions are encountered in the mining operations, emulsion based explosives may be required and these will be purchased in pre-packaged sticks.

#### Surface Explosives

ANFO used in open pit mining will be mixed in a bulk explosives mixing truck as opposed to mixing in a plant. Ammonium nitrate prills are discharged from a tote bag into a feed hopper that subsequently feeds a mixing auger on the truck. In turn, the auger feeds directly into the top of the truck. Once mixed aboard the truck, the ANFO will be delivered and dispensed directly into blast holes where required on surface in the open pits.

### 2.5.4 Equipment, Vehicle and Aircraft Use

Typically, mining equipment will be diesel driven, and include haul trucks ranging in capacity from about 40 to 100 tonnes. Loading equipment will range from rubber-tired or tracked loaders to mechanical shovels using hydraulic or wire rope mechanisms. Other equipment will include dozers, drills, graders, service vehicles, and explosives haulage trucks.

Ore and mine waste rock from the open pits will be hauled by 100 tonne capacity trucks operating on roads linking the pits, waste rock piles and ore stockpile area adjacent to the processing facility (Figure PD.3a). The overall mine site is compact and the total length of haulage roads is less than about 5 km. Loaded haul trucks on flat terrain and good ground conditions have a top speed of 60 km/hr. Much of the loaded truck haul will be uphill from the pit floor to the waste rock piles or processing facility and will be at lower speeds.

Ore and waste rock haulage from underground development and production areas to waste rock piles and stockpiles will be handled with 40 to 50 tonne diesel articulated trucks. The trucks are typically loaded with 6 m<sup>3</sup> of material. Load-Haul-Dump (LHD) diesel articulated units typically will be used to dig into blasted muck piles. All underground mobile equipment will be rubber-tired. Typical ground support will consist of standard 1.8 m and 2.4 m rockbolts that will be installed with hand held rock drills on scissor type trucks, or with mechanized bolting machines.

## Project Description Supporting Regulatory Applications

To the practical extent possible, mine haul traffic will be kept separate from other site traffic traveling to the airstrip and dock site. Only a limited number of light vehicles and maintenance equipment will enter the mine haul road network. During the summer months, a water truck will be used to suppress dust in the operating areas including the mine haul roads. There will also be daily trips by a waste collection truck between the processing facility, camp, incinerator and landfill.

Table PD.11 and Table PD.12 provide the preliminary estimated equipment lists proposed for open pit and underground mining, respectively.

**Table PD.11 Equipment List for Open Pit Mining**

Equipment Type	Quantity
Shovel	2
Excavator/backhoe	1
Haul truck	7
Bulldozer	2
Grader	2
Rubber tire dozer	1
Water/gravel truck	1
Drill (7-7/8" hole size)	2
Pickup trucks	8
Vans	2
Buses	1
Light towers	4
Lube van	1
Fuel truck	1
Fork lift	1
Tire changer	1

**Table PD.12 Equipment List for Underground Mining**

Equipment Type	Quantity	
	West Zone	AB and D Zones
Jumbo drill	2	1
8 yd. LHD loader	6	1
40 t truck	6	1
In-the-hole (ITH) drill	4	1
Rockbolter	1	-
Scissor lift	5	1
Boom truck	1	-
Grader	1	-
Personnel vehicle	6	2
ANFO truck	1	-
Fork lift	2	-

## Project Description Supporting Regulatory Applications

The processed copper and zinc concentrate will be transported by truck to the Grays Bay dock facility and stored for shipping during the short summer season. An average of two flights per week by chartered turbo-prop commuter aircraft are expected during mining operations. An average of one third of the total operation workforce will be rotated each week. In addition, the flights will bring in perishable foodstuffs and other miscellaneous supplies not anticipated in the annual sealift to Grays Bay. A preliminary Access and Traffic Management Plan will be included in Volume 8 of the *High Lake Project Proposal*. Traffic and aircraft protocols will be as described for the construction phase in Section 2.4.5.

### 2.5.5 Hazardous Materials Handling and Storage

The processing facility will use a variety of chemicals or reagents that are standard in the mineral processing industry. Reagents will be shipped in sea containers, with further packaging in industry standard drums or bulk bags, according to best practices. All reagents will be stored in a secure area within or immediately adjacent to the processing facility building. An outside lime silo will also be provided. The estimated amounts of reagents to be used at the High Lake processing facility are provided in Table PD.13.

**Table PD.13 Estimated Reagent Consumption at High Lake Processing Facility**

Reagents	Use	Description	Approximate Annual Consumption (tonne)
PE26	Gangue Depressant	Sodium Carboxymethyl Cellulose	200
PAX	Copper Sulphide Collector	Potassium Amyl Xanthate	63
SIPX	Zinc Sulphide Collector	Sodium Isopropyl Xanthate	19
MIBC	Copper Circuit Frother	Methyl Isobutyl Carbinol	241
ZnSO <sub>4</sub>	Iron Sulphide Depressant	Zinc Sulphate	91
CuSO <sub>4</sub>	Zinc Sulphide Activator	Copper Sulphate	211
NaCN	Iron Sulphide Depressant	Sodium Cyanide	28
CaO	PH Modifier	Lime	2,795
Flocculant	Fine Particle Aggregation	polyacrylamide	5

*Assumptions:*

- 4,348 tpd mill feed, mill operating at 92% efficiency
- annual mill feed is 1,440,000 tonnes
- 360 operating days per year
- copper concentrate is about 7% of mill feed weight
- zinc concentrate is about 6% of mill feed weight
- use reagent consumption from G & T Metallurgical Lab tests for processing facility consumption

## Project Description Supporting Regulatory Applications

Most of the High Lake reagents are powders, containing minor amounts of moisture. To alleviate freeze solidification in winter, shipping barrels will be warmed inside the processing facility prior to use.

Hazardous waste will be shipped off-site for disposal at an approved facility or for processing. These materials will be packaged securely into sea containers for transport by truck to Grays Bay, and for back-haul shipping to a port where they can be disposed of appropriately.

### 2.5.6 Heat Balance

Most heat generated at the processing facility will be produced by diesel generators. Heat will be conveyed from the generators by water and air. The generator cooling water stream will provide an average heat supply of 6.2 MW. This will be used to heat water and fuel oil (760 kW), plus processing facility and camp heating when required (up to 5.9 MW).

Supplemental heating will be provided by the exhaust air stream. The exhaust air stream will provide an average heat supply of 4.2 MW. This will be used for concentrate drying (2.9 MW), leaving 1.3 MW available for supplemental heating .

The overall heat balance for the diesel generators is summarized as follows:

	Winter Extreme	Summer Extreme
Total Required Heat	9.6 MW	3.5 MW
Total Available Heat	10.4 MW	10.4 MW
<b>Balance</b>	<b>+800 kW</b>	<b>+6.9 MW</b>

On average, 4.4 MW of heat will be released to the atmosphere through heat exchangers. There will be five exhaust stacks at the processing facility building, as follows:

- Stack A (Boiler Exhaust Stack) protruding 11.9 m above the roof;
- Stack B (Boiler Exhaust Stack) protruding 11.9 m above the roof;
- Stack C (Dryer bypass Stack) protruding 11.9 m above the roof, and emits 6.6 m<sup>3</sup>/s at 540°C;
- Stack D (Copper Dryer) protruding 6.1 m above the roof and emits 24.3 m<sup>3</sup>/s at 170°C; and
- Stack E (Zinc Dryer) protruding 6.1 m above the roof and emits 17 m<sup>3</sup>/s at 170°C.

The height of the building varies between 12.5 m and 14.3 m above ground.

## Project Description Supporting Regulatory Applications

### 2.5.7 Ore Crushing and Grinding

Processing of High Lake ores will involve crushing and grinding. The crushing and primary grinding circuits are designed to handle all ore types from the AB, D, and West Zone deposits.

The ore may be stockpiled temporarily prior to crushing. A loader will move ore from the stockpile and dump it into the jaw crusher's feed hopper and vibratory feeder. A jaw crusher will reduce the run-of-mine ore (maximum size 600 mm) to a minimum size of 150 mm.

The crushed ore will be transported by conveyor to the screening plant, where a vibratory screen will separate particles up to a 20 mm size. The screen oversize exceeding 20 mm will be conveyed back to the crusher building and fed to a cone or gyratory crusher to be further reduced and placed back on the conveyor belt that feeds the screening plant. The screen undersize is then conveyed to the fine ore bin for temporary storage prior to being conveyed into the processing facility for grinding. The crushed ore is then conveyed to rotating grinding devices or "mills" where it is further reduced to a slurry format.

The ground ore slurry is pumped to a set of cyclones, where the finer fraction is pumped to the copper rougher/scavenger flotation circuit. The coarser fraction in the cyclone underflow returns to the mill for further grinding. Reagents will be added to the grinding mill to pre-condition the ore for flotation.

Facilities such as the crusher and screening plant where dust generation is expected will be equipped with dust suppression and collection systems. Two dust collectors will service these facilities, both drawing air at a rate of 3 m<sup>3</sup>/s and cleaning the air to less than 2 mg/m<sup>3</sup> of particulate matter before discharging to the atmosphere. One will service the crusher feed, discharge areas and conveyer transfer points, while the other will service the primary screen and transfer points upstream of the fine ore bin. The particulate matter from the dust collector bags will be added back into the crushed material at the transfer conveyor.

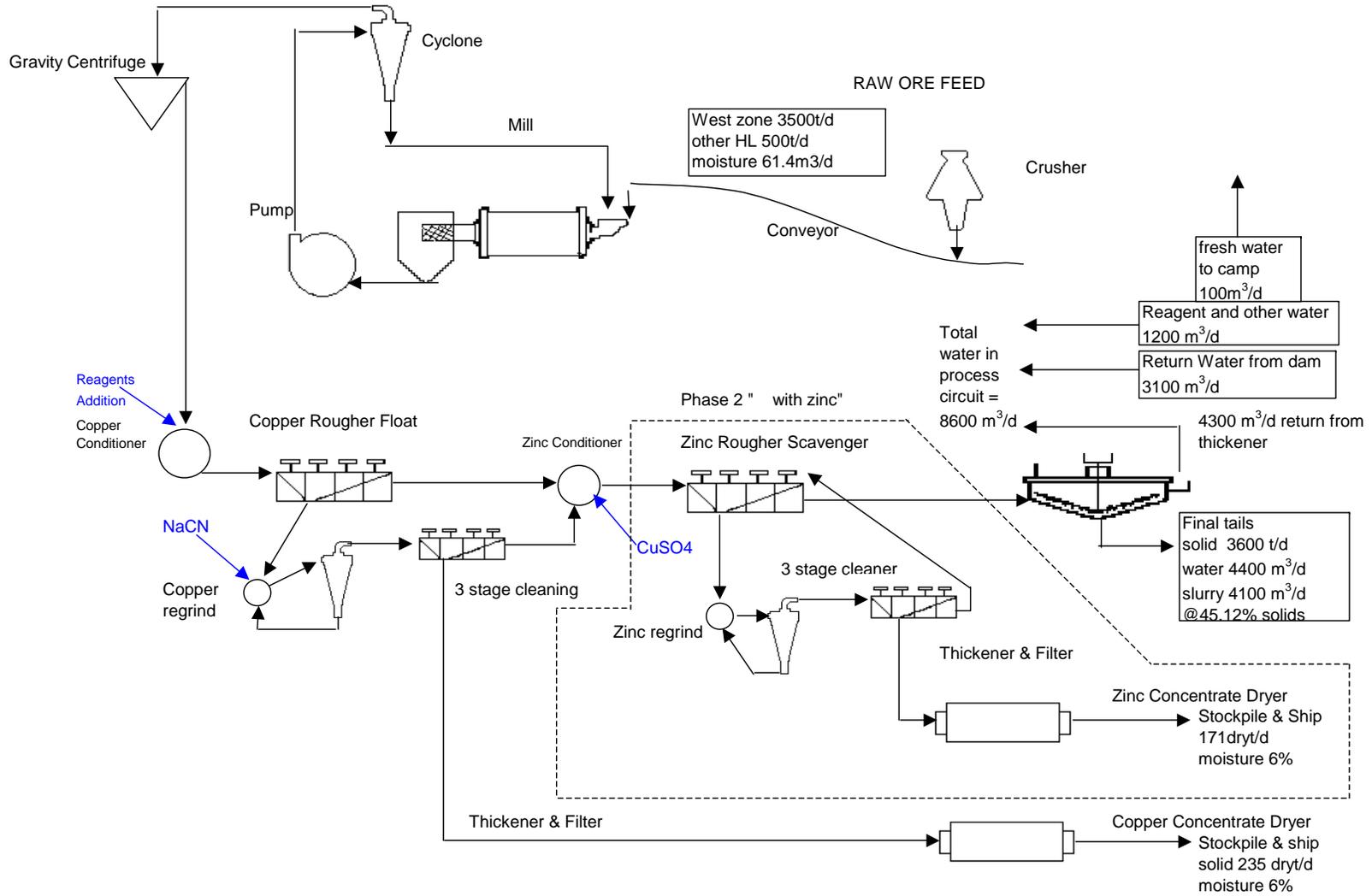
### 2.5.8 Ore Concentrates Processing

Figure PD.8 provides a conceptual overview of the processing circuits for the High Lake ores within the processing facility. A description of these circuits is provided below. Ore processing at the High Lake processing facility is summarized as follows:

- 3,000 to 4,000 tpd of High Lake ore throughput;
- combined production of copper and zinc concentrates: up to 140,000 tpy;
- silver production: approximately 23,400,000 ounces will be produced (off-site) mostly with the copper concentrates; and
- gold production: approximately 410,000 ounces will be produced (off-site) with the copper concentrate.

Project Description Supporting Regulatory Applications

Figure PD.8 Process Flow Chart



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## Project Description Supporting Regulatory Applications

These numbers may be lower at any time over the Project life because of a variation in production throughput.

**Copper and Zinc Concentration**

In the initial stages of operation, mill feed will be from the AB Zone, which contains copper and no other metal of significant quantity. The AB ore will be processed through the copper flotation circuit as follows (Figure PD.8):

- The cyclone overflow from the grinding circuit will be conditioned with reagents prior to flotation in the copper rougher/scavenger circuit.
- Copper concentrate from this circuit overflows into a pump box and combines with the discharge of the copper regrind mill.
- The slurry is pumped to a second set of cyclones where the underflow from these cyclones returns to the copper regrind mill.
- The cyclone overflow is pumped to the copper flotation cleaner circuit. There are three stages of flotation cleaning, with first and second cleaner concentrates re-floated in subsequent banks in the cleaner circuit. The second and third cleaner tails are recycled within the circuit.
- The final copper concentrate (i.e., third cleaner concentrate) is pumped to the copper dewatering circuit. There, the concentrate is thickened, filtered, and dried. It is then conveyed to the copper concentrate storage shed.
- The copper rougher/scavenger tails and the copper first cleaner tails will be combined to form a single tailings stream and pumped to the tailings thickener.

The D Zone and West Zone ores will then be processed through the zinc flotation circuit as follows (Figure PD.8):

- The combined tailings from the copper circuit are conditioned with reagents and pumped to the zinc flotation circuit.
- The third stage zinc concentrate, or final concentrate, is thickened, filtered, dried and conveyed to the zinc concentrate storage shed.
- The zinc rougher/scavenger tailings and the zinc first cleaner tails are combined and pumped to the tailing disposal and process water recovery circuit.

Any gold and silver present within the concentrated ores will mostly stay with the copper concentrate. The resulting copper and zinc mineral concentrates will be dewatered to approximately 6% moisture content using a combination of settling tanks (thickeners), filters and rotary dryers which are heated with diesel exhaust gases from the electrical generating plant.

## Project Description Supporting Regulatory Applications

**2.5.9 Snow Clearing and Stockpiling**

During the operation phase, snow clearing will be conducted the same way as during construction (Section 2.4.6).

**2.5.10 Waste Management**

Section 2.3.3 describes the waste management facilities. The activities during the operation phase are described below.

**Incineration and Landfill**

Table PD.14 summarizes estimated solid waste generation at the High Lake mine site during operation.

**Table PD.14 Annual Solid Waste Generation at High Lake Mine Site (Operation)**

<b>Annual Solid Waste Generation</b>		
<b>Material</b>	<b>Estimated Amount (tonnes)</b>	<b>Disposal Method</b>
Reagent Packaging	31	neutralize in mill (if necessary), landfill/incinerate
Used oils/petroleum products	125	burned in used oil heaters/incinerator
Mercury Lamps	1	container and shipped off site for recycle
Batteries	2	container and shipped off site for recycle
Automobile Tires	65	landfilled in waste rock pile
Scrap metal	169	stockpiled and landfilled
Soil contaminated with Petroleum Products	40	landfarmed
Wood products	40	incinerate
Sewage treatment sludge	4	chlorinate/landfill
Household wastes	265	landfill/incinerate

A full set of operating procedures specifying how waste is collected and disposed will be developed before start-up. Examples of waste management procedures to be employed at the High Lake mine site are:

- Garbage will not be stored for long periods of time. Materials contaminated by food will be collected and incinerated as quickly as practical.
- Garbage from offices, maintenance garage and camps will be collected one or two secure locations several times a day.

## Project Description Supporting Regulatory Applications

- Garbage will be transported to the incinerator in a covered vehicle.
- The incinerator building will be located within a fenced compound and, depending on demand, will be operated semi-continuously.

### Mine Rock

Excavated waste rock will be loaded on trucks and hauled to the surface waste rock piles (Figure PD.3a). The physical and chemical characteristics of mine rock materials have been characterized in a preliminary series of acid base accounting tests to assess potential for acid generation and metals leaching. The results indicate that approximately 60% by weight of the host mine rock has potential for adverse chemical reactions. However, the remaining material is expected to be suitable for general construction and capping mine rock piles. The plan for waste rock management includes the following:

- Containment of all material within the High Lake drainage area.
- Representative sampling and geochemical characterization of waste rock to define practical and reliable criteria for segregating mine waste rock into categories of benign and potentially problematic with regards to geochemical and water quality protection.
- Capping of all permanent rock piles with a surface layer of non-reactive waste materials that will be physically stable and geochemically benign during seasonal thaws.
- Aggradation of underlying permafrost to permanently freeze all potentially chemically reactive mine rock.
- Diversion of seepage and other water in contact with potentially reactive mine rock to the High Lake tailings impoundment for treatment if required.

A summary of estimated annual quantities of waste rock production at the High Lake mine site is provided in Table PD.7. The concepts for the distribution of mine rock produced in both open pit and underground mining to surface rock piles, temporary stockpiles and underground backfill is described in Section 2.2.7. Further detail on waste rock management will be presented in Volume 8 of the *High Lake Project Proposal*.

### Tailings

The residual tailings from the ore concentration process will be contained permanently on site by disposal to the High Lake tailings impoundment and within the AB Zone and D Zone open pits (Figure PD.3a). Processing of the High Lake ores at 4,000 tpd will result in a tailings production rate of approximately 3,600 tpd of tailings solids. A detailed summary of estimates for total annual tailings production at the High Lake processing facility is provided in Table PD.7, including the distribution of tailings to the High Lake impoundment, and to the AB and D Zone open pits.

## Project Description Supporting Regulatory Applications

At the processing facility, the tailings slurry will be thickened to 45% solids (by weight) for transfer to High Lake and the AB Zone and D Zone open pits in on-surface insulated high-density polyethylene pipelines contained within channels. In order to avoid settling, and to minimize pump pressures, 75 mm diameter piping has been selected. Drain ports will be provided at all low spots to allow complete drainage of the piping in the event of an extended shut-down when air temperatures are below freezing. Discharge from the drain points will be contained in lined sumps.

Tailings will be discharged into the deepest areas of the High Lake impoundment structure. The piping will be submerged and anchored approximately 2 to 3 m below the water surface by a series of anchor and buoy cables. The submergence will suspend the piping above the surface of deposited tailings and below ice. This will allow retrieval and relocation of the piping using boats during the summer.

The tailings will be discharged through multiple openings in the submerged pipeline so that the upper surface of the deposited tailings is relatively flat. The tailings will be covered with a minimum of 2.5 m of water as a precaution against the disturbance of the tailings by winter ice cover.

The performance of the High Lake tailings impoundment will be monitored throughout its operating life and into the post-closure period. Monitoring will include hydrogeological, geotechnical and thermal instrumentation configured to assess and confirm that design intents and assumptions are achieved.

### **2.5.11 Water Management and Use**

The water management systems for the High Lake mine site will include:

- site-wide water balances for the mines, processing facility, stockpiles, mine rock and tailings containment systems, and infrastructure that are all within the High Lake drainage area;
- quantity and quality predictions for discharges to the environment of all waters affected by site activities;
- alteration or diversion of drainage patterns within the High Lake drainage area;
- seepage interception and collection measures from tailings dams, if required;
- underground mine water pumped to surface from below permafrost at the West Zone mine;
- water treatment;
- water conservation and recycling measures – plant thickener and pumping from the tailings impoundment; and
- facilities for washing equipment, and containment and treatment of wash water – standard operating procedures at the maintenance garage.

## Project Description Supporting Regulatory Applications

Approximately two tonnes of water ( $2 \text{ m}^3$ ) will be used for every tonne of ore processed. The process circuit is designed to recycle water used at least twice before returning it to High Lake impoundment, from which the bulk of the process water is being extracted. It is currently anticipated that approximately 85% of the process water requirements will be met by recycled and reclaimed waters.

Process water supply will be obtained by a combination of the following (Figure PD.8):

- recycling in the processing facility using a thickener:  $4,300 \text{ m}^3/\text{d}$ ;
- pumping reclaimed water from the primary polishing pond in the tailings impoundment:  $3,100 \text{ m}^3/\text{d}$ ;
- fresh water for process make-up from Lake L4: up to  $1,300 \text{ m}^3/\text{d}$ ;
- fresh water for process make-up (and potable water) from Lake L5: up to  $1,000 \text{ m}^3/\text{d}$ ; and
- possibly by pumping from the open pits after any major storm events.

On average,  $4,400 \text{ m}^3/\text{d}$  of water will be discharged with the tailings from the processing facility to High Lake during operation. Further information will be included in the Water Management Plan (Volume 8) of the *High Lake Project Proposal*.

## 2.6 High Lake Mine Site Closure and Reclamation Concepts

This section describes the reclamation concepts for the High Lake facilities including the buildings, processing facility, roads, airstrip, waste rock piles, open pits, underground mine workings and tailings impoundment. Long term closure objectives have been taken into account during mine planning. A Preliminary Reclamation and Closure Plan will be contained in Volume 8 of the *High Lake Project Proposal*.

### 2.6.1 Open Pits

A rock berm will be placed around the lip of the open pits upon closure. This protective berm will be constructed and maintained throughout the development of the open-pit to secure all high risk areas of the open-pits to protect both humans and wildlife.

The rock berm will be built of rock mined from the open pit after it is pushed back to its final position. Waste rock from the mine will be dumped directly in place and dozed into a berm. The design of the berm will incorporate traditional knowledge.

Reclamation of the open pits includes several options such as forming a lake, backfilling, or partial backfilling. Preliminary conceptual plans for closure of the open pits are as follows:

## Project Description Supporting Regulatory Applications

- Both AB and D pits will incorporate underground mining components that will be accessed by ramps at the base of the pits. Mine rock will be used to partially backfill the underground workings and following completion of mining activities, it is anticipated that the underground workings and open pits will be flooded with water and used to store tailings. It is anticipated that the tailings and water stored at the AB Zone will eventually become frozen and incorporated into the permafrost. At the D zone, the tailings will be permanently covered by water and a permanent talik will form beneath.
- It is anticipated that the AB Zone pit will be available for tailings storage between approximately Years 7 to 10 of mine operation, following the completion of underground mining activities. During this period, the AB Zone pit will receive 100% of the tailings stream and will be essentially filled with tailings. Upon completion of tailings deposition, excess water will be drained from the tailings surface to enable the placement of a layer of NAG waste rock of sufficient thickness to insulate the PAG rock from the seasonal freeze-thaw cycle of the active layer. The surface will be contoured to direct surface runoff towards the tailings basin and the entire tailings mass will be allowed to freeze.
- The D Zone pit cannot feasibly be completely backfilled with tailings or mine rock because it will remain in production until approximately Year 12. It is currently anticipated that the D Zone pit will receive approximately 50% of the tailings from Year 12 of mine operation and 100% of the tailings from Years 13 and 14. This will fill the pit to approximately 75% of its capacity with tailings (1.5 of available 2.1 Mm<sup>3</sup> up to lowest point of pit perimeter), leaving a minimum water cover over the tailings of 10 m. Following this initial flooding, natural runoff and precipitation will maintain the pit lake in a near-flooded condition with seasonal overflow of water to High Lake.
- Some pit walls will remain exposed in the D Zone pit where these rise above the elevation of the water outflow location. Gradual degradation and weathering of the rock exposed in the pit walls will occur, resulting in talus slopes of broken rock. Eventually the lower part of these slopes will become permanently submerged. A permanent talik is expected to develop beneath the D pit lake.
- The incorporation of the open pits for tailings storage has the added advantage of reducing the storage requirements in the tailings impoundment, thereby reducing the requirement to construct perimeter containment dams to raise the flooded water level. This in turn enhances long term stability of the tailings impoundment.

### 2.6.2 Underground Mines

The underground mine at the West Zone will be reclaimed by closing and sealing all points of access, including the portal and ventilation or exhaust raises. A stable structure that is compatible with the surrounding terrain will be provided to close each opening. The portions of underground workings within permafrost will likely be used for the permanent disposal of demolition materials produced from the closure activities across the Project site, together with any contaminated soils that are not amenable to remediation in the land farm (e.g., soil contaminated by concentrate spillage). Other underground mining areas are accessed through the open pits and would be reclaimed as described in Section 2.6.1.

## Project Description Supporting Regulatory Applications

### 2.6.3 Buildings and Surface Structures

All buildings and fixed internal equipment at the High Lake mine site and Sand Lake airstrip will be demolished. The debris will be placed in the underground mine workings where they will freeze. Other inert materials will be buried within surface mine rock piles and capped. Some salvageable items may be removed and shipped offsite.

All generators will be drained of fuel and oil, packaged and shipped off site for use elsewhere if practical or buried underground. The soil will be inspected for contamination and excavated for underground disposal if necessary.

All infrastructure and pipelines associated with tailings distribution and water reclaim from High Lake will be dismantled and discarded appropriately (either placed in the underground working or shipped from site). The tailings pipeline route will be inspected to identify tailings spills and all tailings-contaminated soil will be relocated appropriately, either to the High Lake tailings basin or buried in the underground workings. Pipeline routes will be re-contoured where required to prevent ponding of surface water and to restore natural drainage.

The floating rafts containing the water intake pumps and the electrical service equipment installed at Lake L4 and Lake L5 will be removed. The pumps, tanks and water lines will be drained, dismantled, packaged and transported from site. All water supply related infrastructure will be dismantled and removed from the site or buried underground.

The landfill locations within the rock piles will be decommissioned and permanently capped with NAG rock to minimize infiltration of precipitation and generation of leachate. The thickness of the final cap will be determined by the minimum thickness required to ensure that the active thaw zone does not extend into the landfill. The incinerator will be dismantled and salvageable parts will be packaged and shipped off-site for use elsewhere if practical or buried underground. The barrel will be landfilled or buried underground.

Upon final closure the fuel remaining in the diesel fuel and aviation fuel tanks will be drained into a transport tank for shipment offsite, cleaned, decommissioned, contaminated soils removed for treatment or disposal and the high-density polyethylene liners cut up, removed and disposed of in the onsite landfill. Soils at the ANFO mixing plant will be tested for ammonia levels and excavated if necessary.

All remaining explosives, detonators and ANFO will be removed from site. The explosives storage structures will be salvaged and removed from site. The area will be thoroughly cleared of any foreign objects.

## Project Description Supporting Regulatory Applications

Compacted soils will be loosened as required to promote revegetation. Areas with minor damage to vegetation, small areas of exposed substrates and areas with rocky substrate will be left to revegetate naturally. Previously vegetated areas where the substrates are fine and prone to wind erosion, water erosion or thermokarst will be actively revegetated.

Upon final closure, the area will be thoroughly cleared of foreign objects. Building foundations will be excavated and/or buried by a contoured rockfill cover so no concrete pedestals or walls are exposed above final grade. Granular foundations will be graded to blend in smoothly with the natural contours and to provide positive drainage.

#### 2.6.4 Tailings Impoundment

The tailings impoundment has been designed to maintain a flooded water cover over the tailings in perpetuity. During the closure and reclamation phase, a permanent flood release spillway, capable of safely passing the Probable Maximum Flood (PMF) storm event, will be constructed at the north end of the High Lake impoundment. The spillway will direct overflow from the tailings basin, by an engineered spillway channel, towards the Kennarctic River.

The tailings deposition plan is designed to generate a relatively flat tailings surface. Upon closure, the spillway invert will be set so that a minimum 2.5 m deep water cover is maintained over the tailings surface at all times. This will ensure that the tailings are below the maximum ice depth and prevent tailings becoming entrained in the ice during the winter months. The expected final elevation of the tailings solids will be at elevation 286 m at its highest point. This will be 3 m above the natural elevation of the lake at this point. The current surface of High Lake is at elevation 283 m. The expected final elevation of the water will be 288.5 m (an increase of 5.5 m).

Upon closure, the tailings pond water quality is expected to be suitable for release to the environment without treatment. Upon cessation of operation, treatment of the tailings water will continue until it is demonstrated that the tailings water quality is consistently acceptable for release without treatment. During this initial monitoring period (one to two years) the tailings impoundment will be equipped with a water control structure so the tailings pond water can be retained pending confirmation of water quality and/or additional treatment prior to discharge in a controlled manner. Once treatment is no longer required, sludge from the final polishing pond will be collected and returned to the tailings impoundment and the water control structure will be removed.

As discussed in Sections 2.2.8 and 2.6.4, the tailings deposition plan will make use of the depleted open pits to store about 6.8 Mt of tailings (about 5 Mm<sup>3</sup>) in the AB and D open pits. Approximately 5 Mt of tailings (3.5 Mm<sup>3</sup> at an assumed 1.36 tonnes/m<sup>3</sup> in-situ dry density) will be stored in AB pit during Years

## Project Description Supporting Regulatory Applications

7 to 10 of operation. The D pit may receive approximately 2 Mt (1.5 Mm<sup>3</sup>) tailings during Years 12 to 14 of operation, provided the economical reserves in the D Zone can be mined out in time.

A benefit of diverting tailings deposition to the open-pits is the opportunity to observe the water quality in High Lake for several years prior to closure in the absence of tailings deposition. This will provide valuable insight into the optimal closure configuration and anticipated long term performance under closure conditions.

Upon closure, perimeter dams will be modified, if required, to ensure long term stability. Potential modifications include flattening slopes to ensure stability against extreme seismic events and upgrading erosion protection to minimize the potential for erosion and the associated requirements for ongoing care and maintenance. The dam crests will be at elevation 290.5 m, with downstream face heights in the order of 8 to 10 m and 4.5 m on the upstream face. The width of the crest will be a minimum of 6 m. Given that the perimeter dams will include frozen foundations, all critical structures will be instrumented with an assortment of thermistors and geotechnical instrumentation and monitored regularly to ensure that the foundation remains frozen and the dams continues to function as designed.

## 2.6.5 Rock Piles

### Mine Rock

Surface mine rock piles will be designed and operated to encapsulate PAG rock within a thick layer of NAG rock such that the PAG material progressively freezes due to the aggradation of permafrost. The thickness of the NAG rock will be sufficient to insulate the PAG rock from the seasonal freeze-thaw cycle. Closure and reclamation at completion of mining will involve the placement of a minimum 3 m thick capping layer of NAG waste rock and the construction of side slopes to a minimum 2:1 (H:V) or shallower to ensure long term stability. Surface runoff from the mine waste piles will continue to be directed towards the High Lake tailings impoundment. Appropriate measures will be taken to ensure that the defined drainage channels are resistant to erosion and instability.

A backfill storage area will be located adjacent to the West Zone underground mine portal. It will have the capacity to store up to 1.5 Mt of waste rock during operation, and will be completely depleted by the end of mining operation. A smaller 8,000 tonne capacity pad will be located adjacent to the portal for temporary storage of mine rock during bad weather. Upon closure, these waste rock storage areas will be cleaned of any deleterious materials, regraded to establish positive drainage and revegetated, to minimize the potential for erosion.

## Project Description Supporting Regulatory Applications

**Ore Stockpile**

Stockpiling of ore adjacent to the processing facility will begin prior to commissioning the processing facility and will continue throughout the entire life of the Project. The ore stockpile will be completely depleted by the end of mining operation. Upon closure, the areas around the ore stockpile will be inspected for signs of contamination. All contaminated soils will be relocated either to the underground mine or to the waste rock piles where, in either case, the soil will be frozen into permafrost. Following the removal of contaminated soils, the area will be regraded to establish positive drainage and revegetated as appropriate to minimize the potential for erosion.

**Inclement Weather Ore Pad**

The inclement weather ore pad located adjacent to the portal will be used in white-out conditions when transport of ore to the processing facility is considered unsafe. Upon closure, the soils around the inclement weather ore pad will be inspected for signs of contamination. All contaminated soils will be relocated either to the underground mine or to the waste rock piles where, in either case, the soil will be frozen into permafrost. Following the removal of contaminated soils, the area will be regraded to establish positive drainage and revegetated as appropriate to minimize the potential for erosion.

**Overburden Stockpiles**

It is anticipated that there will be a relatively small amount of overburden stripped during mine development and operation. Stripped overburden may contain frozen soils and ice lenses which could lead to slope instability and erosion upon thawing. Care will be taken to ensure that overburden slopes remain stable under all conditions.

Overburden that is suitable for incorporation in the mine revegetation efforts will be windrowed to allow for the thawing and draining of frozen materials prior to re-use. Overburden that cannot be re-used will be recontoured to fit with the surrounding topography and revegetated as appropriate. The area around the overburden stockpiles will be recontoured to restore positive drainage while minimizing the potential for erosion and siltation. The location of the overburden stockpile has not been determined, but will be within the High Lake drainage area so runoff can be managed.

**2.6.6 Roads and Airstrip**

The majority of onsite roads will remain in place until the final year of closure and reclamation. All roads not required for long term monitoring post closure will be decommissioned by removing culverts to allow minor drainages to be restored. Road surfaces and the airstrip will be loosened to promote revegetation. Revegetation measures will be as described in the Section 2.6.3.

## Project Description Supporting Regulatory Applications

The Sand Lake airstrip will be scarified and graded to stable conditions, restoring pre-existing natural drainage patterns wherever possible. The related navigational aids will be removed and, prior to vacating the site, the airstrip will be formally closed.

### 2.6.7 Contaminated Soil

Contaminated soil investigations will be undertaken prior to mine closure through a Phase I Environmental Site Assessment or by equivalent means. Contaminated soil remediation levels will be established through the application of the applicable Canadian Council of Ministers of the Environment (CCME) guidelines. The CCME has established federal guidelines to address the protection of atmospheric, aquatic, and terrestrial resources. These guidelines were developed using conservative, risk-based procedures selecting the most stringent receptors and tests to provide equal protection to human and ecological receptors and include the following documents:

- Canadian Environmental Quality Guidelines (1999); and
- Canada Wide Standards for Petroleum Hydrocarbons in Soil (2001).

Upon closure, soil found to exceed the appropriate cleanup criteria will be disposed on site. Metal contaminated soil will be disposed in the underground mine, the waste rock pile or within an engineered landfill where it will freeze. Hydrocarbon contaminated soil will be remediated on site using the landfarm or buried underground. The remediated soil will either be used as a reclamation covering material or contoured in place.

## 3. Grays Bay Dock and Associated Facilities

### 3.1 Overview of Grays Bay Dock Site

Grays Bay is located on the Coronation Gulf about 50 km north of the High Lake mine site and about 2.5 km west of the mouth of the Kennarctic River (Figure PD.1). A bathymetric survey conducted in the summer of 2004 confirmed that safe navigational access for shipping from Coronation Gulf into Grays Bay is feasible. The Grays Bay dock will service the High Lake mine site, providing a facility for loading concentrate onto ships and for receipt of general cargo and fuel.

During the construction phase temporary facilities at the Grays Bay dock site will occupy a total Project disturbance footprint of approximately 25 ha (Figure PD.9). Throughout the operation phase, the Grays Bay dock and associated facilities will occupy an area of approximately 10 ha (Figure PD.9).

## Project Description Supporting Regulatory Applications

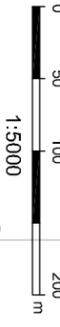
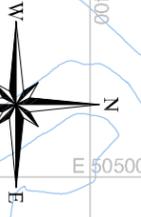
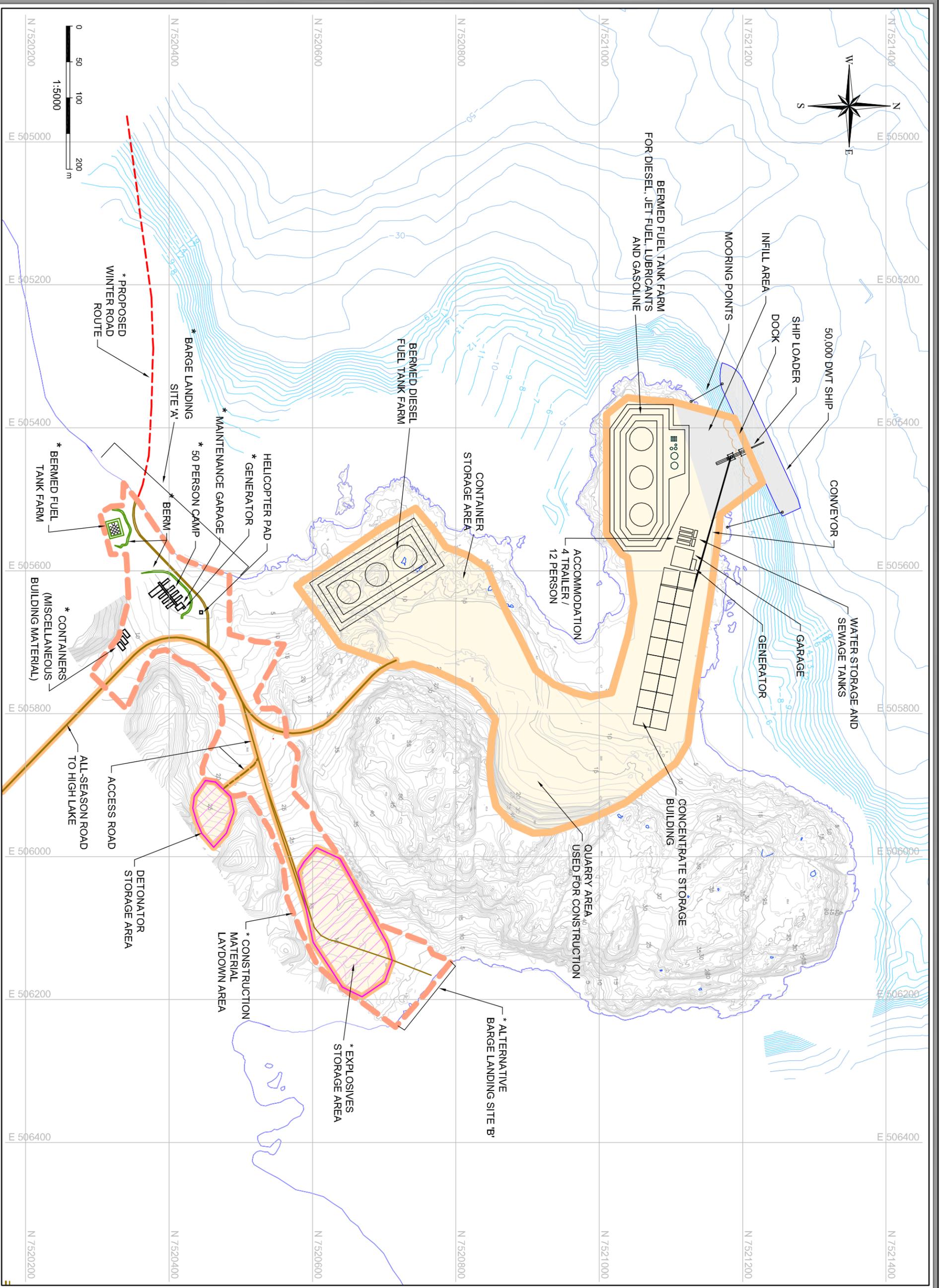
Temporary facilities during the construction phase will comprise of (Figure PD.9):

- shore landing areas approximately 800 m south of the proposed dock site on either side of the main peninsula (Barge Landing Sites 'A' and 'B');
- 50-person construction camp, including a water treatment plant, an incinerator and a sewage treatment plant;
- power generation;
- fuel storage;
- maintenance garage;
- explosives storage;
- 600 m by 150 m laydown area; and
- helicopter pad.

During the construction phase, construction materials will be stored in the laydown area identified on Figure PD.9.

The facilities located at the dock site during the operation phase will include the following (Figure PD.9):

- dock (concrete superstructure supported by cellular sheet piles);
- ship loading and unloading equipment;
- concentrate storage building;
- fuel/oil storage tank farms;
- container storage area;
- service/maintenance garage;
- living/office complex;
- power generation (1,750 kW);
- waste water holding tank;
- potable water storage tank;
- roads and utility lines for power, communications and piping; and
- storage areas for explosives and detonators, situated at regulated safe distances from the other facilities.



**WOLDEN**  
Resources Inc.

High Lake Project

*Project Description*

**Grays Bay Dock**

**Legend**

- Ground Contours (1m)
- Bathymetric Contours (1m)
- Road
- Berms
- Storage Area - Operations
- Disturbance Footprint - Operation
- Construction Footprint - Construction
- \* Indicates Facilities to be Used Only During Construction Phase

**References:**  
DRAWINGS BY WARDROP ENGINEERING INC.  
0551310100-DWG-G90003 REV J DATED 06 01 27  
0551310100-DWG-G90015 REV D DATED 06 05 18  
0551310100-DWG-G90017 REV D DATED 06 05 15  
0551310100-DWG-G90018 REV D DATED 06 02 01

GROUND CONTOURS AS MODIFIED BY WARDROP IN THEIR FIGURE G 0551310100-DWG-G90003 REV G

BATHYMETRY FROM CHALLENGER GEOMATICS DEC 2004 DATA

Prepared By: PW/MP  
Reviewed By: AK  
Projection: UTM Zone 12 MAD 83  
Revision: 1  
Date: September 18, 2006

**Figure:** PD. 9

**Gartner Lee**

Project Description Supporting Regulatory Applications

Construction of the Grays Bay dock will occur in Years minus 1 and 2. Table PD.15 shows the proposed schedule for installation of facilities at the Grays Bay dock. Once operational, the Grays Bay dock site will not be staffed except during ship loading and unloading operations, but will serve as an emergency refuge throughout operation.

**Table PD.15 Schedule of Grays Bay Dock Facilities Installation**

Schedule	Grays Bay Dock Facilities Installation
Year minus 2	<ul style="list-style-type: none"> <li>• Installation of temporary fuel oil storage facility (about 1 ML)</li> <li>• Installation of 50-person construction camp</li> <li>• General site preparation works, including development of a rock quarry on the central part of the peninsula (Figure PD.9)</li> </ul>
	<ul style="list-style-type: none"> <li>• Equipment transported to Grays Bay for temporary storage until needed for construction (see Section 6)</li> <li>• Marine blasting and dredging for cellular sheet pile type sub-structure during permissible periods</li> <li>• Installation of permanent fuel and explosives storage facilities</li> </ul>
Year minus 1	<ul style="list-style-type: none"> <li>• Installation of sheet piles through the winter sea ice for cellular structure</li> </ul>
	<ul style="list-style-type: none"> <li>• Backfilling behind the line of cells.</li> </ul>
	<ul style="list-style-type: none"> <li>• Marine construction work to be completed off barges</li> <li>• Construction of the above water dock structure</li> </ul>
Year 1	<ul style="list-style-type: none"> <li>• Dock commissioning</li> </ul>

### 3.2 Grays Bay Dock and Associated Facilities Description

#### 3.2.1 Grays Bay Dock

The dock facilities at Grays Bay (Figure PD.9) will accommodate single ships of up to approximately 50,000 Dead Weight Tonnage (DWT), which requires a water depth at low tide of approximately 15 m. The dock will also handle freight barges. The operating platform of the dock will be made of a reinforced concrete deck supported by sheet-pile cells. The main dock will be approximately 100 m long and will run parallel to the shoreline and be connected to the shoreline by a short causeway built of blasted rock fill. The conveyor and ship-loader will be supported on structural framework that can move on the deck of the dock, allowing uniform loading of the ship holds. During operation, no dredging activity for maintenance of appropriate water depths at the dock is expected to be required.

The construction contract for the docking facilities at Grays Bay will be awarded to a marine construction firm that is experienced in building arctic dock facilities. A preliminary evaluation of several wharf construction methods used successfully in the arctic has been carried out. This work indicates that a cellular sheet pile type of substructure would be suitable for the Grays Bay site.

## Project Description Supporting Regulatory Applications

The main buttress of this type of dock comprises a line of circular sheet pile enclosed cells, backfilled with rock fill. The cells would be founded on the ocean bottom following preparation of the seabed to provide a stable, safe base for the cells. Based on preliminary geotechnical investigations consisting of depth sounding, geophysical survey boreholes and diving inspections, it is assumed that some dredging of soft sediments (1 to 4 m deep) and blasting will be required during construction to flatten the seabed prior to erection of the cells and backfilling. The structure will be designed to resist ice and mooring forces as an energy reflecting structure.

It is anticipated that mechanical dredging/excavating will be used, either with a long-stick backhoe or a clam dredge. Dredged materials and blasted rock will be deposited in the area between the sheet pile cells and the shoreline, such that erodible materials are encapsulated by non-erodible materials.

### **3.2.2 Laydown Areas**

During construction, a 600 m by 150 m laydown area will be located approximately 800 m south of the dock (Figure PD.9). During operation, a 200 m by 150 m container storage area located approximately 400 m south of the dock will provide sufficient capacity to accommodate up to 300 standard sea-containers (Figure PD.9).

### **3.2.3 Concentrate Storage Building**

The 200 m by 40 m concentrate storage building will be a pre-engineered structure large enough to store one complete year of copper and zinc concentrate, (estimated to be up to 140,000 tonnes). The building will be divided into two sections to accommodate separate storage of zinc and copper concentrates and will be constructed over a concrete foundation and floor. The concrete foundation will be levelled by cut and fill blasting techniques. The concentrate storage building will not be heated and soil and rock under the building will remain frozen.

### **3.2.4 Fuel Storage**

The shipments through the dock facility for the construction and operational phases is summarized in the Table PD.16. The temporary and permanent fuel storage facilities are described below.

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**Table PD.16 Inventory of Fuel to be Stored at Grays Bay Laydown Area – Construction and Operation Phases**

Fuel Type <sup>1</sup>	Shipping Container	Yearly Construction Quantity (	Yearly Operation Quantity
Diesel	<ul style="list-style-type: none"> <li>Bulk by sea and by air during construction</li> </ul>	1 ML at dock	30 ML; it is proposed to store twice this amount as a contingency
Jet B for helicopters and Jet A for aircraft	<ul style="list-style-type: none"> <li>All shipped by air in drums or bulk</li> </ul>	10,000 L Jet B	200,000L Jet B 2 ML Jet A
Gasoline	<ul style="list-style-type: none"> <li>Drums by air during construction</li> <li>Bulk by sea during operation</li> </ul>	10,000 L	55,000 L
Propane and other industrial gases	<ul style="list-style-type: none"> <li>Bottles</li> </ul>	As required	As required
Lubricants	<ul style="list-style-type: none"> <li>Cubes – plastic with metal frame (1 m size)</li> </ul>	20 cubes	100 cubes

Note: 1. All fuel used for the High Lake Project will have a low sulphur content (15 ppm).

**Temporary Fuel Storage at Grays Bay for Construction Phase**

A temporary tank farm will be constructed at the Grays Bay dock for use during construction. It will be located on flat terrain near Barge Landing Site 'A' (Figure PD.9) and will contain ten 100,000 L diesel fuel tanks. The tanks will be located within a lined bermed spill containment compound. The compound will be sized to contain the volume of one tank plus 10% of the contents of the remaining tanks. The floor and dikes will be constructed of locally available granular material. An impermeable membrane (arctic liner) will be embedded in the floor and dike walls and will be protected from rock puncture by a layer of sand above and below the membrane and/or a layer of geo-textile material. Tank foundations will be constructed of appropriate compacted granular material. Foundations will be deep enough to ensure the permafrost remains frozen.

A drum storage compound containing about 50 drums of jet B fuel and 50 drums of gasoline will be located adjacent to the tank farm (Figure PD.9). The compound will be diked and be constructed with an impermeable liner.

Lighting will be provided for the tank farm and drum compound. Drainage sumps will be provided to allow pump-out of collected precipitation, which will be treated if required prior to discharge to the ocean.

Once the installation of the permanent 60 ML fuel storage tank farm is completed, the temporary tank farm and drum storage compound will be removed and the site remediated.

## Project Description Supporting Regulatory Applications

***Fuel Receiving at Grays Bay for Construction Phase***

The fuel receiving facility will include ship mooring anchors and a spill basin at the fuel hose connection location on shore. The spill basin will include a hose winch and hose anchor. The pipe manifold at the spill basin will include a hose coupling, shut-off valve and check valve. Steel piping (100 mm) will run from the spill basin to the tank farm. Non-return valves will be provided within the tank farm containment area, to prevent tank drainage should the fill line accidentally rupture.

***Fuel Dispensing at Grays Bay for Construction Phase***

A heated and ventilated pump house will be provided with pumping and control equipment for dispensing fuel to fuel tanker trucks and other vehicles. Spill containment pads would be provided at the dispensing station.

**Permanent Fuel Storage at Grays Bay for Operation Phase**

About 30 ML of diesel fuel will be used each year for mine operations. Fuel storage capacity of 60 ML will be constructed at Grays Bay to take advantage of fluctuating fuel prices, and also allow for adverse conditions where annual re-supply is not achieved.

The permanent fuel storage facilities will receive fuel from sea going ships and barges and will comprise two fuel storage tank farms. Both will be located on flat terrain, one adjacent to the dock structure and the other approximately 400 m south of the dock (Figure PD.9). Together, the two fuel tank farms will provide the following:

- six 10 ML tanks for diesel, providing 60 ML for two years supply of diesel fuel;
- two 1 ML tanks for Jet A fuel;
- two 100,000 L tanks for Jet B fuel; and
- one 55,000 L tank for gasoline (or alternately a 100,000 L diesel fuel tank relocated from the temporary fuel storage compound and converted to gasoline service).

The tank farms will be within lined and bermed spill containment compounds, which will be sized to contain the volume of one tank plus 10% of the contents of the remaining tanks. An impermeable membrane (arctic liner) will be embedded in the floor and dike walls. Tank foundations above permafrost will be deep enough to ensure the permafrost remains frozen.

Lighting will be provided for the tank compounds, which will be fenced and locked. Tanks and fences will be grounded to meet electrical code requirements. Drainage sumps will also be provided within the compounds to allow pump-out of collected precipitation, which will be treated if required prior to discharge to the ocean.

## Project Description Supporting Regulatory Applications

***Fuel Receiving at Grays Bay for Operation Phase***

The fuel receiving facility will include ship mooring anchors and a spill basin at the fuel hose connection on the dock. The spill basin will include a hose winch and hose anchor. The pipe manifold at the spill basin will include Jet A, Jet B, Diesel Fuel and Gasoline receiving piping connecting to each of the two tank farm locations. Each fuel line will include a hose coupling, shut-off valve and check valve. Non-return valves will be provided for each fuel line within the tank farm containment areas, to prevent tank drainage should a fuel line accidentally rupture.

***Fuel Dispensing at Grays Bay for Operation Phase***

All fuel received at Grays Bay during the operation phase will be transferred to the High Lake mine site on the backhaul of the ore concentrate haulage trucks using trailer tankers. The trucks will deliver concentrate and transfer fuel daily to High Lake, with an estimated 10 to 15 vehicle round trips per day.

At each of the tank farms, a heated and ventilated pump house will be provided with pumping and control equipment for dispensing fuel to trailer tankers and other vehicles. Spill containment pads will be provided at the dispensing stations.

Motorized shut off valves will be provided within the fuel containment compounds on the pump suction line from the tanks to the pump house. The valves will be closed except when pumps are in operation. This will protect against spillage due to accidental damage to piping located outside the tank compounds. Piping to the dispensing buildings will be run above grade to allow for monitoring of pipe condition.

Local snow drifting patterns will be considered in the layout design for the pump houses and access roads to minimize snow clearing and to ensure suitable road access.

The tank compounds will be designed to facilitate access by fire fighting equipment and to allow for potential future expansion. The sites will incorporate a security system, including appropriate levels of illumination, and the facility will be inspected at least weekly. Electrical grounding of the entire site will include piping systems and grounding of tanks. Proper safety warning signage will be provided at entrances to the tank farms, fuel dispensing buildings and at fuel transfer points, including the vessel unloading connection.

**3.2.5 Explosives Storage**

During construction, before permanent explosives storage facilities for ammonium nitrate and detonators are completed at the Grays Bay dock, pre-mixed ANFO for use in construction at the dock site will be flown to site and stored at the laydown area to the southeast of the dock area. During operation, once

## Project Description Supporting Regulatory Applications

permanent facilities are completed, all explosives and detonators will be stored in separate fenced laydown areas approximately 800 m southeast of the dock (Figure PD.9). These facilities will be used for the temporary holding of incoming materials each summer, pending transfer by truck to the storage facilities at High Lake.

### **3.2.6 Living/Office Complex**

A temporary 50-person construction camp will be installed adjacent to Barge Landing Site 'A' on the western side of the peninsula (Figure PD.9).

During operation, accommodation for 12 people and a small office will be located approximately 150 m southeast of the dock (Figure PD.9). The accommodation will consist of mobile trailers. The site will not be staffed except during ship loading and unloading operations, and the accommodation will be an emergency refuge throughout the operation phase.

### **3.2.7 Service/Maintenance Garage**

The temporary maintenance garage used for the construction phase will be located adjacent to the temporary camp (Figure PD.9). It will be a membrane building, equipped with a floor designed to prevent leakage of spilled hydrocarbons.

During operation, a permanent pre-engineered garage will allow for storage and maintenance of miscellaneous dock equipment such as the ship loader, road maintenance equipment and container handling equipment. It will be located adjacent to the concentrate storage building (Figure PD.9). The building will be erected over a layer of non-frost-sensitive engineered fill with a lined area and sumps for collection of spilled fuel and lubricants.

### **3.2.8 Power Generation**

During construction, power will be provided by appropriately sized diesel generators. During operation, power requirements are expected to total approximately 750 kW. Power will be provided by several diesel generators and will likely comprise two new or used 800 kW sets, with one used as a standby unit. A third 150 kW unit will be provided to handle the site load in periods where the ship loader is not in operation. The generators will be located adjacent to the maintenance garage.

### 3.2.9 Water Supply and Sewage Treatment

During the construction phase, water will be sourced from either a water treatment plant using sea water or taken from nearby lakes when access can be provided by the Grays Bay to High Lake winter or all-season roads. Treated discharges will meet the Nunavut Water Board's *Guideline for Discharge of Domestic Wastewater in Nunavut* (2000).

During operation, the water supply system will use a heated 2,500 L water storage tank, supplied by tanker truck from High Lake. Sewage will be stored in a holding tank and transferred by truck to the High Lake mine site for treatment and disposal.

### 3.2.10 Roads and Utilities

Roads, powerlines, communications lines and piping will be constructed throughout the dock area as required. The roads will be constructed using blasted rock fill obtained from general civil earthworks at the dock site. The roads within the dock site will be two lane and approximately 18 m wide, including allowance for ditches and berms.

On-surface protected cabling will be used for power and communication lines. All water and sewage lines will be located on-surface and will be enclosed, heat traced, insulated and protected from traffic and winter conditions.

## 3.3 Grays Bay Dock Construction Activities

### 3.3.1 Earth Moving (Blasting, Excavation, Drilling, Grading and Backfilling)

Construction of the overall dock facility will use cut and fill methods to create level and stable building platforms, roadways and the helicopter pad. Drilling and blasting will be required. Sub-excavation of unsuitable soils may be required in limited areas. It is estimated that the overall dock site development will include approximately 50,000 m<sup>3</sup> of cut and approximately 325,000 m<sup>3</sup> of fill placement. Accounting for bulking, it is estimated that the overall dock site development will require approximately 200,000 m<sup>3</sup> of quarrying. A rock quarry will be developed on the central part of the peninsula (Figure PD.9). PAG rock will be avoided and left undisturbed. Some crushing of rock by portable crusher will be required to provide aggregate.

### 3.3.2 Marine Dredging, Blasting & Drilling

Approximately 250 m<sup>3</sup> of rock excavation will be required on the ocean floor in the vicinity of the proposed dock, entailing a couple of months of drilling and blasting activity. It is estimated that 8 to 10 small blasts will be needed, each breaking 50-100 m<sup>3</sup> of rock to create a construction platform for the cellular sheet pile structure. The edges of the slope will be trimmed. All dredging or blasting operations will be carried out in accordance with applicable guidelines and regulations for construction work carried out on shorelines, in or near water, including the following:

- A comprehensive sediment control plan will be developed by the contractor. Sediment control will be installed prior to any work in the water and maintained throughout and following construction until such time as the dock is fully constructed and there is no more risk of construction activities releasing fine sediment into the water column. The sediment control measures will likely include the deployment of a floating boom draped with a silt curtain and an anchor chain pouch resting on the seabed, as well as appropriate controls on runoff and drainage for the land-based construction activities;
- A blasting control plan that will stipulate the powder factors, size of blast, timing of blasting, monitoring for the presence of marine mammals in the immediate area, deployment of bubble curtain systems (if required), as well as measures to discourage the occupation of the blast area by fish and marine mammals (noise maker systems); and
- Scheduling work around seasonal restrictions to reduce potential impacts on the marine and terrestrial environment (e.g., timing of any spawning activity, occupation of the area by seals on the pack ice, etc.).

### 3.3.3 Drainage Management

Perimeter ditching and drainage control across the site will follow appropriate best practices to prevent release of sediment-laden runoff from the site during construction. In addition, the rock at the proposed excavation and quarry sites will be assessed and tested for potential acid generation and metals leaching. NAG rock will be used for construction fill.

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### 3.3.4 Explosives Storage and Handling

During construction, before permanent explosives storage facilities for ammonium nitrate and detonators are completed at the Grays Bay dock, pre-mixed ANFO for use in construction at the dock site will be flown in and stored at the laydown area to the southeast of the dock area. It is anticipated that approximately 200 tonnes or less will be required.

### 3.3.5 Equipment, Vehicle and Aircraft Movements

Construction equipment and vehicles will include blasthole drills, trucks, bulldozers, compactors and miscellaneous mobile equipment such as cranes, generator sets and a portable crusher. A stationary fire suppression system will be installed at the dock site, with support from High Lake mobile equipment if necessary. All equipment and vehicles will remain within designated routes and roadways.

Frequent helicopter movements are expected during the construction phase, especially before the all-season road to High Lake has been completed. Fixed wing aircraft will also deliver supplies by landing on the sea ice in winter. Traffic and aircraft protocols will be as described in Section 2.4.5. In addition, a preliminary Access and Traffic Management Plan has been developed and will be included in Volume 8 of the *High Lake Project Proposal*.

During construction, prior to completion of the dock structure, a shore landing area south of the dock site (Barge Landing Site 'A' or 'B') will be used for unloading barges (Figure PD.9). Once the barge is secured, ramps will be secured to the barge and a front-end loader will be used to offload the barge. In the case of heavier cargo when no crane is available at the discharge point, an on-board crane will accompany the barge to discharge the cargo.

### 3.3.6 Snow Clearing and Stockpiling

Snow clearing within the dock site will be undertaken as needed during construction. Stockpiles of cleared snow will be managed so that sediment can be collected.

### 3.3.7 Waste Management

In the construction phase, an incinerator will be operated temporarily at Grays Bay. After the all-season road is established, all domestic waste generated at the dock will be hauled to High Lake for incineration or landfilling. Waste deemed as hazardous will be shipped off-site for proper disposal each shipping

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season. Hazardous waste will be stored within a fenced area at the dock site for security purposes while awaiting transfer off-site.

Upon abandonment of the temporary incinerator at Grays Bay in Year 1, any impacted soil will be removed and taken to High Lake for underground disposal or landfilling.

### **3.4 Grays Bay Dock Operations Activities**

#### **3.4.1 Drainage Management**

Surface runoff from site roads and building platforms and laydown areas will be managed so as to avoid erosion and sediment generation. The concentrate shed will be fully enclosed and kept dry in order to minimize potential surface runoff contamination.

#### **3.4.2 General Freight Handling**

Ship unloading equipment will be used to unload bulk materials, sea containers and fuel at the Grays Bay dock. Ship unloading equipment at the dock will consist of a 250-tonne mobile crane and mobile container handlers, including three or more large front-end loaders. These loaders will be equipped with forks for moving containers and cargo or alternatively dedicated forklifts will be required. In the event that the ship is not properly equipped with onboard cranes of sufficient capacity to handle the cargo to be unloaded, the 250-tonne crane will be employed for the lift. Once the sea containers are off the ship, they will be transported by a container handler to the lay-down area. All unloading equipment will be stored within the permanent maintenance garage when not in use.

#### **3.4.3 Concentrate Delivery and Handling**

Concentrate will be hauled from the High Lake mine site to the concentrate storage building by means of standard highway trucks, equipped with covers to prevent loss of concentrate into the environment. Concentrate will be unloaded from haulage trucks directly onto the concrete floor of the storage shed and stacked by loaders, with the shed doors closed. After unloading in the storage shed, haulage truck tires will be cleaned prior to exiting the building to return to the High Lake mine site.

### 3.4.4 Vehicle and Equipment Use

Light vehicles for personnel movement, and trucks/dozers/loaders/graders may be temporarily stationed at the dock to assist road maintenance and transfer of commodities. Intermittent helicopter operations are also anticipated in the event of emergencies or other non-routine mine activities and exploration. Traffic and aircraft protocols will be as described in Section 2.4.5, and in the preliminary Access and Traffic Management Plan, which will be included in Volume 8 of the *High Lake Project Proposal*.

### 3.4.5 Explosives Storage and Handling

Ammonium nitrate will be shipped in 1,000 kg tote bags on pallets while detonators will be shipped in specialized containers. All explosives and detonators will be stored in separate fenced laydown areas approximately 800 m southeast of the dock (Figure PD.9). Ammonium nitrate will be stored in weather-proof bags on pallets, and high explosives (detonators) will be stored in purpose built secure containers.

### 3.4.6 Ship Loading/Unloading

Concentrate will be transferred to the ships by means of elevated inclined conveyors, which will feed material into a telescoping vertical chute inserted into the ship holds. This will serve to control dust and even placement within the holds. The ship loading system is only capable of longitudinal motion as opposed to angular motion and will thus require repositioning of the ship to completely load the concentrate. Ships will be loaded with concentrate at a rate of 750 tonnes/hr such that typical berth times will be two to three days. A small dozer may be used inside the ship's holds to level off loads.

The conveyor will be enclosed to control loss of concentrate under windy conditions. In addition, dust collectors will be provided at enclosed conveyor transfer points to limit emissions. Scrapers will minimize material falling from the returning empty conveyor belt. Additional facilities will be provided to collect fugitive concentrate dust beneath and adjacent to the ship loader.

### 3.4.7 Snow Clearing & Stockpiling

Snow clearing within the dock site will be undertaken as needed during operations. Stockpiles of cleared snow will be managed so that sediment can be collected.

### 3.4.8 Waste Management

Solid waste will be transferred to the High Lake mine site for incineration. Waste deemed as hazardous will be shipped off-site for proper disposal each shipping season. Hazardous waste will be stored within a fenced area at the dock site for security purposes while awaiting transfer off-site.

## 3.5 Grays Bay Dock Closure and Reclamation Concepts

The following subsections describe the closure and reclamation concepts for the Grays Bay Dock. Further information will be provided in a Preliminary Closure and Reclamation Plan, which will be included in Volume 8 of the *High Lake Project Proposal*.

### 3.5.1 Dock Structure

The structural elements of the dock will be removed, if practical, or otherwise permanently buried by granular material, leaving granular rockfill on the seafloor. There will be no residual navigation hazards at the shoreline.

### 3.5.2 Buildings and Surface Structures

Following the removal of all temporary equipment and supplies from the construction phase at Grays Bay, the area will be inspected for evidence of spills or leaks, and remediation activities will commence if required. The containment features developed by grading to prevent runoff from the storage area from reaching the ocean will then be breached to avoid ponding of water.

Upon final closure, the Grays Bay barge landing and temporary construction material laydown area will be thoroughly cleared of any foreign objects. All operations phase mechanical equipment and buildings will be demolished and removed as part of the deconstruction of facilities at the dock site. Some salvageable items may be removed by barge or ship. Other demolition debris may either be hauled to High Lake for burial underground or landfilling, or may be landfilled at the dock site if the dock site quarry can be adapted to serve as a permanent landfill.

All building foundations will be excavated and/or buried by a contoured rockfill cover. Liners from beneath the fuel storage areas and any other contaminated soils or materials will be removed and transferred to the High Lake mine site for underground disposal.

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The concentrate handling facility will be dismantled and the area will be inspected for signs of contamination. All contaminated soils will be excavated and either landfilled and capped, or transferred to High Lake for underground disposal.

### 3.5.3 Roads

Site roads will be decommissioned by the removal of any culvert structures to allow minor drainages to be restored. Road surfaces will be loosened to promote revegetation. Revegetation measures will be as described in the final paragraph of Section 2.6.3.

## 4. Winter Road: Grays Bay to High Lake Mine Site

### 4.1 Grays Bay to High Lake Mine Site Winter Road Description

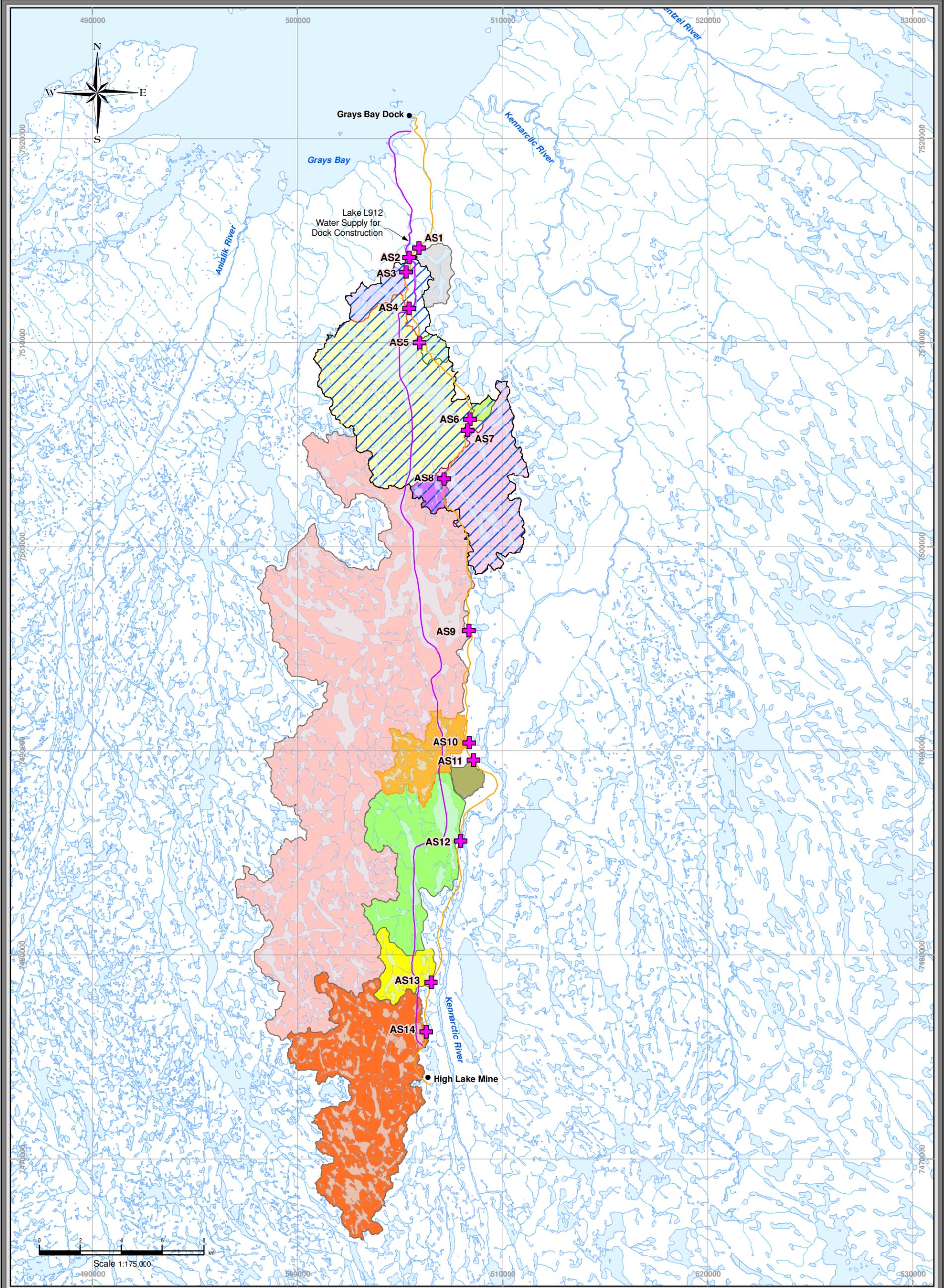
In Year minus 2, prior to construction of the all-season road between the Grays Bay dock and the High Lake mine site, a temporary winter haulage road between the two sites will be constructed (Figure PD.10). The winter road will be approximately 49 km in length. Construction of the all-season road will commence as quickly as possible in Year minus 2. If the all-season road is not completed by the end of Year minus 2, a winter road will also be constructed in Year minus 1.

For each year of winter road construction, the alignment will be selected and marked out in the fall by experienced winter road-building personnel and construction will commence in January. The winter road will be routed to follow lakes and watercourses wherever possible to minimize the length of on-land portions. No major earthmoving, excavation or grading is contemplated in the construction of the Grays Bay to High Lake winter road.

The winter road will be in service from late January to the end of May, or for as long as conditions permit safe use. Sanding may be required in some sections for traction assistance.

The road surface will be 20 to 30 m wide and will be constructed to geometric standards required by wheeled highway tractor-trailer units with a gross vehicle weight of up to 65 tonnes. Trailers will be configured to haul up to 40 tonnes of materials and fuel. Speed limit signs, curve signs, chevron markers and road delimiters will be used to mark the limits of the roadways and to post operating speed limits.

Based on an average disturbance width of about 90 m, the total disturbance footprint for the winter road is expected to be about 491 ha.



Proposed Project Components		Drainage Basins Upstream of Stream Crossings	
●	Project site	AS1	AS8
+	Stream Crossing (All-Season Road)	AS2	AS9
—	All-Season Road	AS3	AS10
—	Winter Road	AS4	AS11
Hydrological Features		AS5	AS12
—	Waterbody	AS6	AS13 (C2)
—	Watercourse	AS7	AS14



Project Description

Road Alignment and Stream Crossings

References:  
 Drainage basins delineated by Gartner Lee are approximate and are based on 1:50,000 scale topographic data.  
 National Topographic Database (NTDB) compiled by the government of Canada, Natural Resources Canada (NRCAN) at 1:1,000,000

Projection: UTM Zone 12 NAD 83  
 Revision: 1  
 Date: September 18, 2006

Gartner Lee Figure: PD. 10

## **4.2 Grays Bay to High Lake Mine Site Winter Road Construction and Operation Activities**

### **4.2.1 Snow Clearing and Stockpiling**

The winter road will be constructed using a water truck to build up ice embankments with water and snow. The ice embankments, which will serve as the road running surface, will be constructed from the ground surface up to protect the tundra vegetation. Snow will be obtained from within the road right-of-way and from lake ice clearing. Due to vehicle ground pressures, the road will require a clearance over the underlying tundra of 150 to 300 mm, to be determined based on site conditions. Snow and ice will also be used to level out topographic variations in the overland segments of the road to produce consistent grades, slopes and crossfalls.

As and when required, snow will be ploughed or blown clear of the roadway to promote freezing and maintain trafficable conditions. These operations will avoid obstructing major watercourses and caribou migration pathways, where identified.

### **4.2.2 Water Management & Use**

Depending on the maximum loads that will be transported along the winter road, water may be added to the roadway to build up the ice thickness to safely carry the anticipated loads. Water will be drawn from lakes situated along the proposed road alignment (Figure PD.10), and spread using water tanker trucks and tanks mounted on Nodwell type rubber tracked muskeg tractors. It is anticipated that approximately 410 m<sup>3</sup> of water per kilometre of portage (on-land portions) will be required to build the winter road ice embankment. Approximately 6,200 m<sup>3</sup> of water will be drawn from the lakes along the road route.

### **4.2.3 Drainage Management**

Where the winter road embankment follows pre-existing drainage courses, the road alignment will be situated to the side of the creek or river channel wherever feasible so as not to interfere with the streams normal flow during the spring freshet.

### **4.2.4 Sanding Requirements**

To minimize the need to sand the winter road, which shortens its life, the alignment has been carefully planned so that approach embankments from overland sections to over-water sections will be constructed

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with gentle slopes. Sanding may be required where the road cannot be graded to allow tractor-trailer vehicles to climb and descend hills safely without traction assistance. In addition, some sanding may be required at tight bends in the road or where the embankment is exposed to high winds that polish the road surface to smooth ice. Approximately 50 tpy is anticipated to be required for the Grays Bay to High Lake winter road. The sand will be extracted from natural borrow sources such as at Sand Lake or along the road route (Figure PD.7).

#### 4.2.5 Vehicle and Equipment Use

The winter road will primarily be used by heavy truck traffic delivering fuel, freight, machinery and building materials. Travel on the winter road will not commence until its construction is complete and the travel surface meets the required standards for operator safety and protection of tundra vegetation. Travel will not be permitted on the winter road when weather and road conditions could result in damage to the tundra or road surface due to rutting. Temporary road closures may be required to extend the use of the winter road. Chains will only be used when absolutely necessary as they can deteriorate the snow packed road surface.

The winter road speed limits will be such that vehicles are able to safely slow down or stop if they encounter a hazard or approaching vehicle. The operating speed limit will be set according to ice conditions at the time the road is in service. It is anticipated that trucks likely will be limited to between 15 km/hr and 30 km/hr on ice, depending on conditions. Speed limits on the portages are expected to be 30 km/hr loaded and 50 km/hr empty. A protocol for radio communications will be developed for the road. Typically this will involve truck operators reporting their location and direction at a prescribed interval. For safety and orderly traffic control, light vehicles will be subjected to the same speed restrictions. When approaching land or meeting other trucks, operators will reduce speed to prevent an ice wave rebound and to allow for reduced visibility due to swirling snow when passing trucks travelling in the opposite direction. Trucks will need to maintain a 1 km separation when travelling in the same direction across lakes.

Traffic on the road will be controlled by dispatch centres located at High Lake and Grays Bay security offices. Trucks will be dispatched from each site in a controlled manner and standards will be established for the minimum distances between the vehicles according to weight and travel speed. GPS based trip recorders will be installed in the trucks to monitor the operator's compliance with speed limits and to maintain a count of the number of trips on the road.

Vehicles will generally travel in the central portion of the ice road to minimize loading at the sides where the weight of the snow storage banks is carried. Trucks will not be permitted to park, load or unload on ice roads as the constant weight of one or more trucks could create an ice failure. Loading and unloading of all trucks and storage of material will only occur on land.

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Vehicle operators will be briefed on the importance of maintaining minimal interaction with wildlife while travelling on the winter road. If a group of caribou is observed in the vicinity of construction or operation activity, traffic activity controls will be implemented and monitored with the appropriate response, including reducing speed, re-routing or stopping traffic, control/stoppage of construction or operations, and/or re-scheduling flights.

#### 4.2.6 Emergency Management

Ice road failures, road maintenance, sudden storms, snow drifting and whiteout conditions preventing travel are potential hazards associated with use of the winter road. Due to the relatively short distance from Grays Bay to High Lake, refuge stations will not be established along the route. However, wilderness survival training and ice road driving training will be provided to all vehicle operators using the winter road. Adequate clothing, personal medication, fuel to reach the destination, vehicle and survival equipment and radio communication will be supplied in every vehicle travelling on the winter road. Vehicle operators will be required to maintain a 24-hour daily log-book.

Safety and preparedness for accidents and spills will be paramount. Procedures will be established for monitoring vehicles in transit and for controlling traffic during inclement weather or if wildlife migrations necessitate vehicle movement restrictions. In the event of a spill, a Spill Response Team will attend the site with appropriate containment and collection facilities. Any contaminated soil will be collected and disposed of in an appropriate manner. Further details on emergency response will be provided in the preliminary Emergency Response and Contingency Plan, which will be contained within Volume 8 of the *High Lake Project Proposal*.

### 4.3 Grays Bay to High Lake Mine Site Winter Road Closure and Reclamation Concepts

Each spring, ice bridges along the winter road will be excavated to permit free flowing conditions in streams and river channels. Logistical facilities such as signs, refuge stations, fuel tanks and other man-made features will be removed from the roadway prior to spring break-up and stored for re-installation the following winter.

Upon final closure, the winter road will be thoroughly cleared of any foreign objects. If necessary, in areas of previously continuous vegetation cover along the winter road, damaged exposed areas of sediment will be actively revegetated. Further details on revegetation will be provided in a Preliminary Reclamation and Closure Plan, which will be contained within Volume 8 of the *High Lake Project Proposal*.

## 5. All-season Road: Grays Bay to High Like Mine Site

### 5.1 Grays Bay to High Lake Mine Site All-Season Road Description

The High Lake mine site will be serviced in the long term by a 53 km long all-season road extending from the High Lake mine site to the Grays Bay dock (Figure PD.10). The all-season road will be designed and constructed as a single-lane, two-way road with pull-outs approximately every kilometre to facilitate passing. Based on an average disturbance width of about 22 m, the total disturbance footprint for the all-season road is expected to be approximately 119 ha.

The selected route was identified following studies in 2004 and 2005 of potential dock facility locations, environmentally significant features, potential aggregate borrow deposits (Figure PD.2) and consideration of cost factors (length and ground conditions). Construction of the all-season road will occur in Years minus 1 and minus 2. Minor variations in the actual roadway alignment may be necessary to ensure design geometrics are achieved.

The proposed route was chosen to minimize impacts to environmentally sensitive areas while ensuring a safe roadway alignment and suitable foundation. The aquatics and archaeology teams worked closely with the engineers in the preliminary design of the road alignment. There are 14 stream crossings and one lake encroachment along the proposed route of the all-season road (Figure PD.10). Expected ground conditions along the route include exposed or thinly covered bedrock escarpments, granular outwash plains, and marine deposits. A Heritage Resources Protection Plan was developed for the Project, and will be contained in Volume 8 of the *High Lake Project Proposal*.

Design criteria proposed for the all-season road are:

- minimum sight stopping distance 130 m;
- maximum grades 10%;
- minimum turn radius 80 m;
- road surface width 6 m;
- design speed 50 km/hr;
- gross vehicle weight for trucks is 65 tonnes;
- 40 lost days due to weather per year;
- turnout width 4 m, average spacing 1 km;
- 15 round trips per day (five haul trucks, three round-trips each per day);

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- all vehicles equipped with two-way radios; and
- typically, 150 mm thickness of crushed aggregate on surface (maximum size 37.5 mm).

The all-season road will also be designed with minimal embankments to reduce impediments to caribou migration patterns and delineator markers will be used to identify the edge of the road, instead of a guide-rail system, to allow free passage of wildlife.

Higher traffic volume and frequency of usage is anticipated on the southern 12 km of road between the High Lake mine site and the Sand Lake airstrip, with up to 100 vehicle round trips per day. On the northern road segment from the Sand Lake airstrip to the Grays Bay dock, total daily traffic is expected to be below 30 vehicle round trips per day. The speed limit for the all-season road will be 50 km/hr for all vehicles.

## 5.2 Grays Bay to High Lake Mine Site All-Season Road Construction Activities

### 5.2.1 Excavation and Filling

There are four basic construction types, based on whether the road is in a cut or fill location, and the type of subgrade present, as follows:

1. granular subgrade – 150 mm thickness of crushed rock, over a 300 mm sub-base of rockfill;
2. marine sediment subgrade – 150 mm thickness of crushed rock, separated by a non-woven geotextile, over a 1,000 mm thick sub-base of rockfill;
3. in-situ bedrock subgrade (fill section) – as for marine sediment subgrade; and
4. in-situ bedrock subgrade (cut section) – 150 mm thickness of crushed rock.

The all-season road will be constructed with rock fill sub-base topped with crushed aggregate, which may be blended with sand and fine gravel from granular borrow sources. Table PD.17 provides the anticipated distribution along the roadway of each of the four subgrade conditions, beginning at Station #10 at the High Lake mine site.

Several borrow locations for granular base materials and for quarrying for rockfill have been identified along the all-season route (Figure PD.2). It is estimated that the following materials will be required for the all-season road:

- 600,000 m<sup>3</sup> of general rockfill, most of it generated by cut excavations along the route;
- 150,000 m<sup>3</sup> of processed granular materials for the roadway surface; and

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- an additional 30,000 m<sup>3</sup> used for upgrading and maintenance over its intended life.

Blast rock for roadbed sub-base will be obtained from rock excavations along the roadway. A rock quarry will be required at the Grays Bay dock site for aggregate requirements at the northern limits of the all-season roadway and for development of the dock facilities (Section 3.3.1 and Figure PD.9).

Borrow sources for granular based materials and for quarrying will be refined in the detailed engineering phase of the Project. A preliminary Borrow Management Plan will be included in Volume 8 of the *High Lake Project Proposal*.

**Table PD.17 Embankment/Road Cuts Along High Lake to Grays Bay All-Season Road**

Station # and Location	Terrain Unit/Description	Embankment/ Road Cut Type*
10 (+000) - 14 (+700)	Till over bedrock	3
14 (+700) - 16 (+300)	Glaciofluvial veneer over bedrock	1
16 (+300) - 16 (+600)	Bedrock	3
16 (+600) - 23 (+300)	Glaciofluvial plain	1
23 (+300) - 26 (+900)	Marine deposits	2
26 (+900) - 28 (+200)	Bedrock	3
28 (+200) - 28 (+900)	Marine deposits	2
29 (+900) - 29 (+800)	Bedrock	3
29 (+800) - 30 (+200)	Marine deposits	2
30 (+200) - 31 (+200)	Bedrock	3
31 (+000) - 31 (+300)	Marine deposits	2
31 (+300) - 34 (+800)	Bedrock	3
34 (+800) - 35 (+300)	Marine deposits	2
35 (+300) - 45 (+500)	Bedrock, bouldery	3
45 (+500) - 46 (+700)	Marine deposits	2
46 (+700) - 47 (+800)	Bedrock	3 / 4
47 (+800) - 50 (+400)	Marine deposits	2
50 (+400) - 51 (+300)	Bedrock	3 / 4
51 (+300) - 52 (+900)	Marine deposits	2
52 (+900) - 53 (+300)	Bedrock	3 / 4
53 (+300) - 61 (+100)	Marine deposits	2
61 (+100) - 62 (+100)	Bedrock	3 / 4
62 (+100) - 63 (+800)	Marine deposits	2

\* Embankment/Road Cut Types: 1 = fill on granular subgrade; 2 = fill on marine subgrade; 3 = fill on bedrock subgrade; 4 = cuts on rock subgrade.

Preliminary assessment of the geological conditions along the proposed road route indicates that most of the materials to be borrowed will be NAG materials. However, detailed construction assessment and

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design will include provisions to sample and confirm that this assumption is correct. Depending on the outcome of the detailed assessments, appropriate amendments to borrow plans will be developed to preclude the use of PAG materials being excavated and used in road fills.

The bulk of the fill used for the road will be obtained from road cuts. Other sources for road construction materials include esker sands and gravels, quarried rock, and available rocky colluvium and felsenmeer material (ice-jacked bedrock particles). Potential issues affecting esker sources include potential ice lensing, environmental and archaeological constraints, and haul distance. The use of eskers will be minimized. Much of the bedrock in the area is relatively strong and competent with the result that colluvium and felsenmeer is coarsely sized and expensive to handle and process for fill or road base and surfacing. The alternative source is rock quarrying by drilling, blasting and crushing for both general fill and surface materials. Dust suppression methods during earth moving activities will include application of water during placement and compaction of granular materials.

## 5.2.2 Drainage Management

There are 14 identified stream crossings and one lake encroachment (numbered AS1 to AS15) along the proposed all-season road (Figure PD.10). Preliminary selection of crossing type and size has been conducted and the results are summarized in Table PD.18. The crossing size and type takes into account the quality of aquatic habitat and requirements for flood control during the life of the Project.

**Table PD.18 High Lake to Grays Bay Road Drainage Crossings**

Crossing No.	Drainage Area (km <sup>2</sup> )	100 Year Storm Flow (m <sup>3</sup> /s)	Fisheries Potential	Culvert Size (mm)	Number of Culverts
AS1	3.8	2.4		1000	3
AS2	78.4	50.7	√	20 m span bridge	
AS3	3.8	2.4		1000	3
AS4	70.7	46.2	√	20 m span bridge	
AS5	Lake – no flow		√	Fill embankment	
AS6	0.9	0.3		600	1
AS7	23.9	16.4	√	20 m span bridge	
AS8	2.3	1.3		1000	2
AS9	165.6	94.4	√	25 m span bridge	
AS10	10.3	7.0		1200	5
AS11	2.0	1.2		1200	1
AS12	25.5	17.5	√	10 m span bridge	
AS13	5.9	3.9		1200	3
AS14	49.3	33.1	√	20 m span bridge	
AS15	0.7	0.2		600	1

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For streams with important fisheries potential crossings will be either a clear span bridge constructed entirely outside the high water level or a modular rigid frame structural steel culvert with pre-cast open footings situated outside the high water level of the channel (Table PD.18).

For any other minor streams, oversized corrugated steel culverts will be inset 10% into existing ground (where possible) and in-filled with gravel to restore a natural streambed. Where the existing channel is not clearly defined, embankment fills approaching the crossings will be constructed from blast rock to prevent erosion and sedimentation of the watercourse.

The roadway embankment extending into the lake at AS5 will be constructed with blast rock from a side hill cut at the same location. Blast rock will be placed into the water by backhoe to minimize infill limits, and provide a suitable roadbed foundation.

Appropriate erosion and sediment control measures (silt fence, flow checks in ditches, erosion control blankets and/or seeding and mulch on exposed earth slopes) will be utilized to prevent negative impacts to watercourses during construction and operation of the roadway. All in-water work will be conducted during acceptable time periods to reduce potential impacts to fisheries.

### **5.2.3 Vehicle & Equipment Use**

Higher traffic volume and frequency of usage is anticipated on the southern 12 km road segment between the High Lake mine site and the Sand Lake airstrip, with up to 100 vehicle round trips per day. On the northern road segment it is anticipated that convoys of vehicles will depart from the High Lake mine site to travel to the Grays Bay dock, and return to the High Lake mine site every four hours. Total daily traffic on the northern road segment, including both the transport trucks and occasional personnel vehicles, is expected to be below 30 vehicle round trips per day. During the construction phase, this will include heavy equipment transport trailers. The traffic protocols described in Section 2.4.5 will be followed. A preliminary Access and Traffic Management Plan will be included in Volume 8 of the *High Lake Project Proposal*.

## **5.3 Grays Bay to High Lake Mine Site All-Season Road Operations Activities**

### **5.3.1 Road Maintenance**

Periodic maintenance of roadway surfaces and embankments will be required to repair defects and any erosion. This will be conducted using conventional civil construction equipment including graders, dozers, haul trucks and loaders. Culverts and bridges will be regularly inspected, particularly preceding

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and during spring thaw. Dust suppression during operation of the roadway will be achieved by application of calcium chloride.

### 5.3.2 Emergency Management

Safety and preparedness for accidents and spills will be paramount. Procedures will be established for monitoring vehicles in transit and for controlling traffic during inclement weather or if wildlife migrations necessitate vehicle movement restrictions. Due to the relatively short distance from Grays Bay to High Lake, refuge stations will not be established along the route. However, wilderness survival training will be provided to all vehicle operators. The consequences of an unexpected delay, breakdown or accident when travelling in this isolated area can be life threatening, therefore adequate clothing, personal medication, fuel to reach the destination, vehicle and survival equipment, two-way radio communication will be supplied in every vehicle travelling on the all-season road.

In the event of low visibility conditions, traffic will not be permitted on the northern segment (Sand Lake airstrip to the Grays Bay dock). Emergency accommodations (including sufficient food and medical supplies for an extended period) will be available at the Grays Bay dock for transport and dock personnel that are unable to travel to High Lake mine site. Radio communication and satellite phones will be maintained at the Grays Bay dock.

In the event an accident occurs along the all-season road, a warning will be broadcast to all road users. If the accident causes any serious injuries a medical emergency response will be made by land or air transportation (dependent on location and travel conditions at time of accident). Cleanup and salvage activities will be initiated as soon as medical emergencies (if any) have been attended too. Upon completion of cleanup operations, normal road usage will be resumed.

In the event of a spill, a Spill Response Team will attend the site with appropriate containment and collection facilities. Any contaminated soil will be collected and disposed of in an appropriate manner.

Further details on emergency response will be provided in the preliminary Emergency Response and Contingency Plan, Volume 8 of the *High Lake Project Proposal*.

### 5.3.3 Snow Clearing and Stockpiling

As and when required, snow will be ploughed or blown clear of the roadway to maintain trafficable conditions. These operations will avoid obstructing major watercourses and identified caribou migration pathways.

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### 5.3.4 Vehicle and Equipment Use

During the mine operation phase, vehicles using the all-season road will typically include normal passenger and service vehicles, and concentrate and fuel transport trucks and trailers. These multi-purpose vehicles will typically travel north to the Grays Bay dock with mineral concentrate then return south to the High Lake mine site with fuel or supplies.

Higher traffic volume and frequency of usage is anticipated on the southern 12 km of road between the High Lake mine site and the Sand Lake airstrip, with up to 100 vehicle round trips per day. On the northern road segment from the Sand Lake airstrip to the Grays Bay dock, it is anticipated that convoys of up to five trucks will depart from High Lake mine site to travel to Grays Bay dock, and return every four hours. Total daily traffic, including both the transport trucks and occasional passenger vehicles, is expected to be below 30 vehicle round trips per day on the northern road segment. The speed limit for the all-season road will be 50 km/hr for all vehicles. Traffic protocols are described in Section 2.4.5. Issues related to access, traffic, safety and wildlife will be addressed in management plans. A preliminary Access and Traffic Management Plan and a preliminary Wildlife Mitigation and Monitoring Plan will be included in Volume 8 of the *High Lake Project Proposal*.

## 5.4 Grays Bay to High Lake Mine Site All-Season Road Closure and Reclamation Concepts

This section describes the closure and reclamation concepts for the all-season road. Further information will be provided in a Preliminary Closure and Reclamation Plan, which will be contained in Volume 8 of the *High Lake Project Proposal*.

The all-season road will be decommissioned by the removal of culvert and bridge structures to restore natural drainages. Appropriate erosion and sediment control measures will be utilized during the removal of these structures and all work shall be timed to minimize negative impacts to fisheries. The road will be reclaimed to stable conditions and pre-existing natural drainage patterns will be restored wherever possible. Road surfaces will be loosened to promote revegetation (see Section 2.6.3).

The borrow sources developed to construct the all-season roads and mining infrastructure (Figure PD.2), will be reclaimed upon final closure. Any temporary berms will be removed and the area re-contoured. The quarries and granular borrow pits will be re-contoured wherever practical, and their final slopes will adhere to the most recent regulatory guidelines for reclamation of quarry walls. Erosion by surface water will be controlled with a combination of re-contouring, drainage swales and berms. Unused quarried material will be flattened, and used to re-grade uneven surfaces within the quarry. Where practicable the quarry and pit floors will be sloped upon completion to allow for adequate drainage. All quarry and pit areas will be cleaned of debris, garbage, wire, and other foreign objects upon completion of closure.

## 6. Mobilization and Shipping

The details associated with the mobilization and shipping at the construction, production and closure stages of the High Lake Project have been developed at a general pre-feasibility mine planning level. As the planning for the High Lake Project becomes more advanced and markets for the concentrates are secured, a detailed mobilization plan will be developed for regulatory approvals. The following is an overview that summarizes the options available for Wolfden Resources Inc. at this time.

### 6.1 Mobilization - Construction Phase

#### 6.1.1 Mobilization – Nanisivik Equipment

Wolfden Resources Inc. purchased a mill complex from Breakwater Resources that was used at the former operating Nanisivik mine on Baffin Island to provide the necessary milling and metal recovery infrastructure to process the ore at High Lake. The Nanisivik mill will be cleaned, disassembled and shipped to Grays Bay for subsequent transport inland to High Lake. This approach of “recycling” current mine infrastructure is an example of Wolfden Resources Inc.’s sustainable approach to developing mineral resources in Nunavut.

During the summer of 2008 (Year minus 2), it is planned that an ice-class cargo ship will be chartered to carry the following items from Nanisivik to Grays Bay:

- mill structural steel (3,300 tonnes);
- jaw crusher (56 tonnes);
- cone crusher (45 tonnes);
- rod mill (63 tonnes);
- ball mill (106 tonnes);
- re-grind mill/grate mill (15 tonnes);
- small concentrate dryer (16 tonnes);
- large concentrate dryer (53 tonnes);
- miscellaneous pumps, fans & piping (550 tonnes); and,
- diesel generator sets (5 Units), (combined weight = 130 tonnes).

## Project Description Supporting Regulatory Applications

The total tonnage of the above equipment is approximately 4,334 tonnes. It is proposed that the Nanisivik equipment will be temporarily stored in a gently sloping area approximately 800 m south of the main dock in Grays Bay, as shown on Figure PD.9. The ground preparation work required for the temporary storage facility will be approved through land use authorizations by both Indian and Northern Affairs Canada.

This equipment will be unloaded and transported to shore by a tug and barge at either Barge Landing Site 'A' or Barge Landing Site 'B' (Figure PD.9). Discharging of goods from barges will be done with ramps and a crane in combination with front-end loaders to move heavy material on to the lay down area. As outlined above, mobilization details and loading/offloading protocols will be finalized through the approvals process required for both shipping and temporary land use permits.

### 6.1.2 Mobilization – Other Equipment

In addition to the mobilization of Nanisivik equipment, options are being considered for the delivery of the other construction equipment and materials for use in the construction of the Grays Bay dock and the High Lake mine site. Both options service Nunavut communities during the summer shipping season. The two options are as follows:

- Western Option by tug and barge from Hay River NT via Mackenzie River and Beaufort Sea (Figure PD.11), with a trans shipment at Tuktoyaktuk at Inuvik; and
- Eastern Option by ice class vessel from the upper St. Lawrence in the Province of Quebec.

Determination of the preferred option will take into consideration the following criteria:

- Vessel reliability and risk factors under adverse weather conditions;
- Cost effectiveness based on where the majority of the cargo will originate;
- Overall costs in terms of routes and their distances and handling charges,
- Environmental and community considerations; and,
- Other factors.

The tug and barge option will have a triple tow configuration such as or similar to the tug barge combinations used by Northern Transportation Company Limited (NTCL), which utilize one tug and three barges. The barges will be approximately 67 m long and 17 m wide, with a usable deck space of approximately 930 m<sup>2</sup> each.

**Shipping Route Map**

**Legend**

-  Approximate Shipping Route
-  Grays Bay Dock Site
-  Hay River Barge Route

Note: Routes are indicative only and may vary according to sea and ice conditions.



References:  
Base data 1:2,000,000; Penn State University, University Libraries, Pattee Maproom.

Project components provided by Gartner Lee Limited. Communities, and index map compiled by ESRI. Mine sites provided by Wolfden Resources.

Files supplied by Wardrop Engineering in February, 2006  
SKT-R0002-A Northwest Passage Map Details.doc and  
SKT-R0001-A Northwest Passage Map Overview.doc

Projection: Canada Lambert Conformal Conic  
Revision: 1  
Date: September 18, 2006

File: 51027\_B4\_EngPD\_1PR1\_Shipping\_Route.mxd

## Project Description Supporting Regulatory Applications

A preliminary list of equipment and supplies that are to be transported to Grays Bay during the summer of 2008 (Year minus 2) for use in the construction phase are as follows:

- four tractor-trailer haulage trucks;
- reinforcing steel bar – approximately 600 tonnes;
- formwork and lumber – six containers (20 foot long);
- a 50 person construction camp (if required);
- 3,000 to 5,000 tonnes of cement;
- 3,000 to 5,000 tonnes of prefabricated equipment for the processing facility;
- mining equipment for underground development;
- civil construction equipment including airtrack drills, trucks, bulldozers, compactors etc;
- miscellaneous equipment such as pumps and pipelines;
- fuel – 1 million litres (ML) for construction equipment and camp;
- ammonium Nitrate for construction blasting – up to 200 tonnes;
- mill chemicals and reagents;
- miscellaneous mobile equipment including cranes, gensets, delivery and maintenance trucks, and a portable crusher; and
- material for the construction of a temporary equipment maintenance garage.

Fuel will be delivered either by barge or by fuel tanker and discharged directly to the temporary fuel storage area at Grays Bay (Figure PD.10). Table PD.19 outlines the proposed schedule for sealifts of equipment and materials to Grays Bay during the construction phase.

**Table PD.19 Proposed Schedule of Sealifts to Grays Bay – Construction Phase**

<b>Schedule</b>	<b>Route of Delivery</b>	<b>Equipment and Materials</b>
2008 (Year minus 2)	Nanisivik to Grays Bay	Nanisivik mill components and equipment shipped to Grays Bay.
2008 (Year minus 2)	Barge transport Hay River to Grays Bay; or by ship from upper St. Lawrence (Eastern Canada)	New mill equipment and other supplies, construction materials and equipment.
2009 (Year minus 1)	Barge transport Hay River to Grays Bay; or by ship from upper St. Lawrence (Eastern Canada)	First mill chemicals and reagents, other supplies, construction materials and equipment.

## 6.2 Operation Phase

### 6.2.1 Vessel and Routing Options

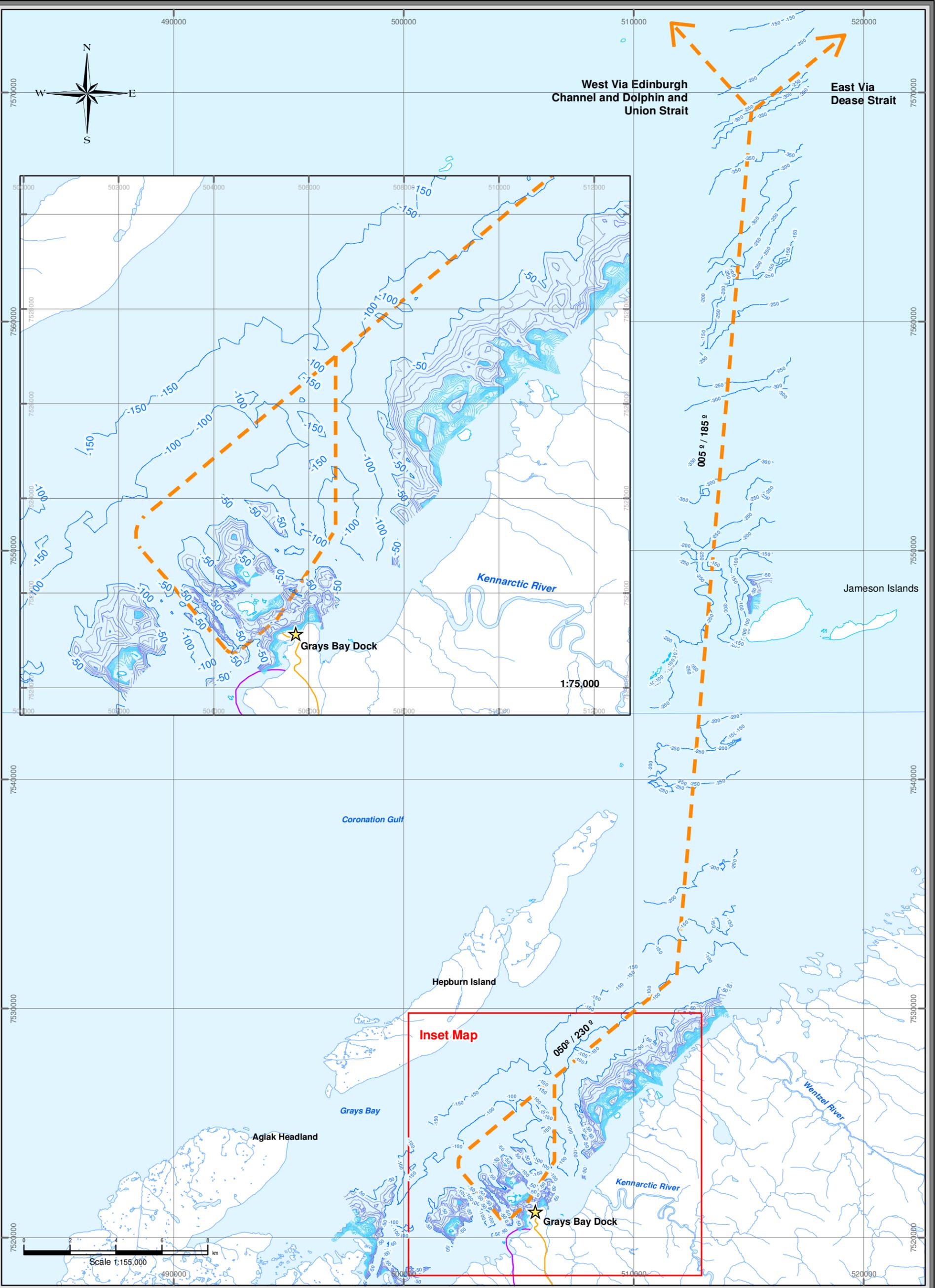
It is estimated that up to 300, 20 ft sea containers per year will be required for the annual supply of materials (dry foodstuffs, lime, reagents, cement, ammonium nitrate, milling steel, spare parts, tires, and high explosives) to the mine operations, with an estimated weight of approximately 30,000 tonnes.

Supply materials will be brought in by the ships arriving at the Grays Bay dock for concentrate loading, and, if supplementary transport support is needed barges will also be used. Regular summer barge service for miscellaneous re-supply may also be used.

Ships for the High Lake Project will follow known shipping routes through the Northwest Passage, either through a western access route, or through an eastern access route. Ships will either travel from the west through Bering Strait to the Coronation Gulf or through Davis Strait from the east to the Coronation Gulf, as shown on Figure PD.11. Ice-breaker support may be required during the summer shipping season. Considerations in the selection of a preferred option will include market locations for the concentrates, locations for concentrate transfer to other vessels (if required) and the most suitable location for the loading of operating supplies and fuel. Both Asian and European markets are being considered at this time.

Ships will deviate briefly from the known shipping route through the Coronation Gulf to travel south to Grays Bay (Figure PD.12). This segment short would follow a route northeast from the dock across Grays Bay to the channel to the immediate east of Hepburn Island, then into Coronation Gulf. This part of the shipping route was surveyed in 2004 and determined to be safely navigable. The proposed location of the dock in Grays Bay was selected on the basis of bathymetric surveying within Grays Bay.

The selected vessel will be capable of bringing in general cargo and operating supplies. It will be configured for both oil and bulk ore cargo to bring in the fuel and operating supplies and transport the concentrates out. This has been a successful mode of operation at former producing mines in Nunavut such as Polaris. The bulk concentrate carriers will have approximately 50,000 DWT capacity. The anticipated production of copper and zinc concentrates is up to 140,000 tpy, and therefore four to six ships will be required to haul concentrates each year. Materials may be trans-shipped to non-ice class vessels at a non-Canadian port.



Legend	
<b>Proposed Project Components</b>	
	Grays Bay Dock
	Proposed Shipping Route
	Winter Road
	All-Season Road
<b>Bathymetric Contours</b>	
	1m
	5 m
	5-10 m
	10 m
	50 m



*Project Description*

**Proposed Shipping Route from Grays Bay Dock**

References:  
Proposed Shipping routes defined by Chris Anderson - May 2006.  
Bathymetry by Challenger Geomatics and is based on a hydrographic survey conducted in July and August, 2004.

National Topographic Database (NTDB)  
compiled by the government of Canada,  
Natural Resources Canada (NRCAN) at 1:1,000,000

Projection: UTM Zone 12 NAD 83  
Revision: 1  
Date: September 18, 2006



Figure: **PD. 12**

## Project Description Supporting Regulatory Applications

**Western Shipping Access Route**

Preliminary findings indicate that for ships using the western access route, a berth-operating window ranging from 30 days in a severe ice year to 90 days in a mild ice year is available. The estimated average season for berth operations is 70 days along the western shipping route. In conformity with draft West Kitikmeot Regional Land Use Plan Requirement 6.2, shipping and ice breaking will not be considered during caribou migration periods or when human traffic across the sea ice is likely, including the periods from mid October to December, and from March to June. Ice-breaker support may be required during adverse ice conditions during the summer. The schedule of shipping will also take into account the impact on marine mammals and hunting and will ensure that mitigation measures through a Shipping Management Plan will take into account sensitive coastal and offshore areas as well sensitive life cycle times such as migration.

**Eastern Shipping Access Route**

A significantly shorter ice-free shipping period is expected for the eastern access route than for the western access route. However, incentives to use the eastern routes may include a shorter distance to market or European demand for High Lake concentrate. It is more likely that ice-breaker support, or ships with high ice classification will be required for the eastern route, compared to the western one. As outlined above a Shipping Management Plan will take into account sensitive coastal and offshore areas as well sensitive life cycle times for caribous and marine mammals. Terms in the North Baffin Regional Land Use Plan state that:

- “whenever safe and practical to do so, all ships shall remain at least 10 km from all coastlines in the region, unless approaching or leaving port”;
- “...all ships shall remain at least 20 to 25 km from the coasts of Lancaster Sound, unless approaching or leaving port”; and
- “ship traffic through and around the floe edges in April, May and June shall be minimized”.

These conditions will be considered in developing a Shipping Management Plan, if the eastern access route is utilized.

**6.2.2 Docking and Loading/Unloading at Grays Bay**

All ship/barge docking and landing of barges will conform to the following procedures:

- best practices will be followed at all stages including emergency response protocols;
- risks associated with weather and sea conditions will be assessed prior to docking and loading/off loading;

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- shore landings for barges will comply with safe navigation practices through navigation charts, detailed bathymetry and pre-landing inspections;
- the approach must be clear of any visible obstructions or hazards;
- barges not secured will be attended by a tug;
- tie up (bow or side) will be determined by the load configuration; and
- good communications through radio checks at all phases of docking and loading between the wheelhouse and barge/ship deck.

All ships will be capable of berthing unassisted under normal conditions.

### **Navigation**

There is no requirement to provide navigational aids for marine traffic at the Grays Bay dock location. Navigation will be make use of on board GPS, in conjunction with official maps to chart course and determine water depths along the route and in the area of the final destination.

### **Waste Management**

Wastewater and sewage from ships and tugs will be contained on board and managed according to Canadian regulations.

## **7. Human Resources**

### **7.1 Project Management and Administration**

Project management and administration will be based at the High Lake mine site office, with support from Wolfden Resources Inc.'s head office in Thunder Bay, Ontario.

Project management and administration will be the responsibility of the Mine Manager with the following staff:

- two personnel officers;
- community liaison officer;
- seven security, health and safety, and training staff;
- 16 procurement and general administrative staff during open pit mining;

## Project Description Supporting Regulatory Applications

- 21 procurement and general administrative staff during underground mining; and
- three off-site logistics and clerical staff.

The Mine Manager's time will be primarily dedicated between the High Lake mine, with some time spent at the head office located in Thunder Bay, Ontario.

A community liaison office will be established in one of the Kitikmeot communities. A Community Liaison Officer will be hired to interact with Kitikmeot communities and residents throughout the life of the Project.

## 7.2 Construction Workforce

Construction will occur over two years. The construction workforce will grow rapidly from an initial crew of 25 to over 350 persons within the first three months of construction, peaking at approximately 440 persons at the beginning of the second year of construction (Figure PD.13). During Years 2 and 3 of operations, a small construction workforce will be installing a separate circuit at the mill to extract zinc. Over the Project life approximately 775 person-years of construction employment will be generated.

Construction workforce estimates by job skill levels are presented in Table PD.20, and the types of construction jobs available by skill level is shown in Table PD.21. Table PD.20, the values shown reflect the highest number of jobs available in that year by job skill category. The person-years are stated at the bottom of the table and in some years they do not equal to the number of jobs. The reason for this is that some jobs are short-term and do not last for a whole year. In years when there are many short-term jobs, the number of jobs available will be higher than the person-years. For example, if a job is only for three months that would be equal to 1/4 of a person year. Person years are a sum of the number of months when each job occurs divided by 12.

## 7.3 Operational Workforce

The expected life of the mine is 14 years. Before mining operation starts, a small workforce will begin mining ore for commissioning the process plant, as well as begin road maintenance. This will occur during the last three to six months of construction (Year minus 1). By the end of construction, 135 operational staff will be on-site and include general and administrative staff, camp housekeeping, catering, mill operators, truck drivers, open pit mining, and surface facilities maintenance crews.

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Figure PD.13 High Lake Project Construction Workforce

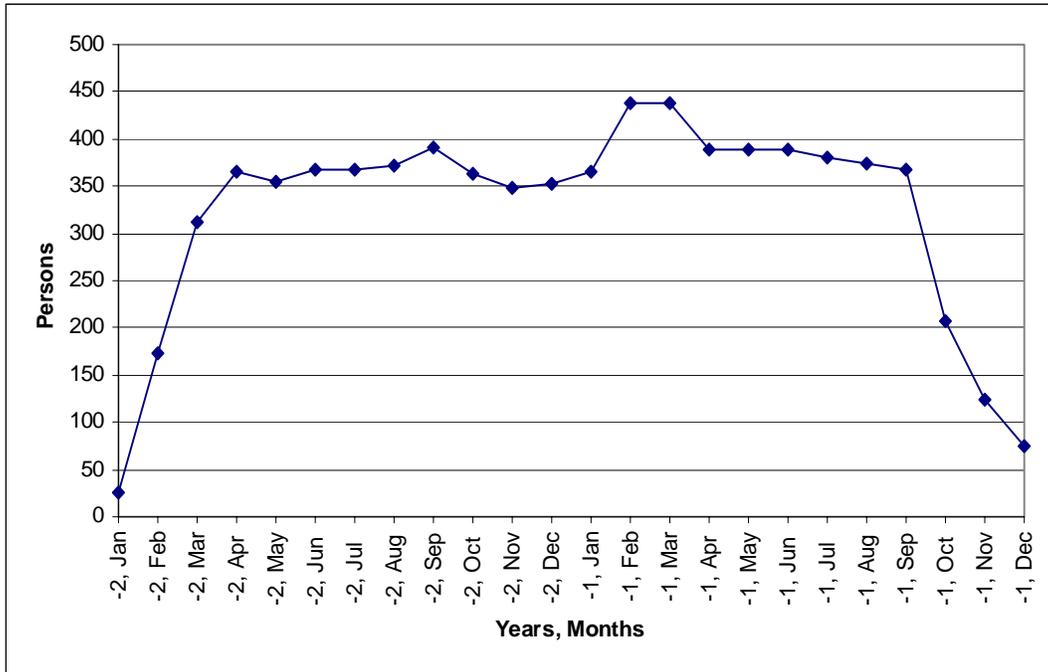


Table PD.20 Construction Workforce Estimates (Number of Jobs)

Year	Year minus 2	Year minus 1	Construction Phase Average	Year 2	Year 3	Years 2 and 3 Average	
<b>Skill Level</b>							
Professional/Managerial	14	14	14	4	4	4	
Skilled	276	323	299	51	48	49	
Semi-skilled	51	51	51	6	6	6	
Unskilled	50	50	50	6	6	6	
<b>Total Jobs by Year</b>	<b>391</b>	<b>438</b>	<b>414</b>	<b>67</b>	<b>64</b>	<b>65</b>	
							<b>Total</b>
<b>Person-Years</b>	<b>316</b>	<b>328</b>		<b>67</b>	<b>64</b>		<b>775</b>

The workforce will typically be about 290 people during operation, with only half this number on-site due to rotations. The workforce will peak at about 335 persons in Year 4 when underground mining overlaps with the final stages of the open pit mine operation. A secondary peak will occur in operational Year 6 to Year 10, when sustaining capital work (work undertaken to keep the mine in good working order) will be performed (Figure PD.14).

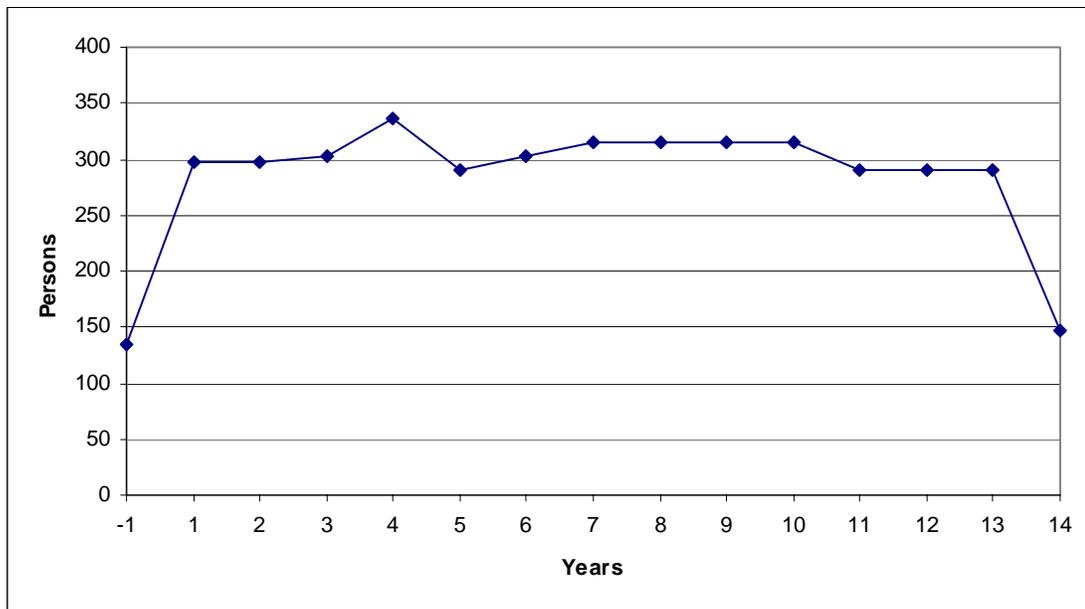
Project Description Supporting Regulatory Applications

**Table PD.21 Construction Jobs by Skill Levels**

Skill Level	Definition/Positions
Professional/ Managerial	Skilled positions are those in a managerial role of staff and/or the organization, e.g., Project superintendent, general foreman, plant foreman, safety training supervisor, human resource supervisor, nurses.
Skilled	Skilled positions are those that require a Certified Journeyman or individuals with a certain level of training and/ or experience, e.g., safety training personnel, Human Resource personnel, iron workers, riggers, pipe fitters, sheet metal workers, millwrights/mechanics, welders, carpenters, boiler makers, instrumentation technicians, electricians, drillers, surveyors, heavy equipment operators, truck operators, plant crew – concrete work, bricklayers, labourers, warehousemen and administration.
Semi-skilled	Semi-skilled positions are those that require some basic literacy and training skills, e.g., artisan helpers, drillers helpers, and camp accommodation staff.
Unskilled	Unskilled positions are those that are entry-level, e.g., labourers, cleaners, and catering staff. Unskilled positions will require a minimum of grade 10 education.

Source: Vaydik, M. 2006. Personal Communications. General Manager, NWT and Nunavut Chamber of Mines, Yellowknife Northwest Territories, March 31, 2006.

**Figure PD.14 High Lake Project Operation Workforce**



Operation workforce estimates by job skill levels are presented in Table PD.22. Not all positions occur throughout the life of the Project. In this table, the number of operational jobs in the second year of construction are shown as the peak number of jobs for that year. Person years are a sum of the number of months when each job occurs divided by 12. Skill level definitions are provided in Table PD.23.

HIGH LAKE PROJECT

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**Table PD.22 Operation Workforce Estimates (Number of Jobs)**

	Skill Level	Estimated Operational Jobs by Location								Sub-Total By Skill Level
		High Lake Accommodation, Housekeeping and Catering	Mill	Open Pit Mines		Underground Mines		Surface Facilities and Sustaining Capital Projects	Grays Bay Dock	
				Office/ Admin	Operation	Office/ Admin	Operation			
Second Year of Construction (Year minus 1) (peak month)	Professional/ Managerial	0	5	10	6	0	0	0	0	21
	Skilled	0	28	8	35	0	0	6	0	77
	Semi-skilled	5	5	2	2	0	0	4	0	18
	Unskilled	6	7	0	2	0	0	4	0	19
	<b>Sub-Total by Location</b>	<b>11</b>	<b>45</b>	<b>20</b>	<b>45</b>	<b>0</b>	<b>0</b>	<b>14</b>	<b>0</b>	<b>-</b>
Total Jobs (Peak Month for Year Minus 1)										<b>135</b>
Person Years (Year Minus 1)										<b>67</b>
Years 1-4	Professional/ Managerial	0	7	11	13	3	4	0	0	38
	Skilled	0	58	12	82	4	16	12	0	184
	Semi-skilled	10	8	3	2	1	1	4	14	43
	Unskilled	12	10	0	4	0	0	8	10	44
	<b>Sub-Total by Location</b>	<b>22</b>	<b>83</b>	<b>26</b>	<b>101</b>	<b>8</b>	<b>21</b>	<b>24</b>	<b>24</b>	<b>-</b>
Total Jobs (Years 1-4 Average)										<b>309</b>
Person Years (Years 1-4 Average)										<b>309</b>
Years 5-14	Professional/ Managerial	0	7	0	0	14	12	0	0	33
	Skilled	0	55	0	0	18	78	11	0	162
	Semi-skilled	10	8	0	0	3	4	15	13	53
	Unskilled	11	9	0	0	0	0	8	10	38
	<b>Sub-Total by Location</b>	<b>21</b>	<b>79</b>	<b>0</b>	<b>0</b>	<b>35</b>	<b>94</b>	<b>34</b>	<b>23</b>	<b>-</b>
Total Jobs (Years 5-14 Average)										<b>286</b>
Person Years (Years 5-14 Average)										<b>279</b>

## Project Description Supporting Regulatory Applications

**Table PD.23 Operational Jobs by Skill Levels**

<b>Skill Level</b>	<b>Definition/Positions</b>
<b>Professional/Managerial</b>	Skilled positions are those in a managerial role of staff and/or the organization, e.g., mine manager, Project manager, superintendents at mill and mines, shift and maintenance supervisors, foremen (general, maintenance, shift and utility foremen), engineers (chief engineer, mining and field engineers), metallurgists, geologists, accountants/payroll administrators, human resource personnel, head of health and safety, head of training/safety/security, and nurses.
<b>Skilled</b>	Skilled positions are those that require a Certified Journeyman or individuals with a certain level of training and/ or experience, including: <ul style="list-style-type: none"> <li>• mining specialists, process plant and equipment operators, such as assayers, metallurgical technicians, drillers, blasters, mining/geology technicians, surveyors, nipper/construction crew, jackleg drillers/cable bolters, loader operators, crushers operators, grinding operators, flotation operators, reagent operators, filter/dryer operators, concentrate load out operators, concentrate/haul truck drivers, heavy equipment operators, and shunt truck operators;</li> <li>• maintenance jobs, such as mechanics/millwrights, welders, electricians and instrumentation technicians, fuel service, lubrication service and dewatering/utility;</li> <li>• general administration, positions in health and safety, security and training, procurement, computer technicians, training/ safety/security officers, logistics coordinators, and purchasing agents, and warehousemen/stocktakers.</li> </ul>
<b>Semi-skilled</b>	Semi-skilled positions are those that require some basic literacy and training skills, e.g., buckers/samplers, blasting helpers, road maintenance, secretaries, clerks and housekeeping.
<b>Unskilled</b>	Unskilled positions are those that are entry-level, e.g., labourers, grinding circuit helpers, seasonal material helpers at dock,, steam cleaner/utility, cleaners, and catering staff. Unskilled positions will require a minimum of grade 10 education.

Source: Vaydik, M. 2006. Personal Communications. General Manager, NWT and Nunavut Chamber of Mines, Yellowknife Northwest Territories, March 31, 2006.

## 7.4 Closure and Reclamation Workforce

Progressive reclamation will occur throughout the life of the Project and some closure work will begin in the last year of the operating phase. Most of the reclamation is planned for Year 15 following mine closure. Final site reclamation is estimated to take three years (Year 15 to Year 17). After Year 17, follow-up monitoring will occur for about five years. The reclamation workforce will be about 32 persons. Monitoring workforce estimates will be developed later in the Project.

## 7.5 Total Workforce Summary

Total Project workforce estimates are presented in Table PD.24 and the anticipated fluctuation over the life of the Project is illustrated in Figure PD.15. The peak workforce will occur when the mine becomes operational and small construction workforce is still in place (Year 2 and Year 3). By Year 5 the workforce will stabilize at around 315 people and begin declining in Year 10. This table shows the average number of jobs for each year.

HIGH LAKE PROJECT

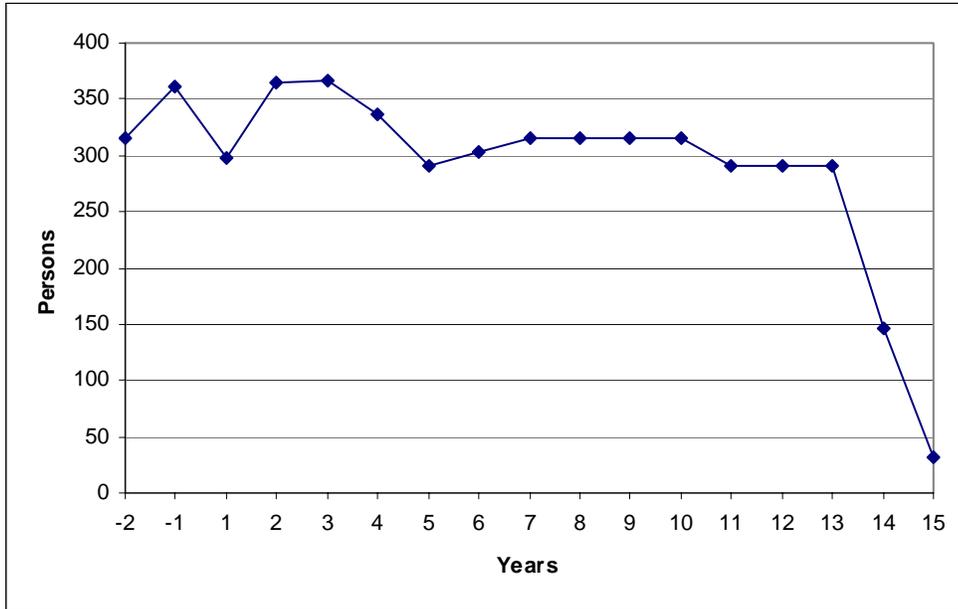
Project Description Supporting Regulatory Applications

**Table PD.24 High Lake Project Workforce Summary**

(Average Number of Persons)

Project Activity Year(a)	Construction Phase		Operation Phase														Closure Phase
	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Construction Workforce	316	328		67	64												
Operation Workforce		33	298	298	303	337	291	303	315	315	315	315	291	291	290	147	
Closure Workforce																	32
Total Workforce	316	361	298	365	367	337	291	303	315	315	315	315	291	291	290	147	32
Person-years of Employment	316	395	298	365	367	337	291	295	299	299	299	299	291	291	290	140	21

**Figure PD.15 High Lake Project Total Workforce**



## 7.6 Workforce Mobilization and Schedule

Access to the site will be by air, with two to three flights each week. Approximately 25 people will be transported to site at a time using a turboprop plane. A jet may be used in future. Flights will connect with regional labour centers and pick-ups for local workers will be provided in Kugluktuk, Cambridge Bay, Gjoa Haven, Taloyoak, and Kugaaruk.

The construction workforce will not rotate. Most construction workers will stay on-site for several months at a time, working until their jobs are finished. Most of the operational workforce will work 12 hour days in a two weeks on and two weeks off rotation. Some management and professional staff may work a three- week in and one week off rotation.

A 12-person camp will be installed at Grays Bay and will be manned during ship loading and unloading. It will serve as living accommodation during these periods. This camp will also serve as shelter for haul truck drivers.

## **7.7 On-site Services and Facilities for Workers**

### **7.7.1 Construction Services and Facilities**

#### **Health**

A nurse or certified first aid responder will be stationed at High Lake and the first aid station will be operational 24 hours a day, seven days a week. Medical emergencies will be evacuated to Yellowknife. In some circumstances, it may be appropriate to evacuate emergencies to Cambridge Bay or medical centers in nearby communities.

#### **Recreational Hunting and Fishing**

Workers will not be allowed to hunt or fish (fish populations cannot support intensive fishing). No personal firearms will be allowed on-site.

#### **Accommodation**

Shared accommodation will be provided as described in Section 2.3.1.

### **7.7.2 Operation Services and Facilities**

#### **Health**

During operation, first aid services and medical emergencies will be handled the same as during construction (Section 7.7.1).

#### **Accommodation and Food Services**

The permanent accommodation will consist of individual rooms and washroom facilities, as described in Section 2.3.1. An overflow camp for temporary workers and contractors, e.g., maintenance contractor will also be provided. Workers will be provided with lockers. Eating and sleeping areas will be non-smoking in compliance with GN's *Environmental Tobacco Smoke Work Site Regulations*. As allowed within these regulations, a well ventilated smoking room will be provided.

Food services will include country foods when available. All food services and catering contracts will be overseen by a nutritionist and all food workers will be trained food handlers.

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**Recreation and Communications**

Recreational facilities in the camp will be available 24 hours a day, seven days a week. Generally, services will include:

- gym and sports facilities;
- lounge with television and DVD facilities;
- access to telephone and email for workers to communicate with family;
- computer facilities; and
- a quiet room for studies, library, reading or religious practices.

Workers will be encouraged to establish a recreation committee to supplement on-site activities. Other types of facilities and services may be provided if there is sufficient workforce interest, e.g., a carving workshop.

**Recreational Hunting and Fishing**

Workers will not be allowed to hunt or fish (fish populations cannot support intensive fishing). No personal firearms will be allowed on-site.

**7.8 Human Resource Management**

This section summarizes Wolfden Resources Inc.'s planned approach to human resource management. Detailed human resource policies, plans and procedures will be developed before the High Lake mine is operational. Wolfden Resources Inc. will stipulate in contract documents that contractors provide similar or equivalent policies and benefits to their employees. A more detailed description will be provided in Volume 8 (Human Resources Management Plan) of the *High Lake Project Proposal*.

**7.8.1 Employment Opportunities and Conditions****Minimum Qualifications**

The minimum qualifications for entry level (unskilled jobs) for construction and operation will be:

- completion of grade 10;
- the ability to pass criminal check; however leniency or pardons for minor crimes will be considered; and
- the ability to pass health exam, including alcohol and drug check.

## Project Description Supporting Regulatory Applications

**Inuit Hiring Preference**

Preference will be given to hiring qualified Inuit workers, with the intention of maximizing Inuit employment. During operation, specific initiatives will be implemented to encourage Inuit hiring and retention and so people have access to meaningful, long term employment.

- Inuit meeting the minimum entry level qualifications will be given hiring preference.
- Employee pick-up points will be Kugluktuk, Cambridge Bay, Gjoa Haven, Taloyoak and Kugaaruk.
- The most effective and appropriate means of notifying Inuit about job opportunities will be used. This is likely to include a high quality website, clear and easy to understand job descriptions, regular community liaison contacts and informing high school students about future mining jobs.
- Retaining and supporting Inuit workers is important. Wolfden Resources Inc. wants to ensure that Inuit employees have the opportunity to grow, develop and progress in their jobs and careers at High Lake. To help with this, a range of training, counselling, family support, mentoring and performance incentives will be provided for Inuit. Further details are provided in Section 7.8.2 and Section 7.8.3.
- Turnover is expected to be high among young Inuit workers for the first year or two of their employment as they adjust to the rotation and mining lifestyle. This will be considered when establishing the final hiring policy. The hiring policy will clearly specify the rehiring terms and conditions, e.g., people will not be rehired for three months, requirement to take appropriate counseling.
- All contractors will be required to follow Wolfden Resources Inc.'s Inuit hiring policies. The requirements for Inuit hiring will be specified in all contracts.

**Salary and Benefits**

The construction workforce will mostly be composed of contract workers hired by contractors. The operation workforce will be a combination of Wolfden Resources Inc. employees and contract workers. Contract workers will be offered salaries and benefits similar to employees. During all phases, the salary and benefits package for workers will be competitive with other northern mines and construction projects.

The standard benefits package for the operational workforce will include:

- health benefits, including medical travel assistance;
- life insurance;
- disability insurance for sickness and injury income protection;
- three week vacation;
- miscellaneous payroll deductions including options for retirement and mortgage deductions; and
- employee incentives for safety, attendance and length of service.

## Project Description Supporting Regulatory Applications

**Workforce Rotation**

Workforce rotation and hours of work has been presented in Section 7.6.

**7.8.2 Human Resource Policies**

Human resource policies will be developed and implemented to guide management of the workforce during construction and operation at the High Lake Project. Examples of the types of policies to be developed are as follows.

- Alcohol and Drug Policy
  - Alcohol and drugs will not be allowed on-site. Random luggage searches will occur upon arrival.
  - Alcohol and drug counselling will be provided for workers and families as required.
  - There will be a behaviour code of conduct developed for workers to be followed while they are in transit to High Lake. They must be sober when picked up for work and no drinking will be allowed on planes. If a plane is delayed in a community, employees will not be allowed to drink or do drugs.
- Inuit Language and Cultural Support
  - To the extent possible and without compromising health and safety, the use of the Inuit language will be supported at the worksite. Signs and training materials will be translated into Inuktitut/Innuinaqtun where possible, e.g., the workplace hazardous materials information system.
  - To the extent possible, entry-level Inuk workers will be assigned an Inuk supervisor who will play a mentoring role. Further information on this initiative is provided in Section 7.8.4.
  - County food will be served when it is available.
  - Cultural awareness training provided for non-Inuit.
- Performance Problems, Harassment and Labour Relations
  - Employee rights will be respected.
  - There will be no tolerance for harassment, fighting or bullying on-site.
  - Employees will be provided information on acceptable performance levels as well as unacceptable performance levels that would require correction or warrant dismissal.
  - The process for addressing unacceptable performance will include Inuit sensitive approaches.
  - A dispute resolution process established.
- Health and Safety
  - To ensure safety at the workplace and to meet federal and territorial safety regulations, on-going health and safety training will be provided for all personnel.
  - A Health and Safety Plan will be developed and implemented that addresses health and safety training, health and safety procedures for workers, reporting and monitoring requirements, health and safety roles and responsibilities, e.g., the establishment of a health and safety committee.

## Project Description Supporting Regulatory Applications

- Employees handling of hazardous materials will be trained in their handling.
- A hygiene and medical surveillance program will be developed as needed for employees working in the assay lab.
- Personal firearms will not be allowed on-site.
- Emergency Response Plans
  - To meet federal and territorial safety requirements, an emergency response plan will be developed and implemented. The plan will include, but not be limited to: training requirements, roles and responsibilities, equipment use and protocols. The plan will undergo an annual review. A preliminary Emergency Response and Contingency Plan will be included in Volume 8 of the *High Lake Project Proposal*.

### 7.8.3 Human Resource Practices

Human resource practices will be implemented to help ensure that the organizational objectives for High Lake are met while the Project contributes positively to the development of people in the Kitikmeot. Examples of the types of practices that will be implemented are as follows.

- Orientation training
  - All new hires will be provided work orientation training. Employees will be given a realistic and accurate description of the job they are to perform, including the positive and negative aspects of camp life, and accepted performance levels.
- Worker Counselling
  - Non-Inuit will be provided counselling on, but not limited to, cultural awareness and alcohol and drug issues. Inuit will be provided counselling on, but not limited to, alcohol and drugs, money management and separation from family.
  - On-going professional counselling services will be provided to employees through a professional service provider. Counselling services available to employees will be provided confidentially and will include alcohol and drugs, money management, family issues, work performance, career development and general health and wellness.
- Home Ownership Information
  - The quality of housing is an issue in all communities and adversely affects the health, wellness and productivity of workers and their families. Lack of well-paying, long term jobs and understanding of how to finance home ownership are barriers to home ownership in the Kitikmeot. To support Inuit employees with homeownership, awareness about mortgages will be promoted and there will be assistance with the paperwork required for financial arrangements involved in owning a home.

## Project Description Supporting Regulatory Applications

- Family Support
  - Counselling support will be available for families throughout the worker's employment. Worker orientation will include family counselling on money management, alcohol and drug abuse, gambling and coping with an absent partner, as well as information to the family members about the type of work their spouses will be doing at High Lake and about camp life in general. Professional counselling providers will be available to worker's families as needed through the life of the Project.
  - Family members will be invited to visit the mine site at least once per year to gain a better understanding of their partner's work-life.
  - Telephone and internet will be provided on-site so workers can communicate with family.
- Performance Incentives
  - The value of workers will be recognized and rewarded through a recognition program. Awards and in some cases bonuses will be offered to workers for completion of first year of work, maintaining a good safety record, low absenteeism, and progression through trade levels.

#### 7.8.4 Training

This section outlines Wolfden Resources Inc.'s general approach to training and education of employees. Supplementary initiatives related to training and education will be found in Volume 3, Section 1 of the *High Lake Project Proposal*.

##### Orientation Training

All workers will receive orientation training. Two types of orientation training will be provided: a short course for non-Inuit workers and longer training for Inuit workers and their families.

Both short and long orientation courses will cover:

- orientation to the job and camp life;
- information benefits, hours of work, rotation schedule, and so forth;
- health and safety training;
- camp and work site rules and policies; and
- cultural awareness and cross-cultural training for Inuit and non-Inuit workers.

In addition, the training for Inuit workers and their families will include the social and family support and counselling as described in Section 7.8.3.

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**Supervisor and Mentor Training**

Supervisory and management development training will be included in the training plan. A number of mature Inuit workers with the desire and skill for supervising and mentoring young Inuit workers will receive intensive training on the mine operations, health and safety as well as development training on supervisor and foreman responsibilities. Consideration will be given to initiating the mentor/supervisor training before the High Lake mine is operational so the mentor/supervisors will be ready to lead young workers upon operation.

**On-the-Job Training and Advancement of Entry-level Workers**

Wolfden Resources Inc. is committed to promoting from within. Promising entry-level Inuit workers will be developed and trained over the life of the Project. The intent is to fill all unskilled positions and as many of the semi-skilled positions as possible with Inuit workers by the end of the Project. Unskilled workers will be developed through equipment or job-specific training. As vacancies in unskilled and semi-skilled positions occur, concerted efforts will be made to fill these positions with Inuit workers.

**Apprentice Training**

Opportunities will be provided for workers to obtain the necessary hours to achieve their trades certificate in the trades that exist on-site, including: heavy equipment operation, electrician, mechanic and mill operators. The number of opportunities will be modest and in keeping with industry standards, e.g., normally a trades person cannot have more than two apprentices at a time.

## 8. Project Costs

Total Project costs are estimated to be \$2.1 billion, including \$0.4 billion in capital costs and \$1.7 billion in operating costs.

### 8.1 Capital Costs

Estimated capital costs for the High Lake Project are provided in Table PD.25. All values are in 2005 Canadian dollars.

HIGH LAKE PROJECT  
Project Description Supporting Regulatory Applications

**Table PD.25 High Lake Project Estimated Capital Costs**

All values are in millions of 2005 Canadian dollars

Year Project Activity	Construction Phase		Operation Phase														Closure Phase	Project
	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Infrastructure	55.7	55.7																111.3
Mining				12.3	13.9	31.6	23.9	17.2	9.5									108.3
Process	22.0	22.0			2.6													46.6
Operation	4.1	4.1																8.3
Closure																	7.0	7.0
Sustaining									7.3									7.3
Total Direct Cost	81.8	81.8		12.3	16.5	31.6	23.9	17.2	16.8	0	0	0	0	0	0	0	7.0	288.8
Indirect Cost <sup>(a)</sup>	23.9	23.9																47.8
Contingency on Preproduction Costs <sup>(b)</sup>	23.5	23.5																46.9
- Direct (20.5%)	16.8	16.8																33.5
- Indirect (28%)	6.7	6.7																13.4
Repayment on Kennecott Royalty <sup>(c)</sup>			1.0															1.0
Total	129.1	129.1	1.0	12.3	16.5	31.6	23.9	17.2	16.8	0	0	0	0	0	0	0	7.0	383.5

Numbers may not add up to totals due to rounding

<sup>(a)</sup> Includes only part of indirect costs. Additional \$2.6 M of indirect costs is included in direct costs.

<sup>(b)</sup> Calculated as percentage of direct and indirect costs

<sup>(c)</sup> Payment for reduction in the Net Smelter Return (NSR)

## Project Description Supporting Regulatory Applications

The total Project capital costs are estimated to be \$383.5 M and consist of \$288.8 M in direct costs, \$47.8 M in indirect costs, \$46.9 M as a contingency allowance on preproduction costs and \$1.0 M repayment on net smelter royalty to Kennecott Canada Inc. Direct capital costs include the following:

- \$111.3 M for infrastructure development;
- \$108.3 M for mining activity;
- \$46.6 M for development of processing facilities;
- \$8.3 M in operation capital;
- \$7.0 M for closure activity; and
- \$7.3 M as sustaining capital.

The contingency allowance is included to provide for potential cost overruns during construction of the mine facilities and was calculated as 20.5% of direct costs and 28% of indirect costs.

## 8.2 Operating Costs

Estimated operating costs for the High Lake Project are provided in Table PD.26. All values are in 2005 Canadian dollars.

The total Project operating costs are estimated to be \$1.7 billion. Annual costs in years of full operation will range from approximately \$103 M to \$137 M, averaging at approximately \$119 M. The bulk of the operating expenditures (about 70% of the total) will occur in smelting and refining, underground mining and ore processing (\$645.7 M, \$268.7 M, and \$248.3 M, respectively). Twenty-five percent of the operating expenditures will be required for concentrate shipping between Grays Bay and a market in Asia, administration, and open pit mining. The remaining 5% will be required for the Grays Bay dock and surface facilities operations, concentrate haulage between the mine and Grays Bay, and barging of supplies to the dock.

HIGH LAKE PROJECT

Project Description Supporting Regulatory Applications

**Table PD.26 High Lake Project Estimated Operating Costs**

All values are in millions of Canadian dollars

Project Activity	Year	Operation Phase														Total
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Open pit Mining		31.4	32.3	26.7	3.6											<b>94.0</b>
Underground Mining				1.5	16.3	27.2	27.8	28.0	28.0	28.0	28.0	28.0	25.0	23.8	7.1	<b>268.7</b>
Ore Processing		14.0	18.1	18.7	18.6	20.0	20.0	20.0	20.0	20.0	20.0	20.0	17.5	16.4	5.0	<b>248.3</b>
Smelting and Refining		27.8	28.1	45.8	46.4	55.1	57.7	58.1	54.0	52.7	55.9	54.9	45.2	49.0	15.5	<b>645.7</b>
General and Administration		9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	2.3	<b>124.9</b>
Surface Facilities Operation		2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	0.5	<b>28.4</b>
Grays Bay Dock Operation		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	0.5	<b>26.8</b>
Concentrate Haul Transport between Mine & Grays Bay		1.3	1.3	1.4	1.3	1.5	1.4	1.3	1.3	1.4	1.4	1.4	1.2	1.2	0.3	<b>17.6</b>
Concentrate Shipping		14.1	14.2	14.9	14.7	16.6	15.2	14.7	14.2	15.3	15.9	15.4	13.1	13.1	3.2	<b>194.7</b>
Barging of Supplies to Dock (via Hay River to Grays Bay)		1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0.4	<b>19.9</b>
<b>Total</b>		<b>103.5</b>	<b>109.1</b>	<b>124.0</b>	<b>116.1</b>	<b>135.5</b>	<b>137.2</b>	<b>137.2</b>	<b>132.6</b>	<b>132.4</b>	<b>136.4</b>	<b>134.2</b>	<b>117.2</b>	<b>118.6</b>	<b>34.9</b>	<b>1669.0</b>

Numbers may not add up to totals due to rounding.

## 9. Contracting and Procurement

### 9.1 General

Wolfden Resources Inc. will undertake mine management, development and underground mining.

The following types of activities and services will be contracted out:

- facility construction;
- some engineering;
- concentrate shipping;
- worker mobilization services; and
- open pit mining.

Services such as camp housekeeping, logistics and explosives may be contracted out.

### 9.2 Inuit Contracting and Business Support

An identification of the type of Inuit businesses in the Kitikmeot that may be able to bid on contracts has been undertaken. The types of businesses include:

- |                    |                          |                                    |
|--------------------|--------------------------|------------------------------------|
| • security         | • site maintenance       | • logistics                        |
| • medical coverage | • waste management       | • expediting/scheduling of flights |
| • counselling      | • administration/payroll | • airstrip operation               |
| • camp services    | • environmental services | • dock operation                   |

Wolfden Resources Inc. is committed to supporting Kitikmeot businesses where they can deliver a timely, competitive and efficient product. The following support will be provided to Kitikmeot businesses to help them prepare for bidding on contracts and maximize Inuit content.

- Information sessions will be held in the Kitikmeot on contracting opportunities and expectations.
- Advance notification of up to one year for routine procurement opportunities will be provided whenever possible. Advance notification will not include procurement that is required on an as-needed basis, e.g., new parts for equipment repair.

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- Where specific procurement will be given to Kitikmeot businesses that have the potential to supply the items, general notification lists will be supplemented with detailed information and specifications.

## 10. Community Outreach

### 10.1 Use of Community Services and Resources

The Project does not require use of community services and resources in the Kitikmeot such as accommodation, wellness centres, landfills, sewage systems or policing. Some medical services may be directed to a Kitikmeot community (Section 7.7.1).

### 10.2 Community Liaison Officer

A Community Liaison Officer will be hired to interact with Kitikmeot communities and residents throughout the life of the Project. The office will be located in one of the Kitikmeot communities.

The Community Liaison Officer will:

- assist in identifying Inuit workers and businesses interested in taking advantage of related employment and business opportunities during all phases of the High Lake Project;
- act as a liaison with the Inuit employees of the Project;
- assist with the fulfillment of contracting and procurement obligations;
- assist with the development and implementation of work place training;
- assist in the development of employment policies;
- develop and/or implement a program for family separation, money management, life skills, alcohol/drug and gambling education/awareness programs to prepare Inuit workers and their families for lifestyle changes associated with shift work rotation;
- develop and/or implement any program for counselling and support programs to promote individual and family well-being; and
- assist with the implementation of additional mitigation measures as may be identified.

### **10.3 Communications and Consultations**

Wolfden Resources Inc. will continue to conduct ongoing communications and consultation with community residents and leadership, prospective Inuit workers, Inuit bodies in the Kitikmeot, the Government of Nunavut, the federal government and other mining developments. This will be accomplished through the following:

- regular community visits and communications from community liaison officer;
- occasional visits by managers and professionals to communities for key events;
- clear, accessible and up-to-date Project website that provides general information as well as specific details about local jobs and contracts; and
- extensive use of internet, email and other modern communications tools used by youth and businesses in the Kitikmeot.

### **10.4 Access to High Lake Project Facilities**

The Project facilities will not be made available to the general public. The dock and access roads to the High Lake mine site will be operated as private facilities for mine construction and operation purposes, except in emergency situations. Warning signs will be posted accordingly and reasonable efforts will be made to advise the local communities of these restrictions.