Boston Land Treatment Area Management and Monitoring Plan

Report Prepared for

Hope Bay Mining Ltd.

Report Prepared by

srk consulting

SRK Consulting (Canada) Inc.
1CH008.068
January 2012

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List of Abbreviations

AANDC – Aboriginal Affairs and Northern Development Canada

BTEX – benzene, toluene, ethylbenzene and xylene

CALA – Canadian Association for Laboratory Accreditation Inc.

CCME - Canadian Council of Ministers of the Environment

CFU – colony forming units

CWS – Canada Wide Standards

EC – electrical conductivity

EPD – Environmental Protection Division of the Nunavut Department of Environment

ESR – Environmental and Social Responsibility

HBML – Hope Bay Mining Ltd.

HDPE –high density polyethylene

KIA – Kitikmeot Inuit Association

LTA – Land Treatment Area

NWB – Nunavut Water Board

PAH – polycyclic aromatic hydrocarbon

PCB – polychlorinated biphenyl

PHC – petroleum hydrocarbon

PID – photoionization detector

QA/QC – Quality Assurance and Quality Control

SAR – sodium adsorption ratio

TPH – total petroleum hydrocarbon

VOC – volatile organic compound

1 Introduction and Scope of Report

The Hope Bay Project is currently an advanced exploration project located on Inuit Owned Land in the West Kitikmeot region of Nunavut approximately 125 km southwest from Cambridge Bay and 75 km northeast from Umingmaktok (Figure 1). The various elements of the Hope Bay Project are centred at approximately N 68° 09’ and W 106° 40’ and extend from the head of Roberts Bay (an extension of Melville Sound) in the north to the Boston site located approximately 70 km to the south.

The Hope Bay Project is owned and operated by:

Project Operator: Hope Bay Mining Ltd.
Suite 300, 889 Harbourside Drive
North Vancouver, BC VCP 3S1

Parent Company: Newmont Mining Corporation
6363 South Fiddler’s Green Circle
Greenwood Village, CO
80111, USA

An integral part of the activities associated with the advanced exploration and infrastructure development program is the development of a Land Treatment Area (LTA) for the storage and management of hydrocarbon contaminated materials, including soil and water, generated at the site and with the associated facilities.

The Hope Bay Project *Boston Land Treatment Area Management and Monitoring Plan* is submitted by Hope Bay Mining Ltd (HBML) in accordance with the requirements specified in Part D Item 21 and Part E Item 7 in Water Licence No. 2BB-BOS0712 issued to HBML by the Nunavut Water Board (NWB).

The Boston LTA is currently at capacity. Disposal of the contaminated soils will be in accordance with the requirements of the Water Licence and Section 3.2 of this management plan. All future use of the Boston LTA will be in accordance with this management plan.

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Boston Land Treatment Area Management and Monitoring Plan

Location Map

Job No: 1CH008.068

Filename: 1CH008.068_boston_lf_mgt_fig_01_location map

Hope Bay Project

Date:	Approved:	Figure:
January 2012	MP/ML	1

2 Background

2.1 Location

The Boston LTA facility is located at the Boston Camp Site, approximately 20 m south west of the tank farm at approximately 67º 23’ 2” North and 106º 39’ 25” West (Figure 2 and Figure 3).

2.2 Construction

The Boston LTA was constructed in the summer of 2003 in response to three separate diesel fuel spills that occurred in 2003. The facility was designed and constructed, under the supervision of EBA Engineering Consultants Ltd., on top of the native esker materials that underlie the Boston Site. The construction stratigraphy of the facility consists of native esker material overlain by crushed waste rock, which is in turn overlain by Bentomax matting followed by a high density polyethylene (HDPE) liner. The physical dimensions of the LTA are approximately 20 m x 30 m, with berms constructed to an average height of 0.75 m. The facility is intended to contain a maximum of 450 m^3 of material within its 600 m^2 area (Figure 4), however, it is currently filled nearly to the top of the berms.

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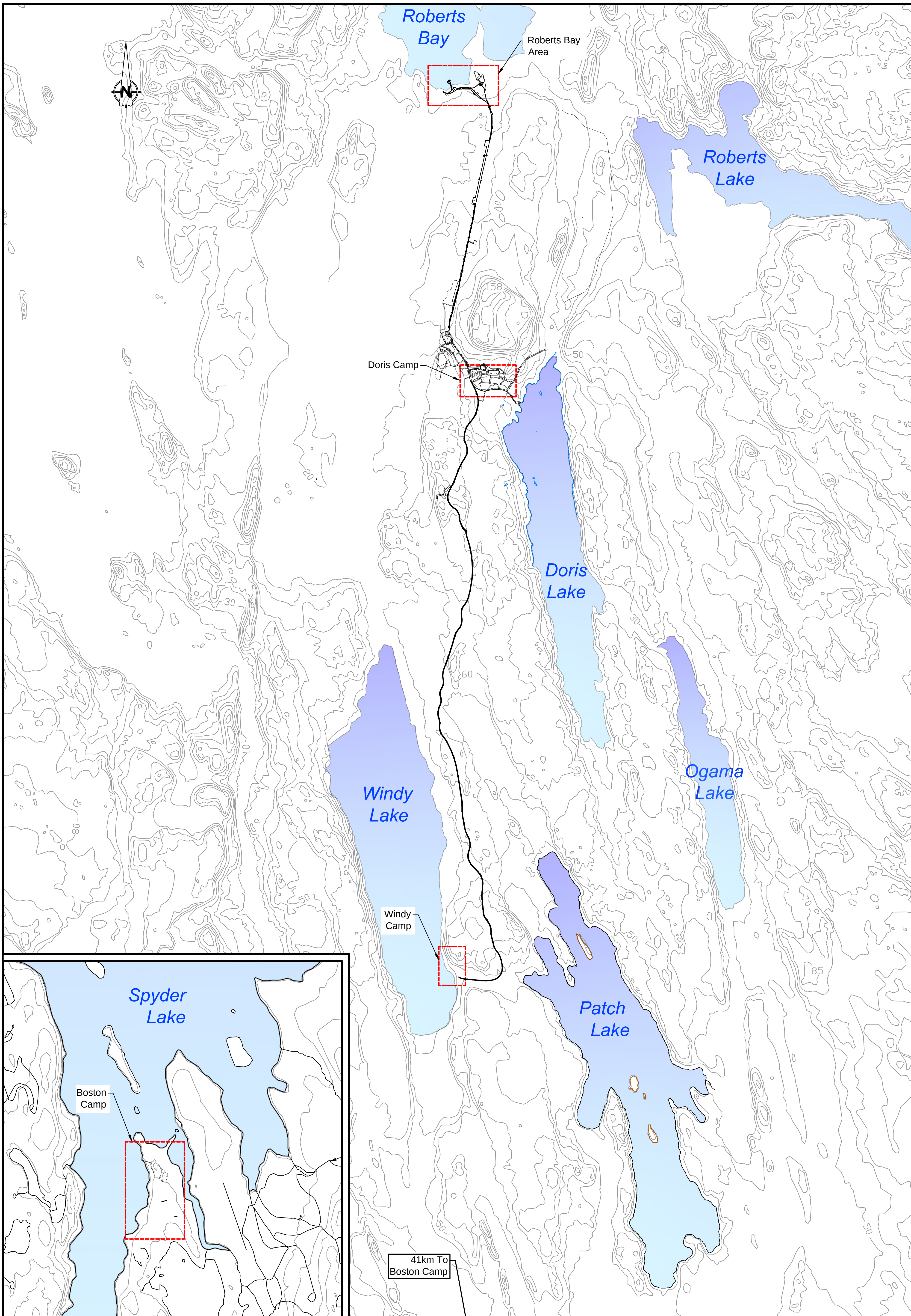

0 50 100 150 200 250
Scale in Metres

Topographic Information Supplied by BHP World Minerals Inc.
National Topographic Series (NTS) Maps
North American Datum (NAD) 1927

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Hope Bay Project

Boston Land Treatment Area Management and Monitoring Plan

Hope Bay Project Overview

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January 2012	MP/ML	2

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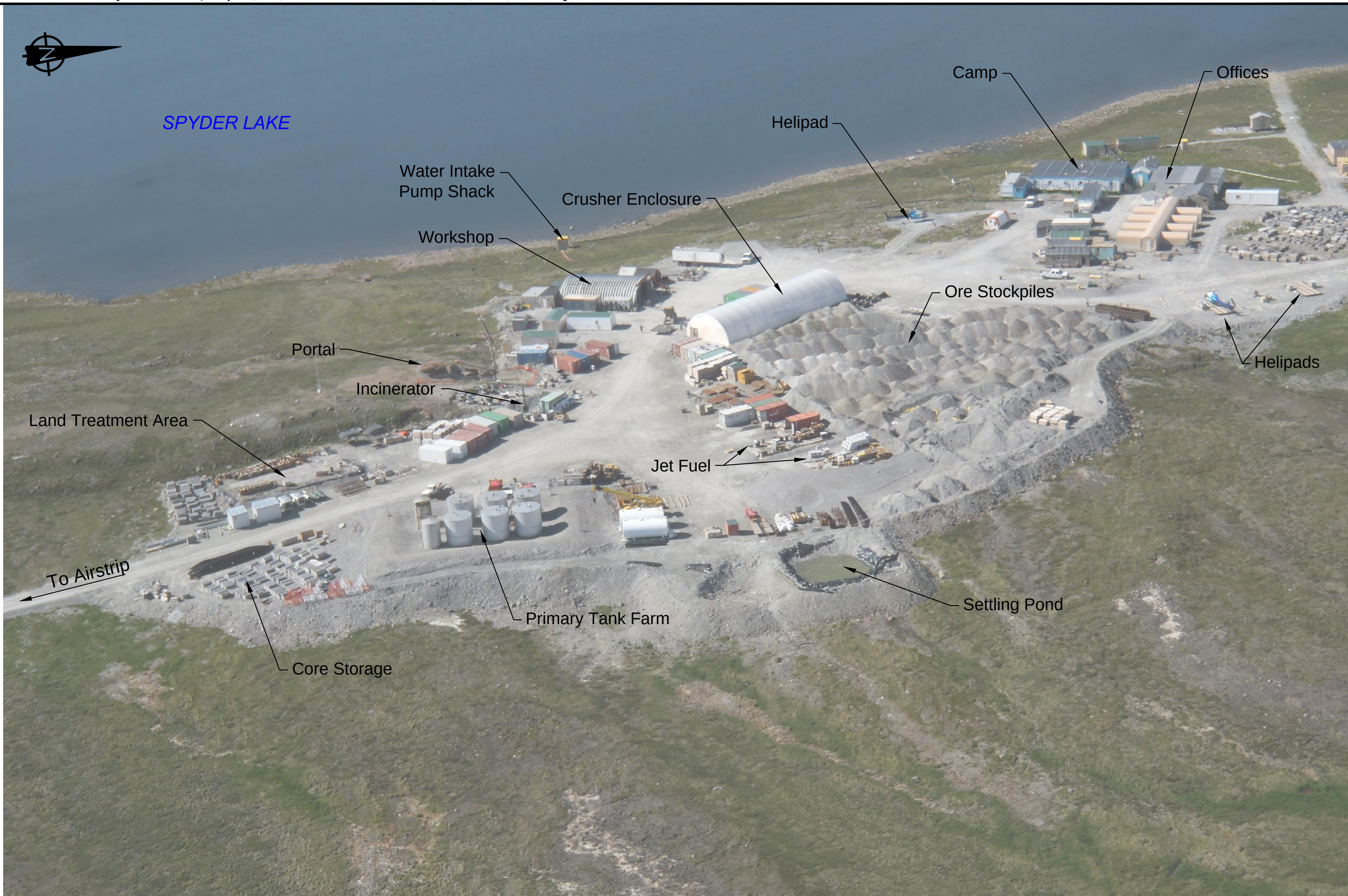

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Boston Land Treatment Area
Management and Monitoring Plan

Boston Location

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Hope Bay Project

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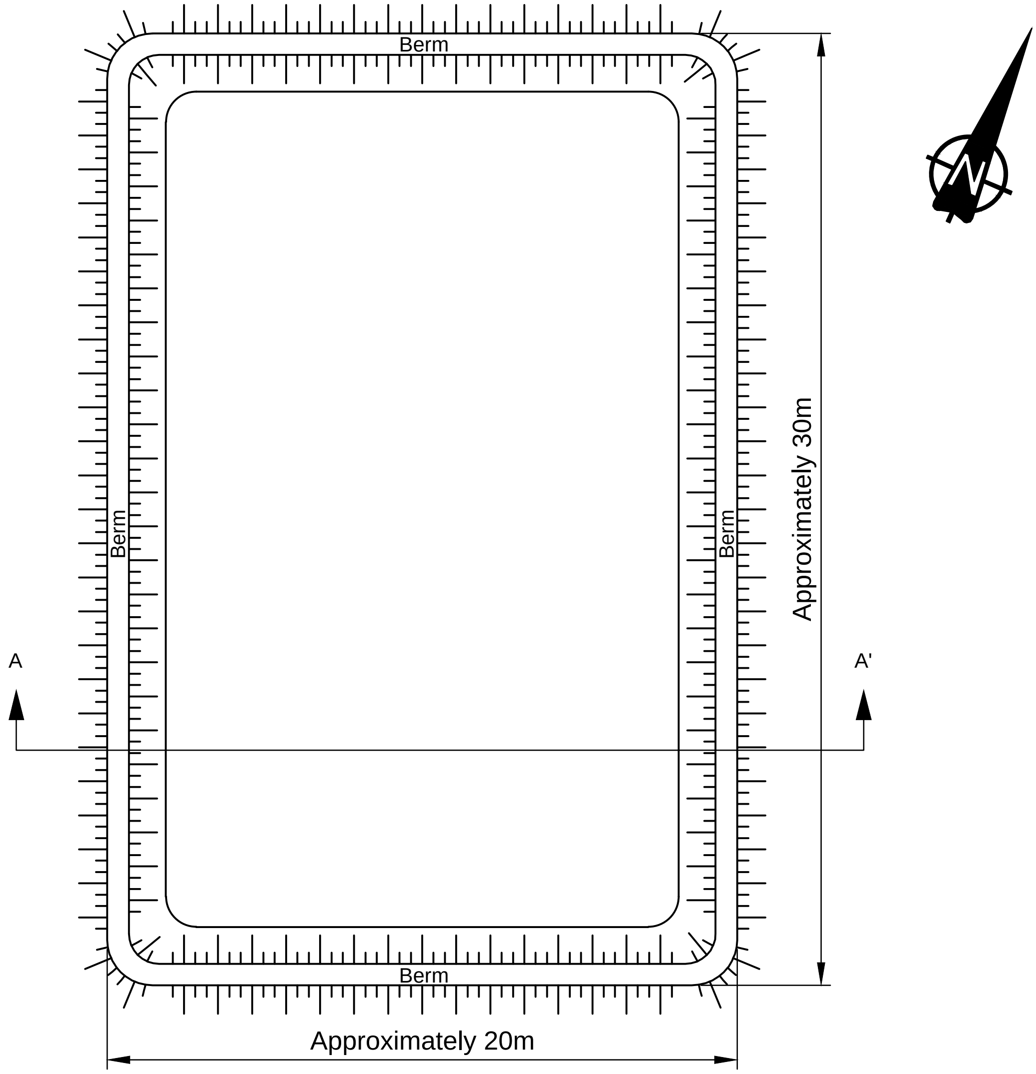
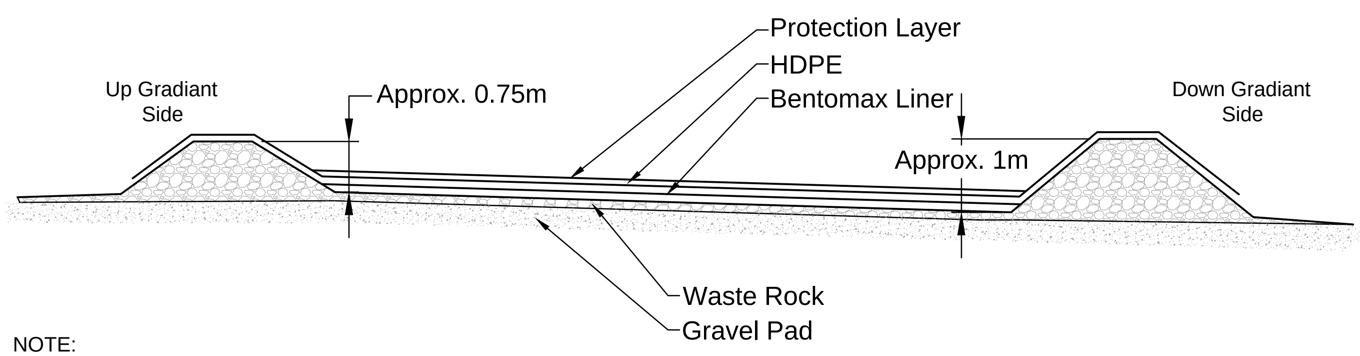


Plan View



NOTE:
Bentomax Liners and HDPE Material shown seperately for clarity

Cross Section A-A'

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3 Land Treatment Area Management

3.1 Roles and Responsibilities

Table 1 shows the roles and responsibilities for the LTA management.

Table 1: Roles and Responsibilities

General Manager of Operations (or designate)	• responsible for the management and operations of the Boston LTA and for providing the necessary resources to manage the facility
Facilities Manager	• implementing the Boston Land Treatment Area Management and Monitoring Plan; • providing onsite resources to operate the facility (turning of the soil, treatment and removal of water and snow, and the removal of treated soils); • ensuring that only suitable hydrocarbon contaminated soil and/or snow is placed in the facility (no heavy metals, glycol or heavy oils that are not able to be remediated); • conducting and documenting regular inspections; • collecting soil moisture samples and submitting them to the ESR Coordinator; • notifying ESR if water accumulation is noted in the facility; • ensuring that water treatment and discharge activities take place as requested by ESR and logs of discharge quantities and locations are provided to ESR; and • providing input on the modifications in the design and the operation of the facility.
ESR Compliance Manager	• Updating the Boston Land Treatment Area Management and Monitoring Plan; • providing the necessary resources for completing the water and soil sampling programs. • Liase with AANDC inspector prior to removal of and placement of remediated soils.
ESR Site Manager	• ensuring water and soil sampling programs are completed as needed; • determining when the soils have been remediated to regulatory standards; • determining when and where the soil should be moved to following remediation; and • ensuring internal records are kept of the quantities of contaminated soils (source, material and contamination type and time) placed within the facility.
ESR Coordinator	• monthly LTA inspections (between May and October); • conducting the water and soil sampling as required; • complete soil moisture analysis; and • keeping records of on-site analysis, observations, photographs, water and soil discharge activities and laboratory analysis

3.2 Soil Management

Only materials containing the following hydrocarbons will be farmed at the Boston LTA:

- Diesel fuel;
- Aviation fuel; and
- Gasoline.

Prior to placement in the LTA, the contaminated soil will be characterized to determine if land farming is the appropriate method of remediation and to determine the concentrations of contaminants. Characterization will be conducted by laboratory analysis, spill records or a combination of both. Information recorded regarding the type and amount of spill contamination may reduce the required sampling effort. The characterization will also help to identify which chemical parameters should be monitored during the remediation process. Land farming is recommended for remediating petroleum hydrocarbon (PHC) contaminated soils, but not for all types of contamination. Table 2 shows the type of analyses recommended for contaminated soil characterization.

Table 2: Recommended Analyses Based on Suspected Soil Contamination

Contaminant Source	**Parameters Analyzed**						
	Canadian Wide Standards (CWS) - Petroleum Hydrocarbon (PHC) fractions	**Benzene, Toluene, Ethylbenzene & Xylene (BTEX)**	**Total Petroleum Hydrocarbon (TPH) (Calculate)**	**Total Metals**	**Polychlorinated Biphenyl (PCB)**	**Phenols**	**Polycyclic Aromatic Hydrocarbons(PAH)**
Unleaded gasoline	X	X	X	X			
Leaded gasoline, aviation gasoline	X	X	X	X			
Fuel oil, diesel, kerosene, jet fuel, mineral oil/spirits, motor oil	X	X	X	X			X
Petroleum solvents	X		X		X		
Crude oils, hydraulic fluids	X		X	X			X
Waste petroleum products	X	X	X	X	X	X	X

Note: Source - Table adopted from SAIC (2005).

Materials deemed to be inappropriate for land farming will be packaged for off-site disposal at a licenced remediation/disposal facility.

3.2.1 Soil Characterization

PHC-impacted soils should have less than 3% total petroleum hydrocarbons (TPH), or written approval from the General Manager and the ESR Site Manager, for acceptance to the LTA. This will avoid accumulation of materials that cannot be remediated by land farming. For effective remediation, the concentrations of contaminants must not exceed the Canadian Council of Ministers of the Environment (CCME) industrial soil remediation criteria for the following parameters:

- F3 and F4 hydrocarbon fractions;
- CCME metal concentrations;
- pH;
- Electrical conductivity (EC); and
- Sodium adsorption ratio (SAR).

Chlorinated hydrocarbons and heavy fraction PHC (lubricating oil and grease and hydraulic oil) are not suitable for land farming because they are difficult to biodegrade without enhancement.

The material in the Boston LTA was placed by Miramar in 2003 after the three diesel spills that occurred at the camp. This material was not characterized to determine if the contamination can be effectively remediated by land farming; therefore, HBML will characterize the material and begin land farming the materials if appropriate. If the materials are deemed not to be treatable by land farming, then the material will be packaged for off-site disposal.

3.2.2 Placement of Contaminated Soil in Land Treatment Area

It is recommended that the contaminated soil be placed in plots or windrows at a depth of 0.35 to 0.40 m for optimal remediation with a maximum depth of 0.50 m. Soil depth is also dependent on the equipment available for tilling and space availability.

Trucks or equipment should not be allowed to drive in the LTA because their weight will pack the soil, making it more difficult to till, and may prolong the time to complete soil remediation. The contaminated soil should be tilled with a backhoe, disk, or rototiller to disperse soil clumps and mix and aerate the soil as it is being deposited.

The soil should not be placed on a layer of snow or ice or if the soil base is saturated because it will encourage glaciation which will slow the melting in the spring and could slow the remediation process during the short warm period. Contaminated soils excavated from site will be placed in the western portion of the facility (which has a higher elevation) in winter for spreading during the following spring/summer. Contaminated materials can also be placed in the western portion during periods when the LTA is saturated in the spring and rainy weather.

Prior to placement of any new materials into the facility, HBML must first characterize and treat the existing material that was placed in the facility by Miramar. New materials that are deemed appropriate for land farming may be stored in drums until the existing materials have been remediated and removed or may be shipped off site for disposal. The material may also be placed in the Doris North Land Farm with advance permission from the NWB.

The Facility Manager will maintain a record of the amount of contaminated soil placed in the LTA and the location of each batch of contaminated soil by contaminant type and date of deposition. Copies of these records must be readily available for internal and external audits and for inspectors.

3.2.3 Moisture Content, Nutrients and pH of the Soils

At the start of the land farming season, soils samples should be analyzed for nutrient, moisture, and pH content to achieve most efficient remediation of PHC. Optimum conditions are as follows:

- moisture content between 40 and 85%;
- a carbon: nitrogen: phosphorus ratio between 100:10:1 to 100:10:5; and
- soil pH between 6 and 8 pH units.

Additional nutrient, moisture, or pH testing should occur during the summer season if soil conditions are suspected to differ from the start of the land farming season, or at the discretion of the ESR Site Manager.

The LTA will be monitored weekly during summer months by the Facilities Manager. Moisture samples will be collected by the Facilities Manager and sent to the ESR Coordinator for analysis to ensure proper operating conditions of soil moisture and aeration (optimal moisture content between 40 to 85% in non-compacted soil), or a soil moisture probe may be used by the Facilities Manager to measure and record the moisture content.

3.2.4 Additional Parameters of the Soils

Soil sampling to verify interim treatment results should also include BTEX and F1 to F4 hydrocarbon fraction analysis. Periodic measurement of the volatile organic compounds (VOC) concentrations with a photoionization detector (PID) is a useful indicator of remediation progress but should not be substituted for remediation verification sampling.

Biodegradation rates can slow down or cease due to excessive salt content, PHC concentrations, and other parameters. If biodegradation is suspected to be stalled, a microbial population density test can be conducted.

3.2.5 Product Addition for Optimal Land Farming

Land farming remediation time can be reduced by maintaining optimal soil conditions for microbial PHC biodegradation and volatilization. If testing indicates that the land farming conditions are not optimal for remediation, the following suggestions for amending soil conditions could be applied:

- Moisture: To increase moisture retention, organic matter can be tilled into the land farm soil. Irrigating with sump water, freshwater, suitable water from other site containment areas, treated sewage effluent, and the application of fresh snow are also acceptable means of increasing soil moisture content. Recycled water from the sump should not contain a PHC sheen, which could be removed by using absorbents, or avoided by drawing water from beneath the water surface.
- pH: The addition of lime will increase soil pH and addition of elemental sulphur will decrease pH.
- Nutrients: Fertilizer can be applied in solid form during tilling or in liquid form during irrigation to increase nitrogen and phosphorous concentrations. The use of slow-release fertilizers can reduce application frequency. Application of fertilizer can lower pH and increase salt concentrations, which can be harmful to micro-organisms.
- Soil texture: Bulking agents such as gypsum or sawdust can be added to clay soils to increase soil surface area for microorganism growth.

3.2.6 Tilling

Most soil microorganisms degrade PHC better in an aerobic environment. Tilling provides aeration of the soil and re-distribution of nutrients and moisture which aids in the bio-remediation and volatilization processes. Tilling should therefore be conducted weekly, if soil conditions are appropriate, in the summer months to aerate the soil and enhance remediation activities.

Weekly tilling should occur when the soil moisture content is within the optimal range of 40% to 85%. Very dry soils should not be tilled until after irrigation to avoid dust generation. Wet soils do not benefit from tilling due to compaction of the soil by passing equipment. If soils appear muddy, or stick to the tires of the equipment, it is too wet to till.

The tilling equipment operator must be careful not to till below the contaminated material and inadvertently damage or disturb the underlying HDPE liner. As per design, the LTA was constructed with a slight gradient from west to east therefore; extra care must be taken when tilling the soils. The depth to the liner should be carefully determined prior to beginning to till. Damage of the underlying liner, surrounding berms, or sump area must be reported to the Facilities Manager and the ESR Site Manager immediately.

3.3 Soil Remediation Sampling and Monitoring

The Environmental Protection Division (EPD) of the Nunavut Department of Environment has published the “Environmental Guideline for Contaminated Site Remediation March 2009”, this document provides an outline of the remediation criteria for PHC and other contaminants present in soils for Nunavut (Table 3, Table 4 and Table 5). These guidelines are from “Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health” (CCME 1999 updated September 2007). HBML will use the “industrial” land use remediation guidelines as set out in Table 3, Table 4, and Table 5 to determine when soil has been remediated to a level acceptable for removal from the LTA.

Contaminated soil in the facility will be sampled at the beginning and end of each summer, at minimum, to determine the concentrations of contaminants within the soils being remediated. The frequency of sampling may increase when soil is nearing the successful remediation levels, as defined by EPD (2009), to verify when soil can be removed from the LTA and used in site reclamation.

Sampling will be conducted by HBML prior to any soil being removed from the land farm to demonstrate that the soil has been successfully remediated. There are no CCME guidelines for density of soil sampling in a land farm, therefore HBML proposes that each separate area within the LTA be divided into cells and sampled with a target density of one composite sample made of ten samples per 25 m^3 to adequately characterize the soil’s hydrocarbon and other parameter concentrations.

Soil samples will be analyzed for the parameters shown in Table 2 including PHC fractions (Fractions F1, F2, F3, and F4), BTEX, TPH, PCB and total metals using an element ICP-MS scan. The soil sampling records and corresponding analytical results will be kept by the ESR Coordinator and reported to the Kitikmeot Inuit Association (KIA) and the NWB if requested and results of LTA soil sampling will be submitted within the annual report.

Soil will only be removed from the LTA after they are approved by the Aboriginal Affairs and Northern Development Canada (AANDC) Inspector. Remediated fine textured soils will be used for general reclamation purposes and initially on areas where the existing vegetative cover has been disturbed; coarse textured materials will be used in construction activities as needed, or possibly in reclamation activities if appropriate.

Table 3: Remediation Criteria for Petroleum Hydrocarbon Fractions

Land Use	Soil Texture	Fraction 1 (C6-C10)	Fraction 2 (>C10-C16)	Fraction 3 (>C16-C34)	Fraction 4 (>C34)
Industrial	Fine-grained soil	320 (170[a])	260 (230[a])	2500	6600
	Course-grained soil	320 (240[a])	260	1700	3300

a = Where applicable, for protection against contaminated groundwater discharge to an adjacent surface water body or for protection of potable groundwater.

b = Assumes contamination near residence.

Table 4: Interim Remediation Criteria

Substance	Industrial (mg/kg soil)
General Parameters	
Conductivity [dS/m]	4
pH	6 to 8
Sodium adsorption ratio	12
Inorganic Parameters	
Antimony	40
Beryllium	8
Boron (hot water soluble)	-
Cobalt	300
Fluoride (total)	2000
Molybdenum	40
Silver	40
Sulphur (elemental)	-
Tin	300
Monocyclic Aromatic Hydrocarbons	
Chlorobenzene	10
1,2-Dichlorobenzene	10
1,3-Dichlorobenzene	10
1,4-Dichlorobenzene	10
Styrene	50
Phenolic Compounds	
Chlorophenols[a] (each)	5
Nonchlorinated[b] (each)	10
Polycyclic Aromatic Hydrocarbons (PAHs)	
Benzo(a)anthracene	10
Benzo(b)fluoranthene	10
Benzo(k)fluoranthene	10
Dibenz(a,h)anthracene	10
Indeno(1,2,3-c,d)pyrene	10
Phenanthrene	50
Pyrene	100
Chlorinated Hydrocarbons	
Chlorinated aliphatics[c] (each)	50
Chlorobenzenes[d] (each)	10
Hexachlorobenzene	10
Hexachlorocyclohexane (Lindane)	-
Miscellaneous Organic Parameters	-
Nonchlorinated aliphatics (each)	-
Phthalic acid esters (each)	-
Quinoline	-
Thiophene	-

Note: Source - EPD March 2009 - Table A4.2. Interm Remediation Criteria (mg/kg soil)
Subscript notes in Appendix A1

Table 5: Canadian Soil Quality Guidelines

Substance[y]	Industrial (mg/kg soil)	
	Course	Fine
Arsenic (inorganic)	12[b]	
Barium	2000[c]	
Benzene		
Surface[w]	0.03[t,u]	0.0068[t,u]
Subsoil[w]	0.03[t,u]	0.0068[t,u]
Surface[x]	0.03[t,u]	0.0068[t,u]
Subsoil[x]	0.03[t,u]	0.0068[t,u]
Benzo(a)pyrene	0.7[f]	
Cadmium	22[b]	
Chromium		
Total chromium	87[b]	
Hexavalent chromium (IV)	1.4[h]	
Copper	91[b]	
Cyanide (free)	8.0[b]	
DDT (total)	12[i,j]	
Diisopropanolamine (DIPA)[z]	180[b]	
Ethylbenzene		
Surface	0.082[t]	0.018[t,u]
Subsoil	0.082[t]	0.018[t,u]
Ethylene glycol	960[k]	
Lead	600[b]	
Mercury (inorganic)	50[b]	
Naphthalene	22[h]	
Nickel	50[l]	
Nonylphenol (and its ethyloxylates)	14[p]	
Pentachlorophenol	7.6[b]	
Phenol	3.8[b]	
Polychlorinated biphenyls (PCB)	33[j,l]	
Polychlorinated di-benzo-p-dioxins/dibenzofurans (PCDD/Fs)	4 ng TEQ/kg[s]	
Propylene glycol	Insuff Info[v]	
Selenium	2.9[b]	
Sulfolane[z]	1[b]	
Tetrachloroethylene	0.6[f]	
Thallium	1[o]	
Toluene		
Surface	0.37[t]	0.08[t]
Subsoil	0.37[t]	0.08[t]
Trichloroethylene	0.01[b,u]	
Uranium[z]	300[t]	
Vanadium	130[i]	
Xylenes		
Surface	11[t]	2.4[t]
Subsoil	11[t]	2.4[t]
Zinc	360[l]	

Note: Source - EPD March 2009 - Table A4.1. Canadian Soil Quality Guidelines (mg/kg soil)
Subscript notes in Appendix A2

3.4 Water Management

3.4.1 Precipitation

The precipitation and temperature profile for the Boston area was taken from the baseline meteorology data compiled for the Doris North Project. The average monthly air temperature is typically above 0°C between June and September with the peak in July and below freezing between October and May with the coldest temperatures usually occurring in February. The mean annual precipitation adjusted for under-catch is approximately 207 mm with 41% occurring as rain between May and October and 59% as snow through the remainder of the year (Miramar 2007).

The Boston LTA has a footprint of approximately 600 m^2 (including the berm footprint) providing a total precipitation collection area of 600 m^2 from which water must be collected and treated. Mean precipitation ranges from 94 mm to 207 mm, with only about 41% falling as rain. Annual lake evaporation (typically occurring between June and September) is about 220 mm. Consequently the mean annual volume of precipitation runoff expected to be collected is as follows:

56 m^3 to 124 m^3 = (600 m^2 (LTA area) x (mean precipitation in mm/1,000))

The majority of this runoff will be lost through wind movement of snow, sublimation and evaporation. For the purposes of estimating the maximum potential volume of water to be treated through the oil adsorption system; these losses have not been considered. Offsetting sublimation and evaporation losses from within the liner of the tank farm and LTA treatment facilities will be contaminated snow brought to the facility for remediation (estimated at approximately 3 m^3 per year) (Miramar 2007).

To prevent wind-dispersal of soils over the winter season, a spray of water on the surface after some snow cover has been established will consolidate the snow and “cap” the soils if required.

Snow should be removed from the facility prior to spring freshet. A minimum of 10 cm of snow cover should remain on the surface to avoid removing surface soil or potentially contaminated contact snow. If the soil surface in the LTA is very even, making it difficult to remove snow carefully, snow should not be removed using equipment. Shovels may be used to carefully remove drifts if necessary

The LTA does not have a sump, therefore, precipitation collects in the lowest areas. This pooled water will be removed to a temporary holding tank or the containment pond, if required, for treatment through the oil adsorption treatment system.

3.4.2 Water Sampling and Monitoring

Prior to the discharge of water from the LTA, a water sample will be collected and analyzed for comparison to the water licence BOS-6 discharge criteria for pH, total suspended solids, total oil and grease, benzene, toluene, ethylbenzene and lead (Table 6). This sample can be collected pre- and/or post-Oil Adsorption Treatment. If discharge criteria are met, AANDC will be notified and discharge will commence 10 days after notification or upon receipt of AANDC approval.

Table 6: Boston Land Treatment Area Effluent Discharge Limits for Monitoring Station BOS6

Parameter	Maximum Average Concentration (mg/L)
Benzene	370
Toluene	2
Ethylbenzene	90
Lead	1
Oil & Grease	15 & no visible sheen

Note: Source - 2BB-BOS0712 Part D Section 21"

During the discharge of effluent from the LTA to the tundra (Station BOS-6) a sample will be collected monthly and analyzed for TPH, PAH, BTEX, pH, EC, nitrate-nitrite, oil and grease, total phenols, total alkalinity, total hardness, calcium, potassium, sulphate, magnesium, sodium, total arsenic, total copper, total iron, total mercury, total cadmium, total chromium, total lead and total nickel.

The water sampling records will be kept by the ESR Department and reported to the NWB in the monthly monitoring reports.

4 Land Treatment Area Facility Inspection and Monitoring

HBML will implement an inspection and monitoring program for the Boston LTA during frost-free seasons. The objective is to ensure that the facility is functioning properly and to measure the parameters of the soil and water to verify that they have been remediated to acceptable levels and can be removed from the LTA.

4.1 Land Treatment Area Facility Inspections and Reporting

Maintenance of the LTA is essential for ensuring its effectiveness. Table 7 shows the items to be inspected.

Table 7: Inspection Components for the Boston Land Treatment Area

Item	Responsibility	Purpose	Frequency	Required Records
LTA Operations Inspection	Facility Manager or delegate	Record keeping of treatment operations and berm performance for due diligence.	Once per day during spring freshet, or after rainfall events. Weekly at other times.	• Inspection checklist and field notes including date, weather, and facility condition including any repairs required, odour noted, quantity of water accumulated and amount of freeboard. • Record of berm performance with emphasis on observations of cracking or any signs of instability. • Check moisture content of soils to see if they are too dry or too wet to till. • Record of any unauthorized discharges or deposits and follow-up action taken. • Photographic record.
Soil Sampling for Soils Acceptance at Facility	ESR or delegate	To determine if soils are acceptable for treatment at facility.	Once per spill, unless spilled material is known	• Soils origin and associated spill report number, if applicable. • Field notes including sampling details, soil texture, moisture content, colour, and odour. • Laboratory-issued reports including QA/QC. • Summary tabulation of results. • Documentation of fate of rejected soils. • Record of any treatability tests done. • Location of soil placement in LTA if accepted from Facility Manager.
Soil Sampling for Remediation Progress and Verification of Remediation	ESR or delegate	To provide interim indications of remediation progress and to determine if remedial objectives have been met.	Once at the beginning and end of season. Additional sampling as remediation nears completion if desired.	• Field notes and sketch of location and depth of samples taken. • Photographic record. • Laboratory-issued reports including QA/QC and chain of custody. • Summary tabulation of results. • Analysis of percent removal of hydrocarbon constituent treated and treatment time; evaluation should include weather information, soil texture, and soil moisture. • Documentation of fate of treated soils. • Annual quantities in cubic metres of all soil and types of contaminants.
Water Sampling During Remediation	ESR or delegate	Due diligence and to conform to Water Licence Requirements.	Monthly	• Field notes and observations made at time of sampling. • Laboratory-issued reports including QA/QC and summary tabulation of results.
Water Sampling prior to Discharge	ESR or delegate	To conform to Water Licence Requirements.	As required prior to discharge	• Document notification of AANDC Inspector (written notification at least 10 days prior to discharge). • Record depth of water in LTA. • Calculate approximate water volume to be discharged. • Laboratory-issued reports including QA/QC and summary tabulation of results.
Geotechnical Inspection	SRK Geotechnical Engineer	To identify any maintenance requirements.	Annually	• Inspection of geotechnical performance of facility. • Document recommendations of any repair/maintenance work. • Record of any repair work made to the facility.

4.2 Reporting

As required by Part J, Section 23 of the Water Licence 2BB-BOS0712, a Monthly Program summary report shall be submitted to the NWB for review within thirty (30) days following the month being reported and shall include sample analysis from Station BOS-6.

As required by Part B, Section 7 of the Water Licence 2BB-BOS0712, an Annual Report must be filed by March 31 of the following year that includes:

vi. The annual quantities in cubic meters of all contaminants and soil types from all locations that are placed within the land farm facility;

vii. Tabular summaries of all data generated under the Monitoring Program; and

x. Updates or revisions to the Abandonment and Restoration Plan, QA/QC, Waste Rock and Ore Storage Plan, Spill Plan Contingency Plan, Landfill Plan, and Land Farm Plan.

4.3 QA/QC Procedures for Water and Soil Sampling

Quality assurance and quality control (QA/QC) is a set of operating principles that, if strictly followed during sample collection and analysis, will produce data of known and legally defensible quality. A high level of quality assurance can be achieved by applying the following principles:

- Personnel involved in sampling and analysis are trained and competent;
- Sampling and testing equipment are calibrated regularly and are kept in good working condition;
- Standard procedures are implemented for the collection and transportation of samples, based on acceptable and approved operating practices;
- Use of Canadian Association for Laboratory Accreditation Inc. (CALA) certified external laboratories to conduct chemical analyses;
- QC programs are developed and implemented, based on recognized best operating practice, to assess the quality of the analytical data and provide warning of unacceptable analytical or samplers errors;
- Prompt remedial action is taken when deficiencies are identified; and
- Analytical results and QC program results are reported internally and externally using standard procedures. Including field blanks, travel blanks, duplicates, etc.

Sampling procedures include:

- Using clean sampling gloves for each composite sample;
- Cleaning sampling equipment between each composite sample;
- Collecting samples using bottles and jars provided by the laboratory following the instructions provided by the laboratory for each parameter type;
- Labelling sample containers clearly with the sample station, date, time, and analysis requested;
- Keeping samples cool and dark during storage and shipment to the laboratory; and
- Checking field notes for accuracy and completeness at the end of each sampling session.

Detailed QA/QC procedures are available in the Hope Bay Mining Limited Quality Assurance and Quality Control Plan.

5 Land Treatment Area Closure

The Boston LTA will be decommissioned at mine closure, upon closure of the existing Boston Camp, or upon construction of a new LTA. The liner system will be removed and the berms graded to promote positive drainage across the site. Remediated soils remaining in the LTA can either be graded with the facility or removed for other site applications.

Details of LTA and Boston facilities closure is available in the Boston Closure and Reclamation Plan (under revision by SRK).

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Principal

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

6 References

CCME 2011 - Canadian Council of Ministers of the Environment http://www.ccme.ca/publications/ceqg_rcqe.html

HBML 2011 – *Hope Bay Mining Ltd Quality Assurance and Quality Control Plan Revision 6*

CCME 2008 – *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil Technical Supplement* – Canadian Council of Ministers of the Environment , January 2008

GN DOE 2009 – Department of Environment Government of Nunavut - *Environmental Guideline for Contaminated Site Remediation,* March 2009

Miramar 2007 – *Landfarm Operations & Maintenance Manual for Boston Camp Landfarm Treatment Area & Windy Lake Camp Landfarm Treatment Area* - October 2007

SAIC 2005 – *Federal Guidelines for Landfarming Petroleum Hydrocarbon Contaminated Soils* – December 2005

SRK 2010 – *Doris North Land Farm Management and Monitoring Plan* – 1CH008.038.003 – May 2010

2BB-BOS0712 – *Boston Type B Water Licence*

Document Control Record

DOCUMENT CONTROL REVISION HISTORY					
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Position	Name	Signature	Date
VP Environmental Affairs	Chris Hanks		
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Appendices

Appendix A1: Subscript Notes for Table 4

Notes (Table 4):

All values are in mg/kg soil unless otherwise indicated.

Interim remediation criteria were published in 1991 in "Interim Canadian Environmental Quality Criteria for Contaminated Sites (CCME, 1991).

These interim remediation criteria are considered generally protective of human and environmental health and were based on experience and professional judgement.

These interim criteria (CCME, 1991) should only be used when soil quality guidelines based on the CCME soil protocol (CCME, 1996; 2006) have not yet been developed for a given chemical. Also, because the interim remediation criteria were not developed using the soil protocol and its integral checks, they cannot be modified through the site specific remediation objective procedure.

a = Chlorophenols include

Chlorophenol isomers (ortho, meta, para)

Dichlorophenols (2,6- 2,5- 2,4- 3,5- 2,3- 3,4-)

Trichlorophenols (2,4,6- 2,3,6- 2,4,5- 2,3,4- 3,4,5-)

Tetrachlorophenols (2,3,5,6- 2,3,4,5- 2,3,4,6-)

b = Nonchlorinated phenolic compounds include

2,4-dimethylphenol

2,4-dinitrophenol

2-methyl 4,6-dinitrophenol

Nitrophenol (2-,4-)

Phenol

Cresol

c = Aliphatic chlorinated hydrocarbons include

Chloroform

Dichloroethane (1,1- 1,2-), Dichloroethene (1,1- 1,2-)

Dichloromethane

1,2-dichloropropane, 1,2-dichloropropene (cis and trans)

1,1,2,2-tetrachloroethane, tetrachloroethene

Carbon tetrachloride

Trichloroethane (1,1,1- 1,1,2-), trichloroethene

d = Chlorobenzenes include

All trichlorobenzene isomers

All tetrachlorobenzene isomers

Pentachlorobenzene

Note: Source – "Government of Nunavut" and "Environmental Guideline for Contaminated Site Remediation"

Appendix A2: Subscript Notes for Table 5

Notes (Table 5):

Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health are published in “Canadian Environmental Quality Guidelines (CCME, 1999, updated 2007).

SQG_E = Soil Quality Guideline for Environmental Health

SQG_{HH} = Soil Quality Guideline for Human Health [*]

For guidelines derived prior to 2004, differentiation between soil texture (coarse/fine) is not applicable.

[a] Guidelines released in 1997 were originally published in a working document entitled “Recommended Canadian Soil Quality Guidelines” (CCME 1997) and have been revised, edited and reprinted here. Guidelines revised/released in 1999 are published here for the first time.

[b] Data are sufficient and adequate to calculate an SQG_{HH} and an SQG_E. Therefore the soil quality guideline is the lower of the two and represents a fully integrated *de novo* guideline for this land use, derived in accordance with the soil protocol (CCME 1996; 2006).

[c] Data are insufficient/inadequate to calculate an SQG_{HH}**,** a provisional SQG_{HH}**,** an SQG_E or a provisional SQG_E. Therefore, the interim soil quality criterion (CCME 1991) is retained as the soil quality guideline for this land use.

[d] Data are sufficient and adequate to calculate only a provisional SQG_E. It is greater than the corresponding interim soil quality criterion (CCME 1991). Therefore, in consideration of receptors and/or pathways not examined, the interim soil quality criterion is retained as the soil quality guideline for this land use.

[e] Data are sufficient and adequate to calculate an SQG_{HH} and a provisional SQG_E. Both are greater than the corresponding interim soil quality criterion (CCME 1991). Therefore, in consideration of receptors and/or pathways not examined, the interim soil quality criterion is retained as the soil quality guideline for this land use.

[f] Data are sufficient and adequate to calculate an SQG_{HH} and a provisional SQG_E. Both are less than the corresponding interim soil quality criterion (CCME 1991). Therefore, the interim soil quality guideline supersedes the soil quality criterion for this land use.

[g] The soil-plant-human pathway was not considered in the guideline derivation. If produce gardens are present or planned, a site-specific objective must be derived to take into account the bioaccumulation potential (e.g. adopt the agricultural/wildland guideline as objective). The off-site migration check should be recalculated accordingly.

[h] Data are sufficient and adequate to calculate only a provisional SQG_E, which is less than the existing interim soil quality criterion (CCME 1991). Therefore, the provisional soil quality guideline supersedes the interim soil quality criterion for this land use.

[i] Data are sufficient and adequate to calculate only an SQG_E. An interim soil quality criterion (CCME 1991) was not established for this land use therefore, the SQG_E becomes the soil quality guideline.

[j] In site-specific situations where the size and/or the location of commercial and industrial land uses may impact primary, secondary or tertiary consumers, the soil and food ingestion guideline is recommended as the SQG_E.

[k] Data are sufficient and adequate to calculate only a provisional SQG_E.

[l] Data are sufficient and adequate to calculate only an SQG_E, which is less than the interim soil quality criterion (CCME 1991) for this land use. Therefore the SQG_E becomes the soil quality guideline for this land use.

[m] Data are sufficient and adequate to calculate only an SQG_E, which is greater than the interim soil quality criterion (CCME 1991) for this land use. Therefore the interim soil quality criterion (CCME 1991) is retained as the soil quality guideline for this land use.

[n] Data are sufficient and adequate to calculate a provisional SQG_{HH} and an SQG_{E}. The provisional SQG_{HH} is equal to the SQG_{E} and to the existing interim soil quality criterion (CCME 1991) and thus becomes the soil quality guideline for this land use.

[o] Data are sufficient and adequate to calculate a provisional SQG_{HH} and an SQG_{E}. The provisional SQG_{HH} is less than SQG_{E} and thus becomes the soil quality guideline for this land use.

[p] Data are sufficient and adequate to calculate only an SQG_{E}. An interim soil quality criterion (CCME 1991) was not established for these substances therefore, the SQG_{E} becomes the soil quality guideline.

[q] Data are sufficient and adequate to calculate only a provisional SQG_{HH} which is less than the existing interim soil quality criterion (CCME 1991). Thus the provisional SQG_{HH} becomes the soil quality guideline for this land use.

[r] Data are sufficient and adequate to calculate only a provisional SQG_{HH}. An interim soil quality criterion (CCME 1991) was not established for this land use therefore, the provisional SQG_{HH} becomes the soil quality guideline.

[s] Data are sufficient and adequate to calculate only an SQG_{HH}. An interim soil quality criterion (CCME 1991) was not established for this land use therefore, the SQG_{HH} becomes the soil quality guideline.

[t] Data are sufficient and adequate to calculate an SQG_{HH} and an SQG_{E}. Therefore the soil quality guideline is the lower of the two and represents a fully integrated *de* novo guideline for this land use.

[u] This guideline may be less than the common limit of detection.

[v] Data are sufficient and adequate to calculate only a provisional SQG_{FWAL} (Soil Quality Guideline for Freshwater Aquatic Life). This value is 6,210 mg/kg.

[w] 10^{-5} incremental risk.

[x] 10^{-6} incremental risk.

[y] Unless otherwise indicated supporting documents are available from the National Guidelines and Standards Office, Environment Canada.

[z] Supporting documents are available from the Canadian Council of Ministers of the Environment.

Note: Source – “Government of Nunavut” and “Environmental Guideline for Contaminated Site Remediation”