LANDFARM MANAGEMENT AND MONITORING PLAN

HOPE BAY, NUNAVUT

January 2017

PLAIN LANGUAGE SUMMARY

This Plan describes how hydrocarbon contaminated materials, including water, snow or soils originating from operations or closure at the Hope Bay Project is to be managed. These materials will be temporarily stored in the Boston Land Treatment Area in accordance with Module B of this Plan until they can be relocated to the Doris mine where they will be remediated in the Doris Landfarm in accordance with Module A of this Plan, or placed in the Doris underground mine for permanent storage in accordance with the *Hope Bay Project Groundwater Management Plan*.

REVISION HISTORY

Revision #	Date	Section	Summary of Changes	Author	Approver
1	2010		Approved Plan under 2AM-DOH1323.	SRK	HBML
2	2014	Throughout	Changes to document structure for operational suitability and efficiency. TMAC as current licensee for the Hope Bay region.	SRK	TMAC
3	2017	Throughout	Changes to document structure for operational suitability and efficiency.	SRK	TMAC

GLOSSARY AND ACRONYMS

TERM	DEFINITION
BTEX	benzene, toluene, ethylbenzene and xylene
CALA	Canadian Association for Laboratory Accreditation Inc.
CCME	Canadian Council of Ministers of the Environment
CWS	Canada Wide Standards
EC	electrical conductivity
EPD	Environmental Protection Division of the Nunavut Department of Environment
ESR	Environmental and Social Responsibility
HDPE	high density polyethylene
INAC	Indigenous and Northern Affairs Canada
LTA	Land Treatment Area
NWB	Nunavut Water Board
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PHC	petroleum hydrocarbon
QA/QC	Quality Assurance and Quality Control
SAR	sodium adsorption ratio
TMAC	TMAC Resources Inc.
TPH	total petroleum hydrocarbon

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Landfarm Management and Monitoring Plan Module B: Boston

1. INTRODUCTION

This Hope Bay Landfarm Management and Monitoring Plan (the Plan) has been prepared by TMAC Resources Inc. (TMAC) in accordance with various water licences held by TMAC associated with developments throughout the Hope Bay region.

The Plan is intended primarily for use by TMAC and its contractors to ensure that best practices for minimizing potential environmental impacts and potential environmental liabilities with respect to hydrocarbon contaminated water, snow and soils (including waste rock and ore) are followed, and that the conditions of the water licences are met.

This Plan is structured in a manner such that one document pertaining to storage and management of hydrocarbon contaminated materials is approved and implemented across all TMAC Hope Bay Project sites, while still addressing site- and licence-specific needs: the main document outlines TMAC's approach to storage and management of hydrocarbon contaminated materials as it pertains to all TMAC Hope Bay developments; subsequent modules provide details for each site and the associated water licence. In the event of a new water licence, or an existing licence amendment, only the specific modules pertaining to that licence and site will need to be revised. This is intended for consistency and efficiency across operations and for compliance management.

1.1. OBJECTIVES

Hydrocarbon contaminated water, snow and soils (including waste rock and ore) can be treated on site, or can be relocated off site to an appropriate treatment facility. Treatment of hydrocarbon contaminated water and snow can readily be done at each site; however, treatment of hydrocarbon contaminated soils (including waste rock and ore) will be relocated to the Doris mine where it will be treated in the Doris Landfarm or placed in the Doris underground mine for permanent storage. The objectives of this Plan is therefore to outline how these contaminated materials will be managed within the Hope Bay Project site.

1.2. RELEVANT LEGISLATION AND GUIDANCE

Worker health and safety and operational components of the Plan are part of TMAC's mine plan and come under the jurisdiction of the Nunavut Mines Inspector. Environmental elements of the Plan come under the jurisdiction of the Nunavut Water Board (NWB), the Nunavut Impact Review Board (NIRB) and other regulatory agencies.

Implementation of the Plan should be considered alongside the following relevant legislation:

- Workers Safety and Compensation Commission (WSCC) Chief Mines Inspector as per Mine Health and Safety Act, and its associated Regulations (Government of Nunavut, 1995).

1.3. Related Documents

Table 1: List of Documents Related to the Hope Bay Landfarm Management and Monitoring Plan

Document Title	Year	Relevance
Hope Bay Project Groundwater Management Plan	2016	This Plan describes the approved procedures for disposing of hydrocarbon contaminated materials within the Doris North mine
Landfarm Management and Monitoring Plan Module A: Doris	2017	Management Plan for the Doris site
Landfarm Management and Monitoring Plan Module B: Boston	2017	Management Plan for the Boston site

1.4. Plan Management

Revisions to the Plan can be triggered by activities such as changes in the mine plan, operational performance, personnel or organizational structure, mine ownership, regulatory or social considerations, and life cycle or design philosophy. The Plan is reviewed annually and is revised or updated as necessary in accordance with changing circumstances.

Overall responsibility for the Plan implementation and updates lies with the General Manager of Operations. The functional site-based lead for assigning and applying appropriate resources to execute the Plan rests with the Facilities Manager. The ESR Site Manager is responsible for day-to-day execution of activities associated with the Plan.

1.5. Roles and Responsibilities

Table 2 shows the roles and responsibilities for the Landfarm Management Plan.

Table 2: Roles and Responsibilities

General Manager of Operations (or designate)	• Responsible for the management and operations of the facilities and for providing the necessary resources to manage the facilities.
Site Superintendent	• Implementing the Plan; • Providing onsite resources to operate the facilities; • Conducting and documenting regular inspections; • Notifying ESR if water accumulation is noted in the facilities; • 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 facilities.
Environmental Manager	• Updating the Plan; • Providing the necessary resources for completing the water sampling programs; and • Liaise with Indigenous and Northern Affairs Canada (INAC inspector prior to removal of and placement of contaminated soils.
Environmental Coordinator	• Ensuring water sampling programs are completed as needed; • Ensuring internal records are kept of the quantities of contaminated soils (source, material and contamination type and time) placed within the facilities; • Monthly LTA inspections (between May and October); and • Keeping records of on-site analysis, observations, photographs, water and soil discharge activities and laboratory analysis.

2. CONTAMINATED MATERIAL MANAGEMENT

Hydrocarbon contaminated materials will either be temporarily stored at the Boston LTA, treated at the Doris Landfarm, placed in the Doris underground mine for permanent storage or packaged for off-site disposal at a licenced remediation/disposal facility.

Only material containing the following hydrocarbons will be farmed at the Doris Landfarm Facility:

- Diesel fuel;
- Aviation gasoline (Avgas);
- Jet fuels (Jet A, Jet A-1, and Jet B); and
- Gasoline.

All other materials will be deemed inappropriate for landfarming and will ultimately be placed in the Doris mine for permanent storage in accordance with the *Hope Bay Project Groundwater Management Plan* or packaged for off-site disposal at a licenced remediation/disposal facility.

If the type of contamination is unclear it will be characterized prior to placement in the LTA or Doris Landfarm facility, to determine if landfarming is the appropriate method of remediation and to determine the concentrations of contaminants present. Characterization will be conducted by laboratory analysis, spill records or a combination of the two. Information recorded regarding the type and volume of the spill may reduce the required characterization sampling. Characterization may help to identify which chemical parameters should be monitored during the remediation process. Landfarming is recommended for remediating petroleum hydrocarbon (PHC) contaminated materials, but not for all types of contamination.

Table 3 shows the type of analyses recommended for contaminated material characterization with the Federal Guidelines for Landfarming Petroleum Hydrocarbon Contaminated Soils (SAIC 2006).

Table 3: 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)	Lead	Total Heavy Metals[ii]	Chromium/Cadmium	Polychlorinated Biphenyl (PCB)	Phenols	Polycyclic Aromatic Hydrocarbons (PAH)
Unleaded gasoline	X	X	X		X				
Leaded gasoline, aviation gasoline	X	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		

Contaminant Source	Parameters Analyzed								
	Canadian Wide Standards (CWS) - Petroleum Hydrocarbon (PHC) Fractions	Benzene, Toluene, Ethylbenzene & Xylene (BTEX)	Total Petroleum Hydrocarbon (TPH) (Calculate)	Lead	Total Heavy Metals[ii]	Chromium/Cadmium	Polychlorinated Biphenyl (PCB)	Phenols	Polycyclic Aromatic Hydrocarbons (PAH)
Crude oils, hydraulic fluids	X		X	X	X				X
Waste petroleum products	X	X	X	X	X	X	X	X	X

Note: Source - Table adopted from SAIC (2006)

i Modified from Environment Canada, 1993

ii Heavy metals analyses required to determine if constituents are not present at levels toxic to micro-organisms (>2500 ppm) (USEPA. 1994)

Placement of Contaminated Material in Facilities

Placement of the contaminated material in the management facilities is to be conducted as per the relevant site module.

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

Contaminated Material Handling within Facilities

Management and handling of the contaminated material in the management facilities is to be conducted as per the relevant site module.

Recovery of Contaminated Material from Facilities

Recovery of contaminated material must be undertaken with adequate care and supervision such that the facility liner is not damaged.

Immediately following recovery of contaminated material from a facility, the liner should be inspected for damage. Any damage should be repaired prior to additional placement of contaminated materials and prior to the spring freshet.

3. WATER MANAGEMENT

Water management within each of the facilities is to be conducted as per the relevant site module and water license.

Water management is focussed on surface water accumulation within the facilities. The facilities have no external catchment and there is no potential for groundwater contamination due to the liner and underlying permafrost at the site.

4. MONITORING AND EVALUATION

TMAC will implement an inspection and monitoring program for each of the facilities. The objective is to ensure that each facility is functioning properly. The monitoring and evaluation programs for each facility are presented in the relevant site module and water license.

4.1. QA/QC PROCEDURES FOR WATER 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 Quality Assurance and Quality Control Plan (TMAC 2017).

4.2. Documentation and Reporting

Documentation and reporting shall be prepared and submitted as per each sites relevant module to this plan and water license.

5. Contingencies

Should additional new contaminated material require storage at any site, that exceeds the capacity of the site facility, a temporary lined facility may be required to store the excess material or the material will be required to be permanently stored underground within the Doris Mine is accordance with the *Hope Bay Project Groundwater Management Plan*.

6. Facilities Closure

The facilities will be decommissioned at mine closure, upon closure of the existing site Camp, or upon construction of a new facility as a replacement. The liner system will be removed and the berms graded to promote positive drainage across the site. Remaining contaminated soils will be stored underground within the Doris Mine is accordance with the *Hope Bay Project Groundwater Management Plan*.

Details of each sites facilities closure is available in the relevant Closure and Reclamation Plan.

7. REFERENCES

Environment Canada. 1993. "Appendix 3: Guidelines on the Ex-Situ Bioremediation of Petroleum Hydrocarbon Contaminated Soils on Federal Crown Land" in the *Study on the Use of Landfarming and Surface Impoundments in the Management of Hazardous and Non-Hazardous Waste*. Conservation and Protection. June 23, 1993.

Government of Nunavut. 1995. Consolidation of Mine Health and Safety Act (Nunavut). S.N.W.T. 1994, c.25; In force December 15, 1995; SI-014-95. As Amended by Northwest Territories Statues: S.N.W.T. 1996, c.9; In force April 16, 1996. As Amended by Statues Enacted Under Section 76.05 of Nunavut Act: S.N.W.T. 1998, c.34; In Force April 1, 1999.

SAIC. 2006. Federal Guidelines for Landfarming Petroleum Hydrocarbon Contaminated Soils. Science Applications International Corporation. March. Project No. 11953.B.S08.

SRK Consulting (Canada) Inc. 2016. Hope Bay Project Groundwater Management Plan. Report Prepared for TMAC Resources Inc. August 2016.

TMAC Resources Inc. 2017. Quality Assurance and Quality Control Plan, Hope Bay, Nunavut. January 2017.

USEPA. 1994. "Chapter V" in *How to Evaluate Alternative Cleanup Technologies for Underground Storage Tank Sites: A Guide for Corrective Action Plan Reviewers*. (EPA 510-B-94-003; EPA 510-B-95-007; and EPA 510-R-04-002). October 1994.

LANDFARM MANAGEMENT AND MONITORING PLAN
MODULE A: DORIS

HOPE BAY, NUNAVUT

January 2017

PLAIN LANGUAGE SUMMARY

This Plan describes how hydrocarbon contaminated materials, including water, snow or soils originating from operations at Doris or transported from Boston Site will be managed at the Doris Site. These materials will be temporarily stored and remediated in the Doris Landfarm (a dedicated lined facility) or placed in the Doris underground mine for permanent storage in accordance with the *Hope Bay Project Groundwater Management Plan*.

REVISION HISTORY

Revision #	Date	Section	Summary of Changes	Author	Approver
1	2010		Approved Plan under 2AM-DOH1323.	SRK	HBML
2	2014	Throughout	Changes to document structure for operational suitability and efficiency. TMAC as current licensee for the Hope Bay region.	SRK	TMAC
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GLOSSARY AND ACRONYMS

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CALA	Canadian Association for Laboratory Accreditation Inc.
CCME	Canadian Council of Ministers of the Environment
CWS	Canada Wide Standards
EC	electrical conductivity
EPD	Environmental Protection Division of the Nunavut Department of Environment
ESR	Environmental and Social Responsibility
HDPE	high density polyethylene
INAC	Indigenous and Northern Affairs Canada
LTA	Land Treatment Area
NWB	Nunavut Water Board
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PHC	petroleum hydrocarbon
QA/QC	Quality Assurance and Quality Control
SAR	sodium adsorption ratio
TMAC	TMAC Resources Inc.
TPH	total petroleum hydrocarbon

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1. INTRODUCTION

This Landfarm Management and Monitoring Plan Module A: Doris (the Plan) has been prepared by TMAC Resources Inc. (TMAC) in accordance with various water licences held by TMAC associated with developments throughout the Hope Bay region.

The Plan is intended primarily for use by TMAC and its contractors to ensure that best practices for minimizing potential environmental impacts and potential environmental liabilities with respect to hydrocarbon contaminated water, snow and soils (including waste rock and ore) are followed, and that the conditions of water licences are met. The Plan has been prepared as part of the renewal of Water License 2AM-DOH1323 and is to be implemented under the renewed license.

The Doris Landfarm Facility (previously Doris North Landfarm Facility) (the Facility) is located on a previously disturbed area approximately 0.6 km north of the existing Doris Camp Area, at approximately 432,573 Easting and 7,559,542 Northing (UTM NAD 83, Zone 13). The Facility is located in a restricted area of the site and is situated between the existing all weather road and Quarry 2 (Drawing LF-01). Access to the Facility is gained via an 8.0 m wide access road originating immediately southwest of the Crusher Pad, as shown in Drawing LF-01. Drawings are included in Attachment 1.

1.1. FACILITY CONSTRUCTION AND DESCRIPTION

Construction of the Facility began in July 2011 with the physical dimensions being approximately 61 m by 97 m. Drawing LF-02 provides the layout of the facility, Drawing LF-03 provides details on the foundation pad and Drawings LF-04 to LF-08 provide additional details including cross sections at various points within the facility. As shown in these drawings, the entire Facility was constructed on an existing overburden fill pad which had a thickness of approximately 1 m. This pad was overlain by a woven geotextile followed by a foundation base and containment berms for each separate pond (Drawing LF-03). The base was constructed by placing a 0.3 m layer of 6" quarry material followed by a 0.1 m thick layer of ¾" crushed material. The berms were constructed with similar material in a similar sequence as shown in Drawings LF-04, LF-05, LF-07 and LF-08.

In order to facilitate drainage and the collection of water, the base of each of the three separate ponds was sloped at approximately 1% grade to a sump area located in the northwest corner of each pond. Each of the berms (interior and exterior) have a 3 m wide crest and side slopes of 2H:1V, with the exceptions of the north and south exterior berms which have side slopes of 1.5H:1V. All berms were constructed to provide a minimum storage of 1 m from the base of each pond to the berm crests.

Each pond floor and interior slope of all berms were lined with a continuous layer of 60 mil textured HDPE liner. This liner was extended over the crest to the edge of the outside slope of all external berms of each pond. The HDPE liner was then overlain by a 12 oz. non-woven geotextile layer which was in turn overlain by an "overliner" layer consisting of a 0.6 m layer of ¾" crushed rock to act as an armouring layer and prevent damage to the HDPE liner (Drawings LF-05 and LF-07).

A 5.1 m wide access ramp was constructed in the southwest corner of each separate pond to facilitate the entry and exit of equipment to place hydrocarbon contaminated soils and snow without causing damage to the HDPE liner or to the integrity of the containment berms. The final configuration of the water and snow ponds has a base of 18.0 m X 25.0 m with a 1.0 m berm providing secure storage for approximately 190 m^3 of water (or, in the case of the snow pond, approximately 570 m^3 of snow assuming a 30% snow/water equivalent). The soil pond has a base of 30.0 m X 25.0 m and a 1.0 m high berm providing secure storage of approximately 325 m^3 of material, although mounding of the

contaminated material in the centre of the Facility would increase the total secured storage capacity of the pond, if required.

All landfarm construction activities were supervised by qualified SRK personnel, who were responsible for ensuring appropriate QA/QC of construction materials and activities. As required by Section 26, Part D of Water Licence 2AM-DOH0713, the *Doris North Project 2012 Construction Summary* dated October 2012 (SRK 2012) was submitted to the NWB. The summary included the design of the Doris Landfarm Facility and the as-built engineering drawings. These as-built drawings have been re-issued as part of this Plan (Attachment A).

1.2. OBJECTIVES

Hydrocarbon contaminated water, snow and soils (including waste rock and ore) can be treated or permanently stored underground on site. Treatment of hydrocarbon contaminated water and snow can readily be done on site; however, treatment of hydrocarbon contaminated soils (including waste rock and ore) cannot readily be done in an arctic setting. The objectives of this Plan is therefore to outline how these contaminated materials will be managed at the Doris site given these constraints.

1.3. RELATED DOCUMENTS

Table 1 lists the documents related to the Landfarm Management and Monitoring Plan Module A: Doris

Table 1: Documents Related to the Landfarm Management and Monitoring Plan Module A: Doris

Document Title	Year	Relevance
Landfarm Management and Monitoring Plan	2017	Overarching Management Plan document.
Landfarm Management and Monitoring Plan Module B: Boston	2017	Management Plan for the Boston site. Material from Boston may be transported to Doris for management.
Hope Bay Project Groundwater Management Plan	2016	This plan describes the approved procedures for disposing of hydrocarbon contaminated materials within the Doris Mine

1.4. ROLES AND RESPONSIBILITIES

The roles and responsibilities for the Doris Landfarm management are outlined in the Landfarm Management and Monitoring Plan.

2. LANDFARM FACILITY MANAGEMENT

2.1. SOIL MANAGEMENT

Only soils containing the following hydrocarbons will be farmed at the Doris Landfarm Facility:

- Diesel fuel;
- Aviation gasoline (Avgas);
- Jet fuels (Jet A, Jet A-1, and Jet B); and
- Gasoline.

All other materials will be deemed inappropriate for landfarming and will be placed in the Doris underground mine for permanent storage in accordance with the *Hope Bay Project Groundwater Management Plan* or packaged for off-site disposal at a licenced remediation/disposal facility.

If the type of contamination is unclear it will be characterized prior to placement in the landfarm facility, to determine if landfarming is the appropriate method of remediation and to determine the concentrations of contaminants present. Characterization will be conducted by laboratory analysis, spill records or a combination of the two. Information recorded regarding the type and volume of the spill may reduce the required characterization sampling. Characterization may help to identify which chemical parameters should be monitored during the remediation process. Landfarming is recommended for remediating petroleum hydrocarbon (PHC) contaminated soils, but not for all types of contamination.

The Landfarm Management and Monitoring Plan presents the type of analyses recommended for contaminated soil characterization.

Placement of Contaminated Soil in Doris Landfarm

For optimal remediation of the contaminated soil, soil plots or windrows should be at a depth of 0.35 to 0.40 m with a maximum depth of 0.50 m. Soil depth will also be dependent on the equipment available for tilling and availability of space in the pond.

Trucks or equipment should not be allowed to drive in the landfarm ponds, except for placing the material because their weight will pack the soil, making it more difficult to till, which may prolong the time to complete soil remediation. The contaminated soil should be tilled using equipment that will disperse soil clumps, mix, and aerate the deposited soil but not compact it (e.g. a backhoe, skid steer, disk, rototiller, etc.).

The soil should not be placed on a layer of snow or ice. If the soil base is saturated it will encourage glaciation which will slow melting in the spring and ultimately slow the remediation process during the short warm period. Contaminated soils excavated from site should be placed in the eastern portion of the Facility (which has a higher elevation) in winter for spreading during the following spring and summer. Contaminated materials may also be placed in the eastern portion during periods when the landfarm is saturated in the spring and during rainy weather. Alternatively, contaminated material may be stored in containment (such as drums) until it can be processed in the landfarm.

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

Tilling

A substantial amount of soil hydrocarbon remediation is achieved simply through the exposure to air and subsequent volatilization of the hydrocarbons. Additionally, 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 to aerate the soil and enhance remediation activities.

Tilling should occur when the soil moisture content is moderate (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 sticks 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 landfarm was constructed with a slight gradient from east to west 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 Surface Manager and the Environmental Manager immediately.

Moisture Content, Nutrients and pH of the Soils

To ensure the effectiveness of the Facility at the start of the landfarming season, soil samples may be analyzed for nutrients, moisture, and pH content to achieve the 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 landfarming season, or at the discretion of the Environmental Manager.

The Landfarm Facility will be monitored weekly during summer months by the Surface Manager to ensure that water build-up is not occurring.

Product Addition for Optimal Landfarming

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

- Moisture: To increase moisture retention, organic matter may be tilled into the landfarm 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 may 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.

It is noted that soil amendments may reduce the potential post-treatment uses of the soil. Any soil product addition will be considered in approving post-treatment use

Additional Analyses of the Soils During Remediation

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 or landfarm remediation rates can slow down or cease all together due to excessive salt content, PHC concentrations, and other parameters present in the soils. If the rates of remediation decline or cease all together, the following parameters can be tested to help identify the source of the problem:

- Microbial population density test;
- TPH or total extractable hydrocarbons (THE);
- Total heavy metal concentration;
- Electrical conductivity (EC); and
- Sodium adsorption ratio (SAR).

Soils with parameter concentration of contaminants that exceed the following recommended levels shown in Table 2 are not suitable for landfarming. Soils that are no longer suitable for landfarming will will be placed in the Doris underground mine for permanent storage in accordance with the *Hope Bay Project Groundwater Management Plan* or packaged for off-site disposal at a licenced remediation/disposal facility.

Table 2: Recommended Concentrations to Avoid Unsuitable Landfarming Conditions

Parameter	Concentration
TPH or THE	<3%
Total heavy metals	<2500 ppm
EC	< 4 dS/m
SAR	<6

Source: SAIC 2006

Recovery of Soil from Landfarm Facility

Recovery of soil must be undertaken with adequate care and supervision such that the liner is not damaged.

Immediately following recovery of soil from the Landfarm, the liner should be inspected for damage. Any damage should be repaired prior to additional placement of contaminated materials and prior to the spring freshet.

2.2. 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" (EPD 2009). This document provides an outline of the remediation criteria for PHC and other contaminants present in soils for Nunavut (Table 3). These guidelines are from Interim Canadian Environmental Quality Criteria for Contaminated Sites" (CCME 1991) and "Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health" (CCME 1999 updated September 2007). TMAC will use the "industrial" land use remediation guidelines, as set out in Table 3 to determine when soil has been remediated to a level acceptable for removal from the landfarm facility. All remediated soils will be used in an industrial land use setting or placed in the Doris underground mine for permanent storage in accordance with the *Hope Bay Project Groundwater Management Plan*.

Contaminated soil in the Facility will be sampled annually and prior to removal, at minimum, to determine the concentrations of contaminants within the soils being remediated. Soil will only be removed from the Facility when the remediation levels defined by the EPD (2009) are met, or if it is determined that the material cannot be successfully remediated and will subsequently be shipped off-site for appropriate disposal.

Sampling will be conducted by TMAC prior to any soil being removed from the landfarm to demonstrate that the soil has been successfully remediated. There are no CCME guidelines for density of soil sampling in a landfarm, therefore TMAC proposes that each separate area within the landfarm soil pond be divided into cells and sampled with a target density of 1 sample per 5 m^3 to adequately characterize the soil's hydrocarbon and other parameter concentrations.

Soil samples will be collected from a depth ranging between 0 and 20 cm, with an additional sample being collected if the soil depth is greater than 20 cm. The location and depth of all soil samples collected will be recorded. The soil samples will be analyzed for the parameters shown in Table 3, including PHC fractions (Fractions F1, F2, F3, and F4), benzene, toluene, ethylbenzene, xylene (BTEX), total petroleum hydrocarbons (TPH), polychlorinated biphenyl (PCB), phenols, lead, and total metals using a 36 element ICP-MS scan. The soil sampling records and corresponding analytical results will be kept by the Environmental Manager and reported to the KIA and the NWB if requested.

Soil will only be removed from the Landfarm Facility and used on site following the consultation and approval by the KIA, Government of Nunavut, Department of Environment and an 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

Substance[y]	Industrial (mg/kg soil)	
	Course	Fine
Conductivity [dS.m]	4	
pH	6 to 8	
Sodium Adsorption Ration (SAR)	12	
Antimony	40	
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]	
Beryllium	8	
Cadmium	22[b]	
Chromium		
Total chromium	87[b]	
Hexavalent chromium (IV)	1.4[h]	
Cobalt	300	
Copper	91[b]	
Cynaide (free)	8.0[b]	
DDT (total)	12[ij]	
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]	
Fluoride (total)	2000	
Lead	600[b]	
Mercury (inorganic)	50[b]	
Molybdenum	40	
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-	4 ng TEQ/kg[s]	

Substance[v]	Industrial (mg/kg soil)	
	Course	Fine
Propylene glycol	Insufficient Information[v]	
Selenium	2.9[b]	
Silver	40	
Sulfolane[z]	1[b]	
Tetrachloroethylene	0.6[f]	
Thallium	1[o]	
Tin	300	
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	
Monocyclic Aromatic Hydrocarbons		
Chlorobenzene	10	
1,2-Dichorobenzene	10	
1,3-Dichorobenzene	10	
1,4-Dichorobenzene	10	
Styrene	50	
Phenolic Compounds		
Chlorophenols[1] (each)	5	
Nonchlorinated[2] (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 Hydrocarbon		
Chlorinated aliphatics[3] (each)	50	
Chlorobenzenes[4] (each)	10	
Hexachlorobenzene	10	

Substance[v]	Industrial (mg/kg soil)	
	Course	Fine
Fractions		
Fraction 1 (C6 - C10)	320 (240[5])	320 (170[5])
Fraction 2 (>C10 - C16)	260	260 (230[5])
Fraction 3 (>C16 - C34)	1700	2500
Fraction 4 (>C34)	3300	6600

Source: EPD 2009, Table 1, A4.2 and A4.2
Note: Subscript notes in Attachment 2

2.3. WATER MANAGEMENT

Landfarm Facility Water Management

The overall water management strategy for the Landfarm Facility is to keep the snow pond empty to the extent possible during the open water season (summer months) in order to provide a contingency for the storage of potentially contaminated water resulting from precipitation coming in contact with hydrocarbon contaminated material in either the snow or soil ponds.

Following spring melt and all significant precipitation events, hydrocarbon impacted water in the Landfarm Dacility will be treated for discharge.

In instances where water having accumulated in the Facility is suspected to be only mildly contaminated, a pre-treatment sample may be collected, and if discharge criteria are met, this water may be discharged directly to the environment following the necessary approvals/requirements for discharge to the environment outlined below.

Snow Pond

Water from the soil pond will be passed through the oil separation (absorbent) treatment system and deposited into the snow pond. This will be accomplished by installing a pump in the soil pond sump to transfer water to the oil separation system. The oil separation (absorbent) treatment system will be located on the berm between the soil and snow pond in such a manner to ensure that any leakage that may occur will report to the soil pond. Only once the treated water meets discharge criteria, as verified through laboratory analysis, will it be discharged to the environment in accordance with the necessary approvals/requirements for discharge to the environment outlined below.

If necessary, water in the snow pond will be recirculated from the snow pond through the oil separation (absorbent) treatment system and back to the snow pond. Only once the water quality in the snow pond meets discharge criteria, verified through laboratory analysis, will it be discharged to the environment in accordance with the necessary approvals/requirements for discharge to the environment outlined below. If this method of treatment is used no additional snow or water will be added to the snow pond to avoid adding additional contaminants to the pond.

Clean Water Pond

Once water from the soil pond and/or snow pond has been treated (passed through the oil separation (absorbent) treatment system) and verified through laboratory analysis to meet discharge criteria it may be discharged to the environment as outlined below or transferred to the clean water pond for storage prior to discharge to the environment. This will be accomplished by placing a portable pump into the sump of the pond to be emptied with the attached hose/piping laid across the berm so that the water will discharge back to the source pond in the unlikely event of a leaky line. Only water that is suitable for discharge to the tundra will be placed into the clean water pond.

Discharge of Treated Water

Once a sufficient volume of water has accumulated in either the clean water pond or snow pond, a sample of water from the pond(s) will be collected, appropriately preserved and submitted to an accredited laboratory for analysis. No water will be discharged from the Facility until the results of the analysis are received and confirm that the water is suitable for discharge in accordance with subsection 24(c), Part G of Water Licence No: 2AM-DOH1323 issued to TMAC by the NWB and summarized in Table 4 and 10-day notification has been provided to the INAC Inspector.

Table 4: Landfarm Effluent Discharge Quality Limits for Monitoring Station ST-4

Parameter	Maximum Average Concentration (mg/L)	Maximum Concentration in any Grab Sample (mg/L)
pH	6.0 - 9.0	9.0
Total Suspended Solids (TSS)	15.0	30.0
Total Oil & Grease	5 and no visible sheen	10 and no visible sheen
Total Ammonia-N	2.0	4.0
Total Lead	0.01	0.02
Benzene	0.37	-
Toluene	0.002	-
Ethyl Benzene	0.090	-

Once the INAC inspector has been provided with a 10-day notification and confirmation of the water quality is received, the water will be discharged to the tundra in accordance with subsection 24(d), Part G of Water Licence No: 2AM-DOH1323. This will be accomplished by installing a portable pump in the clean water or snow pond sump and laying a hose across the Quarry 2 access road and onto the tundra (Drawing LF-01). If the water from the Facility does not meet discharge criteria following treatment, the water from the pond will be transferred to the Tailings Impoundment Area for disposal.

Care will be taken not to disturb any settled solids at the bottom of the source pond sump (if present) and pumping of the sump will only take place when conditions are suitable. The previously approved discharge location was selected in part to ensure that discharged water does not enter fish bearing waters. In addition, the pump discharge should be positioned in a manner that minimizes erosion and siltation of the area downstream of the discharge location. Documentation of flow rates for water release, as well as erosion and vegetation changes at the release sites will be monitored.

Alternatively, once confirmation is received that the water within the Facility is suitable for release, the vacuum truck may be used to remove the water from the pond for use in dust suppression on site access roads. This action would have a benefit in that it will reduce the amount of clean water removed from lakes for dust suppression activities.

Pump Power Supply

The power supply to operate all temporary pumps used within the Facility will be provided by portable gas powered units. Each of the units are self-contained and will have “drip trays”.

3. MONITORING AND EVALUATION

3.1. SPRING FRESHET AND POST-PRECIPITATION EVENT INSPECTION

During spring freshet, a visual inspection of the Landfarm Facility will be conducted once per day to verify water levels in each of the three ponds. The objective of the inspection will be to ensure that sufficient freeboard exists within the Facility to ensure that no hydrocarbon contaminated water exits the Facility and to decide on the most efficient time to commission the oil adsorption (separation) treatment activity.

Similarly, during the open water season (summer), a visual inspection of the Facility will be completed after each significant precipitation event in order to ensure that sufficient freeboard exists within the Facility ensuring that no hydrocarbon contaminated water exits the facility.

Monitoring should note the use of ponds by any water dependent birds as per the Wildlife Mitigation and Monitoring Plan (ERM 2016).

3.2. CLEAN WATER POND DISCHARGE

Pre-Discharge Water Sampling and Quality Verification

No water will be discharged to the environment from the Landfarm Facility until the results of the sample analysis confirm that the water is suitable for release and the INAC Inspector has been notified. The results of this analysis will be retained on-site and will be available for review upon request.

Visual Inspections during Discharge

Prior to commencing any discharge, the volume of water to be discharged will be calculated. The results will be recorded and the record maintained on site.

Once confirmation is received that the water within the Facility is suitable for release it will be pumped to the tundra southwest of Quarry 2. Daily during pumping, a visual inspection of the Landfarm Facility and pumping activities will be conducted by staff from either the surface or the environmental department. These inspections are to ensure that all pumps and hosing/piping are operating properly and that the discharged water is not causing unacceptable erosion downstream. Additionally, flow, volume and duration of the discharge will be measured or calculated and recorded, all records will be maintained on site.

Water Quality Sampling during Discharge

Once a day during the visual inspections of discharge to the tundra a water sample will be collected from monitoring station ST-4 by the Environmental Manager or delegate and analyzed for the parameters listed in Table 4 (Section 3.6.1) as stated in Schedule J of Water Licence No: 2AM-DOH1323. The results of all analyses will be retained on-site and will be available for review upon request.

3.3. ANNUAL GEOTECHNICAL INSPECTION

As per subsection 18(i) Part J of the Water Licence, a geotechnical inspection of the landfarm will be conducted by a qualified Geotechnical Engineer between July and September each year. The inspection will be conducted in accordance with the Canadian Dam Safety Guidelines where applicable and take into account all earthworks making up the facility, as well as the Facility itself.

3.4. SUMMARY OF INSPECTIONS AND MONITORING

Table 5 and Table 6 provide summaries of the monitoring, inspection and sampling that will be undertaken during the operation of the Doris Landfarm Facility.

Table 5: Doris Landfarm Facility Inspection and Monitoring Summary

Item	Responsibility	Purpose	Frequency	Required Records
Landfarm Treatment Operations Inspection	Surface Manager or delegate	Record keeping of treatment operations and berm performance for due diligence.	Once per day during spring freshet, or after precipitation events. Monthly at other times.	• Inspection date and field notes, e.g. weather, and facility condition including any repairs required, odor noted, quantity of water accumulated in the ponds, water level of the ponds, and amount of freeboard. • Record of any unauthorized discharges or deposits and follow-up action taken.
Soils Acceptance at Facility	Environmental Manager or delegate	To determine if soils are acceptable for treatment at the Landfarm Facility.	Once per spill, unless spilled material is known.	• Soils origin and associated spill report number, if applicable. • Field notes, e.g. sampling details, soil texture, moisture content, colour, odour. • Location of soil placement in landfarm following placement approval.
Soil Sampling for Remediation Progress and Verification of Remediation	Environmental Manager or delegate	To provide interim indications of remediation progress and to determine if remedial objectives have been met.	Once per year. Additional sampling prior to discharge.	• Field notes and sketch of location and depth of samples taken. • Laboratory issued reports including QA/QC and chain of custody. • Documentation proving compliance with discharge criteria, notification of discharge of soils to inspector, and fate of treated soils. • Update of landfarm soil placement map as required.
Operation of Oil Adsorption (separation) Treatment System	Surface Manager or delegate (operator)	To identify any maintenance requirements and minimize chances of unexpected discharges to the environment.	Once at the beginning of operation and once per day during operation.	• Daily volume pumped and any field observations (e.g. location of discharge, flow, piping) to be provided to Environmental Manager.
Water Sampling prior to Discharge	Environmental Manager or delegate	To conform to Water License requirements.	As required prior to discharge.	• Document notification of INAC Inspector (written notification at least 10 days prior to discharge) including estimate of volume to be pumped. • Field notes including sampling details e.g. colour, and odour. • Laboratory-issued reports including QA/QC and chain of custody.
Water Sampling and Visual Monitoring During Discharge	Environmental Manager or delegate	To conform to Water License requirements.	Daily during discharge.	• Field notes including sampling details e.g., color, and odor. • Laboratory issued reports including QA/QC and chain of custody. • Field notes for discharge to tundra from monitoring station ST-4 including flow, volume, and duration.
Geotechnical Inspection	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.

Table 6: Doris North Landfarm Facility Sampling Summary

Item	Responsibility	Purpose	Frequency	Parameter/Sampling Required	Remediation Values
Soil Acceptance at Facility	Environmental Manager or delegate	To determine if soils are acceptable for treatment at the Landfarm Facility.	Once per spill, unless spilled material is known.	Soil: • Quantity • PHC Fractions • BTEX • TPH • Lead • Total heavy metals • PBC • Phenols • PAHs	N/A
During Remediation	Environmental Manager or delegate	Effective remediation of PHC and to determine source of slow down or cease of landfarm remediation rates.	As deemed helpful during remediation.	Soil (remediation of PHC): • Moisture content • carbon:nitrogen:phosphorus ratio • pH • BTEX • Fractions (F1 to F4) • VOC Soil (source of slow down or cease in remediation rates): • Microbial population density test • TPH or THE • total heavy metal concentration • EC • SAR	• Moisture between 40 and 85% • carbon:nitrogen:phosphorus ratio 100:10:1 to 100:10:5 • Soil pH between 6 and 8 pH units • Microbial population density test minimum heterotrophic plate count 10^3 CFU/g • TPH or THE <3% • total heavy metals <2500 ppm • EC <4 dS/m • SAR <6
Soil Sampling for Remediation Progress and Verification of Remediation	Environmental Manager or delegate	To provide interim indications of remediation progress and to determine if remedial objectives have been met.	Once per year.	Soil: • Parameters listed in Table 3 Soils for discharge: • Sample composite made onsite placed in sealed containers from 10 samples per 25 m^3 (B.C. MoE 2013)	• Remediation criteria listed in Table 3
Water Sampling prior to Discharge	Environmental Manager or delegate	To conform to Water License requirements.	As required prior to discharge.	Water: • pH • TSS • Total oil and grease • Total ammonia • Total lead • Benzene • Toluene • Ethyl Benzene	• Discharge limits listed in Table 4
Water Sampling During Discharge	Environmental Manager or delegate	To conform to Water Licence requirements.	Daily during discharge.	Water: • pH • TSS • Total oil and grease • Total ammonia • Total lead • Benzene • Toluene • Ethyl Benzene	• Discharge limits listed in Table 4

3.5. Documentation and Reporting

Annual Geotechnical Inspection Report

As required by section 19, Part J (or equivalent) of Water Licence, TMAC will submit to the NWB a geotechnical engineer's inspection report within sixty (60) days of completion of the annual geotechnical inspection. That report will include the results of the assessment of the Landfarm Facility and include a cover letter from TMAC outlining an implementation plan to address recommendations made by the geotechnical engineer in his/her report.

Clean Water Discharge - Volume and Quality

In the event that water is discharged to the environment, TMAC will report the volume of water discharged from the Landfarm Facility and the results of the analysis of the water released. This information will be provided in the monthly monitoring report submitted to satisfy section 21, Part J (or equivalent) of the Water Licence issued by the NWB.

An annual report will be submitted as required by Part B, Section 3 (or equivalent) of the Water Licence by March 31 of the following year. The annual report will satisfy the requirements in Schedule B Section 1 (or equivalent) that pertain to the Doris Landfarm.

Soil Treatment Reporting

A report will be submitted presenting the results of the soil treatment testing utilised in verification of remediation prior to removing remediated soils from the facility.

3.6. QA/QC Procedures for Water Sampling

Quality assurance and quality control (QA/QC) procedures for water sampling are outlined in the Landfarm Management and Monitoring Plan.

Detailed QA/QC procedures are available in the Quality Assurance and Quality Control Plan (TMAC 2017).

4. CONTINGENCIES

Should additional new contaminated material require storage at Doris, that exceeds the capacity of the landfarm, a temporary lined facility may be required to store the excess material or the material will be required to be permanently stored underground within the Doris Mine is accordance with the *Hope Bay Project Groundwater Management Plan*.

Should the spring freshet or other unanticipated precipitation events cause excess water to accumulate within the Landfarm Facility beyond the rate at which oil adsorption and separation can occur. The Snow Pond (which is to be maintained empty) will be used to store the excess water temporarily to avoid any overflow events.

5. LANDFARM FACILITY CLOSURE

The Doris Landfarm will be decommissioned at mine closure, upon closure of the existing Doris Camp, or upon construction of a new Landfarm. The liner system will be removed and the berms graded to promote positive drainage across the site. Remaining contaminated soils will be stored underground within the Doris Mine is accordance with the *Hope Bay Project Groundwater Management Plan*.

Details of Doris facilities closure is available in the Doris Closure and Reclamation Plan (SRK 2015).

6. REFERENCES

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SRK Consulting (Canada) Inc. 2015. Doris North Mine Interim Closure and Reclamation Plan June 2015. Report prepared for TMAC Resources Inc. June 2015.

SRK Consulting (Canada) Inc. 2016. Hope Bay Project Groundwater Management Plan. Report prepared for TMAC Resources Inc. August 2016.

TMAC Resources Inc. 2017. Quality Assurance and Quality Control Plan, Hope Bay, Nunavut. January 2017.

2AM-DOH1323 – *Doris Type A Water Licence.*

Attachment 1: Engineering Drawings for the Doris North Landfarm, Doris North Project, Nunavut, Canada

Engineering Drawings for the Doris North Land Farm, Doris North Project, Nunavut, Canada

ACTIVE DRAWING STATUS

SRK DWG #	NEWMONT DWG NUMBER	DRAWING TITLE	REV	DATE	STATUS	OLD/REPLACED REVISIONS					
LF-00	HB+D-CIV-CIV-OND-0031	Engineering Drawings for Doris North Land Farm	AB	April 20, 2012	2011 As-built	Rev. 8, Jul. 11, 2011	Rev. 7, Jun. 28, 2011	Rev. 6, Mar. 31, 2011	Rev. 5, Mar. 22, 2010	Rev. 4, Aug. 9, 2010	Rev. 3, Apr. 27, 2010
LF-01	HB+D-CIV-CIV-OND-0032	Land Farm Location Map	5	Jun. 28, 2011	Gen. Revs to New O.G.	Rev. 4, Aug. 9, 2010	Rev. 3, Apr. 27, 2010	Rev. 2, Feb. 8, 2010	Rev. 1, Feb. 1, 2010	Rev. 0, Dec. 17, 2009	
LF-02	HB+D-CIV-CIV-OND-0033	Land Farm General Arrangement	AB	April 20, 2012	2011 As-built	Rev. 5, Jun. 28, 2011	Rev. 4, Aug. 9, 2010	Rev. 3, Apr. 27, 2010	Rev. 2, Feb. 8, 2010	Rev. 1, Feb. 1, 2010	Rev. 0, Dec. 17, 2009
LF-03	HB+D-CIV-CIV-OND-0034	Foundation Base Plan View	AB	April 20, 2012	2011 As-built	Rev. 6, Jun. 28, 2011	Rev. 5, Mar. 22, 2011	Rev. 4, Aug. 9, 2010	Rev. 3, Apr. 27, 2010	Rev. 2, Feb. 8, 2010	Rev. 1, Feb. 1, 2010
LF-04	HB+D-CIV-CIV-OND-0035	Containment Berm Plan View	AB	April 20, 2012	2011 As-built	Rev. 5, Jun. 28, 2011	Rev. 5, Jun. 28, 2011	Rev. 4, Aug. 9, 2010	Rev. 3, Apr. 27, 2010	Rev. 2, Feb. 8, 2010	Rev. 1, Feb. 1, 2010
LF-05	HB+D-CIV-CIV-OND-0036	Containment Berm Sections and Details	AB	April 20, 2012	2011 As-built	Rev. 6, Jul. 11, 2011	Rev. 5, Jun. 28, 2011	Rev. 4, Aug. 9, 2010	Rev. 3, Apr. 27, 2010	Rev. 2, Feb. 8, 2010	Rev. 1, Feb. 1, 2010
LF-06	HB+D-CIV-CIV-OND-0037	Completed Land Farm Plan View	AB	April 20, 2012	2011 As-built	Rev. 5, Jun. 28, 2011	Rev. 4, Aug. 9, 2010	Rev. 3, Apr. 27, 2010	Rev. 2, Feb. 8, 2010	Rev. 1, Feb. 1, 2010	Rev. 0, Dec. 17, 2009
LF-07	HB+D-CIV-CIV-OND-0038	Final Sections and Details	AB	April 20, 2012	2011 As-built	Rev. 5, Jun. 28, 2011	Rev. 4, Aug. 9, 2010	Rev. 3, Apr. 27, 2010	Rev. 2, Feb. 8, 2010	Rev. 1, Feb. 1, 2010	Rev. 0, Dec. 17, 2009
LF-08	HB+D-CIV-CIV-OND-0131	Land Farm Liner Plan View	AB	April 20, 2012	2011 As-built	Rev. 1, Jul. 11, 2011	Rev. 0, Jun. 28, 2011				

HOPE BAY MINING LTD.

srk consulting

PROJECT NO: 1CH00□033□05□
2011 As-Built
Revision AB
Apr. 20□2012
LF-00 □HB□D-CIV-CIV-OND-0031

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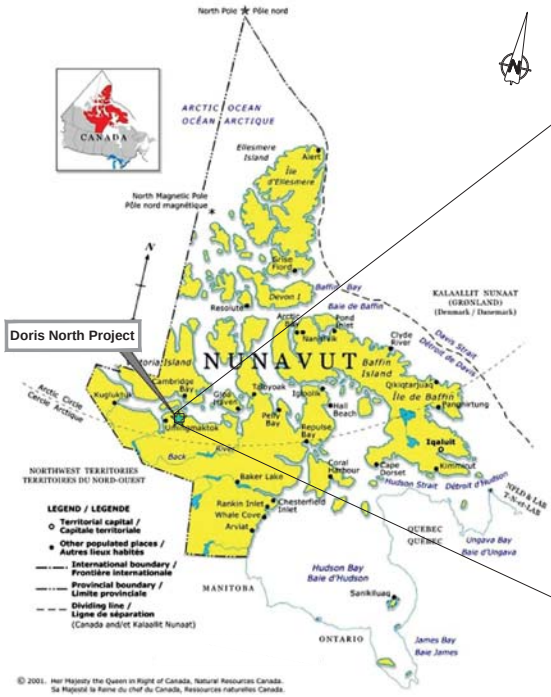
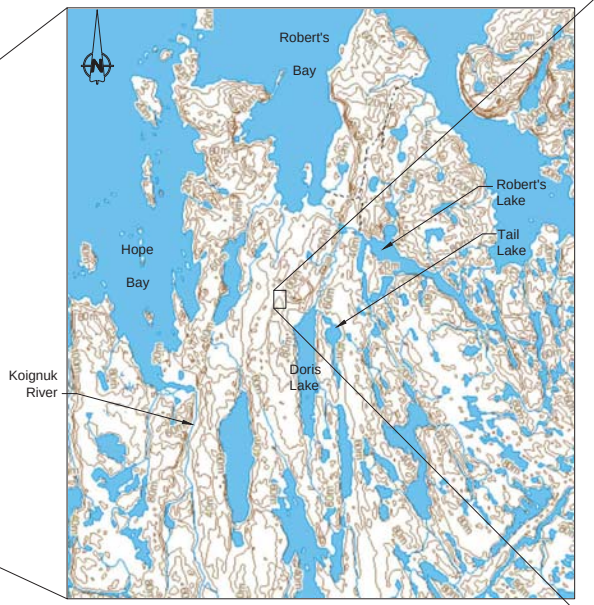


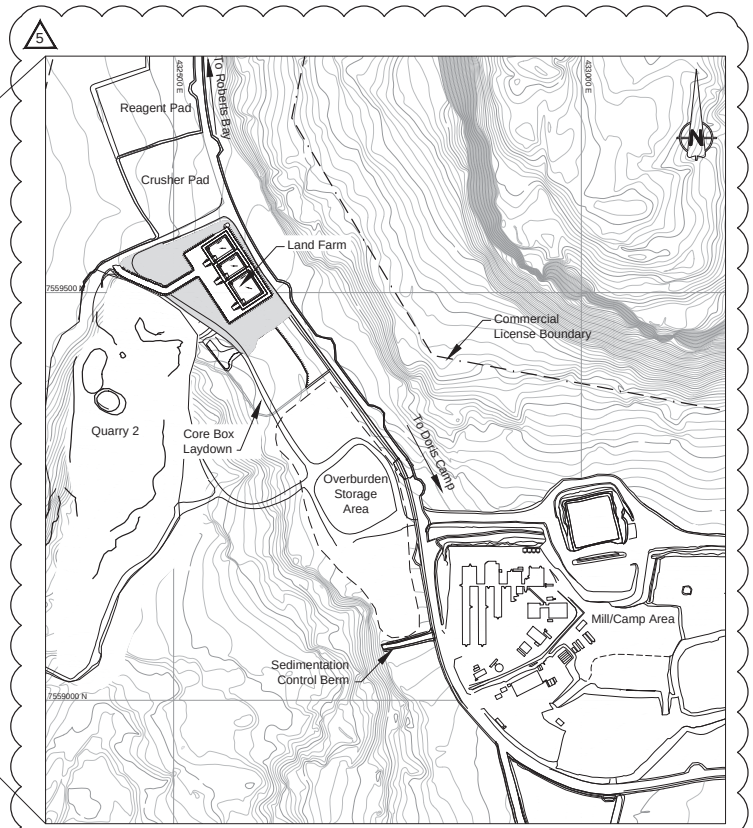
TERRITORIAL LOCATION

Approx. Scale 200 0 200 400 600 Km



REGIONAL LOCATION

0 1 2 3 4 5 Km



SITE LOCATION

0 50 100 150 200 250 300

Scale in Metres

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
5	GENERAL REVISIONS TO NEW O.G.	JBK	EMR	06/28/11
4	ISSUED FOR CONSTRUCTION	LW	EMR	08/09/10
3	ISSUED FOR CONSTRUCTION	IM	EMR	04/27/10
2	ISSUED FOR COMMENT	LW	EMR	02/08/10
1	WATER LICENSE REVIEW	PM	EMR	02/01/10

REVISIONS

Original Drawings Stamped and Signed by Engineer

This drawing is uncontrolled when printed unless stamped and signed with original ink and recorded on a Distribution Register.

PROFESSIONAL ENGINEER'S STAMP

srk consulting

DESIGN:	DRAWN:	REVIEWED:
CB/JBK	NV/JBK	EMR
CHECKED:	APPROVED:	DATE:
JBK	EMR	June. 28, 2011

FILE NAME: 1CH008.033-Land Farm_LocationMap.dwg

NEWMONT NORTH AMERICA

HOPE BAY MINING LTD.

SRK JOB NO.: 1CH008.033 SRK DWG NO.: LF-01

Doris North Project

DRAWING TITLE:

Land Farm Location Map

NEWMONT DRAWING NO.	SHEET	REVISION NO.
HB+D-CIV-CIV-OND-0032	2 OF 9	5

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NOTES

1. The Contractor is not responsi□le to o□tain all necessary permits and approvals for the Works□ however□the Contractor must confirm that such approvals have □een o□tained from the Owner prior to proceeding with any construction.
2. Topographic contour data for the terrain model was provided □y the Contractor.
3. The co-ordinate system is UTM NAD □3□□one 13.
4. All dimensions are in metric units□unless specifically mentioned.
5. Typical details are Not to Scale □NTS□unless specifically mentioned.
6. All drawings are scaled appropriately for D-Si□e construction drawings. Scales may not □e correct if these drawings are reproduced and presented in any other si□e format.
7. Notes and specifications on any drawings in this set apply e□ually to all drawings in the set.
8. All work is to □e set out prior to the start of any construction□according to the Stake-Out Ta□les or 3D surface files provided. Should there □e any difference □etween the co-ordinates provided and the field location□the Engineer is to □e informed immediately.
9. Su□surface soil conditions have not □een confirmed at this location. SRK has □een ver□ally informed of the conditions □y the Owner. It is understood that foundation conditions consist of a□out 1m of random over□urden fill which has □een leveled using a do□er□ overlying ice-rich marine silt and clay permafrost□ possi□ly up to 20m thick. The random fill was originally placed as fro□en lumps of soil mixed with snow and ice with random □uantities of □uarry rock. This fill was allowed to thaw in and was su□se□uently leveled. The fill was not compacted□and no □uality control was carried out. SRK has informed the Owner of the risks associated with founding the land farm on this leveling pad without undertaking further geotechnical investigation.
10. The scope of work descri□ed in these drawings specifically exclude all electrical and mechanical elements.

LEGEND

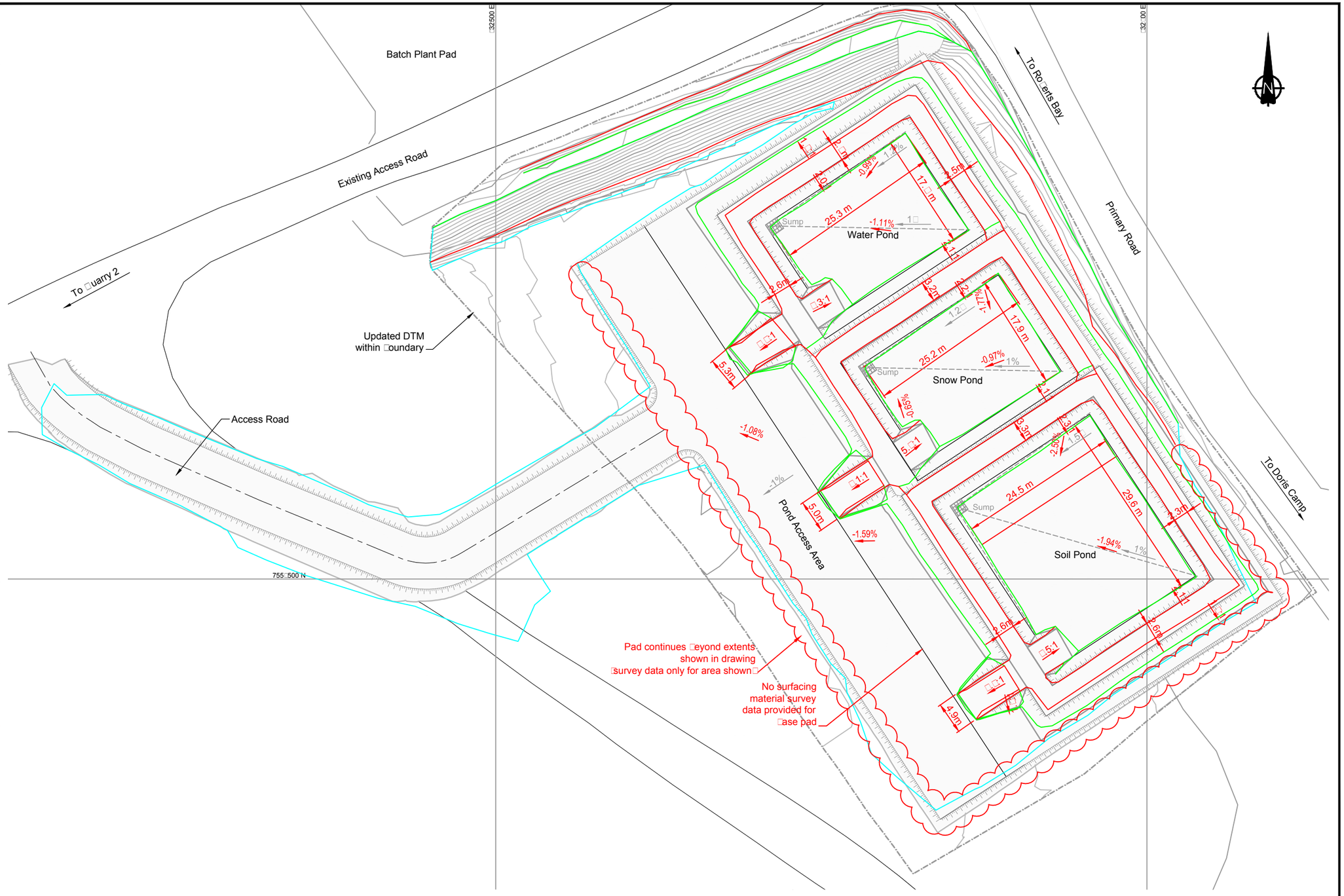
- As-□uilt Crest
- As-□uilt Toe
- As-□uilt Extent of RO□

As-built Containment

- Soil Pond As-□uilt volume □325 m^3 at El. 5□75 m
- Snow Pond As-□uilt volume □1□5 m^{3}at El. 5□□5 m
- Water Pond As-□uilt volume □1□□ m^3 at El. 55.□3 m

Note

□As □uilt capacities calculated from within crush surface final down from the low point of the liner crest □i.e. liner free□oard□containment elevation□



DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
–	–		

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
AB	As-built	JBK	EMR	04/20/12
5	GENERAL REVISIONS TO NEW O.G.	JBK	EMR	06/28/11
4	ISSUED FOR CONSTRUCTION	IM	EMR	08/09/10
3	ISSUED FOR CONSTRUCTION	IM	EMR	04/27/10
2	ISSUED FOR COMMENT	LW	EMR	02/08/10
1	WATER LICENSE REVIEW	PM	EMR	02/01/10
0	ISSUED FOR REVIEW	TG	EMR	12/17/09

REVISIONS

This drawing is uncontrolled when printed unless stamped and signed with original ink and recorded on a Distribution Register.

PROFESSIONAL ENGINEERS STAMP

srk consulting

DESIGN:	DRAWN:	REVIEWED:
CB/JBK	NV/LR	EMR
CHECKED:	APPROVED:	DATE:
MMM	EMR	APR. 20, 2012

FILE NAME: 1CH008.033–Land Farm_GA.dwg

NEWMONT NORTH AMERICA

HOPE BAY MINING LTD.

SRK JOB NO.: 1CH008.033/.058 SRK DWG NO.: LF-02

Doris North Project

DRAWING TITLE:

Land Farm
General Arrangement

NEWMONT DRAWING NO.	SHEET	REVISION NO.
HB□D-CIV-CIV-OND-0033	3 OF 9	AB

J:\01_SITES\Hope Bay\LACAD\2011 Drawings\Land Farm\As-builts\1CH008.033–Land Farm_GA.dwg

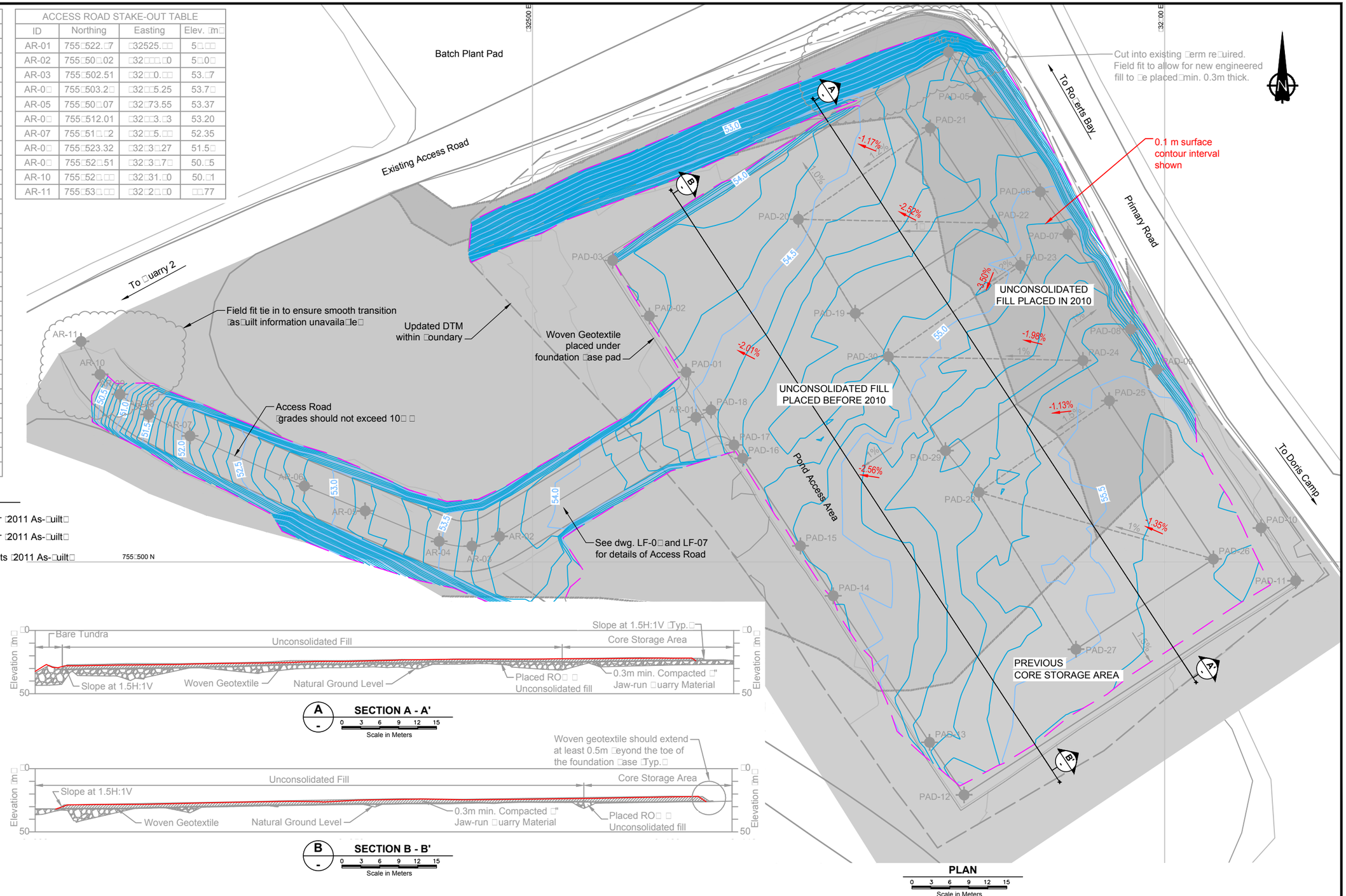
FOUNDATION BASE STAKE-OUT TABLE			
ID	Northing	Easting	Elev. (m)
PAD-01	7555530.03	3252.32	55.55
PAD-02	7555531.00	3251.50	55.31
PAD-03	7555507.70	32512.71	55.12
PAD-04	7555500.50	3255.33	55.01
PAD-05	7555573.50	32570.55	55.01
PAD-06	7555555.55	3250.33	55.01
PAD-07	7555551.50	3255.73	55.31
PAD-08	7555531.00	3255.01	55.31
PAD-09	7555530.50	3255.70	55.01
PAD-10	7555505.30	32515.25	55.01
PAD-11	7555507.02	3252.70	55.01
PAD-12	7555503.13	3252.20	55.57
PAD-13	755571.00	3252.53	55.53
PAD-14	7555500.03	3257.50	55.02
PAD-15	7555502.52	3252.50	55.11
PAD-16	7555510.00	32533.20	55.02
PAD-17	7555510.50	32531.00	55.77
PAD-18	7555520.03	3252.20	55.03
PAD-19	7555530.33	32551.00	55.00
PAD-20	7555550.20	3252.00	55.50
PAD-21	7555500.50	3252.53	55.00
PAD-22	7555553.01	32572.01	55.00
PAD-23	7555500.01	32577.21	55.00
PAD-24	7555531.07	3257.00	55.00
PAD-25	7555525.51	3251.20	55.70
PAD-26	7555500.00	32507.73	55.70
PAD-27	7555500.10	3255.00	55.70
PAD-28	7555511.01	32570.03	55.30
PAD-29	7555517.50	3255.35	55.00
PAD-30	7555532.00	3255.33	55.00

ACCESS ROAD STAKE-OUT TABLE			
ID	Northing	Easting	Elev. (m)
AR-01	7555522.07	32525.00	55.00
AR-02	7555502.02	32500.00	55.00
AR-03	7555502.51	3250.00	53.07
AR-04	7555503.20	3255.25	53.70
AR-05	7555507.07	3273.55	53.37
AR-06	7555512.01	3253.03	53.20
AR-07	7555512.02	3255.00	52.35
AR-08	7555523.32	3253.27	51.50
AR-09	7555552.51	3253.07	50.05
AR-10	7555502.00	3251.00	50.01
AR-11	7555503.00	3252.00	50.77

LEGEND

- RO Foundation Pad Major Contour 2011 As-built
- RO Foundation Pad Minor Contour 2011 As-built
- RO Foundation Pad Outline Extents 2011 As-built

755500 N



A - SECTION A - A'

0 3 6 9 12 15
Scale in Meters

B - SECTION B - B'

0 3 6 9 12 15
Scale in Meters

PLAN

0 3 6 9 12 15
Scale in Meters

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
–	–		

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
AB	AS-BUILT	JBK	EMR	04/20/12
6	GENERAL REVISIONS TO NEW O.G.	JBK	EMR	06/28/11
5	UPDATED STAKE OUT TABLE	IM	EMR	03/22/11
4	ISSUED FOR CONSTRUCTION	IM	EMR	08/09/10
3	ISSUED FOR CONSTRUCTION	IM	EMR	04/27/10
2	ISSUED FOR COMMENT	LW	EMR	02/08/10
1	WATER LICENSE REVIEW	PM	EMR	02/01/10
0	ISSUED FOR REVIEW	TG	EMR	12/17/09

REVISIONS

Original Drawings Stamped and Signed by Engineer

This drawing is uncontrolled when printed unless stamped and signed with original ink and recorded on a Distribution Register.

PROFESSIONAL ENGINEERS STAMP

srk consulting

DESIGN:	DRAWN:	REVIEWED:
CB/JBK	NV/LR	EMR
CHECKED:	APPROVED:	DATE:
JBK	EMR	APR. 20, 2012

FILE NAME: 1CH008.033–Land Farm_Base Pad.dwg

NEWMONT NORTH AMERICA

HOPE BAY MINING LTD.

SRK JOB NO.: 1CH008.033/.058 SRK DWG NO.: LF-03

Doris North Project

DRAWING TITLE:

Foundation Base Plan View

NEWMONT DRAWING NO.	SHEET	REVISION NO.
HB-D-CIV-CIV-OND-003	4 OF 9	AB

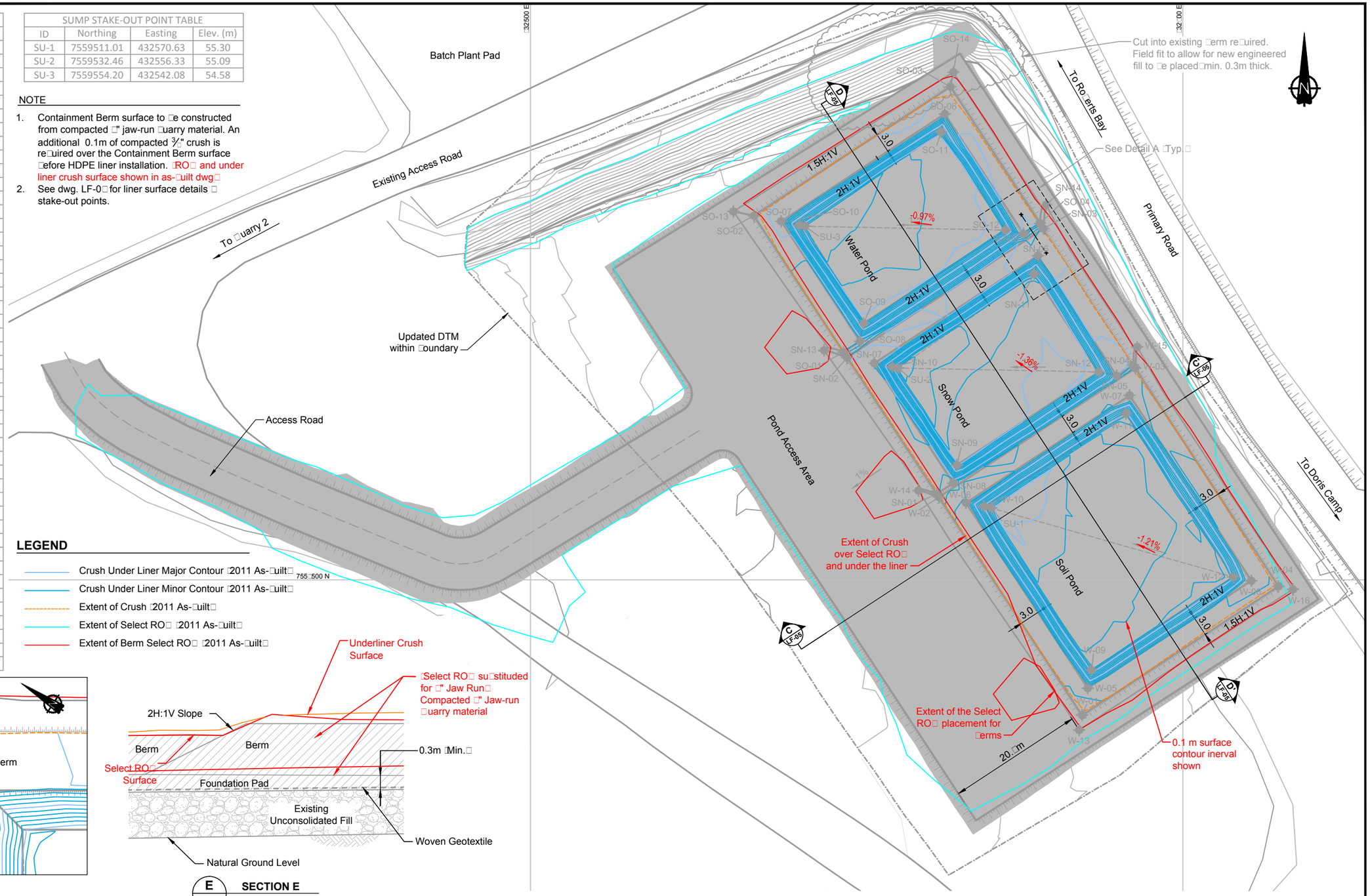
J:\01_SITES\Hope Bay\1ACAD\2011 Drawings\Land Farm\As-builts\1CH008.033-Land Farm_Base Pad.dwg

WATER POND STAKE-OUT TABLE			
ID	Northing	Easting	Elev. (m)
W-01	7559479.24	432584.56	56.70
W-02	7559512.67	432562.60	56.70
W-03	7559532.44	432592.69	56.70
W-04	7559499.00	432614.65	56.70
W-05	7559483.39	432585.42	56.70
W-06	7559511.81	432566.76	56.70
W-07	7559528.28	432591.83	56.70
W-08	7559499.86	432610.50	56.70
W-09	7559486.16	432585.99	55.70
W-10	7559511.24	432569.53	55.70
W-11	7559525.51	432591.26	55.70
W-12	7559500.44	432607.73	55.70
W-13	7559476.99	432584.09	55.62
W-14	7559513.69	432559.47	55.32
W-15	7559535.70	432593.01	55.33
W-16	7559498.54	432616.86	55.63
SNOW POND STAKE-OUT TABLE			
SN-01	7559513.18	432562.27	56.40
SN-02	7559534.07	432548.55	56.40
SN-03	7559553.83	432578.64	56.40
SN-04	7559532.94	432592.36	56.40
SN-05	7559531.29	432589.86	56.40
SN-06	7559549.68	432577.78	56.40
SN-07	7559533.21	432552.70	56.40
SN-08	7559514.82	432564.78	56.40
SN-09	7559517.59	432565.35	55.40
SN-10	7559532.64	432555.47	55.40
SN-11	7559546.91	432577.21	55.40
SN-12	7559531.86	432587.09	55.40
SN-13	7559535.17	432545.01	54.83
SN-14	7559557.50	432579.04	54.84
SOIL POND STAKE-OUT TABLE			
SO-01	7559534.91	432548.00	55.90
SO-02	7559555.81	432534.27	55.90
SO-03	7559575.58	432564.36	55.90
SO-04	7559554.67	432578.09	55.90
SO-05	7559553.03	432575.58	55.90
SO-06	7559571.42	432563.50	55.90
SO-07	7559554.95	432538.43	55.90
SO-08	7559536.56	432550.50	55.90
SO-09	7559539.33	432551.08	54.90
SO-10	7559554.38	432541.20	54.90
SO-11	7559568.65	432562.93	54.90
SO-12	7559553.61	432572.81	54.90
SO-13	7559556.47	432531.10	54.38
SO-14	7559577.81	432564.83	54.82

SUMP STAKE-OUT POINT TABLE			
ID	Northing	Easting	Elev. (m)
SU-1	7559511.01	432570.63	55.30
SU-2	7559532.46	432556.33	55.09
SU-3	7559554.20	432542.08	54.58

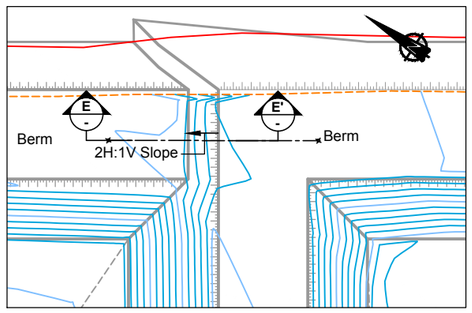
NOTE

1. Containment Berm surface to □e constructed from compacted □" jaw-run □uarry material. An additional 0.1m of compacted ¾" crush is re□uired over the Containment Berm surface □efore HDPE liner installation. □RO□ and under liner crush surface shown in as-□uilt dwg□
2. See dwg. LF-0□ for liner surface details □ stake-out points.



LEGEND

- Crush Under Liner Major Contour □2011 As-□uilt□
- Crush Under Liner Minor Contour □2011 As-□uilt□
- Extent of Crush □2011 As-□uilt□
- Extent of Select RO□ □2011 As-□uilt□
- Extent of Berm Select RO□ □2011 As-□uilt□



DETAIL A (TYPICAL)

0 0.□ 0.□ 1.2 1.□ 2.0

Scale in Metres

E - **SECTION E**

0 0.□ 0.□ 1.2 1.□ 2.0

□Scale in Metres

NO.	DESCRIPTION	CHK'D	APP'D	DATE
AB	AS-BUILT	JBK	EMR	04/20/12
5	GENERAL REVISIONS TO NEW O.G.	JBK	EMR	06/28/11
4	ISSUED FOR CONSTRUCTION	IM	EMR	08/09/10
3	ISSUED FOR CONSTRUCTION	IM	EMR	04/27/10
2	ISSUED FOR COMMENT	LW	EMR	02/08/10
1	WATER LICENSE REVIEW	PM	EMR	02/01/10
0	ISSUED FOR REVIEW	TG	EMR	12/17/09

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
–	–		

REFERENCE DRAWINGS

REVISIONS

Original Drawings Stamped and Signed by Engineer

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PROFESSIONAL ENGINEERS STAMP

srk consulting

DESIGN:	DRAWN:	REVIEWED:
CB/JBK	NV/LR	EMR
CHECKED:	APPROVED:	DATE:
JBK	EMR	APR. 20, 2012

FILE NAME: 1CH008.033–Land Farm_Containment Berm.dwg

NEWMONT NORTH AMERICA

HOPE BAY MINING LTD.

SRK JOB NO.: 1CH008.033/.058 SRK DWG NO.: LF-0□

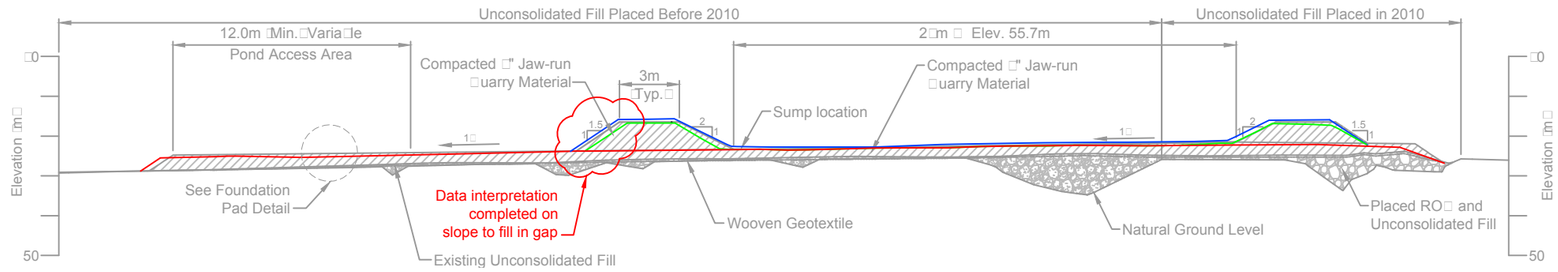
Doris North Project

DRAWING TITLE:

Containment Berm Plan View

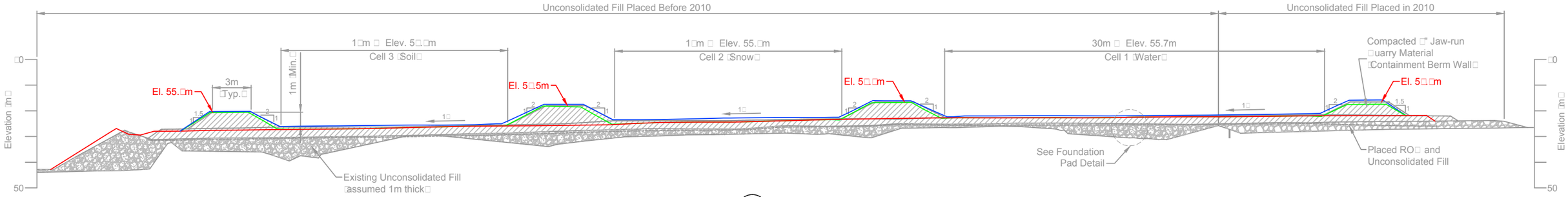
NEWMONT DRAWING NO.	SHEET	REVISION NO.
HB□D-CIV-CIV-OND-0035	5 OF 9	AB

J:\01_SITES\Hope Bay\LACAD\2011 Drawings\Land Farm\As-builts\1CH008.033–Land Farm_Containment Berm.dwg



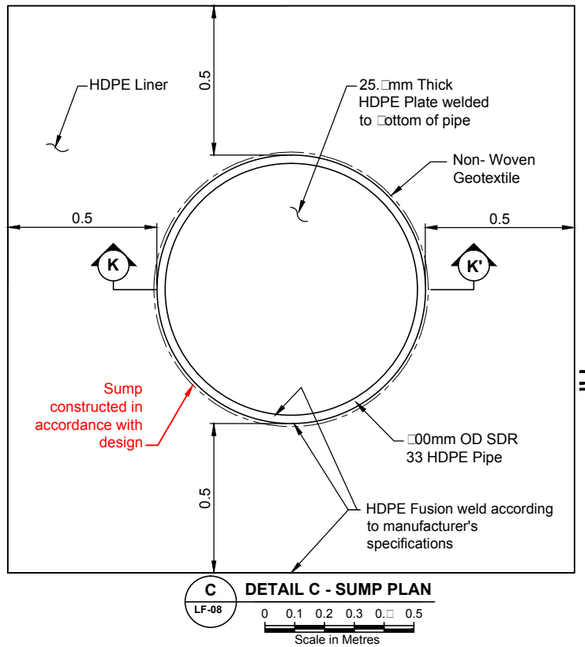
C LF-04 **SECTION C - C'**

0 1.5 3 4.5 6 7.5
Scale in Meters



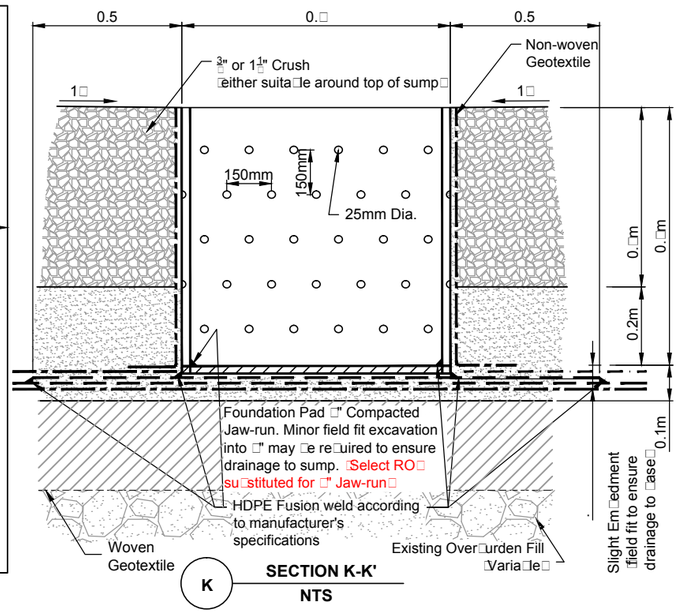
D LF-04 **SECTION D - D'**

0 1.5 3 4.5 6 7.5
Scale in Meters



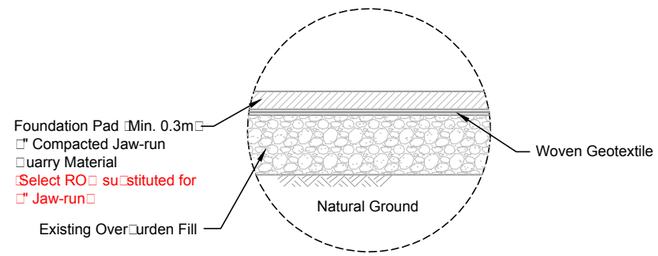
C LF-08 **DETAIL C - SUMP PLAN**

0 0.1 0.2 0.3 0.□ 0.5
Scale in Metres



K **SECTION K-K'**

NTS



TYPICAL FOUNDATION BASE PAD DETAIL

□NTS□

LEGEND

- Compacted □" Jaw-run □uarry material
- Existing Unconsolidated Fill
- RO□ □Run of □uarry□Fill
- As-□uilt Crush Under Liner
- As-□uilt Berm RO□
- As-□uilt Foundation Pad RO□

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
–	–		

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
AB	AS-BUILT	JBK	LW	04/20/12
6	SUMP DETAILS ADDED	JBK	LW	07/11/11
5	GENERAL REVISIONS TO NEW O.G.	JBK	EMR	06/28/11
4	ISSUED FOR CONSTRUCTION	IM	EMR	08/09/10
3	ISSUED FOR CONSTRUCTION	IM	EMR	04/27/10
2	ISSUED FOR COMMENT	LW	EMR	02/08/10
1	WATER LICENSE REVIEW	PM	EMR	02/01/10
0	ISSUED FOR REVIEW	TG	EMR	12/17/09

REVISIONS

Original Drawings
Stamped and
Signed by Engineer

This drawing is uncontrolled when printed unless stamped and signed with original ink and recorded on a Distribution Register.

PROFESSIONAL ENGINEERS STAMP

srk consulting

DESIGN:	DRAWN:	REVIEWED:
CB/JBK	NV/LR	EMR
CHECKED:	APPROVED:	DATE:
JBK	EMR	APR. 20, 2012

FILE NAME: 1CH008.033–Sections_Details.dwg

NEWMONT NORTH AMERICA

HOPE BAY MINING LTD.

SRK JOB NO.: 1CH008.033/.058 SRK DWG NO.: LF-05

Doris North Project

DRAWING TITLE:

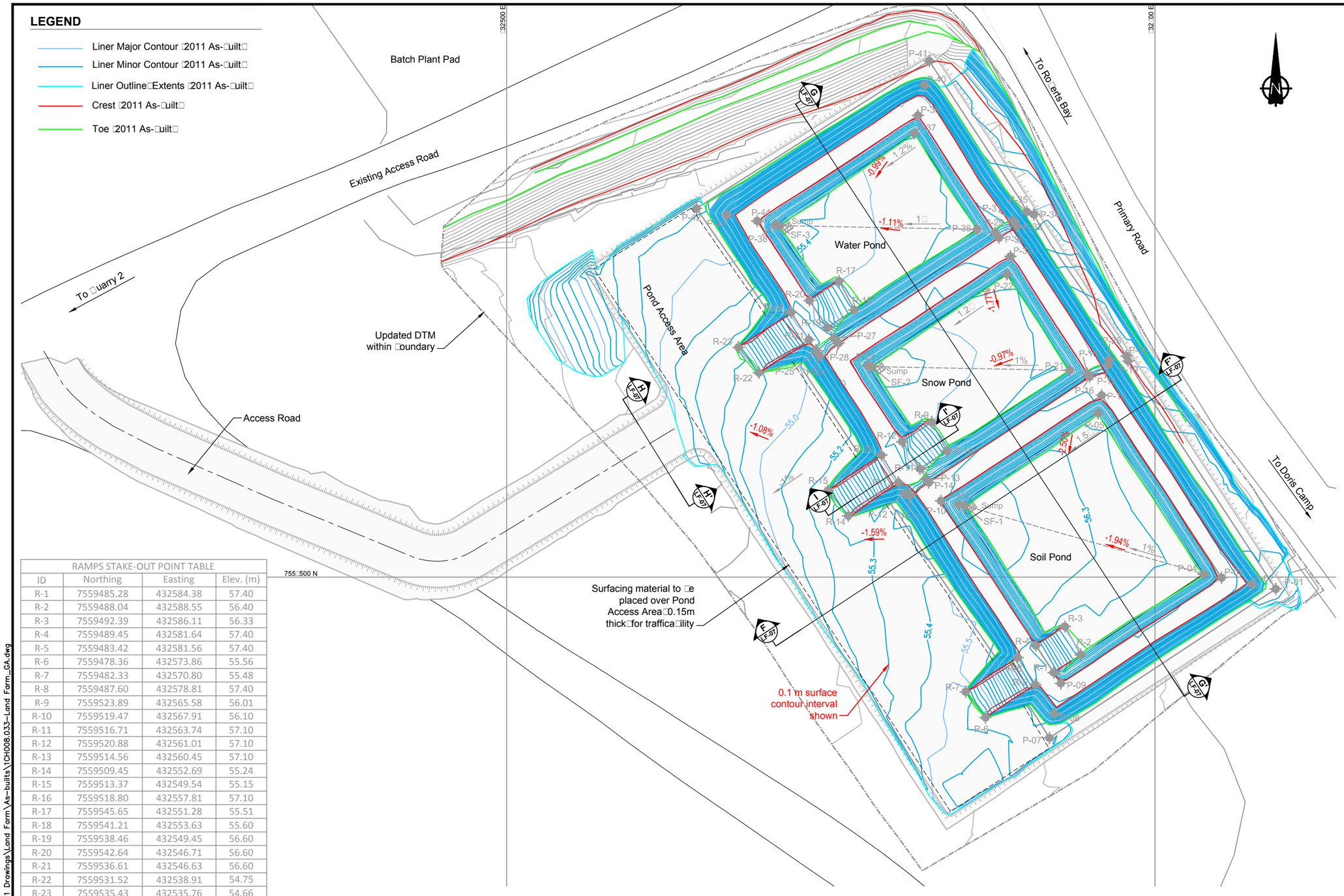
Containment Berm
Sections and Details

NEWMONT DRAWING NO.	SHEET	REVISION NO.
HB□D-CIV-CIV-OND-003□	6 OF 9	AB

J:\01_SITES\HopeBay\1ACAD\2011 Drawings\Land Form\As-builts\1CH008.033-Sections_Details.dwg

LEGEND

- Liner Major Contour □2011 As-□uilt□
- Liner Minor Contour □2011 As-□uilt□
- Liner Outline□Extents □2011 As-□uilt□
- Crest □2011 As-□uilt□
- Toe □2011 As-□uilt□



RAMPS STAKE-OUT POINT TABLE

ID	Northing	Easting	Elev. (m)
R-1	7559485.28	432584.38	57.40
R-2	7559488.04	432588.55	56.40
R-3	7559492.39	432586.11	56.33
R-4	7559489.45	432581.64	57.40
R-5	7559483.42	432581.56	57.40
R-6	7559478.36	432573.86	55.56
R-7	7559482.33	432570.80	55.48
R-8	7559487.60	432578.81	57.40
R-9	7559523.89	432565.58	56.01
R-10	7559519.47	432567.91	56.10
R-11	7559516.71	432563.74	57.10
R-12	7559520.88	432561.01	57.10
R-13	7559514.56	432560.45	57.10
R-14	7559509.45	432552.69	55.24
R-15	7559513.37	432549.54	55.15
R-16	7559518.80	432557.81	57.10
R-17	7559545.65	432551.28	55.51
R-18	7559541.21	432553.63	55.60
R-19	7559538.46	432549.45	56.60
R-20	7559542.64	432546.71	56.60
R-21	7559536.61	432546.63	56.60
R-22	7559531.52	432538.91	54.75
R-23	7559535.43	432535.76	54.66
R-24	7559540.79	432543.88	56.60

LAND FARM STAKE-OUT POINT TABLE

ID	Northing	Easting	Elev. □m□
P-01	755□□□□.1□	□32□1□.□□	55.□2
P-02	755□□□□.□□	□32□1□.□□	57.□0
P-03	755□□□□.□1	□32□10.27	57.□0
P-0□	755□500.□□	□32□07.50	5□.□0
P-05	755□525.2□	□325□1.21	5□.□0
P-0□	755□511.1□	□325□□.75	5□.□0
P-07	755□□75.21	□325□3.72	55.□0
P-0□	755□□7.□5	□325□□.50	57.□0
P-0□	755□□□3.□2	□325□5.□7	57.□0
P-10	755□511.77	□325□□.□□	57.□0
P-11	755□512.7□	□325□2.31	57.□0
P-12	755□512.□1	□325□1.□□	57.10
P-13	755□515.0□	□325□□.□0	57.10
P-1□	755□51□.5□	□325□5.12	57.□0
P-15	755□531.3□	□325□□.□0	57.10
P-1□	755□530.□7	□325□□.□1	57.□0
P-17	755□532.73	□325□2.75	57.□0
P-1□	755□52□.05	□325□1.7□	57.□0
P-1□	755□533.32	□325□5.□5	55.□□
P-20	755□53□.10	□325□5.□0	55.□3
P-21	755□531.□1	□325□□.□□	5□.10
P-22	755□5□□.□□	□32577.1□	5□.10
P-23	755□532.5□	□32555.70	5□.10
P-2□	755□53□.13	□325□□.2□	57.10
P-25	755□53□.□7	□325□7.71	5□.□0
P-2□	755□533.5□	□325□2.□3	57.10
P-27	755□53□.□2	□32550.53	5□.□0
P-2□	755□53□.07	□32551.20	57.10
P-2□	755□553.11	□32575.33	5□.□0
P-30	755□552.32	□32575.□□	57.10
P-31	755□55□.□□	□3257□.15	5□.□0
P-32	755□55□.13	□3257□.70	57.10
P-33	755□5□□.□5	□32577.73	57.10
P-3□	755□555.□0	□325□1.33	5□.□□
P-35	755□55□.33	□325□0.2□	5□.□□
P-3□	755□553.□5	□32572.5□	55.□0
P-37	755□5□□.□2	□325□2.□□	55.□0
P-3□	755□55□.33	□325□1.□2	55.□0
P-3□	755□571.1□	□325□3.□5	5□.□0
P-□0	755□575.□7	□325□□.□2	5□.□0
P-□1	755□57□.5□	□325□5.1□	5□.□1
P-□2	755□55□.□5	□3252□.2□	5□.3□
P-□3	755□555.□□	□32533.□□	5□.□0
P-□□	755□55□.□1	□3253□.□5	5□.□0

SUMP FINAL STAKE-OUT TABLE

ID	Northing	Easting	Elev. (m)
SF-01	7559511.01	432570.63	56.00
SF-02	7559532.46	432556.33	55.78
SF-03	7559554.20	432542.08	55.28

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
–	–		

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
AB	As-built	JBK	EMR	04/20/12
5	GENERAL REVISIONS TO NEW O.G.	JBK	EMR	06/28/11
4	ISSUED FOR CONSTRUCTION	IM	EMR	08/09/10
3	ISSUED FOR CONSTRUCTION	IM	EMR	04/27/10
2	ISSUED FOR COMMENT	LW	EMR	02/08/10
1	WATER LICENSE REVIEW	PM	EMR	02/01/10
0	ISSUED FOR REVIEW	TG	EMR	12/17/09

REVISIONS

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DESIGN:	DRAWN:	REVIEWED:
CB/JBK	NV/LR	EMR
CHECKED: JBK	APPROVED: EMR	DATE: APR. 20, 2012

FILE NAME: 1CH008.033–Land Farm_GA.dwg

NEWMONT NORTH AMERICA

HOPE BAY MINING LTD.

SRK JOB NO.: 1CH008.033/.058 SRK DWG NO.: LF-0□

Doris North Project

DRAWING TITLE: Land Farm Stakeout Points

NEWMONT DRAWING NO.	SHEET	REVISION NO.
HB□D-CIV-CIV-OND-0033	3 OF 9	5

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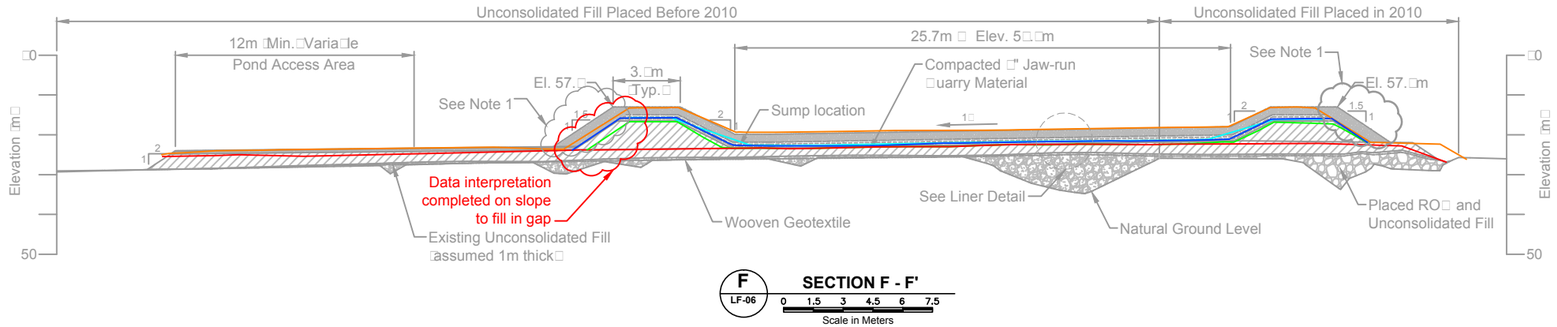
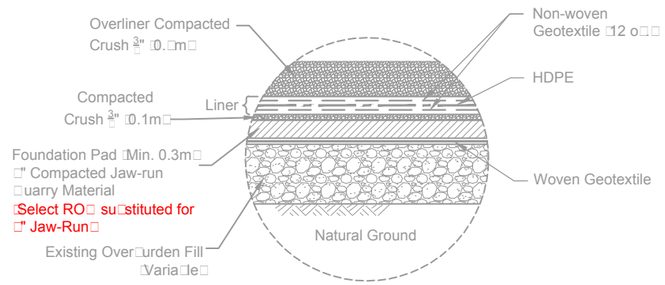


F LF-06 **SECTION F - F'**

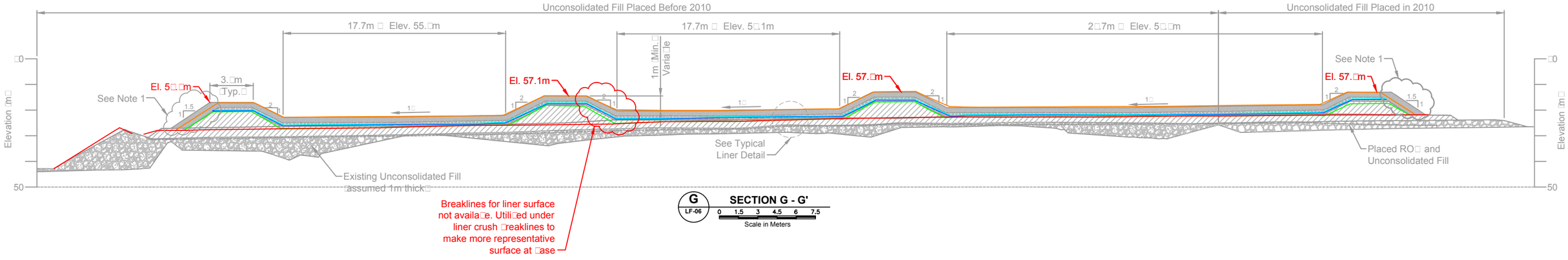
0 1.5 3 4.5 6 7.5

Scale in Meters



TYPICAL LINER DETAIL

□NTS□



G LF-06 **SECTION G - G'**

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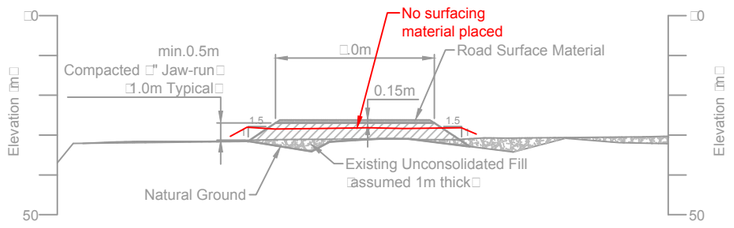
Scale in Meters



H LF-06 **SECTION H - H'**

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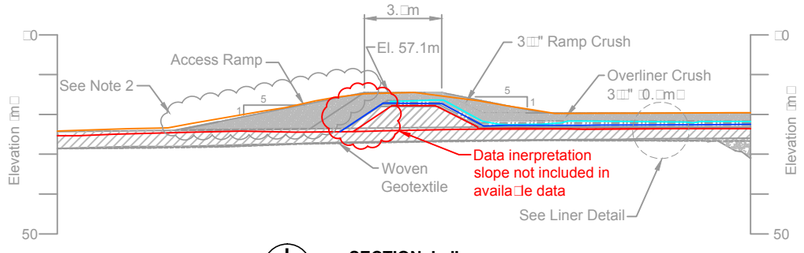
Scale in Meters



I LF-06 **SECTION I - I'**

0 1.5 3 4.5 6 7.5

Scale in Meters

LEGEND

- Overliner Compacted Crush 3□" □0.□m□
- Compacted □" Jaw-run □uarry Material
  □Select RO□ su□stituted for □" Jaw-run□
- Existing Unconsolidated Fill
- RO□ □Run of □uarry□and Unconsolidated Fill
- As-□uilt Crush A□ove Liner
- As-□uilt Liner
- As-□uilt Crush Under Liner
- As-□uilt Berm RO□
- As-□uilt Foundation Pad RO□

NOTES

1. On the outside 1.5H:1V □erm slopes□i.e. where no liner has □een placed□compacted 1-1□" or □" Jaw-run material may □e su□stituted for 3□" overliner material.
2. For the Access Ramp slope outside of the lined containment □i.e. south of the areas where liner has □een placed□□1-1□" crush or compacted □" Jaw-run material□overlaid □y 0.15m of surfacing material□may □e su□stituted for the outlined 3□" ramp crush.
   □Select RO□ su□stituted as per NL-RFI-033.□

Description	Material Specifications	Quantity
Foundation Pad: Base (min. 0.3m)	Compacted 6" Jaw-run quarry material	4093 m^3
Woven Geotextile	LP315 or equilavent 6 oz woven geotextile	6608 m^2
Foundation Pad: Berms	Compacted 6" Jaw-run quarry material	1793 m^3
Non-woven Geotextile	12 oz non-woven geotextile	6798 m^2
HDPE Geomembrane Liner	Solmax 460T or equilavent 60 mil textured HDPE	3399 m^2
Underliner (0.1m)	3/4" crushed rock	340 m^3
Overliner (0.6m)	3/4" crushed rock	2591 m^3
Access Ramps	3/4" crushed rock	142 m^3
Access Road Base (min 0.5, typically 1.0m)	Compacted 6" Jaw-run quarry material	975 m^3
Access Road Surfacing (0.15m)	1 1/4" crushed rock	89 m^3
Pond Access Area Surfacing (0.15m)	1 1/4" crushed rock	290 m^3

These □uantities are neat line □uantities and the Contractor needs to apply the appropriate □ulking and□or shrinkage factors as well as make the necessary allowances for liner and geotextile overlap.

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DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
–	–		

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NO.	DESCRIPTION	CHK'D	APP'D	DATE
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3	ISSUED FOR CONSTRUCTION	IM	EMR	04/27/10
2	ISSUED FOR COMMENT	LW	EMR	02/08/10
1	WATER LICENSE REVIEW	PM	EMR	02/01/10
0	ISSUED FOR REVIEW	TG	EMR	12/17/09

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CHECKED: JBK | APPROVED: EMR | DATE: MAR. 28, 2012

FILE NAME: 1CH008.033-Land Farm_LF-07.dwg

NEWMONT NORTH AMERICA

HOPE BAY MINING LTD.

SRK JOB NO.: 1CH008.033/.058 | SRK DWG NO.: LF-07

Doris North Project

DRAWING TITLE:

Final Sections and Details

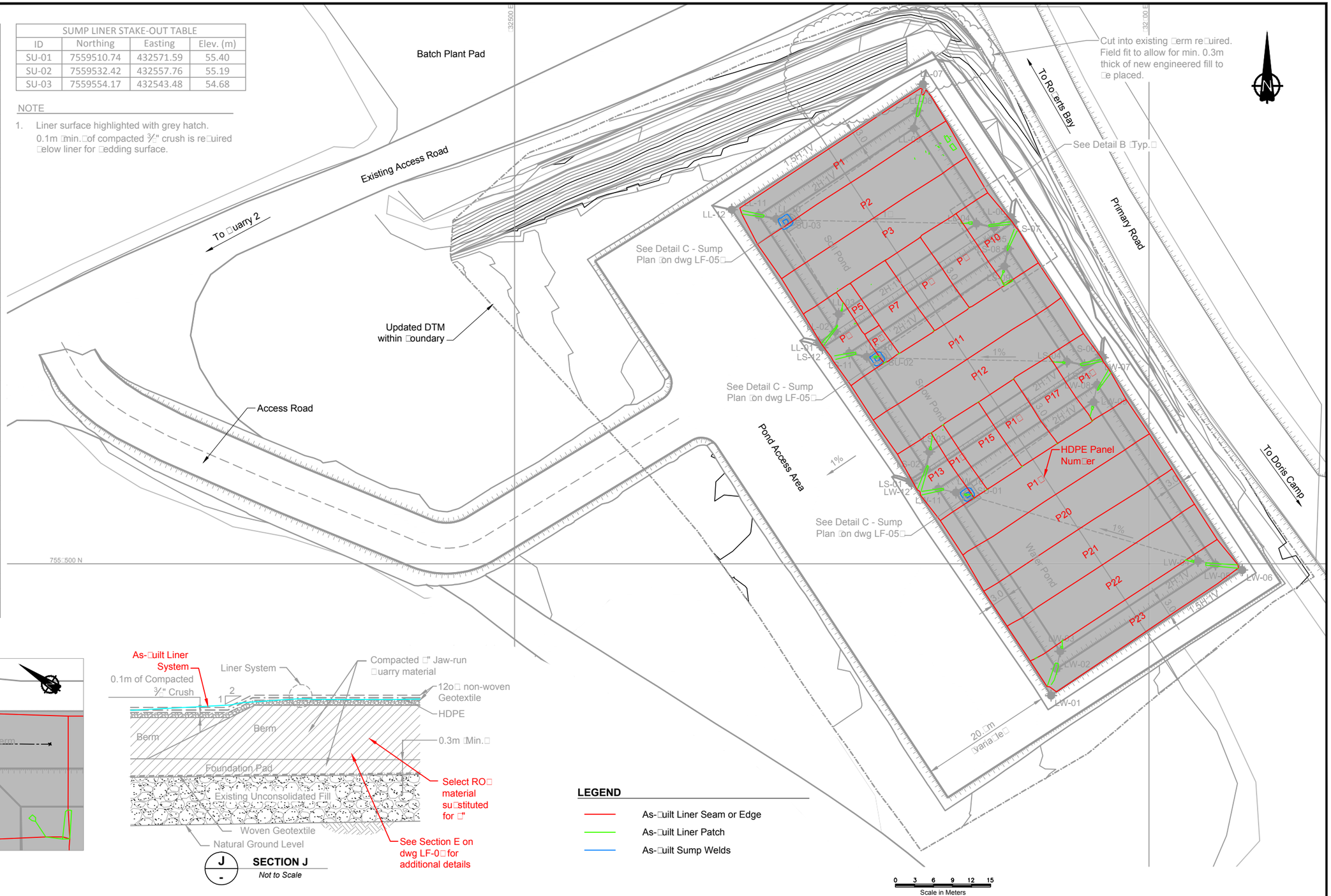
NEWMONT DRAWING NO.: HB□D-CIV-CIV-OND-003□ | SHEET: 8 OF 9 | REVISION NO.: AB

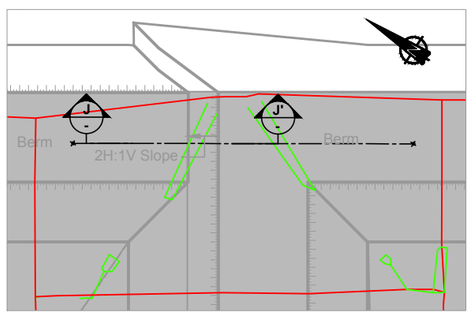
WATER POND LINER STAKE-OUT TABLE			
ID	Northing	Easting	Elev. □m□
LW-01	755□□7□.20	□325□□.55	5□.□0
LW-02	755□□□3.□3	□325□5.□3	5□.□0
LW-03	755□□□□.20	□325□□.00	55.□0
LW-0□	755□500.□□	□32□07.□□	55.□0
LW-05	755□□□□.□7	□32□10.□□	5□.□0
LW-0□	755□□□□.□□	□32□1□.□□	5□.□0
LW-07	755□532.□□	□325□2.70	5□.□0
LW-0□	755□52□.25	□325□1.□3	5□.□0
LW-0□	755□525.□□	□325□1.25	55.□0
LW-10	755□511.23	□325□□.5□	55.□0
LW-11	755□511.□1	□325□□.7□	5□.□0
LW-12	755□512.□□	□325□2.5□	5□.□0
SNOW POND LINER STAKE-OUT TABLE			
LS-01	755□513.1□	□325□2.25	5□.50
LS-02	755□51□.□□	□325□□.7□	5□.50
LS-03	755□517.□3	□325□5.3□	55.50
LS-0□	755□531.□7	□325□7.05	55.50
LS-05	755□531.30	□325□□.□2	5□.50
LS-0□	755□532.□5	□325□2.3□	5□.50
LS-07	755□553.□□	□3257□.□5	5□.50
LS-0□	755□5□□.□5	□32577.77	5□.50
LS-0□	755□5□□.□□	□32577.20	55.50
LS-10	755□532.□3	□32555.51	55.50
LS-11	755□533.21	□32552.7□	5□.50
LS-12	755□53□.0□	□325□□.51	5□.50
SOIL POND LINER STAKE-OUT TABLE			
LL-01	755□53□.□□	□325□7.□□	5□.00
LL-02	755□53□.□0	□32550.51	5□.00
LL-03	755□53□37	□32551.0□	55.00
LL-0□	755□553.□1	□32572.7□	55.00
LL-05	755□553.0□	□32575.55	5□.00
LL-0□	755□55□.□□	□3257□.12	5□.00
LL-07	755□575.□2	□325□□.37	5□.00
LL-0□	755□571.3□	□325□3.50	5□.00
LL-0□	755□5□□.□2	□325□2.□2	55.00
LL-10	755□55□.37	□325□1.23	55.00
LL-11	755□55□.□5	□3253□.□□	5□.00
LL-12	755□555.□2	□3253□.23	5□.00

SUMP LINER STAKE-OUT TABLE			
ID	Northing	Easting	Elev. (m)
SU-01	7559510.74	432571.59	55.40
SU-02	7559532.42	432557.76	55.19
SU-03	7559554.17	432543.48	54.68

NOTE

1. Liner surface highlighted with grey hatch. 0.1m □min.□of compacted ¾" crush is re□uired □elow liner for □edding surface.





DETAIL B (TYPICAL)

0 1 2 3 □ 5
Scale in Metres

J
-
SECTION J
Not to Scale

LEGEND

- As-□uilt Liner Seam or Edge
- As-□uilt Liner Patch
- As-□uilt Sump Welds

0 3 6 9 12 15
Scale in Meters

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
–	–		

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
AB	AS-BUILT	MMM	LW	04/20/12
1	SUMP DETAILS ADDED	JBK	LW	07/11/11
0	ISSUED FOR CONSTRUCTION	JBK	EMR	06/28/11

REVISIONS

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CHECKED:	APPROVED:	DATE:
MMM	EMR	APR. 20, 2012

FILE NAME: 1CH008.033-Land Farm_Liner-LF-08.dwg

NEWMONT NORTH AMERICA

HOPE BAY MINING LTD.

SRK JOB NO.: 1CH008.033/.058 SRK DWG NO.: LF-0□

Doris North Project

DRAWING TITLE:
Land Farm Liner
Plan View

NEWMONT DRAWING NO.	SHEET	REVISION NO.
HB□D-CIV-CIV-OND-0131	9 OF 9	AB

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Attachment 2: Appendix A: EPD 2009 – Environmental Guideline for Contaminated Site Remediation, Subscript Notes

Notes (Table 6):

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.

[0] 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”

Notes (Table 6):

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.

1 = 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-)

2 = Nonchlorinated phenolic compounds include

2,4-dimethylphenol

2,4-dinitrophenol

2-methyl 4,6-dinitrophenol

Nitrophenol (2-,4-)

Phenol

Cresol

3 = 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

4 = Chlorobenzenes include

All trichlorobenzene isomers

All tetrachlorobenzene isomers

Pentachlorobenzene

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

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

Landfarm Management and Monitoring Plan Module B: Boston

LANDFARM MANAGEMENT AND MONITORING PLAN
MODULE B: BOSTON

HOPE BAY, NUNAVUT

January 2017

PLAIN LANGUAGE SUMMARY

This Plan describes how hydrocarbon contaminated materials, including water, snow or soils originating from operations or closure at Boston will be managed. These materials will be temporarily stored in a dedicated lined facility until they can be relocated to the Doris Mine where it will be managed in accordance with the *Landfarm Management and Monitoring Plan Module A: Doris*, or placed in the Doris underground mine for permanent storage in accordance with the *Hope Bay Project Groundwater Management Plan*.

REVISION HISTORY

Revision #	Date	Section	Summary of Changes	Author	Approver
1	2012	All	Approved Plan under 2BB-BOS0712.	SRK	HBML
2	2017	Throughout	Changes to document structure for operational suitability and efficiency Changes operating approach to no longer treat contaminated soils, but to only provide for temporary storage.	SRK	TMAC

GLOSSARY AND ACRONYMS

TERM	DEFINITION
BTEX	benzene, toluene, ethylbenzene and xylene
CALA	Canadian Association for Laboratory Accreditation Inc.
CCME	Canadian Council of Ministers of the Environment
CWS	Canada Wide Standards
EC	electrical conductivity
EPD	Environmental Protection Division of the Nunavut Department of Environment
ESR	Environmental and Social Responsibility
HDPE	high density polyethylene
INAC	Indigenous and Northern Affairs Canada
LTA	Land Treatment Area
NWB	Nunavut Water Board
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PHC	petroleum hydrocarbon
QA/QC	Quality Assurance and Quality Control
SAR	sodium adsorption ratio
TMAC	TMAC Resources Inc.
TPH	total petroleum hydrocarbon

TABLE OF CONTENTS

List of Figures

List of Tables

1. INTRODUCTION

This Landfarm Management and Monitoring Plan Module B: Boston (the Plan) has been prepared by TMAC Resources Inc. (TMAC) in accordance with various water licences held by TMAC associated with developments throughout the Hope Bay region.

The Plan is intended primarily for use by TMAC and its contractors to ensure that best practices for minimizing potential environmental impacts and potential environmental liabilities with respect to hydrocarbon contaminated water, snow and soils (including waste rock and ore) are followed, and that the conditions of water licences are met. The Plan has been prepared as part of the renewal of Water License 2BB-BOS1217 and is to be implemented under the renewed license.

The Boston land treatment area (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 1 and Figure 2).

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 3).

1.1. OBJECTIVES

Treatment of hydrocarbon contaminated water and snow can readily be done on site; however, treatment of hydrocarbon contaminated soils (including waste rock and ore) should, when possible be relocated to the Doris Mine for disposal underground, or alternately for temporary storage in the Doris Landfarm. The objective of this Plan is therefore to outline how these contaminated materials will be managed at the Boston Site prior to transport to the Doris Landfarm.

1.2. RELATED DOCUMENTS

Table 1 lists the documents related to the Landfarm Management and Monitoring Plan Module B: Boston.

Table 1: Documents Related to the Landfarm Management and Monitoring Plan Module B: Boston

Document Title	Year	Relevance
Landfarm Management and Monitoring Plan.	2017	Overarching Management Plan document
Landfarm Management and Monitoring Plan Module A: Doris.	2017	Management Plan for the Doris site. Material from Boston may be transported to Doris for management
Hope Bay Project Groundwater Management Plan	2016	This plan describes the approved procedures for disposing of hydrocarbon contaminated materials within the Doris mine

Roberts Bay

Roberts Bay Area

Roberts Lake

Doris Camp

Doris Lake

Ogama Lake

Windy Lake

Windy Camp

Spyder Lake

Boston Camp

Patch Lake

41km To Boston Camp

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

srk consulting

SRK JOB NO.: 1CT022.019

FILE NAME: 1CT022.019_Boston_LFM&MP_Overview_rev01.dwg

TMAC RESOURCES

Hope Bay Project

Landfarm Management and Monitoring Plan
Module B: Boston

Hope Bay Project Overview

DATE:	APPROVED:	FIGURE:
January 2017	EMR	1

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