BACK RIVER PROJECT
Landfarm Management Plan

October 2017

BACK RIVER PROJECT
LANDFARM MANAGEMENT PLAN

Table of Contents

List of Tables

TABLE **PAGE**

List of Appendices

Revision Log

Version	Date	Section	Page	Revision
1	October 2017	All	All	Supporting Document for Type A Water Licence Application, submitted to Nunavut Water Board for review and approval

Acronyms

CCME	Canadian Council of Ministers of the Environment
CEPA	*Canadian Environmental Protection Act*
BMP	Best Management Practice
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
FEIS	Final Environmental Impact Statement
GN	Government of Nunavut
INAC	Indigenous and Northern Affairs Canada
LMP or the Plan	Landfarm Management Plan
MAD	Main Application Document
MLA	Marine Laydown Area
NIRB	Nunavut Impact Review Board
NT/NWT	Northwest Territories
NWB	Nunavut Water Board
PHC	Petroleum Hydrocarbon
SOP	Standard Operating Procedures
TDG	Transportation of Dangerous Goods
QA	Quality Assurance
QC	Quality Control
WHMIS	Workplace Hazardous Materials Information System

1. Introduction

The Back River Project (the Project) is a proposed gold project owned by Sabina Gold & Silver Corp. (Sabina) within the West Kitikmeot region of southwestern Nunavut. It is situated approximately 400 kilometres (km) southwest of Cambridge Bay, 95 km southeast of the southern end of Bathurst Inlet (Kingaok), and 520 km northeast of Yellowknife, Northwest Territories. The Project is located predominantly within the Queen Maud Gulf Watershed (Nunavut Water Regulations, Schedule 4).

The Project is comprised of two main areas with interconnecting winter ice roads (Main Application Document [MAD] Appendix A, base Figure 2): Goose Property (MAD Appendix A, base Figure 3) and the Marine Laydown Area (MLA) (MAD Appendix A, base Figure 4) situated along the western shore of southern Bathurst Inlet. The majority of annual resupply will be completed using the MLA, and an approximately 160 km long winter ice road will interconnect these sites. Refer to the MAD Appendix A, base Figures 1 to 5 for general site layout and locations. A detailed project description is provided in the MAD.

This Landfarm Management Plan (LMP or the Plan) outlines the approach plan for managing hydrocarbon contaminated waste materials at the Project. The LMP and other management plans are intended to support the Type A Water Licence Application for the Project.

The Plan was prepared following the requirements of the Supplementary Information Guidelines (SIG) for Mining and Milling MM3 and Water Works M1, issued by Nunavut Water Board (NWB 2010 b, c); the Environmental Impact Statement (EIS) Guidelines issued by the Nunavut Impact Review Board (NIRB) to Sabina (NIRB 2013); and in accordance with Best Management Practices (BMPs) and in conformance with current Federal and Territorial statutory requirements (see Section 3 Applicable Legislation and Guidelines).

This plan is a living document to be updated upon changes in related regulatory requirements; management reviews; incident investigations; changes to facility operation or maintenance, and environmental monitoring results; best practice updates; or other Project specific protocols once construction starts through to Project closure activities. Any updates will be filed with the Annual Report submitted under the Type A Water Licence.

The information presented herein is current as of September 2017. An update will be initiated prior to the start of construction. The Plan will be reviewed and updated at least annually. Completion of the review of the Plan will be documented through signatures of the personnel responsible for reviewing, updating, and approving the Plan.

Sabina will maintain a distribution list providing contact details for all parties to receive the Plan including key personnel, contractors, organizations, and external agencies.

2. Scope and Objectives

The LMP is one of the documents that forms part of Sabina's overall Waste Management Program for the Project. This plan has been written to meet requirements of a Type A Water Licence and applies to all Sabina projects in the Kitikmeot region.

This plan is divided into the following components:

- Applicable Legislation and Guidelines (Section 3);
- Planning and Implementation (Section 4);
- Roles and Responsibilities (Section 5);
- Operation and Maintenance (Section 6);
- Landfarm Management and Operation (Section 7);
- Acceptable Landfarm Material (Section 8);
- Remediation Objectives (Section 9);
- Environmental Protection Measures (Section 10);
- Health and Safety (Section 11);
- Monitoring (Section 12);
- Record Keeping (Section 13);
- Environmental Reporting (Section 14);
- Adaptive Management (Section 15); and
- Reclamation (Section 16).

The overall goal of Sabina's LMP is to minimize potential effects of the Project on the environment from its landfarm management activities; this objective will be achieved through proper management practices. These practices include the development of systems and procedures for the proper handling and disposal of landfarm acceptable wastes, and to comply with all applicable legislation, regulations, authorizations, permits, and licenses for the duration of the Project. Refer to the waste disposal related documents for handling and disposal of other types of waste generated on-site.

The scope of the LMP includes hydrocarbon contaminated soil, snow, and ice at the MLA and Goose Property. For the purposes of this plan, the term landfarming refers to the process whereby hydrocarbon-contaminated soils are distributed and spread out in thin layers (usually approximately 0.5 m thick), nutrients are added, and the soil is periodically mixed (Paudyn et. al, 2008). In this process, hydrocarbons are removed through a combination of volatilization and microbial biodegradation.

2.1 RELATED DOCUMENT

Documents within the Application for the Type A Water Licence which support this plan include the following:

- Risk Management and Emergency Response Plan (Supporting Document [SD]-15);
- Environmental Management and Protection Plan (SD-20);
- Incineration Management Plan (SD-11);
- Landfill and Waste Management Plan (SD-10);
- Hazardous Materials Management Plan (SD-13);
- Tailings Management Plan (SD-09);
- Mine Waste Rock Management Plan (SD-08);
- Fuel Management Plan (SD-16); and
- Occupational Health and Safety Plan (FEIS Volume 10, Chapter 25).

3. Applicable Legislation and Guidelines

Specific legislation, regulations and guidelines related to waste management in Canada, and specifically within Nunavut, are summarized in Table 3.1-1. Waste management in Nunavut is regulated under:

- *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (2002);
- *Nunavut's Public Health Act* (1988);
- N*unavut Environmental Protection Act* (1988);
- *Canadian Environmental Protection Act* (1999); and
- *Federal Transportation of Dangerous Goods* (TDG) *Act* (1992).

Sabina will also be bound by the terms and conditions of its land use permits to be issued by Indigenous and Northern Affairs Canada (INAC) for Crown Lands, and the Kitikmeot Inuit Association for Inuit Owned Land, and its Type A Water Licence to be issued by the Nunavut Water Board (NWB).

Table 3.1-1. Applicable Legislation to Waste Management in Nunavut

Acts	Regulations	Guidelines
Federal		
Canadian Environmental Protection Act (CEPA; 1999)	Schedule 1: List of Toxic Substances Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2002-301)	Environment Canada (EC) Technical Document for Batch Waste Incineration (EC 2010) Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil (CCME 2001).
Transportation of Dangerous Goods Act, 1992 (1992) and Regulations	Regulations Amending the Transportation of Dangerous Goods Regulation (SOR/2012-245)	
Nunavut Waters and Nunavut Surface Rights Tribunal Act (2002)	Nunavut Water Regulations (2013)	
Territorial Lands Act (1985)	Territorial Land Use Regulations (CRC, c.1524) Northwest Territories and Nunavut Mining Regulations (CRC, c.1516)	Implications of Global Warming and the Precautionary Principle in Northern Mine Design and Closure (BGC 2003)
Hazardous Products Act (2015)	Controlled Products Regulations	Workplace Hazardous Materials Information System (WHMIS)
Territorial – Nunavut		
Nunavut *Environmental Protection Act* (1988)	Spill Contingency Planning and Reporting Regulations (NWT Reg (Nu) 068-93)	Environmental Guideline for Contaminated Site Remediation (GN 2009)
Nunavut *Public Health Act* (1988)		
Safety Act (1988)	Occupational Health and Safety Regulations (2016)	
Workers' Compensation Act (2007)	Workers Compensation General Regulations (2010)	
Territorial – Northwest Territories		
Northwest Territories Environmental Protection Act (1988)	Used Oil and Waste Fuel Management Regulations (NWT Reg. 064-2003).	Mine Site Reclamation Guidelines for the Northwest Territories (AANDC 2013)

In addition to the mandatory requirements, a number of waste management guidelines have been considered in the preparation of this plan, and/or will be considered in the design and operation of the Project landfarms, including:

- The Mackenzie Valley Land and Water Board's (2011) guidelines for developing a waste management plan were followed in general development of the landfarm management plan;
- Mine closure guidelines developed by the Department of INAC (2013) were followed regarding specific landfarm design and mitigation for potential impacts pertaining to waste;
- The Federal Guidelines for Landfarming Petroleum Hydrocarbon Contaminated Soils (FCSAP 2013) were referenced in the design of the landfarm and in the development of the landfarm management plan; and
- The Government of Nunavut Environmental Guideline for Contaminated Site Remediation (GNU Department of Environment 2009) was used to develop the target end points for soil treatment.

4. Planning and Implementation

The LMP considers existing (baseline) conditions, potential impacts of the Project, conceptual mitigation strategies and specific mitigation measures to execute these strategies. Conceptual mitigation strategies and measures will continue to be elaborated and executed throughout the Construction, Operations, and Closure phases of mining.

Monitoring will be the principal mechanism to continually gauge the effectiveness of environmental performance. Operational control will be facilitated through contractor job-specific standard operating procedures (SOPs), work instructions, on-the-job instruction, tailgate meetings where required, contract requirements, and service agreements. The effectiveness of physical operational control will be reviewed according to preventative maintenance, and review procedures and schedules.

Responsible waste management begins by managing all waste materials, including hydrocarbon contaminated waste, within defined waste streams. Sabina is committed to undertaking waste collection, storage, transport and disposal in a safe, efficient and environmentally compliant manner by actively encouraging and implementing the four 'R's of waste management: waste Reduction, Reuse, Recycling, and Recovery, as illustrated in Image 4-1.

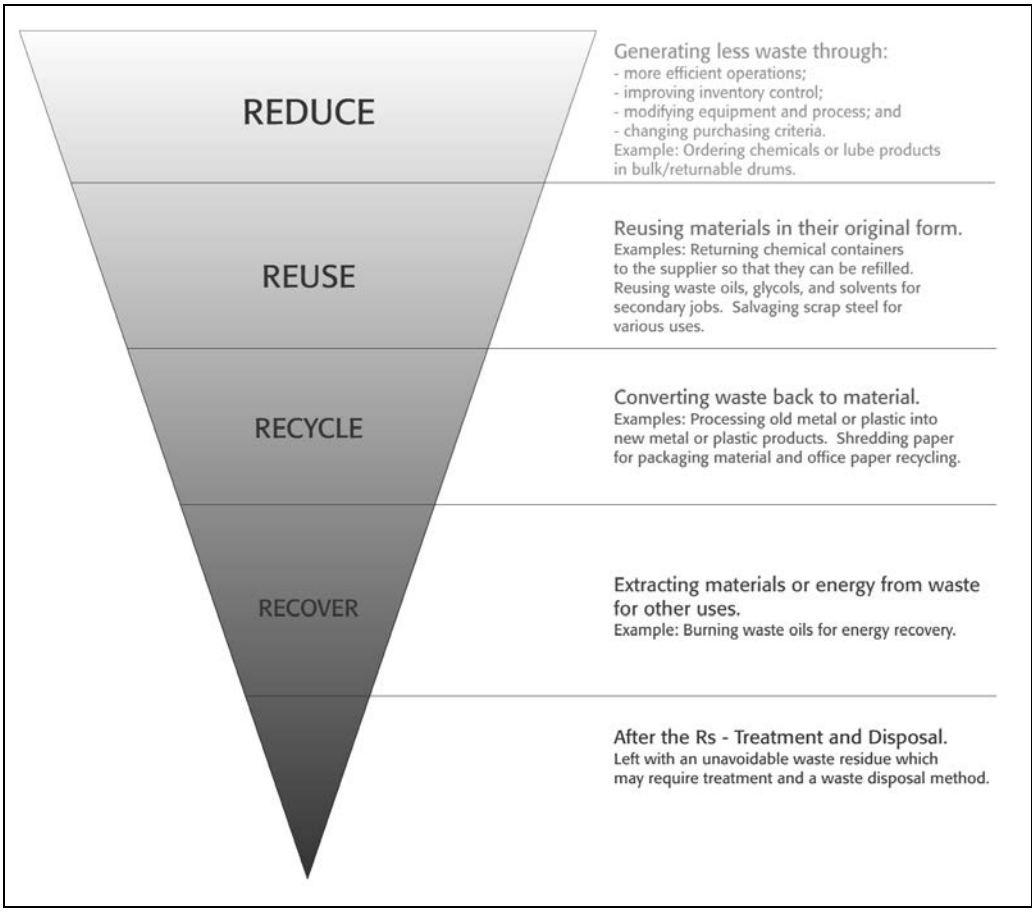


Image 4-1. Basic Principles of Waste Management

These basic principles of the waste management hierarchy will be executed throughout the Construction, Operations, Closure, and Post-Closure phases of mining. Where possible, Sabina will apply the four R waste management principles to hydrocarbon contaminated soils. Refer to Section 4 of the Landfill and Waste Management Plan (SD-10) for additional information on the four 'R's.

Sabina's overall implementation and management practices associated with landfarming of hydrocarbon contaminated soils benefit from understanding the current northern practices related to landfarming. A landfarm options analysis prepared for Agnico Eagle by Golder Associates Ltd. (2007) identified factors relevant to landfarming in the north. These included environmental factors and physical properties of the soil that affect microbial growth and rates of biodegradation, including temperature, pH, soil moisture, nutrient content, salinity, and soil particle size.

Although rates of biodegradation decline with temperature, landfarming is still a feasible technique applied and authorized in Arctic climates as demonstrated by the Meadowbank landfarm (Water Licence, 2AM-MEA1525) and Meliadine landfarm (Water Licence, 2AM-MEL1631) both operated by Agnico Eagle. Degradation in the north is typically restricted because microbial activity stops between 0 to -5°C restricting biodegradation to the months of June to September. Nevertheless, degradation has been reported at 90% over two summers on Resolution Island (Paudyn et al. 2008).

5. Roles and Responsibilities

The General Manager is ultimately responsible for the success of this plan and approves all relevant policies and documents, auditing, action planning and the verification process.

The Environmental Superintendent along with his/her direct reports are responsible for:

- Implementation of this plan including overall management of the plan and internal reporting;
- Operation, maintenance, and monitoring of the landfarm;
- Designation of training requirements;
- Auditing Project performance to ensure compliance; and
- Adaptive management.

All other Project personnel involved with waste management activities will be responsible for the effective implementation of this plan including: completion of required training, and maintaining compliance with training requirements as set out by this plan or by Sabina's SOPs and BMPs. All employees are to work in compliance with Health and Safety Laws and Regulations.

5.1 TRAINING

As part of orientation, all on-site personnel, including Sabina Personnel and contractors, will receive basic environmental and waste management training, including separating waste (combustible waste, hydrocarbon contaminated waste, and hazardous waste) and a familiarization with proper spill contingency measures.

The Sabina Sustainable Development Policy will be communicated to all on-site personnel during orientation, and it will be emphasized that it is everyone's responsibility to properly dispose of waste, including the sorting of waste and monitoring protocols.

Project personnel responsible for the handling of wastes will be fully trained in safe work and sorting procedures, and the identification of misdirected waste. Personnel working with waste materials will undertake formal training to ensure compliance with applicable legislation and Sabina's SOPs.

Safe handling procedures will be developed for all wastes at the Site, and employees will be trained in how to follow these procedures and BMPs. Personal protective equipment will be recommended by manufacturers and described in detailed SOPs for the safe handling of waste materials.

All personnel involved in the handling of hazardous wastes will receive Workplace Hazardous Materials Information System (WHMIS), Personal Safety and Protection and response training. Where applicable, personnel will receive TDG training.

Site-specific training will be provided by Sabina and renewed as required according to SOPs and legislative requirements. Contractors will be requested to provide copies of safety certificates, including First Aid, WHMIS, and TDG.

Sabina will manage and update training logs to ensure that all on-site staff are in compliance with the above, and have been suitably trained for their respective tasks.

Prior to commencing work at the landfarm, all workers involved with the operations must have a safety orientation. The orientation session will include:

- Physical and Chemical Hazards;
- Hazard Mitigation;
- Use and care of Personal Protective Equipment;
- Use and care of the monitoring equipment;
- Use and care of the Respiratory Protective Equipment; and
- Emergency procedures.

Refer to Section 11 for health and safety mitigation measures and monitoring.

6. Operation and Maintenance

6.1 LOCATION

Hydrocarbon contaminated soil, snow, and ice will be treated within dedicated landfarms to be located at both the Goose Property and MLA. Currently there are no existing landfarms at either the Goose Property or the MLA.

The overall site plans showing the main infrastructure for the Project, including the landfarms, is shown in figures A-01 and A-02. The Goose landfarm is proposed to be located directly south of the Goose Plant Site; the final location will be subject to final engineering optimization results. The MLA landfarm will be located at the construction laydown area.

A Landfarm Operation, Maintenance, and Monitoring Plan will be prepared and submitted to the NWB for approval 60-days prior to start of construction or as otherwise directed by the NWB. Below is an overview of Sabina's approach to landfarm design, operation, and closure.

6.2 LANDFARM DESIGN CONSIDERATIONS

The landfarms will be designed to receive soils, rock, snow, and ice contaminated with petroleum hydrocarbons, including light hydrocarbons such as diesel and gasoline. The design volume of the landfarm is based on allowances for materials being treated at similar northern mining operations (i.e., Meadowbank). Design considerations include:

- The facilities will be bermed and lined with a 60 mil HDPE liner. The berm height will be approximately 1.5 m above the bottom of the treatment area. A rock structural pad will be constructed below the landfarm cells. Medium weight, non-woven geotextile fabric will be placed on either side of the liner, with ¾" compacted granular fill also placed above and below the liner to protect it from tears. An orange plastic snow fencing material will be placed within the upper protective layer of granular fill along the base of the cell to act as indicator strip when moving/mixing soil with heavy equipment. See Figures A-03 through Figures A-06 for details of the design.
- Ramps will be constructed along one side of the cells for heavy equipment access to the treatment area(s) for mixing and soil addition/removal.
- The landfarm at the Goose Property will consist of three soil cells and one snow/ice cell (Figure A-03) so that soil can be segregated and treated based on level on petroleum hydrocarbon (PHC) impact. The landfarm at the MLA Property will consist of one soil cell and one smaller snow/ice cell (Figure A-05).
- The cells are constructed and contaminated materials placed. It may require more than one season to effectively achieve remediation objectives. Afterwards, soil may be removed and re-purposed. The process can start over again.
- Additional cells, or sub-cells, may be constructed or developed at the Goose Property and the MLA in response to operational needs. If additional cells are necessary, Sabina would do so only following NWB approval. Should forecasts indicate that additional cells are necessary, Sabina with provide notice of modification as required under the licence at least 60 days prior to the

disposal of waste. The modification request would include waste disposal quantities and volumes, disposal timing, effects to closure, and appropriate mitigation and monitoring plans.

- The facilities will be sloped with a 1% grade in the base of the cells to collect contact water and snow melt in sumps.
- The landfarm treatment areas will be sized to accommodate a target volume of soil, assuming a treatment depth of 0.5 m. Provisionally, this will be 1,050 m^3 at the Goose Property, and 170 m^3 at the MLA.
- The landfarm designs will be finalized to accommodate the actual construction site topography, borrow material properties, and landfarm sizing requirements.

7. Landfarm Management and Operation

Remediation of fine grained PHC contaminated soil in the landfarms will occur naturally through volatilization and aerobic microbial degradation. Soil aeration and addition of nutrient amendment are recognized as methods of improving rates of remediation. While it is also recognized that regulating pH, salinity, moisture content, and microbial population density also contributes to increased rates of degradation, these factors will not be explicitly investigated or managed unless remediation rates are too slow to allow meeting targets set for closure.

7.1 PLACEMENT IN THE LANDFARM

After excavation and transport of contaminated soil to the landfarm area, the soil will be dumped and spread. Where possible, highly impacted soil will be segregated from lightly and moderately impacted soil. The Goose landfarm has been designed with three separate treatment cells so that soil with varying degrees of impact can be treated separately. This will increase the treatment efficiency of the landfarm and will ensure that newly contaminated soil with elevated concentrations of PHCs is not mixed with soil that has been treated and is nearing the remediation objective. Based on the limited amount of impacted soil anticipated at the MLA site, only one cell is proposed; however, different areas of the cell will be designated for low and highly impacted soil.

The soil will be tilled as it is spread, continuing until all the soil has been deposited to ensure that the material has been well aerated. Materials identified as acceptable in the landfarm will be spread evenly to a maximum thickness of approximately 0.5 m. A record will be kept by the on-site Environmental Coordinator of the amount of contaminated soil placed in the landfarm, and the location of each load within it. Wherever possible, larger coarse material (rocks) will be separated from the finer material (sand and gravel) in the landfarm and assessed visually for PHC staining and product. If the material is saturated it will be spread to allow volatilization in a designated area of the landfarm.

7.2 AERATION

To promote aerobic conditions throughout the landfarms, soil will be mixed mechanically with earth-moving equipment. This turnover/tilling will occur approximately every two weeks during the summer months. Operational experience and adaptive management principles will be applied to assess effectiveness of frequency proposed. Care will be taken not to puncture or damage the liner during mixing. If the compacted granular fill or the orange snow fence indicator strip placed above the liner is encountered during mixing, the depth of excavation will be adjusted to a slightly shallower depth.

Following the last tilling/aeration session of the season, the landfarm cells will be winterized.

7.3 SOIL MOISTURE AND DUST CONTROL

Prior to tilling, site personnel will ensure that soil is not so dry as to generate significant dust, nor overly saturated. Ideally, the landfarm soil moisture level should be kept at approximately 40 to 85% of water-holding capacity (i.e., moist but not dripping wet) (FCSAP 2013). If soil is too dry, non-contaminated water from within the landfarm containment area, or as a contingency freshwater, will be used as a moisture source and sprayed on the piles.

7.4 NUTRIENT AMENDMENT

Biodegradation requires that micro-organisms are meeting nutritional requirements. The carbon:nitrogen:phosphorus ratio within the soil will be maintained between 100:10:1 and 100:1:0.5 (FCSAP 2013). This will be conservatively calculated by assuming the total mass of PHCs in the soil represents the mass of carbon available for biodegradation (USEPA 1994). If the available nutrients are not sufficient, soil amendment in the form of commercial fertilizers, is required. Subject to NWB approval, the use of treated sewage sludge as a nutrient amendment may also be placed in the landfarm on an as needed basis, and only if the available nutrients are not sufficient. The use of treated sewage sludge as a nutrient amendment has precedent in the north. Sewage sludge as a nutrient source has also been proposed for the Milne Inlet Mary River Project (EBA 2010). This material not only provides the benefit of nutrients, but also adds organic matter to help retain moisture and microorganisms. The soil will be periodically sampled and analyzed for nutrient content to assess if nutrients should be applied.

7.5 WATER MANAGEMENT

Since the landfarm facility is uncovered to facilitate natural weathering, water accumulating inside the bermed area may come into contact with contaminated material. While the landfarm will have an impermeable liner, visual inspections by the Environment Department will be conducted for seepage of contact water coming through the perimeter berm, or the accumulation of water within the containment berm or sump. In the event of water accumulation, the ponded water will be tested to assess if it meets the discharge criteria presented in Table 7.5-1. In the event the water does not meet the discharge criteria, it will be treated and re-tested prior to discharge to the receiving environment.

Table 7.5-1. Proposed Landfarm Pooling Water Quality Discharge Criteria

Parameter	Maximum Average Concentration(mg/L)
pH	6.0 – 9.0
Total Suspended Solids	15
Oil and Grease	15 and no visible sheen
Benzene	0.370
Ethylbenzene	0.090
Toluene	0.002
Xylene	0.300

Sources: Nunavut Water Board Water Licence No: 2AM-MRY1325 (2013); Back River technical comment DEIS-ECCC-TC-30

7.6 SNOW MANAGEMENT

Snow and/or ice that has become impacted during winter operations will be transported to the landfarm for placement in the snow/ice cells. Following snowmelt, any meltwater produced will be handled as described above, and the base soil in these cells will be excavated and added to existing soil treatment cells.

8. Acceptable Landfarm Material

8.1 CONTAMINANTS

The landfarm facilities will only treat and/or store PHC contaminated soils that have been generated through mine related activities at the Project.

The following products are acceptable for treatment in the landfarm if used on-site and spilled on soil:

- diesel fuel;
- gasoline;
- aviation fuel (Jet A);
- hydraulic oil; and
- other light oil (e.g., engine oil, lubricating oil).

In the event the contaminant source is unknown, soil samples will be analyzed for PHCs and possibly additional contaminants prior to placement in the landfarm. Analysis for additional compounds will be determined by the Environment Department on a case-by-case basis. These additional parameters could include total metals, oil and grease, and volatile organic compounds. Concentrations of contaminants will be compared to the site background values (for metals) and/or criteria in the Government of Nunavut (GN) Guidelines for Contaminated Site Remediation (GN 2009). If this analysis indicates soil contamination above background or GN guidelines for any substance not approved for landfarming (i.e., non-PHC contaminants), the spill material will not be placed in the landfarm. This is to ensure that PHC contaminated soils are not contaminated with other products.

Spills of non-PHC material (e.g., solvents) will be placed in drums and stored on-site for shipment south to approved facilities.

8.1.1 Contaminated Snow/Ice

Petroleum hydrocarbon contaminated snow and ice will be placed in a separate designated cell within the landfarm and treated as contact water after snowmelt.

8.1.2 Contaminated Soil

Soil contaminated with the above-described petroleum hydrocarbon materials will be excavated and transported to the landfarm facility. Care will be exercised to ensure that the entire spill is excavated (verified by olfactory, visual assessment, or confirmatory sampling if necessary).

8.2 GRAIN SIZE

Volatilization of contaminants from very coarse, large-grain sized soil material will occur more rapidly (SAIC 2006). It has been noted that this material likely contains lower concentrations of contaminants due to a lower volume to surface area ratio, and can typically be screened out prior to landfarming (SAIC 2006). As a result, soils and rock material will be separated from larger-grained material, where possible. The soil fractions will be treated separately in the landfarm. Oil absorbent pads will be used to help remove visible product from coarse-grained material. Used absorbent materials will be incinerated.

8.3 DESIGN SPECIFICATIONS

The design criteria for the landfarms are outlined in Table 8.3-1. The landfarm footprint will be approximately 6,200 m^2 at the Goose Property and 1,800 m^2 at the MLA. Contaminated soil will be piled no more than 0.5 m high so that the material is below the crest height of the perimeter berm.

Table 8.3-1. Landfarm Design Criteria

Design Criteria	Goose Landfarm	MLA Landfarm
Potential peak volume of PHC impacted soil/rock during Construction, Operations, and Closure	1050 m^3 (see Section 8.4 below)	170 m^3 (see Section 8.4 below)
Remediation time	Assumed to be 3 years	Assumed to be 3 years
Thickness of PHC in containment facility	Maximum of 0.5 m	Maximum of 0.5 m
Facility Structure		
Facility base thickness	3 m of ROQ rock	3 m of ROQ rock
Slopes of Berm	3H:1V for exterior berms and 2H:1V for interior berms	3H:1V for exterior berms and 2H:1V for interior berms
Crest Width (m)	2.5 m	2.5 m
Berm Height (m)	1.5 m	1.5 m
Total Fill Thickness below Liner System (m)	150 to 300 mm of ¾" compacted granular fill	150 to 300 mm of ¾" compacted granular fill
Total Fill Thickness above Liner System (m)	600 mm of ¾" compacted granular fill	600 mm of ¾" compacted granular fill

It should be noted that the ROQ rock base thickness may be modified during detailed design and construction depending on the thermal stability of the underlying permafrost layer.

8.4 SOIL VOLUME REQUIREMENTS

The Goose landfarm is expected to effectively treat up to 6,150 m^3 of contaminated soil over the Construction, Operations, and Closure phases of the Project, and 500 m^3 of snow and ice annually. The MLA landfarm is expected to effectively treat up to 630 m^3 of contaminated soil over the Construction, Operations, and Closure phases of the Project, and 25 m^3 of snow and ice annually. Table 8.4-1 and Table 8.4-2 outline the estimated volumes of contaminated soils and rock, and contaminated snow and ice expected during each phase of the mine at the Goose Property and MLA, respectively.

Table 8.4-1. Estimated Volume of Contaminated Soil/Rock and Ice/Snow at Goose Property

Project Phase	Years	Annual Volume of PHC Impacted Soil/Rock (m^3)	Total Volume of PHC Impacted Soil/Rock (m^3)	Annual PHC Impacted Snow/Ice (m^3)
Construction	3	350	1050	500
Operations	10	350	3500	
Closure - Active Stage	2	350	700	
Closure - Passive Stage	6	150	900	
Estimated Potential Total			**6150**	

Table 8.4-2. Estimated Volume of Contaminated Soil/Rock and Ice/Snow at the Marine Laydown Area

Project Phase	Years	Annual Volume of PHC Impacted Soil/Rock (m^3)	Volume of PHC Impacted Soil/Rock (m^3)	Annual PHC Impacted Snow/Ice (m^3)
Construction	2	30	60	25
Operations	10	50	500	
Closure - Active Stage	1	70	70	
Closure – Passive Closure	6	0	0	
Estimated Potential Total			**630**	

As described in Agnico Eagle (2008), it is estimated that soils contaminated with light end PHCs would require three full summer seasons for complete remediation. The remediated soil will be used for construction of the Waste Rock Storage Areas cover if needed, or will be disposed of in one of the non-hazardous solid waste landfills.

9. Remediation Objectives

9.1 SAMPLING AND ANALYSIS

Soil within the landfarm cells will be sampled annually at the end of the summer season to determine if remediation objectives have been met (see Table 9.1-1). Representative composite samples will be taken of each of the landfarm cells for analysis for PHCs to estimate remaining PHC concentrations. The number of samples will be determined once the landfarm is in use and soil type and contaminant are confirmed. A sample grid may be established and then replicated seasonally to assess performance.

Clean disposable gloves will be used to transfer soil into the sample container. The gloves will be disposed of between sample locations. Sample containers will be provided by the analytical laboratory.

The soil samples collected during each sampling event will be submitted to an accredited chemical analysis laboratory under chain-of-custody. Samples will be analyzed for petroleum hydrocarbons including benzene, toluene, ethyl benzene, xylenes (the benzene, toluene, ethylbenzene, and xylene [BTEX] compounds), and PHC Fractions F1 through F4. As described above, nutrient concentrations may also be assessed during the treatment season to determine if sewage sludge should be applied to the soil to optimize the rate of biodegradation.

After two seasons of treatment in the landfarm, degradation rates will be assessed to estimate the total remediation time required for PHC contaminated soil under Project site conditions. If remediation to GN guidelines is feasible within the life-of-mine timeframe, landfarm operations will continue, with aeration and possible nutrient amendments as described above. If rates of degradation are not sufficient through the proposed landfarming, alternate options or modifications to the existing system will be further investigated.

The following parameters will be measured and compared with GN remediation criteria to determine whether PHC contaminated soil has been adequately remediated:

- BTEX; and
- PHC fractions 1 to 4.

The GN remediation criteria for industrial land use coarse-grained soils will be applied to the Project. Table 9.1-1 presents the applicable Tier 1 criteria.

Table 9.1-1. Summary of Relevant GN Tier 1 Soil Remediation Criteria for Surface Soil (mg/kg)

Land Use Criteria (mg/kg)	
Parameter	**Industrial**
PHC Fraction 1	240
PHC Fraction 2	260
PHC Fraction 3	1700
PHC Fraction 4	3300
Benzene	0.03
Ethylbenzene	0.082
Toluene	0.37
Xylene	11

9.2 SOIL REMOVAL

Oversized (very coarse-grained) soils within the landfarm will be assessed near the end of the summer season for PHC vapour concentrations and visually for PHC residue. The material may be washed at the discretion of the environment staff. All washing would occur on a soilless portion of the landfarm or in a truck bed, and runoff collected in the sump.

When sample analysis of fine-grained material at the end of a season indicates that concentrations of contaminants in one or more cells are below guidelines, soil from those areas of the landfarm will be deemed acceptable for removal from the treatment facility and reuse.

The remediated soil will be used for construction of the Waste Rock Storage Areas cover if needed or disposed of in one of the non-hazardous solid waste landfills. Soil that has not yet reached the GN guidelines will remain within the landfarm for further treatment.

10. Environmental Protection Measures

Sabina has an ongoing commitment to implementing environmental protection measures for all components of its operations. As previously indicated, Sabina is committed to undertaking waste collection, storage, transportation and disposal in a safe, efficient and environmentally compliant manner, by actively encouraging and implementing the four 'R's of waste management: waste reduction, reuse, recycling, and recovery.

For wildlife mitigation and management, refer to the Wildlife Mitigation and Management Plan (FEIS Addendum Volume 10, Chapter 10).

11. Health and Safety

Operation and sampling of the Landfarm will involve potential exposure to both physical and chemical hazards and noise. Physical hazards will include heavy lifting, operating heavy equipment, and continuous exertion during sampling and walking over soft and uneven soil.

Chemical hazards include potential exposure to petroleum hydrocarbons and sewage (used as a nutrient amendment) through:

- dermal contact (getting soil on the skin or in the eyes);
- ingestion (getting contaminated soil in the mouth); and
- inhalation (breathing in hydrocarbon vapours or dust).

11.1 HAZARD MITIGATION

Physical hazards can be mitigated by ensuring that there are adequate workers to lift and move heavy equipment.

Adequate breaks and job-sharing will be provided to minimize continuous exertion. All workers will be reminded to consume adequate fluids (e.g., water) during periods of exertion to prevent dehydration.

Provision of steps, ramps and railings into each cell will minimize the potential for slips and trips when entering a landfarm.

Noise exposure can be mitigated with the use of hearing protection. Hearing protection must be worn at all times while operating heavy equipment.

Mitigation of dermal contact exposure to hydrocarbons and sewage sludge will be achieved by providing Personal Protective Equipment including protective coveralls, boots, gloves and safety glasses that are to be worn whenever the workers are on the landfarm.

Potential exposure through ingestion will be mitigated by having the workers thoroughly clean hands and faces (with soap and water), and removing all Personal Protective Equipment before meals and breaks (including cigarette breaks).

Mitigation of potential exposure through inhalation will be mitigated by monitoring hydrocarbon vapour concentrations, avoiding working on the landfarm during times of high hydrocarbon volatilization (e.g., mid-day, high temperatures), managing moisture content in the soil to avoid dust, and provision of respiratory protective equipment.

11.2 VAPOUR MONITORING

Contamination limits[1] for inhalation of gasoline vapours have been developed for worksites in Nunavut. These limits are considered applicable to operation of the landfarm. Gasoline vapours tend to be more volatile than diesel vapours, and therefore the gasoline limits are considered conservative and protective.

The eight-hour limit for gasoline is 300 ppm, and the 15-minute limit is 500 ppm. If there is a potential for exposure to a vapour concentration in excess of 300 ppm, respiratory protective equipment will be required.

Concentrations of hydrocarbons vapours will be monitored on a regular basis while working on the landfarm. Monitoring will be conducted using a combustible gas detector that measures concentrations of hydrocarbon vapours in parts per million (ppm) for direct comparison to the limits explosive limit.

The combustible gas detector will be operated, calibrated and maintained as per the manufacturer's instructions. Records of maintenance and calibration will be kept with the instrument.

Monitoring will be conducted immediately prior to entering the landfarm. A walkover of the landfarm will be completed while holding the instrument at about waist level. When sampling, the gas detector will be held in the breathing zone, which may be lower than waist level.

[1] Occupational Health and Safety Regulations, Workers' Safety & Compensation Commission.

12. Monitoring

Sabina is also committed to implementing appropriate waste and runoff monitoring programs to satisfy regulatory requirements and achieve environmental protection. A summary of landfarm activities, analysis, and records are provided in Table 12-1. Waste and runoff monitoring requirements will be prescribed in the Type A Water Licence.

Table 12-1. Landfarm Activities, Analysis, and Records

Activity	Analysis	Frequency of Analysis	Record
Excavation of spill and transport of contaminated material to landfarm	If unsure of full excavation - F1-F4, BTEX If contaminant source unknown, case by case basis	As needed	Date, time and location of spill and excavation; estimated volume of spill; estimated quantity of excavated soil; storage/disposal location of excavated soil, if applicable. Any evidence of remaining product
Soil aeration	N/A	Every two weeks during the summer	Date and time of the aeration; location; soil condition
Soil treatment with sewage sludge as nutrient supplement	Visual inspection to ensure proper incorporation	As needed basis	Date and time; type of treatment (aeration or nutrient amendment); location in landfarm; any odour noticed during aeration
Sampling for progress of remediation	Hydrocarbon vapour; F1-F4, BTEX	Vapour – as needed; Laboratory - annually	Date and time; location; odour; laboratory report
Soil removal from landfarm	Removal subject to meeting GN criteria	Once criteria are met	Date and time; location; quantity of soil removed; final location
Ponded contact water	BTEX, oil and grease, lead, TSS, pH	Prior to any dewatering; if reused in landfarm, no sampling necessary	Date and time, location, laboratory report, in Annual Report
Seepage	Visual inspection	Weekly during summer	Location, extent, approximate depth, evidence of sheen
Identification of maintenance requirement	Visual inspection of landfarm	Weekly during summer	Inspected areas; condition of berm and base; previously unidentified safety concerns

13. Record Keeping

A maintenance log is required to be kept for regulatory review. The maintenance log will be used to record routine maintenance activities or operational changes, the date completed, personnel responsible, and observations during maintenance activities. The maintenance log will also note any problems encountered.

Regulatory compliance reporting requirements will be defined in various regulatory authorizations issued for the Project, including the water licence.

14. Environmental Reporting

It is expected that execution of this LMP (subject to ongoing updates) will be a condition of Sabina's Type A Water Licence for the Project. As such, the water licence will prescribe the required record keeping and reporting with respect to landfarm management. Such environmental reporting is expected to include:

- Filing of updates to the LMP with the NWB;
- Submission of design and as-built reports for landfarm facilities; and
- Reporting of landfarm management activities and monitoring results, as prescribed in the water licence.

An annual report will be prepared indicating the volume of material added to the facility, amount of material removed, disposal or reuse location, all analysis results, volume and type of nutrient addition, visual inspection results, and volume of contact water pumped.

Sabina will implement a series of Quality Assurance (QA) and Quality Control (QC) plans and programs at all levels of the waste management and landfill operation. QC procedures implemented as part of the LMP will be variable and program-specific. QA/QC procedures will be implemented immediately and updated as necessary based on findings of the year-end reporting.

The following additional QA/QC measures will also be implemented:

- Field notes will be recorded during all stages of the sampling and inspection events.
- Disposable sampling gloves are to be worn during the collection of samples and discarded between sampling events. Sampling tools are to be decontaminated between sampling points.
- All equipment will be calibrated prior to use and a record of the calibration kept with the instrument.
- All samples are to be collected in laboratory-supplied bottles and jars, and analyzed at a Canadian Association of Laboratory Accreditation (CALA) accredited laboratory. Chain-of-Custody procedures will be used for the shipment of samples to the analytical laboratory.
- All samples will be stored in accordance with laboratory quality assurance and quality control requirements prior to submission for analysis.

Internal audits and inspections will be conducted as required by permit and other regulatory requirements on all components related to the LMP. Qualified personnel will perform regular inspections of the landfarms to ensure that waste segregation and inventory are being documented correctly.

15. Adaptive Management

The LMP will be updated regularly to reflect the operating conditions at the Project during Construction, Operations, and Closure. The plan will be reviewed on a regular basis to incorporate any lessons learned, major changes to facility operation or maintenance, and environmental monitoring results. Any updates to the LMP will be filed with the Annual Report submitted under the Type A Water Licence unless otherwise requested by the NWB.

All employees will be informed of relevant updates, and the updated LMP will be located in a designated area at each site.

Sabina will retain all raw data records and annual reporting for at least two years in digital format. The updated LMP, raw data, and annual reporting will be made available by Sabina for review by the lands and waters inspectors, the NWB, and INAC.

16. Reclamation

The landfarms will be closed in accordance with the Interim Closure and Reclamation Plan (SD-26). The landfarms at both Project sites will be managed as long as it is efficient for the overall Project closure activities and closure schedule. After removal of all remediated material, and prior to closure and reclamation of each landfarm, the berm and base will be sampled to determine if these soils are free from PHC contamination. If the soils meet the required criteria (see Table 9.1-1), the landfarm area will be regraded to confirm positive surface drainage. The HDPE liner will be left in place and covered with overburden. If they do not meet the required criteria, the landfarm will be covered with 2 m of waste rock or other material used for reclamation. The surrounding berm will be breached to avoid water accumulation on the landfarm.

17. References

1985. *Hazardous Products Act*, RSC. C. H-3.

1985. *Territorial Lands Act*, RSC. C. T-7.

1988. *Environmental Protection Act*, RSNWT. C. E-7.

1988. *Environmental Protection Act*, RSNWT (Nu). C. E-7.

1988. *Public Health Act*, RSNWT (Nu). C. P-11.

1992. *Transportation of Dangerous Goods Act*, 1992, SC. C. 34.

1999. *Canadian Environmental Protection Act*, SC. C. 33.

Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations, SOR/2002-301.

Northwest Territories and Nunavut Mining Regulations, CRC, c.1516.

Territorial Land Use Regulations, CRC, C.1524.

Transportation of Dangerous Goods Regulation, SOR/2012-245.

Used Oil and Waste Fuel Management Regulations, NWT Reg. 064-2003.

Agnico Eagle (Agnico Eagle Mines Limited). 2008. Landfarm Design and Management Plan In Accordance with Water License 2AM-MEA0815, Meadowbank Gold Project, 20 p. + Figures and Appendix. October 2008.

AANDC, 2013. *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories*.

American Society of Civil Engineers and Canadian Society for Civil Engineering, 1996. *Cold Regions Utilities Monograph, 3rd Ed.* Edited by Daniel W. Smith. ISBN: 9780784474136.

BGC. 2003. Implications of Global Warming and the Precautionary Principle in Northern Mine Design and Closure. Prepared for Indian and Northern Affairs Canada by BGC Engineering Incorporated: Calgary, AB.

CCME. 2001. Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil. http://www.ccme.ca/ourwork/soil.html?category_id=43.

EBA. 2010. Hydrocarbon Impacted Soils Storage and Landfarm Facility Operations, Maintenance and Monitoring Plan, Milne Inlet, Mary River Project, Nunavut. Prepared for: Baffinland Iron Mines Corporation. Issued for Review. December 2010.

Environment Canada (EC). 2010. Technical Document for Batch Waste Incineration. http://www.ec.gc.ca/gddmw/default.asp?lang=En&n=F53EDE13-1.

Ferguson Simek Clark Engineers and Architects. 2003. *Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the NWT*. Report prepared for the Department of Municipal and Community Affairs, Government of Northwest Territories, April 2003.

Federal Contaminated Sites Action Plan (FCSAP), 2013. Federal Guidelines for Landfarming Petroleum Hydrocarbon Contaminated Soils. ISBN 978-1-100-22284-4

Golder (Golder Associates Ltd.). 2007. Landfarm Option Analysis, Meadowbank Gold Project, Nunavut. Prepared for Agnico-Eagle Mines Limited. August 23, 2007.

Government of the Northwest Territories. 1996. *Guidelines for the Preparation of and Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories.* Prepared by Diep Duong and Ron Kent, for the Department of Municipal and Community Affairs. October 1996.

Government of Nunavut Department of Environment (GN Department of Environment), 2009. Environmental Guideline for Contaminated *Site* Remediation was used to develop the target end points for soil treatment.

GN. 2011a. *Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities*. Government of Nunavut, Department of Environment, Environmental Protection Service. http://env.gov.nu.ca/sites/default/files/industrial_waste_discharges_2011.pdf.

GN. 2011b. *Environmental Guideline for Waste Asbestos. Nunavut Department of Environment, Environmental Protection Service*. http://env.gov.nu.ca/sites/default/files/waste_asbestos_2011.pdf.

GN. 2011c. *Environmental Guideline for Ozone Depleting Substances. Nunavut Department of Environment, Environmental Protection Service*. http://env.gov.nu.ca/sites/default/files/ozone_depleting_substances_2011.pdf.

GN. 2012. *Environmental Guideline for the Burning and Incineration of Solid Waste*. Government of Nunavut, Department of Environment, Environmental Protection Service. http://env.gov.nu.ca/sites/default/files/guideline_burning_and_incineration_of_solid_waste_2012.pdf.

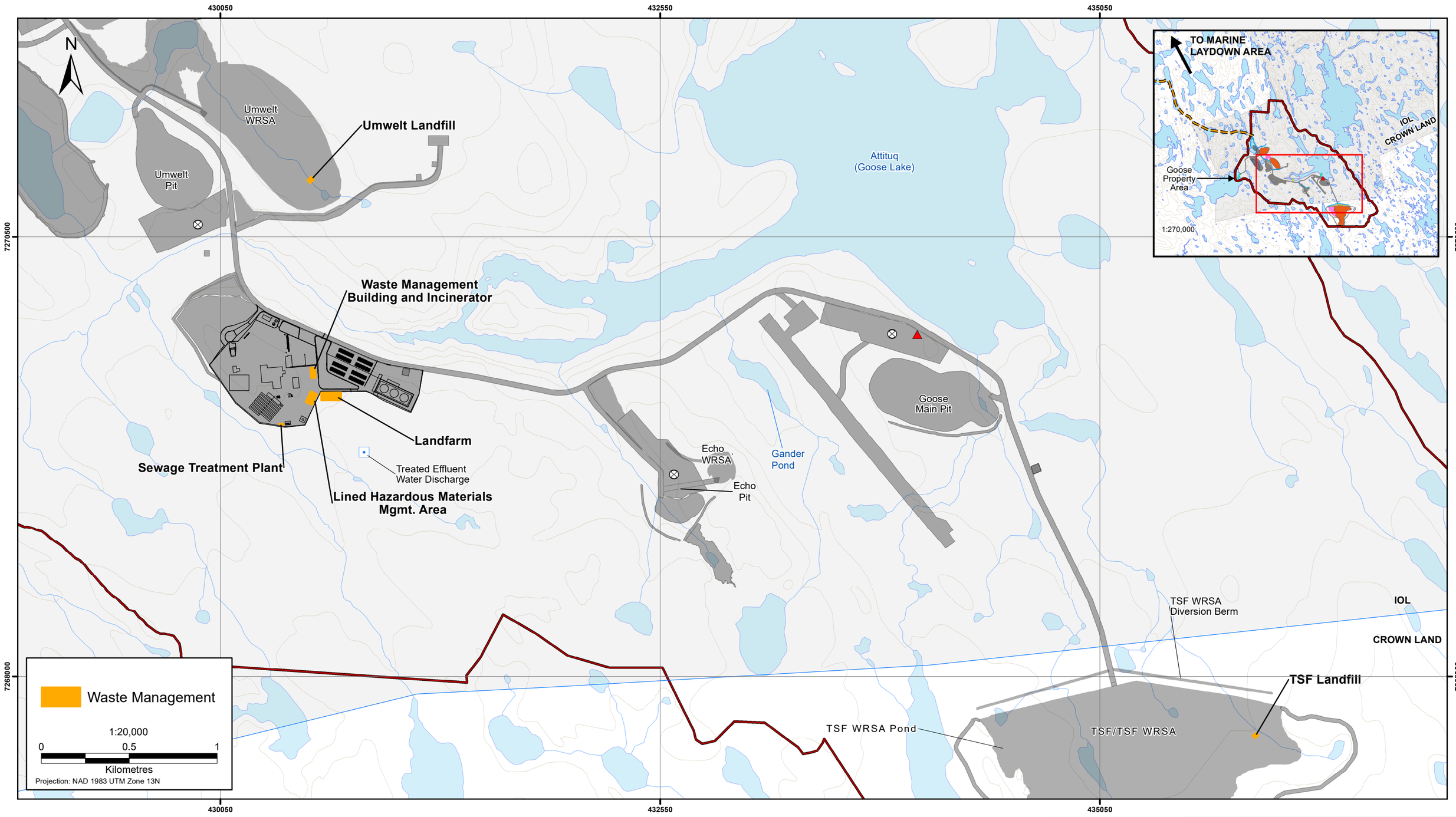
INAC. 1996. *QA/QC Guidelines for Use by Class "B" Licensees in Meeting SNP Requirements*.

Mackenzie Valley Land and Water Board. 2011. *Guidelines for Developing a Waste Management Plan*. March 31, 2011. Available at: http://mvlwb.com/sites/default/files/documents/MVLWB-Guidelines-for-Developing-a-Waste-Management-Plan-Mar-31_11-JCWG.pdf.

Paudyn, K, Rutter, A., Rowe, K., and Poland, J., 2008. *Remediation of Hydrocarbon Contaminated Soils in the Canadian Arctic by Landfarming*. Cold Regions Science and Technology, 53 (2008) 102-114.

United States Environmental Protection Agency (USEPA), 1994. How to Evaluate Alternative Cleanup Technologies for Underground Storage Tank Sites. Chapter V – Landfarming.

Appendix A. Figures



Sabina
GOLD & SILVER CORP.

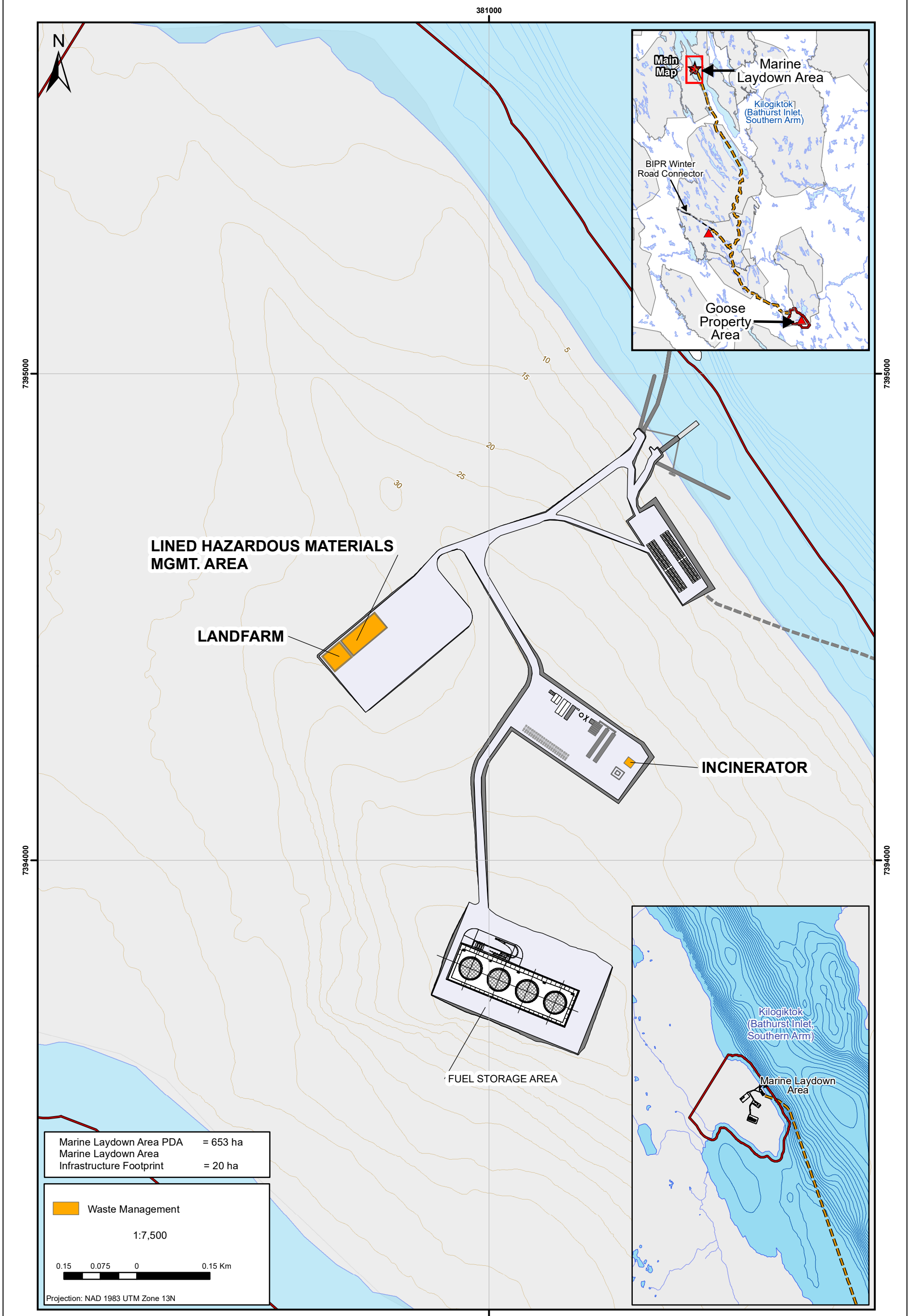
Goose Property Area
Waste Management Infrastructure
Type A Water Licence

Figure A-01

W:\BackRiver\04_Exploration\BackRiverRegion\GIS_Products_FEIS\ESRI_MXDs\Water Permitting _Back Up Figures and MXDs\BackRiverRegion Water_Permitting\BR_NA_tab_LMP_MLAWasteManagement_WL_A.mxd

GIS # BR_NA_tab_LMP_MLAWasteManagement_WL_A

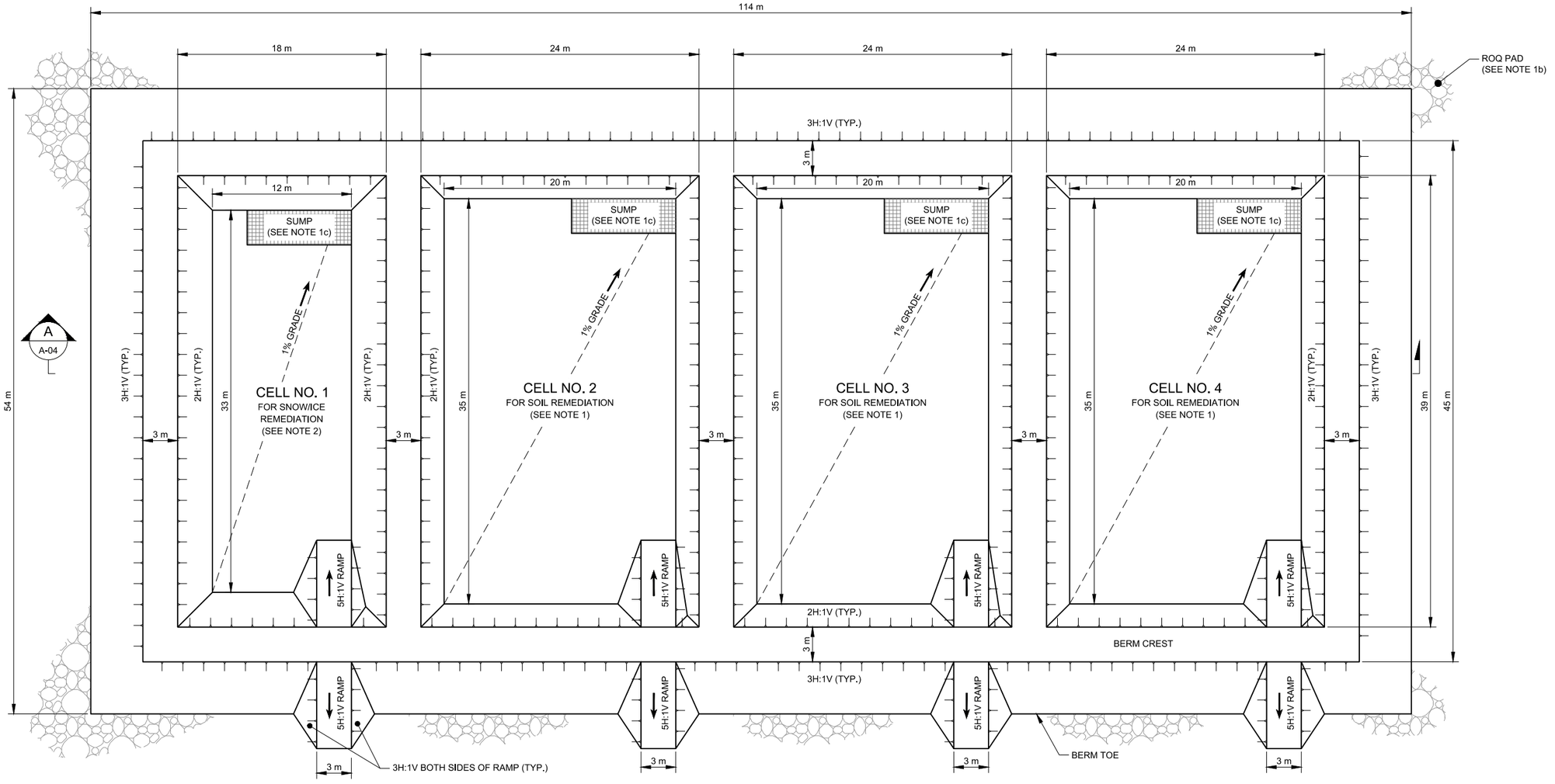
September 25 2017



Sabina GOLD & SILVER CORP.

Marine Laydown Area
Waste Management Infrastructure
Type A Water License

Figure A-02



NOTE(S)

1. GENERAL ARRANGEMENT IS CONCEPTUAL.
   a. REMEDIATION CELL DIMENSIONS ARE SUBJECT TO CHANGE AS PROJECT PROGRESSES. HENCE VOLUME ESTIMATES WILL BE REFINED SO THAT THE LANDFARM STRUCTURE DIMENSIONS AND BORROW MATERIAL VOLUMES CAN BE FURTHER DELINEATED TO THE ACTUAL VOLUMES OF CONTAMINATED SOILS, SNOW AND ICE.
   b. ROQ PADS ARE SUBJECT TO CHANGE AS PROJECT PROGRESSES. CONCEPT DRAWINGS ASSUME NO EXCAVATION IN THE AREA.
   c. SUMPS ARE SUBJECT TO CHANGE AS PROJECT PROGRESSES. VERIFY MINIMUM STORAGE CONTAINMENT ONCE LINER SELECTION HAS BEEN CONFIRMED. CONCEPT DRAWINGS ASSUME A 1H:1V SUMP SIDE SLOPES, 1 m DEEP AND;
   i. 3 m WIDE BY 9 m LONG FOR THE GOOSE PROPERTY AREA, AND;
   ii. 1.5 m WIDE BY 1.5 m WIDE FOR SNOW/ICE REMEDIATION CELL AND 3 m WIDE BY 4.5 m LONG FOR THE MLA .
2. SURFACE RUNOFF, SNOW AND ICE MELT, EQUIPMENT WASH DOWN, AND LEACHATE TO DRAIN TO SUMPS WITHIN EACH OF THE SOIL AND SNOW/ICE CELLS.
3. ¾-INCH GRANULAR FILL TO BE VERIFIED AND CONFIRMED UPON REVIEW OF GEOTECHNICAL INVESTIGATION.
4. ON SIDE SLOPES WHERE EQUIPMENT TRAFFIC IS NOT ACCESSIBLE THE GRANULAR FILL THICKNESS MAY BE REDUCED FROM 600 mm TO 300 mm.
5. NORTH ARROW NOT SHOWN UNTIL FINAL APPROVAL OF THE LOCATION AND ORIENTATION OF THE LANDFARMS.

REFERENCES:

1. DRAWING DOES NOT ADHERE TO ANY COORDINATE SYSTEM OR GRID.

ISSUED FOR

PERMITTING

0 10 20
1:400 METRES

CLIENT
SABINA GOLD & SILVER CORP.

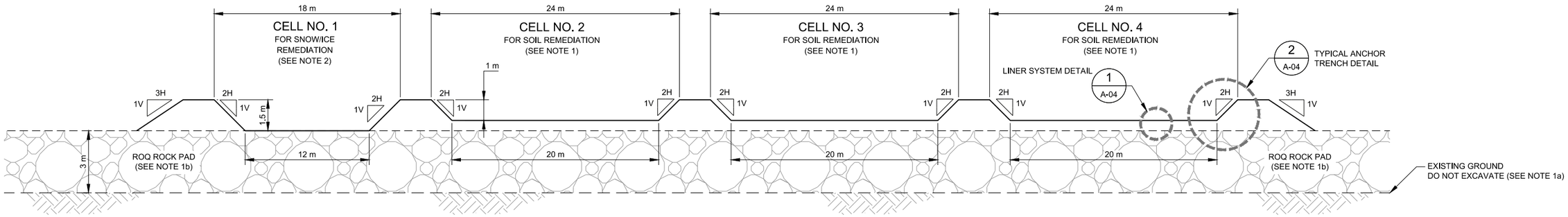
CONSULTANT
Golder Associates

YYYY-MM-DD	2016-06-14
DESIGNED	LR
PREPARED	CV
REVIEWED	JB
APPROVED	DF

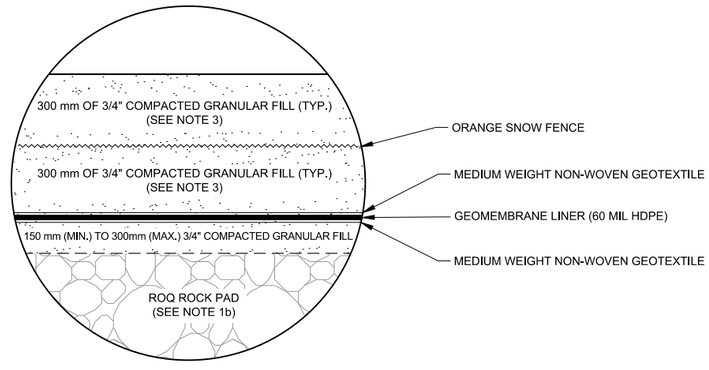
PROJECT
BACK RIVER PROJECT

TITLE
GOOSE PROPERTY AREA LANDFARM CONCEPT PLAN

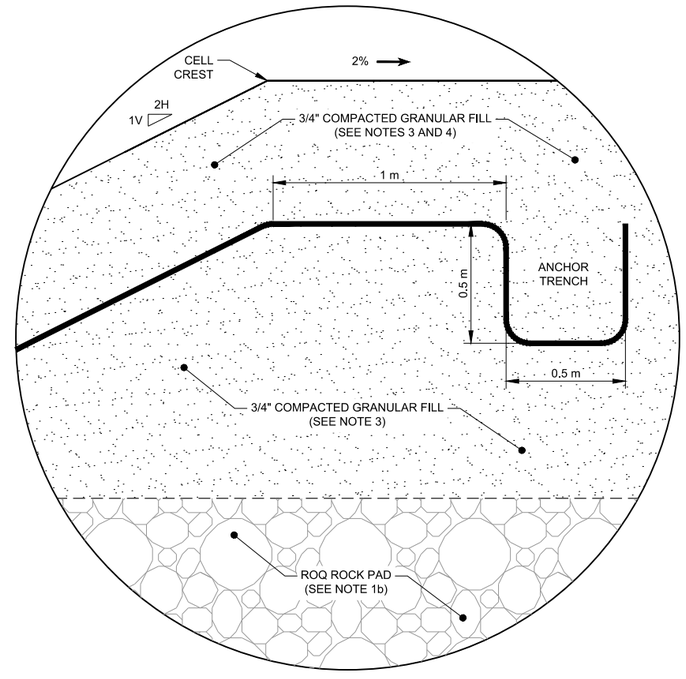
PROJECT NO.	REV.	FIGURE
1545534	A	A-03



SCALE 1:400 (A / A-03) TYPICAL SECTION - LANDFARM



SCALE 1:25 (1 / A-04) DETAIL - LINER SYSTEM



SCALE 1:25 (2 / A-04) DETAIL - TYPICAL ANCHOR TRENCH

NOTE(S)

1. GENERAL ARRANGEMENT IS CONCEPTUAL.
   a. REMEDIATION CELL DIMENSIONS ARE SUBJECT TO CHANGE AS PROJECT PROGRESSES. HENCE VOLUME ESTIMATES WILL BE REFINED SO THAT THE LANDFARM STRUCTURE DIMENSIONS AND BORROW MATERIAL VOLUMES CAN BE FURTHER DELINEATED TO THE ACTUAL VOLUMES OF CONTAMINATED SOILS, SNOW AND ICE.
   b. ROQ PADS ARE SUBJECT TO CHANGE AS PROJECT PROGRESSES. CONCEPT DRAWINGS ASSUME NO EXCAVATION IN THE AREA.
   c. SUMPS ARE SUBJECT TO CHANGE AS PROJECT PROGRESSES. VERIFY MINIMUM STORAGE CONTAINMENT ONCE LINER SELECTION HAS BEEN CONFIRMED. CONCEPT DRAWINGS ASSUME A 1H:1V SUMP SIDE SLOPES, 1 m DEEP AND;
   i. 3 m WIDE BY 9 m LONG FOR THE GOOSE PROPERTY AREA, AND;
   ii. 1.5 m WIDE BY 1.5 m WIDE FOR SNOW/ICE REMEDIATION CELL AND 3 m WIDE BY 4.5 m LONG FOR THE MLA .
2. SURFACE RUNOFF, SNOW AND ICE MELT, EQUIPMENT WASH DOWN, AND LEACHATE TO DRAIN TO SUMPS WITHIN EACH OF THE SOIL AND SNOW/ICE CELLS.
3. ¾-INCH GRANULAR FILL TO BE VERIFIED AND CONFIRMED UPON REVIEW OF GEOTECHNICAL INVESTIGATION.
4. ON SIDE SLOPES WHERE EQUIPMENT TRAFFIC IS NOT ACCESSIBLE THE GRANULAR FILL THICKNESS MAY BE REDUCED FROM 600 mm TO 300 mm.
5. NORTH ARROW NOT SHOWN UNTIL FINAL APPROVAL OF THE LOCATION AND ORIENTATION OF THE LANDFARMS.

REFERENCES:

1. DRAWING DOES NOT ADHERE TO ANY COORDINATE SYSTEM OR GRID.

ISSUED FOR

PERMITTING

CLIENT
SABINA GOLD & SILVER CORP.

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-06-14
DESIGNED	LR
PREPARED	CV
REVIEWED	JB
APPROVED	DF

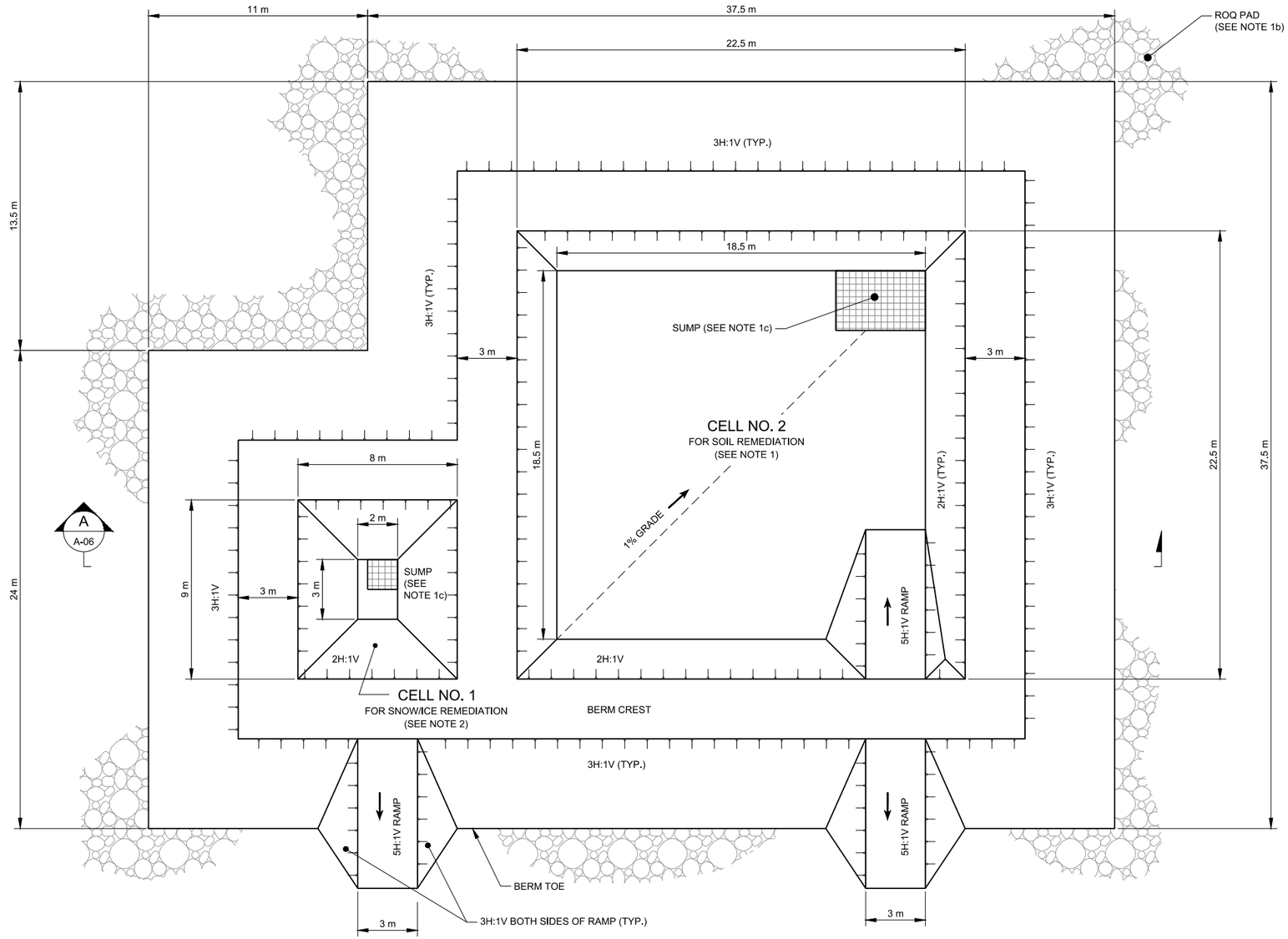
PROJECT
BACK RIVER PROJECT

TITLE
GOOSE PROPERTY AREA LANDFARM CONCEPT SECTIONS AND DETAILS

PROJECT NO.	REV.	FIGURE
1545534	A	A-04

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25 mm
0

Path: \\golder.gds\cal\gary\EDCAD\2015\1545534\production\FIGURES\ | File Name: 1545534FG04.dwg



NOTE(S)

1. GENERAL ARRANGEMENT IS CONCEPTUAL.
   a. REMEDIATION CELL DIMENSIONS ARE SUBJECT TO CHANGE AS PROJECT PROGRESSES. HENCE VOLUME ESTIMATES WILL BE REFINED SO THAT THE LANDFARM STRUCTURE DIMENSIONS AND BORROW MATERIAL VOLUMES CAN BE FURTHER DELINEATED TO THE ACTUAL VOLUMES OF CONTAMINATED SOILS, SNOW AND ICE.
   b. ROQ PADS ARE SUBJECT TO CHANGE AS PROJECT PROGRESSES. CONCEPT DRAWINGS ASSUME NO EXCAVATION IN THE AREA.
   c. SUMPS ARE SUBJECT TO CHANGE AS PROJECT PROGRESSES. VERIFY MINIMUM STORAGE CONTAINMENT ONCE LINER SELECTION HAS BEEN CONFIRMED. CONCEPT DRAWINGS ASSUME A 1H:1V SUMP SIDE SLOPES, 1 m DEEP AND;
   i. 3 m WIDE BY 9 m LONG FOR THE GOOSE PROPERTY AREA, AND;
   ii. 1.5 m WIDE BY 1.5 m WIDE FOR SNOW/ICE REMEDIATION CELL AND 3 m WIDE BY 4.5 m LONG FOR THE MLA .
2. SURFACE RUNOFF, SNOW AND ICE MELT, EQUIPMENT WASH DOWN, AND LEACHATE TO DRAIN TO SUMPS WITHIN EACH OF THE SOIL AND SNOW/ICE CELLS.
3. ¾-INCH GRANULAR FILL TO BE VERIFIED AND CONFIRMED UPON REVIEW OF GEOTECHNICAL INVESTIGATION.
4. ON SIDE SLOPES WHERE EQUIPMENT TRAFFIC IS NOT ACCESSIBLE THE GRANULAR FILL THICKNESS MAY BE REDUCED FROM 600 mm TO 300 mm.
5. NORTH ARROW NOT SHOWN UNTIL FINAL APPROVAL OF THE LOCATION AND ORIENTATION OF THE LANDFARMS.

REFERENCES:

1. DRAWING DOES NOT ADHERE TO ANY COORDINATE SYSTEM OR GRID.

ISSUED FOR

PERMITTING

0 5 10

1:250 METRES

CLIENT

SABINA GOLD & SILVER CORP.

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-06-14
DESIGNED	LR
PREPARED	CV
REVIEWED	JB
APPROVED	DF

PROJECT

BACK RIVER PROJECT

TITLE

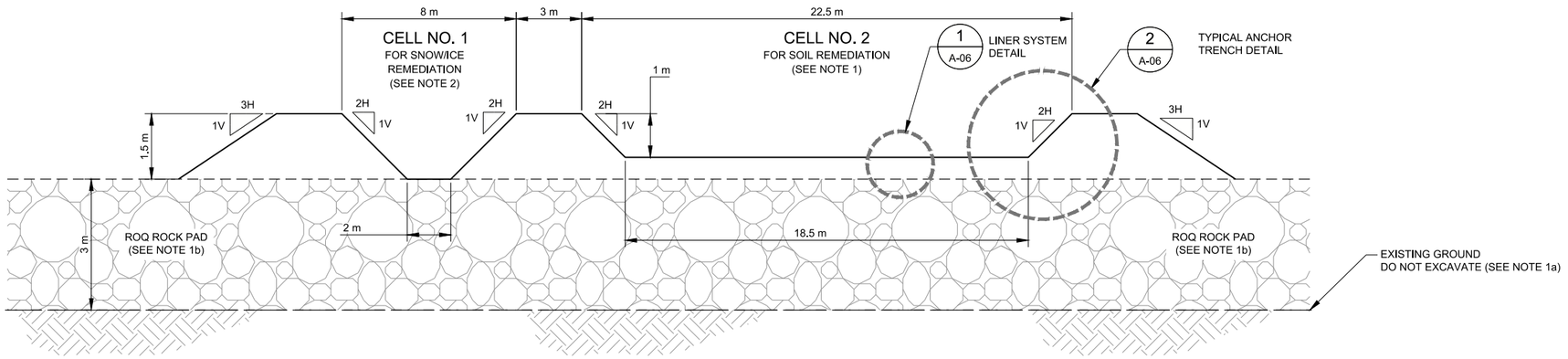
MARINE LAYDOWN AREA (MLA) LANDFARM CONCEPT PLAN

PROJECT NO. 1545534 | REV. A | FIGURE A-05

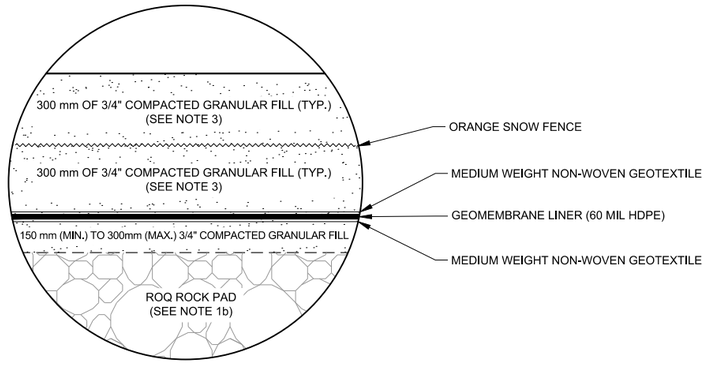
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm

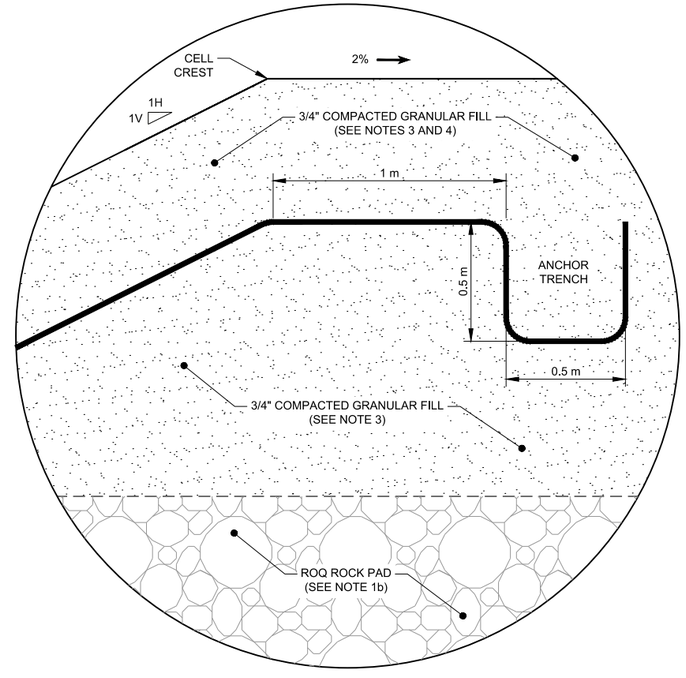
Path: \\golder.gds\calgary\EDCAD\2015\1545534\production\FIGURES\ | File Name: 1545534FG05.dwg



SCALE 1:250 2X VERTICAL SCALE — A / A-05 — TYPICAL SECTION - LANDFARM



SCALE 1:25 — 1 / A-06 — DETAIL - LINER SYSTEM



SCALE 1:25 — 2 / A-06 — DETAIL - TYPICAL ANCHOR TRENCH

NOTE(S)

1. GENERAL ARRANGEMENT IS CONCEPTUAL.
   a. REMEDIATION CELL DIMENSIONS ARE SUBJECT TO CHANGE AS PROJECT PROGRESSES. HENCE VOLUME ESTIMATES WILL BE REFINED SO THAT THE LANDFARM STRUCTURE DIMENSIONS AND BORROW MATERIAL VOLUMES CAN BE FURTHER DELINEATED TO THE ACTUAL VOLUMES OF CONTAMINATED SOILS, SNOW AND ICE.
   b. ROQ PADS ARE SUBJECT TO CHANGE AS PROJECT PROGRESSES. CONCEPT DRAWINGS ASSUME NO EXCAVATION IN THE AREA.
   c. SUMPS ARE SUBJECT TO CHANGE AS PROJECT PROGRESSES. VERIFY MINIMUM STORAGE CONTAINMENT ONCE LINER SELECTION HAS BEEN CONFIRMED. CONCEPT DRAWINGS ASSUME A 1H:1V SUMP SIDE SLOPES, 1 m DEEP AND;
   i. 3 m WIDE BY 9 m LONG FOR THE GOOSE PROPERTY AREA, AND;
   ii. 1.5 m WIDE BY 1.5 m WIDE FOR SNOW/ICE REMEDIATION CELL AND 3 m WIDE BY 4.5 m LONG FOR THE MLA .
2. SURFACE RUNOFF, SNOW AND ICE MELT, EQUIPMENT WASH DOWN, AND LEACHATE TO DRAIN TO SUMPS WITHIN EACH OF THE SOIL AND SNOW/ICE CELLS.
3. ¾-INCH GRANULAR FILL TO BE VERIFIED AND CONFIRMED UPON REVIEW OF GEOTECHNICAL INVESTIGATION.
4. ON SIDE SLOPES WHERE EQUIPMENT TRAFFIC IS NOT ACCESSIBLE THE GRANULAR FILL THICKNESS MAY BE REDUCED FROM 600 mm TO 300 mm.
5. NORTH ARROW NOT SHOWN UNTIL FINAL APPROVAL OF THE LOCATION AND ORIENTATION OF THE LANDFARMS.

REFERENCES:

1. DRAWING DOES NOT ADHERE TO ANY COORDINATE SYSTEM OR GRID.

ISSUED FOR

PERMITTING

CLIENT
SABINA GOLD & SILVER CORP.

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-06-14
DESIGNED	LR
PREPARED	CV
REVIEWED	JB
APPROVED	DF

PROJECT
BACK RIVER PROJECT

TITLE
MARINE LAYDOWN AREA (MLA) LANDFARM CONCEPT SECTIONS AND DETAILS

PROJECT NO.	REV.	FIGURE
1545534	A	A-06

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25 mm

Path: \\golder.gds\calgary\EDCAD\2015\1545534\production\FIGURES\ | File Name: 1545534-FG06.dwg