



# GOOSE PROJECT

## INTERIM CLOSURE AND RECLAMATION PLAN VERSION 5.0

DATE  
June 2026

REFERENCE  
0814868



# **GOOSE PROJECT**

## **INTERIM CLOSURE AND RECLAMATION PLAN VERSION 5.0**

June 2026

### **B2GOLD CORP.**

Suite 3400, Park Place, 666 Burrard Street  
Vancouver, British Columbia, Canada, V6C 2X8  
Telephone: +1 604 681 8371

[www.b2gold.com](http://www.b2gold.com)

## PLAIN LANGUAGE SUMMARY

---

The Interim Closure and Reclamation Plan (ICRP or Plan) outlines the activities and monitoring required for the temporary closure or permanent closure and reclamation of the Goose Project, previously the Back River Project (Project). For the purposes of the ICRP, the Closure Phase includes an Active and Passive Closure Stage, during which reclamation and remediation activities are undertaken, followed by a Post-Closure Phase, during which confirmatory testing is conducted to confirm closure activities have been effective. This Plan also outlines the progressive reclamation procedures to be undertaken when use of a particular portion of the Project has ceased.

It is anticipated that this Plan will be developed and updated further as the Project moves through Operations. A Final Closure and Reclamation Plan will be submitted at least 12 months prior to the end of mining in accordance with Part J, Item 2 of the Water Licence, 2AM-BRP1831 Amendment No. 1.

A Reclamation Liability Cost Estimate for the permanent closure of the fully constructed Project has been developed and is included in this Plan as Appendix D. This cost estimate is directly based on the closure and reclamation activities outlined in this Plan as well as the associated monitoring activities.

The Reclamation Liability Cost Estimate forms the basis for the security that will be set aside for the Project to confirm appropriate closure will take place regardless of the reasons for the closure.

The ICRP and associated Reclamation Liability Cost Estimate (Appendix D) are based on the previously approved versions submitted to the Nunavut Water Board (NWB), most recently in 2021. Revisions have been made to reflect the Project Modification Package to the NIRB (B2Gold 2026d) and the NWB (Sabina 2020a); FEIS Addendum to the NIRB (Sabina 2023); to address closure, reclamation, and cost estimate-specific requirements of the Project Certificate No. 007 Amendment No. 1 and Water Licence 2AM-BRP1831 Amendment No. 1; and the 2025 Modification Package.

## CONTENTS

---

PLAIN LANGUAGE SUMMARY	I
1. INTRODUCTION	1-1
1.1 Purpose and Scope of the Closure and Reclamation Plan	1-1
1.1.1 Project Description and Corporate Overview	1-1
1.1.2 Purpose and Scope of the Interim Closure and Reclamation Plan	1-1
1.2 Interim Closure and Reclamation Plan Goal and Framework	1-3
1.2.1 Closure Principles	1-3
1.3 Interim Closure and Reclamation Plan Team	1-4
1.4 Engagement	1-4
1.4.1 Key Consultation Findings	1-6
1.5 Regulatory Instruments for Closure and Reclamation	1-6
1.5.1 Legislation and Guidance Applicable to Mine Closure	1-6
1.5.2 Current Permits and Approvals	1-10
1.6 Additional Approved Development Infrastructure / Mining Areas	1-20
1.6.1 Descriptions of Additional Approved Development Infrastructure / Mining Areas	1-20
2. ENVIRONMENT	2-1
2.1 Atmospheric Environment	2-1
2.2 Physical (Terrestrial) Environment	2-1
2.2.1 Geotechnical Characteristics	2-2
2.2.2 Seismicity	2-3
2.2.3 Geology	2-3
2.2.4 Hydrogeology	2-3
2.2.5 Lake Bathymetry	2-4
2.2.6 Surface Hydrology	2-4
2.2.7 Archaeological Sites	2-5
2.3 Chemical Environment	2-5
2.3.1 Freshwater Water and Sediment Quality	2-5
2.3.2 Marine Water and Sediment Quality	2-5
2.3.3 Geochemical Characterization	2-5
2.4 Biological Environment	2-6
2.4.1 Vegetation and Special Landscape Features	2-6
2.4.2 Wildlife	2-6
2.4.3 Birds	2-7
2.4.4 Freshwater Fish and Aquatic Habitat	2-7
2.4.5 Freshwater Fish Communities	2-8

2.4.6	Marine Fish and Aquatic Habitat	2-8
2.4.7	Marine Fish Community	2-8
3.	PROJECT DESCRIPTION	3-1
3.1	Location and Access	3-1
3.2	Site History and Exploration	3-1
3.3	Construction and Operations	3-4
3.4	Project Summary	3-4
3.4.1	Goose Mine	3-4
3.4.2	Marine Laydown Area	3-5
3.4.3	Winter Ice Road	3-5
3.5	Life of Mine Plan	3-5
4.	PERMANENT CLOSURE AND RECLAMATION	4-1
4.1	Definition of Permanent Closure and Reclamation	4-1
4.2	Site-Wide Closure Considerations	4-2
4.2.1	Pre-Disturbance and Final Site Conditions	4-2
4.2.2	Closure Objectives and Criteria	4-2
4.2.3	Post-Closure Monitoring and Maintenance	4-6
4.3	Open Pit Mine Workings / Tailings Facilities	4-6
4.3.1	Open Pit / Tailings Facility Description	4-6
4.3.2	Pre-Disturbance, Existing, and Final Site Conditions	4-8
4.3.3	Closure Objectives and Criteria	4-8
4.3.4	Consideration of Closure Options and Selection of Closure Activities	4-8
4.3.5	Engineering Work Associated with Selected Closure Activity	4-12
4.3.6	Predicted Residual Effects	4-15
4.3.7	Uncertainties	4-15
4.3.8	Post-Closure Monitoring and Maintenance	4-16
4.3.9	Contingencies	4-16
4.4	Underground Mine Workings	4-17
4.4.1	Underground Mine Workings Description	4-17
4.4.2	Pre-Disturbance, Existing, and Final Site Conditions	4-18
4.4.3	Closure Objectives and Criteria	4-18
4.4.4	Consideration of Closure Options and Selection of Closure Activities	4-18
4.4.5	Engineering Work Associated with Selected Closure Activity	4-20
4.4.6	Predicted Residual Effects	4-20
4.4.7	Uncertainties	4-20
4.4.8	Post-Closure Monitoring and Maintenance	4-20
4.4.9	Contingencies	4-21
4.5	Waste Rock Storage Areas	4-21

4.5.1	Waste Rock Storage Areas Description	4-21
4.5.2	Pre-Disturbance, Existing, and Final Site Conditions	4-23
4.5.3	Closure Objectives and Criteria	4-23
4.5.4	Consideration of Closure Options and Selection of Closure Activities	4-23
4.5.5	Engineering Work Associated with Selected Closure Activity	4-25
4.5.6	Predicted Residual Effects	4-26
4.5.7	Uncertainties	4-26
4.5.8	Post-Closure Monitoring and Maintenance	4-26
4.5.9	Contingencies	4-27
4.6	Buildings and Equipment / Mine Infrastructure	4-27
4.6.1	Buildings, Equipment, and Mine Infrastructure Description	4-28
4.6.2	Pre-Disturbance, Existing, and Final Site Conditions	4-30
4.6.3	Closure Objectives and Criteria	4-30
4.6.4	Consideration of Closure Options and Selection of Closure Activities	4-30
4.6.5	Engineering Work Associated with Selected Closure Activity	4-34
4.6.6	Predicted Residual Effects	4-34
4.6.7	Uncertainties	4-34
4.6.8	Post-Closure Monitoring and Maintenance	4-35
4.6.9	Contingencies	4-35
4.7	Rock Fill Pads, Roads, and Airstrips	4-35
4.7.1	Pads, Roads, and Airstrips Description	4-35
4.7.2	Pre-Disturbance, Existing, and Final Site Conditions	4-36
4.7.3	Closure Objectives and Criteria	4-36
4.7.4	Consideration of Closure Options and Selection of Closure Activities	4-38
4.7.5	Engineering Work Associated with Selected Closure Activity	4-38
4.7.6	Predicted Residual Effects	4-38
4.7.7	Uncertainties	4-39
4.7.8	Post-Closure Monitoring and Maintenance	4-39
4.7.9	Contingencies	4-39
4.8	Waste Management Sites	4-39
4.8.1	Waste Management Site Description	4-39
4.8.2	Pre-Disturbance, Existing, and Final Site Conditions	4-41
4.8.3	Closure Objectives and Criteria	4-41
4.8.4	Consideration of Closure Options and Selection of Closure Activities	4-41
4.8.5	Engineering Work Associated with Selected Closure Activity	4-41
4.8.6	Predicted Residual Effects	4-43
4.8.7	Uncertainties	4-43
4.8.8	Post-Closure Monitoring and Maintenance	4-43
4.8.9	Contingencies	4-44

4.9	Water Management Systems	4-44
4.9.1	Water Management Systems Description	4-44
4.9.2	Pre-Disturbance, Existing, and Final Site Conditions	4-47
4.9.3	Closure Objectives and Criteria	4-47
4.9.4	Consideration of Closure Options and Selection of Closure Activities	4-47
4.9.5	Engineering Work Associated with Selected Closure Activity	4-47
4.9.6	Predicted Residual Effects	4-50
4.9.7	Uncertainties	4-50
4.9.8	Post-Closure Monitoring and Maintenance	4-51
4.9.9	Contingencies	4-51
4.10	Quarries and Borrow Sites	4-51
4.10.1	Quarries and Borrow Sites Description	4-51
4.10.2	Pre-Disturbance, Existing, and Final Site Conditions	4-52
4.10.3	Closure Objectives and Criteria	4-53
4.10.4	Consideration of Closure Options and Selection of Closure Activities	4-53
4.10.5	Engineering Work Associated with Selected Closure Activity	4-53
4.10.6	Predicted Residual Effects	4-55
4.10.7	Uncertainties	4-55
4.10.8	Post-Closure Monitoring and Maintenance	4-55
4.10.9	Contingencies	4-55
4.11	Reporting	4-55
5.	PROGRESSIVE RECLAMATION	5-1
5.1	Definition of Progressive Reclamation	5-1
5.2	Opportunities for Progressive Reclamation	5-1
5.2.1	Open Pits and Tailings Facilities	5-1
5.2.2	Underground Mines	5-2
5.2.3	Waste Rock Storage Areas	5-2
5.2.4	Buildings, Equipment, and Infrastructure	5-2
5.2.5	Contaminated Materials and Waste Disposal	5-2
5.3	Progressive Revegetation Studies	5-3
5.4	Completed Progressive Reclamation	5-3
6.	TEMPORARY CLOSURE	6-1
6.1	Temporary Closure Goal and Closure Objectives	6-1
6.2	Temporary Closure Activities	6-2
6.2.1	Short-Term Temporary Closure	6-2
6.3	Long-Term Temporary Closure	6-3
6.4	Temporary Closure Monitoring and Maintenance	6-4
6.5	Temporary Closure Contingency Program	6-5

6.6	Temporary Closure Schedule	6-5
6.7	Temporary Closure Reporting	6-5
7.	POST-CLOSURE SITE ASSESSMENT	7-1
8.	FINANCIAL SECURITY	8-1
9.	REFERENCES	9-1

## LIST OF TABLES

Table 1.5-1	Primary Acts, Regulations, and Guidelines Applicable to Closure and Reclamation	1-7
Table 1.5-2	Summary of Land and Water Access Permits / Licences for the Project	1-11
Table 1.5-3	ICRP Concordance with Project Certificate No. 007 and Water Licence 2AM-BRP1831	1-15
Table 2.3-1	Geochemical Classification Criteria for the Umwelt and Goose Main Deposits	2-6
Table 2.3-2	Site-Specific Geochemical Classification Criteria for the Echo and Llama Deposits	2-6
Table 3.2-1	Historical Ownership Milestones and Exploration/Development Summary	3-2
Table 4.2-1	Closure Objectives and Criteria – Site Wide	4-5
Table 4.3-1	Open Pit Physical Characteristics Summary	4-7
Table 4.3-2	Tailings Facility Estimated Volumes	4-7
Table 4.3-3	Closure Objectives and Criteria – Open Pit Workings	4-10
Table 4.4-1	Dimensions of Underground Workings at End of Operations	4-17
Table 4.4-2	Closure Objectives and Criteria – Underground Mine Workings	4-19
Table 4.5-1	Waste Rock Storage Area Descriptions	4-21
Table 4.5-2	Closure Objectives and Criteria – Waste Rock Storage Areas	4-24
Table 4.6-1	Closure Objectives and Criteria – Buildings and Equipment / Mine Infrastructure	4-32
Table 4.7-1	Closure Objectives and Criteria – Rock Fill Pads, Roads, and Airstrips	4-37
Table 4.8-1	Closure Objectives and Criteria – Waste Management Facilities	4-42
Table 4.9-1	Goose Mine Diversion and Containment Structure Summary	4-45
Table 4.9-2	Closure Objectives and Criteria – Water Management Facilities	4-48
Table 4.9-3	Water Management Structure Breach Schedule	4-50
Table 4.10-1	Closure Objectives and Criteria – Quarries and Granular Borrow Sites	4-54

## LIST OF FIGURES

---

Figure 1.1-1	Goose Project Overview	1-2
Figure 1.5-1	Goose Mine – Potential Development Area and Layout	1-13
Figure 1.5-2	Marine Laydown Area General Arrangement Plan at End of Operations	1-14
Figure 3.5-1	Project Phases and Stages	3-6
Figure 4.2-1	Goose Mine Area Orthophoto of Existing Conditions	4-3
Figure 4.2-2	Marine Laydown Area Orthophoto of Existing Conditions	4-4
Figure 4.3-1	Phase 4 – Post-Closure (Year 21+)	4-9
Figure 4.3-2	Phase 3 – Closure (Year 14 to Year 20)	4-14
Figure 4.6-1	MLA General Arrangement Plan at End of Closure	4-31

## LIST OF APPENDICES

---

Appendix A	Glossary of Terms and Definitions
Appendix B	List of Acronyms, Abbreviations, Units, and Symbols
Appendix C	Reclamation Studies
Appendix D	Reclamation Liability Cost Estimate

# 1. INTRODUCTION

---

## 1.1 PURPOSE AND SCOPE OF THE CLOSURE AND RECLAMATION PLAN

### 1.1.1 PROJECT DESCRIPTION AND CORPORATE OVERVIEW

The Goose Project, previously the Back River Gold Project (Project) and associated Project area is located in the west Kitikmeot region of southwestern Nunavut, approximately 95 km southeast of the southern end of Bathurst Inlet and 400 kilometer (km) southwest of the Hamlet of Cambridge Bay. The Project is comprised of two main areas: the Goose Mine and the Marine Laydown Area (Figure 1.1-1).

Sabina Gold & Silver Corp. (Sabina) acquired the property in 2012 and conducted exploration drilling and technical studies including a published Preliminary Economic Assessment. In 2023, B2Gold Back River Corp. acquired a 100% interest in Sabina and all of its assets, including the Goose Mine (Mine). The Project and all mineral tenure are wholly owned by B2Gold Back River Corp. (B2Gold Nunavut), a wholly-owned subsidiary of B2Gold Corp., which is a Canadian mining company headquartered in Vancouver, BC with international operations in Canada, Mali, Namibia, and the Philippines.

The Mine is composed of four mining areas: Echo, Umwelt, Llama, and Goose Main. The current mine plan includes development of Echo, Umwelt, Llama, and Goose Main open pits and undergrounds.

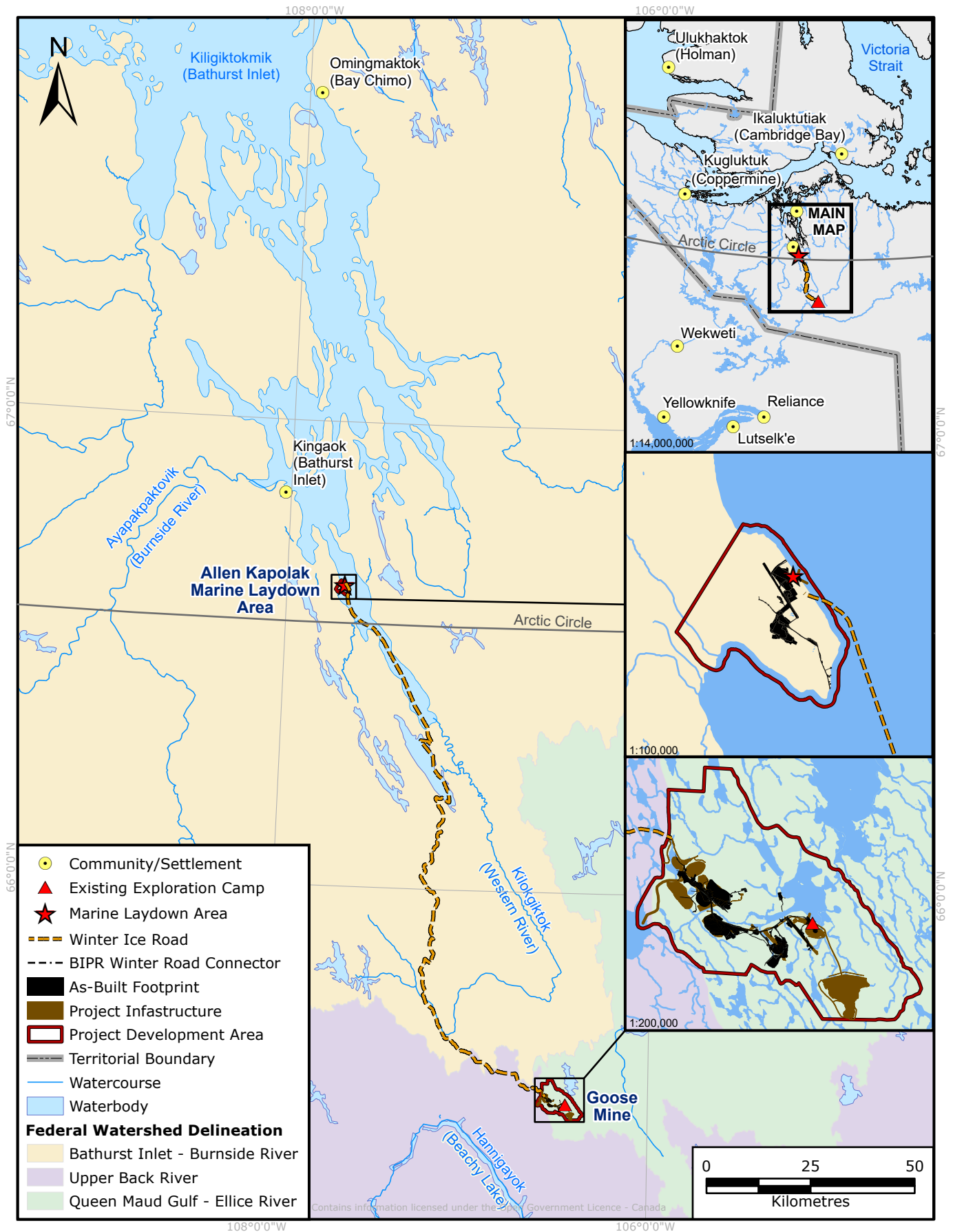
### 1.1.2 PURPOSE AND SCOPE OF THE INTERIM CLOSURE AND RECLAMATION PLAN

The Interim Closure and Reclamation Plan (ICRP or Plan) was developed to address and align with applicable regulatory guidance and requirements, including those of Water Licence 2AM-BRP1831 Amendment No. 1 (the Licence) and Project Certificate Amendment No. 1 (No. 007). Once approved by the Nunavut Water Board (NWB), this Plan will supersede all previous plans. This update of the ICRP addresses specific requirements outlined in the Licence and Project Certificate No. 007 related to closure, post-closure, reclamation, and cost estimation. This update specifically addresses the Licence requirement to submit an ICRP to the NWB within 12 months of commencing the Operation Phase in accordance with Part J, Item 1 of the Water Licence, 2AM-BRP1831 Amendment No. 1. This ICRP has been based on the current mine design as outlined in B2Gold Nunavut 2026 Modification and Management Plan Updates submitted to the NWB (B2Gold Nunavut 2026d).

This version of ICRP has been updated to align with the 2026 modifications and associated updates of management plans as well as the 2023 NIRB authorization of the Energy Centre Project (Amendment 1 to NIRB Project Certificate 07). A Final Closure and Reclamation Plan (FCRP) will be submitted at least 12 months prior to the end of mining (per Part J, Item 1 of the Licence).

For the purposes of this Plan, Closure is sub-divided into two phases: the Closure Phase (including Active Closure and Passive Closure stages) and the Post-Closure Phase. Active Closure refers to the stage during which the demolition, earth-moving, and waste disposal is undertaken. Passive Closure refers to the stage during which monitoring is the primary activity along with final closure activities. The Post-Closure Phase is primarily a monitoring phase during which closure success is monitored to confirm the site is stable.

FIGURE 1.1-1 GOOSE PROJECT OVERVIEW



Although this ICRP focuses on closure and reclamation-specific activities, mine closure planning is an iterative process that starts during Mine conception and continues until mine closure is complete following the end of mine life. During the conceptual development of this Project, extensive consideration was given to minimizing Project impacts and to facilitating an efficient, effective, and stable closure. These considerations are documented in Sabina's FEIS (Sabina 2015), Sabina's FEIS Addendum (Sabina 2023), and B2Gold Nunavut's 2026 Modification & Management Plan Updates (2026d), as well as in this ICRP. These documents also provide comprehensive descriptions of the pre-existing environmental conditions in the Project area. This baseline information informs the development of appropriate closure approaches and objectives for the Project. During Project Construction and Operations, a suite of management and monitoring programs ensure facilities are managed, and activities are conducted, in a manner that continues to minimize potential impacts and align with the closure principles outlined in this Plan.

## 1.2 INTERIM CLOSURE AND RECLAMATION PLAN GOAL AND FRAMEWORK

The reclamation and closure goal, closure objectives, and closure criteria provide a framework to evaluate success of closure plan implementation. The overall goal of closure is to return the mine site and affected areas to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities (Mackenzie Valley Land and Water Board; MVLWB 2013).

### 1.2.1 CLOSURE PRINCIPLES

B2Gold Nunavut is committed to environmentally responsible and socially acceptable exploration and mining practices. B2Gold Nunavut is dedicated to creating and maintaining a safe environment for both the land it occupies and the people that drive its success. B2Gold Nunavut also subscribes to the principles of sustainable development in mining. While mining cannot occur without an impact on the surrounding natural environment and communities, B2Gold Nunavut's responsibility is to limit negative environmental and social effects and to enhance positive effects.

The closure goal for the Goose Project is supported by four closure principles outlined in the MVLWB (2013) Closure Guidelines:

- ◆ **Physical stability** – Project components that remain on-site following the Passive Closure stage are physically stable (i.e., not prone to erosion, subsidence, or other forms of earth movement). Physical stability ensures that these Project components do not pose a long-term risk to humans, wildlife, or aquatic life.
- ◆ **Chemical stability** – Project components that remain on-site following the Passive Closure stage are chemically stable (i.e., seepage and/or water quality does not negatively impact the ability of the Project to meet closure water quality criteria). Closure water quality criteria will be developed to be protective of terrestrial and aquatic life.
- ◆ **No long-term active care requirements** – Any Project components remaining following the Passive Closure stage will not require long-term active care and maintenance.
- ◆ **Compatibility with future land uses** – The closure landscape should align with future land uses developed in collaboration with stakeholders and rights holders.

Relevant closure objectives and criteria for each Mine component are provided in Section 4. The proposed objectives and criteria are qualitative and largely describe closure activities. This approach is appropriate given the current Mine stage (i.e. early Operations). Closure criteria will be advanced in future iterations of the ICRP towards SMART (i.e., specific, measurable, achievable, relevant, and time-bound) criteria, which will be included in the FCRP as required by the NWB.

### 1.3 INTERIM CLOSURE AND RECLAMATION PLAN TEAM

The corporate address is: Park Place Suite 3400  
666 Burrard Street  
Vancouver, British Columbia  
V6C 2X8 Canada  
  
Tel: 604-681-8371  
Fax: 604-681-6209  
Toll Free: 800 316 8855

The Project site is located at: Latitude 65°32'42" N, Longitude 106°25'43" W (Goose Mine)  
Latitude 65°32'40" N, Longitude 106°25'32" W (MLA)  
Territory of Nunavut, Canada

The main contact person is: Macoura Koné, PhD., PGeol., PGeo.  
Manager, Environment  
Cell: 403-669-3231  
Fax: 587-701-0594  
Email: [Macoura.Kone@b2gold.com](mailto:Macoura.Kone@b2gold.com)

### 1.4 ENGAGEMENT

Public consultation, government engagement, and Traditional Knowledge (TK) were incorporated during the development of the FEIS, FEIS Addendum, and NWB regulatory review process. Public consultation and engagement are a legal requirement in Nunavut, an industry best practice, and an important corporate commitment. Effective public consultation and engagement helps ensure that community members are informed and knowledgeable about proposed projects, that community support for those projects is more readily obtained, and sustainable development goals are achieved. A key goal of B2Gold Nunavut's public consultation and engagement program has been to ensure the Company obtains a "social licence to operate," by securing the support of a majority of residents from potentially impacted local communities. To obtain this goal, a number of process goals have been followed:

- ◆ Identification and prioritization of communities and community stakeholder groups;
- ◆ Developing an understanding of key community and stakeholder views regarding the Project;
- ◆ Addressing community and stakeholder issues and expectations; and
- ◆ Continuous improvement.

B2Gold Nunavut continues to actively consult and engage the public as well as regulatory stakeholders relevant to the Project. B2Gold Nunavut's public consultation and engagement program is multi-faceted. It includes a commitment to cultural sensitivity and inclusiveness, and the use of various community engagement methods and tools. These include public meetings, meetings with key stakeholders and stakeholder groups, meetings with community advisory groups in Cambridge Bay and Kugluktuk, Project site visits, social media (e.g., websites and Twitter/email/RSS feeds), a Project newsletter, other distribution materials, establishment of a Cambridge Bay office, use of local employees and contractors including a Cambridge Bay-based Community Liaison Officer, execution of TK studies in partnership with the Kitikmeot Inuit Association (KIA) and Kugluktuk Hunters' and Trappers' Organization, execution of various socio-economic/environmental studies, the development of an Inuit Impact Benefit Agreement (IIBA) with the KIA, other forms of community engagement (e.g., radio shows, trade show participation, cross-cultural training, and community advertisements), and community donations. Engagement also occurs through standardized regulatory processes, from project assessment and permitting to renewal, amendment, and modification applications, and plan and study submissions.

B2Gold Nunavut recognizes that effective and satisfactory closure of this Project is of particular importance to the local communities and the landowners, represented by the KIA and the Crown. B2Gold Nunavut has and will continue to engage with the KIA, which is the primary Inuit organization with rights and responsibilities in the Project area, as well as the local communities. Kitikmeot Region communities have also been a key focus of B2Gold Nunavut's public consultation and engagement activities. Various levels of consultation and engagement were employed by B2Gold Nunavut depending on a community's proximity to the Project. The communities that have been the focus of B2Gold Nunavut's public consultation and engagement program include:

- ◆ Cambridge Bay (Ekaluktutiak);
- ◆ Kugluktuk (Coppermine);
- ◆ Kingaok (Bathurst Inlet);
- ◆ Omingmaktok (Bay Chimo);
- ◆ Gjoa Haven (Ursuqtuq);
- ◆ Taloyoak (Spence Bay);
- ◆ Kugaaruk (Pelly Bay); and
- ◆ Yellowknife.

A number of Northwest Territories Aboriginal organizations have also been engaged for the Project.

Ongoing consultation and engagement are managed through B2Gold Nunavut's Socio-Economic Monitoring Plan and the Back River Socio-Economic Monitoring Committee. Engagements are documented and reported in B2Gold Nunavut's annual report to the NIRB, as well as the KIA. Since June 2012, more than 300 meetings and major correspondences with Project stakeholders have occurred. Input and TK gained through these engagements have been incorporated into Project design and execution as well as monitoring programs and management plans, including the development of this ICRP. Further details of B2Gold Nunavut's engagement practices are outlined in the Socio-Economic Monitoring Plan, and engagement summaries are provided in the annual reports for the Project.

### 1.4.1 KEY CONSULTATION FINDINGS

Meeting minutes were taken during many of B2Gold Nunavut's public consultation and engagement activities and this information has been incorporated into a public consultation database. This database has been analyzed to identify key issues and concerns amongst communities and stakeholders.

Key issues and concerns identified through public consultation can be categorized under three main themes:

- ◆ Community benefits and engagement;
- ◆ Employment and training; and
- ◆ Environmental management and monitoring.

Information on these themes is presented in detail, along with B2Gold Nunavut's commitments to addressing key issues, in Volume 3 of the FEIS (Sabina 2015).

Of the key issues and concerns identified in the FEIS, the following items pertaining to closure were considered of particular importance during the development of this ICRP:

- ◆ Inuit culture, harvesting, and livelihoods should not be negatively affected by the Project.
  - ◇ B2Gold Nunavut has addressed this through the development of appropriate Closure goals and objectives.
- ◆ A comprehensive environmental management and monitoring program should be developed. Key areas of concern for local communities include: caribou, fish, water quality, mine tailings and contaminants, and other wildlife resources.
  - ◇ This is addressed in part by this ICRP as a whole, and in full by B2Gold Nunavut's comprehensive suite of management and monitoring plans and programs.
- ◆ Guarantees must be in place that mine closure will be done properly.
  - ◇ This is addressed through the maintenance of reclamation security defined in the Licence and based on the Reclamation Liability Cost Estimate (RLCE) included as Appendix D of this ICRP. This reclamation security is held by the KIA and the Minister of Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) and is sufficient to allow for the complete closure of the Project if necessary.

## 1.5 REGULATORY INSTRUMENTS FOR CLOSURE AND RECLAMATION

### 1.5.1 LEGISLATION AND GUIDANCE APPLICABLE TO MINE CLOSURE

Specific primary relevant acts, regulations, and guidelines applicable to closure and reclamation are provided in Table 1.5-1. B2Gold Nunavut also subscribes to the Towards Sustainable Mining (TSM) Initiative, including the implementation of the Mine Closure Framework (MAC 2008).

**Table 1.5-1 Primary Acts, Regulations, and Guidelines Applicable to Closure and Reclamation**

Acts	Regulations	Guidelines
<b>Federal</b>		
<i>Canadian Environmental Protection Act (1999)</i>	Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations (SOR/2008-197) Environmental Emergency Regulations (SOR/2019-51) Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2002-301) Release and Environmental Emergency Notification Regulations (SOR/2011-90)	Canadian Council of the Ministers of Environment - Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products Notice with respect to substances in the National Pollutant Release Inventory Canada-Wide Standards for Particulate Matter (PM) and Ozone Canada-Wide Standards for Petroleum Hydrocarbons (PHC) In Soil Canadian Council of Ministers of the Environment (CCME) – Freshwater Aquatic Life Quality Guidelines; Soil Quality Guidelines.
<i>Canada Wildlife Act (1985f)</i>		
<i>Species at Risk Act (2002b)</i>		Species at Risk Policies
<i>Canadian Transportation Accident Investigation and Safety Board Act (1989)</i>	Transportation Safety Board Regulations (SOR/2014-37)	
<i>Transportation of Dangerous Goods Act (1992)</i>	Transportation of Dangerous Goods Regulations (Canada 2001)	
<i>Canadian Navigable Waters Act (1985b)</i>	Navigable Waters Works Regulations (C.R.C., c. 1232) Navigable Waters Bridges Regulations (C.R.C., c. 1231)	

Acts	Regulations	Guidelines
<b>Federal (cont'd)</b>		
<i>Fisheries Act (1985c)</i>	<p>Metal and Diamond Mining Effluent Regulations (SOR/2002-2222)</p> <p>Marine Mammal Regulations (SOR/93-56)</p>	<p>Fisheries and Fish Habitat Protection Policy Statement (DFO 2019a)</p> <p>Policy for Applying Measures to Offset Adverse Effects on Fish and Fish Habitat Under the <i>Fisheries Act</i> (DFO 2019b)</p> <p>DFO Measures to Protect Fish and Fish Habitat (DFO 2019c), including those for the Timing Window to Conduct Projects In or Around Water, Sediment Control, and other applicable measures (DFO Standards and Codes of Practice (DFO 2020), including those for End-of-Pipe Fish Protection Screens for Small Water Intakes in Freshwater (also see DFO 1995), Culvert Maintenance, Temporary Stream Crossings, and other applicable standards</p> <p>Protocol for Winter Water Withdrawal from Ice-Covered Waterbodies in the Northwest Territories and Nunavut (DFO 2010)</p> <p>Freshwater Intake End-of-Pipe Fish Screen Guideline (DFO 1995)</p> <p>Method for Determining Available Winter Water Volumes for Small-Scale Projects (April 27, 2020, MVLWB)</p>
<i>Canada Labour Code (1985d)</i>	<p>Canada Labour Standards Regulations (C.R.C., c. 986)</p> <p>Canada Occupational Health and Safety Regulations (SOR/86 304)</p>	
<i>Territorial Lands Act (1985e)</i>	<p>Nunavut Mining Regulations (SOR/2014-69)</p> <p>Territorial Land Use Regulations (C.R.C. 1524)</p> <p>Territorial Quarrying Regulations (C.R.C. c. 1527)</p>	
<i>Nunavut Planning and Project Assessment Act (2013)</i>		
<i>Nunavut Waters and Nunavut Surface Rights Tribunal Act (2002a)</i>	<p>Nunavut Waters Regulations (2013b)</p>	

Acts	Regulations	Guidelines
<b>Federal (cont'd)</b>		
<i>Nunavut Act (1993a)</i>	Nunavut Archaeological and Paleontological Sites Regulations (SOR/2001-220)	
<i>Nunavut Land Claims Agreement Act (1993b)</i>		
<b>Territorial – Nunavut</b>		
<i>Environmental Protection Act (1988b)</i>	Spill Contingency Planning and Reporting Regulations (NWT Reg (Nu) 068-93)	Guideline on Dust Suppression Guideline for the General Management of Hazardous Waste in Nunavut Environmental Guideline for Waste Asbestos Guideline for Industrial Waste Discharges in Nunavut Guideline for Industrial Projects on Commissioner’s Land
<i>Historical Resources Act (2013)</i>		
<i>Territorial Parks Act (1988d)</i>	Territorial Parks Regulations (RRNWT (Nu) 1990 c T-13)	
<i>Wildlife Act (2003)</i>	Wildlife General Regulations (NWT Reg (Nu) 026-92) Wildlife Licences and Permits Regulations (NWT Reg (Nu) 027-92) Wildlife Management Barren-Ground Caribou Areas Regulations (NWT Reg (Nu) 099-98) Wildlife Management Zones Regulations (RRNWT (Nu) 1990 c W-17) Wildlife Regions Regulations (NWT Reg (Nu) 108-98)	
<i>Commissioner’s Land Act (1988a)</i>	Commissioner’s Land Regulations (RRNWT 1990, c C-13)	
<i>Mine Health and Safety Act (SNWT (Nu) 2012, c17, s.20)</i>	Mine Health and Safety Regulations (S.Nu, 2013, c.13, s.6, R-020-2018 and R-025-2018)	
<i>Explosives Use Act (RSNWT. 1988, C.E-10, Amended 2010)</i>		

The development of this Plan was also based on the following guidance:

- ◆ Guidelines issued by NIRB for the Project (NIRB 2013) and specifically those relating to the preparation of a closure and reclamation plan;
- ◆ Mine Site Reclamation Policy for Nunavut (AANDC 2002);
- ◆ Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories (MVLWB 2013);
- ◆ Canadian Council of Ministers of the Environment (CCME) Guidelines for the protection of Aquatic Life (CCME 2013, 2016);
- ◆ Abandonment and Reclamation Policy for Inuit Owned Lands (QIA no date);
- ◆ Environmental Guideline for Site Remediation (Government of Nunavut [GN] 2010);
- ◆ CCME Guidelines for the Protection of Environmental and Human Health (CCME 1999b); and
- ◆ CCME Canada-Wide Standard for Petroleum Hydrocarbons in Soil (CCME 2008).

### 1.5.2 CURRENT PERMITS AND APPROVALS

Land use authorizations and Water Licences are the primary regulatory instruments applicable to mine closure in Nunavut. A summary list of land and water access permits/licences for the Project is provided in Table 1.5-2.

Land ownership in relation to the Project is shown in Figure 1.5-1 and Figure 1.5-2 for the Goose Mine and Marine Laydown Area (MLA), respectively. The majority of the Project is located on Inuit Owned Land (IOL). Surface rights for IOL are vested in the KIA, which administers the access and management of IOL for the benefit of the Inuit in that region. Access to and use of surface lands requires an Inuit land use permit, licence, or commercial lease issued by the KIA. The planned development areas addressed in this Plan are located on either surface rights, or surface and subsurface rights on IOL administered by the KIA. An additional potential future development area, specifically a tailings containment facility (i.e., Tailings Storage Facility), located on Crown Land was originally assessed by the NIRB as part of the initial project description (Section 1.6). Surface rights on Crown Land are vested in the federal government and are administered by CIRNAC. Access to and use of these surface lands requires a land use permit, licence, or commercial lease issued by CIRNAC.

The use of water resources as well as waste disposal in Nunavut is regulated by the NWB. The Project has Type A Water Licence (2AM-BRP1831; the Licence) for mine development, pursuant to the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (Canada 2002a).

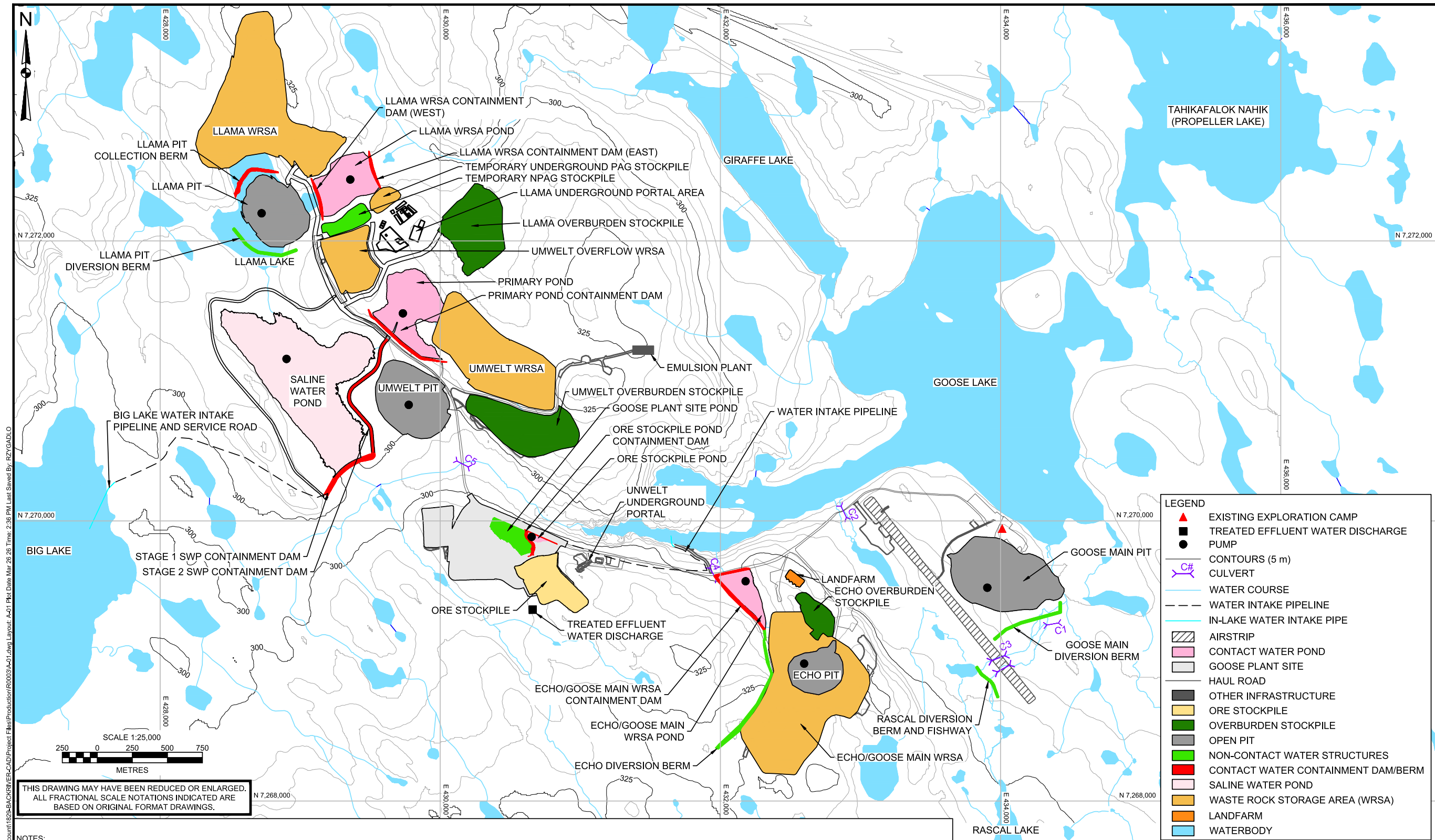
Terms and conditions of the Licence applicable to abandonment, reclamation, and closure are listed in Table 1.5-3, along with where these terms and conditions are addressed in this Plan. The Project Certificate for the Goose Project also contains a number of terms and conditions related to abandonment, reclamation, and closure that are included in Table 1.5-3 along with the location in this Plan where these terms and conditions are addressed.

**Table 1.5-2 Summary of Land and Water Access Permits / Licences for the Project**

Authorization No.	Expiry (YYYY-MM-DD)	Agency	Description
PC No. 007	N/A	NIRB	Back River Project NIRB Project Certificate
2AM-BRP1831	2031-12-31	NWB	Back River Type A Water Licence
N/A	2038-06-31	KIA	Inuit Impact and Benefit Agreement
KTCL-18D001	2038-04-20	KIA	Commercial Lease – Goose
KTCL-18D002	2038-04-20	KIA	Commercial Lease – MLA
KTCL-18D003	2038-04-20	KIA	Commercial Lease – Winter Road
KTAEL-18C001	2026-04-20	KIA	Advanced Exploration Lease – George
LUL-XX	5 years from Effective Date	KIA	Land Use Licence as per KIA Framework Agreement
KTL312C004	2026-05-26	KIA	Wishbone-Malley Exploration Activities
N2024F0027	2029-11-28	CIRNAC	CAT Train Beechy Lake Area
N2024F0027	2029-11-28	CIRNAC	CAT Train connecting Bathurst Inlet – Back River Project
N2025F0021	2030-10-10	CIRNAC	Back River (Beechy Lake) Exploration Activities
N2025F0020	2030-10-2028	CIRNAC	Winter Ice Road Back River Project
Lease No. 76J/12-7-2	2048-08-14	CIRNAC	Marine environment land lease – adjacent to MLA
Lease No. 76J/9-1-2	2048-04-26	CIRNAC	Goose Lake Tailings Storage Facility
2BE-GOO2028	2028-02-18	NWB	Goose Water Licence (Type B)
2BE-GEO2530	2030-06-19	NWB	George Water Licence (Type B)
2BE-MLL2328	2028-05-04	NWB	Wishbone-Malley Water Licence (Type B)
12-HCAA-CA7-00007	2031-12-31	DFO	<i>Fisheries Act</i> Authorization – Back River Project

Authorization No.	Expiry (YYYY-MM-DD)	Agency	Description
18-HCAA-00185	N/A	DFO	Letter of Authorization – Gander Culvert
18-HCAA-00971	N/A	DFO	Letter of Authorization – MLA
18-HCAA-01626	N/A	DFO	Letter of Authorization – Winter Ice Road
12-HCAA-CA7-00007	N/A	DFO	Letter of Authorization – Rascal Stream Diversion
22-HCAA-00586	N/A	DFO	Letter of Advice – Rascal stream West Culvert Construction
24-HCAA-01561	N/A	DFO	Letter of Advice – Construction of Shoreline Pad Extension
2012-600767-002	N/A	TC	<i>Navigation Protection Act</i> – MLA Discharge Pipeline Authorization
2012-600767-003	N/A	TC	<i>Navigation Protection Act</i> – MLA Intake Pipeline Authorization
2012-600767-006	N/A	TC	<i>Navigation Protection Act</i> – MLA Lightering Barge Authorization
12-HCAA-CA7-00007	N/A	ECCC	Amendment to Metal and Diamond Mining Effluent Regulations – Schedule 2

FIGURE 1.5-1 GOOSE MINE - POTENTIAL DEVELOPMENT AREA AND LAYOUT



**LEGEND**

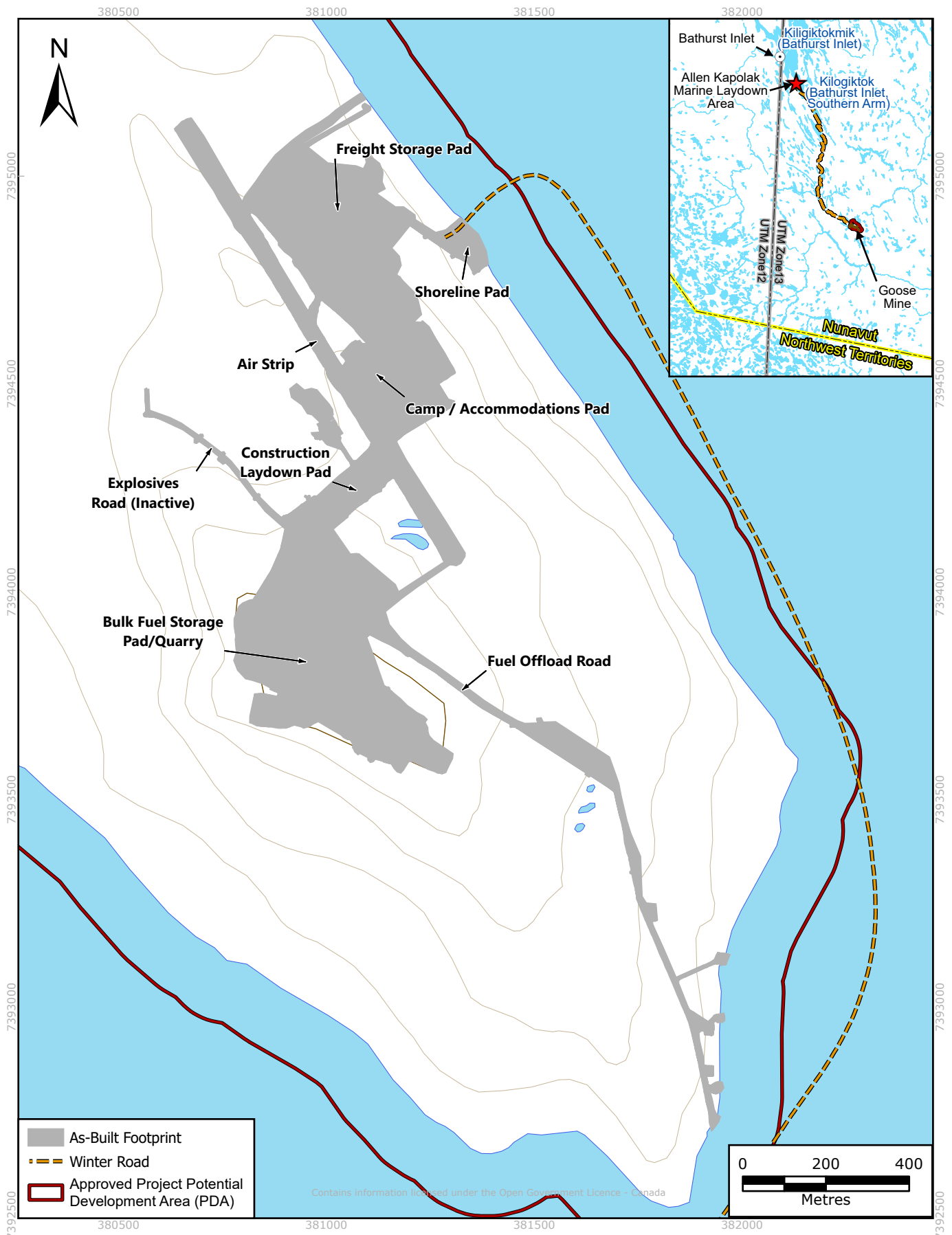
- ▲ EXISTING EXPLORATION CAMP
- TREATED EFFLUENT WATER DISCHARGE
- PUMP
- CONTOURS (5 m)
- CULVERT
- WATER COURSE
- WATER INTAKE PIPELINE
- IN-LAKE WATER INTAKE PIPE
- ▨ AIRSTRIP
- CONTACT WATER POND
- GOOSE PLANT SITE
- HAUL ROAD
- OTHER INFRASTRUCTURE
- ORE STOCKPILE
- OVERBURDEN STOCKPILE
- OPEN PIT
- NON-CONTACT WATER STRUCTURES
- CONTACT WATER CONTAINMENT DAM/BERM
- SALINE WATER POND
- WASTE ROCK STORAGE AREA (WRSA)
- LANDFARM
- WATERBODY

THIS DRAWING MAY HAVE BEEN REDUCED OR ENLARGED.  
ALL FRACTIONAL SCALE NOTATIONS INDICATED ARE  
BASED ON ORIGINAL FORMAT DRAWINGS.

- NOTES:**
1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
  2. THIS DRAWING MUST BE READ IN CONJUNCTION WITH BGC'S REPORT TITLED "GOOSE PROJECT WATER MANAGEMENT PLAN", AND DATED MARCH 2026.
  3. HYDROGRAPHY DATA OBTAINED FROM GEOGRATIS DEPARTMENT OF NATURAL RESOURCES CANADA MODIFIED BY GOLDBERGER. CONTOUR INTERVAL IS 5 m.
  4. FOOTPRINT DATA RECEIVED BY B2GOLD ON DECEMBER 12, 2025 AND JANUARY 7, 2026.
  5. COORDINATE SYSTEM IS UTM NAD 83 ZONE 13.
  6. BGC PREPARED THIS DRAWING FOR THE EXCLUSIVE USE OF BGC'S CLIENT IDENTIFIED ON THIS DRAWING. UNLESS BGC AGREES OTHERWISE IN WRITING, THIS DRAWING MUST NOT BE MODIFIED OR USED FOR ANY PURPOSE OTHER THAN THE SPECIFIC PURPOSE FOR WHICH BGC GENERATED IT. BGC SHALL HAVE NO LIABILITY FOR ANY DAMAGES, INJURY, OR LOSS ARISING FROM ANY UNAUTHORIZED USE OR MODIFICATION OF THIS DRAWING. THIRD PARTIES USE OR RELY UPON THIS DRAWING AT THEIR OWN RISK.

SCALE: 1:25,000	CLIENT: B2GOLD NUNAVUT	PROJECT: GOOSE PROJECT, WATER MANAGEMENT PLAN
DATE: MAR 2026		TITLE: GOOSE MINE AREA - POTENTIAL DEVELOPMENT AREA AND LAYOUT
DRAWN: AA		PROJECT No.: 1829001
REVIEW: ZMM		DWG No.: A-01
APPROVED: PC		

FIGURE 1.5-2 MARINE LAYDOWN AREA GENERAL ARRANGEMENT PLAN AT END OF OPERATIONS



Contains information licensed under the Open Government Licence - Canada

**Table 1.5-3 ICRP Concordance with Project Certificate No. 007 and Water Licence 2AM-BRP1831**

Regulatory Instrument	Term or Condition	Term or Condition/Reporting Requirement	Where Addressed in ICRP
PC No. 007	7	Climate and Meteorology – Mine Closure and Reclamation Plan  The Proponent shall maintain a Mine Closure and Reclamation Plan designed to: identify the processes that may act upon the mine components after closure and reclamation so that they can be factored within the design and operation of the mine; ensure physical and chemical stability of mine components that remain after closure; ensure mine components that remain after closure will not require long-term active care; and consider future use and aesthetics of the area with the surrounding lands. This plan should include:	This Plan as a whole
		a. An adaptive management component that documents monitoring and mitigation measures to ensure long-term containment of the Tailings Storage Facility and Waste Rock Storage Areas;	8
		b. Details for monitoring the thermal condition and stability of storage facilities;	Monitoring details will be reported in annual reports and relevant information included in future ICRP updates if needed.
		c. Details on the triggers for implementing alternative mitigation options;	5.2.1.8
		d. Details pertaining to ongoing monitoring and research being conducted to supplement the adaptive management protocols;	Appendix E
		e. Details on the plans to maintain the integrity of the groundwater quality within and adjacent to the Project; and	5.2.2
		f. Details on how the Proponent will carry out continued analyses over time to confirm or update the approximate fill time for the mine pits.	5.2.1
		Reporting: The plan should be submitted to the Nunavut Impact Review Board (NIRB) at least 60 days prior to the start of construction of the Project, and any approved Modifications, with results submitted annually thereafter or as may otherwise be required by the NIRB.	This submission of the Plan

Regulatory Instrument	Term or Condition	Term or Condition/Reporting Requirement	Where Addressed in ICRP
PC No. 007	15	The Proponent shall have in place a plan for the progressive reclamation of project components, areas, and infrastructure throughout the life of the Project. The plan shall detail:	6
		a. projected timelines for the reclamation of project features, methodologies for undertaking such activities, and monitoring measures to ensure the effectiveness of reclamation methods employed;	1.3; 4.3; 5; 8
		b. specific measures for adaptive management and triggers for their application, should monitoring results reveal trends that could affect the reclamation and closure objectives.; and	8
		c. how Inuit Qaujimagatugangit and Traditional Knowledge was collected and used to inform closure plans and the design of project components.	1.4; Appendix B Tables 010, 011, 013, 015, 016, 017, 018, 020, 022. Inuit Qaujimagatugangit and Traditional Knowledge collection and integration into Project assessment and design is detailed in Sabina's FEIS
		Reporting: The plan should be submitted to the Nunavut Impact Review Board (NIRB) at least 90 days prior to the start of construction, with results and details submitted annually thereafter or as may otherwise be required by the NIRB.	This submission of the Plan
PC No. 007	35	The Proponent shall develop a progressive revegetation program for disturbed areas that are no longer required for operations, such as a program to incorporate measures for the use of test plots, reseeded, and replanting of native plants as necessary. It is further recommended that this program be directly associated with the management plans for erosion control established for the Project.	6.3
		Reporting: The program and associated revegetation results should be provided within the Proponent's annual report submitted to the Nunavut Impact Review Board.	6.3

Regulatory Instrument	Term or Condition	Term or Condition/Reporting Requirement	Where Addressed in ICRP
PC No. 007	36	<p>The Proponent shall include revegetation strategies within its Mine Closure and Reclamation Plan that support progressive reclamation, and promote natural revegetation and recovery of disturbed areas compatible with the surrounding natural environment. These strategies should include exploration of the feasibility and practicality of topsoil/organic matter salvage through Project development. The Closure and Reclamation Plan should be updated on an on-going basis as more information becomes available from similar reclamation efforts at other northern projects, as applicable.</p>	6.3
		<p>Reporting: Within 3 (three) years from the commencement of construction, information regarding the revegetation strategies developed and implemented by the Proponent in fulfillment of this Term and Condition shall be included in the Proponent’s annual report to the Nunavut Impact Review Board. Subsequently, information regarding the Proponent’s progress in fulfillment of this Term and Condition shall be provided annually in the Proponent’s annual report to the Nunavut Impact Review Board.</p>	6.3
WL 2AM-BRP1831	Part C, Item 10	<p>The Licencee shall submit, within the updated Interim Closure and Reclamation Plan as per Part J, Item 1, an updated reclamation cost estimate of the total mine closure restoration liability, using the most current version of CIRNAC’s RECLAIM Reclamation Cost Estimating Model, its equivalent or other similar method approved by the Board in writing, in accordance with principles of the INAC (as CIRNAC was previously known as) “Mine Site Reclamation Policy in Nunavut” (2002).</p>	8
WL 2AM-BRP1831	Part C, Item 11	<p>The Licencee shall submit, within the Final Closure and Reclamation Plan as per Part J, Item 2, an updated reclamation cost estimate of the total mine closure restoration liability, using the most current version of CIRNAC’s RECLAIM Reclamation Cost Estimating Model, its equivalent or other similar method approved by the Board in writing, in accordance with principles of the “Mine Site Reclamation Policy for Nunavut” (2002). Upon the Project entering into or being maintained in Care and Maintenance, an updated estimate of total mine closure reclamation liability shall be submitted, as above, within twelve (12) months of entering Care and Maintenance and every three (3) years thereafter.</p>	Not applicable at this time

Regulatory Instrument	Term or Condition	Term or Condition/Reporting Requirement	Where Addressed in ICRP
WL 2AM-BRP1831	Part J, Item 1	The Licencee shall implement the approved Interim Closure and Reclamation Plan. The Licencee shall submit to the Board for approval within twelve (12) months following the commencement of the Operation Phase an updated Interim Closure and Reclamation Plan.	This Plan as a whole
WL 2AM-BRP1831	Part J, Item 2	The Licencee shall submit to the Board for approval, at least twelve (12) months prior to the expected end of planned mining, a Final Closure and Reclamation Plan. The Final Closure and Reclamation Plan shall incorporate revisions, which reflect the pending closed status of the mine, and include:  Soil Quality Remediation Objectives reflecting the applicable CCME Guidelines and the Government of Nunavut Environmental Guideline for Site Remediation;  Environmental Site Assessment plans in accordance with the applicable Canadian Standards Association (CSA) criteria; and  An evaluation of the human health and ecological risks associated with the Closure options proposed.	Not applicable at this time
WL 2AM-BRP1831	Part J, Item 3	The Licencee shall submit to the Board, at least sixty (60) days prior to, or as soon as practically possible, written notification of the Licencee's intention to enter into a Care and Maintenance Phase.	Not applicable at this time
WL 2AM-BRP1831	Part J, Item 4	The Licencee shall provide the Board, within thirty (30) days of the Licencee providing notice of intent to enter into Care and Maintenance under Part J, Item 3, a Care and Maintenance Plan that details the Licencee's plans for maintaining compliance with the Terms and Conditions of the Licence.	Not applicable at this time
WL 2AM-BRP1831	Part J, Item 5	The Licencee shall, should the Project remain, or be in Care and Maintenance, submit an updated estimate of total mine closure restoration liability, within twelve (12) months of entering Care and Maintenance and every three (3) years thereafter.	Not applicable at this time
WL 2AM-BRP1831	Part J, Item 6	The Licencee shall review the Plans referred to in this Part as required by changes in operation and/or technology and modify the Plans accordingly. Revisions to the Plans should incorporate design changes and adaptive engineering required and implemented during Construction and reflect actual site conditions and monitoring results over the life of the Project.	This revised Plan is being provided to reflect the proposed changes to the Project

Regulatory Instrument	Term or Condition	Term or Condition/Reporting Requirement	Where Addressed in ICRP
WL 2AM-BRP1831	Part J, Item 7	The Licencee shall include, with the Plan submitted under Part J, Items 1, 2, and 5, an updated reclamation cost estimate of the total mine closure restoration liability, using the most current version of CIRNAC's RECLAIM Reclamation Cost Estimating Model, its equivalent or other similar method approved by the Board in writing, in accordance with principles of the INAC (as CIRNAC was previously known as) "Mine Site Reclamation Policy in Nunavut" (2002).	8
WL 2AM-BRP1831	Part J, Item 8	The Licencee shall complete all reclamation work in accordance with the Plan(s) referred to in this Part, as and when approved by the Board in writing.	1.1
WL 2AM-BRP1831	Part J, Item 9	The Licencee shall implement Progressive Reclamation of any component of the Project no longer required by the Project.	See Section 6 for Progressive Reclamation approach.
WL 2AM-BRP1831	Part J, Item 10	The Licencee shall remove any culverts and restore, as practicable, the drainage to match the natural channel. Measures shall be implemented to minimize erosion and sedimentation.	1.2.1; 5.2.7
WL 2AM-BRP1831	Part J, Item 11	All roads and airstrip, if any, shall be regraded, as practicable, to match natural contours to reduce erosion.	1.2.1; 5.2.7
WL 2AM-BRP1831	Part J, Item 12	Areas that have been contaminated by hydrocarbons from normal fuel transfer procedures shall be reclaimed to meet objectives as outlined in the Government of Nunavut's Environmental Guideline for Site Remediation, (2010 version or current version in place at the time of Reclamation).	1.2.1; 1.5.1; 5.2.7; 5.2.8.1; 8
WL 2AM-BRP1831	Part J, Item 13	To the extent practical, the Licencee shall contour and stabilize all disturbed areas to a pre-disturbed state upon completion of work.	1.2.1; 5.2.2; 5.2.7.5; 5.2.8.5; 5.2.9; 5.2.10
WL 2AM-BRP1831	Part J, Item 14	The Licencee shall submit to the Board, at least sixty (60) days prior to the Licencee intending to seek Recognized Closed Mine status for the Project, written notification of the intent to seek closure status.	Not applicable at this time

## 1.6 ADDITIONAL APPROVED DEVELOPMENT INFRASTRUCTURE / MINING AREAS

Project components previously assessed and permitted but not a part of the current mine plan may be reintroduced into the mine plan in future based on market considerations and engineering advancement. As these components were assessed by NIRB under the Project Certificate (PC No. 007; NIRB File No. 12MN036) and subsequently approved in the ICRP by the NWB Part, B Item 14g. Reintroduction of these mining areas to the mine plan in future would not constitute a modification to the Project under Part G of the existing Type A Water Licence, 2AM-BRP1831. Similarly, in the NIRB letter *Direction Regarding the “Back River Project 2020 Modification Package” submitted by Sabina Gold & Silver Corp. in relation to the Back River Project* (K. Kaluraq to M. Pickard; August 11, 2020; NIRB File No. 12MN036), the NIRB determined that the Back River Project 2020 Modification Package would not constitute a significant modification that requires further assessment by the NIRB, including “the use of mined-out open pits as tailings storage” (NIRB 2020).

The mining areas and associated support infrastructure that may be reintroduced and reintegrated into the mine plan, and subsequently future ICRPs, are listed below:

- ◆ Tailings Storage Facility (TSF) including all associated infrastructure (e.g., TSF Waste Rock Storage Area [WRSA]), equipment, and facilities.

The Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories (MVLWB/AANDC 2013) require that a “description of each project component, including proposed components and historical components no longer in use” be included in closure and reclamation plans. Although the components described above are not currently proposed, nor are they historical components no longer in use, a further description of each of these components has been retained in Section 1.6 this Plan for reference.

Should B2Gold Nunavut choose to reintegrate any of these components into the mine plan in future, all closure activities and approaches outlined in this Plan would be maintained for the closure of these components. Additionally, a notice of modification prior to the disposal of waste would be provided to the NWB (per 2AM-BRP1831; Part B, Item 17) and would include information on: waste disposal quantities, volumes, disposal timing, maximum pit capacity, effects to pit closure, and appropriate mitigation and monitoring plans. Any necessary plans that may need updating, including this ICRP, would also be updated.

### 1.6.1 DESCRIPTIONS OF ADDITIONAL APPROVED DEVELOPMENT INFRASTRUCTURE / MINING AREAS

#### 1.6.1.1 TAILINGS STORAGE FACILITY AND ASSOCIATED WASTE ROCK STORAGE AREA

The TSF is the only facility at the Goose Mine that is located on Crown Land as opposed to IOL. The majority of pre-disturbance surface area of the TSF is located on land; however, four small ponds and streams also exist within the TSF footprint.

The TSF is permitted to store tailings solids and process water as well as waste rock. The TSF would be situated south of the Goose Main Pit, and would be composed of two embankments:

- ◆ The TSF Containment Dam would be a 1,744-m long embankment at its centerline, with a maximum height of 14 m; this dam would be situated at the north end of the facility and oriented east-west; and
- ◆ The South Dike would be a 200-m long embankment at its centerline, with a maximum height of 3 m; this dike would be situated at the south end of the facility.

The TSF Containment Dam would be constructed as a frozen foundation rockfill dam using non-potentially acid generating (NPAG) waste rock with a geosynthetic liner. The liner would be frozen into the permafrost of the TSF key trench; thermal modelling confirmed that, over the life of the structure, the foundation would not thaw deep enough to compromise this seal. Any seepage through the TSF would be collected using a downstream berm, called the TSF WRSA Diversion Berm, with an impermeable liner keyed into the permafrost.

Exposed tailings beaches with the TSF would likely be an ongoing source of sulphate and arsenic leaching and if tailings were left exposed for an extended period of time (e.g., decades or more), pH changes may result in increased concentrations of other trace elements. However, the development of acidic conditions would be expected to be delayed considerably by the cold temperatures, with the alkalinity from the deposition of fresh tailings helping to maintain neutral pH conditions (Geochem Characterization Report, FEIS Appendix V2-7D).

The TSF would transition to a WRSA (i.e., TSF WRSA) with the WRSA created on and around the pre-existing TSF. A 5 m NPAG cover would be progressively placed over the potentially acid generating (PAG) waste rock and tailings in the facility to encapsulate these materials and to promote freezing conditions. The TSF WRSA would be closed out by reclaiming all TSF supernatant water through the Process Plant and by completing the NPAG cap on the facility. Once closure criteria are met, the TSF WRSA Diversion Berm would be breached, and water would be allowed to flow to the mined-out Goose Pit (then Goose Main Reservoir).

## 2. ENVIRONMENT

---

The Project is located in a remote area within the Kitikmeot Region of Nunavut. The closest communities to the Project are Kingaok, located approximately 160 km north of the Goose Mine, and Omingmaktok, located approximately 250 km northeast of the Goose Mine. The communities of Kugluktuk and Cambridge Bay are the closest major regional settlements (Figure 1.1-1).

Virtually no development and little human disturbance have occurred in the Project area aside from various mineral exploration campaigns conducted since 1982. A comprehensive and extensive overview of the baseline environmental conditions is provided in the FEIS for the Back River Project (Sabina 2015). A summary of existing environmental conditions relevant to the Closure Phase is provided below.

### 2.1 ATMOSPHERIC ENVIRONMENT

The climate in the Project area is characterized by extremes. The winter period lasts from October to May, consisting of snow and extremely cold mean monthly temperatures, ranging from -33.0°C to -1.3°C. The remainder of the year (i.e., June to September) is cool, with mean monthly temperatures ranging from -0.3°C to 14.5°C. The Project area experiences relatively low amounts of rainfall (summer means ranging from 4 mm to 211 mm), but due to sub-zero temperatures for the majority of the year, also experiences high snow accumulation (annual mean precipitation ranging from 125 mm to 344 mm). Summer is a season of nearly perpetual sunlight, while winter is dominated by night, twilight, and extreme cold. Climate change shows that the annual mean temperature will increase approximately 5.3°C over the next century (B2Gold Nunavut 2026b). Permafrost conditions are expected to remain, with a deeper seasonal active zone.

Due to the relative absence of obstructions to impede the wind (e.g., trees, buildings, mountains), wind speeds are generally high. Baseline air quality and noise reflect predominantly pristine conditions, a result of the Project location's remoteness and general lack of local anthropogenic influence.

### 2.2 PHYSICAL (TERRESTRIAL) ENVIRONMENT

The Project is located within the continuous permafrost region of western Nunavut. A seasonally thawed active layer is present immediately beneath ground surface to a depth typically up to approximately 2 m. Permafrost extends to a depth of approximately 500 m. Taliks surrounding waterbodies may extend to sub-permafrost groundwater (i.e., through taliks), where waterbodies can be greater than 200 m wide. Beneath the permafrost, the regional sub-permafrost groundwater is elevated in total dissolved solids (TDS), which is ubiquitous throughout the Arctic environment.

The Project area is dominated by gently undulating or rolling landscapes with numerous kettle lakes connected by streams. Terrain elevation ranges between 300 metres above sea level (masl) and 700 masl, and slope gradients rarely exceed 7%. Uplands are typically covered by morainal materials deposited on Precambrian sedimentary, metamorphic, or intrusive rocks. Glaciofluvial, organic, marine, and lacustrine deposits are less common. Most soils are moderately coarse (e.g., loam, sandy loam, fine sandy loam). Exposed bedrock occurs occasionally. The thickness of mineral soils overlaying bedrock

(e.g., overburden) is the highest in plains and very gently sloping areas (average of 10.6 m thickness) and decreases in rolling and undulating landscapes (average of 4.8 m thickness).

A number of distinct landform types, including eskers, morainal rocky ridges, and boulder fields, exist throughout the region. Several soil phenomena are also associated with the permafrost setting. Thermokarsts typically occur in wetlands as a system of very irregular hummocks and hollows, which form as a result of frost heaving and ice accumulation on the bottom of organic horizons. Frost boils are typically circular (1 m to 3 m in diameter) upwellings of mud that are created by frost heaving. The presence of permafrost and annual cycles of freezing and thawing result in poor development of soils. About two-thirds of the inspected soils have been classified as Static Cryosols and one-third as Turbic Cryosols.

### 2.2.1 GEOTECHNICAL CHARACTERISTICS

Baseline geotechnical field investigations in the vicinity of the Goose Mine and MLA were carried out between 2011 and 2015. Laboratory testing on geotechnical samples confirms that overburden soils at the Goose Mine and onshore MLA generally consist of silty sands with some clay and gravel, which are likely the result of reworked marine and glacial sediments. The physical state (i.e., frozen or thawed) of soils likely defines its apparent strength. In a thawed state, the soils likely have a relatively low strength, whereas in a frozen state, the ice contributes to the cohesive strength so that the soil strength increases with decreasing temperatures (SRK 2015a).

#### 2.2.1.1 MARINE LAYDOWN AREA

Studies in an adjacent area 13 km south of the MLA indicate that offshore sediments consist primarily of normally consolidated marine clay deposits with occasional silty sand lenses. The soft, weak clays were found to be unfrozen with an average water content of 60% (Nishi-Khon/SNC Lavalin 2001).

#### 2.2.1.2 GOOSE MINE

In general, the overburden thickness ranges from 0 m to 25 m across the Goose Mine. The thickest overburden deposits are along the airstrip alignment, along the west edge of Goose Main Pit, and along the northwestern end of the Llama Pit (SRK 2010, 2011).

Thermistors installed in the active layer revealed depth ranges from 1.3 metres below ground surface (mbgs) to 4.2 mbgs, with the greatest depths occurring in areas where bedrock forms part of the active layer (Rescan 2014). The porewater salinity across the Goose Mine averages approximately 26 parts per thousand (ppt) with a maximum of 85 ppt. Higher salinity values have the effect of depressing the freezing point as well as contributing to higher unfrozen water content.

The rock quality designation (RQD) values of shallow bedrock underlying soils at the Goose Mine are generally “good” with minor occurrences of “poor”, “fair”, and “very good” rock mass qualities across the site (Knight Piésold 2013; SRK 2015a).

### 2.2.2 SEISMICITY

A preliminary assessment of the regional seismicity has been carried out to enable selection of appropriate design earthquake events for the Project facilities. Review of historical earthquake records and regional tectonics indicates that the Project is located in a region of low seismicity surrounded by large regions of sparse, diffuse seismicity.

Seismic parameters were calculated for the Project area using the National Building Code of Canada website, which provides ground accelerations and probability of occurrence. A peak ground acceleration (PGA) of 0.036g for a 1:2,475-year event was selected for the design of the Project facilities.

### 2.2.3 GEOLOGY

The Property is located in the central-eastern portion of the Slave Structural Province and forms part of the Canadian Shield. The Slave Structural Province is predominantly comprised of metamorphosed greenstone and turbidite sequences and plutonic rock underlain by older gneiss and granitoids. Volcanic-turbidite series rocks are widespread and abundant, consisting of large areas of turbidites flanked by narrow volcanic belts. Iron formations are locally abundant in the volcanic turbidite series and host most of the strata-bound gold deposits.

The Goose Mine is underlain by a turbidite sequence cut by felsic and gabbroic dikes. The turbidite sequence is comprised of greywacke, iron formations, and mudstones. Most of the gold mineralization is hosted in the central greywacke and lower iron formation units. All units are crosscut by gabbro dikes.

Regional structural features have been identified from field mapping and from interpretation of geophysical data sets. Deposit scale features, such as folding and faulting, have been identified from drill core intersections and field mapping. Host rock units exhibit folding; Goose Main Pit sits in an antiform, and Echo Pit, Llama Pit, and Umwelt Pit sit in antiform/synform sets. Most faults transecting the deposits have been identified firstly by lithologic offset, and then subsequently supported by observations from drill core and field mapping. The Llama fault trends northwest/southeast and may be coincident with a gabbroic dike. The Umwelt fault trends north-northwest/south-southeast and truncates the deposit on the western limb. Multiple faults have also been modelled at Goose Main Pit; one offsets mineralization and trends north/south, one trends north-northeast/south-southwest and one trends northeast/southwest. All lithologies and fault structures have been modelled in 3D and have been used to assist with the Project design.

Gold mineralization at the Goose Mine is situated within folded silicified and sulphidized oxide iron formations and locally in the underlying greywacke located within antiform structures. As a result, the mineralization geometry is relatively continuous between sections and down-dip. However, within the interpreted mineralized zones, gold grades can be highly erratic and discontinuous.

### 2.2.4 HYDROGEOLOGY

As the Project is located within a zone of continuous permafrost, groundwater is present deep below the continuous permafrost layer (e.g., greater than 400 mbgs). Water present in the active layer above the permafrost, which is thawed during the summer only, can interact with surface waters. There is minimal connection between the active layer and deep groundwater flow regimes due to the presence of

continuous permafrost. The deep sub-permafrost groundwater is hydraulically connected with the surface water and the active layer only via open taliks (i.e., through taliks) beneath large lakes, such as below Goose Lake.

Structural features in the bedrock, such as the northwest-southeast trending faults commonly found at the Goose Mine, may act as preferential flow pathways for groundwater in taliks and beneath the permafrost. In general, the deep groundwater flows from higher elevation large lakes to lower elevation large lakes; therefore, the flow direction can be inferred from the surface elevation of the large lakes that overlie open taliks. Site-specific groundwater data were collected annually from 2012 to 2015 within the Goose Mine. Thermistor strings, vibrating wire piezometers, borehole packer testing, and a Westbay well have been used to characterize the groundwater environment. The Westbay well, which was installed adjacent to the Umwelt deposit in 2013, has been used to conduct groundwater quality sampling. Preliminary results of groundwater sampling indicate that the deep groundwater is more saline than seawater and has elevated levels of chloride and certain trace metals.

### 2.2.5 LAKE BATHYMETRY

Lakes at the Project area are generally small and shallow, ranging from 5 ha to 500 ha in surface area and less than 10 m in maximum depth. Lakes shallower than 2 m are usually frozen to the bottom during the winter months. Lakes are usually well mixed from the surface to the lake bottom sediments during the open-water season due to wind-driven forcing. Some gradients in temperature and density may occur in deeper lakes or in ice-covered lakes in winter. The water clarity of lakes is generally high, despite the potential for wind-driven mixing to the sediments. Water temperatures in lakes and streams tend to follow the Arctic climate, with greatest temperatures observed in August at the height of the short summer.

### 2.2.6 SURFACE HYDROLOGY

The Project is located within the watershed boundaries of the Queen Maud Gulf Watershed and the Back River Watershed. The majority of proposed infrastructure at the Goose Mine lies within the Queen Maud Gulf Watershed, which flows northwest and enters the ocean on the west side of Bathurst Inlet. The Back River Watershed is located south of the Goose Mine and flows east, eventually entering the Arctic Ocean south of Gjoa Haven.

Surface hydrology is governed by the Arctic nival regime where peak flow occurs during the spring, shortly after air temperature rises above freezing. In small basins, these high flows can last as little as a few days. Due to the presence of permafrost, small streams do not receive groundwater contributions, and flow discharges from these basins may cease after freshet until the late summer rains begin. For rivers draining larger watersheds, the freshet peak may be delayed relative to smaller drainages as snowmelt from upper portions of the watershed is routed through the drainage network.

Precipitation events in the late summer and early fall may lead to a second hydrographic peak, but this peak is generally of lower magnitude than the freshet peak. Channel freeze-up typically occurs between late October and early November. In smaller drainage basins, stream channels typically freeze to their bottom, with zero flow occurring in winter. In very large catchments and larger lake outlets, flow energy and water turbulence may sufficiently maintain streamflow and prevent downstream reaches from freezing completely.

## 2.2.7 ARCHAEOLOGICAL SITES

Archaeological surveys were conducted prior to Project development, and site locations were documented in reports submitted to the Government of Nunavut. Sites that could not be avoided in Project design will be mitigated.

## 2.3 CHEMICAL ENVIRONMENT

### 2.3.1 FRESHWATER WATER AND SEDIMENT QUALITY

Baseline water and sediment quality data have been collected for the Goose Mine since 1994, with extensive baseline water sampling programs being carried out from 2010 to 2015. The water of lakes and streams is typical of pristine Arctic surface waters, with low concentrations of anions, suspended material, nutrients, and most metals. Metal concentrations in baseline water quality samples are below CCME guidelines (CCME 1999), with the exceptions of cadmium and copper, and to a lesser extent, aluminum, iron, lead, and nickel. Lake and stream sediments have naturally elevated metal concentrations that are often greater than CCME guidelines for arsenic, cadmium, chromium, copper, and/or zinc (CCME 1999a).

### 2.3.2 MARINE WATER AND SEDIMENT QUALITY

Baseline studies show that water quality in southern Bathurst Inlet is typical of pristine Arctic marine waters, with low concentrations of nutrients, suspended solids, and metals.

The sediment environment in Bathurst Inlet is generally a function of water depth and physical processes. Shallower, near-shore areas are subjected to increased erosion and resuspension due to the interaction of the wind-driven water currents and the seabed. Metal concentrations in marine sediments are strongly correlated to the relative abundance of silt and clay particles and, therefore, are generally greater in the deeper waters. Naturally elevated concentrations of arsenic, chromium, and copper were observed in the deeper sediment samples and were often greater than the CCME guidelines (CCME 1999a). Sediment metal concentrations near the MLA were observed to be naturally low, as expected because of the relative dominance of sand-size particles.

### 2.3.3 GEOCHEMICAL CHARACTERIZATION

Geochemical characterization of the waste rock, ore, quarry rock, overburden, tailings, and mine workings has been completed on the Property (Rescan 2013; SRK 2015b). Additional geochemical characterization studies were completed in 2025 to refine the metal leaching / acid rock drainage (ML/ARD) potential of waste rock based on updated kinetic testing. Results from these characterizations indicated that approximately 58% of the open pit and underground mine waste rock is PAG. The geochemical classification criteria for the Umwelt and Goose Main deposits are provided in Table 2.3-1, and geochemical classification criteria for the Echo and Llama deposits are provided in Table 2.3-2.

**Table 2.3-1 Geochemical Classification Criteria for the Umwelt and Goose Main Deposits**

Acid Generation Potential	Criteria
Non-potentially acid generating	NP/AP $\geq$ 2 or total S $\leq$ 0.08%
Potentially acid generating	NP/AP $<$ 2 and total S $>$ 0.08%

**Table 2.3-2 Site-Specific Geochemical Classification Criteria for the Echo and Llama Deposits**

Acid Generation Potential	Criteria
Non-potentially acid generating	NP/AP $\geq$ 3 or total S $\leq$ 0.15%
Potentially acid generating	NP/AP $<$ 3

Based on laboratory test conditions, PAG rock on site and may lead to acidic drainage after a lag time of 14 to 20 years. Field conditions in the Arctic (e.g., low temperatures) slow reaction times relative to laboratory conditions such that the actual lag time experienced in the field would be expected to be longer. All PAG rock on site will be progressively covered with 5 m of NPAG waste rock, to freeze. Acidic conditions are expected to occur more rapidly in some of the waste rock; however, average pH conditions in seepage and runoff would be expected to remain buffered until WRSA freeze-back conditions develop. As such, long-term acid rock drainage and metal leaching are not anticipated.

Samples from the Umwelt Quarry and the Airstrip Quarry located at the Goose Mine have indicated the rock in these locations is NPAG. However, some rocks in the iron formation from the Airstrip Quarry have been characterized as PAG, and elevated concentrations of arsenic have been observed in samples from both quarries. Overburden across the Goose Mine has been characterized as NPAG. Further details on waste rock segregation and waste rock and overburden management are provided in the Waste Rock Management Plan and the Borrow Pits and Quarry Management Plan.

The majority of the tailings samples from the Goose Mine have been characterized as PAG (Rescan 2013; SRK 2015b).

## 2.4 BIOLOGICAL ENVIRONMENT

### 2.4.1 VEGETATION AND SPECIAL LANDSCAPE FEATURES

Vegetated ecosystems, constituting 73% of the Project site, are dominated by mesic tundra, dry-sparse tundra, and moist shrub-dominated tundra. Sparsely vegetated ecosystems constitute nearly 9% of the total site. The remaining areas are dominated by freshwater lakes and ponds. Special landscape features include esker complexes, cliffs, bedrock outcrop and lichen-dominated ecosystems, riparian ecosystems, wetland ecosystems, and marine beaches and old beach heads.

### 2.4.2 WILDLIFE

There are three barren-ground caribou herds whose ranges interact regionally. Satellite collaring data indicate that the Bathurst herd, Beverly and Ahiak herds, and Dolphin and Union herds are found in the region during portions of the year.

Using a DNA mark-recapture analysis, the regional population of bears was calculated to be 72 females and 54 males in 2012, and 64 females and 54 males in 2013. TK indicates that grizzly bears are found throughout the region, especially in association with major river systems, such as the Western River and coastal areas, including Bathurst Inlet.

Muskoxen occur at moderate to low densities across the Canadian Arctic. TK indicated that muskox populations have been undergoing a long-term recovery from previously low numbers and occur throughout and surrounding the region at low densities.

Wolverine and grey wolves were selected as representative of furbearer species. Baseline studies estimated the local population of wolverine to be very low. However, habitat suitability modelling for wolverine indicates that there is approximately 44.7% high-quality habitat within the region. TK identified eskers as the primary denning habitat for wolves, and eight dens were identified on eskers during denning surveys conducted for grey wolf, of which five dens produced pups.

Aerial surveys were also conducted during the spring moulting period (i.e., mid-May through mid-July) between 2007 and 2013 to assess the abundance and distribution of ringed seals. Results indicated that ringed seal abundance was spatially variable in Bathurst Inlet, with moderate densities present in most parts of the inlet except south of Kingaok, where very low densities of adult and 8-week-old to 10-week-old pups were found. Ringed seal lairs were only found further to the north. During the summer, ringed seal density is anticipated to be very low in Bathurst Inlet.

### 2.4.3 BIRDS

Aerial surveys for water birds indicate that Canada geese accounted for 80% to 90% of all detections of water bird species. Additionally, a key staging site was identified in the western region near the Goose Mine, where large flocks of geese and ducks were consistently observed during both spring and fall staging surveys. Upland birds were mostly found along the shoreline of Bathurst Inlet. A total of 147 raptor nest sites were mapped on cliffs; nests of peregrine falcon were the most abundant of all raptor species.

Aerial and ground surveys documented a total of 23 species of seabirds, although no evidence of breeding was recorded during breeding surveys in any years. In spring, staging areas appeared to occur in open-water areas and near major river drainages. In late-summer and fall (i.e., mid-July and August), large numbers (i.e., >50 birds) of Canada geese and ducks were observed in the shallow bay southwest of the MLA footprint. The greatest abundances of seabirds and seaducks were observed in late-summer and fall periods.

### 2.4.4 FRESHWATER FISH AND AQUATIC HABITAT

Comprehensive baseline studies on freshwater fish and aquatic habitat were conducted for the Goose Mine with more than 30 streams characterized. Lake zooplankton and lake and stream benthic invertebrate communities all showed considerable variation, consistent with the close coupling between trophic levels and the strong local effects. Site-specific baseline information has characterized healthy and robust communities of benthic invertebrates.

### 2.4.5 FRESHWATER FISH COMMUNITIES

The freshwater fish communities around the Goose Mine are characteristic of Arctic freshwater ecosystems and include freshwater as well as anadromous species at the MLA. Baseline studies were conducted extensively from 2010 to 2015, and periodically from then onwards. The freshwater fish communities are typical of inland, headwater regions of the Canadian Arctic. Lake trout was the dominant species, followed by round whitefish, Arctic grayling, slimy sculpin, and ninespine stickleback. Other species include burbot and lake whitefish. No Arctic char have been captured at the Goose Mine, although this species is likely present within the region.

### 2.4.6 MARINE FISH AND AQUATIC HABITAT

Based on nearshore surveys and TK, potentially important habitat areas for marine and anadromous fish were identified. The outlets of some rivers are important habitat for Arctic char.

### 2.4.7 MARINE FISH COMMUNITY

The marine fish community of Bathurst Inlet is characteristic of Arctic marine ecosystems and includes marine, anadromous, and freshwater/estuarine species. Nineteen fish species typically found in the Arctic have been captured during baseline studies. Although no Arctic char were captured at the MLA, this species is presumed to occur due to favourable habitat and appropriate spawning streams that flow into Bathurst Inlet.

## 3. PROJECT DESCRIPTION

---

### 3.1 LOCATION AND ACCESS

Although remote, the Project is accessible year-round through air transportation. There are all-weather airstrips located at the Goose Mine and the MLA, both of which will be extended for continued use. Both the Goose Mine and the MLA can be serviced by ice airstrips in the winter and by float planes in the open water season, if required. Crew movements to the Goose Mine and the MLA are facilitated by chartered air service from Edmonton, Yellowknife, Cambridge Bay, or Kugluktuk. Helicopters and fixed-wing aircraft are used as needed to support exploration and environmental monitoring and for movement between the MLA and Goose Mine sites.

Bulk cargo may be shipped by either of two open water marine shipping routes to the MLA on Bathurst Inlet. The ships and barges are self-sufficient for offloading cargo. Lightering barges may be used to transfer cargo from the vessel to the MLA. Bulk fuel is transported to the MLA via tanker ships or barges and then transferred to storage tanks on land at the MLA. Incoming freight and fuel are staged at the MLA to await transfer to the Goose Mine over the Winter Ice Road (WIR), a 160 km long seasonal winter road. Summer-season transfer of goods and personnel between the MLA and Goose Mine is by air. Outgoing cargo will be staged at the MLA to await the appropriate vessel for back-haul. Ground transportation within the Goose Mine and MLA is completed by all-weather roads.

### 3.2 SITE HISTORY AND EXPLORATION

Comprehensive summaries of historical work on the Property were compiled in previous technical reports by WGM (2005), Coffey Mining (2009), and Nakai-Lajoie and Cater (2011). A summary of the historical ownership milestones of the Property is presented in Table 3.2-1.

Exploration activities have been carried out in the Project area since 1982 and will continue over the life of the Project. Exploration activities are currently ongoing across the Back River District. The exploration activities at the Back River District are being completed in accordance with the approved Type B Water Licences (2BE-GOO2028 and 2BE-GEO2025) and land use permits. Goose exploration facilities located at the Goose Mine that are dedicated to exploration work include an all-season exploration camp, core processing facilities, heavy equipment storage facilities, warehouses and maintenance shops, fuel storage, local all-weather airstrip and roads, core box and supply storage, and a quarry (called the Airstrip Quarry). George exploration facilities located on the George Claims Group include an all-season exploration camp, core processing facilities, heavy equipment storage facilities, warehouses and maintenance shops, fuel storage, local all-weather airstrip and roads, and core box and supply storage.

The Goose and George exploration facilities are not covered in this ICRP as these facilities are covered under the Type B Exploration Facilities ICRP (2BE-GOO2028 and 2BE-GEO2025).

With respect to the airstrip and quarry at the Goose Mine site, only the works related to the existing all-weather airstrip for the Goose Mine and further development of the Airstrip Quarry are included in this ICRP.

**Table 3.2-1 Historical Ownership Milestones and Exploration/Development Summary**

<b>Dates / Period</b>	<b>Operator / Owner</b>	<b>Ownership Milestone</b>	<b>Exploration Completed</b>	<b>Reports or Studies Completed</b>
1982	Back River Joint Venture (BRJV)	BRJV formed	Reconnaissance exploration	–
1983–1985	Back River Joint Venture	-	Gridding, geological mapping, sampling, exploration drilling, aeromagnetic surveys	–
1985	F.W. Hill & Esso Minerals Canada	Investor and operator	Airborne magnetics and electromagnetic surveys	–
1985–1986	Kerr-McGee Corp.	Acquired interest; operator in 1986	Exploration drilling	–
1986	Bow Valley	-	Soil sampling at Del prospect, trenching, exploration drilling	–
1987–1996	Homestake Mineral	Earn-in; operator from 1991	Geological mapping, panel and till sampling, exploration and infill drilling, geochemical study, geophysics, legal surveying	Prefeasibility and Feasibility Study
1997–1998	Arauco (later Kit Resources)	Acquired BRJV	Geological mapping, sampling, exploration and infill drilling	Resource Estimate
1999–2002	Kinross	Earn-in; operator	Spectral IP/resistivity survey, till sampling, geological mapping, channel sampling, soil sampling, exploration and infill drilling	Resource Estimate and Conceptual Study
2003–2004	Miramar	Earn-in; operator	Exploration and infill drilling	NI 43-101 Report
2005–2008	Dundee Precious Metals (DPM)	Earn-in; operator	Trench sampling, geological mapping, exploration and infill drilling, structural analysis, airborne magnetic, electromagnetic and radiometric surveys, geochemistry and rock samples	NI 43-101 Report
2009–2011	Sabina Gold & Silver Corp. (Sabina)	Acquired 100% ownership of the Back River Gold District	District-scale exploration; geological mapping; infill, extension, and geotechnical drilling at Goose, Umwelt, Llama, and George deposits; infrastructure and logistics planning	Technical reports supporting project advancement
2012–2013	Sabina	-	Extensive infill, extension, and geotechnical drilling in support of project advancement; discovery and expansion of multiple mineralized zones; regional target testing	Pre-Feasibility Study (Back River Project)

Dates / Period	Operator / Owner	Ownership Milestone	Exploration Completed	Reports or Studies Completed
2014–2016	Sabina	-	Ongoing resource definition drilling; environmental baseline studies; project design refinement	NI 43-101 Technical Reports and updated resource estimates
2017–2018	Sabina	-	Advanced permitting and stakeholder engagement; execution of Inuit Impact and Benefit Agreement (Framework Agreement with Kitikmeot Inuit Association, 2018)	Environmental assessment documentation
2019–2020	Sabina	-	Feasibility-level engineering; optimization of mine plan and infrastructure; continued permitting activities	Updated Feasibility Study
2021–2022	Sabina	-	Early works and construction readiness activities; site infrastructure development; winter road and logistics preparation	Updated Feasibility Study; NI 43-101 technical updates
2023	B2Gold Corp. (B2Gold)	Acquired 100% ownership of the Back River Gold District	Transition to B2Gold ownership; confirmation of development plans for Goose Mine	Acquisition disclosures and technical continuity filings
2024–2025	B2Gold	-	Mine construction at Goose; infrastructure installation; commencement of mining operations	Construction and operational updates
2025–Present	B2Gold	-	Goose Mine achieved first gold production (June 2025) and declared commercial production (October 2025); district-scale planning for additional deposits	Operational disclosures and technical updates

Source: Summary by AMC Mining Consultants (Canada) Ltd., based on information provided by Sabina Gold & Silver Corp. (2015).

Note: Trigg, Woollett, Olsen Consulting Limited (TWOCL) was the founder of the Back River Joint Venture (BRJV).

### 3.3 CONSTRUCTION AND OPERATIONS

The Construction Phase was completed in 2025, and key construction activities included open pit excavation and construction of water management structures as well as pads and roads. Major infrastructure was constructed at both the Goose Mine and the MLA. The Operations Phase will extend for an estimated 14 years and will consist of both open pit and underground mining at the Goose Mine. Three Tailings Facilities (TFs) will be operated sequentially through Operations in mined-out open pits (i.e., Echo TF, Umwelt TF, and Llama TF).

Four deposits (i.e., Echo, Llama, Umwelt, and Goose Main) will be mined as both open pits and underground workings. A total of 18.8 Mt of ore is planned to be mined, at a nominal milling rate of 4,000 tonnes per day (tpd), with a ramping down period in the last year of Operations. Open pit mining began prior to Process Plant commissioning to generate an ore stockpile to feed the Process Plant.

The ore from all open pits will be recovered using conventional truck and shovel open pit mining methods. There will be one main Ore Stockpile at the Goose Mine, southeast of the Process Plant, and additional temporary stockpiles at the underground laydowns areas (Figure 1.5-1). The Ore Stockpile will contain different sub-stockpiles that will vary by grade, and all ore will be processed in the Process Plant on site during Operations using conventional gravity concentration and cyanidation techniques. Runoff from the Ore Stockpile will be collected in the Ore Stockpile Pond and managed as site contact water (Sabina 2017a).

### 3.4 PROJECT SUMMARY

The current mine plan is a subset of the previously approved permitted mine and the modifications outlined in the 2026 Modification & Management Plan Updates (B2Gold Nunavut 2026d). The current condition of each site component is provided in Section 4, including details of the proposed reclamation plan for each component. The main components and subcomponents of the ICRP are listed below and shown on Figure 1.5-1 and Figure 1.5-2.

#### 3.4.1 GOOSE MINE

The major permitted infrastructure at the Goose Mine includes the following:

- ◆ Goose Plant Site (Goose Camp Accommodations and Process Plant);
- ◆ Ore Stockpile;
- ◆ Open pits and underground mine workings (i.e., Echo, Umwelt, Llama, and Goose Main open pits and undergrounds);
- ◆ Tailings management facilities – In pit deposition (i.e., Former Echo Open Pit transitioned to Echo TF, former Umwelt Open Pit transitioned to Umwelt TF, and former Llama Open Pit transitioned to Llama TF);
- ◆ Permanent Waste Rock Storage Areas (i.e., Umwelt WRSA, Llama WRSA, Echo / Goose Main WRSA, Umwelt Overflow WRSA);
- ◆ Temporary Waste Rock Storage Stockpiles (i.e. Underground PAG Temporary Stockpile, Temporary NPAG Stockpile);
- ◆ Goose Property All-weather Airstrip;

- ◆ Saline Water Pond (SWP) (i.e., Umwelt Lake, once dewatered);
- ◆ Primary contact water storage pond (i.e., Primary Pond);
- ◆ Goose Main Reservoir (i.e., Goose Main Pit as meromictic lake);
- ◆ Event ponds (i.e., Llama WRSA Pond, Echo / Goose Main WRSA Pond, Plant Site Pond, Ore Stockpile Pond);
- ◆ Freshwater intake systems;
- ◆ Landfarm; and
- ◆ Haul and service roads.

### 3.4.2 MARINE LAYDOWN AREA

The major permitted infrastructure at the MLA includes the following:

- ◆ Industrial area, including camp and storage areas;
- ◆ Hazardous waste management area and landfarm;
- ◆ Desalination plant and associated water management infrastructure;
- ◆ Construction laydown area; and
- ◆ Fuel storage and offloading pad.

### 3.4.3 WINTER ICE ROAD

The permitted infrastructure along the WIR includes the following:

- ◆ Three service/emergency camps; and
- ◆ Quarries.

## 3.5 LIFE OF MINE PLAN

The total life of the Goose Project includes four phases spanning approximately 28 years: Construction, Operations, Closure, and Post-Closure. The first phase, Construction, was an approximately 3-year phase that was completed in 2025. Figure 3.5-1 presents the Project phases and stages, along with tailings and waste rock disposal scheduling and key water management activities for each of the deposits.

Throughout the mine planning process, the Goose Project has been designed with final closure in mind. Where possible, the designs of waste rock and tailings disposal areas, berms, and water management infrastructure have been chosen or modified to reduce the potential overall impact of the development and to facilitate progressive reclamation. Examples of designing for closure include:

- ◆ The use of mined-out open pits for tailings deposition, reducing disturbance related to a stand-alone tailings storage facility;
- ◆ The use of mined-out open pits as water management ponds (i.e., Goose Main Reservoir); and
- ◆ Placement of the NPAG closure cover over WRSAs during mine operations.



## 4. PERMANENT CLOSURE AND RECLAMATION

---

This section presents the interim plans for the permanent closure of the Goose Project. Closure and reclamation planning is an iterative process, and it is recognized that at this stage in the Goose Mine development it is premature to have detailed environmental and engineering plans for all aspects of final closure. The interim plans provide records of closure and reclamation planning over specific time periods and are critical milestones in the process of developing a final optimized closure and reclamation plan.

For the purposes of organizing information on closure and reclamation planning, the mine site has been divided into the following closure management areas:

- ◆ Open pit mine workings;
- ◆ Underground mine workings;
- ◆ WRSAs;
- ◆ TFs;
- ◆ Buildings and Equipment;
- ◆ Mine Infrastructure;
- ◆ Rock Fill Pads, Roads, and Airstrips;
- ◆ Waste Management Sites;
- ◆ Water Management Systems; and
- ◆ Quarries and Borrow Sites.

The refined mine plan outlined in this ICRP is based on a subset of the previously approved and permitted mine plan, 2020 Modification Package, and the proposed 2026 Modification and Management Plan Updates (B2Gold Nunavut 2026d). This Plan does not currently include the TSF. However, the TSF may still be developed in future based on results of continued advancement in detailed engineering and market considerations (Section 1.6). In this event, B2Gold Nunavut will update the ICRP as outlined in Part B, Item 17 of the Type A Water Licence, 2AM-BRP1831 Amendment No. 1.

### 4.1 DEFINITION OF PERMANENT CLOSURE AND RECLAMATION

Permanent closure is defined as the final closure of a mine site, with no foreseeable intent to return to either active exploration or mining. Permanent closure indicates that the proponent intends to have no further activity on the site aside from Closure-related activities and Post-Closure monitoring and potential contingency actions. Permanent closure does not, however, preclude the proponent or another party from pursuing opportunities at the existing site or in the area at a time beyond the foreseeable future (MVLWB 2013).

Mine closure is anticipated to consist of four phases:

- ◆ **Progressive Closure (i.e., progressive reclamation):** Some closure activities are undertaken, in whole or in part, during mine operations.
- ◆ **Active Closure:** During this time, Active Closure activities, such as demolition, earth-moving, waste disposal, and rerouting of pipelines, will occur. Water treatment may also occur during this time, if required.
- ◆ **Passive Closure:** Seasonal water treatment (if required) and monitoring will be completed following Active Closure. A final demobilization and demolition of mine facilities will occur at the end of this stage.
- ◆ **Post-Closure:** A period of time during which confirmatory water quality, stability, aquatic effects, and ecosystem monitoring is conducted to ensure closure objectives have been met and application of any necessary adaptive management actions.

An important consideration of permanent closure is the effect of mine closure on employees, contractors, suppliers, and the public, which will be managed and minimized through the Socio-Economic Monitoring Committee (SEMC) and Socio-Economic Monitoring Plan (SEMP). It is B2Gold Nunavut's aim to plan for closure so that adequate notice (if possible, on the order of a year or more) can be given to employees and the public.

Some infrastructure may stay in place should local communities, KIA, GN, federal government bodies, or other appropriate parties choose to take ownership of it. The schedule outlined in this ICRP assumes that all infrastructure associated with the Project will be removed.

## 4.2 SITE-WIDE CLOSURE CONSIDERATIONS

### 4.2.1 PRE-DISTURBANCE AND FINAL SITE CONDITIONS

The Project area was previously undeveloped. The pre-disturbance conditions are based on baseline data collection programs summarized in Section 2. The completion of the construction, project development, and continuous exploration drilling have changed the existing conditions from their pre-disturbance state. Figure 4.2-1 and Figure 4.2-2 present aerial photographs of the Goose Mine and MLA, respectively, from 2019.

### 4.2.2 CLOSURE OBJECTIVES AND CRITERIA

Closure objectives and criteria that apply throughout the site, regardless of the mine area, are summarized in Table 4.2-1. This table includes a description of each site-wide closure objective, the criteria that will be used in the evaluation of the noted actions/measurements, and the nature of the monitoring that would be carried out to demonstrate that the objectives have been met. An overview of criteria is presented for each objective, with numerical values (where applicable) to be developed for the FCRP.

FIGURE 4.2-1 GOOSE MINE ORTHOPHOTO OF EXISTING CONDITIONS

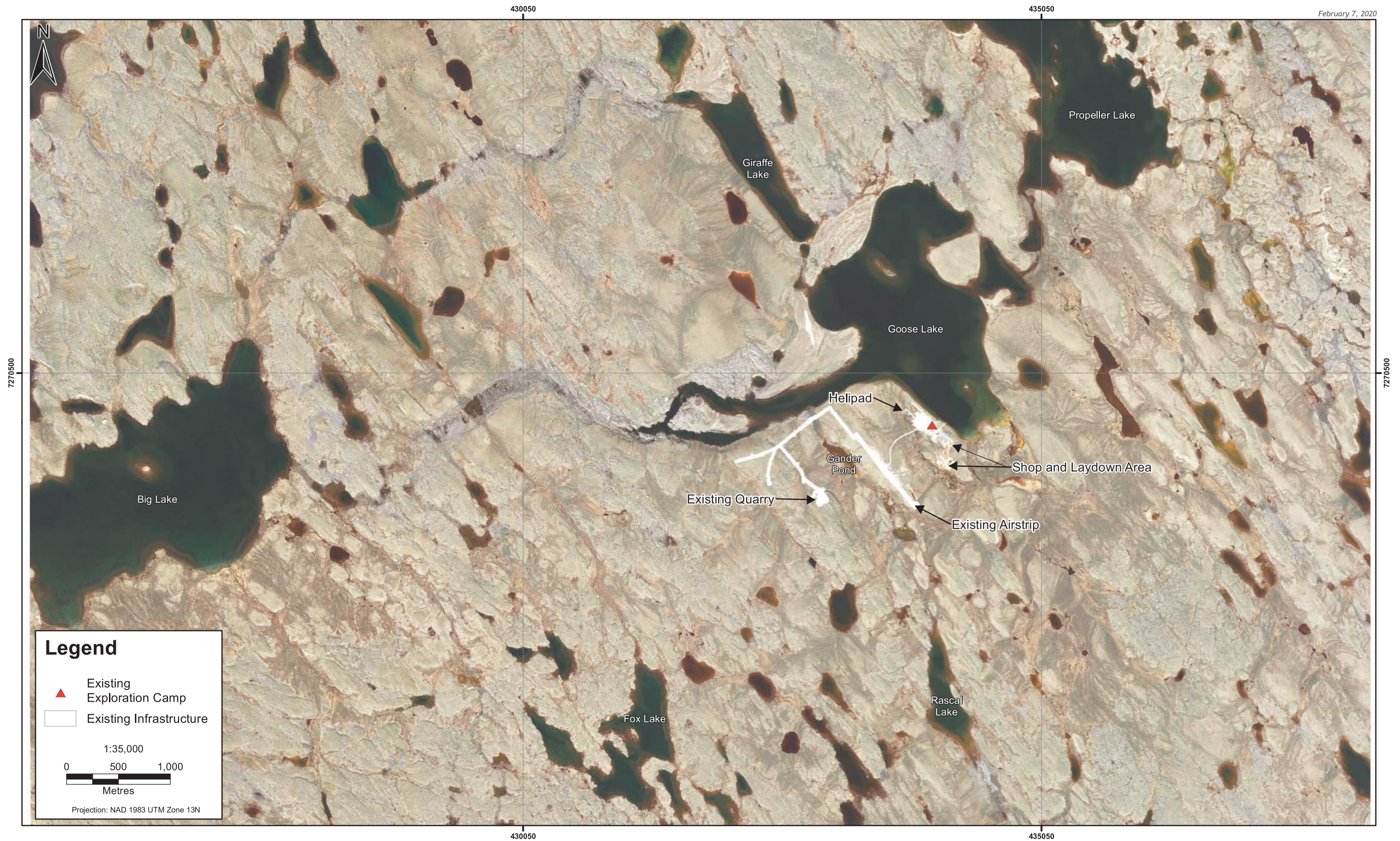


FIGURE 4.2-2 MARINE LAYDOWN AREA ORTHOPHOTO OF EXISTING CONDITIONS



CLIENT: B2Gold Nunavut  
GRAPHICS NUMBER: BAC-26ERM-008\_T:2

**Table 4.2-1 Closure Objectives and Criteria – Site Wide**

<b>Component</b>	<b>Closure Objectives</b>	<b>Closure Criteria</b>	<b>Actions/Measurements</b>
Air	Meet Canadian Ambient Air Quality standards	Best management practices for controlling fugitive and exhaust emissions during active reclamation will be implemented	Routine air quality monitoring
	Control dust generation from demolition and active reclamation activities	Best management practices to control dust	Implement controls and routine air quality monitoring
Community	Consider community land use expectations and Inuit Qaujimagatunangit (IQ, or Inuit Traditional Knowledge) in the closure planning	Community engagement and solicitation of IQ will continue to be implemented	Public engagement
	Consider transition plans	Community programs will be established to transition into closure	Physical inspection

### 4.2.3 POST-CLOSURE MONITORING AND MAINTENANCE

The Post-Closure monitoring and maintenance program will be implemented following the Closure Phase. Post-Closure monitoring and maintenance for the open pit mine workings is discussed in the following sections, along with the reporting requirements. Some of the sections below are general and apply for the other Project components as well.

Monitoring programs will be initiated during Construction and Operations to provide additional baseline information on which to base the FCRP. The adaptive management plans to be used in Closure and Post-Closure will follow the actions completed during Operations and will be coordinated with the operational monitoring programs (e.g., Aquatic Effects Monitoring Plan [AEMP] and Environmental Management and Protection Plan) to set appropriate trigger levels, mitigation plans, and actions.

Monitoring and maintenance programs that are implemented during the Closure and Post-Closure phases will use the data collected during operational monitoring to assess the performance of reclamation and closure, and to identify long-term maintenance requirements, if any. The data collected during Post-Closure monitoring will allow the procedures and activities to be adjusted or modified as necessary to confirm ongoing environmental protection.

#### 4.2.3.1 CLOSURE AND POST-CLOSURE STRATEGIES

Development of monitoring and maintenance programs is an iterative process in consultation with communities and regulators as the Project advances. The Closure and Post-Closure monitoring and maintenance programs will be extensions of efforts undertaken during the Operations Phase and would reflect the success of the management of the site during Operations to limit contamination. The actual conditions or impact from the Operations within the mine footprint would be understood at Closure and this information would be used to modify monitoring plans moving through Closure and into Post-Closure.

Closure and Post-Closure monitoring and maintenance will be carried out at a reduced frequency depending on the results of the monitoring and the measures of success selected for closure.

## 4.3 OPEN PIT MINE WORKINGS / TAILINGS FACILITIES

### 4.3.1 OPEN PIT / TAILINGS FACILITY DESCRIPTION

There will be four open pits at the Project: Echo, Umwelt, Llama, and Goose Main. The mined-out Echo, Umwelt, and Llama Pits will be used for tailings storage following completion of mining (i.e., Echo TF, Umwelt TF, and Llama TF). Approximately 18.2 Mt of tailings will be produced over the life of mine. Tailings deposition will begin at Echo, and transition to Umwelt and Llama.

A summary of open pit characteristics is provided in Table 4.3-1. The estimated final volumes of tailings deposition are summarized by pit in Table 4.3-2.

**Table 4.3-1 Open Pit Physical Characteristics Summary**

Open Pit	Length	Width (m)	Depth (m)	Footprint (ha)	Depth (m)	Estimated Volume (Mm <sup>3</sup> )
Echo	400	300	100	10.9	100	3.2
Umwelt	620	460	150	21.9	150	11.2
Llama	530	400	150	17.6	150	12.0
Goose Main	810	460	180	30.4	180	18.2

**Table 4.3-2 Tailings Facility Estimated Volumes**

Location	Final Tailings Volume (Mt)	Final Tailings Volume (Mm <sup>3</sup> *)
Echo TF	4.5	3.23
Umwelt TF	9.9	7.04
Llama TF	4.4	3.14
<b>Total Project</b>	<b>18.8</b>	<b>13.41</b>

Notes:

\* The tailings dry density is 1.4 t/m<sup>3</sup>.

Supernatant water contained in TFs will be reclaimed and reused in the Process Plant. Discharges from TFs are not planned until the pits have been closed. Water from the Umwelt TF and Llama TF will be treated through recirculation during Operations and will continue into Closure until discharge limits have been achieved. As part of recirculation treatment, water withdrawn from each TF will be treated and discharged back into the same TF (B2Gold Nunavut 2026c).

The majority of the tailings samples from the Goose Mine have been characterized as PAG (Rescan 2013; SRK 2015b). As such, tailings in the Echo TF will be covered with waste rock and overburden material from the Goose Main Open Pit once tailings deposition in Echo TF is complete, including a 5-m cover of NPAG material, to create the Goose Main WRSA. The Umwelt and Llama TFs will be flooded with a minimum freshwater depth of 5 m for closure to reduce oxidation of the tailings. The Goose Main Pit will be flooded, with a portion of the saline water from the SWP pumped to the bottom of the pit and then a freshwater cover to create a meromictic lake, forming Goose Main Reservoir. Partial filling with tailings in the TFs is expected to increase the physical stability of the open pits. Refer to the Tailings Management Plan (B2Gold Nunavut 2026a) for further tailings management details.

As permitted under Water Licence 2AM-BRP1831, other site effluent will also be directed to these facilities; this effluent will include seepage from the WRSAs and Ore Stockpile, saline water and contact water collected at the Project site, and sewage and effluent from other facilities that do not meet their discharge criteria. B2Gold Nunavut has committed to test a mixture of tailings and water treatment plant (WTP) sludges to evaluate the potential for remobilization of arsenic from this material. Tests will be conducted in the first year that WTP sludges are produced (B2Gold Nunavut 2026a).

### 4.3.2 PRE-DISTURBANCE, EXISTING, AND FINAL SITE CONDITIONS

The pre-disturbance surface area of Echo, Umwelt, and Goose Main pits are located on land, whereas the Llama Open Pit will be developed over a portion of Llama Lake.

At closure, the open pits / TFs will be flooded, with water treatment in TFs as required, at which point water will naturally overflow. Once closure and remediation activities are complete, the flooded open pits / TFs will become new waterbodies on the landscape, as shown in Figure 4.3-1.

The ultimate mine development of the Goose Mine is shown in Figure 1.5-1. Once closure and remediation activities are complete, the flooded TFs will be new features on the landscape or be left for natural revegetation process to take place as shown in Figure 4.3-1.

### 4.3.3 CLOSURE OBJECTIVES AND CRITERIA

The closure objectives and closure criteria for the open pit mine workings are listed in Table 4.3-3.

### 4.3.4 CONSIDERATION OF CLOSURE OPTIONS AND SELECTION OF CLOSURE ACTIVITIES

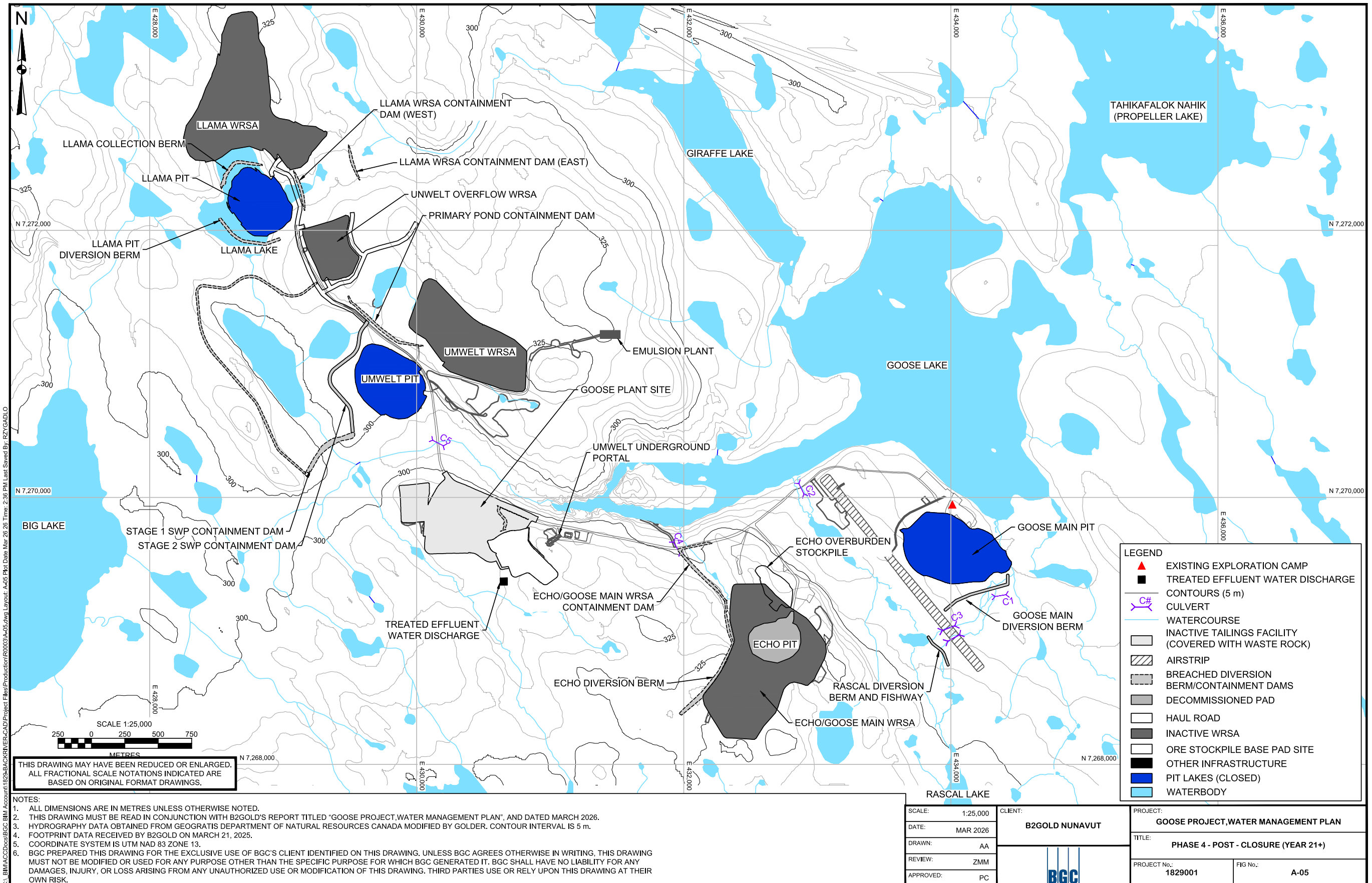
A number of reclamation studies were identified in the preliminary Mine Closure and Reclamation Plan submitted as part of the DEIS. Several of these studies were discussed during the Feasibility Study (FS) and development of the FEIS. A brief description of the closure activities considered for the open pits is provided below along with the rationale for the selection of the closure activities described in this Plan. For more details, see the Project Feasibility Study Report (JDS 2015) and FEIS (Sabina 2015).

#### 4.3.4.1 OPEN PIT FILLING AND FLOODING

The water balance completed for the Project (BGC Engineering Inc. [BGC] 2026) confirms that under average hydraulic conditions, a combination of active and passive flooding will complete pit filling near the end of Closure (Figure 3.5-1). During the FS, the financial and technical considerations of active filling were considered, and active flooding was not the preferred option due to the limited pumping window (i.e., primarily during freshet) and the associated costs. B2Gold Nunavut intends to primarily use passive flooding to fill pits; active flooding using water from local freshwater sources will be used as required to meet closure objectives. B2Gold Nunavut will work with regulatory bodies to ensure that any potential overall effects to freshwater sources are minimized as much as feasible.

The potential to backfill any of the pits with waste rock, and the additional option to backfill open pits with tailings, was also evaluated. Details of this analysis are provided in the Multiple Accounts Analysis submitted in the FEIS Information Request Response Package (Sabina 2016). The waste management strategy selected involves using open pits to hold tailings once mining is completed (i.e., Echo TF, Umwelt TF, Llama TF). At Closure, tailings deposited in the Echo TF will be covered with waste rock. Tailings deposited in the Umwelt and Llama TFs will be covered with a water cap that is sufficiently deep to avoid resuspension of tailings solids.

FIGURE 4.3-1 PHASE 4 - POST-CLOSURE (YEAR 21+)



CLIENT: B2Gold Nunavut  
 GRAPHICS NUMBER: BAC-26ERM-009\_T:3

**Table 4.3-3 Closure Objectives and Criteria – Open Pit Workings**

Component	Closure Objectives	Closure Criteria	Actions/Measurements
Land	Reduce the potential for inadvertent access by humans to slopes that are dangerous or unstable – mostly completed during Operations as progressive reclamation	Stabilize all slopes to the extent possible. It is noted that the partial backfilling with tailings and flooding will both increase stability.	Physical inspection by a qualified engineer; construction of the safety berms during Operations as progressive reclamation to extent possible
		Define a setback line in accordance with rock mechanics studies conducted for pit stability	
		Berms will be constructed around the open pit outside of the setback lines where slopes will exist above final water levels	
	Meet appropriate design levels for engineered structures for closure	The pit overflow structures and pipeline to the WTP will be designed and constructed according to the extreme precipitation event selected for its design	Design and construction of the overflow structures and pipeline
Water	Reduce and control contaminated drainage from the flooded pits	Integrate a water management plan to reduce and control contaminated drainage from the flooded pits	Routine monitoring and sampling; water treatment if required
		Implement a system to manage these waters, and to treat as necessary to meet site permit water quality objectives before release	
	Ensure outflow from the flooded open pits meets water licence criteria	Prior to overflow, the water quality will be profiled, and the most appropriate treatment method will be determined if necessary (e.g., in-pit treatment or through the WTP)	Routine monitoring and sampling; in-pit or water treatment at the WTP if required
	Control pit flooding	The bottom of Umwelt Pit will be partially filled with saline water to form meromictic conditions. Llama Pit will be partially filled with tailings. After that, all pits will be passively flooded with natural runoff and precipitation such that they can become natural outflow systems.	Routine monitoring and sampling; in-pit water treatment or water treatment at the WTP as necessary prior to release of open pit water

Component	Closure Objectives	Closure Criteria	Actions/Measurements
Wildlife	Discourage access to open pit; mostly completed during Operations as progressive reclamation	A plan will be developed to allow for reasonable exit should access occur All pit access ramp will be secured by rock berm barricades	Physical inspection; construction of rock barricades during Operations as progressive reclamation
	Reduce the possibility that water in the flooded open pits will affect wildlife health	Prior to overflow, the water quality will be profiled, and the most appropriate treatment method will be determined if necessary (e.g., in-pit treatment or through the WTP)	Routine monitoring and sampling; in-pit water treatment or water treatment at the WTP, if required
Health and Safety	Allow emergency access and exit from flooded pits – mostly completed during Operations as progressive reclamation	A plan will be developed to allow for reasonable exit should inadvertent access occur	Physical inspection
	Reduce the potential for inadvertent access by humans to slopes that are dangerous or unstable – mostly completed during Operations as progressive reclamation	Define a setback line in accordance with rock mechanics studies conducted for pit stability. Berms will be constructed around the open pit outside of the setback line where slopes will exist above the final water line	Physical inspection by a qualified engineer; construction of the berms during Operations as progressive reclamation to extent possible
	Reduce the possibility that water quality of downstream flows will affect human health	The effluent water quality will be monitored, and the most appropriate treatment method will be determined if necessary	Routine monitoring and sampling downstream of the decommissioned pits; in-pit water treatment or water treatment at the WTP as necessary prior to release of open pit water

Notes:

WTP = water treatment plant

During Operations, the mined-out Goose Main Pit will be converted to a water reservoir (i.e., Goose Main Reservoir). A portion of saline water from the SWP will be pumped to the bottom of Goose Main Reservoir to create meromictic conditions. The Goose Main Reservoir will be passively flooded during late Operations with site runoff and precipitation such that it can become a natural outflow system.

The flooding of open pits will reduce the exposure of high pit walls that might otherwise pose an acid generating and metal leaching risk. The covering of the Echo TF will also reduce acid generation and metal leaching potential.

#### 4.3.4.2 OPEN PITS GEOTECHNICAL STABILITY

The open pit slopes are designed to be stable under operating conditions. During pit development, a pit wall monitoring program, including geotechnical structural mapping, will be implemented to confirm design assumptions and to rapidly detect any unexpected conditions for follow-up and identify the adaptive measures to be undertaken. It is also noted that the partial backfilling with tailings and the flooding of open pits, as well as the development of a WRSA over Echo Pits, will increase stability.

Based on the planned activities through Operations and into Closure, no additional activities (e.g., regrading of slopes, erosion protection, revegetation) have been evaluated for increasing the stability of the pit walls after Closure.

#### 4.3.4.3 OPEN PIT PERIMETER—PEOPLE AND WILDLIFE PROTECTION

The open pits may be hazardous to wildlife species as animals may be injured by inadvertent access. Environmental design features and mitigation, as well as current wildlife management practices used in other mining projects, will be implemented at the Project to limit wildlife access and injury.

A setback line will be defined in accordance with rock mechanics studies conducted for pit stability. Rock berms will be constructed around each of the open pits outside of the setback line where residual slopes will exist above the final flood levels to reduce inadvertent human and wildlife access to dangerous or potentially unstable slopes. The construction of the rock berms will be mostly completed during Operations as progressive reclamation; the remainder of the perimeter berm will be completed during the Active Closure Stage. The rock berms were selected over fences based on feedback received from communities and reviewers regarding concerns relating to wildlife safety.

#### 4.3.5 ENGINEERING WORK ASSOCIATED WITH SELECTED CLOSURE ACTIVITY

In general, use of the open pits for tailings storage represents progressive reclamation during the Operations Phase. The tailings discharge infrastructure will be removed once tailings deposition reaches capacity for all facilities. Mine dewatering infrastructure (i.e., pumps, pipelines, and power sources) within the open pits will be either hauled to surface for reuse or drained of fluids and left in place at the bottom of the pits prior to backfilling with tailings and/or passive flooding. The open pits and TFs will be flooded such that these facilities can become natural outflow systems.

Supernatant water from the Echo TF will be reclaimed in the Process Plant, and waste rock from open pit developments will be used to cover the tailings surface. PAG waste rock will be placed over the tailings, and the entire PAG surface, whether PAG waste rock or tailings, will receive a final NPAG waste rock cover at least 5 m thick as described in Section 4.3.1.

The Umwelt TF and Llama TF will begin closure once tailings deposition in these locations cease. The TFs will be filled to a maximum of 5 m below their overflow elevations to provide sufficient storage for water to passively accumulate in the TFs to form a permanent water cover, which is deemed sufficient to limit resuspension of tailings solids due to wave action, surge following storm events, and ice scour. Flooding will also ensure adequate meromictic conditions in the Goose Main Reservoir and will, in all cases, reduce the exposure of high walls that might pose a ML/ARD risk.

Water from the Umwelt and Llama TFs will be treated to reduce metals and suspended solids loading starting in late Operations and continuing until closure objectives have been met; this treatment is also expected to include recirculation during Operations as these pits fill. Water treatment will be undertaken year-round during the Operations Phase with contingency treatment available during the Closure Phase, if required.

All pits will be progressively reclaimed, starting during Operations if practicable, by either flooding or by partially filling with tailings followed by passive/active flooding. Pit flooding times were estimated in the Water and Load Balance (BGC 2026), assuming flooding commences as soon as possible to reduce overall passive flooding requirements in Closure. Based on average hydrological conditions, the Llama and Umwelt TFs and Goose Main Reservoir will overflow by end of Closure (Figure 3.5-1).

The assumptions made in preparing the plan for pit closure include:

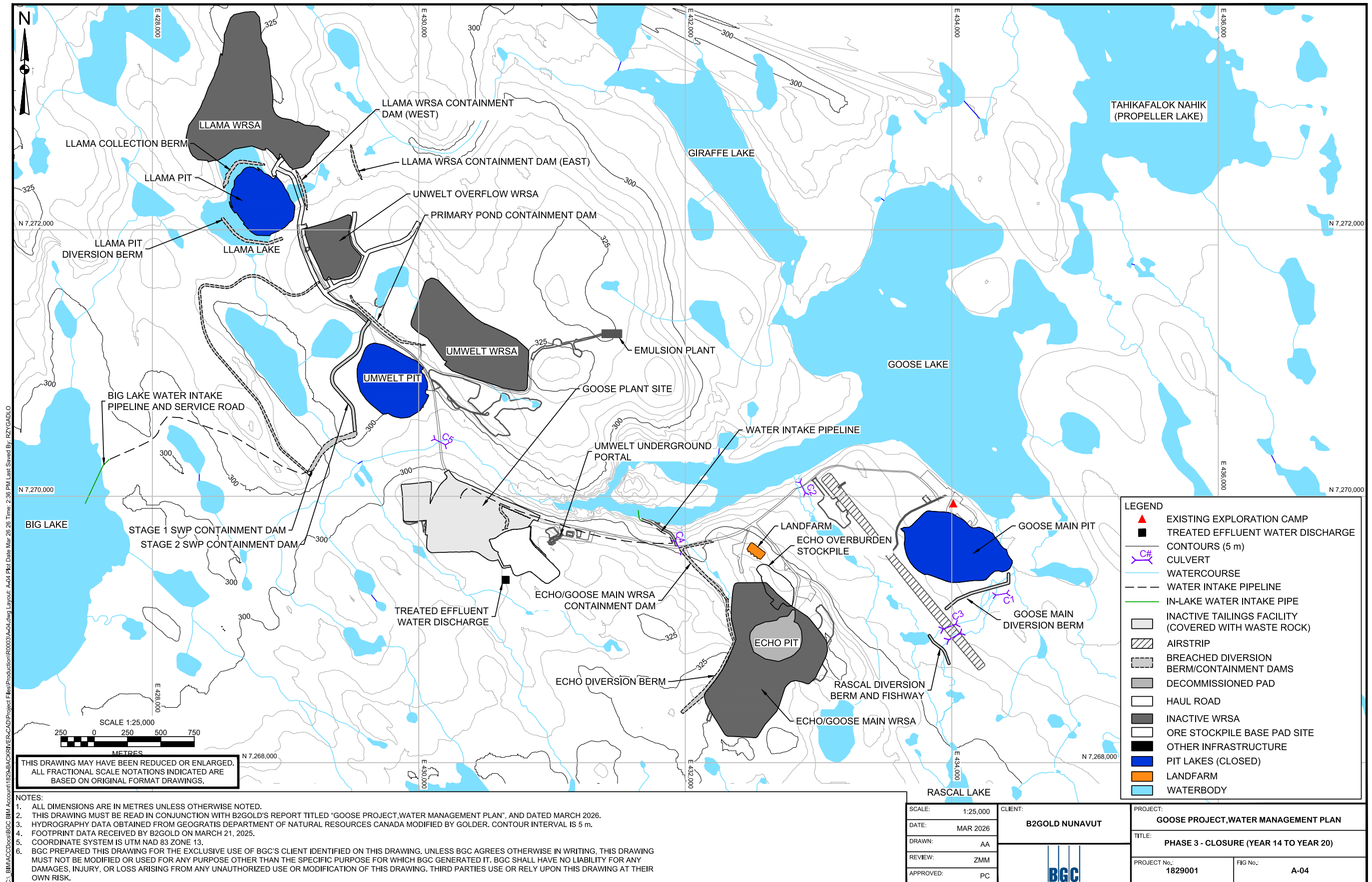
- ◆ Average hydrologic conditions (based on baseline hydrology and meteorology data) persist into the Operations and Closure phases.
- ◆ Tailings and saline water volumes that will be stored in open pits; and
- ◆ Overburden slopes around pit perimeters will be managed for stability during pit development so that additional reclamation work will not be required at Closure. This work would include possible cladding of these slopes for thermal stability, if necessary.

All open pits will be flooded to submerge as much of the pit walls as possible. Throughout both the Active and Passive Closure stages, water quality monitoring will occur at strategic control points to ensure closure criteria are being met. Monitoring locations at flooding mined-out pits will include the closed-out Umwelt TF, Llama TF, and Goose Main Reservoir. Monitoring will also occur in Goose Lake to ensure that discharge requirements are being met.

Non-contact water diversion berms around open pits will be breached during Closure. Spillways will be excavated at the Umwelt Pit and the Goose Main Pit to connect these facilities to the natural water system; no spillway construction is required at Llama Pit as natural drainages exist. Each flooded pit and TF will discharge to the environment on a seasonal basis. Discharge locations for the Goose Mine are shown as breach locations in Figure 4.3-2. It is expected that the overflow water discharged from the flooded pits and TFs will meet Metal and Diamond Mining Effluent Regulations (MDMER) Schedule 4 limits and all applicable limits outlined in the Licence at the time of flooding (B2Gold Nunavut 2026c).

Based on lag time calculations completed for the waste rock, it is possible that acidic conditions could develop in some of the PAG rock that is exposed in the pit walls; this possibility was considered in developing water quality predictions for the flooded pits (B2Gold Nunavut 2026c). However, results from the Water and Load Balance indicate that water from these pits will meet applicable discharge criteria, which will enable passive discharge into nearby watercourses (BGC 2026). In addition, passive flooding is planned to start during Operations once each facility is no longer required, potentially reducing exposure durations and cumulative loadings.

FIGURE 4.3-2 PHASE 3 - CLOSURE (YEAR 14 TO YEAR 20)



#### 4.3.6 PREDICTED RESIDUAL EFFECTS

The flooded open pits and resulting TFs as well as the Goose Main Reservoir, will be permanent features on the landscape. The following residual effects were predicted following reclamation:

- ◆ The extent of the effect on terrain, soil quantity, and vegetation communities will consist of approximately 25 ha of residual ground disturbance associated with the flooded open pits. This area excludes the majority of Llama Pit, which is located in Llama Lake.
- ◆ Flooding of open pits at Closure will result in the retreat of permafrost away from the flooded pit areas, which may result in the formation of through taliks, connecting the surface hydrological regime with the sub-permafrost hydrogeological regime. It is noted that a through talik likely already exists under Llama Lake and will continue to exist after flooding.
- ◆ Water quality changes (e.g., increased concentrations of arsenic, copper, and explosives residues) predicted in the updated Water and Load Balance Report (BGC 2026) may last into Closure and Post-Closure phases for some waterbodies, although levels will steadily decrease.
- ◆ Although wildlife species will be discouraged from using the flooded open pits, some may still do so, and these wildlife could potentially ingest surficial water.

The Project will have no long-term effect on the surface albedo; therefore, the effect of solar heating will be the same as on the surrounding landscape. No significant long-term residual effects were identified as part of the FEIS for the open pits. The Post-Closure impacts of these features are expected to be negligible.

#### 4.3.7 UNCERTAINTIES

The following uncertainties were identified during closure planning for the Project open pits and TFs.

##### 4.3.7.1 WATER QUALITY

While surficial water quality within the flooded open pits is predicted to meet requirements for direct discharge to the environment at or before Closure, actual water quality conditions will not be known with certainty until flooding is complete. Water within the TFs will be treated until water quality meets requirements for direct discharge; timelines will be confirmed during late Operations. Section 4.3.9 includes contingencies to minimize this potential risk.

##### 4.3.7.2 GEOTECHNICAL STABILITY

The open pit slopes are designed to be stable under operating conditions, but the walls of the open pits will have been exposed for a number of years during Operations, and some weathering will have occurred resulting in changes to the slope conditions. Therefore, the long-term stability of the open pit walls is an uncertainty in closure planning design. Nonetheless, the partial backfilling of the open pits with tailings, together with the flooding or waste rock capping of all open pits, will have a positive effect on long-term stability.

A much better understanding of these uncertainties will be gained by observing the behaviour of the slopes during Operations, and also from physical inspections to be carried out during Operations and Closure. In addition, Closure monitoring will add insight about the likely long-term behaviour of the

slopes. If this monitoring indicates potential problems, the rock berms construct around open pits can be relocated further from the pit rims.

#### 4.3.8 POST-CLOSURE MONITORING AND MAINTENANCE

Site-wide monitoring and maintenance considerations are presented in Section 4.2.3. The following are relevant monitoring and maintenance strategies for the planned open pit facilities during Closure and Post-Closure:

- ◆ Visually inspect the reclaimed areas;
- ◆ Identify unstable areas;
- ◆ Check stability of pit walls and overburden slopes above the pit water level at the start of the Post-Closure Phase to confirm the slopes are stable and that conditions remain as predicted;
- ◆ Sample surface water and profiles of flooded pits;
- ◆ Identify and test water management points (including seepage) that were not anticipated; and
- ◆ Inspect remaining barriers such as breached berms.

Water quality monitoring will occur at each open pit/TF until water quality objectives are met, at which time these facilities would be allowed to overflow. It is anticipated that after five years in the Post-Closure Phase, monitoring would no longer be required. The Closure and Post-Closure monitoring described above will determine the long-term maintenance that would be required for the Post-Closure Phase. B2Gold Nunavut notes that an allowance for long-term monitoring beyond the Post-Closure Phase has been included in the RLCE (Appendix D).

#### 4.3.9 CONTINGENCIES

Prior to flooding of the open pits, the quality of surface water and any groundwater seepage reporting from the pit walls will be sampled to assess the potential for contamination of the pit water during flooding. If additional water is needed for water covers or pit flooding, water will be pumped from Goose Lake. The surface water and vertical profiles of the flooded open pits will be sampled. If the results of water quality monitoring indicate that water in the flooded open pits is not suitable for direct discharge, the following alternatives will be considered as contingencies for the treatment of the flooded pit water:

- ◆ In-Pit water treatment; and
- ◆ Pumping to the WTP for active treatment prior to discharge into the receiving environment.
  - ◇ The WTP will be maintained for two additional treatment seasons following completion of flooding as a contingency.

As a contingency for pit flooding, B2Gold Nunavut may consider the closure of any TF by placing a 5-m cover of NPAG waste rock and overburden material over the tailings-filled open pit; this strategy is already employed for the Echo TF. The supernatant water would be reclaimed to the Process Plant once the tailings capacity was exhausted in the TF and then waste rock would be placed over the exposed tailings surface.

Thermistors will be installed in each WRSA to monitor the rate of freeze-back and permafrost development progress during the Operations Phase. The locations for the thermistors and monitoring schedule will be determined during the final detailed design stage and confirmed during Operations.

Should B2Gold Nunavut choose this closure option for TFs, all applicable management plans, including the ICRP, will be updated to reflect these changes, and B2Gold Nunavut will adhere to all appropriate requirements of the Project Certificate (PC No. 007) and the Type A Water Licence (2AM-BRP1831).

## 4.4 UNDERGROUND MINE WORKINGS

### 4.4.1 UNDERGROUND MINE WORKINGS DESCRIPTION

Each of the four deposits (i.e., Echo, Umwelt, Llama, and Goose Main) will also be mined using underground mining methods. All of the underground mines will be spatially located below the open pits; however, access will be from ramps and portals outside of the open pits themselves. Underground mining activities will occur over the entire mine life. The approximate dimensions for the four underground workings at the end of Operations are provided in Table 4.4-1.

**Table 4.4-1 Dimensions of Underground Workings at End of Operations**

Deposit	Depth (mbgs)
Umwelt	30
Llama	490
Echo	425
Goose Main	170

Notes:

mbgs = meters below ground surface.

The underground deposits will be accessed via declines driven from surface and will typically be 4.5 m wide by 5.0 m high at a -15% gradient. The declines will be used for haulage of ore and waste, and access of personnel, equipment, materials, and services. The declines will also be used as an exhaust airway. The locations of the portals were chosen such that environmental offset limits from streams and lakes were maintained.

The underground mining methods chosen for the various deposits are as follows:

- ◆ Umwelt: Post pillar cut-and-fill;
- ◆ Echo: Longitudinal open stoping; and
- ◆ Llama and Goose Main: drift and fill.

All selected underground mining methods require backfill to maintain ground stability and to provide a work base for the equipment on the next cut above. The primary source for backfill material is planned to be development waste rock from the underground mines. At each underground operation, there will be a net shortage of backfill material; the shortfall (approximately 1.5 Mt based on 2025 Life of Mine plans) will be made up by utilizing PAG waste rock from the open pit operations.

Ventilation systems for the underground operations, consisting of fresh air raises and main fans, have been designed to dilute and remove dust, diesel emissions, and blasting fumes, and to thus maintain compliance with Nunavut mine regulations. Based on ventilation modelling results, a twinned 4-m diameter fresh air raise system is required at each underground mine. In addition, a 4-m diameter exhaust air raise system will be required midway down the Umwelt deposit.

Groundwater inflows are expected at Umwelt, Llama, and Goose Main underground mines, and these inflows are expected to be saline. The Echo Underground does not extend into the permafrost. Inflows are anticipated where mine workings extend below the base of permafrost, which correlates to approximately 320 mbgs to 350 mbgs. In mining areas above the permafrost, no groundwater inflows are expected. The predicted groundwater inflow rates at the cessation of underground mining at each location are as follows:

- ◆ Umwelt: 312 m<sup>3</sup>/d;
- ◆ Llama: 246 m<sup>3</sup>/d; and
- ◆ Goose Main: 64 m<sup>3</sup>/d.

After underground mining is completed and the potential for an extension of the underground operations has been dismissed, dewatering will cease and the underground workings at Llama, Umwelt, and Goose Main will be flooded with saline water from the SWP. Underground workings at Echo will be flooded with site contact water entering through the portal and through the connection to Echo Pit.

#### 4.4.2 PRE-DISTURBANCE, EXISTING, AND FINAL SITE CONDITIONS

The surface area associated with the underground workings are limited to an access portal and vent raises.

#### 4.4.3 CLOSURE OBJECTIVES AND CRITERIA

The closure objectives and closure criteria for the underground mine workings are listed in Table 4.4-2.

#### 4.4.4 CONSIDERATION OF CLOSURE OPTIONS AND SELECTION OF CLOSURE ACTIVITIES

Backfilling the portal with waste rock and capping the vent raises is considered to be the only viable option for eliminating access to the underground mine workings.

As part of the FS (JDS 2015), water management for the Project was optimized to reduce the surface disturbance footprint, and pumping of saline water from the SWP to the underground workings was preferred over allowing workings to flood passively with groundwater inflows.

**Table 4.4-2 Closure Objectives and Criteria – Underground Mine Workings**

Component	Closure Objectives	Closure Criteria	Actions/Measurements
Land	Eliminate access to underground mine workings and surface openings	The portals will be backfilled with waste rock, and the vent raises will be capped to eliminate the access to the underground mine workings	Physical inspection and monitoring
	Remove hazardous materials from the underground mine	Fuels, oils, chemicals, and other hazardous materials will be removed for disposal off site at a licenced facility prior to flooding	Physical inspection and monitoring
Water	Eliminate access to underground mine workings and surface openings	The portal will be backfilled with waste rock, and the vent raises will be capped to eliminate the access to the underground mine workings	Physical inspection and monitoring
	Allow underground to flood	The Umwelt underground workings will be flooded with water from the SWP	Initial physical monitoring to check flooding but limited once ventilation is turned off.
Wildlife	Eliminate access to underground mine workings and surface openings	The portal will be backfilled with waste rock, and the vent raises will be capped to eliminate the access to the underground mine workings	Physical inspection and monitoring
Health and Safety	Eliminate access to underground mine workings and surface openings	The portal will be backfilled with waste rock, and the vent raises will be capped to eliminate the access to the underground mine workings	Physical inspection
	Ensure the stability of underground workings after closure	The underground will be designed and mined to be physically stable; it will be back-filled as needed during Operations	Meet appropriate design levels, physical inspection and crown pillar stability assessment by a qualified engineer and monitoring

#### 4.4.5 ENGINEERING WORK ASSOCIATED WITH SELECTED CLOSURE ACTIVITY

The relevant engineering works associated with the permanent closure activities for the underground mine workings are as follows:

- ◆ Surface openings will be sealed; the portal will be backfilled with NPAG waste rock, and the vent raises will be capped with concrete to eliminate access to the underground mine workings;
- ◆ Any equipment or infrastructure left underground will be cleaned, drained of fluids, inspected, and remediated as appropriate to eliminate the risk of contaminant leakage;
- ◆ Hazardous materials (e.g., fuels, oils, glycol, batteries, explosives) will be removed and disposed at an approved disposal facility;
- ◆ Contamination associated with vehicle and equipment fuelling areas will be identified and remediated;
- ◆ Disturbed surface areas will be re-contoured to stabilize and establish positive natural drainage patterns and blend in with the surrounding topography to the extent possible;
- ◆ Unused explosives will be consumed on site or removed and shipped off site;
- ◆ Areas with excessive hydrocarbon contamination will be removed and cleaned in the on-site landfarm if appropriate; and
- ◆ The underground workings will be flooded as soon as feasible on the completion of mining.

#### 4.4.6 PREDICTED RESIDUAL EFFECTS

No significant long-term effects have been identified for the underground mine workings. After Closure, the only surface expression of the underground workings will be the vent raise pads, and the backfilled portal and ramp leading to the portal. It is expected that the temperature of the underground mine workings will return to that of the pre-existing permafrost. The Post-Closure impacts of these features are expected to be negligible.

#### 4.4.7 UNCERTAINTIES

The long-term stability of the crown pillars will be a function of the final dimensions (i.e., stope width and crown pillar thickness) as well as actual local bedrock conditions and the extent of backfilling. A rock mechanics study will be carried out at the end of underground mining to determine if any potentially unstable crown pillars exist and to specify any remedial actions, if necessary.

There are currently no other identified uncertainties associated with the closing of the surface openings to the underground or flooding the underground works.

#### 4.4.8 POST-CLOSURE MONITORING AND MAINTENANCE

Site-wide monitoring and maintenance considerations are presented in Section 4.2.3. The following presents the relevant monitoring and maintenance strategies for the underground mines:

- ◆ Visual inspections of the reclaimed areas (specially at and around the backfilled portal and closed vent raises);
- ◆ Check for surface expression (i.e., subsidence) of underground failure;

- ◆ Periodically backfill areas of subsidence as required; and
- ◆ Instrumentation for groundwater monitoring will be placed in vent raises or manways as mining operations is completed to allow for Post-Closure monitoring of flooding.

#### 4.4.9 CONTINGENCIES

If crown pillar or shallow drifts collapse back to surface resulting in subsidence, then the subsidence area will be backfilled to grade with waste rock. If subsidence continues, the area will be delineated with a rock berm, and signs will be posted warning of the subsidence area.

### 4.5 WASTE ROCK STORAGE AREAS

#### 4.5.1 WASTE ROCK STORAGE AREAS DESCRIPTION

A total of approximately 112 Mt of overburden and waste rock will be generated for the Project. Descriptions of WRSAs, including footprints, heights, and maximum capacities are provided in Table 4.5-1. There will be four WRSAs at the Goose Mine as follows (B2Gold Nunavut 2026d):

- ◆ Umwelt WRSA: Located east of the Umwelt Open Pit.
- ◆ Umwelt Overflow WRSA: Located north of the Umwelt Open Pit.
- ◆ Llama WRSA: Located southeast of the Llama Open Pit.
- ◆ Echo/Goose Main WRSA: Located adjacent to the Echo Open Pit.

**Table 4.5-1 Waste Rock Storage Area Descriptions**

WRSA	Footprint (ha)	Height (m)	Maximum Capacity (Mt)
Llama WRSA	59	110	42.1
Umwelt WRSA	38	80	23.2
Umwelt Overflow WRSA	13	30	4.4
Echo WRSA <sup>a</sup>	28	30	8.2
Goose Main WRSA	63	100	52.4

Notes:

<sup>a</sup> Echo WRSA values included in Goose Main WRSA.

Additionally, there will be two temporary WRSAs located north of the Umwelt Overflow WRSA that will be used during Operations as follows:

- ◆ Temporary NPAG Stockpile.
- ◆ Temporary Underground PAG Stockpile.

The locations of the WRSAs were chosen based on consideration of the environmental, social, economic, and technical aspects of waste rock management, which included the following:

- ◆ Minimize the overall footprints of the WRSAs while maintaining the short-term and long-term stability of the facilities;
- ◆ Avoid or minimize effects impact to fish bearing lakes (Sabina 2017b);
- ◆ Minimize the haul distance from the open pits to the WRSAs;
- ◆ Minimize the number of water catchment areas potentially affected by drainage from the WRSAs;
- ◆ When feasible, divert the upstream clean natural non-contact run-on water away from the WRSAs;
- ◆ Facilitate the collection and management of contact water from the WRSAs during Operations to avoid potential effects on the surrounding environment;
- ◆ Maintain a minimum distance of 100 m between the toe of the WRSAs and the open pits;
- ◆ Maintain a minimum distance of 100 m between the toe of the WRSAs and adjacent lakes that will not be disturbed by mine activities; and
- ◆ Build the WRSAs to maximize progressive reclamation and minimize dedicated closure activities during the Closure Phase.

#### 4.5.1.1 UMWELT WRSA

The Umwelt WRSA will permanently occupy an area of approximately 38 ha with a height of approximately 80 m. The Umwelt WRSA will be used to store the majority of the waste rock and overburden from the Umwelt Open Pit. Some geochemically suitable waste rock from Umwelt Pit may also be used for the construction of site roads and pads. One small stream and two ponds are located within the footprint, or immediately upstream, of the Umwelt WRSA and will be covered by the facility. The stream and ponds are non fish-bearing, less than 2 m deep, and freeze to the bottom annually during winter. To manage slope stability, overburden will be placed within areas surrounded, and ultimately covered, by waste rock.

#### 4.5.1.2 UMWELT OVERFLOW WRSA

A secondary, smaller WRSA, designated as the Umwelt Overflow WRSA, will be utilized once the Umwelt WRSA reaches its design capacity. The Umwelt Overflow WRSA will permanently occupy an area of approximately 13 ha with a height of approximately 30 m north of the Umwelt Open Pit. There are no ponds or streams located within the footprint of the facility.

#### 4.5.1.3 LLAMA WRSA

The Llama WRSA will permanently occupy an area of approximately 59 ha with a height of approximately 110 m. The Llama WRSA will store waste rock and overburden from the Llama Open Pit. There are no ponds or streams located within the footprint of the facility. To manage slope stability, overburden will be placed within areas that will be surrounded by waste rock.

#### 4.5.1.4 ECHO / GOOSE MAIN WRSA

The Echo / Goose Main WRSA will be developed in two stages: Echo WRSA and Goose Main WRSA. The Echo WRSA, which will be located directly adjacent to Echo Open Pit, will be developed with waste rock from Echo Pit during Construction. The Goose Main WRSA will expand the footprint of the Echo WRSA, including covering the Echo TF once tailings deposition has ceased. The Echo / Goose Main WRSA will permanently occupy an area of approximately 63 ha with a height of approximately 100 m. There are no ponds or streams located within the footprint of the facility.

#### 4.5.1.5 TEMPORARY WASTE ROCK STOCKPILES

The Temporary NPAG Stockpile and Temporary Underground PAG Stockpile will temporarily store NPAG and PAG materials, respectively during the Operations Phase. These stockpiles will both be located north of the Umwelt Overflow WRSA and will be used to temporarily manage waste rock until this material can be either placed in a permanent WRSA or placed underground. The Temporary NPAG Stockpile and Temporary Underground PAG Stockpile are expected to reach its design capacity in Year 4 and Year 8, respectively.

### 4.5.2 PRE-DISTURBANCE, EXISTING, AND FINAL SITE CONDITIONS

The WRSAs are designed to be physically stable over the long-term, and no additional regrading will be carried out at Closure. It is expected that the final WRSAs will be frozen except for an active layer from approximately 1.3 m to 4.2 m deep, within the NPAG cap. During Operations, runoff from the WRSAs will be directed to contact water storage ponds, and then to the active TF. This water will eventually be pumped to the WTP for treatment prior to discharge.

All final WRSA side slopes are designed to be 2.5H:1V overall, which provides for long term slope stability (B2Gold Nunavut 2026b). Approximate dimensions for the WRSAs at the end of Operations are provided in Table 4.5-1.

Once closure and remediation activities are complete, the WRSAs will be new features on the landscape, as shown on Figure 4.3-1.

#### 4.5.3 CLOSURE OBJECTIVES AND CRITERIA

The closure objectives and closure criteria for the WRSAs are listed in Table 4.5-2.

#### 4.5.4 CONSIDERATION OF CLOSURE OPTIONS AND SELECTION OF CLOSURE ACTIVITIES

As part of the FEIS, a comprehensive Waste Management Multiple Accounts Analysis (MAA) report on the mine waste rock and tailings disposal alternatives was prepared. The detailed report was included as an appendix to the Information Request Responses (Sabina 2016). The criteria used to evaluate the alternatives included closure considerations such as management of ML/ARD potential and landowner opinion and relative preferences. The waste rock management approach presented in the ICRP is the one recommended in the MAA report.

**Table 4.5-2 Closure Objectives and Criteria – Waste Rock Storage Areas**

Component	Closure Objectives	Closure Criteria	Actions/Measurements
Land	Confirm the WRSA slopes and top are stable	The WRSAs will be designed for closure and will account for seismic and permafrost conditions	Physical inspection by a qualified engineer, and monitoring
		A thermal cover of NPAG rock will be placed on the WRSAs surface during progressive reclamation and closure to limit acid generating reactions	Thermistors to monitor and verify that the piles are frozen throughout except for the predicted active layer
Water	Confirm runoff and seepage is collected	The runoff and seepage from the WRSAs will continue to be directed to the contact water storage ponds or the active TF and eventually pumped for treatment in the WTP, as per operational practices, until monitoring results demonstrate that water quality conditions from the WRSAs are acceptable for direct discharge  As above	Physical inspection. Routine monitoring and sampling
	Confirm runoff and seepage from the WRSAs meet water licence criteria		Routine monitoring and sampling
Wildlife	Ensure the WRSA surfaces are safe for wildlife	WRSAs at post-closure will not compromise wildlife safety	Physical inspection
	Reduce the possibility that water from the WRSAs will affect wildlife health	The runoff and seepage from the WRSAs will continue to be directed to the contact water storage ponds or the active TF and eventually pumped for treatment in the WTP, as per operational practices, until monitoring results demonstrate that water quality conditions from the WRSAs are acceptable for direct discharge	Routine monitoring and sampling
Health and Safety	Ensure the WRSAs are safe for monitoring and physical inspections	WRSAs at Post-Closure will not compromise people’s health	Routine monitoring and physical inspection

Notes:

WRSA = Waste Rock Storage Area; WTP = water treatment plant.

The assessment of alternative methods for managing ML/ARD mine waste material considered the following disposal technologies:

- ◆ Freeze-back with a thermal NPAG waste rock cover;
- ◆ Low permeability covers;
- ◆ Co-mixing of mine waste material;
- ◆ Co-disposal of mine waste rock and tailings; and
- ◆ Subaqueous disposal in lakes and/or open pits.

#### 4.5.4.1 SUB-AQUEOUS DISPOSAL

Sub-aqueous disposal can include disposal in an engineered structure, in a natural waterbody, in a mined out open pit, or a mined-out underground development. Construction of a permanent, water retaining, engineered structure was ruled out since it would not be considered best practice. Deposition in a natural waterbody was also ruled out as the lakes around the Goose Mine are either shallow (i.e., limited capacity) or are larger lakes that provide good aquatic habitat.

The underground mining methods employed on the Project require a portion of material from open pit development as mine backfill. As such, this backfill material will be composed, as much as practicable, of PAG waste rock, either sourced locally from underground development or backhauled from surface development. Consideration was given to storing PAG waste rock in mined-out open pits; however, the current mine scheduling, and the preference to use the pits for tailings and water management, made this a less desirable option. If future mine scheduling allows for in-pit disposal of waste rock, this option would be reconsidered.

#### 4.5.4.2 LOW PERMEABILITY COVERS

Consideration was given to low permeability covers. However, no suitable natural materials are generated by Project activities and as such, this alternative would not be a cost-effective option. Therefore, the only viable low infiltration cover would be geosynthetic liners. The initial capital costs and long-term replacement costs of these liners make this alternative an unsustainable option.

Based on technical, environmental, socio-economic, and economic considerations, encapsulation of PAG waste rock with the placement of a NPAG waste rock thermal cover was found to be the preferred methodology. During progressive reclamation and in Closure, the PAG waste rock will be surrounded and capped by NPAG material to protect the underlying waste rock from seasonal thawing and promote the aggregation of permafrost into the PAG waste rock. The active layer will be maintained in the NPAG waste rock cover.

#### 4.5.5 ENGINEERING WORK ASSOCIATED WITH SELECTED CLOSURE ACTIVITY

The relevant engineering works associated with the permanent closure activities for the WRSAs are as follows:

- ◆ The WRSAs will be constructed as designed with associated engineering control and monitoring. This construction includes progressive placement of the 5 m NPAG closure cover during mine operations.

- ◆ Thermistors will be installed in completed WRSAs to enable representative monitoring of internal temperatures.
- ◆ Geotechnical monitoring of completed WRSA physical stability and internal temperature will be conducted.
- ◆ The WRSAs are expected to be stable over the long-term, and no additional regrading will be carried out at Closure.

#### 4.5.6 PREDICTED RESIDUAL EFFECTS

The WRSAs will be permanent features on the landscape. Active revegetation of the coarse rock cover is not practicable as these facilities cannot easily support vegetation; however, the WRSAs may be naturally colonized by plants over the subsequent decades. The Post-Closure impacts of these features are expected to be negligible.

#### 4.5.7 UNCERTAINTIES

The following uncertainties have been identified during closure planning of the WRSAs:

##### 4.5.7.1 PERMAFROST DEVELOPMENT

The thermal conditions within the WRSAs and the performance of the closure cover will depend on the actual waste placement plan and schedule, initial waste temperatures when placed, and thermal conditions of the original ground before the waste materials are placed. Therefore, thermistors will be installed in each WRSA to monitor the rate of freeze-back and permafrost development progress in the facilities during Operations and to enable refinement of predictions. The locations for the thermistors and monitoring schedule will be determined in the Thermal and Geotechnical Monitoring Plan.

##### 4.5.7.2 WRSA SEEPAGE WATER QUALITY

Seepage and runoff from the WRSAs are predicted to meet closure criteria as the encapsulated PAG waste rock freezes. However, the timeframe for freezing and achieving acceptable seepage water quality depends on a variety of external factors that cannot be precisely predicted. Therefore, water quality will be monitored routinely during the Operations Phase and Active Closure Stage to track trends and refine predictions. Additionally, contingency measures are identified in the event of unforeseen outcomes.

#### 4.5.8 POST-CLOSURE MONITORING AND MAINTENANCE

Site-wide monitoring and maintenance considerations are presented in Section 4.2.3. The following presents the relevant Post-Closure monitoring and maintenance strategies for the WRSAs:

- ◆ Performance of periodic inspections either by, or under the direction of, a Qualified Professional geotechnical engineer to visually assess stability and performance of the WRSAs;
- ◆ Completion of thermistor data monitoring to evaluate permafrost aggradation/encapsulation within the WRSAs based on thermal conditions;

- ◆ Completion of monitoring for water quality and water volumes from controlled discharge points around the WRSAs to confirm that drainage is performing as predicted and is not adversely affecting the environment; and
- ◆ Identification and monitoring of any water discharge areas that were not anticipated; these areas will be monitored for seepage volume and quality.

Ground temperature and water quality monitoring will be undertaken at each WRSA throughout Closure under the Water Management Plan (B2Gold Nunavut 2026c). Further details on the contact water management system in Closure are presented in Section 4.9.

#### 4.5.9 CONTINGENCIES

The mine design, including the WRSA design, was prepared in consideration of the vast database of site characterization data gathered for the Project, coupled with rigorous engineering analysis. Where data was limited, conservative assumptions were consistently applied. While there is a high level of comfort that the plans are viable and realistic, it is understood that mining activities are by nature inherently uncertain. Therefore, additional mitigation or adaptive management measures may be required. These measures may include changes to WRSA development based on operational, engineering, and/or environmental monitoring. Any additional mitigation or adaptive management measures that are found to be required will be implemented in a timely manner. Possible contingency strategies focused on the closure uncertainties identified above have been developed.

If there is a shortfall of NPAG waste rock for covering, contingencies have been identified in the Waste Rock Management Plan (B2Gold Nunavut 2026b). These contingencies include the potential use of a geosynthetic liner over a portion of the WRSA, disposal of a portion of PAG material in mined-out open pits, or sourcing additional NPAG material locally. Should B2Gold Nunavut require a contingency plan that is beyond the bounds of current authorizations, new or amended authorizations will be requested.

Mine waste rock will be monitored during Operations under the Waste Rock Management Plan (B2Gold Nunavut 2026b). Predictive modelling for permafrost aggradation and water quality may be updated if monitoring data indicate unexpected negative trends. Since most final WRSA covers will be applied during the Operations Phase, B2Gold Nunavut will monitor the aggradation of permafrost and water quality during Operations as well as Closure to provide increased time for monitoring and adaptive management, if necessary, prior to the Post-Closure Phase. While it is expected that the WRSAs will be substantively closed during Operations, a monetary allowance has been made to account for some final WRSA capping.

#### 4.6 BUILDINGS AND EQUIPMENT / MINE INFRASTRUCTURE

The main supporting facilities for development of the Project include:

- ◆ **Goose Mine:** mine infrastructure (i.e., ore stockpiles, crusher plant, and Process Plant), explosives storage; fuel tank farm; maintenance and service buildings; laydown area, including heated, unheated, and outdoor storage; operations centre at the airstrip; Goose camp; water intakes and discharges; water treatment facilities; diesel power plant and power utility building; wind and solar energy infrastructure; and machinery and mobile equipment.

- ◆ **MLA:** explosives and ammonium nitrate storage pad; fuel storage facility; maintenance and service buildings; laydown area; MLA camp; modular desalination water treatment system; water intakes and discharges; diesel power plant and power utility building; and machinery and mobile equipment.
- ◆ **WIR:** three service emergency camps and supporting infrastructure, maintenance shop, laydowns, and water intakes.

Buildings and equipment related to waste and domestic wastewater management are addressed in Section 4.8. Rock fill pads, which underlie buildings, laydowns, energy infrastructure, and equipment storage areas, are addressed with roads and airstrips in Section 4.7. Project infrastructure locations are provided in Figure 1.5-1 and Figure 1.5-2.

## 4.6.1 BUILDINGS, EQUIPMENT, AND MINE INFRASTRUCTURE DESCRIPTION

### 4.6.1.1 MINE INFRASTRUCTURE

Ore will be hauled from the open pit and underground mines to the Process Plant and sorted based on ore grade into separate stockpiles. These stockpiles will be located on the same pad southeast of the Process Plant. At the end of Operations, all ore stockpiles will be processed at the Process Plant. Foundation design of the ore stockpiles will follow the site-wide infrastructure foundation design criteria to achieve short-term and long-term thermal stability of underlying permafrost. All surface runoff and seepage from the Ore Stockpile is contained within the Ore Stockpile Pond, which is addressed as part of the water management system.

Ore will be fed by front-end loader from the stockpiles to a crusher. Fine crushed ore will be transported in a covered conveyor to the enclosed Fine Ore Stockpile. Reclaim belt feeders located underneath the Fine Ore Stockpile will draw material from the Fine Ore Stockpile onto a covered conveyor, which feeds the Process Plant.

### 4.6.1.2 EXPLOSIVES AND AMMONIUM NITRATE STORAGE

The main storage of ammonium nitrate (AN) will be located at the Goose Mine at the AN Facility laydown pad. A temporary storage area (for transit) will also be developed at the MLA. Packaged explosives and explosive detonators will be stored in approved explosive magazines located at the Goose Mine. Bulk AN will be stored in 1-tonne tote bags within seacans. Fuel oil will be stored in a double-wall fuel tank also located on the AN Facility pad. The AN and fuel oil (ANFO) will be manufactured in the AN Facility.

The Goose Mine is planning to transition from ANFO to emulsion (See Figure 1.5-1). Details about this transition will be provided in future updates of the ICRP.

### 4.6.1.3 FUEL TANK FARMS

There will be movable double-walled fuel tanks situated throughout the Goose Mine that will be utilized as day tanks at the underground mine portals, incinerator, explosives storage, boilers, and power plants in addition to other portable double-walled fuel tanks. Bulk fuel storage at the MLA will consist of up to a 60.5 ML tank farm; this fuel will be divided between the MLA Fuel Storage Area (60 ML), and the MLA Fuel Transfer Area (0.5 ML). The Goose Mine will also have a bulk fuel storage facility, with a total capacity of 45 ML.

The fuel tank farms will be designed to have bermed spill containment and an impervious high-density polyethylene (HDPE) liner membrane. Fuel will be delivered to the MLA in the summer and transported to the Goose Mine in the winter via the WIR.

#### 4.6.1.4 CAMPS

The Goose Mine accommodations will expand from the existing exploration camp to include a new camp located near the Goose Plant Site to accommodate the personnel required for the Operations Phase. The camp used during the Operations Phase will be decommissioned during the Active Closure Stage and replaced with a small camp (i.e., approximately 20 beds) for ongoing closure activities.

A camp is established at the MLA to support Construction and Operations, and three camps will be constructed along the WIR route to service the WIR seasonally and provide emergency shelter.

#### 4.6.1.5 POTABLE WATER TREATMENT FACILITIES

Freshwater required for the Goose Camp will be pumped from either Big Lake or Goose Lake. The domestic (i.e., potable) water supply will be treated and disinfected. The treatment plant will likely consist of multimedia filtration and activated carbon filtration, followed by ultraviolet (UV) disinfection and chlorination.

Water for the MLA Camp will be drawn from Bathurst Inlet, and a desalination facility will be constructed as part of the Project.

Water to support the WIR camps will be metered and sourced from waterbodies proximal to the WIR. The treatment plant will likely consist of multimedia filtration followed by UV disinfection and chlorination.

#### 4.6.1.6 DIESEL POWER PLANT

A main power plant will be used to meet the electrical power demand necessary to support the Goose Mine operation including the underground mines. To maximize overall efficiency and energy conservation, the power plant will operate as a combined heat and power plant. The airstrip will have a back-up generator.

Power at the MLA will be generated on site with the use of three 500 kW diesel generators or similar. To maximize overall efficiency and energy conservation, this power plant will also operate as a combined heat and power plant. Smaller generators will also be used to support the WIR service/emergency camps.

Other power equipment and materials, including oil-filled transformers, will be drained and disposed of on site. The transformer oil will be incinerated on site or removed for off-site disposal with other hazardous wastes.

#### 4.6.1.7 WIND AND SOLAR ENERGY INFRASTRUCTURE

A BRP Energy Centre will be located at the north side of the Goose Mine to supplement the electrical power requirements for the Project. The BRP Energy Centre will include a wind generation facility, solar panel array, and Battery Energy Storage System (BESS) capable of generating approximately 55 megawatts (MW). Wind and solar electricity that is not utilized immediately will be stored by the BESS with battery storage capacities of approximately 50 megawatt-hours (MWh).

The wind generation facility will include 13 Wind Turbine Generators (WTGs) spaced along an all-weather road to support construction and maintenance activities during operation of the facility. Each WTG will include a rotatable tubular tower, nacelle, rotor with three blades, and the foundation design is anticipated to consist of rock anchors and a hybrid of steel and concrete to meet design requirements at each WTG location.

The BESS will use lithium-ion battery technology stored in approximately ten 40-foot seacans on an aggregate pad adjacent to the power plant. The solar panel array will also be constructed on this aggregate pad, with additional solar panels installed on existing buildings, if feasible. Electrical transmission lines will be laid directly on the tundra and covered with aggregate, and these transmission lines will interconnect the WTGs to a collection/connection station (Electrical Station) located near the power plant.

#### 4.6.1.8 MACHINERY AND MOBILE EQUIPMENT

The main production equipment and earth-moving machinery that will be used during Operations includes various drills, hydraulic shovels, loaders, haulage trucks, forklifts, fuel trucks, lube trucks, water trucks, dozers, surface graders, portable welders, light duty service trucks, and mobile pit dewatering pumps. A fleet of mobile site support equipment is utilized to provide support to operations at each of the sites.

#### 4.6.2 PRE-DISTURBANCE, EXISTING, AND FINAL SITE CONDITIONS

The existing exploration camp and supporting facilities are located near the future Goose Main Pit area. The existing conditions at all other buildings and laydown areas are the same as the pre-disturbance conditions.

Once closure and remediation activities are complete, there will be no new features on the landscape of either Project sites as a result of buildings and laydown areas, as shown in Figure 4.3-1 (Goose Mine) and Figure 4.6-1 (MLA).

#### 4.6.3 CLOSURE OBJECTIVES AND CRITERIA

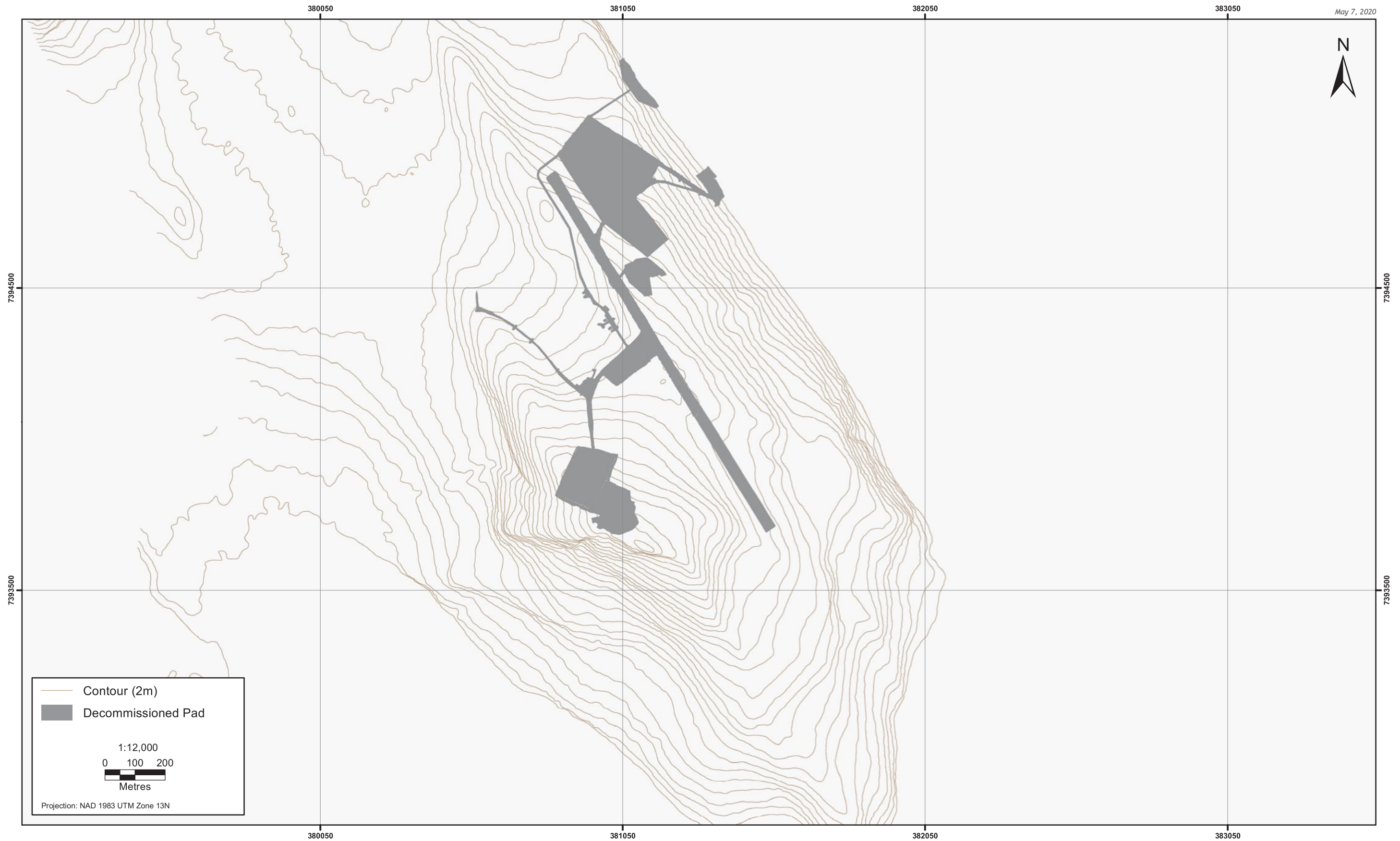
The closure objectives and closure criteria for the buildings and equipment are listed in Table 4.6-1.

#### 4.6.4 CONSIDERATION OF CLOSURE OPTIONS AND SELECTION OF CLOSURE ACTIVITIES

An option at the end of Project life is for part, or all, of the infrastructure to remain in place for other use. B2Gold Nunavut will consider transferring the facilities to a third party should there be such interest. However, this ICRP assumes that all infrastructure associated with the Project will be removed.

If not properly reclaimed, wildlife may be injured by entering reclaimed areas with depressions and if subsidence occurs. Environmental design features and mitigation, as well as current wildlife management practices used in other mining projects, will be implemented at the Project to limit wildlife injury. This may include re-contouring reclaimed areas to reduce hazards to wildlife. Equipment not required for Post-Closure activities will be drained and landfilled or removed from the site. Buildings will be demolished and buried in an on-site landfill.

FIGURE 4.6-1 MLA GENERAL ARRANGEMENT PLAN AT END OF CLOSURE (YEAR 13+)



**Table 4.6-1 Closure Objectives and Criteria – Buildings and Equipment / Mine Infrastructure**

Component	Closure Objectives	Closure Criteria	Actions/ Measurements
Land	Maintain required site infrastructure during active reclamation	Reduce the use of facilities after closure to promote early decommissioning	Physical inspection
	Clean up and remove machinery, materials, and equipment	Machinery, materials, and equipment will be disposed of in an on-site landfill	Physical inspection
		Fluid hydrocarbons drained from equipment will be burned in generators or incinerated where approved. Other fluids will be removed from site for recycling or disposal at a licenced facility	Physical inspection
	Remove all reagents and hazardous wastes	Unused reagents will be returned to suppliers or shipped off site by a licenced handler	Physical inspection
		Hazardous wastes will be shipped off site for disposal at a licenced facility	
	Remove all fuels, chemicals, and industrial wastes	During or prior to closure, a site inventory of all these products will be updated	Physical inspection
		Any unused petroleum products will be burned in generators or incinerated where approved. Other chemicals will be sold, returned to suppliers, or shipped off site for disposal at a licenced facility.	
	Remove surface infrastructure	Any above-ground infrastructure will be offered to third parties at closure for potential reuse elsewhere, otherwise it will be dismantled and buried in a landfill	Physical inspection
		Remaining concrete structures at grade will be perforated and covered or removed to a landfill. The area will be regraded to promote natural drainage	
	Remove contaminated soils	An assessment will be carried out to identify areas where soils may be contaminated by hydrocarbons	Physical inspection
		A more detailed investigation will be carried out of the potential soil contaminated areas (i.e., Phase 1 and 2 ESA investigations) to determine the extent of the contamination	Environmental Site Assessment
		Selected hydrocarbon contaminated soils will be excavated and hauled to the landfarm area for remediation in alignment with Government of Nunavut’s Environmental Guideline for Site Remediation	Physical inspection

Component	Closure Objectives	Closure Criteria	Actions/ Measurements
Water	Ensure runoff is channelled through the watershed	Surfaces will be regraded to promote natural drainage	Physical inspection and monitoring
Wildlife	Ensure the remaining surface areas are safe for wildlife use and access	Remaining areas will be scarified and remaining concrete structures at grade will be perforated and covered and rebar will be cut in pieces and buried or removed to a landfill	Physical inspection
Health and Safety	Ensure reclaimed areas support continuation of human land use activities	Human land use of the reclaimed area at post-closure will not compromise people's health	Routine monitoring and physical inspection

#### 4.6.5 ENGINEERING WORK ASSOCIATED WITH SELECTED CLOSURE ACTIVITY

Guidance on engineering options or strategies for closure of buildings and general mine infrastructure is provided in MVLWB/AANDC (2013). The relevant engineering works associated with the permanent closure activities for the supporting building and equipment removal are discussed below.

- ◆ The salvage value of equipment and machinery is expected to be limited due to the remoteness of the site and consequently, high backhaul transport costs. As such, it has been assumed that all buildings, machinery, and equipment will be disposed of in an on-site landfill at Closure.
- ◆ B2Gold Nunavut will consider transferring the facilities to a third party should there be such interest.
- ◆ Fluid hydrocarbons drained from equipment will be burned in generators or incinerated where approved. Other fluids will be removed from site for recycling or disposal at a licenced facility.
- ◆ Above-grade concrete structures will be demolished to ground level and broken up, and the rubble will be disposed of in an on-site landfill. Concrete slabs on grade will be perforated and covered with waste rock or overburden. Rebar will be cut so that it is flush with grade and cut rebar will be disposed of in an on-site landfill. Subgrade concrete structures will be infilled with NPAG waste rock, if needed.
- ◆ Any unused petroleum products will be burned in the generators or incinerated where approved. Unused chemicals will be sold, returned to suppliers, or shipped off site for disposal at a licenced facility.
- ◆ Any infrastructure components to be landfilled on site will be cleaned, drained of fluids, inspected, and remediated, as appropriate, to eliminate the risk of contaminant leakage.
- ◆ All hazardous wastes (e.g., fuels, oils, batteries, solar panels) will be removed from the site and transported to a licenced facility for disposal.
- ◆ Explosives and inert components still in their original packing may be returned to vendors for restocking, if economic to do so. All other explosives will be used up or destroyed on site.
- ◆ Fuel tanks will be steam cleaned, cut up, and landfilled. The rinse water will be treated before disposal.
- ◆ Fuel not required during the closure and reclamation activities will be sold, returned to suppliers, or incinerated.
- ◆ A new 20-bed camp will be established to support ongoing activities during the Passive Closure Stage and Post-Closure Phase.
- ◆ Equipment used for closure activities and long-term maintenance (e.g., trucks, backhoes) will be disposed once no longer required. Most of the mobile equipment will be disposed once the Closure Phase is complete. A small subset of equipment will be retained on site for the Post-Closure Phase.

#### 4.6.6 PREDICTED RESIDUAL EFFECTS

There will be no permanent buildings, equipment, or infrastructure left on the landscape as a result of supporting mine infrastructure. The Post-Closure impacts are expected to be negligible.

#### 4.6.7 UNCERTAINTIES

As all buildings, equipment or infrastructure will be removed, there are no uncertainties.

#### 4.6.8 POST-CLOSURE MONITORING AND MAINTENANCE

Site-wide monitoring and maintenance considerations are presented in Section 4.2.3. The following presents the relevant Post-Closure monitoring and maintenance strategies for the supporting buildings and equipment (guidance on generic monitoring and maintenance programs for Closure and Post-Closure is provided in MVLWB/AANDC [2013]):

- ◆ Periodic inspections will be performed to visually assess the reclaimed areas;
- ◆ All buildings left on site during Closure will be maintained until no longer required, after which they will be demolished and disposed of in an on-site landfill; and
- ◆ Mobile equipment left onsite during Closure will be maintained until no longer required, after which they will be landfilled or removed from the site.

#### 4.6.9 CONTINGENCIES

Wherever possible, mobile equipment will be salvaged and shipped off site for reuse. Likewise, materials will be sold and shipped off site for scrap where possible. Given the remoteness of the site, the extent of such salvage and scrap sales is expected to be limited by economics. Once mobile equipment has been drained of fluids, they may be disposed of in one of the flooded open pits in the event the landfill active at Closure is at capacity or has already been closed.

There are no other activities proposed as contingencies for the closure of the mine infrastructure, buildings, and equipment. As noted previously, some infrastructure may stay in place should local communities, KIA, GN, federal government bodies, or other appropriate parties choose to take ownership of it. However, this ICRP assumes that all infrastructure associated with the Project will be removed.

### 4.7 ROCK FILL PADS, ROADS, AND AIRSTRIPS

The Project will be accessible year-round through air transportation. There are existing all-weather airstrips at the Goose Mine and the MLA that will be extended for continued use. Both the Goose Mine and the MLA are serviced by ice airstrips in the winter, as well as float planes, if required. Freight is brought in by sea during the summer and hauled over the WIR to the Goose Mine during the winter. Site roads will be established within each of the MLA and Goose Project areas and sections of the WIR will be upgraded with rock fill to improve winter operations. Rock fill pads will underlie all infrastructure and laydown areas, including WIR service/emergency camps.

#### 4.7.1 PADS, ROADS, AND AIRSTRIPS DESCRIPTION

Rock fill pads will underlie all infrastructure and comprise all pad and laydown areas at the MLA and Goose as well as the three WIR service/emergency camps. Construction materials for both roads and pads will be sourced from locally developed, geochemically suitable locations. Rock will be placed directly onto the tundra to preserve the permafrost, and a layer of graded surfacing material will be placed to provide a protective trafficking layer. Laydown areas will be constructed at the Goose Mine and the MLA to store equipment, materials, and supplies for the Project. In addition, small laydown areas will be located in the vicinity of the underground workings for temporary stockpiling of waste rock prior to use as backfill material and temporary stockpiling of ore, as well as at the WIR camps. By the end of Operations, all waste

rock on these laydown areas will have been hauled back underground or relocated to a WRSA, all ore will have been processed, and all other materials will have been consumed, landfilled, or backhauled.

The existing all-weather exploration airstrip at the Goose Mine will be upgraded for use during Construction and Operations. The proposed upgrade is focused on extending the airstrip length to 1,830 m (from 914 m) and widening it from 30 m to 60 m. A 1,524 m by 60 m airstrip will also be constructed at the MLA. Airstrips will be equipped with lights, communications equipment, and instrumentation in accordance with appropriate Federal regulations. The airstrips will continue to be used during the Closure and Post-Closure phases.

Site roads within the Goose Mine and MLA will be constructed as all-weather roads. The Goose Mine will have approximately 4 km of service roads and approximately 9 km of haul roads. Haul roads will be constructed in accordance with mine haul road specifications, which require safety barricades. The MLA will have approximately 2 km of service roads and no haul roads.

Freight and fuel will be transported from the MLA to the Goose Mine annually on the WIR during the winter seasons. The WIR will be approximately 160 km long and travel over both land and water. Up to 15 km of the WIR will be upgraded with aggregate. A shoreline pad will be developed at the MLA for the offloading of sealift materials. This pad will have a 420 m<sup>2</sup> in-water footprint.

#### 4.7.2 PRE-DISTURBANCE, EXISTING, AND FINAL SITE CONDITIONS

The creek that flows from Gander Pond to Goose Lake, located between the Airstrip Quarry area and the airstrip at the Goose Mine, includes fair spawning and good rearing habitat for Arctic grayling and was rated as important overall.

The Goose Mine currently includes existing on-site roads, listed in Section 4.3, as well as the Goose Mine existing all-weather airstrip and associated pads. At the MLA, camp pads, laydown areas, and some structures have been constructed (Figure 1.5-2). The rest of the road areas at both Project sites are the same as the pre-disturbance conditions.

A description of site conditions at the end of Operations is provided in Section 4.7.1. On-site access roads, as well as airstrip construction, may require crossing of the Gander Outflow and installation of a fish-bearing culvert as well as up to four other culvert crossings. Once closure and remediation activities are complete, roads, airstrips, and pads will remain, and will be reconfigured where needed to avoid pooling or diversion of water.

Prior to initial construction and use of the WIR, baseline conditions underlying the road alignment were documented and reported to the NIRB.

#### 4.7.3 CLOSURE OBJECTIVES AND CRITERIA

The closure objectives and closure criteria for the transportation routes and pads are listed in Table 4.7-1.

**Table 4.7-1 Closure Objectives and Criteria – Rock Fill Pads, Roads, and Airstrips**

<b>Component</b>	<b>Closure Objectives</b>	<b>Closure Criteria</b>	<b>Actions/Measurements</b>
Land	Ensure preservation of permafrost	Culverts will be removed, and the natural drainage restored. Roads and the airstrip will be scarified when they become redundant; they will otherwise remain intact for preservation of permafrost	Physical inspection
Freshwater	Ensure drainage is restored	Culverts will be removed, and the natural drainage restored	Physical inspection
Marine	Ensure chemical and physical stability	Shoreline pad based will be left in place so as not to disturb the in-water environment	Physical inspection
Wildlife	Ensure the remaining surface areas are safe for wildlife use and access	The roads and airstrip will be designed to be safe for wildlife use and access for Operations – no additional work is expected at closure except for scarification and the removal of the culverts	Physical inspection
Health and Safety	Ensure reclaimed areas support continuation of human land use activities and do not become a source of contamination	Human land use of the reclaimed area at post-closure will not compromise people’s health	Routine monitoring and physical inspection

#### 4.7.4 CONSIDERATION OF CLOSURE OPTIONS AND SELECTION OF CLOSURE ACTIVITIES

An option at the end of Project life is for part, or all, of the infrastructure to remain in place for other use. B2Gold Nunavut will consider transferring the facilities to a third party should there be such interest. The Plan assumes that all roads and airstrip associated with the Project will be decommissioned.

#### 4.7.5 ENGINEERING WORK ASSOCIATED WITH SELECTED CLOSURE ACTIVITY

Guidance on generic engineering work options or strategies for closure of transportation routes is provided in MVLWB/AANDC (2013). The relevant engineering works associated with the permanent closure activities for the pads, roads, and airstrip are discussed below.

- ◆ Developed areas at each of the Project sites will be regraded and contoured to stabilize, remove uneven ground for public and wildlife safety, to reduce the potential for erosion, and to blend with the surrounding landscape. Cover materials may be required for erosion and dust control. It is anticipated that a succession of native plant species will naturally revegetate the surface over time.
- ◆ Rock bases extending into the marine environment will be left in place and capped at the substrate, so not as to disturb the in-water environment.
- ◆ An assessment will be carried out to identify areas where soils may be contaminated by hydrocarbons; contaminated soils will be excavated and hauled to the landfarm area for remediation per the Government of Nunavut's Environmental Guideline for Site Remediation (2010).
- ◆ Once the all-weather roads are no longer required for Closure and Post-Closure activities, the culverts will be removed, and the natural drainage will be restored as practicable. Measures will be implemented to minimize erosion and sedimentation.
- ◆ The remaining all-weather road sections (with no culverts) as well as pads will be scarified, but will otherwise remain intact to ensure preservation of permafrost.
- ◆ The airstrip will remain functional with a gravel surface for use during Post-Closure monitoring. Final closure of the airstrip will be similar to the all-weather roads.
- ◆ It is anticipated that a succession of native plant species will naturally revegetate the roads and airstrip surface over time.

#### 4.7.6 PREDICTED RESIDUAL EFFECTS

Changes to aquatic habitat caused by water crossings could result in some alteration or loss of some aquatic populations; however, the disturbed surfaces are localized and are expected to regenerate over time. Changes to terrain caused by the construction and subsequent reclamation of the Goose airstrip could result in some alteration or loss of plant populations and plant communities; however, the disturbed surfaces are expected to naturally revegetate over time. The Post-Closure impacts of these features are expected to be negligible.

#### 4.7.7 UNCERTAINTIES

With the exception of WIR subbase upgrades and service emergency camp pads, active revegetation of the Property as part of Closure is not planned given the cold climate setting of the Project as well as the precedent established for mine closure in Nunavut. The isolated areas of WIR subbase upgrades as well as WIR service emergency camp pads will be scarified and reseeded on closure to promote revegetation to the extent reasonable. In other areas, strategies that support or encourage natural revegetation and recovery will be used where appropriate.

#### 4.7.8 POST-CLOSURE MONITORING AND MAINTENANCE

Site-wide monitoring and maintenance considerations are presented in Section 4.2.3. The following presents the Post-Closure monitoring and maintenance strategies for the transportation routes (guidance on generic monitoring and maintenance programs for Closure and Post-Closure is provided in MVLWB/AANDC [2013]):

- ◆ Periodic inspections will be performed to visually assess the reclaimed areas;
- ◆ All roads to be used during Closure and Post-Closure will be maintained until they are no longer required; and
- ◆ The airstrip will be maintained during Closure and Post-Closure.

#### 4.7.9 CONTINGENCIES

There are no activities proposed as contingencies for the closure of the pads, roads, and airstrip.

### 4.8 WASTE MANAGEMENT SITES

#### 4.8.1 WASTE MANAGEMENT SITE DESCRIPTION

The waste management infrastructure at the Goose Mine will consist of:

- ◆ A sewage treatment plant;
- ◆ An incinerator for combustion of non-hazardous and combustible wastes;
- ◆ A landfarm for the treatment of contaminated soils, ice, and snow;
- ◆ A waste sorting facility;
- ◆ Landfills for disposal of non-hazardous solid wastes; and
- ◆ A hazardous waste storage area.

The waste management infrastructure at the MLA will consist of:

- ◆ Pacts or incinerating toilets;
- ◆ An incinerator for combustion of non-hazardous and combustible wastes;
- ◆ A landfarm for the treatment of contaminated soils, ice, and snow;
- ◆ A waste sorting facility; and
- ◆ A hazardous waste transfer laydown area.

Sewage at the Goose Mine will be treated using a packaged Wastewater Treatment Facility (WWTF), such as a membrane bioreactor or similar. The WWTF will be located in the Goose Plant Site area. During Closure and Post-Closure, the Goose Camp will convert to Pacto or incinerating toilets, and effluent discharge will not be necessary. Sludge will be incinerated.

The waste management philosophy on site will be to reduce, reuse, recycle, or recover material where practicable, and these principles are implemented through B2Gold Nunavut's various waste management plans. Non-salvageable, non-degradable solid waste material generated during Construction, Operations, and Closure will be disposed of in inert, non-hazardous solid waste landfills within a WRSA. Approximately 5,000 t of non-hazardous waste is expected to be disposed of in the landfills over the mine life. As the various WRSAs are closed progressively during Operations, some of the landfills within them may also be closed, if they have reached capacity. Additional closure landfills could be established within the WRSAs if the Operations Phase landfills reach capacity. Landfilled material will be placed in lifts, compacted, and covered with a minimum 300-mm layer of material before placing subsequent landfill materials. This layering is an ongoing process throughout Construction, Operations, and Closure and will minimize potential settlement. The landfills will be in use from Construction through to Closure, and as a result, any landfill settlement can be addressed throughout the operational period. Consistent with standard NWB licence terms and conditions, an annual geotechnical inspection (during Operations and the Active Closure Stage) of earthworks will be undertaken as part of the Thermal and Geotechnical Monitoring Plan. Any evidence of landfill settlement during Operations will be observed and addressed on annual basis as required.

An industrial incinerator will be located at each of the Goose Mine and the MLA. Incinerators selected for the Project will incorporate technologies capable of satisfying the criteria set forth in Environment and Climate Change Canada's Technical Document for Batch Waste Incineration (EC 2010). The incinerator will accept waste, such as organic matter, containers and wrappings, medical waste, and used oils and waste fuel (Sabina 2020b).

Hazardous waste will be hauled to the MLA and later backhauled by sealift during the open water season or by air to authorized waste disposal areas off site; refer to the Hazardous Materials Management Plan for more information. Dedicated and lined storage pads will be constructed at the MLA or Goose Mine to receive and temporarily store hazardous wastes pending removal from sealift. All waste material will be handled, stored, and transported in accordance with the Canadian and Territorial waste regulations and the Hazardous Materials Management Plan.

Hydrocarbon contaminated soil, snow, and ice will be treated within dedicated landfarms that will be located at both the Goose Mine and MLA. Landfarming is a widely used bioremediation treatment that uses naturally occurring microorganisms to metabolize and breakdown petroleum hydrocarbons in soils. The Goose landfarm will be located north of the Echo Pit area. The landfarm at the Goose Mine will consist of three soil cells and one snow/ice cell, so that soil can be segregated and treated based on level on petroleum hydrocarbon impact. The landfarm at the MLA Property will consist of one soil cell and one smaller snow/ice cell. The facilities will be bermed and lined with an HDPE liner. The berm heights will be approximately 1.5 m above the bottom of the treatment area. A rock structural pad will be constructed below the landfarm cells. Non-woven geotextile fabric will be placed on either side of the liner, with compacted granular fill also placed above and below the liner to protect it from tears.

Soil will be considered remediated and removed from the landfarm when sampling demonstrates that soils meet Nunavut's Environmental Guideline for Site Remediation (Government of Nunavut 2010). At the Goose Mine, the remediated soil may be used for construction of the WRSA covers, if needed, or disposed of in one of the non-hazardous solid waste landfills. At the MLA, the remediated soil may be used for closure site grading.

#### 4.8.2 PRE-DISTURBANCE, EXISTING, AND FINAL SITE CONDITIONS

A description of site conditions at the end of Operations are provided in Section 4.8.1. Once closure and remediation activities are complete, there will be no other new features on the landscape at either the Goose Mine or MLA as a result of the waste management facilities.

#### 4.8.3 CLOSURE OBJECTIVES AND CRITERIA

The closure objectives and closure criteria for the waste management facilities are listed in Table 4.8-1.

#### 4.8.4 CONSIDERATION OF CLOSURE OPTIONS AND SELECTION OF CLOSURE ACTIVITIES

If not properly reclaimed, wildlife may be injured by entering reclaimed areas with depressions and if subsidence occurs. Environmental design features and mitigation, as well as current wildlife management practices used in other mining projects, will be implemented at the Project to limit wildlife injury. This may include re-contouring reclaimed areas to reduce hazards to wildlife. Equipment not required for Post-Closure activities will be drained and landfilled or removed from the site. Buildings will be demolished and buried in an on-site landfill.

#### 4.8.5 ENGINEERING WORK ASSOCIATED WITH SELECTED CLOSURE ACTIVITY

Guidance on generic engineering work options or strategies for closure of waste management facilities is provided in MVLWB/AANDC (2013). The relevant engineering works associated with the permanent closure activities for the waste management facilities are discussed below.

The closure schedule will allow for substantial closure of landfills and removal of most hazardous materials off site during the Active Closure Stage. Monitoring will continue during the Passive Closure Stage. After closure criteria have been met in the TFs and the contingency period for water quality has finalized, final decommissioning of the WTP will be required. In addition, at the end of the Passive Closure Stage, the Closure camp will require final decommissioning. The final camp, mobile equipment, pipelines, and pumping systems will require landfilling, and any remaining hazardous wastes will require removal from site. Post-closure monitoring will continue at the start of the Post-Closure Phase; however, there is not expected to be significant landfilling necessary after the Passive Closure Stage concludes. If necessary, a designated area of the landfill will be maintained for Post-Closure activities, and this area will be closed once no longer required. The landfills at both Project sites may be covered with PAG waste rock and will be ultimately covered with 5 m of NPAG waste rock.

**Table 4.8-1 Closure Objectives and Criteria – Waste Management Facilities**

Component	Closure Objectives	Closure Criteria	Actions/Measurements
Land	Treat contaminated soils, ice and snow in the landfarm areas	As per operational practices contaminated soils, ice and snow will be treated in the landfarm areas during the Active Closure Stage	Physical inspection
		Remediated soils will be hauled and disposed of in landfills or used for construction of the WRSAs cover	Physical inspection
	Clean up and remove waste management system components or materials	All components or materials will be cleaned up and disposed in the on-site landfill when no longer required	Physical inspection
		Metals will be separated and shipped off-site as scrap if economical to do so or disposed of in the on-site landfill	
	Remove all hazardous wastes	Hazardous wastes will be removed for disposal at a licenced facility Used oils and waste fuel could be burned in the on-site incinerators if required and approved	Physical inspection
	Remove surface infrastructure	Any above-ground infrastructure will be demolished/dismantled, and the non-hazardous debris will be disposed in the on-site landfill or within the mined-out open pits	Physical inspection
		Remaining concrete structures at grade will be perforated and covered. Any rebar will be cut in pieces and buried or removed and the area regraded to promote natural drainage	
Landfills are encapsulated	The landfill areas will be covered with 5 m NPAG waste rock when no longer required	Physical inspection	
Water	Ensure runoff is channelled through the watershed	Surfaces will be regraded to promote natural drainage	Physical inspection
Wildlife	Ensure the remaining areas are safe for wildlife use and access	Keep wildlife out of the landfills as per operational practices. Place the 5 m NPAG cover when no longer required The remaining areas will be regraded to reduce hazards to wildlife	Physical inspection
Health and Safety	Ensure reclaimed areas support continuation of human land use activities	Human land use of the reclaimed area at post-closure will not compromise people’s health	Routine monitoring and physical inspection

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 petroleum hydrocarbons contamination. If the soils meet the required criteria, the landfarm area will then be regraded to confirm positive surface drainage. The HDPE liner will be left in place, perforated if required, and covered with overburden. If soils do not meet the required criteria, the landfarm will be covered with 2 m of NPAG waste rock or other material used for reclamation. The surrounding berm will be breached to avoid water accumulation on the landfarm.

Domestic waste will be burned in the incinerator located at each site during Operations and Closure as part of camp maintenance. Used oils and waste fuel will be burned in the generators or incinerated if approved. Hazardous wastes will be removed and shipped off site for disposal at a licenced facility.

Developed areas at each of the Project sites will be regraded and contoured to remove uneven ground for public and wildlife safety, reduce the potential for erosion, and blend with the surrounding landscape. Cover materials may be required for erosion and dust control. It is anticipated that a succession of native plant species will naturally revegetate the surface over time.

#### 4.8.6 PREDICTED RESIDUAL EFFECTS

At the MLA, a closed landfarm will remain after Closure. At the Goose Mine, non-hazardous landfills will remain; however, these landfills will be integrated into the closed, covered WRSAs. A closed, covered landfarm may also remain at the Goose Mine. Changes to terrain caused by the construction and subsequent reclamation of the waste management facilities could result in some alteration or loss of plant populations and plant communities; however, the disturbed surfaces are expected to revegetate naturally over time.

No significant long-term effects were identified as part of the FEIS for the closure of waste management facilities. The post-closure impacts of these features are expected to be negligible.

#### 4.8.7 UNCERTAINTIES

The length of time it will take to bio-remediate and treat materials in the landfarms is dependent on the final quantity of contaminated materials at Closure. The landfarms at both Project sites will be managed as long as it is efficient for the overall Project closure activities and closure schedule.

#### 4.8.8 POST-CLOSURE MONITORING AND MAINTENANCE

Site-wide monitoring and maintenance considerations are presented in Section 4.2.3. Guidance on generic monitoring and maintenance programs for Closure and Post-Closure is provided in MVLWB/AANDC (2013). The following presents the Post-Closure monitoring and maintenance strategies for the waste management facilities:

- ◆ Periodic inspections will be performed to visually assess the reclaimed areas;
- ◆ All waste management facilities to be used during Closure and Post-Closure will be maintained until they are no longer required; and
- ◆ Visual observations will be completed periodically for cracking or slumping of the landfill cover and for underlying waste material pushing its way up through the cover.

## 4.8.9 CONTINGENCIES

There are no activities proposed as contingencies for the closure of the landfill and other disposal areas.

## 4.9 WATER MANAGEMENT SYSTEMS

### 4.9.1 WATER MANAGEMENT SYSTEMS DESCRIPTION

#### 4.9.1.1 WATER TREATMENT PLANT

A WTP will be operational in the open water season at the Goose Mine to initially dewater Llama and Umwelt lakes to create storage for contact water and saline water, respectively, and to support the mining of Llama Pit. Treatment of saline water will occur by reverse osmosis at the SWP until the Umwelt and Llama TFs are operational to reduce metal and total suspended solids (TSS) loadings in these facilities. As a contingency, the WTP will be maintained for two additional water treatment seasons following the Active Closure Stage, should additional water treatment be required.

#### 4.9.1.2 FRESHWATER INTAKE PIPELINES

At the Goose Mine, water intake structures will be constructed in Goose and Big lakes to supply domestic, industrial, and process make-up water. The selected locations for these intake pipelines are deep and close to shore. These structures are expected to consist of an insulated PVC pipe installed into the lake on a small rockfill base to keep the pipe off the lake bottom. Washed rock armour will be placed over the pipelines to provide ice scour protection. Insulated HDPE pipelines will convey all freshwater from the intakes to dedicated pumphouses for the Process Plant and Goose Camp. A potable water treatment plant will be constructed at the end of the domestic supply pipeline.

At the MLA, ocean water will be drawn from Bathurst Inlet and will be desalinated using a reverse osmosis plant (or equivalent) to achieve appropriate criteria, to supply freshwater. The desalination facility will discharge brine as a by-product of the desalination process. Discharge of brine water from the desalination plant will meet the CCME salinity guideline for the protection of marine life and will not cause the salinity of the receiving environment to fluctuate by more than 10% of the natural expected salinity (CCME 1999a).

#### 4.9.1.3 GOOSE MINE WATER – CONTACT, NON-CONTACT, AND SALINE

Site water at Goose Mine is categorized into three types:

- ◆ Contact water: surface water that is impacted by / contacts mine workings (e.g., runoff over waste rock, ore stockpiles, open pits, tailings);
- ◆ Non-contact water: surface water that is not impacted by / does not contact mine workings; and
- ◆ Saline water: groundwater that flows into Llama Open Pit and underground workings.

Each type of water is managed separately throughout each Project phase, to the extent practicable. Contact water is contained within event ponds and TFs and is conveyed on site via diversions and pumped pipelines. Non-contact water is diverted off site through berms and culverts.

The Goose Main Open Pit will be converted to the Goose Main Reservoir by pumping saline water from the SWP to the bottom of the pit and allowing site runoff and precipitation to form a freshwater cover on top to create a meromictic lake. The Umwelt TF, Llama TF, and Goose Main Reservoir will be passively flooded with site runoff and precipitation as well as actively flooded with freshwater such that these facilities can become natural outflow systems. Underground workings will be backfilled with waste rock and actively or passively flooded.

Three types of berms will be constructed to support water management across the Project area:

- ◆ Unlined non-contact water diversion berms;
- ◆ Lined contact water containment dams and berms; and
- ◆ Unlined contact water diversion berms, which are used only where any contact water flows through the berm would be captured as part of the broader water management system.

All diversion berms will be constructed directly onto the tundra surface with NPAG run of mine or run of quarry material that contains sufficient fines to contain and convey water. All containment dams and berms will be constructed with run of mine or run of quarry material; in addition, all lined structures and will contain a geosynthetic clay liner (GCL) that will be tied into the active permafrost layer. Table 4.9-1 summarizes the conveyance structures at Goose Mine.

**Table 4.9-1 Goose Mine Diversion and Containment Structure Summary**

Structure	Lining Details	Notes
Llama Open Pit Diversion / Collection Berms	Unlined	Divert (or partially diverts) upstream non-contact runoff. Minimize non-contact water volumes entering Llama Open Pit and assists with general water management at the Pit. The Llama Open Pit collection berm will intercept runoff from Llama WRSA for pumping to Primary Pond of Llama WRSA Pond
Llama WRSA Containment Dams (West / East)	Lined	Contains runoff from Llama WRSA into Llama WRSA Pond
Primary Pond Containment Dam	Lined	Contains contact water in the Primary Pond to the east, alignment along haul road. Designed to CDA (2013, 2014) standards
SWP Containment Dam	Lined	South section of dam containing saline water, around former Umwelt Lake footprint / outlet of former Umwelt Lake. Will be designed to CDA (2013, 2014) standards
Ore Stockpile Pond Containment Dam	Lined	Contains contact water from the Ore Stockpile. Designed to CDA (2013, 2014) standards
Echo Diversion Berm	Unlined	Diverts (or partially diverts) non-contact runoff away from the Echo / Goose Main WRSA
Echo / Goose Main Containment Dam	Lined	Contains runoff from Echo / Goose Main WRSA into Echo / Goose Main WRSA Pond. Will be designed to CDA (2013, 2014) standards

Structure	Lining Details	Notes
Goose Main Diversion Berm	Unlined	Diverts non-contact runoff around Goose Main Open Pit
Rascal Berm	Unlined	Redirects flow in the Rascal Lake catchment away from the Goose Main Open Pit and into Gander Pond catchment.

Saline water is pumped out of the underground workings, as well as Llama Open Pit, and stored in the SWP (previously Umwelt Lake). Saline water from the SWP will be treated with reverse osmosis during Operations.

Beginning in late Operations, the Umwelt TF and Llama TF water is recirculated through treatment year-round to reduce metals, nitrogen species, major ions and suspended solids loading in these facilities. Recirculation treatment in Umwelt and Llama TF, based on a treatment rate of approximately 5,000 m<sup>3</sup>/day for each pit, is expected to continue to end of Closure Phase. Final treatment rates will be based on the detailed design of the water treatment plants; refined engineering, pending tender, will determine the treatment system(s) to be utilized. Treatment sludge will be landfilled on site if sampling demonstrates that the sludge is not considered a hazardous waste; otherwise, the treatment sludge will be shipped off site for disposal at a licenced facility. Details of the water treatment strategy are provided in the Water and Load Balance Report (B2Gold Nunavut 2026c).

At the Goose Mine, mine contact water will be treated to levels specified in the MDMER or Site-Specific Water Quality Objectives (SSWQOs) prior to release at the final discharge point. B2Gold Nunavut will meet water quality objectives for entry into receiving waters (i.e., Goose Lake) as per the Type A Water Licence (2AM-BRP1831).

#### 4.9.1.4 STREAM DIVERSIONS

The majority of Project infrastructure has been located to avoid fish bearing waters and, wherever possible, to avoid encroaching on freshwater fish habitat. Additional mitigation to avoid adverse effects on fish is required for streams that may experience reduced discharge, resulting in the potential for increased fish and egg stranding. In these cases, all potential fish use (i.e., migration, spawning, rearing, and egg incubation) will be prevented by creating fish barriers at migratory pathways into channels prior to ice melt.

Fish barriers will be installed on Rascal Creek, which discharges to Goose Lake, at the southern discharge point of Goose Lake, and downstream of the SWP. Blocking fish access to these locations will involve creating a permanent impassable fall or cascade barrier to prevent fish access to upstream water management areas. Additional detail on the fish barriers will be provided as part of the FCRP.

Breached diversion structures will remain in place beyond the Post-Closure Phase. However, collection ponds will have been breached, liners removed and landfilled, and the areas re-contoured and armoured (if necessary) to allow for passive runoff.

#### 4.9.1.5 MLA CONTACT WATER

The MLA does not require any ditches or ponds for water management purposes and will remain in the same condition for both the Construction and Operations phases. A desalination plant will produce domestic and industrial water, and greywater will be discharged to the tundra. Roads and pads will be

designed to have runoff disperse as sheet flow to minimize channelized flow. Water that accumulates within the tank farm bund will be tested and then released on surface. Runoff from pads will discharge towards Bathurst Inlet along the same flow paths as the predevelopment topography. Site contact water that reaches the marine environment is predicted to meet the CCME water quality guidelines for the protection of marine aquatic life.

#### 4.9.2 PRE-DISTURBANCE, EXISTING, AND FINAL SITE CONDITIONS

The existing conditions at the water management areas are the same as the pre-disturbance conditions. A description of site conditions at the end of Operations are provided in Section 4.9.1. The flooded pits and WRSAs are addressed in Section 4.3.

#### 4.9.3 CLOSURE OBJECTIVES AND CRITERIA

The closure objectives and closure criteria for the water management facilities are listed in Table 4.9-2.

#### 4.9.4 CONSIDERATION OF CLOSURE OPTIONS AND SELECTION OF CLOSURE ACTIVITIES

Diversion structures will be required around the main facilities to divert non-contact water away from mining areas. This strategy will reduce the total amount of contact water generated by the Project. Mine water runoff management has been optimized based on the plans assessed in the FEIS (Sabina 2015). The management strategies will continue to evolve and will be finalized during detailed design. Closure actions have been selected to establish a passive and physically stable state.

#### 4.9.5 ENGINEERING WORK ASSOCIATED WITH SELECTED CLOSURE ACTIVITY

Water management will be an important element of the Active Closure Stage at the Goose Mine. Pumping and pipeline infrastructure from the WTP will be dismantled and landfilled once no longer required. The SWP Containment Dam will be breached once all saline water has been pumped out to allow Umwelt Lake to re-establish.

Sediments that have accumulated in the SWP will be tested and, if necessary, will be excavated and deposited in Llama TF once the SWP has been dewatered. The metals in the sediments will primarily be in the solid particles. Sediment solids excavated from the SWP and placed in Llama TF will settle once deposited.

Collection ponds will be breached, liners removed and landfilled, and the areas re-contoured and armoured (if necessary) to allow for passive runoff. Breached diversion structures will remain in place beyond the Closure Phase.

At Closure, all pumphouses will be drained, decommissioned, and landfilled. All water intake and discharge pipelines will be cut at the shoreline, decommissioned, and landfilled (Goose Mine) or removed from site (MLA). The pipelines extending into the water, along with the surrounding rock armour and rock bases, will be left in place and capped at the substrate so not as to disturb the in-water environment.

Once pumping and pipeline infrastructure are decommissioned, water management berms will also be breached in strategic locations to restore natural surface water drainages. Table 4.9-3 outlines the berm and dam breaching schedule for the Goose Mine.

**Table 4.9-2 Closure Objectives and Criteria – Water Management Facilities**

Component	Closure Objectives	Closure Criteria	Actions/ Measurements
Land	Maintain surface water drainage control systems	Fresh water intakes and distribution system will be reclaimed after active closure	Physical inspection
		Maintain water management components until no longer required	Physical inspection
	Ensure berms and dams are stable	Berms and dams will be breached once water quality meets licence criteria for direct discharge	Physical inspection by qualified engineer
	Remove surface infrastructure (i.e., pipelines, culverts, pump systems, WTP)	All components or materials will be cleaned up and disposed in the on-site landfill when no longer required	Physical inspection
		Any above ground pipelines will be dismantled, and associated distribution equipment will be disposed in the on-site landfill	Physical inspection
		Reclaimed areas will be regraded	Physical inspection
		Any culverts and equipment will be removed and will be disposed in the on-site landfill	Physical inspection
		Any above-ground infrastructure will be demolished/dismantled, and the non-hazardous debris will be disposed in the on-site landfill or within the mined-out open pits	Physical inspection
		Remaining concrete structures at grade will be perforated and covered. Any rebar will be cut in pieces and buried or removed and the area regraded to promote natural drainage	Physical inspection
	Remove all hazardous wastes	Hazardous wastes will be removed for disposal at a licenced facility	Physical inspection

Component	Closure Objectives	Closure Criteria	Actions/ Measurements
Water	Ensure runoff is channelled through the watershed	Surfaces will be regraded to promote natural drainage	Physical inspection
	Ensure collected runoff and seepage meets water licence criteria	Runoff and seepage collected in the Llama TF will be treated through the WTP until water quality meets licence criteria for direct discharge	Routine monitoring and sampling
	Remove facilities when treatment is no longer required	When water quality from the mine components is deemed suitable for direct discharge to the environment the berms will be breached	Routine monitoring and sampling
Wildlife	Discourage wildlife from entering the facilities	Wildlife will be discouraged from entering the facilities until water quality is acceptable	Physical inspection
Health and Safety	Ensure the remaining areas are left in a healthy state that supports continuation of human land use activities	Human land use of the reclaimed areas at post-closure will not compromise people's health	Routine monitoring and physical inspection

**Table 4.9-3 Water Management Structure Breach Schedule**

<b>Water Management Structure</b>	<b>Closure Timeline</b>	<b>Closure Strategy</b>
SWP Containment Dam and Berms	Closure	Decommissioned water collected in SWP (now Umwelt Treatment Pond) is suitable for direct discharge to the environment.
Primary Pond Containment Dam	Closure	All Primary Pond flows conveyed to the restored Umwelt Lake (formerly SWP). Umwelt WRSA capped and freeze-back promoted.
Ore Stockpile Pond Containment Dam	Closure	Ore Stockpile Pond is dewatered after removal of the Ore Stockpile/ Runoff from the area will report to Goose Lake.
Llama WRSA Containment Dams and Llama Open Pit Diversion / Collection Berms	Closure	Drains Llama WRSA Pond into Llama TF when open pit mining is complete, and Closure begins. Allow Llama TF to flood. Llama WRSA capped and freeze-back promoted.
Echo / Goose Main WRSA Containment Dam and Echo Diversion Berm	Closure	Echo / Goose Main WRSA Pond is dewatered upon completion of mining operations. Runoff from the area will report to Goose Lake. Echo / Goose Main WRSA capped and freeze-back promoted.
Goose Main Pit Diversion Berm	Closure	Breached upon completion of Operations, allowing Goose Main Reservoir to flood.

The MLA does not require any pond or diversion infrastructure for water management purposes and remains in the same condition for both the Construction and Operations phase.

#### 4.9.6 PREDICTED RESIDUAL EFFECTS

No significant long-term effects were identified as part of the FEIS for the water management facilities. However, changes to terrain caused by the construction and subsequent reclamation of the facilities, including the residual breached diversion berms, could result in some alteration or loss of plant populations and plant communities; however, the disturbed surfaces are expected to revegetate naturally over time.

The breached diversion/containment berms and permanent fish barriers will be new features on the landscape. There will be no other new features on the landscape of the MLA as a result of water management facilities. The Post-Closure impacts of these features are expected to be negligible at both Project sites.

#### 4.9.7 UNCERTAINTIES

Water quality modelling predicts that year-round water treatment in the Llama TF and Umwelt TF will result in water quality that is suitable for discharge during the Operations Phase. The actual time required may vary depending on actual water quality and treatment efficiency.

Active revegetation of the Project sites as part of Closure is not planned given the cold climate setting of the Project as well as the precedent established for mine closure in Nunavut.

Water quality monitoring will occur at strategic control points during Operations to track trends in the site water quality and to provide additional information for future closure water quality prediction and planning modifications.

#### 4.9.8 POST-CLOSURE MONITORING AND MAINTENANCE

Site-wide monitoring and maintenance considerations are presented in Section 4.2.3. The following presents the Post-Closure monitoring and maintenance strategies for the water management facilities (guidance on generic monitoring and maintenance programs for closure and post-closure is provided in MVLWB/AANDC [2013]):

- ◆ Surface and groundwater will be sampled if site-specific conditions dictate during the Closure Phase;
- ◆ Water management points (including seepage) that were not anticipated will be identified and monitored;
- ◆ Ongoing inspection and maintenance of passive or active water treatment facilities associated with non-compliant mine water or runoff discharge will be conducted;
- ◆ Periodic inspections will be performed to visually assess the reclaimed areas;
- ◆ Unstable areas will be identified and monitored; and
- ◆ All water management facilities to be used during Closure will be maintained until they are no longer required.

#### 4.9.9 CONTINGENCIES

##### 4.9.9.1 WATER QUALITY

Once water quality from the mine components meets MDMER and Licence criteria for direct discharge, the WTP will be maintained for two additional water treatment seasons as a contingency before being dismantled and disposed of in an appropriate landfill facility.

##### 4.9.9.2 WATER FLOW

At select water crossings, pumping or siphoning may be employed to facilitate the transfer of water from one side of the structure to the other side. Pumping may be required at crossings where culverts were not installed, culverts were improperly installed, or culverts were installed with insufficient capacity. Pumping can also serve as a temporary solution during freshet or prior to a culvert installation.

#### 4.10 QUARRIES AND BORROW SITES

##### 4.10.1 QUARRIES AND BORROW SITES DESCRIPTION

Aggregate will be required for construction of Project infrastructure, including:

- ◆ Haul roads connecting to mine workings;
- ◆ Pads for mine infrastructure and laydown;
- ◆ Goose Airstrip (upgrade of existing exploration airstrip);

- ◆ Fuel storage and other containment areas; and
- ◆ Water management berms and structures.

The Goose Airstrip Quarry was initially permitted for exploration use but will be expanded for mine use. This quarry will be used for construction of the facilities located at the Goose Mine.

Additional material necessary for construction will be sourced from the cut/fill balance of the Goose Plant Site area and from open pit mining. Overburden removal will occur during the preparation of mining and construction activities. The site overburden material and excavated material will either be handled as run of mine waste and stored in WRSAs, or it will be segregated and used where possible in reclamation activities.

At the MLA, aggregate will be required for construction of service roads, laydown pads, infrastructure foundations, and fuel storage and other containment areas. All material will be sourced from the excavation for the fuel storage laydown foundation. Cut material will be used to fill all other infrastructure areas.

Quarries will also be required along the WIR to improve some sections of ground along the route through the placement of aggregate and to establish laydown and camp pad areas. Sections of the WIR that were difficult to build and maintain due to steep grades, dense boulder fields, undulating terrain, limited snow cover, and areas with reduced access to water are difficult to traverse and operate, and pose increased safety, environmental, and operational risks to success of the annual WIR hauling program. Placement of quarries and/or borrow areas to support the WIR will be determined and approved as needed and all will meet the requirements of the Borrow Pits and Quarry Management Plan.

Borrow areas and quarry sites will be operated and closed as per the Borrow Pits and Quarry Management Plan (Sabina 2020c). Quarries will only be developed in areas that have been drilled off and geochemically tested in advance and shown to be sources of NPAG material that is suitable for construction. It is therefore unlikely, but not impossible, that PAG materials will be exposed in the backslopes or base of the quarries. Should PAG material be exposed, all loose blast-damaged PAG material would be removed and disposed of in the WRSAs so that the only PAG materials that could be left exposed in the quarries would be composed of intact bedrock. All final borrow areas and quarry sites will be graded to drain and will not result in topographic low points.

To mitigate the impacts of runoff/sedimentation into freshwater aquatic habitat, B2Gold Nunavut will maintain an appropriate setback distance between Project quarries and fish-bearing or permanent waterbodies, or implement appropriate mitigation measures, as required to prevent ML/ARD into such waterbodies in accordance with Project Certificate Term and Condition 23.

#### 4.10.2 PRE-DISTURBANCE, EXISTING, AND FINAL SITE CONDITIONS

The pre-disturbance surface areas of the quarries are located on land. The pre-disturbance site conditions based on baseline data collection programs are summarized in Section 3.

The Airstrip Quarry is an expansion of the existing quarry located west of the Goose all-weather airstrip. The exploration-related site disturbance area is less than 1 ha. The existing conditions at all other borrow pits and quarries are the same as the pre-disturbance conditions.

A description of site conditions at the end of Operations are provided in Section 4.10.1. The footprints of the Umwelt Quarry and the cut and fill locations at Goose Mine and the MLA will have been used for other Project facilities during Operations and are addressed in previous sections of the ICRP. Once closure and remediation activities are complete, the excavated areas will be contoured and be graded to drain naturally.

#### 4.10.3 CLOSURE OBJECTIVES AND CRITERIA

The closure objectives and closure criteria for the quarries and granular borrow sites are listed in Table 4.10-1.

#### 4.10.4 CONSIDERATION OF CLOSURE OPTIONS AND SELECTION OF CLOSURE ACTIVITIES

If not properly reclaimed, wildlife may be injured by steep slopes in borrow or quarry areas. Environmental design features and mitigation, as well as current wildlife management practices used in other mining projects will be implemented at the Project to limit wildlife injury. Such measures may include flattening steep slopes, constructing boulder walls, and re-contouring reclaimed areas to reduce hazards to wildlife.

#### 4.10.5 ENGINEERING WORK ASSOCIATED WITH SELECTED CLOSURE ACTIVITY

The relevant engineering works associated with the permanent closure activities for the quarries and granular borrow sites are discussed below. While reclamation and closure will depend on the individual site conditions and may commence prior to the end of mining, proposed closure activities for quarries and granular borrow pits will generally include the following:

- ◆ All mobile and stationary equipment will be removed.
- ◆ An excavator will be used to trim and flatten any backslopes and the quarry floor will be graded to eliminate topographic low points and to allow free drainage.
- ◆ When Operations is complete, the overall reclamation objective for the quarry/borrow areas is to return the site to a condition that blends in with the existing topography and surrounding landscape. It is anticipated that a succession of native plant species will naturally revegetate the surfaces over time.
- ◆ Final closure of the quarry areas will include water quality monitoring. Since no extraction will occur below water level and the areas will be contoured to drain positively, there will be no residual ponds once the sites are closed.
- ◆ Quarry wall areas identified as PAG during quarrying activities will be covered with 2 m of NPAG rock on closure.

**Table 4.10-1 Closure Objectives and Criteria – Quarries and Granular Borrow Sites**

<b>Component</b>	<b>Closure Objectives</b>	<b>Closure Criteria</b>	<b>Actions/ Measurements</b>
Land	Surfaces are stabilized	Quarries and granular borrow sites will be contoured to achieve gentle side slopes	Physical inspection
Water	Channel runoff through the watershed	Surfaces will be regraded to promote natural drainage, and new surface drainage patterns will be established if needed	Physical inspection
	Meet Water Licence criteria for runoff	A water management strategy will be implemented to control the transport of sediments out of borrow and quarry areas should it be encountered.	Physical inspection
Wildlife	Ensure surfaces are safe for wildlife use and access	Quarries and granular borrow sites will be re-contoured to reduce hazards to wildlife	Physical inspection
Health and Safety	Ensure surfaces are left in a healthy state that supports continuation of human land use activities	Land use of the areas at post-closure will not compromise people’s health	Routine monitoring and physical inspection

#### 4.10.6 PREDICTED RESIDUAL EFFECTS

Development of borrow pits and quarries will form depressions in the landscape at both the Goose Mine and MLA; however, these areas will be contoured and graded to drain positively. Changes to terrain caused by the construction and subsequent reclamation of the facilities could result in some alteration or loss of plant populations and plant communities; however, the disturbed surfaces are expected to revegetate over time.

#### 4.10.7 UNCERTAINTIES

Should quarry water quality indicate additional measures are needed to address quarry wall PAG, NPAG wall cover thickness may be increased from the prescribed 2 m thickness or alternate management measures considered.

#### 4.10.8 POST-CLOSURE MONITORING AND MAINTENANCE

Site-wide monitoring and maintenance considerations are presented in Section 4.2.3. The following presents the Post-Closure monitoring and maintenance strategies for the quarries and granular borrow sites:

- ◆ Periodic inspections will be performed to visually assess the reclaimed areas; and
- ◆ All quarries and granular borrow sites will be maintained until they are no longer required.

#### 4.10.9 CONTINGENCIES

In addition to the sampling and testing that will be required to identify and segregate NPAG quarry rock for use in construction, further quality assurance and quality control sampling and testing will be completed to verify that the geochemical characteristics of quarry rock used in construction are within expected ranges. Should acid-generating bedrock be exposed, this material will either be handled as with all other PAG waste rock on site, or, if left in place at the end of quarry operations, these areas will be covered with a minimum of a 2 m thick layer of NPAG soil or rock.

### 4.11 REPORTING

The preparation of the following reports is required by the MVLWB/AANDC (2013) guidelines for closure and reclamation of all components of mine sites:

- ◆ **Annual Closure and Reclamation Plan Progress Report:** The general purpose of these annual reports is to provide an opportunity for all parties to track, modify, and report on reclamation. The annual review of research results also provides an opportunity to identify missing research tasks, which allows the research plans to continually evolve. The progress reports keep all parties informed about closure planning and allow NWB to confirm that the proponent has remained on schedule. Any proposed changes to the ICRP with supporting rationale should be presented in these reports for NWB approval.
- ◆ **Reclamation Completion Report:** The general purpose of the reclamation completion report is to provide details, including figures, of the actual reclamation work completed, and an explanation of any work that deviated from the original or approved ICRP. The report should also provide a preliminary assessment on whether appropriate closure objectives and criteria have been achieved.

With each reclamation completion report, there may be an opportunity to revise the financial security estimate depending on the stage of the operation and the current ICRP.

- ◆ **Performance Assessment Report:** A performance assessment report is prepared at the completion of the reclamation work and following submission of the reclamation completion report. The general purpose of the performance assessment report is to provide a detailed comparison of conditions at the site against the appropriate closure objectives and closure criteria. With each performance assessment report, there may be an opportunity to revise the security estimate depending on the stage of the operation and the current ICRP.

The anticipated timelines for preparation and submission to NWB of the above reports are as follows:

- ◆ **Annual Closure and Reclamation Plan Progress Report:** Annually during Operations.
- ◆ **Reclamation Completion Report:** Upon completion of the Active and Passive Closure components, such as decommissioning and reclaiming mine buildings and infrastructure, and completion of passive pit flooding.
- ◆ **Performance Assessment Report:** Performance assessment reports will be prepared a maximum of five years following the completion of the closure effort and will recur a maximum of every five years until ultimate closure conditions have been met. Performance assessment reporting will be used to determine at what time the effluent quality is of a suitable quality for discharge without the respective management measures, where applicable.

## 5. PROGRESSIVE RECLAMATION

---

### 5.1 DEFINITION OF PROGRESSIVE RECLAMATION

Progressive reclamation is defined as the opportunistic reclamation activities completed during the operational phase of a project before permanent closure (MVLWB/AANDC 2013). It takes place prior to permanent closure of the entire Project to reclaim components and/or to decommission facilities that are no longer required for the ongoing operation of the mine. It is a requirement of the Project Certificate that B2Gold Nunavut have a Progressive Reclamation Plan as part of the ICRP (Term and Condition 15). Progressive reclamation can be initiated during the mine operations once a particular activity has been completed, or when the facilities no longer serve a purpose (e.g., starting to flood mined-out underground mine workings and open pits). These progressive activities takes advantage of cost and operating efficiencies by utilizing available mining resources to conduct reclamation activities during the revenue-generating phase of the Project, and typically reduces risks, final closure costs, and the time frame for achieving closure objectives.

### 5.2 OPPORTUNITIES FOR PROGRESSIVE RECLAMATION

The key closure activities that have been identified for progressive reclamation are summarized in the following sections for each individual component of the Project. The progressive reclamation activities provided in this ICRP will be updated in future versions to include new opportunities for progressive reclamation identified during Operations.

#### 5.2.1 OPEN PITS AND TAILINGS FACILITIES

Following completion of mining at each of the open pits, progressive reclamation will commence. In summary, the progressive reclamation measures for each pit or TF are as follows:

- ◆ **Goose Main Reservoir:** The mined-out Goose Main Pit will be converted to a water reservoir during the Operations Phase. The bottom of Goose Main Reservoir will be partially filled with saline water pumped from the SWP to form meromictic conditions. The Goose Main Reservoir will continue to passively flood, reaching capacity during the Closure Phase. Overflow from the Goose Main Reservoir is expected to meet discharge requirements without water treatment.
- ◆ **Echo, Umwelt, and Llama TFs:** After open pit mining of each of the Echo, Umwelt, and Llama pits concludes, these facilities will be used to store tailings. The Umwelt and Llama pits will then be allowed to passively flood. The Echo TF will be covered with NPAG waste rock and reclaimed as part of the Goose Main WRSA. Water in the flooded TFs will be continuously treated and returned to the TF. The TFs are expected to meet discharge requirements during Operations and maintain this quality through Post-Closure.

In addition, the following generic reclamation activities will occur:

- ◆ Establishing partial or full boulder fences around open pits, where physical barriers are required to reduce the likelihood of entry by people or animals;
- ◆ Installing proper signage around mine openings and open pits; and
- ◆ Constructing open pit outflow structures, where necessary.

Boulder fencing and signage are not necessary in areas that do not represent a physical hazard, such as pit walls that will be submerged after flooding. The engineering works presented in Section 4.3.5 will be carried out to the extent possible prior to Closure.

## 5.2.2 UNDERGROUND MINES

Underground workings will be backfilled with waste rock during the mining process for underground support and to reduce the quantity of stockpiled PAG waste rock on surface. Once underground mining and backfilling is complete, the remaining void volume will be filled with saline water from the SWP or the Goose Main Reservoir. The engineering works presented in Section 4.4.5 will mainly be carried out during progressive reclamation.

## 5.2.3 WASTE ROCK STORAGE AREAS

PAG waste rock within the WRSAs will be progressively capped using NPAG waste rock and overburden sourced from adjacent or nearby active open pit operations. All WRSAs will be fully constructed during the operating mine life such that final reclamation can be undertaken progressively before the end of the Operations Phase.

Application of a final cover over PAG waste rock using NPAG waste rock and overburden from active pit operations represents the most substantial progressive reclamation effort proposed. As such, the engineering works presented in Section 4.5.5 will mainly be carried out during progressive reclamation.

## 5.2.4 BUILDINGS, EQUIPMENT, AND INFRASTRUCTURE

Potential progressive reclamation activities for the buildings and equipment include:

- ◆ Demobilize, remove, and decommission equipment and facilities once these facilities are identified as no longer being required for Operations; and
- ◆ Reduce inventories of consumables leading up to the end of Operations.

## 5.2.5 CONTAMINATED MATERIALS AND WASTE DISPOSAL

Materials (e.g., soil, snow, ice) that may become contaminated during Construction and Operations due to fuel or other spills will be cleaned up immediately following the spill. Soil will be remediated on site in lined landfarms. Final disposal of remediated soil will be placed in a WRSA or reused on site, if appropriate, once the soil meets Nunavut Site Remediation criteria for industrial land use. At the MLA, the remediated soil may be used for closure site grading.

Inert, non-hazardous landfills will be established within WRSAs at Goose Mine during the Construction and Operations phases. As the various WRSAs are closed, so may some of the landfills within them, if they have reached capacity. The engineering works presented in Section 4.6.5 will be carried out to the extent possible prior to Closure. Hazardous wastes will be shipped off site periodically to reduce the amount of waste requiring removal at Closure.

### 5.3 PROGRESSIVE REVEGETATION STUDIES

Active revegetation of the Property during Closure is not planned due to the cold climate and established practices for mine closure in Nunavut (Sabina 2021). However, isolated areas such as the WIR subbase upgrades and service emergency camp pads along with WIR will be scarified and reseeded at Closure to promote revegetation where feasible. For all other areas, strategies that encourage natural revegetation and ecological recovery will be applied as appropriate.

A revegetation research program has been initiated by B2Gold Nunavut, based on a review of reclamation practices and studies from other northern mine sites. The findings, summarized in Appendix C, include studies of active revegetation, seeding, and/or soil amendment trials. This review concluded that active revegetation offers limited benefits that are offset by logistical and cost challenges, as well as potential environmental impacts. Key constraints include harsh Arctic growing conditions, limited availability of native seed, lack of suitable growth media, lack of soil amendments, and possible adverse effects on the physical stability of surficial soils.

Future reclamation work by B2Gold Nunavut will be documented in subsequent revisions of the ICRP. In accordance with Project Certificate No. 007, Terms and Conditions 35 and 36, these studies will further examine the feasibility and practicality of topsoil and organic matter salvage during Project development.

Additional research may include updates to the previously conducted review as well as observational or experimental field-based studies of re-vegetation of progressively reclaimed areas of the Project.

Within three years of Construction commencing, results from the revegetation strategies developed, evaluated, or applied will be included in the annual report to the NIRB, per Project Certificate Term and Condition 35. Any information on the progress in fulfillment of Term and Condition 35 will be included in the annual report to the NIRB, per Project Certificate Term and Condition 36.

### 5.4 COMPLETED PROGRESSIVE RECLAMATION

In 2025, a portion of the Umwelt WRSA was encapsulated using NAG as part of progressive reclamation. Future progressive reclamation will be captured in Annual Closure and Reclamation Plan Progress Reports and future iterations of the ICRP. Progressive reclamation measures will be considered successful if these measures are completed as described in this section and monitoring confirms that the completed work is consistent with the stated closure objectives.

## 6. TEMPORARY CLOSURE

---

Temporary closure (also termed Care and Maintenance) is defined as the cessation of mining and processing operations for a finite period of time with the intention of resuming operations upon resolution of the cause of the cessation (MVLWB/AADNC 2013). Possible reasons for implementing temporary closure measures include economic factors (e.g., severely depressed gold price, major mechanical failure, late delivery of critical supplies), environmental factors (e.g., investigation following unintentional discharge to the environment), or social factors (e.g., labour conflict). Temporary closure could last for several weeks or as long as several years depending on the nature of the contributing factor(s).

As a requirement of Project Certificate No. 007, Sabina, and subsequently B2Gold Nunavut, have assessed the potential impacts and risks related to temporary closure. This evaluation gave particular consideration to how communities in the Kitikmeot region may be affected by temporary closure of the mine, including economic, social, and cultural effects.

It is also possible that temporary closure could lead to permanent closure without resumption of mining. This unlikely event would be triggered by a commercial decision by B2Gold Nunavut not to continue operating. This decision would require the FCRP to be filed with the NWB, or a notification to the NWB that the company intends to execute the latest ICRP as its FCRP. Following any required NWB approval, the final closure and reclamation measures described in Section 4 would be executed.

This section provides and general principles and approach that will be undertaken in the event of a temporary closure. The Licence requires B2Gold Nunavut provide a Care and Maintenance Plan at least 30 days prior to entering Care and Maintenance (per 2AM-BRP1831 Amendment No. 1; Part J, Item 4). This Care and Maintenance Plan will expand on the information provided in this section and will be based on the specific developmental stage of the mine at the time of temporary closure initiation. Should the Project remain in Care and Maintenance, an updated estimate of total mine closure restoration liability will be submitted within 12 months of entering Care and Maintenance and every three years thereafter (per 2AM-BRP1831 Amendment No.1; Part J, Item 5).

### 6.1 TEMPORARY CLOSURE GOAL AND CLOSURE OBJECTIVES

Temporary closure is focused on the care and maintenance activities that are required during the cessation of a mining operation. Temporary closure could occur during the Construction or Operations phases for the Project and, as such, temporary closure activities are phase and development stage dependent.

The overall objective of temporary closure is to ensure that the Project facilities are kept in a manner that is safe for humans, wildlife, and the environment, and will include physically and chemically stabilizing mine components. The success of the temporary closure provisions will be monitored by conducting routine physical and chemical inspections.

## 6.2 TEMPORARY CLOSURE ACTIVITIES

The following temporary closure scenarios have been considered:

- ◆ **Short-Term Temporary Closure:** This scenario would apply to any anticipated short-term shut down or closure period of less than one year and could last for a period of weeks or several months (up to 12 months) based on economic, environmental, social, or health factors. This scenario includes potential for a Planned Operational Shutdown as defined under the Wildlife Mitigation and Management Plan.
- ◆ **Long-Term Temporary Closure:** This scenario, or indefinite shutdown, is a cessation of mining and processing operation for an indefinite period of time greater than one year. The intention is that the mine will resume operations as soon as possible after the cause for the indefinite shutdown has been addressed. The Project must maintain safety and environmental stability during this time. Possible causes for an indefinite shutdown could include prolonged adverse economic conditions, extended labour disputes, or shutdowns necessitated or mandated due to external conditions such as disease, war, terrorism, or natural disaster. A decision on the estimated length of the indefinite shutdown would be made after the initial one-year period. Decisions on possible extensions to the indefinite shutdown would be made every six months thereafter and would be based on the conditions at that time. At present, the maximum length of time or number of extensions for interim shutdown before moving to final closure has not been defined.

The proposed short-term and long-term temporary closure activities are presented in the following subsections.

### 6.2.1 SHORT-TERM TEMPORARY CLOSURE

The following short-term temporary closure activities will be implemented as needed depending on the Project phase at which temporary closure takes place.

- ◆ **Access and Security:** Adequate staffing levels will be maintained to carry out care and maintenance activities. Mechanical, hydraulic, and electrical systems will be locked out and maintained in a secure state (i.e., in a no-load condition) if not required to operate through the temporary closure period. Mobile heavy equipment that is not required during temporary closure will be stored in appropriate areas in a no-load condition.
- ◆ **Mine Openings:** Warning signs will be posted around open pits and other mine openings. Mine openings will be barricaded.
- ◆ **Monitoring Programs:** All physical, chemical, and biological treatment and monitoring required to comply with applicable regulatory instruments will be continued. Routine geotechnical stability monitoring and maintenance will continue at a reduced rate compared to that conducted during Operations. Monitoring details will be described in the Care and Maintenance Plan submitted prior to the initiation of temporary closure.
- ◆ **Hazardous Materials:** An inventory of hazardous materials will be completed, including process chemicals, reagents, and petroleum products. Fuel, lubricants, and hydraulic fluids will be removed from the open pit and underground areas and stored in designated areas. Hazardous materials and other chemicals will be properly stored or removed from site.

- ◆ **Bulk Fuel Storage:** Fluid levels in all fuel tanks will be recorded, and the tanks will be routinely inspected for leaks or potential hazards.
- ◆ **Explosives:** Explosives will be relocated to the main magazine and secured, disposed of, or removed from site.
- ◆ **WRSAs and Stockpiles:** WRSAs and ore stockpiles will be maintained such that these facilities are physically stable. The WRSAs and stockpiles will be routinely inspected to ensure stability or to implement any required mitigation measures.
- ◆ **Water Management:** Surface water management measures, including mine dewatering, will continue through temporary closure as required, and will be monitored to ensure proper operation. Surface water quality will be monitored to ensure that regulatory requirements are being met. Depending on the stage at which temporary closure occurs, the water level in the active TF at the time will be monitored as required, as there will be a net buildup of water because no water is being removed for processing. Any unused water distribution lines will be drained but would be left in place.
- ◆ **Infrastructure:** Access roads will be maintained, including plowing snow from active roads and airstrips, clearing and repairing berms and culverts, employing erosion and sediment control measures. Infrastructure, including ditches and spillways, will be routinely inspected to ensure proper operation or to implement contingency measures. Camp facilities will be operated for reduced staffing levels; however, all camp facilities will be maintained. Critical facilities (e.g., Process Plant and camp) will have nominal heat to prevent freezing of the facilities and possible damage.

### 6.3 LONG-TERM TEMPORARY CLOSURE

In addition to the short-term closure activities presented previously, the following long-term temporary closure activities will be implemented as needed depending on the Project Phase at which the temporary closure takes place.

- ◆ **WRSAs and Stockpiles:** WRSAs and ore stockpiles will be maintained such that these facilities are physically stable. As the WRSAs will be designed and operated for long-term stability, it is anticipated that any grading required will be localized and minor. The WRSAs and stockpiles will be routinely inspected to ensure stability or to implement any required mitigation measures.
- ◆ **TF:** Minimum 0.75 m to 1 m cover of NPAG waste rock will be placed over the exposed tailings to control dust. Where feasible, a shallow water cover may be allowed to form as an alternative to a rock fill cover.
- ◆ **Water Management:** Depending on water levels, it may be necessary to begin pumping from the active TF and treating the excess water for discharge. Surface water control structures will be maintained as required. Any unused water distribution lines will be drained.
- ◆ **Infrastructure:** Depending on circumstances, the decision may be made to not construct the WIR in a particular winter season. In such a case, access to the Goose Mine would be via air only.

## 6.4 TEMPORARY CLOSURE MONITORING AND MAINTENANCE

The numbers of personnel on site would be substantially reduced from operational levels. The staff present at site during temporary closure would be sufficient in number and expertise to successfully complete out care and maintenance and monitoring duties, and to address any potential problems that may arise. Sufficient equipment and supplies/reagents would be left on site for any maintenance or reclamation activities that may need to take place.

Programs will be conducted to monitor the physical and chemical stability of mine components, maintain security of the site, and carry out monitoring required for compliance with relevant regulatory instruments. Physical inspections will be conducted to ensure that infrastructure, including embankments, berms, diversions, access roads, surface water management structures, are all performing as designed.

Monitoring, maintenance, and records that will be kept include the following:

- ◆ Recordings of pond water levels and pumping volumes;
- ◆ Recordings of meteorological and hydrological data;
- ◆ Physical inspections of embankments, pipelines, intake structures, and progressively reclaimed areas;
- ◆ Ongoing water quality monitoring (as prescribed in the Type A Water Licence and other applicable approvals);
- ◆ Regular site inspections by the Environmental Superintendent or designate for potential issues;
- ◆ Annual dam safety inspections, if dams are present, and physical inspections of the WRSAs by a qualified Geotechnical Engineer to observe that the embankments and WRSAs are performing as designed and that the TFs are being operated in accordance with the design intent;
- ◆ Ongoing maintenance of access roads;
- ◆ Enforcement of security and access protocols;
- ◆ Site inspections to assess any less obvious signs of potential problems; and
- ◆ Detailed site inspections by the Environmental Superintendent or designate following any extreme events, including freshet. These inspections are needed to identify and assess any damage caused by erosion, settlement, or pooling water that requires attention.

The inspections will be formally recorded and will include details on the inspection results. A summary following each inspection will be provided to B2Gold Nunavut management to identify any urgent concerns or maintenance measures. Physical and chemical monitoring and the associated maintenance activities will be conducted until the Project changes status by either resuming operation or advancing to final closure.

Care and Maintenance monitoring and management measures will be further detailed in the required Care and Maintenance Plan submitted to the NWB 30 days prior to entering a Care and Maintenance phase.

## 6.5 TEMPORARY CLOSURE CONTINGENCY PROGRAM

In addition to having the expertise to successfully address and remediate any conditions or unforeseen events that may arise through the monitoring programs, the key staff at the site would also have access to external consultants and advisors, as required.

The contingency options and actions for events or incidents defined for Operations would be also implemented during the temporary closure (e.g., spill responses, reporting).

## 6.6 TEMPORARY CLOSURE SCHEDULE

The temporary closure schedule would depend on when temporary closure occurs (i.e., what year of Operations and what time of year) and its duration, which are commonly uncertain. Therefore, the schedule for the activities presented in Section 6.2 would be developed as temporary closure advances. Generally, the sequence of activities for short-term and long-term temporary closure would be as follows:

- ◆ Restrict access to the site, buildings, and infrastructure to authorized personnel as required;
- ◆ Carry out an inventory of chemicals and reagents, petroleum products, and other hazardous materials, and either secure these materials appropriately or remove them from site;
- ◆ Post warning signs, and place boulders or berms as needed around the open pit perimeters and underground portals;
- ◆ Remove all mobile equipment except for small service equipment required for open pit inspections and place them in secure on-site storage;
- ◆ Temporary closure of unnecessary facilities and systems; and
- ◆ Continue with environmental and geotechnical monitoring and sampling required for temporary closure maintenance and monitoring as described in the Care and Maintenance Plan, and in accordance with all applicable acts, regulations, licences, permits, and authorizations.

## 6.7 TEMPORARY CLOSURE REPORTING

The Licence requires B2Gold Nunavut provide notice 60 days prior entering Care and Maintenance, or as soon as practically possible (per 2AM-BRP1831 Amendment No. 1; Part J, Item 3). In addition, B2Gold Nunavut will provide the NWB a Care and Maintenance Plan within 30 days of the submission of the notification (2AM-BRP1831; Part J, Item 4). Should the Project remain in Care and Maintenance, an updated mine closure Cost Estimate will be submitted within 12 months of entering Care and Maintenance and every three years thereafter (2AM-BRP1831 Amendment No.1; Part J, Item 5).

If there have been significant changes in the Project or socio-economic conditions since the last socio-economic risk assessment of temporary closure (Sabina 2018), this assessment will be updated and provided to the NIRB, per Project Certificate Term and Condition 69.

B2Gold Nunavut will continue to file reports with the NWB, NIRB, KIA, and other regulatory bodies as required by the licences, permits, and authorizations. These reports will provide jurisdictionally appropriate information on the monitoring undertaken. Care and Maintenance monitoring and reporting will be further detailed in the Care and Maintenance Plan to be submitted 30 days prior to entering a Care and Maintenance phase. Monitoring reports will be prepared to present the findings of the inspections in

accordance with licence requirements and will be submitted to the NWB and NIRB annually. Recommendations for maintenance and any suggested modifications to the monitoring program will be included in these reports. It is anticipated that monitoring and reporting will be consolidated to the extent possible to focus on ensuring the maintenance of the chemical and physical stability of the site.

## 7. POST-CLOSURE SITE ASSESSMENT

---

The ICRP is a living document and includes a commitment to adaptive management and monitoring during all stages of the mine life to demonstrate the safe performance of the mine facilities and to reduce any contamination on the site or in the adjacent area after mine operations cease. Monitoring during Operations and in Closure will identify any non-compliant conditions, allow timely maintenance and clean up as needed, allow timely planning for adaptive and corrective measures, and enable successful completion of the ICRP.

B2Gold Nunavut is required under Part J, Item 2 of the Type A Water Licence, 2AM-BRP1831 Amendment No.1, to submit a FCRP at least 12 months prior to the expected end of planned mining. The FCRP will reflect the pending closed status of the mine and include:

1. Soil Quality Remediation Objectives reflecting the applicable CCME Guidelines and the Government of Nunavut Environmental Guideline for Site Remediation;
2. Environmental Site Assessment plans in accordance with the applicable CSA criteria; and
3. An evaluation of the human health and ecological risks associated with the Closures options proposed.

Post-Closure monitoring is expected to be required for five years after completion of Active and Passive Closure activities. Five years of Post-Closure monitoring has been selected at this stage of Project planning based on the following:

- ◆ The WRSAs will be fully constructed by the middle of Operations and will be progressively reclaimed prior to the end of the Operations;
- ◆ The WRSAs will be frozen and covered with NPAG material; and
- ◆ The Closure Phase (inclusive of Active and Passive Closure stages) is sufficiently long to allow for considerable post-closure monitoring prior to the formal five-year Post-Closure Phase.

As discussed in Section 5, a number of Project components will be progressively reclaimed during the Operations Phase or during the Active Closure Stage. The proposed Post-Closure timeframe may be revisited in future versions of this plan. Post-Closure monitoring is expected to include:

- ◆ Geotechnical inspections of the WRSAs, pit walls, and other areas for physical stability and to ensure that permafrost encapsulation of PAG waste rock is occurring as expected;
- ◆ Water quality sampling at mine effluent discharge locations in accordance with MDMER discharge limits and applicable receiving water quality objectives; and
- ◆ Final Environmental Effects Monitoring (EEM) studies in accordance with the water quality objectives needed to obtain status from Environment and Climate Change Canada as a recognized closed mine.

Adaptive management is proposed through this ICRP, which may include:

- ◆ Carrying out post-closure monitoring beyond the stated five-year Post-Closure monitoring period if closure objectives have not been met; specifically, B2Gold Nunavut has included an allowance for long term monitoring beyond the Post-Closure Phase in the cost estimate.

- ◆ Carrying out water treatment for longer (or shorter) time periods than initially planned should water quality not meet (or sooner meet) closure criteria within specific timeframes; and
- ◆ Modification to the Plan as a result of the findings of the reclamation studies conducted.

Adaptive management will document monitoring and mitigation measures to ensure long-term containment of the tailings and PAG waste rock. The need for adaptive management will be triggered by monitoring results indicating trends that could affect the reclamation and closure objectives. Specific adaptive management actions will be developed through the Closure and Post-Closure phases based on identified, anticipated, or potential needs.

## 8. FINANCIAL SECURITY

---

B2Gold Nunavut is required to maintain a financial security for the Project reflective of the costs associated with closing and reclaiming the Project as described in this Plan, which is based on the modified mine plan. The RLCE for mine closure and reclamation will be revised to reflect the changes in this Plan and is provided in Appendix D. This RLCE covers the closure and reclamation of all Project facilities as described in this Plan and has been prepared using RECLAIM Version 7.0 for permanent closure of the Project.

As required by the Water Licence, 2AM-BRP1831 Amendment No.1, Part J, Item 7, this Cost Estimate will be updated on a prescribed schedule linked to significant milestones. These revision milestones outlined in the Water Licence (2AM-BRP1831 Amendment No.1) include:

1. Twelve (12) months following the commencement of the Operation Phase with an updated Interim Closure and Reclamation Plan (Part J, Item 1);
2. At least twelve (12) months prior to the expected end of planning mining with submission of a Final Closure and Reclamation Plan (Part J, Item 2); and
3. With a Care and Maintenance Plan within twelve (12) months of entering Care and Maintenance and every three (3) years thereafter (Part J, Item 5).

As noted in Section 3.2, B2Gold Nunavut currently holds Type B Water Licences (2BE-GOO2028 and 2BE-GEO2025) for the Back River Project exploration activities. The facilities at the Goose and George properties approved under the Type B Licences are not covered in this ICRP as these facilities are covered under their respective closure plans and cost estimates.

## 9. REFERENCES

---

- AANDC (Aboriginal Affairs and Northern Development Canada). 2002. *Nunavut Mine Site Reclamation Policy for Nunavut: A Policy for the protection of the environment and the disposition of liability relating to mine closures in Nunavut*. ISBN 0-662-32073-5. Copyright: Minister of Public Works and Government Services Canada.
- B2Gold Nunavut. 2026a. *Goose Mine Tailings Management Plan V4.0*. June 2026.
- B2Gold Nunavut. 2026b. *Goose Mine Waste Rock Management Plan V4.0*. June 2026.
- B2Gold Nunavut. 2026c. *Goose Mine Water Management Plan V6.0*. June 2026.
- B2Gold Nunavut. 2026d. *Water Licence No. 2AM-BRP1831 – Modification and Management Plan Updates*. Submitted to the Nunavut Water Board. June 2026.
- BGC Engineering Inc. 2026. *Goose Project 2026 Water and Load Balance Report*. Prepared for B2Gold Back River Corp. Project 1829001, dated June 2026.
- Canada. 2013. *Nunavut Planning and Project Assessment Act*. SC 2013, c. 14, s. 2.
- Canada. 2002a. *Nunavut Waters and Nunavut Surface Rights Tribunal Act*. SC 2002, c. 10.
- Canada. 2002b. *Species at Risk Act*. SC 2002, c. 29.
- Canada. 2001. *Transportation of Dangerous Goods Regulations*. SOR/2001-286.
- Canada 1999. *Canadian Environmental Protection Act 1999*. c.33.
- Canada. 1993a. *Nunavut Act*. SC 1993, c. 28.
- Canada. 1993b. *Nunavut Land Claims Agreement Act*. SC 1993, c. 29.
- Canada. 1992. *Transportation of Dangerous Goods Act, 1992*. SC 1992, c. 34.
- Canada. 1989. *Canadian Transportation Accident Investigation and Safety Board Act*. SC 1989, c. 3.
- Canada. 1985b. *Canadian Navigable Waters Act*. RSC 1985, c. N-22.
- Canada. 1985c. *Fisheries Act*. RSC 1985, c. F-14.
- Canada. 1985d. *Canada Labour Code*. RSC 1985 c. L-2.
- Canada. 1985e. *Territorial Lands Act*. RSC 1985, c. T-7.
- Canada. 1985f. *Canada Wildlife Act*. RSC 1985, c. W-9.
- Canadian Dam Association (CDA). 2013. *Dam Safety Guidelines 2007 (Revised 2013)*. Canadian Dam Association. Revised October 2013. [www.cda.ca](http://www.cda.ca).
- CDA. 2014. *Technical Bulletin: Application of Dam Safety Guidelines to Mining Dams*. 2014. [www.cda.ca](http://www.cda.ca).
- CCME (Canadian Council of Ministers of the Environment). 1999a (with updates to 2017). *Canadian Environmental Quality Guidelines – Summary Table*. Available at: <http://st-ts.ccme.ca/>. Accessed: November 2020.

- CCME. 1999b. *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health* (<http://cegg-rcqe.ccme.ca/en/index.html>).
- CCME. 2008. *Canada-Wide Standard for Petroleum Hydrocarbons in Soil Winnipeg, MB*. Accessed: November 2020.
- CCME. 2013. *Canadian Environmental Quality Guidelines for the Protection of Freshwater Aquatic Life*. Available at: <http://st-ts.ccme.ca/>.
- CCME. 2016. *Canadian Water Quality Guidelines for The Protection of Aquatic Life: Summary Table*. Canadian Council of Ministers of the Environment: Winnipeg, MB. <http://st-ts.ccme.ca/en/index.html> (accessed January 2016).
- Coffey Mining. 2009. *Back River Project, Nunavut Territory, Canada National Instrument 43-101*. Technical Report prepared by Coffey Mining for Sabina Silver Corporation. 6 March 2009.
- Environment and Climate Change Canada; previously Environment Canada (EC). 2010. *Technical Document for Batch Waste Incineration*.
- Government of Nunavut. 2010. *Environmental Guideline for Site Remediation*. Government of Nunavut, Department of Environment, Environmental Protection Service.
- JDS Energy & Mining Inc. 2015. *Technical Report and Feasibility Study for the Back River Gold Property, Nunavut*. October 28, 2015 (Effective Date September 14, 2015).
- Knight Piésold Ltd. 2013. *Site Investigation Summary*. Report Prepared for Sabina Gold and Silver Corp. Project No.: NB101-517/4-1. November 26, 2013.
- Mackenzie Valley Land and Water Board & Aboriginal Affairs and Northern Development Canada (MVLWB/AANDC). 2013. *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories*.
- Mining Association of Canada, The (MAC). 2008. *Towards Sustainable Mining (TSM) – Mine Closure Framework* [web document]. Accessed on August 13, 2015. Located at: [http://mining.ca/sites/default/files/documents/TSM\\_Mine\\_Closure\\_Framework.pdf](http://mining.ca/sites/default/files/documents/TSM_Mine_Closure_Framework.pdf).
- Nakai-Lajoie, P., and D. Cater. 2011. *Technical Report on the Goose Lake Property of the Back River Project, Nunavut Territory, Canada, NI 43-101*. Report prepared by Roscoe Postle Associates Inc. for Sabina Gold & Silver Corp. 31 March 2011.
- Nishi-Kohn/SNC Lavalin and Kitikmeot Geosciences. 2001. *Bathurst Inlet Port and Road Project Feasibility Study, Appendix F: Bathurst Inlet Port Site – Results of Geotechnical Investigation*. Report prepared for Bathurst Port and Road Technical Committee Project No. 334306-0015. December 2001.
- Nunavut. 2013. *Historical Resources Act*. SNU 2013, c. 20, s.16.
- Nunavut. 2012. *Mine Health and Safety Act*. SNWT (Nu) 2012, c. 17, s.20.
- Nunavut. 2003. *Wildlife Act*. SNU 2003, c. 26 (as amended 2018).
- Nunavut. 1988a. *Commissioner’s Land Act*. RSNWT 1988, c. C-11 (as amended 2012).
- Nunavut. 1988b. *Environmental Protection Act*. RSNWT (Nu) 1988, c. E-7 (as amended 2011).
- Nunavut. 1988c. *Explosives Use Act*. RSNWT 1988, c. E-10 (as amended 2010).

- Nunavut. 1988d. *Territorial Parks Act*. RSNWT (Nu) 1988, c. T-4 (as amended 2011).
- Nunavut Impact Review Board (NIRB). 2013. *Guidelines for the Preparation of an Environmental Impact Statement for Sabina Gold & Silver Corp.'s Back River Project (NIRB File No. 12MN036)*. April 2013.
- NIRB. 2020. *Direction Regarding the "Back River Project 2020 Modification Package" submitted by Sabina Gold & Silver Corp. in relation to the Back River Project*. Letter from K. Kaluraq to M. Pickard, dated August 11, 2020, NIRB File No. 12MN036.
- Qikiqtani Inuit Association (QIA). No date. *Abandonment and Reclamation Policy for Inuit Owned Lands*. Version 2.0.
- Rescan Environmental Services Ltd. (Rescan). 2013. *Back River Project: Geochemical Characterization and Metal Leaching/Acid Rock Drainage Potential Report*. Prepared for Sabina Gold & Silver Corp. PROJ#0194096-0040-0007, Rev. A.1, dated October 2013.
- Rescan. 2014. *Back River Project: Cumulative Permafrost Baseline Data Report (2007 to May 2014)*. Prepared for Sabina Gold & Silver Corp. PROJ# 0234411-0010, dated June 2014.
- Sabina. 2015. *Final Environmental Impact Statement*. Submitted to Nunavut Impact Review Board. November 2015.
- Sabina. 2016. *Final Information Request Responses – Part 2*. Submitted to Nunavut Impact Review Board. February 26, 2016.
- Sabina. 2017a. *Back River Project Ore Storage Management Plan*. October 2017.
- Sabina. 2017b. *Final Environmental Impact Statement Addendum*. Submitted to Nunavut Impact Review Board. February 2017.
- Sabina. 2018. *Temporary Mine Closure in the Kitikmeot Region: Risks and Potential Socio-Economic Effects*; submitted September 19, 2018 to the NIRB.
- Sabina. 2020a. *The Back River Project Modification Package*. Version 2. Submitted to Nunavut Water Board. October 2020.
- Sabina. 2020b. *Back River Project Incineration Management Plan*. June 2020. ‘
- Sabina. 2020c. *Back River Project Borrow Pits and Quarry Management Plan*. November 2020
- Sabina. 2023. *Final Environmental Impact Statement Addendum*. Submitted to Nunavut Impact Review Board. March 2023.
- SRK Consulting (Canada) Inc. (SRK). 2010. *Goose Lake Project Airstrip 2010 Site Investigation*. Technical Memorandum prepared for Sabina Gold & Silver Corp. Project No. 1CS020.000. October 25, 2010.
- SRK. 2011. *All-Weather Airstrip and Access Road Geotechnical Field Investigation*. Report prepared for Sabina Gold & Silver Corp. Project No. 1CS020.001. December 2011.
- SRK. 2015a. *Back River Project Geotechnical Design Parameters*. Prepared for Sabina Gold & Silver Corp. PROJ# 1CS020.006, dated November 2015.
- Watts, G., and McQuat Ltd. (WGM). 2005. *Technical Report on the Back River Project, Nunavut for Dundee Precious Metals Inc.* Report filed on SEDAR.

## **APPENDIX A      GLOSSARY OF TERMS AND DEFINITIONS**

## Glossary of Terms and Definitions

Term	Definition
Acid Base Accounting (ABA)	Acid base accounting; a static test that defines the amounts, and relative balance, of potentially acid-generating and acid-neutralizing (or base) minerals in a sample.
Active layer	The layer of ground above the permafrost which thaws and freezes annually.
Acid rock drainage (ARD)	Acidic pH rock drainage due to the oxidation of sulphide minerals that includes natural acidic drainage from rock not related to mining activity; an acidic pH is defined as a value less than 6.0.
Advanced mineral exploration	Any appurtenant undertaking in which the proponent requires a Type A or Type B water licence in order to carry out the proposed activities.
Quarries and Granular Borrow Sites	Site from where soils and aggregates are obtained for use in earthworks construction.
Care and maintenance	The status of a mine when it undergoes a temporary closure.
Closure goal	The guiding statement that provides the vision and purpose of reclamation. Attainment of the closure goal happens when the proponent has satisfied all closure objectives. By its nature, the closure goal is a broad, high-level statement and not directly measurable.
Closure principles	The four core closure principles are 1) physical stability, 2) chemical stability, 3) no long-term active care requirements, and 4) future use (including aesthetics and values). The principles guide the selection of closure objectives.
Closure objectives	Statements that describe what the selected closure activities are aiming to achieve; they are guided by the closure principles. Closure objectives are typically specific to project components, are measurable and achievable, and allow for the development of closure criteria.
Closure options	A set of proposed alternatives for closing and reclaiming each mine component. The closure options are evaluated to determine the selected closure activity, which must be approved by the NWB.
Closure criteria	Standards that measure the success of selected closure activities in meeting closure objectives. Closure criteria may have a temporal component (e.g., a standard may need to be met for a pre-defined number of years). Closure criteria can be site-specific or adopted from territorial/federal or other standards and can be narrative statements or numerical values.
Contaminant	1) any physical, chemical, biological or radiological substance in the air, soil, or water that has an adverse effect; and 2) any chemical substance with a concentration that exceeds background levels or which is not naturally occurring in the environment.
Effluent	Water flows being discharged to the environment.
Engagement	The communication and outreach activities a proponent undertakes with affected communities and Aboriginal organizations/governments prior to and during the operation of a project, including closure and reclamation phases.

Term	Definition
Environmental Site Assessment (ESA)	<p>Phase I ESA: A review of available information to determine the likelihood of actual or potential environmental impacts.</p> <p>Phase II ESA: An intrusive investigation involving sampling and testing to better define the nature and scope of any environmental impacts.</p>
Explosives	<p>Gunpowder, blasting powder, nitroglycerine, gun-cotton, dynamite, blasting gelatine, gelignite, fulminates of mercury or of other metals and every other substance made, manufactured or used with a view to produce a violent effect by explosion.</p>
Humidify cell test (HCT)	<p>A type of kinetic test in which a small sample (about 1 kg) is placed in an enclosed chamber in a laboratory, alternating cycles of moist and dry air is constantly pumped through the chamber, and once a week the sample is rinsed with water; chemical analysis of rinse water yields concentrations of elements and other parameters used to calculate reaction rates.</p>
Kinetic test	<p>A geochemical procedure for characterizing the chemical status of a sample through time during continued exposure to a known set of environmental conditions, such as a humidity cell.</p>
Landfarm	<p>Infrastructure that uses biological and physical processes to treat (remove contaminants) contaminated soil.</p>
Land owner	<p>The responsible authority with administrative control and ownership of a type of land classified as Crown Land, commissioners land or Inuit Owned Land.</p> <p>Crown Land is land belonging to Her Majesty or in respect of which Government has the power of disposition. In Nunavut, this power rests with Crown Indigenous Relations Northern Affairs Canada (CIRNAC).</p> <p>Commissions land is land belonging to the Commissioner for the Government of Nunavut; which typically is land within an established municipality administered by a Municipal Corporation and/or the Department of Community Government and Services (CGS)</p> <p>Inuit Owned Land (IOL) are those lands vested in the Designated Inuit Organization (DIO) pursuant the Nunavut Agreement. For this Project, the DIO is the Kitikmeot Inuit Association.</p>
Land use permit	<p>For Crown Land, a Class A Permit or Class B Permit as required by the Territorial Land Use Regulations SOR/82-217, s.1; SOR/88-169, s.2 administered by CIRNAC Lands Department.</p> <p>For IOLs – Land Use Licence I, II or III or Commercial Lease I, II, III as defined by the DIO.</p> <p>For Commissioners land – a permit or lease as required by the Municipal Land Administration Policy.</p>
Leachate	<p>Water or other liquid that has washed (leached) from a solid material, such as a layer of soil or water; leachate may contain contaminants.</p>
Long-term active care	<p>A post-closure mine site is in long-term active care when sustained monitoring and maintenance of active facilities is required (e.g., for more than 25 years). This should be avoided whenever possible.</p>

Term	Definition
Metal leaching (ML)	The release of a metal from its solid-phase mineral into mine site drainage; described by concentrations in static tests and by metal release rates obtained from kinetic tests.
Long-term passive care	Occasional monitoring coupled with infrequent maintenance or repairs that takes place following reclamation in the Post-Closure Phase of the mine site. Many mine sites require ongoing passive care, which can be an acceptable practice.
Ore	Rock that is considered economic according to the parameters used in the ore reserve estimate. Ore will be processed at the mineral processing plant after it is mined from the Project underground mine and open pits.
Overburden	A general term referring to soil and broken rock, lying above ore and mine rock, that can usually be removed without blasting; at mines in soft sedimentary rock like coal, overburden can be synonymous with mine rock.
Potentially acid generating (PAG)	Rock with an NP/AP ratio less than 2 as determined by static tests, as defined by MEND (2009). PAG rock can also be operationally defined based on the results of static testing such as ABA and net acid generation testing.
Passive treatment	Treatment technologies that can function with little or no maintenance over long periods of time (e.g., use of wetlands).
Permafrost	Bedrock or soil that maintains a temperature at or below 0°C for a continuous period of two years or more.
Progressive reclamation	Selected closure activities that can be taken at advanced mineral exploration and mine sites before permanent closure. Progressive reclamation takes advantage of cost and operating efficiencies by using the resources available from an operation to reduce the overall reclamation costs incurred. It enhances environmental protection and shortens the timeframe for achieving the closure objectives.
Proponent	Applicant for, or a holder of, a water licence and/or land use permit.
Reclamation	The process of returning a disturbed site to its natural state or which prepares it for other productive uses that prevents or minimizes any adverse effects on the environment or threats to human health and safety.
Reclamation research	Literature reviews, laboratory or pilot-scale tests, engineering studies, and other methods of resolving uncertainties. Proponents conduct reclamation research to answer questions pertaining to environmental risks; the design of reclamation research plans aims to provide data and information which will reduce uncertainties for closure options, selected closure activities, and/or closure criteria.
Remediation	The removal, reduction, or neutralization of substances, wastes, or hazardous material from a site in order to prevent or minimize any adverse effects on the environment and public safety now or in the future.
Risk assessment	Analysis of potential threats and options for mitigation for a given site, component, or condition. Risk assessments consider factors such as risk acceptability, public perception of risk, socio-economic impacts, benefits, and technical feasibility. It forms the basis for risk management.
Salvageable Materials	Decommissioned materials which can be sold or reused elsewhere.

Term	Definition
Security deposit	Funds held by the Crown (Aboriginal Affairs and Northern Development Canada) or land owner that can be used in the case of abandonment of an undertaking to reclaim the site or carry out any ongoing measures that may remain to be taken after the abandonment of the undertaking.
Selected closure activity	The closure and reclamation activity chosen from the closure options for each Project component.
Stakeholders	Industry, federal agencies, the territorial government, Aboriginal organizations/governments, land owners, affected communities, proponent, and other parties with an interest in the Project.
Tailings	Material rejected from a mill after the recoverable valuable minerals have been extracted.
Talik	Unfrozen ground surrounded by permafrost.
Traditional Knowledge (TK)	Accumulative, collective body of knowledge, experience, and values built up by a group of people through generations of living in close contact with nature. It builds upon the historic experiences of a people and adapts to social, economic, environmental, spiritual, and political change.
Type A Water Licence	A Type A Water Licence is required if the use is of a type set out in column 2 of Schedule 2 and satisfies a criterion set out in column 5 in respect of an undertaking set out in column 1 of the Nunavut Water Regulations SOR/2013-69  (Note: despite definition of Type B water licence item a), a Type A licence is the appropriate licence for a use of waters if a Type A licence is required for another use of waters, or a deposit of waste, in respect of the same undertaking.)
Type B Water Licence	A Type B water licence is required if the use is of a type set out in column 2 of Schedule 2 and satisfies a criterion set out in column 4 in respect of an undertaking set out in column 1 of the Nunavut Water Regulations SOR/2013-69, or  The use satisfies the criterion set out in paragraph 4(1)(a) but does not satisfy one or more criterion set out in paragraphs 4(1)(b) to (d)
Waste rock	All unprocessed rock materials that a mining operation produces.

## **APPENDIX B      LIST OF ACRONYMS, ABBREVIATIONS, UNITS, AND SYMBOLS**

## List of Acronyms and Abbreviations

Acronym/Abbreviation	Definition
AANDC	Aboriginal Affairs and Northern Development Canada (formerly known as Indian and Northern Affairs Canada, now known as Crown Indigenous Relations and Northern Affairs Canada)
ABA	Acid-Base Accounting
AEMP	Aquatic Effects Monitoring Plan
ARD	Acid Rock Drainage
ANFO	Ammonium Nitrate/Fuel Oil
B2Gold Nunavut	B2Gold Back River Corp.
BESS	Battery Energy Storage System
CCME	Canadian Council for Ministers of the Environment
CDA	Canadian Dam Association
CIRNAC	Crown Indigenous Relations and Northern Affairs Canada; formerly AANDC
CGS	Community and Government Services
EEM	Environmental Effects Monitoring
ESA	Environmental Site Assessment
IOL	Inuit Owned Land
ICRP	Interim Closure and Reclamation Plan
DFO	Fisheries and Oceans Canada
FCRP	Final Closure and Reclamation Plan
FEIS	Final Environmental Impact Statement
GCL	Geosynthetic Clay Liner
GN	Government of Nunavut
HDPE	high-density polyethylene
IQ	Inuit Qaujimagatuqangit
KIA	Kitikmeot Inuit Association
MLA	Marine Laydown Area
ML	Metal Leaching
MDMER	Metal and Diamond Mining Effluent Regulations
MVLWB	Mackenzie Valley Land and Water Board

Acronym/Abbreviation	Definition
NIRB	Nunavut Impact Review Board
NPAG	non-Potentially Acid Generating
NWB	Nunavut Water Board
PAG	Potentially Acid-Generating
PGA	peak ground acceleration
RLCE	Reclamation Liability Cost Estimate
RQD	rock quality designation
Sabina	Sabina Gold & Silver Corp.
SEMC	Socio-Economic Monitoring Committee
SEMP	Socio-Economic Monitoring Plan
SRK	SRK Consulting Canada Ltd.
SWP	Saline Water Pond
TDS	Total Dissolved Solids
TF	Tailings Facility
TK	Traditional Knowledge
TSF	Tailings Storage Facility
TSS	Total Suspended Solids
UV	Ultraviolet
WIR	Winter Ice Road
WRSA	Waste Rock Storage Area
WTG	Wind Turbine Generator
WTP	Water Treatment Plant
WWTF	Wastewater Treatment Facility

### List of Units and Symbols

Units/Symbols	Definition
%	percent
°	degrees
°C	degrees Celsius
dBA	decibels (A-weighted)
g	gram
H:V	horizontal to vertical
ha	hectares
km	kilometre
km/h	kilometres per hour
km <sup>2</sup>	square kilometres
m	metres
m <sup>2</sup>	square metres
m <sup>3</sup>	cubic metres
Mm <sup>3</sup>	million cubic metres
m <sup>3</sup> /day	cubic metres per day
masl	metres above sea level
mbgs	metres below ground surface
mm	millimetres
mm/year	millimetres per year
mg/L	milligrams per litre
mg/kg	milligrams per kilogram
Mt	million tonnes
MW	megawatt
MWh	megawatt-hours
ppt	parts per thousand
t	tonnes
tpd	tonnes per day

## **APPENDIX C      RECLAMATION STUDIES**



## MEMO

TO	B2Gold Nunavut
FROM	Jessica Lowey (MSc, Pag), Katherine Baird (MScF, RPBio)
DATE	20 March 20226
REFERENCE	0773592
SUBJECT	Goose Mine: Reclamation and Revegetation Literature Review

## 1. INTRODUCTION

### 1.1 OBJECTIVES

The objective of this memo is to support revegetation and progressive reclamation planning at the Goose Project (the Project) to meet Nunavut Impact Review Board (NIRB) Project Certificate No. 007 Amendment No. 001 (NIRB 2024) Term and Condition 36, by providing potential options for B2Gold Nunavut to consider and progress closure. In support of this, this memo includes:

- Summary of reclamation and revegetation term and conditions and commitments in the NIRB Project Certificate, FEIS, and associated comments (Section 2);
- Summary of the history of reclamation and current status at the Project (Section 3);
- Literature review of best practices and industry experiences for Arctic reclamation and revegetation (Section 4); and,
- Recommendations for progressive reclamation and revegetation strategies to meet Term and Condition 36, including practicality of topsoil/organic matter salvage, and progress revegetation planning for the eventual closure of the Project (Section 5).

## 2. REVEGETATION AND RECLAMATION CONDITIONS AND COMMITMENTS

NIRB Terms and Conditions (Project Certificate No. 007 Amendment No. 001 [NIRB 2024]) and FEIS (Sabina 2015) commitments on reclamation and revegetation are provided in Attachment A and Attachment B.

NIRB Term and Condition 36 outlines requirements for revegetation at the Project as it relates to the Mine Closure and Reclamation Plan, including considerations for progressive reclamation and maintenance of an up-to-date revegetation plan for the Project. NIRB Term and Condition 36 includes the following:

Category: Vegetation – Mine Closure and Reclamation Plan

Project Phase: Pre-Construction, Construction, Operations, Temporary Closure/Care and Maintenance, Closure and Post-Closure Monitoring

Objective: To maintain an up-to-date revegetation plan for the Project.

Term or Condition: The Proponent shall include revegetation strategies within its Mine Closure and Reclamation Plan that support progressive reclamation, and promote natural revegetation and recovery of disturbed areas compatible with the surrounding natural environment. These strategies should include exploration of the feasibility and practicality of topsoil/organic matter salvage through Project development. The Closure and Reclamation Plan should be updated on an on-going basis as more information becomes available from similar reclamation efforts at other northern projects, as applicable.

Reporting Requirements: Within three (3) years from the commencement of construction of the Back River Gold Mine Project, information regarding the revegetation strategies developed and implemented by the Proponent in fulfillment of this Term and Condition shall be included in the Proponent's annual report to the Nunavut Impact Review Board and this information will include reclamation strategies for the Energy Centre Project. Subsequently, information regarding the Proponent's progress in fulfillment of this Term and Condition shall be provided annually in the Proponent's annual report to the Nunavut Impact Review Board. Whenever the Proponent makes subsequent revisions to the Monitoring Plan(s), the Proponent shall submit the updated Plan to the NIRB within 60 days of revising the Plan(s) and will ensure the updated Plan is posted on the Proponent's project website.

NIRB Term and Condition 36 should be addressed in consideration with other NIRB Terms and Conditions and FEIS commitments that outline reclamation and revegetation requirements. NIRB Terms and Conditions supporting No. 36 include No. 35, 34, 32, 15, and 7 (Attachment A). FEIS (Sabina 2015) commitments related to NIRB Term and Condition 36 are provided in Attachment B, in addition to the Interim Closure and Reclamation Plan (ICRP; Sabina 2021) describing plans for progressive reclamation and closure. Comments on the 2024 NIRB Annual Report from the Crown Indigenous Relations Northern Affairs Canada (CIRNAC) and Kitikmeot Inuit Association (KIA) addressing requirements related to NIRB Term and Condition 36 are included in Attachment C.

### 3. PROGRESSIVE RECLAMATION AT GOOSE PROJECT

The ICRP (Sabina 2021) outlines the activities and monitoring required for the temporary or permanent closure and reclamation of the Project, including the Project's plan for progressive reclamation (ICRP Section 6). Progressive reclamation is the opportunistic reclamation activities completed during the operational phase of a project before permanent closure (MVLWB/AANDC 2013). Opportunities for progressive reclamation are identified for open pits and tailings facility, underground mine, waste rock storage areas, tailings storage facility, contaminated materials and waste disposal, and buildings, equipment and infrastructure (ICRP Section 6.2; Sabina 2021). As construction of Goose Project finished in 2025 and areas remain active, progressive reclamation

and revegetation has not been implemented to date at either the Goose Mine or Marine Laydown Area (ICRP Section 6.4; Sabina 2021).

Through development of the ICRP, natural revegetation was identified for most Project areas due to the cold climate and established practices for mine closure in Nunavut (ICRP Section 6.3; Sabina 2021). For most areas, strategies that support and encourage natural revegetation and recovery will be applied as appropriate (ICRP Section 6.3; Sabina 2021). Natural revegetation and recovery was selected based on results of the literature review of reclamation practices at northern mine sites as summarized in ICRP Appendix E, June 2018 (Sabina 2021), and included studies on active revegetation, seeding, and/or soil amendment trials. This initial review concluded that active revegetation offers limited benefits offset by logistical and cost challenges, as well as potential environmental impacts (Sabina 2021). Key constraints identified included harsh Arctic growing conditions, limited availability of native seed, lack of suitable growth media, lack of suitable soil amendments, and possible adverse effects on the physical stability of surficial soils (Sabina 2021).

In support of reclamation and revegetation, B2Gold Nunavut explored the feasibility of practicality of topsoil/organic matter salvage. B2Gold Nunavut stockpiled topsoil/organic layer and overburden material from the Echo and Umwelt open pits for reclamation at closure. Soil horizons were thin in these areas and so the organic and topsoil layers were not salvaged/stockpiled separately from the overburden material which primarily consists of unconsolidated material (silty clay loam). Assessment of the feasibility of topsoil/organic material salvage will be completed on a site-specific basis.

## 4. REVIEW OF ARCTIC RECLAMATION PRACTICES

A desktop literature review was completed for Arctic reclamation and revegetation strategies, consisting of scientific research, Inuit and government guidelines, and industry experience. The goal of this literature review was to summarize revegetation strategies to support progress towards meeting Term and Condition 36 and identify best practices and successful practices to inform progressive reclamation. Best practices for Arctic reclamation and closure to meet related conditions/commitments were also included. This review expands on the Project's existing summary of revegetation strategies implemented at Arctic mines (ICRP Appendix E, June 2018 [Sabina 2021]; Section 3), by including literature current to 2025, as well as incorporating mine case studies with guidelines and scientific research for a comprehensive assessment and to capture more recent advances in Arctic reclamation. By remaining up to date on emerging revegetation strategies this review demonstrates an ongoing effort to meet Indian and Northern Affairs Canada (INAC; 2002a) requirements for mine reclamation to "adapt to new and improved technologies and methodologies" and "current and comprehensive technical information".

A literature review table referencing and summarizing applicable scientific research, guidelines, and industry case studies is included in Attachment D. A synthesis of Arctic reclamation and revegetation practices and performance from reviewed literature to identify best practices is also provided in the following sections:

- Reclamation Policy and Guidelines (Section 4.1);
- Arctic Conditions and Limitations for Revegetation (Section 4.2);
- Site Preparation (Section 4.3);
- Revegetation (Section 4.4);
- Monitoring (Section 4.5);
- Other Considerations (Section 4.6); and,
- Inuit Traditional Knowledge (Section 4.7).

Northern mining projects relevant to Goose Mine (Nunavut, low Arctic) and incorporated in the review include Mary River Mine (Nunavut, high Arctic), Diavik Diamond Mine (Northwest Territories, Subarctic), Red Dog Mine (Alaska, low Arctic), Colomac Mine (Northwest Territories, Subarctic), Atlin Ruffner Mine (British Columbia, alpine tundra), Ekati Mine (Northwest Territories, Subarctic), Snap Lake Mine (Northwest Territories, Subarctic boreal-tundra transition), Hope Bay Mine (Nunavut, high Arctic), and Meliadine Mine (Nunavut, low Arctic).

#### 4.1 RECLAMATION POLICY AND GUIDELINES

Policy and guidelines for mine reclamation and revegetation in Nunavut include the Mine Site Reclamation Policy for Nunavut (Indian and Northern Affairs Canada [INAC] 2002a), Mine Reclamation Guidelines for the Northwest Territories and Nunavut (INAC 2002b), and Northern Land Use Guidelines (e.g., INAC 2003; INAC 2009; INAC 2010). The Mine Site Reclamation Policy for Nunavut (INAC 2002a) states mine reclamation should be based on the 1994 Whitehorse Mining Initiative definition of mine site reclamation:

returning mine sites and affected areas to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities.

INAC (2002a) also includes the following related to progressive reclamation and revegetation:

Best management practices, including progressive reclamation, should be applied to advance environmental protection and reduce environmental risks.

The selection of key reclamation and closure alternatives should be based on current and comprehensive technical information generated by experts, such as competent, credible consultants.

Mine closure and reclamation plans should be sufficiently flexible to allow adjustments as the life of the mine progresses, including the flexibility to adapt to new and improved technologies and methodologies, and allowing for progressive reclamation, while ensuring obligations under the plans are met.

The reclamation of the surface to meet acceptable standards.

Additional guidelines and best practices for Arctic reclamation and revegetation are available from international, federal, territorial, and research bodies such as Northern Land Use Guidelines for

NWT Lands (GNWT 2015), Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories (MVLWB 2013), Mine Site Reclamation Guidelines for the Northwest Territories (INAC 2007), Northern Landscaping: A Guide to Restoring the Plants and Soil in Northern Communities (CMHC 2002), Yukon Revegetation Manual: Practical Approaches and Methods (Matheus & Omtzigt 2013), Integrated Mine Closure Good Practice Guide, 3rd Edition (International Council on Mining and Metals 2025), among others assessed. Guidelines highlight that successful reclamation requires the re-establishment of soil processes such as nutrient cycling and native plant communities including a diversity of shrub, forb, graminoid, and bryophyte species.

## 4.2 ARCTIC CONDITIONS AND LIMITATIONS FOR REVEGETATION

Arctic environments have a variety of environmental constraints that make revegetation challenging (INAC 2009), including extreme climate, permafrost features, and tundra ecosystem succession. Arctic climates have a short growing season, short frost-free period, low temperatures, low precipitation, and high winds resulting in wind erosion and plant desiccation (Billings 1987; Chapin 1987; MVLWB 2013; Bliss & Matveyeva 1992; Nadelhoffer et al. 1992; Bell & Bliss 1980; Matheus & Omtzigt 2013; Lamarre et al. 2023). Tundra has permafrost-controlled soils (cryosols) that are cold, typically shallow soils with limited (< 5 cm) topsoil development, thin active layer (rooting zone layer that thaws each summer), slow rates of decomposition and nutrient turnover, and limited available moisture and nutrients (Bliss & Matveyeva 1992; Nadelhoffer et al. 1992; Matheus & Omtzigt 2013; MVLWB 2013). Disturbance to surface vegetation cover or the active layer in moist to wet permafrost areas can degrade permafrost and produce thermokarst (heat-pitting) resulting in ground subsidence and damage to permafrost-related landscape features, particularly in Subarctic areas (Matheus & Omtzigt 2013; MVLWB 2013; Webber & Ives 1978). Ecological succession and pedogenesis (soil development) are slow in cold stressed environments like tundra ecosystems (Cargill & Chapin III 1987; MVLWB 2013; Viereck 1966; Webber & Ives 1978). As a result, tundra ecosystems have a slow rate of secondary vegetational development and recovery (e.g., 20-25 years in most sites in northern Alaska; McKendrick 1997) and it may take several hundreds to thousands of years for tundra to reach its climax vegetation (Viereck 1966). These environmental constraints in combination with mine disturbed conditions (Section 4.3.1), have made Arctic revegetation projects difficult (e.g., wind erosion and substrate limitations at Mary River Project in the Canadian high Arctic [Audet & Setterington 2024]).

## 4.3 SITE PREPARATION

Site preparation involves the modification of substrate and surface conditions to facilitate revegetation through creating more favorable conditions for germination, establishment, and growth of native Arctic plant species. This is typically completed through substrate application, topsoil salvage and placement, soil amendment, and surface roughening and microsite creation.

Findings and best practices in site preparation for revegetation are included for:

- Mine Substrates (Section 4.3.1);

- Backfilling and Capping (Section 4.3.2);
- Topsoil and Organic Material Salvage (Section 4.3.3);
- Substrate Amendment (Section 4.3.4); and,
- Surface Preparation (Section 4.3.5).

#### 4.3.1 MINE SUBSTRATES

Mine disturbances and substrates pose additional difficulty for vegetation recovery (Adams & Lamoureux 2005). The physical characteristics of mine substrates include steep slopes and instability, poor soil structure and texture (e.g., coarse soils with low water holding capacity), infertile soil media (low cation exchange capacity, low organic matter) with susceptibility to drought, high surface temperatures, surface evaporation, etc. (Adams & Lamoureux 2005; INAC 2009). Substrates are typically deficient of macronutrients (e.g., nitrogen, phosphorus), organic material, and fungal root associates (i.e., mycorrhiza), making revegetation challenging (Adams & Lamoureux 2005). Tailings and other mine waste also often have elevated metals, salts, or acidity which pose direct limitations to plant growth through heavy metal or ionic toxicity (Adams & Lamoureux 2005; Cater 2010).

Mine substrates requiring reclamation often include mine tailings, waste rock, crushed rock, gravel, or till. Different mine substrates have shown different success in revegetation trials and programs. Heterogeneous substrates (e.g., crushed rock/mixed gravel, glacial till, volcanic silt, lava) with mixed particle size and surface heterogeneity/microhabitats typically show better revegetation success than homogeneous substrates (e.g., processed kimberlite, lake sediment) with similar particle size with smoother surfaces, having higher live cover, density, and spontaneous colonization (Lamarre et al. 2023). Crushed rock and gravel have high reclamation substrate potential, as indicated by good establishment, growth and seed production for Arctic plants including vascular plants, moss, and lichen (Drozdowski et al. 2012; Lamarre et al. 2023; Miller et al. 2021). Tailings such as processed kimberlite are an unsuitable reclamation substrate unless amended due to its physical characteristics and potentially plant toxic concentrations of heavy metals (Miller et al. 2021; Naeth & Wilkinson 2014). Mixes of different substrate types can be used to produce heterogenous particle size, which has also been beneficial for revegetation (Drozdowski et al. 2012; Naeth & Wilkinson 2014).

#### 4.3.2 BACKFILLING AND CAPPING

Backfilling and capping of contaminated areas is typically completed as part of the reclamation process prior to revegetation works. Sufficient covering depth is needed for revegetation success since overburden coverings (caps) which fail result in surface acidification from the buried layers, unsuitable for revegetation (Adams & Lamoureux 2005; Johnson 1987; Pionke & Regowski 1979).

**Best practices for backfilling and capping for Arctic reclamation and revegetation include:**

- In contaminated areas, install a geomembrane liner and gravel layer (capillary break) to prevent movement of water and contaminated materials upward to the rooting zone (Johnson

1987; MVLWB 2013; Stuckless et al. 2025). To support revegetation, the substrate and gravel covering should be sufficiently deep (e.g.,  $\geq 1$  m) for plant roots to prevent root interference with contaminated materials (Stuckless et al. 2025).

- In non-contaminated areas, reclamation substrates are typically applied at depths of 30-50 cm over 50 cm gravel (e.g., Budzey et al. 2025; Drozdowski et al. 2012; Lamarre et al. 2023).

#### 4.3.3 TOPSOIL AND ORGANIC MATERIAL SALVAGE

Soil reconstruction is considered the most important element of reclamation (Johnson 1987). Topsoil salvage and placement involves the removal of the topsoil layer prior to disturbance followed by reapplication to restore native soils for purposes of revegetation as recommended by Arctic reclamation guidelines (Alaska Department of Natural Resources 2025; GNWT 2015; INAC 2009; INAC 2010; MVLWB 2013). Topsoil includes mineral soils with organic material, nutrients, mycorrhizae, and soil biota along with native seed bank and propagules including buried seed, stems, roots, and rhizomes that expedite vegetation growth (Chapin III & Chapin 1980; Johnson 1987; INAC 2009; United States Geological Survey [USGS] 2000).

Topsoil salvage and placement have benefited reclamation and revegetation performance on northern disturbed sites in many cases, including mines (Bishop et al. 1999; Kidd and Max 2001; Bahroudi 2024; Diavik Diamond Mine [Drozdowski et al. 2012; Miller & Neath 2017]; Red Dog Mine [ABR Inc. 2007]; Mary River Project [EDI 2020]; Snap Lake Mine [Turcotte et al. 2025]). For example, salvaged topsoil provided the most consistent increase in plant density among all substrates (Diavik Diamond Mine [Drozdowski et al. 2012]) and also greater below ground (root) biomass (Miller & Neath 2017). Few studies found soil salvage with limited performance (e.g., Diavik Diamond Mine [Miller et al. 2021]), suggested possibly due to long stockpiling time, low application amounts, or incorporation rather than surface application. Johnson (1987) suggests that it is typically not practicable to stockpile or respread less than 10-15 cm topsoil, so thinner upland Arctic topsoil (often  $< 5$  cm) may not be deep enough to stockpile at some sites. However, wetter tundra may have deeper topsoil or may still be suitable for salvage of the organic layer (tundra sod) for transplanting (Section 4.4.2.2).

#### **Best practices for Arctic reclamation topsoil and organic layer salvage and placement include:**

- Salvage topsoil and organic layer where feasible, typically suitable for sites with depths greater than 10-15 cm (Johnson 1987).
- Salvage the organic/sod layer (O horizon) separate from the mineral topsoil (A horizon) and maintain soil horizons where feasible (CMHC 2002; Miller et al. 2021). The organic mat in tussock tundra for example contains abundant buried seeds (Forbes & Jefferies 1999).
- Direct placement of material is preferred where possible, or if direct placement is not possible, it is essential to minimize the length stockpiling time to maintain higher viability of plant propagules like buried seed (Johnson 1987; Miller et al. 2021). Stockpiling time negatively

impacts soil characteristics reducing seed bank viability and germination (Abdul-Kareem and McRae 1984; Birnbaum et al. 2016; Golos et al. 2017; Mackenzie & Naeth 2019).

- When spreading material, prevent compaction by using low compaction tracked equipment, avoid soil handling when wet, and roughening surface after spreading to create microsites (INAC 2009).
- When spreading material, apply on the surface rather than incorporating material and apply with variable coverage, including higher application rates in select areas (Miller et al. 2021; e.g., 15 cm topsoil and 15 cm subsoil [Bahroudi 2024]). For seeding, mineral soil (e.g., topsoil) should be exposed, since Arctic plants typically require exposed mineral soils for germination and seeding onto mulches, erosion control mats, or organics often does not produce established seedlings (Adams & Lamoureux 2005).

#### 4.3.4 SUBSTRATE AMENDMENT

Substrate amendments are materials applied to improve the physical and chemical characteristics of the reclamation substrate, such as use of organic matter (e.g., sewage, compost), fine materials, fertilizers, mycorrhizae, and other amendments. If topsoil salvage and placement are not possible to restore native soils, soil reconstruction can be completed using organic and fine-grained material amendments (Johnson 1987; Forbes & Jefferies 1999). Soil amendment has been shown to facilitate vegetation development in disturbed Arctic environments and mines (e.g., Diavik Mine [Drozdowski et al. 2012; Miller & Naeth 2021; Naeth 2004; Neath & Wilkinson 2014; Diavik Diamond Mines Inc. 2025], Red Dog Mine [ABR Inc. 2007]; Mary River Project [EDI 2020]; Jorgenson and Joyce 1994). Consideration of site-specific characteristics—substrate type, possible contaminants, hydrologic regime, and climate—and revegetation targets are needed to select appropriate soil amendments and application rates.

##### 4.3.4.1 ORGANIC

Organic amendments are organic materials added to substrate to increase organic content and macronutrients, improve moisture retention, or reduce metal bioavailability (Adams & Lamoureux 2005; Jorgenson & Joyce 1994; Meidinger 1979) and generally is recommended by guidelines (e.g., MVLWB 2013). Organic material also provides an insulative cover to protect permafrost damage (Matheus & Omtzigt 2013), and in saline soils, limits evaporation and salt deposition/accumulation at the soil surface (Forbes & Jefferies 1999).

Although salvaged topsoil and organic materials are preferred for organic addition (Section 4.3.3), alternative organic amendments may include sewage sludge (biosolids), bio pellet, water treatment sludge, compost, manure, peat, leonardite, or biochar. Sewage sludge is the most commonly applied organic amendment found to be effective in many studies and mine sites (e.g., Drozdowski et al. 2012; Miller & Neath 2017; Neath 2004; Neath & Wilkinson 2014). Peat (sphagnum peat moss) also shows good performance (Miller & Neath 2017; Neath 2004) but is limited in availability and peat harvesting has negative environmental impacts. Compost shows variability in performance including positive results when incorporated (Ekati Mine [Dominion Diamond Mines Ltd. 2018]) and negative results when applied to the substrate surface as a mulch

(Bahroudi 2024). Organic amendments found to be a less effective amendments include water treatment sludge (Neath & Wilkinson 2014), leonardite (Bahroudi 2024), and biochar (e.g., Diavik Mine [Drozdowski et al. 2012; Miller & Naeth 2017; Naeth 2004; Neath & Wilkinson 2014; Rio Tinto 2017]). Performance of other bio pellets is unknown (Ekati Mine [Dominion Diamond Mines Ltd. 2018]).

Sewage sludge is an effective amendment for enhancing nutrients and plant cover (Bishop et al. 2000; Reid 2003). Neath & Wilkinson (2014) found that sewage increased available nitrogen/phosphorus, plant density/cover, and species richness with seeding. Miller et al. (2021) found best seed establishment in crushed rock with sewage sludge incorporation (upper 5–10 cm). Sewage sludge (biosolids) has been effective at initiating plant growth at northern mines; however, investigation of potential negative effects (e.g., pathogens, heavy metals, nitrates) is ongoing (e.g., Diavik Mine [Drozdowski et al. 2012; Miller & Neath 2017; Naeth 2004; Neath & Wilkinson 2014; Rio Tinto 2017], Red Dog Mine [ABR Inc. 2007], and Ekati Mine [Dominion Diamond Mines Ltd. 2018]). For example, Drozdowski et al. (2012) found sewage sludge had adverse high concentrations of high copper, molybdenum, phosphorus, selenium, sulphate and zinc. Sewage sludge also has fecal coliform (*Streptococcus*) and *Salmonella* (Naeth 2004) but may be reduced by 99.98% through winter application (Ekati Mine [Dominion Diamond Mines Ltd. 2018]). Sewage amendment is included in some reclamation plans, such as sewage mixed with till in progressive reclamation (e.g., Diavik Diamond Mine [Rio Tinto 2025]); however, is not widely applied during reclamation since implementation at a large scale can be impractical.

**Best practices for organic amendments in Arctic reclamation and revegetation include:**

- Incorporate organic amendments into substrate since mulches (topdressing) can block the rooting zone and inhibit plant establishment and growth (e.g., compost in Bahroudi 2024). Incorporation of organic material with surface sediments can be completed using a harrow to (e.g., to 5-10 cm [Miller et al. 2021] or to 10-30cm [Matheus & Omtzigt 2013]).
- Mulches are not recommended unless in special circumstances for erosion control (CMHC 2002).
- Match organic content and thickness to the surrounding site, wherein lowland areas tend to have thicker organic content and upland soils have lower organic content (Matheus & Omtzigt 2013).
- Apply sewage treatments in patches or islands (heterogeneity) and have mineral soil available for seed germination (Miller et al. 2021).
- Priority areas for organic amendment include erosion-prone areas, clay-rich areas, and slopes (Turcotte et al. 2025).

#### 4.3.4.2 INORGANIC FERTILIZERS

Inorganic fertilizers add macronutrients nitrogen, phosphorus, and potassium (NPK) to increase availability in substrates for revegetation. Fertilizers in Arctic environments are shown to accelerate plant growth and cover (especially grasses) and overall biomass; however, may reduce vegetation diversity and inhibit natural revegetation in the long-term (Adams & Lamoureux 2005;

Bahrudi 2024; CMHC 2002; Forbes & Jefferies 1999). Fertilizers tend to favour non-native agronomic plant species rather than native plant species since Arctic native species are often adapted to the low nutrient conditions of the Arctic (e.g., Section 4.2; Chapin III & Chapin 1980; CMHC 2002). The dense flush of grasses in response to fertilization can inhibit natural colonization by shrubs and other species and potentially alter successional pathways (Chapin et al. 1995), relevant considering the shrub succession pattern seen under natural revegetation patterns in which shrubs establish prior to graminoid meadows (Viereck 1966). Shrubs have also been shown to perform better without fertilization (Turcotte et al. 2025). Some studies; however, have found low NPK effective at increasing total vegetation cover of bryophytes and other vascular plants (e.g., Neby et al. 2022). Fertilizers also favour above ground growth rather than root growth, which may be a better indication of long-term revegetation success in Arctic conditions where species have high root:shoot ratios (Adams & Lamoureux 2005). Due to the low holding capacity of coarse materials common in mining reclamation substrate, fertilizer runoff has the potential to impact downstream water bodies (Adams & Lamoureux 2005; MVLWB 2013) and nutrients may not be retained (depleted quickly), so benefits of accelerated growth may be shorter term (ABR Inc. 2007; Miller & Neath 2017).

Guidelines note the importance of minimal and judicious use of fertilizers for Arctic reclamation (e.g., CMHC 2002; MVLWB 2013; Matheus & Omtzigt 2013; USGS 2000), instead favouring topsoil/organic salvage, organic amendment, or nitrogen-fixing native plants to enhance nutrients. Mines have used inorganic fertilizers in some reclamation situations (e.g., Diavik Diamond Mine [Drozdowski et al. 2012; Naeth & Wilkinson 2014]; Ekati Mine [Dominion Diamond Mines Ltd. 2018]; Red Dog Mine [ABR Inc. 2007]; Snap Lake Mine [Turcotte et al. 2024]).

**Best practices for the use of inorganic fertilizers for Arctic reclamation and revegetation include:**

- Consider reclamation objectives – Objective of developing greater plant cover may conflict with the objective of greater species diversity, important when considering fertilization (Forbes & Jefferies 1999). Dry Arctic environments have naturally sparse vegetation cover (Forbes & Jefferies 1999).
- Match soil nutrients to the surrounding site – Native Arctic soils naturally have low nutrients, especially dry sites (Forbes & Jefferies 1999). Wetlands tend to have higher nutrient levels and may be more appropriate for fertilization (Forbes & Jefferies 1999).
- Fertilizer mix and application rate should be based on site conditions of soil chemistry and testing (Turcotte et al. 2025; Matheus & Omtzigt 2013). Typical rates include N 40-90 kg/ha; P<sub>2</sub>O<sub>5</sub> 30-70 kg/ha; K<sub>2</sub>O 30-60 kg/ha; S 0-17 kg/ha (Matheus & Omtzigt 2013).
- Minimize fertilizer application – If fertilization is used, application should be at a low rate with seeding and transplanting (Adams & Lamoureux 2005; Matheus & Omtzigt 2013; USGS 2000). Matheus & Omtzigt (2013) suggest using less than half the recommended rates (e.g., <50kg N/ha). Turcotte et al. (2025) suggest using 200 kg/ha 10:30:25 NPK for overburden. USGS (2000) suggest rate of 560 kg/ha for slow release fertilizer. ABR Inc. (2007) suggest 448-504 kg/ha 20:20:10 NPK)

- Use slow-release fertilizers to avoid leaching (Adams & Lamoureux 2005; USGS 2000), such as MagAmp 7:52:6 NPK or Osmocote 14-14-14 NPK 2-year-release form (USGS 2000).
- Application should occur when plants are large enough to utilize fertilizers (i.e., after a few years growth) to prevent runoff (Adams & Lamoureux 2005).

#### 4.3.4.3 FINE MATERIALS

Fine materials are used to amend coarse materials to improve soil structure for improved water retention ability, soil moisture, and nutrient retention for revegetation (Drozdowski et al. 2012; Forbes & Jefferies 1999; Neath & Wilkinson 2014), and is recommended by guidelines (e.g., MVLWB 2013). Fine materials may include glacial till, lakebed sediments, glaciolacustrine deposits, or zeolite, used to amend coarse materials such as waste rock. In mine reclamation applications, mixes of coarse waste rock with fine textured till have been shown to reduce adverse element concentrations and improve revegetation (e.g., 25:75 mix of processed kimberlite to till; Drozdowski et al. 2012; Neath & Wilkinson 2014). Zeolite amendment (fine textured) was also found to have the highest biomass and species richness (Bahroudi 2024). Lake bed sediments also have potential for reclamation and showed some vegetation recovery (e.g., Miller et al. 2021; Miller & Neath 2017). Fine materials; however, are prone to wind and water erosion (Johnson 1987), which can be reduced by surface roughening. Homogenous fine materials like some mine tailings materials instead should be amended by coarse materials.

#### 4.3.4.4 MINERAL AMENDMENTS

Mineral amendments are used to counteract substrate conditions such as acidity (low pH), sodicity (high sodium), or low magnesium; however, are not referenced in mine reclamation guidelines. Lime (calcium carbonate) is used to amend acidic soils, dolomitic lime (calcium carbonate and magnesium carbonate) is used to amend acidic soils and low magnesium sites, and gypsum (calcium sulfate) is used to amend soil structure in high salinity or heavy clay (Adams & Lamoureux 2005; Cater et al. 2020; Meidinger 1979). Mineral amendments are expensive and not typically used in mine reclamation; however, pelletized dolomitic lime has been used to treat fugitive dust acid-contaminated sites, but results are not known (Red Dog Mine [ABR Inc. 2007]). Instead, capping contaminated areas or mixing with other substrates is preferred and more cost-effective than mineral amendments.

#### 4.3.4.5 OTHER AMENDMENTS

Other less common amendments include mycorrhizae (Ekati Mine [Dominion Diamond Mines Ltd. 2018]) or nitrogen-fixing Rhizobium bacteria (USGS 2000). These amendments have limited research on their application for reclamation and revegetation at northern mines.

#### 4.3.5 SURFACE PERPARATION

Surface preparation techniques recommended and widely applied in Arctic reclamation include contouring/slope stabilization, decompaction, surface roughening, addition of surface features, and other methods to decrease surface compaction and increase availability of microhabitats and seed contact with soil. Literature and best practices highlight the importance of surface

preparation (microhabitats) for revegetation establishment, with some variability based on site-specific considerations (e.g., presence of permafrost, erosion potential). In general, surface preparations should aim to recreate similar site conditions as undisturbed/baseline conditions to which native plants are adapted.

#### 4.3.5.1 SLOPE STABILIZATION AND EROSION CONTROL

Slope stabilization and erosion control are required prior to other surface preparation to prevent loss of fine materials (Johnson 1987). Techniques include contouring to match the surrounding landscape natural angle, constructing gentle (< 2:1) rounded slopes where possible, terracing/stepping steep slopes, rounding excavated slopes, and maintaining natural hydrology (INAC 2009; EDI 2020). Recontouring can be completed using stockpiled overburden with mineral topsoil placed on top at variable depths where possible (INAC 2009). Frozen material for reconstruction is not recommended since the ground ice may melt and cause subsidence (GNWT 2015; INAC 2009; INAC 2010). In cases where erosion is severe, other erosion and sediment controls such as cross ditches, berms or swales, and erosion control mats or tarps may be needed (GNWT 2015a, 2015b; INAC 2009; INAC 2010). Erosion control products such as anionic polymer Soil Lynx (soil binder) are also available but were found to not be effective on diamond mine wastes with high sand content (Miller et al. 2021). Surface decompaction and roughening through the rough-and-loose technique also slows water movement, increases water infiltration, and reduces erosion as shown in Arctic reclamation (Government of Northwest Territories 2017; Section 4.3.5.2).

#### 4.3.5.2 SURFACE ROUGHENING AND DECOMPACTION

Surface decompaction and roughening are used to increase surface heterogeneity and microhabitats for plant propagules (Government of Northwest Territories 2017). Techniques commonly applied in mine reclamation include cultivation/tilling/ripping of severely compacted sites (e.g., roads) using a winged subsoiler, plow or t-plow, or disc trenching (e.g., Budzey et al. 2025; Forbes & Jefferies 1999; Turcotte et al. 2025; Rio Tinto 2025), surface scarification (e.g., CMHC 2002; GNWT 2015a, 2015b; INAC 2010; Turcotte et al. 2025; Rio Tinto 2025), rough-and-loose technique or mounding (e.g., CMHC 2002; Government of Northwest Territories 2017 [Colomac Mine]; Lamarre et al. 2023; Matheus & Omtzigt 2013; Polster 2013), berm and trough creation, and rock-placement (ABR Inc. 2007; CMHC 2002; Ekati Mine [Dominion Diamond Mines Ltd. 2018]). Even in coarse rocky substrates, scarification improves vegetation establishment (Turcotte et al. 2025).

Studies and guidelines recommend and demonstrate the benefits of surface roughening for revegetation in most circumstances, particularly progressive scarification and for promoting natural revegetation (e.g., Budzey et al. 2025; CMHC 2002; Forbes & Jefferies 1999; GNWT 2015a, 2015b; INAC 2010; Turcotte et al. 2025; Rio Tinto 2025). A study found surface preparation for texturing to have limited functional value after a year of their application due to wind erosion of fine materials, and recommend focusing on erosion control and microhabitat stability (e.g., Audet & Settingington 2024 [Mary River Project]), or even poorer performance on tilled TSF than untilled in terms of lower plant diversity than untilled sites (e.g., Bahroudi 2024).

Other uses may be a consideration, since the resulting rough surface from scarification of rock can impede wildlife and human movement, and so it may be desirable to maintain some smooth surfaces for travel in some circumstances (e.g., as identified by Inuit Traditional Knowledge Panel, Diavik Diamond Mine [Rio Tinto 2025]). Near surface permafrost sites also need special considerations for surface roughening such as reduced depth (Section 4.3.6). On slopes scarification/raking should be done perpendicular to the slope to aid in slowing water movement for erosion control.

#### 4.3.6 PERMAFROST CONSIDERATIONS FOR SITE PREPARATION

Contouring, decompaction, and other surface preparation activities with heavy equipment should be managed to prevent permafrost melting. Nunavut RAC (2012) describes Good Environmental Practice Considerations in Canadian Permafrost Regions including use of tracked equipment.

##### **Best practices to protect permafrost during Arctic reclamation include:**

- On lowland permafrost sites with permafrost close to the soil surface, surface work should be minimized to light harrowing or raking (e.g., only the top few centimetres) rather than deep soil turning to avoid damage to permafrost (i.e., do not cultivate the frozen ground; Matheus & Omtzigt 2013). Arctic mines generally implement these best practices, such as limiting earthworks to <35 cm depth to protect permafrost (EDI 2020).
- Restore hydrological function and natural drainage patterns by aligning with surrounding landscape and terrain are also important to prevent water ponding/lakes which can result in permafrost degradation and ground subsidence (EDI 2020; INAC 2009).
- Maintaining 20-30 cm depth gravel fill can also prevent permafrost degradation (Jorgenson & Joyce 1994).
- In areas of human-caused thermokarsting, additional best practices include applying as much topsoil/organic material as possible (e.g., >20 cm), avoid tillage, establish quick cover (e.g., 10% cover crop), and avoid equipment use until the ground is frozen (Matheus & Omtzigt 2013).

#### 4.3.7 BUFFERS AND SHELTERING

Abiotic and biotic vertical structures used as buffers in reclamation are installed perpendicular to the wind direction as wind breaks in an effort to trap snow, reduce wind speeds, wind-injury and wind erosion, and increase soil moisture at the microsite scale (Jorgenson & Joyce 1994; MVLWB 2013). Vertical structures include berms (i.e., artificial raised ridges of soil, embankments, or rock), artificial snow fences, wattle fences, and vegetation buffers such as shrub hedgerows (MVLWB 2013). Evidence for the effects of vertical structures on revegetation success are limited (Lemay et al. 2021); however, abiotic structures have been shown to increase soil moisture (Budzey et al. 2025; Jorgenson & Joyce 1994). Snow fencing may be more effective when taller (e.g., 1 m) and has been beneficial to revegetation in some studies (e.g., Lemay et al. 2021), while shorter snow fencing (0.35 m, 0.65 m) did not have significant effects on revegetation (Budzey et al. 2025; Rausch and Kershaw 2007). Biotic shrub buffers were shown to possibly

reduce plant-available water in summer due to transpiration (Budzey et al. 2025), while natural succession studies show snow accumulation as vegetation develops (Vioreck 1966). Some industry reclamation and closure plans also reference the use of berms for snow capture and rock/boulder placement (ABR Inc. 2007).

## 4.4 REVEGETATION

Arctic revegetation includes both natural and active revegetation to restore plant communities and stabilize permafrost conditions (Nunavut RAC 2012; EC 2012). Active revegetation techniques include seeding, planting, transplanting vegetative mats or plugs, live staking, and cuttings/sprigs. Natural revegetation involves natural colonization and recruitment of plant species, which can be passive or facilitated through site preparation methods or maintenance of seed-sources. Kempenaar et al. (2013) provides information on site-specific considerations for passive versus active revegetation including erosion risk, proximity to seed sources, presence of seed bank, presence of invasive species, site productivity, cost, site diversity, site stressors, and disturbance size. Arctic native plants are well adapted to harsh Arctic environments including poor nutrient conditions and hardy to cold temperatures and frost (Antonovics et al. 1967; Densmore et al 1990; Wielgolaski 1975; Munshower 1994; Brown 1997). Revegetation in the Arctic is generally slow (Section 4.2), with recovered vegetation expected to not provide surface erosion control or visual quality for 1-10 years (Adams & Lamoureux 2005). Early patterns of Arctic plant colonization and growth have been shown to influence later successional community composition (Kearns et al. 2015; Vioreck 1966), highlighting the importance of suitable revegetation methods.

Studies and guidelines generally recommend prioritizing passive or facilitated natural revegetation in stable areas and integrating this with active revegetation where needed. Findings and best practices in revegetation practices are included for:

- Natural Revegetation (Section 4.4.1);
- Active Revegetation (Section 4.4.2); and,
- Species Selection (Section 4.4.3).

### 4.4.1 NATURAL REVEGETATION

Natural revegetation involves allowing establishment and ingress of vegetation with no active revegetation intervention. Facilitated natural revegetation is recommended by Arctic reclamation guidelines in stable areas (e.g., Alaska Department of Natural Resources 2025; GNWT 2015a, 2015b; INAC 2009, 2010; Matheus & Omtzigt 2013; Nunavut RAC 2012; USGS 2000) since it reestablishes local native vegetation composition and structure, typically has greater species diversity, and avoids the risks of active revegetation such as invasive species introduction. However, suitability and effectiveness of natural revegetation depends on the presence of an active seed bank (e.g., topsoil salvage; Section 4.3.3) or proximity to seed sources from intact vegetation (Audet & Settingington 2024; Kempenaar et al. 2013; Matheus & Omtzigt 2013). Factors impeding passive natural revegetation include the presence of non-native or invasive species, site contamination, low productivity, or erosion risk, requiring more active intervention (Kempenaar et al. 2013; Matheus & Omtzigt 2013). Natural revegetation success can be increased

through good site preparation methods (Section 4.3; e.g., topsoil placement, soil reconstruction, surface roughening), snow removal to lengthen growing season (Cater 2010), and through maintenance of nearby seed sources.

Experience across northern mines indicates natural regeneration is generally slower but has favourable effects in terms of greater species diversity and re-establishment of native plants (e.g., ABR Inc. 2007; EDI 2020; Meidinger 1979). Natural regeneration (unassisted) has been effective for mine disturbances (abandoned airstrip and roadsides), with early colonizers present within 1-3 yrs and 60–70% cover after 40 yrs post-disturbance (Audet & Settingington 2024). Arctic graminoids (grasses, sedges) and forbs are generally quicker to recover, while shrubs and mosses are slower to recover, and lichen are very slow to recover (Audet & Settingington 2024). In organic soils, native sedges can re-establish biomass equal to undisturbed tundra within 5-10 years (Chapin III & Chapin 1980) and for minor disturbances (e.g., vehicle tracks on tundra) natural revegetation is just as effective as active revegetation (Neby et al. 2022). Large natural disturbances (e.g., several kilometres [km] length and 1 km width) of gravel outwash (coarse mixed substrates) have also been shown to revegetate naturally without amendment (e.g., Viereck 1966). More expansive disturbances or sites contaminated with mining waste (e.g., tailings) are frequently shown to have very poor passive vegetation recovery (e.g., Naeth & Wilkinson 2014) and facilitated natural revegetation or active revegetation may be needed (Kempenaar et al. 2013; Matheus & Omtzigt 2013).

Similar to most literature recommendations and industry practice, Inuit engagement at other northern mines indicate preference for passive and facilitated natural revegetation (e.g., Diavik Diamond Mine [Rio Tinto 2025]; Snap Lake Mine [Turcotte et al. 2025]). Traditional knowledge may indicate that in areas of potential contamination, land should be allowed time to heal and to avoid attracting wildlife to these areas (e.g., as identified by Inuit Traditional Knowledge Panel, Diavik Diamond Mine [Rio Tinto 2025]). Natural revegetation was also historically allowed to occur in areas of Inuit disturbances and have shaped vegetation communities on the landscape (Oberndorfer et al. 2020; Section 4.7).

#### 4.4.1.1 SEED SOURCE ISLANDS

Natural revegetation relies on seed or other plant propagule sources. Patches/islands of undisturbed vegetation should be maintained undisturbed to provide a seed source for natural revegetation (Forbes & Jefferies 1999; Neby et al. 2022). Incidental disturbances to the adjacent and nearby intact tundra should also be minimized (Neby et al. 2022). Within organic sites, particularly wet sites, undisturbed vegetation patches can expand into disturbed areas as the organic layer builds up, through lateral clonal growth or vegetation fragments that root in soft sediment, producing a complex mosaic where rhizomatous Arctic graminoids *Carex* and *Eriophorum* are common (Forbes & Jefferies 1999).

#### 4.4.2 ACTIVE REVEGETATION

Active revegetation techniques like seeding or planting facilitate revegetation by accelerating vegetation cover at northern mines (e.g., Naeth 2004; EDI 2020). Guidelines and research

recommend integrating natural revegetation with active revegetation methods. Generally, sites with expansive disturbances shown to have very poor natural revegetation recovery, may require intervention with active revegetation (Kempenaar et al. 2013; Matheus & Omtzigt 2013; Naeth & Wilkinson 2014). Guidelines, industry examples, and research findings for best practices are summarized below for active revegetation methods.

Findings and best practices in active revegetation are included for:

- Seeding (Section 4.4.2.1);
- Planting (Section 4.4.2.2);
- Transplanting (Section 4.4.2.3);
- Staking and Sprigs (Section 4.4.2.4); and,
- Bryophyte Propagation (Section 4.4.2.5).

#### 4.4.2.1 SEEDING

Seeding is the most commonly applied and tested active revegetation method in Arctic environments, considered most effective when applied selectively, integrated with natural revegetation, and tailored to site conditions. Seeding can be utilized for large disturbances, erosion-prone slopes, or sites with poor natural recovery potential (Johnson 1987; Kempenaar et al. 2013; INAC 2009; GNWT 2015a; MVLWB 2013). Research and guidelines highlight the importance of using appropriate locally adapted native species to avoid the intentional or accidental introduction of invasive or unsuitable plants. Species selection for seeding include considerations in Section 4.4.3, including use of local native seed (Section 4.4.3.1) and diverse species composition. Seeded species typically include native graminoids and forbs, since direct seeding of shrubs has generally been unsuccessful (e.g., Forbes & Jefferies 1999; Turcotte et al. 2025), apart from willows or alder (Government of the Northwest Territories 2017). Although some northern cultivars of commercial grass seed exist (Matheus & Omtzigt 2013) and establish well and accelerate cover, use is not recommended since this often results in lower long-term species diversity and dominance by graminoids (ABR 2007; Naeth & Wilkinson 2014; Miller et al. 2021; Turcotte et al. 2025). It is recommended to avoid overutilization of grasses which can outcompete forbs and shrubs and inhibit succession and ecosystem recovery (Chapin et al. 1995). Some literature also discusses cautious use of temporary non-native nurse/cover crops where erosion risk is very high and urgent, but recommend alternative erosion control measures and highlight the importance of careful species selection ( $\leq 10\%$  of seed mix; e.g., *Hordeum vulgare*) so that nurse crops do not persist and suppress native recovery (e.g., Forbes & Jefferies 1999; INAC 2009; Matheus & Omtzigt 2013).

Seeding best practices support a conservative seeding approach and discuss application methods, site conditions, timing, and species selection. Site considerations for seeding and seeding rates include substrate type, site preparation, slope and erosion risk, and ability for natural revegetation from neighbouring seed sources or salvaged topsoil material.

**Best practices for Arctic reclamation seeding include:**

- Seed on exposed mineral soils (e.g., topsoil) for better germination (Adams & Lamoureux 2005);
- Rake/furrow soil after seeding (e.g., to 1-2.5 cm) to improve seed-to-soil contact (USGS 2000);
- If mulches, erosion control mats, or organics are used, apply as topdressings since seedlings germinating on top of organics can quickly desiccate (Adams & Lamoureux 2005);
- Spring seeding after snowmelt is best, though fall frost seeding prior to snowfall can also be effective (Johnson 1987; Naeth 2004; Turcotte et al. 2025; Matheus & Omtzigt 2013);
- If commercial seed must be used, seed certification and pure live seed (PLS) quality are essential to prevent accidental introduction of non-native or weed seeds (Naeth 2004; Matheus & Omtzigt 2013);
- Methods of application typically recommended include dry broadcast seeding by hand or using ATV-mounted rotary spreaders, depending on site conditions (e.g., size and accessibility; USGS 2000); and,
- Tailor seeding rates to site-conditions and allow for natural revegetation (infiltration) to occur. Lower seeding rates should be used for flat, organic-rich areas (e.g., natural revegetation or 500-1,000 PLS/m<sup>2</sup>; Matheus & Omtzigt 2013) and higher rates for bare mineral soils or steep slopes ( $\geq 2,250$ – $3,000$  PLS/m<sup>2</sup>; Matheus & Omtzigt 2013) requiring faster establishment (Turcotte et al. 2025).

#### 4.4.2.2 PLANTING

Planting uses nursery stock (e.g., plugs or potted stock) for active revegetation. Planting has been used successfully in reclamation trials (e.g., Minto Mine [Bodley et al. 2025]; Snap Lake Mine [Turcotte et al. 2025]; Colomac Mine [Government of Northwest Territories 2017]), and in mine reclamation (e.g., abandoned Atlin Ruffner Mine [Stuckless et al. 2024]; abandoned Faro Mine [CIRNAC 2025]; Ekati Mine [Dominion Diamond Mines 2018]). However, due to the time and expense of nursery propagation and planting (Hagen 2002), typically using locally collected Arctic native plant species (Section 4.4.2.5) since commercial plant stock of Arctic species is limited, it is selectively applied in northern mine reclamation. Survival of planted Arctic native species is generally good under variable conditions including disturbed gravel areas with low nutrients (Stuckless et al. 2024). Planting has been successful with graminoid and forb species (Budzey et al. 2025; Government of Northwest Territories 2017; Stuckless et al. 2024), as well as trees and shrubs including dwarf shrubs *Dryas integrifolia*, *Empetrum nigrum*, and *Vaccinium vitis-idaea* (Budzey et al. 2025; Matheus & Omtzigt 2013; Stuckless et al. 2024; Turcotte et al. 2025). Greenhouse propagation for planting is effective for most Arctic species; apart from some which may have low propagule viability (e.g., *Cassiope tetragona*, *Dryas octopetala*; Hagen 2002).

#### **Best practices for Arctic reclamation planting include:**

- June planting outperforms fall planting (Stuckless et al. 2024);
- Plant from top downwards on slopes (Stuckless et al. 2024);
- Verify planting densities using post-planting inspections (Stuckless et al. 2024);

- Shelter improves planting survival (Stuckless et al. 2024);
- Implement infill planting or multi-phased planting where required (Kuzyk et al. 2025; Stuckless et al. 2024);
- Water in dry conditions where feasible (May et al. 1982; Stuckless et al. 2024); and,
- Use experienced planters (Stuckless et al. 2024).

#### 4.4.2.3 TRANSPLANTING

Transplanting of Arctic vegetation involves harvesting as tundra sod (i.e., tundra mats or carpets) or as plugs or root saucers from a donor site and placing at placement site (Adams & Lamoureux 2005). Tundra sodding is based on the traditional practice by the Iñupiaq peoples' of Alaska using the Nuna ulu technique (meaning "land/earth knife"), used to construct traditional sod houses and to insulate entryways to ice cellars (Cater 2015). Transplanted materials should be sourced from salvaged material since disturbance to intact tundra is not sustainable (Adams & Lamoureux 2005; Lynn 2025; Forbes & Jefferies 1999; MVLWB 2013; USGS 2020), with tundra sod donor sites including sites prior to disturbance, or possibly ocean bluffs being lost to erosion and climate change. This highlights the importance of salvaging and separating the tundra sod from lower overburden layers during mine construction.

Transplanting of tundra sod has had considerable success in the Arctic (Vital 1976). Wet tundra is more suitable for tundra sodding than drier sites due to their thicker organic layer and rhizomatous species (e.g., *Carex aquatilis*, *Dupontia fisheri*, *Eriophorum angustifolium*, *E. scheuchzeri*) which hold the sod well (Cater 2010; Cater 2015; Lynn 2025; Lynn et al., n.d). Dry or moist tundra typically does not hold together well and upland evergreen and deciduous shrubs typically do not survive transplanting as well (Lynn et al., n.d). For many mine reclamation applications, transplanting is considered impractical due to lack of donor sites (without destroying undisturbed tundra), time and cost constraints (e.g., Diavik Diamond Mine [Rio Tinto 2025; Diavik Diamond Mines Inc. 2025]), or due application difficulty for large areas (Webber & Ives 1978). Despite being labor intensive and costly compared to other revegetation techniques, tundra sodding offers advantages of rapid restoration of vegetation community and insulative cover where needed (Cater et al. 2015), such as is needed such as in areas of human-caused thermokarsting.

Tundra sod can be harvested and transplanted using heavy equipment and/or hand labor. Recent improvements in the tundra sod collection include use of a standard excavator fitted with a 4-ft wide frost bucket modified with plates welded to the bucket's sides, allowing extraction of thick (e.g., 30–40-cm thick), intact pieces of sod that could be loaded directly onto standard 4-ft × 4-ft pallets for loader transport (Lynn et al., n.d.). In situations where damage to tundra with heavy equipment is a concern, hand cutting has also been used (e.g., "Nuna ulu" cutting disc [Cater 2010]; serrated knife [Lynn 2025]; Pulaski [USGS 2020]).

#### **Best practices for Arctic reclamation tundra sodding include:**

- Harvest sod when the soil has thawed 6-12 inches (Cater et al. 2010);
- Scarify the surface prior to transplanting (USGS 2020);

- Direct placement is preferred, but sod can be stored for up to several months or years if kept moist (Webber & Ives 1978; USGS 2020);
- Match donor site to placement site conditions (CMHC 2002); and,
- Excavate placement site if needed so that after sod placement the tundra sod surface is even with the surrounding landscape.

Transplanting individual plants (plugs) or small clusters has been implemented less often in Arctic reclamation but has included the use of wetland sedge plugs (Hewitt et al. 2018; Government of Northwest Territories 2017). Species suitable as plug transplants include graminoids *Juncus stygius*, *Juncus drummondii*, *Equisetum arvense*, *Carex aquatilis* (Hewitt et al. 2018). In an alpine fellfield study (May et al. 1982), transplant plug success of Arctic species was variable, with fibrous-rooted species (e.g., *Deschampsia caespitosa*) more resilient than rhizomatous (e.g., *Carex rupestris*) or other rootstock species (May et al. 1982). Best practices for plug transplanting include careful excavation of roots, removal of soil from roots, and post-transplant watering for several weeks to minimize early mortality for dry sites (May et al. 1982).

#### 4.4.2.4 STAKING AND SPRIGS

Live staking and sprigs are a revegetation and bioengineering technique using plant cuttings within moist and wet areas such as riparian areas or wetlands as recommended by guidelines (e.g., Cater et al. 2010; CMHC 2002; Government of the Northwest Territories 2015a, 2015b; Matheus & Omtzigt 2013; MVLWB 2013; USGS 2000). Live stakes (shrub cuttings) or sprigs (herbaceous cuttings) are collected locally from native species that readily form new roots from stems (adventitious roots) and are easily propagated in the field in moist soil without special treatment (Johnson 1987). Arctic shrubs suitable for live staking include certain willow species (e.g., *Salix alaxensis*, *S. arbusculoides*, *S. athabascensis*, *S. barclayi*, *S. planifolia*, *S. pulchra*) (Adams & Lamoureux 2005; Alaska Department of Fish and Game [ADFG] 2005; Forbes & Jefferies 1999; Hagen 2002; Hewitt et al. 2018; Matheus & Omtzigt 2013; USGS 2000). Arctic herbaceous species suitable for sprigs/cuttings include many wetland graminoids such as *Arctophila fulva*, or even *Leymus* spp. for drier areas (Cater 2010; CMHC 2002; Forbes & Jefferies 1999). Application of staking and cuttings in mine reclamation is limited but has been shown effective in reclamation of riparian areas, wetlands, and tailing storage facility slopes (e.g., ABR Inc. 2007; Government of the Northwest Territories 2017). In some research trials, live stakes were not successful (Diavik Diamond Mine [Diavik Diamond Mines Inc. 2025]).

#### **Best practices for Arctic reclamation staking include:**

- Live stake cuttings should be collected during the dormant season, before bud break (i.e., early spring or fall) and stored frozen until install in spring (ADFG 2005; ABR Inc. 2007);
- Live stake cuttings between 2-5 cm in diameter into 2-3 ft (0.5-1 m) lengths are cut angled at the base (end to be inserted into the soil) and flat at the top, with side branches trimmed; and,
- Prior to install, live stake cuttings should be soaked in water out of direct sunlight for a few days (ADFG 2005; Government of Northwest Territories 2017).

#### 4.4.2.5 BRYOPHYTE PROPAGATION

Bryophyte revegetation is an emerging method for reclamation using mosses and lichen. Mosses and lichen, in combination with bacteria, cyanobacteria/algae, are important components of biological soil crusts which provide bioactive microsites for plant establishment by stabilizing soils and improving water infiltration, particularly in sub-xeric to very xeric sites (Stewart & Siciliano 2015). Moss and lichen can be slow to recover in mine disturbances (e.g., EDI 2020); however, some mosses (e.g., *Polytrichum* and *Sphagnum*) show potential for mine reclamation due to their tolerance to heavy metals, low pH, and their ability to colonize bare sites to initiate soil formation, stabilize surfaces, and improve plant germination (Adams & Lamoureux 2005; Stanley et al. 2000). Although mosses show promise in mine reclamation in Arctic or alpine environments, research to date is limited (e.g., Diavik Diamond Mine [Lamarre et al. 2023]; Ekati Mine [Dominion Diamond Mines 2018]; Grasberg Copper Mine [Stanley et al. 2000]). Findings suggest bryophyte propagation with vegetation fragments is best using locally collected large to medium fragments (Lamarre et al. 2023), with additional methods described in Stanley et al. (2000). In terms of site conditions, surface variability of 1-5 cm (microtopography) was found beneficial (Lamarre et al. 2023). Many studies suggest bryophyte revegetation is best on unamended crushed rock or gravel (Diavik Diamond Mine [Diavik Diamond Mines Inc. 2025; Miller et al. 2021; Neath et al. 2014; Rio Tinto 2025]) while others suggest fertilization could improve moss revegetation of organic substrates (Svalbard tundra vehicle-tracks [Neby et al. 2022]).

#### 4.4.3 SPECIES SELECTION

Native Arctic plant species are recommended for Arctic mine reclamation by guidelines and industry best practices (e.g., Webber & Ives 1978). Local native plants have a long history of genetic sorting and natural selection by the local environment and evolution with native insects and wildlife. Over the long-term, local Arctic native plants are often better able to survive, grow, and reproduce under the environmental extremes of the local area, having better reclamation success compared to introduced plants, as well as providing greater benefits to wildlife species (Brown 1997; Munshower 1994). Non-native, agronomic, and commercially available species (i.e., non-local seed sources or stock) should generally be avoided to reduce intentional and accidental introduction of non-native and potentially invasive species which can outcompete and exclude native species preventing native ecosystems from reestablishing (Adams & Lamoureux 2005; Forbes & Jefferies 1999), an issue of historical reclamation projects which often used agronomic species (Kearns et al. 2015). Recent mine reclamation programs emphasize the use of local native plant species (e.g., Diavik Diamond Mine [Diavik Diamond Mines Ltd. 2025; Rio Tinto 2025]). Species provenance is known to affect plant performance, pollinator networks, and herbivores, with effects extending up to higher trophic levels (Bucharova et al. 2021), so locally sourced species (see Section 4.4.3.1 for plant collection) perform better and are recommended (Kuzyk et al. 2025).

**Literature describes a variety of considerations for local native plant species selection in Arctic mine reclamation:**

- Diversity in plant species and life forms – graminoids, forbs, dwarf shrubs, shrubs, mosses and lichen. Incorporating several types of plant functional groups is more beneficial than just including a higher number of species (e.g., Diavik Mine [Drozdowski et al. 2012; Miller & Naeth 2017; Naeth 2004; Neath & Wilkinson 2014; Rio Tinto 2017]);
- Tolerance to site disturbance and contaminant conditions such as low nutrients, heavy metals (metallophytes), salts (halophytes, e.g., *Puccinellia* spp.), acid or low pH (calcifuges, e.g., legumes), drought, or flooding (Adams & Lamoureux 2005; Matheus & Omtzigt 2013);
- Nitrogen-fixing ability (e.g., legumes, alder) to improve soil macronutrient content and enhance revegetation, while preventing the negative effects of inorganic soil fertilizers like runoff (Adams & Lamoureux 2005; Forbs and Jeffries 1999; Johnson 1987; Jorgenson and Joyce 1994; Matheus & Omtzigt 2013);
- Early successional/pioneer species (USGS 2000) - Ecological succession patterns of natural revegetation (colonization) provide insight to suitable plant species (Viereck 1966);
- Tolerance of human disturbance (hemerophiles) and colonizing by natural revegetation effectively in similar disturbed sites with harsh conditions (e.g., gravel bars, roadsides, etc.; USGS 2000);
- Adaptability to various site conditions – Generalist species with wide ranges and greater tolerance to different site conditions (Webber & Ives 1978);
- Rapid cover ability – Viviparous species that produce an abundance of vegetative propagules (plantlets or bulbils) annually (e.g., *Bistorta vivipara*, *Poa arctica*), rhizomatous and stoloniferous species (clonal) which spread laterally quickly especially in wetlands (e.g., *Arctophila fulva*), and species with fast growth rate or prolific seeding such as *Epilobium angustifolium* or *Puccinellia* spp. (Adams & Lamoureux 2005; Forbes & Jefferies 1999);
- Rooting depth for site-specific concerns for capped areas overlying contaminated soils – e.g., shallow rooting native species (<0.5 m max vegetation height) to reduce the potential for uptake of contaminants from the underlying soil or disturbance to liners (Stuckless et al. 2024);
- Propagule viability and germination rate – Plants with high germination or rooting ability and survivability have greater applicability for active revegetation methods such as greenhouse propagation and outplanting (Hagen 2002);
- Minimal risk to wildlife – low potential for metal accumulation (avoid metallophytes that are hyperaccumulators) and neither attract or repel wildlife (MVLWB 2013); and,
- Cultural significance and traditional knowledge application, requiring Indigenous engagement.

Resources are available which include lists of native plants, tolerances and preferred growing conditions, site suitability, and propagation methods (e.g., CMHC 2002 [Appendix B, C, D]; Matheus & Omtzigt 2013 [Tables 5.19-5.22]; USGS 2020 [Table 9]), in addition to information which can be derived from baseline vegetation data where available (e.g., FEIS; Sabina 2015). Reclamation trials and studies also provide an abundance of information on plant revegetation performance in various conditions, including by natural revegetation or active revegetation. Plant species commonly cited as having high revegetation potential for disturbed mine sites include

grasses (e.g., *Arctophila fulva*, *Agrostis borealis*, *Calamagrostis canadensis*, *Deschampsia* spp., *Festuca altaica*, *Luzula confusa*, *Poa arctica*, *Puccinellia* spp., *Trisetum spicatum*), sedges (*Eriophorum scheuchzeri*, *Carex aquatilis*, *Carex podocarpa*), legumes (e.g., *Astragalus* spp., *Hedysarum* spp., *Lathyrus* spp., *Lupinus* spp., *Oxytropis* spp., *Vicia* spp.) and other forbs (e.g., *Artemisia* spp., Asteraceae, Brassicaceae, *Cerastium beeringianum*, *Epilobium angustifolium*, *Senecio* spp.), and shrubs alder (*Alnus* spp.) and willow (*Salix* spp.), among other plant species (ABR Inc. 2007; Adams & Lamoureux 2005; Forbes & Jefferies 1999; Klebesadel 1973; Viereck 1966; Webber & Ives 1978).

#### 4.4.3.1 LOCAL SEED AND PLANT PROPAGULE COLLECTION

Seed and propagule collection originates from the best practice to source native plants locally to conserve the gene pool/provenance and due to the inadequate commercial source of native Arctic plant species (Johnson 1987; Kuzyk et al. 2025; Webber & Ives 1978) as recommended by guidelines (e.g., CMHC 2002; Government of Northwest Territories 2017; INAC 2009; Matheus & Omtzigt 2013; MVLWB 2013; USGS 2000). Arctic species frequently use vegetative reproduction so propagules can include other plant parts such as stems, rhizomes, or bulbils in addition to seed (CMHC 2002; Hagen 2002). Northern mines have initiated local seed and plant collection programs for reclamation and trials (e.g., Atlin Ruffner Mine [Stuckless et al. 2024]; Diavik Diamond Mine [Lamarre et al. 2023; Miller et al. 2021]; Minto Mine [Budzey et al. 2025]; Snap Lake Mine [Turcotte et al. 2025]).

#### **Best practices for collecting local vegetation materials (seeds, cuttings, transplanting) for Arctic reclamation and revegetation include:**

- Collection site does not contain non-native or invasive species, is the same general vegetation type (capture species' ecotypes), and is nearby the revegetation site (e.g., suggested distances range from a 6 km radius [Adams & Lamoureux 2005] to a 200 km radius and 500 m elevation [CMHC 2002]);
- Minimize disturbance to the collection site and plant population (e.g., collect < 1/3 of seed, harvest from salvage sites; CMHC 2002);
- Collect materials according to timing of seed dispersal which is typically August-September for most Arctic species, apart from willows and alder in May-June (CMHC 2002; Adams & Lamoureux 2005);
- Maintain proper handling and storage (CMHC 2002);
- Local seed/propagule amount can be cyclical and low some years so collection may need to occur over several years and some species have low propagule viability so focus on species with expected high viability (Hagen 2002); and,
- Engage Indigenous communities in collection through to monitoring (Turcotte et al. 2025).

## 4.5 MONITORING

Monitoring reclamation is considered an important component of insuring revegetation success and to identify whether adaptive management is needed (Gann et al. 2019), and post-closure

monitoring is a requirement for mine reclamation in Nunavut (INAC 2002a, 2002b). Circumpolar Arctic Vegetation Science Initiative (CAVSI; 2025) is currently developing Arctic research network and methods/best practices. Studies implemented a variety of methods to assess the performance of reclamation and revegetation practices including greenhouse experiments (e.g., Hagan 2002), landscape level reclamation trials (e.g., Ekati Mine [Dominion Diamond Mines Ltd. 2018]; Mary River Mine [EDI 2020];), randomized block experimental design (e.g., Budzey et al. 2025; Lamarre et al 2023; Miller et al. 2021; Naeth 2004), and time since disturbance chronosequence (e.g., Audet & Settingington 2024). Remote sensing technologies are also applied for revegetation assessment at mines (Gordon et al. 2023). Monitoring timelines for mines post-reclamation are variable but often reference plant cover or other criterion (e.g., Diavik Diamon Mine uses annually until mean 5% cover met, expected in 5-10 years [Diavik Diamond Mines Inc. 2025]).

**Best practices for Arctic reclamation and revegetation monitoring include:**

- Revegetation targets – develop revegetation targets that are specific and based on site conditions and target ecosystems. Different features will potentially require different reclamation strategies and surface configurations (EDI 2020);
- Consider Arctic species have high root:shoot ratios, so root development may be better indicator for long-term revegetation success (Adams & Lamoureux 2005). Assess below ground biomass and long-term survivability, not just initial rate of growth above ground (Adams & Lamoureux 2005);
- Higher vegetation cover is not always better – compare revegetation cover to the control, such as the surrounding environment or baseline which often has naturally sparse vegetation cover. Dry Arctic environments have naturally sparse vegetation cover (Forbes & Jefferies 1999);
- Vegetation assessment metrics include vegetation ground cover, below and above ground biomass, species richness, and general plant health (e.g., signs of chlorosis), while soil metrics include pH and soil nutrients (Turcotte et al. 2025);
- Monitoring program should have adaptive management triggers (Kuzyk et al. 2025); and
- Long-term monitoring – slow recovery of Arctic vegetation necessitates adequate monitoring timelines to assess revegetation success (Kuzyk et al. 2025). Many of the experimental studies identify short monitoring timelines as limitations and recommend long-term monitoring (e.g., Drozdowski et al. 2012; Lamarre et al. 2023). Long-term monitoring can be cost effective by reducing the monitoring interval (frequency) following initial annual monitoring (Kuzyk et al. 2025).

## 4.6 OTHER CONSIDERATIONS

Other considerations for Arctic revegetation and reclamation include:

- Damage to the surrounding tundra from contaminants such as saline drilling brine (salt) or oil (hydrocarbons) may also need restoration, with recommendations described in Cater (2010);

- Timing of activities to avoid disturbance to intact tundra – tundra soils are most vulnerable in spring and least vulnerable in winter (CMHC 2002);
- Invasive plant species – monitor and manage non-native and invasive plants in advance of reclamation works (INAC 2009; Kempenaar et al. 2013; Stuckless et al. 2024);
- Faunal fluctuations and overgrazing by caribou can inhibit revegetation success (Stuckless et al. 2024; Webber & Ives 1978);
- Snow removal effects to increase growing season (Forbes & Jefferies 1999);
- Long lead times are typically needed for native plant seed or plugs, due to source material constraints or time needed for local collection and propagation (Turcotte et al. 2025);
- Arctic has slow rates of vegetational change, so current plants in the baseline conditions and surrounding intact tundra may reflect past conditions (Forbes & Jefferies 1999); and,
- Climate change – Climate change is identified as a concern and consideration by Inuit Tapiriit Kanatami (2019). Long term permafrost monitoring by Natural Resources Canada shows continued warming ( $>0.5^{\circ}\text{C}$  per decade in cold Arctic permafrost) and increasing active layer thickness (Natural Resources Canada 2022). Climate-driven geomorphic transformation expected for the Canadian Arctic (Kokelji 2017; Kuzyk et al. 2025), which could influence vegetation community change and future revegetation. This can affect the stability and moisture regimes of reclamation substrates and the success of plant establishment. Revegetation considerations for climate change include considering a climate-shifted baseline in species selection (i.e., intermediate ecosystems), climate-resilient species, consideration of plant provenance (local), potential for multi-phased revegetation for adaptive management, importance of long-term monitoring, and using a diverse species mix to increase the probability that certain species will be suited to future climate conditions (BC MCM 2025; Kuzyk et al. 2025). ClimateNA climate modeling tool includes mean annual temperature, climate maps, mean annual precipitation, and climatic moisture deficit using the SSP2-4.5 climate scenario into the year 2100 (Kuzyk et al. 2025). BC MCM (2025) provides guidelines on climate change considerations for reclamation for BC which are also applicable to Nunavut, considering regional guidelines for mine reclamation in a changing climate are not currently available.

## 4.7 INUIT TRADITIONAL KNOWLEDGE

Reclamation is recognizing the importance of integrating Inuit Qaujimagatuqangit (i.e., Inuit Traditional Knowledge) and Inuit engagement is a requirement of new mining operations in the Canadian Arctic. Mine reclamation programs have had various success engaging Inuit in review of RCPs and considering Inuit Qaujimagatuqangit in mine reclamation and revegetation, with legacy mining sites often lacking proper engagement and having serious long-term issues like environmental contamination (CIRNAC 2025; Dance 2015; Sandlos & Keeling 2016). Resources to guide meaningful Inuit engagement for reclamation include government resources or requirements (e.g., NIRB; MVLWB 2013; Nunavut Regional Adaptation Collaborative [Nunavut RAC] 2012; Inuit Tapiriit Kanatami 2019), research initiatives (e.g., CAVSI 2025; Dance 2015), and industry-derived resources (e.g., Keeling and Potvin 2025 [Raglan Mine]; Kuzyk et al. 2025;

Sandlos & Keeling 2016 [Giant Mine]). Some Inuit associations have also developed policy and guidelines for reclamation, such as the Qikiqtani Inuit Association (2017) which developed goals for reclamation and obligations of the land user for Inuit Owned Lands in Qikiqtani Region (Baffinland); however, a similar guideline does not exist for Kitikmeot Region, Nunavut.

**Best practices for Inuit engagement in mine reclamation emphasize early, sustained, and meaningful collaboration throughout the entire Life-of-Mine, from operations through closure and post-closure:**

- Engagement can be facilitated through the establishment or continued use of stakeholder bodies. These ensure Inuit rightsholders are centrally involved in shaping the mine closure vision, aligning reclamation goals with intended future land uses and co-developing revegetation prescriptions that reflect Inuit priorities (Kuzyk et al. 2025; MVLWB 2013);
- Effective communications include hosting site-visits, public meetings, face-to-face discussions, and workshops, and developing a 3-D landscape models depicting pre-development, operational, and closure conditions;
- Engagement should address closure objectives, closure options, relevant reclamation research, and other key closure topics to produce a conceptual Closure and Reclamation Plan that reflects both ecological integrity and Inuit cultural values (MVLWB 2013);
- A record of engagement activities should be maintained, and reporting should be shared with Inuit governments (MVLWB 2013); and,
- Include Inuit participation in site monitoring and collaborative reclamation research, aligning Inuit Qaujimajatuqangit with western science (MVLWB 2013).

Inuit Qaujimajatuqangit provides valuable perspectives on reclamation and revegetation considerations, as referenced in this literature review. Considerations may include alternate land uses and land-based activities, traditional practices like wildlife harvesting, culturally important plant species, and concerns such as permafrost thaw (MVLWB 2013; Inuit Tapiriit Kanatami 2019). Insights from Inuit engagement provided in the context of Arctic mine reclamation at other sites have included the following: maintain strategic wildlife and human movement corridors by avoiding scarification in select areas, natural revegetation preferred but apply active revegetation in some instances, importance of all plant forms and species diversity (including important cultural plant species), avoid active revegetation of contaminated areas to avoid attracting wildlife to these areas until the land has had time to heal, cap contaminated areas with till and rock layers, consider traditional wildlife harvesting and other land-based activities, consider alternate uses for sites such as recreation (e.g., Diavik Diamond Mine [Rio Tinto 2025; Diavik Diamond Mines Inc. 2025]; Giant Mine [Sandlos & Keeling 2016]; Raglan Mine [Keeling & Potvin 2025]; Snap Lake Mine [Turcotte et al. 2025]). Some projects have involved Indigenous communities in seed collection, planting, and monitoring (e.g., Snap Lake Mine [Turcotte et al. 2025]).

It is also important to acknowledge the influence of Inuit cultural practices on shaping the landscape and vegetation communities (Oberndorfer et al. 2020). Inuit disturbed areas (e.g., built environments, fishing histories, tent rings) drive biodiversity and have unique species assemblages compared to undisturbed areas, with potential for at least an increase local-scale

plant species diversity but have similar total species diversity (Oberndorfer et al. 2020). Examples include soil enrichment (nutrient inputs) resulting from Inuit fishing histories (favouring grasses) and calcium enrichment (favouring calciphiles) near middens and sod houses of Inuit (bones, shells), influencing plant species composition (Oberndorfer et al. 2020). Iñupiaq peoples of Alaska also traditionally practiced tundra sod collection using the Nuna ulu technique (meaning “land/earth knife”), used to construct traditional sod houses and to insulate entryways to ice cellars (Cater 2015).

## 5. REFERENCES

- Abdul-Kareem, A.W., & McRae, S.G. (1984). The effects on topsoil of long-term storage in stockpiles. *Plant and Soil*, 76(3), 357-363. <https://doi.org/10.1007/BF02205593>
- ABR (ABR, Inc). (2007). *SD F3: Revegetation plan for the Red Dog Mine (Final report, June 2007)*. Prepared for Teck Cominco Alaska Inc. and the Alaska Department of Natural Resources. <https://dnr.alaska.gov/mlw/mining/large-mines/red-dog/pdf/sdf3.pdf>
- Adams, P. W., & Lamoureux, S. (2005). *A literature review of the use of native northern plants for the revegetation of Arctic mine tailings and mine waste*.
- ADFG (Alaska Department of Fish and Game). (n.d.). Staking - Streambank revegetation and protection: A guide for Alaska. Retrieved December 13, 2025, from <https://www.adfg.alaska.gov/index.cfm?adfg=streambankprotection.staking>
- Alaska Department of Natural Resources. (2025). *2025 Reclamation Plan Form for Placer Exploration or Mining*. Alaska DNR.
- Antonovics, J., Bradshaw, A.D., & Turner, R.G. (1971). *Heavy metal tolerance in plants*. In *Advances in Ecological Research* (Vol. 7, pp. 1-85). Academic Press. [https://doi.org/10.1016/S0065-2504\(08\)60202-0](https://doi.org/10.1016/S0065-2504(08)60202-0)
- Audet, P., & Settingington, M.A. (2024). *Challenges of reclamation in the Canadian High Arctic: Pilot study at an active mine site on North Baffin Island, Nunavut*.
- Avens Associates Ltd. & CMHC. (2002). *Northern landscaping: A guide to restoring the plants and soil in northern communities (NH18-1-281-2002)*. Canada Mortgage and Housing Corporation. <https://www.cmhc-schl.gc.ca>
- Bahroudi, B. (2024). *Influence of topsoil-till cover depth and amendments on ecosystem reclamation of a closed tailings storage facility (M.Sc. thesis, Thompson Rivers University)*.
- Bell, K. L., & Bliss, L. C. (1980). Plant reproduction in a high Arctic environment. *Arctic and Alpine Research*, 12(1), 1-10. <https://doi.org/10.2307/1550585>
- Billings, W. D. (1987). Constraints to plant growth, reproduction, and establishment in Arctic environments. *Arctic and Alpine Research*, 19(4), 357-365. <https://doi.org/10.2307/1551400>
- Birnbaum, C., Bradshaw, L. E., Ruthrof, K. X., & Fontaine, J. B. (2016). Topsoil stockpiling in restoration: Impact of storage time on plant growth and symbiotic soil biota. *Ecological Restoration*, 35(3), 237-245. <https://doi.org/10.3368/er.35.3.237>
- Bishop, S. C., Kidd, J. G., Cater, T. C., Rossow, L. J., & Jorgenson, M. T. (1999). *Land rehabilitation studies in the Kuparuk Oilfield, Alaska, 1998*. In Thirteenth annual report (72 pp.). Prepared ARCO Alaska, Inc. Anchorage, AK by ABR, Inc., Fairbanks, AK.
- Bliss, L. C., & Matveyeva, N. V. (1992). *Circumpolar arctic vegetation*. In F. S. Chapin III, R. L. Jefferies, J. F. Reynolds, G. S. Shaver, & J. Svoboda (Eds.), *Arctic ecosystems in a changing climate: An ecophysiological perspective* (pp. 59-89). Academic Press.

- Brown, R. W., & Amacher, M. C. (1997). Selecting plant species for ecological restoration: A perspective for land managers. In *Revegetation with native species* (pp. 1-16). In *Proceedings, 1997 Society for Ecological Restoration Annual Meeting*. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. (Proceedings RMRS P 8).
- Brown, R.W.; Amacher, M.C. 1997. Selecting plant species for ecological restoration: a perspective for land managers. *Revegetation with native species*, pp.1-16 In: *Proceedings, 1997 Society for Ecological Restoration Annual Meeting*. U.S.D.A. Forest Service Rocky Mountain Research Station. Proceedings RMRS-P-8.
- Bucharova, A., Lampei, C., Conrady, M., May, E., Matheja, J., Meyer, M., & Ott, D. (2022). Plant provenance affects pollinator network: Implications for ecological restoration. *Journal of Applied Ecology*, 59, 373-383. <https://doi.org/10.1111/1365-2664.13866>
- Budzey, B. F., Landhäusser, S. M., & Stewart, K. J. (2025). The influence of abiotic (snow fences) and biotic (hedgerows) vertical structures on soil moisture, temperature, and planted seedlings in subarctic mine site reclamation. *Geoderma*, 462, 117512. <https://doi.org/10.1016/j.geoderma.2025.117512>
- Cargill, S. M., & Chapin III, F. S. (1987). Application of successional theory to tundra restoration: A review. *Arctic and Alpine Research*, 19(4), 366. <https://doi.org/10.2307/1551401>
- Cater, T. C. (2010). *Tundra treatment guidelines: A manual for treating oil and hazardous substance spills to tundra (3rd ed.)*. Alaska Department of Environmental Conservation. <https://dec.alaska.gov/spar/perp/ttman>
- CAVSI (Circumpolar Arctic Vegetation Science Initiative). (2025). *The Circumpolar Arctic Vegetation Science Initiative (CAVSI) white paper*.
- Chapin, F. S., III, & Chapin, M. C. (1980). Revegetation of an Arctic Disturbed Site by Native Tundra Species. *Journal of Applied Ecology*, 17(2), 449-456. <https://doi.org/10.2307/2402339>
- Chapin, F. S., III. (1987). Environmental Controls over Growth of Tundra Plants. *Ecological Bulletins*, 38, 69-76. <http://www.jstor.org/stable/20112973>
- Chapin, F. S., III, Shaver, G. R., Giblin, A. E., Nadelhoffer, K. J., & Laundre, J. A. (1995). Responses of Arctic tundra to experimental and observed changes in climate. *Ecology*, 76(3), 694-711. <https://doi.org/10.2307/1939337>
- Dance, A. (2015). Northern reclamation in Canada: Contemporary policy and practice for new and legacy mines. *The Northern Review*, 41, 41-80. <https://doi.org/10.22584/nr41.2015.003>
- Densmore, R. V., Dalle Molle, L., & Holmes, K. E. (1990). *Restoration of alpine and subalpine plant communities in Denali National Park and Preserve, Alaska*. In H. G. Hughes & T. M. Bonnicksen (Eds.), *Proceedings of the First Annual Conference of the Society for Ecological Restoration* (pp. 509-519). Society for Ecological Restoration.

- Diavik Diamond Mines Inc. (2025). *Appendix X-9: Revegetation Strategy Report*. Diavik Final Closure & Reclamation Plan. Rio Tinto. Prepared by WSP.
- Dominion Diamond Mines Ltd. (2018). Ekati Diamond Mine Interim Closure and Reclamation Plan (Version 3.0). Mackenzie Valley Land and Water Board. Retrieved December 14, 2025, from [https://registry.mvlwb.ca/Documents/W2012L2-0001/W2012L2-0001%20-%20Ekati%20-%20ICRP%20-%20Version%203.0%20-%20Part%201%20-%20Aug%2015\\_18.pdf](https://registry.mvlwb.ca/Documents/W2012L2-0001/W2012L2-0001%20-%20Ekati%20-%20ICRP%20-%20Version%203.0%20-%20Part%201%20-%20Aug%2015_18.pdf)
- Drozdowski, B. L., Naeth, M. A. and Wilkinson, S. R. (2012). Evaluation of substrate and amendment materials for soil reclamation at a diamond mine in the Northwest Territories, Canada. *Canadian Journal of Soil Science*, 92, 77-88. <https://doi.org/10.4141/cjss2011-029>
- EDI (Environmental Dynamics Inc.). (2020). *Reclamation pilot study—Mary River Mine Project: Revegetation survey & preliminary reclamation trial (EDI Project No. 19Y0005:2008)*. Prepared for Baffinland Iron Mines Corporation. Unpublished industry report.
- Environment Canada. (2009). Environmental code of practice for metal mines. Environment Canada. Retrieved January 15, 2026, from [https://publications.gc.ca/collections/collection\\_2009/ec/En4-107-2009E.pdf](https://publications.gc.ca/collections/collection_2009/ec/En4-107-2009E.pdf)
- Forbes, B. C., & Jefferies, R. L. (1999). Revegetation of disturbed arctic sites: constraints and applications. *Biological Conservation*, 88, 15-24. [https://doi.org/10.1016/S0006-3207\(98\)00095-0](https://doi.org/10.1016/S0006-3207(98)00095-0)
- Gann, G. D., McDonald, T., Walder, B., Aronson, J., Nelson, C. R., Jonson, J., Hallett, J. G., Eisenberg, C., Guariguata, M. R., Liu, J., Hua, F., Echeverría, C., Gonzales, E., Shaw, N., Decler, K., & Dixon, K. W. (2019). International principles and standards for the practice of ecological restoration: Second edition. *Restoration Ecology*, 27(S1), S1-S46. <https://doi.org/10.1111/rec.13035>
- GNWT (Government of the Northwest Territories). (2015). *Northern land use guidelines: Access—Roads and trails*. Yellowknife, NT. ISBN 978-0-7708-0233-2.
- GNWT. (2015). *Northern land use guidelines: Northwest Territories seismic operations*. Yellowknife, NT. ISBN 978-0-7708-0235-6.
- GNWT. (2017). *Revegetating Colomac Mine, NT—Bioengineering techniques (presentation, August 4, 2017)*.
- Golos, P. J., Dixon, K. W., & Erickson, T. E. (2017). Plant recruitment from the soil seed bank depends on topsoil stockpile age, height, and storage history in an arid environment. *Restoration Ecology*, 24(1), 53-61. <https://doi.org/10.1111/rec.12389>
- Gordon, S., Xu, X., & Wang, Y. (2023). Remote sensing-based revegetation assessment at post-closure mine sites in Canada. *Sustainability*, 15(14), 11287. <https://doi.org/10.3390/su151411287>

- Government of Canada. (2025). *Northern Abandoned Mine Reclamation Program*. Crown-Indigenous Relations and Northern Affairs Canada. Retrieved from <https://www.rcaanc-cirnac.gc.ca/eng/1565968579558/1565968604553>
- Grime, J. P. (1974). Vegetation classification by reference to strategies. *Nature*, 250(5461), 26–31. <https://doi.org/10.1038/250026a0>
- Hagen, D. (2002). Propagation of native Arctic and alpine species with a restoration potential. *Polar Research*, 21(1), 37–47. DOI: <https://doi.org/10.3402/polar.v21i1.6472>
- Hewitt, R., Smith, J. A., Doe, L. M., & Zhang, Q. (2018). Results of the Tundra Mine, NT Revegetation Trial Using Locally Harvested Pioneer Species Instead of Grass Seed and Fertilizer. Presentation Abstract. *November 22, 2018*.
- INAC (Indigenous and Northern Affairs Canada). (2002). *Mine Reclamation Guidelines for the Northwest Territories and Nunavut*. Department of Indian Affairs and Northern Development (DIAND/INAC).
- INAC. (2002). *Mine Site Reclamation Policy for Nunavut*.
- INAC. (2002). *Mine Site Reclamation Policy for the Northwest Territories*.
- INAC. (2003). *Northern land use guidelines: Overview (Cat. R2-226/2003-1E; ISBN 0-662-32738-1)*. Ottawa: Minister of Public Works and Government Services Canada.
- INAC. (2009). *Northern land use guidelines: Pits and quarries (Vol. 07) (Cat. R2-226/8-2009E-PDF; ISBN 978-1-100-14254-8)*. Ottawa: Minister of Public Works and Government Services Canada.
- INAC. (2010). *Northern land use guidelines: Access—Roads and trails (Vol. 05) (Cat. R2-226/6-2010E-PDF; ISBN 978-1-100-14743-7)*. Ottawa: Minister of Public Works and Government Services Canada.
- ITK (Inuit Tapiriit Kanatami). (2019). National Inuit Climate Change Strategy.
- Johnson, L. A. (1987). Management of northern gravel sites for successful reclamation: A review. *Arctic and Alpine Research*, 19(4), 530–536. <https://doi.org/10.1080/00040851.1987.12002637>
- Jorgenson, M. T., & Joyce, M. R. (1994). Six strategies for rehabilitating land disturbed by oil development in Arctic Alaska. *Arctic*, 47(4), 321–420. <https://doi.org/10.14430/arctic1311>
- Kearns, N. B., Jean, M., Tissier, E. J., & Johnstone, J. F. (2015). Recovery of tundra vegetation three decades after hydrocarbon drilling with and without seeding of non-native grasses. *Arctic*, 68(1), 16–31. <https://doi.org/10.14430/arctic4445>
- Keeling, A., & Potvin, V. (2025). Nunavik Inuit and Raglan Mine: New approaches to closure planning (isulinnisanganut parnasimautiit). *Journal of Political Ecology*, 32. <https://doi.org/10.2458/jpe.7586>

- Kempenaar, L., McCarron, J. K., Marques, L. R., McClure, T., & Rennie, D. (2013). *Tools for Arctic Revegetation: What's in Your Toolbox? Canadian Land Reclamation Association National Conference Papers*. Retrieved from [cclmportal.ca/resource/tools-arctic-revegetation-whats-your-toolbox](https://www.cclmportal.ca/resource/tools-arctic-revegetation-whats-your-toolbox)
- Kidd, J. G., & Max, K. N. (2001). *Soil topdressing and revegetation testing*. In Ekati Diamond Mine reclamation research program 2000, NT, Canada (pp. 1-11). Prepared for BHP Diamonds, Inc., Yellowknife, NT by ABR, Inc., Fairbanks, AK.
- Klebesadel, L. J. (1973). *Grasses and legumes for revegetation in Alaska*. In 1973 Alaska Revegetation Workshop Notes (pp. 16-23). Cooperative Extension Service, University of Alaska.
- Kokelj, S.V., Lantz, T.C., Tunnicliffe, J., Segal, R., & Lacelle, D. (2017). Climate-driven thaw of permafrost preserved glacial landscapes. *Geology*, 45(4), 371–374.  
<https://doi.org/10.1130/G38626.1>
- Kuzyk, T., Seahra, S., Lowey, J., Pedlar, R., & Bequet, A.-C. (2025). *Continued evolution of mine closure practices: integration of Indigenous perspectives and climate change in revegetation prescriptions*. Mine Closure 2025. [https://doi.org/10.36487/ACG\\_repo/2515\\_83](https://doi.org/10.36487/ACG_repo/2515_83)
- Lamarre, J. J. M., Dhar, A., & Naeth, M. A. (2023). Arctic ecosystem restoration with native tundra bryophytes. *Arctic, Antarctic, and Alpine Research*, 55(1), 2209394.  
<https://doi.org/10.1080/15230430.2023.2209394>
- Lemay, E., Côté, S. D., & Tremblay, J. P. (2021). *How will snow retention and shading from Arctic shrub expansion affect caribou food resources? Écoscience*, 28(3–4), 313–325.  
<https://doi.org/10.1080/11956860.2021.1917859>
- Lynn, L. (Presenter). (2026, January 13). Indigenous knowledge put to work: Using tundra sod in restoration [Webinar]. Society for Ecological Restoration & Canadian Conservation and Land Management Knowledge Network. Retrieved January 13, 2026, from <https://www.cclmportal.ca/portal/land-management/events/webinar-indigenous-knowledge-put-work-using-tundra-sod-restoration>
- Lynn, L., Cater, T., & Bishop, S. (n.d.). Restoration in Alaska. Society for Ecological Restoration Northwest Chapter. Retrieved January 13, 2026, from <https://chapter.ser.org/northwest/restoration-in-alaska/>
- Mackenzie, D. D., & Naeth, M. A. (2010). The role of the forest soil propagule bank in assisted natural recovery after oil sands mining. *Restoration Ecology*, 18(3), 418–427.  
<https://doi.org/10.1111/j.1526-100X.2008.00500.x>
- Matheus, P. E., & Omtzigt, C. M. (2013). *Yukon Revegetation Manual: Practical Approaches and Methods*. Whitehorse, Yukon: Yucan Environmental Planning. 182 pp. ISBN 978-0-9919499-0-8. Available at [yukonrevegetationmanual.ca](http://yukonrevegetationmanual.ca)

- May, D. E., Webber, P. J., & May, T. A. (1982). Success of transplanted alpine tundra plants on Niwot Ridge, Colorado. *Journal of Applied Ecology*, 19(3), 965-976.  
<https://www.jstor.org/stable/2403297>
- McKendrick, J. D. (1997). *Long term recovery in northern Alaska*. In R. M. M. Crawford (Ed.), *Disturbance and recovery in Arctic lands: An ecological perspective* (pp. 503-518). Kluwer Academic.
- Meidinger, D.V. (1979). Natural revegetation of disturbances in the Peace River Coalfield. *Proceedings of the 3rd Annual British Columbia Mine Reclamation Symposium*, 273-308.  
<https://doi.org/10.14288/1.0303094>
- Miller, V. S., Naeth, M. A., & Wilkinson, S. R. (2021). Micro topography, organic amendments and an erosion control product for reclamation of waste materials at an arctic diamond mine. *Ecological Engineering*, 172, 106399. <https://doi.org/10.1016/j.ecoleng.2021.106399>
- Munshower, F. F. (1994). *Practical handbook of disturbed land revegetation*. CRC Press.  
<https://doi.org/10.1201/9781351075923>
- MVLWB (Mackenzie Valley Land and Water Board). (2013). *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories, MVLWB/AANDC, Canada*. Retrieved from  
<https://canadacommons.ca/artifacts/29995750/guidelines-for-mine-closure-and-reclamation-in-the-northwest-territories/30895595/>
- Nadelhoffer, K. J., Giblin, A. E., Shaver, G. R., & Likens, A. E. (1992). *Microbial processes and plant nutrient availability in Arctic soils*. In F. S. Chapin III, R. L. Jefferies, J. F. Reynolds, G. S. Shaver, & J. Svoboda (Eds.), *Arctic ecosystems in a changing climate: An ecophysiological perspective* (pp. 281-300). Academic Press.
- Naeth, M. A. (2004). *Revegetation of Disturbed Sites at Diavik Diamond Mine, N.W.T.: Research Proposal*. Appendix L.
- Naeth, M.A., Wilkinson, S.R. (2014). Establishment of restoration trajectories for upland tundra communities on diamond mine wastes in the Canadian Arctic. *Restoration Ecology*, 22, 534-543. <https://doi.org/10.1111/rec.12106>
- Natural Resources Canada. (2022). *Permafrost degradation and geochemistry project (Cat. No. M34-56/2022E-PDF)*. Government of Canada.  
[https://publications.gc.ca/collections/collection\\_2024/rncan-nrcan/M34-56-2022-eng.pdf](https://publications.gc.ca/collections/collection_2024/rncan-nrcan/M34-56-2022-eng.pdf)
- Neby, M., Semenchuk, P., Neby, E., & Cooper, E. J. (2022). Comparison of methods for revegetation of vehicle tracks in High Arctic tundra on Svalbard. *Arctic Science*, 8, 1006-1025. <https://doi.org/10.1139/as-2021-0016>
- NIRB (Nunavut Impact Review Board). (2013). *Guidelines for the Preparation of an Environmental Impact Statement for Sabina Gold & Silver Corp.'s Back River Project*. NIRB File No. 12MN036. April 2013.

- NIRB. (2017, December 8). *Project Certificate No. 007* (NIRB Project No. 124149). Back River Gold Mine Project, Kitikmeot Region, Nunavut. NIRB File No. 12MN036. Nunavut Impact Review Board Public Registry. <https://www.nirb.ca/project/124149>
- NIRB. (2024, August 7). *Project Certificate No. 007 Amendment No. 001* (NIRB Project No. 124140). Back River Gold Mine Project, Kitikmeot Region, Nunavut. NIRB File No. 12MN036. Nunavut Impact Review Board Public Registry. <https://www.nirb.ca/project/125740>
- Nunavut RAC (Nunavut Regional Adaptation Collaborative). (2012). *Good Environmental Practices for Northern Mining and Necessary Infrastructure: Task 2 Report*. Government of Nunavut/Natural Resources Canada.
- Oberndorfer, E., Broomfield, T., Lundholm, J., & Ljubicic, G. (2020). *Biodiversity and Conservation*, 29, 1205–1240. <https://doi.org/10.1007/s10531-020-01931-9>
- Pionke, H. B., & Rogowski, A. S. (1969). *How effective is the deep placement of acid spoil materials*. In *Proceedings Canadian Land Reclamation Association Fourth Annual Meeting* (pp. 87-104). Canadian Land Reclamation Association. Retrieved from <https://www.clra.ca/presentations-and-proceedings/>
- Polster, D. (2013). *Making Sites Rough and Loose: A Soil Adjustment Technique*. Technical Note. Prepared for the Boreal Research Institute, Northern Alberta Institute of Technology. 3 pp.
- QIA (Qikiqtani Inuit Association). (2017). *Abandonment and Reclamation Policy for Inuit Owned Lands (Version 2.0)*.
- Reid, N. B. (2003). *Establishment of a vegetation cover on kimberlite mine tailings (Master's thesis, University of Alberta, Department of Renewable Resources)*. University of Alberta Repository, Edmonton, AB.
- Rescan. (2013). *Back River Project: 2012 Socio-economic and Land Use Baseline Report*. Prepared for Sabina Gold & Silver Corp. by Rescan Environmental Services Ltd.: Vancouver, BC.
- Rio Tinto. (2025). *Diavik Final Closure & Reclamation Plan*. Diavik Diamond Mines Inc.
- Sabina (Sabina Gold & Silver Corp). (2015a). *Final Environmental Impact Statement: Back River Gold Project* (NIRB Project No. 124149). Back River Gold Mine Project, Kitikmeot Region, Nunavut. Submitted November 23, 2015 to the Nunavut Impact Review Board. Nunavut Impact Review Board Public Registry. <https://www.nirb.ca/project/124149>
- Sabina. (2015b). *Back River Project Mine Closure and Reclamation Plan*. Revision G.1, November 2015. Volume 10, Chapter 29 of Sabina (2015) *Final Environmental Impact Statement: Back River Gold Project* (NIRB Project No. 124149). Back River Gold Mine Project, Kitikmeot Region, Nunavut. Submitted November 23, 2015 to the Nunavut Impact Review Board. Nunavut Impact Review Board Public Registry. <https://www.nirb.ca/project/124149>
- Sabina. (2017). *Final Environmental Impact Statement Addendum, Volume 5 Addenda: Terrestrial Environment* (NIRB Project No. 124149). Back River Gold Mine Project, Kitikmeot Region,

- Nunavut. Submitted February 2017 to the Nunavut Impact Review Board. Nunavut Impact Review Board Public Registry. <https://www.nirb.ca/project/124149>
- Sabina. (2020). *Back River Project: Vegetation Monitoring Plan*, January 2020.
- Sabina. (2021). *Back River Project: Interim Closure and Reclamation Plan*, July 2021.
- Sandlos, J., & Keeling, A. (2016). Aboriginal communities, traditional knowledge, and the environmental legacies of extractive development in Canada. *The Extractive Industries and Society*, 3(2), 278–287. <https://doi.org/10.1016/j.exis.2015.06.005>
- Stanley, J., Buxton, R., Alspach, P., Morgan, C., Martindale, D., & Sarosa, W. (2000). *A different approach to high altitude revegetation: Establishing mosses on the Grasberg overburden, Irian Jaya*. In Proceedings of the High Altitude Revegetation Workshop No. 14 (pp. 247-251). <https://mountainscholar.org/items/6a1ef9aa-f557-4cf6-a060-912c6a7563d5>
- Stewart, K. J., & Siciliano, S. D. (2015). Potential contribution of native herbs and biological soil crusts to restoration of the biogeochemical nitrogen cycle in mining-impacted sites in northern Canada. *Ecological Restoration*, 33(1), 30-42. <https://doi.org/10.3368/er.33.1.30>
- Stuckless, B., Brillinger, D., Whitehead-Delong, L., & Tannas, S. (2024). *Revegetation with locally harvested native plant seeds at the abandoned Atlin Ruffner Mine*. BC TRCR Conference Proceedings. <https://dx.doi.org/10.14288/1.0447217>
- Turcotte, M. A. H., Van Gulck, J., Stavinga, D., & Peters, M. (2025). An arctic case study of revegetation planning to implementation at Snap Lake Diamond Mine. *Arctic Science*, 11, 1–18. <https://doi.org/10.1139/as-2024-0083>
- USGS (United States Geological Service). (2000). *Native Plant Revegetation Manual for Denali National Park and Preserve*, USGS Biological Science Reports ISSN 1081-292X Information and Technology Reports ISSN 1081-2911 <https://pubs.usgs.gov/itr/2000/0006/report.pdf>
- Viereck, L. A. (1966). Plant succession and soil development on gravel outwash of the Muldrow Glacier, Alaska. *Ecological Monographs* 36:181-199. <https://doi.org/10.2307/1942416>
- Vital, A. D. (1976). *Root systems of sodding plants and their significance for restoration of vegetational cover damaged during economic development of lands*. In P. I. Melnikov (Ed.), Selected abstracts from Symposium on Environmental Protection in Relation to Economic Development of Permafrost Regions (USA CRREL Draft Translation 518, pp. 11 2). U.S. Army Cold Regions Research and Engineering Laboratory.
- Webber, P. J., & Ives, J. D. (1978). Damage and recovery of tundra vegetation. *Environmental Conservation*, 5(3), 171-182. <https://doi.org/10.1017/S0376892900005889>
- Wielgolaski, F.E. (1975). *Primary production of tundra*. In J. P. Cooper (Ed.), Photosynthesis and productivity in different environments (pp. 75-106). Cambridge University Press.

# ATTACHMENT A NIRB TERMS AND CONDITIONS

TABLE A- 1 TABLE A-1 NIRB PROJECT CERTIFICATE NO. 007 AMENDMENT NO. 001 (AUGUST 7, 2024) TERMS AND CONDITIONS FOR RECLAMATION OR REVEGETATION

NIRB Condition No.	Category <sup>a</sup>	Project Phase <sup>a</sup>	Objective	Term or Condition <sup>a</sup>	Reporting Requirements <sup>a</sup>	IRCP Section (July 2021)
36	Vegetation – Mine Closure and Reclamation Plan	Pre-Construction, Construction, Operations, Temporary Closure/Care and Maintenance, Closure and Post-Closure Monitoring	To maintain an up-to-date revegetation plan for the Project.	The Proponent shall include revegetation strategies within its Mine Closure and Reclamation Plan that support <b>progressive reclamation</b> , and promote natural revegetation and recovery of disturbed areas compatible with the surrounding natural environment. These strategies should include exploration of the feasibility and practicality of topsoil/organic matter salvage through Project development. The Closure and Reclamation Plan should be updated on an on-going basis as more information becomes available from similar reclamation efforts at other northern projects, as applicable.	<p>Within three (3) years from the commencement of construction of the Back River Gold Mine Project, information regarding the revegetation strategies developed and implemented by the Proponent in fulfillment of this Term and Condition shall be included in the Proponent’s annual report to the Nunavut Impact Review Board and this information will include reclamation strategies for the Energy Centre Project. Subsequently, information regarding the Proponent’s progress in fulfillment of this Term and Condition shall be provided annually in the Proponent’s annual report to the Nunavut Impact Review Board.</p> <p>Whenever the Proponent makes subsequent revisions to the Monitoring Plan(s), the Proponent shall submit the updated Plan to the NIRB within 60 days of revising the Plan(s) and will ensure the updated Plan is posted on the Proponent’s project website.</p>	6.3
35	Vegetation – Revegetation and Reclamation	Pre-Construction, Construction, Operations, Temporary Closure/Care and Maintenance, Closure and Post-Closure Monitoring	To maximize revegetation in reclaimed areas.	The Proponent shall develop a <b>progressive revegetation</b> program for disturbed areas that are no longer required for operations, such as a program to incorporate measures for the use of test plots, reseeding, and replanting of native plants as necessary. It is further recommended that this program be directly associated with the management plans for erosion control established for the Project.	<p>The program and associated revegetation results should be provided within the Proponent’s annual report submitted to the Nunavut Impact Review Board.</p> <p>Whenever the Proponent makes subsequent revisions to the Monitoring Plan(s), the Proponent shall submit the updated Plan to the NIRB within 60 days of revising the Plan(s) and will ensure the updated Plan is posted on the Proponent’s project website.</p>	6.3
34	Vegetation – Vegetation Monitoring Plan	Pre-Construction, Construction, Operations, Temporary Closure/Care and Maintenance, Closure and Post-Closure Monitoring	To minimize potential impacts to vegetation along the winter road/trail routings and around all project sites, including project components added to the Back River Project under the Energy Centre Proposal.	<p>The Proponent shall have in place a Vegetation Monitoring Plan that is designed to quantify the potential impacts on vegetation from the Project, including the annual construction/operation of the winter ice roads and trails. The plan should include all commitments discussed throughout the assessment of the Project (and subsequent modifications), including commitments to consult with the Kitikmeot Inuit Association, the Government of Nunavut, and other relevant parties, as well as:</p> <ol style="list-style-type: none"> <li>Establishment of pre-construction and post-operation vegetation conditions annually with supporting photographs to allow for long term comparisons of vegetation conditions along winter ice Nunavut Impact Review Board Page 37 of 74 road/trail routings and around project sites including the Energy Centre Project Infrastructure (wind turbines, solar panel array, Battery Energy Storage System, transmission lines, and service roads);</li> <li>Incorporation of measures to prevent or minimize potential destabilization and erosion along winter ice road/trail routings and around project sites, including the Energy Centre Project Infrastructure (wind turbines, solar panel array, Battery Energy Storage System, transmission lines, and service roads);</li> <li>Details on the triggers for implementing adaptive management options if effects to vegetation are observed, including potential impacts from dust deposition; and,</li> </ol>	<p>Within 60 days of the issuance of Project Certificate 007, Amendment No. 1 to reflect the addition of the Energy Centre Project, the Proponent shall submit an updated Vegetation Monitoring Plan to the Nunavut Impact Review Board (NIRB) to include the addition of the Energy Centre Project Infrastructure (wind turbines, solar panel array, Battery Energy Storage System, transmission lines, and service roads).</p> <p>Whenever the Proponent makes subsequent revisions to the Vegetation Monitoring Plan, the Proponent shall submit the updated Plan to the NIRB within 60 days of revising the Plan and will ensure the updated Plan is also posted on the Proponent’s project website.</p>	Submission of the VMP 2020

NIRB Condition No.	Category <sup>a</sup>	Project Phase <sup>a</sup>	Objective	Term or Condition <sup>a</sup>	Reporting Requirements <sup>a</sup>	IRCP Section (July 2021)
				<i>d. Discussion of how the findings from monitoring efforts would be used to inform reclamation planning.</i>		
32	Vegetation – Site Footprint	Pre-Construction, Construction, Operations, Temporary Closure/Care and Maintenance, Closure and Post-Closure Monitoring	To minimize the impacts of the Project and approved Modifications on To minimize the impacts of the Project and approved Modifications on vegetation.	The Proponent shall ensure that Project activities are planned and conducted in such a way as to minimize the Project footprint.	In the Proponent’s annual report to the Nunavut Impact Review Board, the Proponent shall provide information regarding the current Project footprint, taking into account construction and <b>progressive reclamation</b> activities, and including information regarding the loss or alteration of vegetation associated with Project activities (including identifying the type of any habitat losses resulting from these effects). Results shall be reported for all components of the Project including the Energy Centre infrastructure (wind turbines, solar panel array, Battery Energy Storage System, transmission lines, and service roads).	Submission of NIRB Annual Reports
15	Terrestrial Environment – Progressive Reclamation Plan	Pre-construction, Construction, Operations, Temporary Closure/Care and Maintenance, Closure and Post-Closure	To ensure that project components, areas, and infrastructure are progressively reclaimed throughout the life of the Project including approved Modifications.	The Proponent shall have in place a plan for the <b>progressive reclamation</b> of project components, areas, and infrastructure throughout the life of the Project. The plan shall detail: <ul style="list-style-type: none"> <li>a. projected timelines for the reclamation of project features, methodologies for undertaking such activities, and monitoring measures to ensure the effectiveness of reclamation methods employed;</li> <li>b. specific measures for adaptive management and triggers for their application, should monitoring results reveal trends that could affect the reclamation and closure objectives.; and,</li> <li>c. how Inuit Qaujimagatuqangit and Traditional Knowledge was collected, and used to inform closure plans and the design of project components.</li> </ul>	The plan should be submitted to the Nunavut Impact Review Board (NIRB) at least 90 days prior to the start of construction, with results and details submitted annually thereafter or as may otherwise be required by NIRB. Whenever the Proponent makes subsequent revisions to the Monitoring Plan(s), the Proponent shall submit the updated Plan to the NIRB within 60 days of revising the Plan(s) and will ensure the updated Plan is posted on the Proponent’s project website.	6 1.3; 4.3; 5; 8 8 1.4; Appendix B Table 010, 011, 013, 015, 016, 017, 018, 020, 022 Inuit Qaujimagatuqangit and Traditional Knowledge collection and integration into Project assessment and design is detailed in Sabina’s FEIS Submission of the IRCP 2021
7	Climate and Meteorology – Mine Closure and Reclamation Plan	Pre-construction, Construction, Operations, Temporary Closure/Care and Maintenance, Closure and Post-Closure	To ensure mitigation, monitoring, and adaptive management measures are in place for the long-term stability, containment, and integrity of project components, including the approved Modifications, and the protection of environmental features.	The Proponent shall maintain a Mine Closure and Reclamation Plan designed to: identify the processes that may act upon the mine components after closure and reclamation so that they can be factored within the design and operation of the mine; ensure physical and chemical stability of mine components that remain after closure; ensure mine components that remain after closure will not require long-term active care; and consider future use and aesthetics of the area with the surrounding lands. This plan should include: <ul style="list-style-type: none"> <li>a. An adaptive management component that documents monitoring and mitigation measures to ensure long-term containment of the Tailings Storage Facility and Waste Rock Storage Areas;</li> <li>b. Details for monitoring the thermal condition and stability of storage facilities;</li> <li>c. Details on the triggers for implementing alternative mitigation options;</li> <li>d. Details pertaining to ongoing monitoring and research being conducted to supplement the adaptive management protocols; Details on the plans to maintain the integrity of the groundwater quality within and adjacent to the Project; and</li> </ul>	The plan should be submitted to the Nunavut Impact Review Board (NIRB) at least 60 days prior to the start of construction of the Project and any approved Modifications with results submitted annually thereafter or as may otherwise be required by the NIRB.  Whenever the Proponent makes subsequent revisions to the Mine Closure and Reclamation Plan, the Proponent shall submit the updated Plan to the NIRB within 60 days of revising the Plan and will ensure the updated Plan is also posted on the Proponent’s project website.	The IRCP as a whole 8 Monitoring details will be reported in annual reports and relevant information included in future ICRP updates if needed. 5.2.1.8 Appendix E 5.2.2 5.2.1 Submission of the IRCP 2021

NIRB Condition No.	Category <sup>a</sup>	Project Phase <sup>a</sup>	Objective	Term or Condition <sup>a</sup>	Reporting Requirements <sup>a</sup>	IRCP Section (July 2021)
				e. <i>Details on how the Proponent will carry out continued analyses over time to confirm or update the approximate fill time for the mine pits.</i>		

# ATTACHMENT B FEIS COMMITMENTS

TABLE B-1 FINAL ENVIRONMENTAL IMPACT STATEMENT: BACK RIVER GOLD PROJECT (FEIS; SABINA 2015; NIRB PROJECT NO. 124149) COMMITMENTS FOR RECLAMATION OR REVEGETATION

Volume, Section	Page	Commitment <sup>a</sup>	ICRP Section (July 2021)						
FEIS Volume 1, Section 9.3	9-3	<i>Achieving physical stability includes establishing the conditions Post-Closure that allow for natural revegetation so that the land returns to productive use by wildlife. As part of the MCRP, potential revegetation of disturbed sites was reviewed. At this time, active revegetation of the site as part of closure is not planned given the cold climate setting of the Project as well as the precedent established for mine closure in Nunavut.</i>	1.2						
FEIS Volume 10, Chapter 29, Section 1.7	7	<i>Achieving physical stability includes establishing the conditions post-closure that allow for natural revegetation so that the land returns to productive use by wildlife. As part of this MCRP, potential revegetation of disturbed sites, including active revegetation, seeding, and soil amendment, were reviewed. At this time, active revegetation of the Property as part of closure is not planned given the cold climate setting of the Project as well as the precedent established for mine closure in Nunavut. Additional research in this field may be considered in future iterations of the MCRP.</i>	1.2						
FEIS Addendum Volume 5, Section 5.4 (February 2017)	5-16	<p><i>Potential research studies to inform revegetation during progressive reclamation and Closure could include any numerous topics. The progress of these possible options would be dependent on the advancement of Project plans and closure plans and timing:</i></p> <ul style="list-style-type: none"> <li><i>Substrate and plant species selection trials: trials to identify appropriate local native species mixes for revegetation on reclaimed soils. The goal of this research would be to select native species that are suitable for revegetation of various soil conditions expected on reclaimed areas.</i></li> <li><i>Soil and plant processes research: identification of the soil processes, and biological, physical, and chemical conditions that are required to successfully regenerate native plants. This would be a comparative study of undisturbed sites and reclaimed soils to identify soil amendments to improve plant establishment.</i></li> <li><i>Monitoring of progressive revegetation of large footprint areas to provide adaptive feedback to revegetation activities. The goal of this will be to improve revegetation success and long-term site stability and land capability.</i></li> </ul> <p><i>The NIRB has encouraged Sabina to consider revegetation and reclamation measures associated with the protection of vegetation. Sabina reiterates their commitment to research substrate and plant species selection trials, soil and plant processes, and progressive revegetation monitoring.</i></p>	None						
FEIS Addendum Volume 5, Section 5.4 (February 2017)	5-14	<i>In consultation with the KIA, GN, and other relevant parties the Proponent shall develop and implement a vegetation monitoring plan for the winter road that is designed to quantify the potential impacts on vegetation. The plan shall be submitted to the NIRB prior to winter road construction. Findings from these studies will be used to inform reclamation planning as appropriate.</i>	VMP						
FEIS Addendum Volume 5, Section 5.4 (February 2017)	5-16	<p><i>During the FEIS Final Hearing, Sabina repeated their commitment to ongoing revegetation and reclamation research which was provided in F-NSMA-TC-13. During the technical review phase, the topic of revegetation was raised by the NSMA; Sabina provided the following response, F-NSMA-TC-13, which outlines Sabina's previous commitment to revegetation research and progressive reclamation measures:</i></p> <p><i>In the Mine Closure and Reclamation Plan (MCRP; FEIS Volume 10, Chapter 29), Table 4.2-2 provides proposed progressive reclamation activities that will be evolved during the operational phase of the Project before permanent closure.</i></p>	1.2						
FEIS Volume 10, Chapter 29, Section 4, Table 4.2-2 Back River Project MCRP	19	<p><i>As part of the Feasibility Study work, recommendations were made regarding future studies that will impact reclamation activities. Table 4.2-2 presents an update to the proposed reclamation studies going forward.</i></p> <p><i>Table 4.2-2. Updated Proposed Reclamation Studies</i></p> <table border="1"> <thead> <tr> <th>Study No.</th> <th>Description</th> <th>Status and Schedule for Completion</th> </tr> </thead> <tbody> <tr> <td>8</td> <td><i>Revegetation research focused on large footprint areas which will significantly improve long-term stability and usability of the site follow Closure.</i></td> <td><i>Ongoing.</i></td> </tr> </tbody> </table>	Study No.	Description	Status and Schedule for Completion	8	<i>Revegetation research focused on large footprint areas which will significantly improve long-term stability and usability of the site follow Closure.</i>	<i>Ongoing.</i>	6.3 Appendix E
Study No.	Description	Status and Schedule for Completion							
8	<i>Revegetation research focused on large footprint areas which will significantly improve long-term stability and usability of the site follow Closure.</i>	<i>Ongoing.</i>							
ICRP 2021, Section 1.2	1-2 to 1-3	<i>Achieving physical stability entails the removal of any culverts and restoration, as practicable, of the drainage to match the natural channel and implementation of erosion and sedimentation measures where required. Physical stability also includes establishing the conditions post-closure that allow for natural revegetation so that the land returns to productive use by wildlife. This includes the re-grading, if practicable, roads and airstrips to match natural contours to reduce erosion and contouring and stabilizing disturbed areas to the extent practical. Active revegetation of the Property as part of closure is not planned given the cold climate setting of the Project as well as the precedent established for mine closure in Nunavut. Additional research in this field may be considered in future.</i>	1.2						
ICRP 2021, Section 5.2	6-3	<i>The isolated areas of WIR subbase upgrades as well as WIR service emergency camp pads will be scarified and reseeded on closure to promote revegetation to the extent reasonable.</i>	5.2						

Notes:

FEIS = Final Environmental Impact Statement (Sabina 2015)

ICRP = Interim Closure and Reclamation Plan (Sabina 2021)

MCRP = Mine Closure and Reclamation Plan (FEIS Volume 10, Chapter 29; Sabina 2015)

VMP = Vegetation Monitoring Plan (Sabina 2020)

WIR = Winter Ice Road

<sup>a</sup> Direct quotation.

# ATTACHMENT C COMMENTS

TABLE C-1 COMMENTS ON NIRB 2024 ANNUAL REPORT RELATED TO RECLAMATION OR REVEGETATION TERMS AND CONDITIONS AND COMMITMENTS IN NIRB PROJECT CERTIFICATE NO. 007 AMENDMENT NO. 001 (NIRB 2024) AND FEIS (SABINA 2015)

Comment No.	Subject <sup>a</sup>	Reference <sup>a</sup>	Comment <sup>a</sup>	Recommendation <sup>a</sup>	B2Gold Nunavut Response <sup>a</sup>	Requirement
CIRNAC-6	Vegetation – Mine Closure and Reclamation Plan	NIRB Project Certificate No. 007 (Amendment No. 001), Term and Condition 36: Vegetation – Mine Closure and Reclamation Plan Back River Project 2024 Annual Report, Section 4.5.9 Pages 4-95 to 4-96, Appendix H <ul style="list-style-type: none"> <li>Back River Project FEIS Addendum, Volume 5, Page 5-20</li> </ul>	Term and Condition 36 describes that B2Gold is required to develop revegetation strategies within its Mine Closure and Reclamation Plan that supports progressive reclamation, which should include exploration of the feasibility and practicality of topsoil/organic matter salvage through Project development. Revegetation strategies are to be provided within 3 years of the start of construction in the Annual Report and will include reclamation strategies for the Energy Centre Project. In the 2022 Annual Report, Sabina (now B2Gold) stated that an Interim Closure and Reclamation Plan (ICRP) was provided to the NIRB on December 13, 2021, containing a conceptual progressive revegetation program, but it did not include the program or any results with the 2022 Annual Report. This ICRP was also stated to have been further updated in 2022/23 as part of the amendment application process and submitted to the NIRB for review. In response to CIRNAC’s comments on the 2022 Annual Report, B2Gold stated that research of revegetation strategies will be provided to the NIRB in 2023. This information was not provided with the 2023 Annual Report. Furthermore, the updated ICRP was not provided in the 2023 or 2024 Annual Reports, and the 2024 Annual Report provided no information regarding any revegetation strategies developed and implemented by B2Gold. It is unclear to CIRNAC if any revegetation strategies, including topsoil/organic matter salvage strategies, have been proposed as part of the revised ICRP, or if they are applicable to the Energy Centre components. In previous Annual Reports, Sabina/B2Gold stated that the progressive revegetation program in the ICRP was not fully developed as the project was in an early phase of construction, and that it will “...provide initial details in the 2025 Annual Report”. CIRNAC is of the view that this is not an acceptable response, as the Project is no longer in an early phase of construction and B2Gold has had several years to advance the program. B2Gold has not fulfilled its commitment to CIRNAC or the reporting requirements of Term and Condition 36.	CIRNAC recommends that B2Gold: <ul style="list-style-type: none"> <li>Provide revegetation strategies that have been developed and implemented in the 2025 Annual Report.</li> <li>Provide results on the feasibility and practicality of topsoil/organic matter salvage.</li> <li>Provide revegetation strategies for any progressive reclamation activities related to the Energy Centre components.</li> </ul>	As the construction phase commenced in 2023, B2Gold Nunavut will submit revegetation strategies to meet Term and Condition 36 with the NIRB 2025 Annual Report.	In NIRB 2025 Annual Report (March 2026), submit revegetation strategies to meet Term and Condition 36.
KIA-NIRB-13	Incomplete Revegetation and Reclamation Plan	B2B Gold, Back River Project, 2024 Annual Report (April 4, 2025), Section 4.5.9 <ul style="list-style-type: none"> <li>PC Condition No. 35</li> <li>Mine Closure and Reclamation Plan November 2015)</li> <li>Interim Closure and Reclamation Plan (July 2021)</li> </ul>	The references provided are available online at the nirb.ca website and consist of the Interim Closure and Reclamation Plan dated July 2021. The original plan (2015) is not mentioned. The latest Plan indicates that “With the exception of WIR subbase upgrades and service emergency camp pads, active revegetation of the Property as part of Closure is not planned given the cold climate setting of the Project as well as the precedent established for mine closure in Nunavut.” Furthermore, it is indicated that a revegetation research and review program was initiated at other northern mine sites and that undertaking revegetation and seeding would provide limited benefits and be outweighed by the logistics and cost constraints, as well as potential environmental impacts due to the northern climate (e.g., growing conditions, availability of native seed, lack of suitable growth medium). Additional studies are ongoing, and additional prescriptions will be provided in a subsequent version of the Plan. Also, it is unclear whether reclamation has been completed for areas used during construction, but that may not be needed anymore and were closed. Finally, it is unclear if the update to the Plan in 2021 was submitted to the NIRB within 60 days of revising the Plan.	The KIA requests the following: <ul style="list-style-type: none"> <li>The proponent should provide the 2015 version of the Plan in the reference list and detail the changes between the 2015 and 2021 Plan and expected changes for a subsequent version (i.e., in 3 years, as identified in the Annual Report).</li> <li>Provide a statement on whether any areas were closed and revegetated in 2025 (e.g., related to construction).</li> <li>Provide details on the Plan update and submission date to the NIRB.</li> </ul>	B2Gold Nunavut is compliant as documentation is on the NIRB website. Submission of the updated Interim Closure and Reclamation Plan was part of the Terms and Conditions for the Energy Centre and is therefore filed under the Back River Project Energy Centre (Application No. 125740).	None.
KIA-NIRB-40	Missing information on interim closure	B2B Gold, Back River Project, 2024 Annual Report (April 4, 2025)	The Term or Condition for PC Condition No. 15 in the 2024 Annual Report states “The Proponent shall have in place a plan for the progressive reclamation of project components, areas, and infrastructure throughout the life of the Project. The plan shall detail:	The KIA requests the following:	Submission of the updated Interim Closure and	In updated ICRP, include information on

Comment No.	Subject <sup>a</sup>	Reference <sup>a</sup>	Comment <sup>a</sup>	Recommendation <sup>a</sup>	B2Gold Nunavut Response <sup>a</sup>	Requirement
	and reclamation plan, PC Condition No. 15	<ul style="list-style-type: none"> <li>PC Condition No. 15 Back River Project Interim Closure and Reclamation Plan ICRP (July 2021) B2B Gold FEIS</li> </ul>	<ol style="list-style-type: none"> <li>projected timelines for the reclamation of project features, methodologies for undertaking such activities, and monitoring measures to ensure the effectiveness of reclamation methods employed;</li> <li>specific measures for adaptive management and triggers for their application, should monitoring results reveal trends that could affect the reclamation and closure objectives; and,</li> <li>how Inuit Qaujimagatuqangit and Traditional Knowledge was collected and used to inform closure plans and the design of project components.”</li> </ol> <p>The Back River Project Interim Closure and Reclamation Plan ICRP (July 2021) does not contain explicit triggers for applying adaptive management, as stated in the second condition of PC Condition No. 15. Information regarding specific triggers should be added to this plan. The ICRP did not provide details on the collection of Qaujimagatuqangit or Traditional Knowledge to inform closure plans and the design of the project components. However, a line in the ICRP indicated that this is outlined in B2B Gold’s FEIS; thus, it should be referenced in this condition.</p>	<ul style="list-style-type: none"> <li>Please add specific triggers for the application of adaptive management to the ICRC [sic] (July 2021)</li> <li>Please provide the reference for B2B Gold’s FEIS in the reference section of PC Condition No. 15 in the 2024 Annual Report.</li> </ul>	Reclamation Plan was part of the Terms and Conditions for the Energy Centre and is therefore filed under the Back River Project Energy Centre (Application No. 125740). The reference will be added in future annual reports.	adaptive management triggers and details on the collection of Qaujimagatuqangit or Traditional Knowledge. Add reference to ICRP to future NIRB annual reports.
KIA-NIRB-14	Missing information to assess compliance for the site footprint.	B2B Gold, Back River Project, 2024 Annual Report (April 4, 2025) Vegetation Monitoring Plan (January 2020)	<p>The references provided consist of the Vegetation Monitoring Plan (January 2020) and Vegetation Monitoring Program (Golder 2019), available on the nirb.ca website. However, these documents only provide some details on how the footprint monitoring will be completed. The results of the footprint monitoring are provided in the table of the annual report. While this information is provided (e.g., loss or alteration of vegetation associated with Project activities, including identifying the type of habitat loss resulting from these effects), several details are missing. For example:</p> <ul style="list-style-type: none"> <li>Efforts to minimize the Project footprint are not provided.</li> <li>The annual report does not distinguish between construction and progressive reclamation activities.</li> <li>The annual report does not provide a breakdown of footprint effects for the project’s different components, including the Energy Centre infrastructure (wind turbines, solar panel array, Battery Energy Storage System, transmission lines, and service roads).</li> </ul>	The KIA requests the following: The proponent should provide the vegetation monitoring program results while including efforts to minimize project footprints, a breakdown between construction and reclamation activities and a breakdown of footprint effects by Project components.	B2Gold Nunavut can provide this breakdown in future annual reports.	In future NIRB Annual Reports, provide information on vegetation monitoring program results including efforts to minimize project footprints, a breakdown between construction and reclamation activities, and a breakdown of footprint effects by Project components.

Notes:

CIRNAC = Crown Indigenous Relations Northern Affairs Canada

FEIS = Final Environmental Impact Statement (Sabina 2015)

ICRP = Interim Closure and Reclamation Plan (Sabina 2021)

KIA = Kitikmeot Inuit Association

NIRB = Nunavut Impact Review Board

<sup>a</sup> Direct quotation.

# ATTACHMENT D LITERATURE REVIEW TABLE

TABLE D-1 LITERATURE REVIEW OF ARCTIC RECLAMATION AND REVEGETATION RESEARCH AND GUIDELINES

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
1	Meidinger, D.V.	1979	<i>Natural Revegetation of Disturbances in the Peace River Coalfield</i>	Research (Primary)	Reclamation; Revegetation; Surface Preparation; Soil Amendment; Mining	British Columbia, Peace River Coalfield, Foothills, Rocky Mountains	Alpine Tundra/Subalpine	<p><b>Revegetation:</b> Natural revegetation recommended</p> <p><b>Site Preparation:</b> Ripping compacted soils improves revegetation; Dolomitic lime for low magnesium sites; Finer materials preferred; Organic matter content improves revegetation and organic materials recommended</p> <p><b>Other:</b> Environmental Conditions Impacting Revegetation: Moist sites revegetate faster than dry sites, compacted sites with less cover, coarse soils with less cover, organic material increases cover, magnesium sites with more cover</p>	Environmental factors limiting alpine tundra revegetation also applicable to Arctic tundra
2	Hagen, D.	2002	<i>Propagation of native Arctic and alpine species with a restoration potential</i>	Research (Primary)	Revegetation; Propagation	Arctic, Svalbard & Dovre Mountain	High Arctic Tundra; Permafrost; Dry exposed ridges	<p><b>Revegetation:</b> Greenhouse propagation effective (but costly): <i>Luzula arcuata</i>, <i>Oxyria digyna</i>, <i>Papaver dahlianum</i> seed germination good (&gt;50%); <i>Dryas octopetala</i> seed germination low (&lt;10%); Seed storage temp had no effect on germination; Cuttings of <i>Arctostaphylos uva-ursi</i>, <i>Empetrum nigrum</i>, <i>Vaccinium vitis-idaea</i>, <i>Salix herbacea</i>, <i>Salix polaris</i> root well (&gt;70%); Cuttings of <i>Cassiope tetragona</i> and <i>Dryas octopetala</i> weak rooting ability; <i>Bistorta vivipara</i> bulbils had high germination (&gt;50%) but high mortality; Genetic diversity must be considered in large-scale restoration</p>	Arctic native plant propagation methods applicable for planting
3	Alaska Department of Natural Resources	2025	<i>2025 Reclamation Plan Form for Placer Exploration or Mining</i>	Guideline	Reclamation; Topsoil Salvage; Surface Preparation; Erosion Control	Alaska	Arctic/Subarctic	<p><b>Revegetation:</b> Natural revegetation recommended; Active revegetation not discussed</p> <p><b>Site Preparation:</b> Reshape disturbed areas to blend with surrounding terrain; Stabilize slopes; Backfill trenches and shallow auger holes; Protect stockpiles from erosion and contamination; Stockpiled topsoil, overburden muck and vegetation must be redistributed promptly (or separated and stockpiled) - expected promote natural revegetation within five years; Organic material (brush, stumps) spread over reclaimed surfaces to inhibit erosion and support revegetation</p> <p><b>Other:</b> Re-establish unstable stream channels in valley floodplain; Restore hydrology; Seal shafts at closure; Remove structures and debris</p>	Recommendations applicable: Topsoil/organics salvage and application; Stabilize floodplain; Erosion control
4	Adams, P. W.; Lamoureux, S.	2005	<i>A Literature Review of the Use of Native Northern Plants for the Revegetation of Arctic Mine</i>	Research (Review)	Reclamation; Revegetation; Topsoil Salvage; Soil Amendment; Surface Preparation;	Arctic/Subarctic Canada	Arctic/Subarctic; Acidic and Metal-contaminated Tailings	<p><b>Revegetation:</b> Native tundra species (e.g., <i>Arctagrostis</i>, <i>Calamagrostis</i>, <i>Eriophorum</i>) outperform non-native commercial grasses under Arctic stress; Mosses (e.g., <i>Polytrichum</i>, <i>Sphagnum</i>) recommended for extreme substrates to initiate soil formation and stabilize surfaces; Phytostabilization with tolerant grasses plus soil amendments; Source seeds/cuttings locally to</p>	Prioritize native seed mixes and bryophyte establishment on harsh substrates; salvage local topsoil/organics; pilot phytostabilization with tundra species; design monitoring to

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
			<i>Tailings and Mine Waste</i>		Mining; Best Practices			<p>conserve gene pool (rules provided); Species exhibiting acid/heavy metal tolerances; Transplant root saucers or root mats</p> <p><b>Site Preparation:</b> Topsoil salvage and reapplication critical; lime for acid tailings; organic amendments improve moisture retention and reduce metal bioavailability; use slow-release fertilizers to avoid leaching; Apply lime (acidity) and gypsum/calcium nitrate (sodicity); add organic matter; Create rough-and-loose microsites; Maintain some exposed mineral soil surface (seeding germination better on mineral)</p> <p><b>Other:</b> Phytoremediation pathways (phytoextraction, phytostabilization) applicable in low-moderate contamination; conserve local gene pool by sourcing within ~6 km; avoid non-native species to prevent competition and gene introgression; Arctic seeds often dormant; slow seedling growth; high root:shoot ratios; shallow, spreading root systems; caution with topsoil covers over acidic tailings (capillary metal movement)</p>	track succession and dust/metals in lichens; Prioritize native species propagation via local collections; pilot moss layer establishment on tailings/waste rock; lime acidic zones; use slow-release fertilizers; engage Indigenous/local partners for seed/cutting sourcing within ~6 km guideline
5	Budzey, B. F.; Landhäusser, S. M.; Stewart, K. J.	2025	<i>The influence of abiotic (snow fences) and biotic (hedgerows) vertical structures on soil moisture, temperature, and planted seedlings in subarctic mine site reclamation</i>	Research (Primary)	Reclamation; Revegetation; Substrate; Surface Preparation; Buffers; Mining	Yukon, Minto Mine	Subarctic Boreal; Semi-arid; Substrates: waste-rock overburden cover (50 cm), sandy loam to loam, low organic matter, elevated Cu/As; Discontinuous Permafrost	<p><b>Revegetation:</b> Planted fireweed and Canada bluejoint survival &gt;85-93%; Biomass driven more by site-level moisture than structure proximity; Forb/grass aboveground biomass was clipped to ~ 2 cm before planting to reduce drought stress; Shrub hedgerows (planted) using <i>Alnus viridis</i> and <i>Dryas integrifolia</i> were planted using locally collected <i>Alnus viridis</i> and <i>Dryas integrifolia</i> seed collected in central and southern Yukon (grown at NATS Nursery in BC)</p> <p><b>Site Preparation:</b> Site-specific factors like microtopography and substrate type had a greater effect on planted seedling performance by shaping soil moisture and temperature dynamics more strongly than shelter provided by larger physical structures; Substrate texture (sand content, rock fragments) reduced water retention/soil moisture for hedgerow and planted seedling survival and growth; Disc trenching (to 30cm) created microtopography that strongly shaped ponding and water redistribution (including control), outweighing vertical structure effects</p> <p><b>Other:</b> Snow fences and hedgerows did not affect revegetation survival - snow fences may have been too short; Shrub Hedgerows (<i>Alnus viridis</i>, <i>Dryas integrifolia</i>) reduced plant-available water near PWP in summer likely due to transpiration; Snow fences (50% porosity; low 0.35 and 0.65 m) maintained higher soil volumetric water content (VWC) than biotic</p>	Use rough-and-loose microtopography in uplands; Snow fencing to increase spring soil moisture for nurse crop establishment; Align structures to prevailing winds and verify with onsite climate logs.

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
								hedgerows during summer/post-rainfall; Snow fence small height differences (0.35 vs 0.65 m) had limited impact; Vertical structures orientated perpendicular to window direction, 25-35 m long, spaced either 15 cm or 10 cm apart	
6	Turcotte, M. A. H.; Van Gulck, J.; Stavinga, D.; Peters, M.	2025	<i>An arctic case study of revegetation planning to implementation at Snap Lake Diamond Mine</i>	Research (Primary)	Reclamation; Revegetation; Surface Preparation; Topsoil Salvage; Soil Amendment; Mining; Indigenous	Northwest Territories, Snap Lake Mine	Subarctic Boreal-Tundra Transition; Dry Upland Pads/Laydown areas; Morainal Sands/Silts; Permafrost	<p><b>Revegetation:</b> Natural revegetation - recommended; Commercial seeding: Rocky mountain fescue, spiked trisetum, ticklegrass, alpine bluegrass performed best; Locally collected seed and propagation in nursery for planting: shrub seedlings (lingonberry, crowberry) had 46-96% survival (best in no fertilizer); Locally collected: direct shrub seeding failed (lingonberry, crowberry, bearberry); Seeding in spring generally favorable</p> <p><b>Site Preparation:</b> Surface contouring to limit slopes; decompaction and microsite creation (scarification); Scarification and topsoil placement improved establishment; targeted fertilizer rates (200-250 kg/ha of NPK 13-16-10, mix depends on overburden presence); engineered covers left unvegetated on North Pile to deter wildlife; topsoil application (overburden) at 0.4 m thickness; Closure Recommended: 200 kg/ha of 10-30-25 (0) (nitrogen-phosphorous-potassium (sulfur)) fertilizer for areas with overburden (i.e., Active-OFS) and application of 250 kg/ha of 30-25-20 (7) (nitrogen-phosphorous-potassium (sulfur)) fertilizer in areas without overburden</p> <p><b>Other:</b> Regulatory timelines span decades; closure criteria focused on vegetation cover and richness (e.g., min. species counts at 5 and 10 years); Indigenous engagement (Traditional Knowledge): Traditional Knowledge workshops, natural revegetation preferred, importance of all plant forms and diversity (species richness), input on plant species selection, community seed collection/planting/monitoring</p>	Adopt a mixed approach: passive recovery + active seeding/planting in priority areas; set clear cover/richness criteria; integrate Inuit Qaujimagatuqangit and community monitoring; plan logistics (fertilizer/seed supply via winter road).
7	Bahroudi, B.	2024	<i>Influence of topsoil-till cover depth and amendments on ecosystem reclamation of a closed tailings storage facility</i>	Research (Thesis)	Reclamation; Topsoil Salvage; Soil Amendment; Mining	British Columbia, Kamloops	Semi-arid Grassland; Subzone: BGxw1; Coarse-textured Soils; Reclaimed Tailing Storage Facility; 10/20 vs 15/15 cm cover	<p><b>Site Preparation:</b> Soil amendments (zeolite, leonardite, compost) - Zeolite plots had highest biomass and species richness (including forbs), compost likely effective but was not incorporated so blocked rooting in soil; Topsoil/Subsoil cover (10 cm topsoil + 20 cm subsoil, 15 cm topsoil + 15 cm subsoil) - greater topsoil depth had higher biomass (15 cm topsoil + 15 cm subsoil best); Incorporate amendments into substrate/topsoil; Tilling reclaimed TSF did not improve outcomes vs bare tailings blocks (reduced C:N ratio and alpha diversity); Soil N increases</p>	Results not directly applicable to Arctic but general recommendations are; Prioritize sufficient topsoil placement thickness; test zeolite/organic blends at small plots; Avoid thick mulches; Focus on native tundra grasses/forbs and microsite creation in cold, low-precipitation settings

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
								grasses over forbs; Compost raised C, N, SOM and lowered pH; leonardite decreased C/N and SOM	
8	Webber, P. J.; Ives, J. D.	1978	<i>Damage and Recovery of Tundra Vegetation</i>	Research (Review)	Revegetation; Disturbance; Climate Change	Alaska, Canadian Arctic	High Arctic Tundra; Permafrost: Thermokarst	<p><b>Revegetation:</b> Native species preferred; Commercial native seed availability inadequate; Transplanting vegetation mats or plugs used in Arctic but may be impractical for large areas (sod/vegetation mats can be stored for several months if kept moist); Mixed planting recommended; Non-native species likely to only persist in the short-term but some non-native species have invaded Arctic climates; Arctic species with revegetation potential: Early successional native species and with weedy habit including Brassicaceae (e.g., <i>Braya purpurescens</i>) and Asteraceae (e.g. <i>Tephrosieris</i> [Senecio] <i>palustris</i> ssp. <i>congesta</i>), <i>Agrostis borealis</i>, <i>Arctagrostis arundinacea</i>, <i>A. latifolia</i>, <i>Calamagrostis canadensis</i>, <i>C. lapponica</i>, <i>Deschampsia caespitosa</i>, <i>D. sukatschewii</i>, <i>Eriophorum scheuchzeri</i>, <i>Luzula confusa</i>, <i>Poa arctica</i>, <i>P. glauca</i>, <i>P. rigens</i>) Site Preparation: N facilitates non-native plants</p> <p><b>Other:</b> Vegetation recovery slow but possible (faster in low Arctic); Avoid disturbance near northern tree-line; Soil moisture and permafrost thickness influence vulnerability to disturbance - Moist tundra more sensitive than rocky and coarse material tundra which is resistant to disturbance; Disturbance of surface cover or active layer (freeze/thaw layer) can produce extensive thermokarst; Erosion as a result of thermokarsting in permafrost areas with high water content; Current vegetation may be adapted to past climate conditions and therefore be difficult to reestablish; Replacing organic mat to restore thermal regime</p>	Use native sods and transplanting; prioritize mapping and site-specific planning; avoid non-native species
9	Forbes, B. C.; Jefferies, R. L.	1999	<i>Revegetation of disturbed arctic sites: constraints and applications</i>	Research (Review)	Revegetation; Surface Preparation; Soil Amendment; Substrate; Snow Removal	Canadian Arctic, Alaska, Russia, Iceland	Disturbed Tundra; Upland Gravel; Sandy and Saline Soils; Wetlands	<p>Revegetation: Clonal propagation and seeding in wetlands aids recovery (patches of undisturbed vegetation recover smaller disturbance – rhizomatous Arctic graminoids, such as species of <i>Carex</i> and <i>Eriophorum</i>); Caution with exotic species which prevent re-establishment and recovery of native ecosystems (often dominated by grasses); Willow cuttings in wetlands; Organic mat in tussock tundra contains abundant buried seeds; Viviparous species can produce an abundance of propagules annually (vs. seminiferous); Transplanting can damage donor populations; Arctic species with revegetation potential: Pioneer N-fixing herbs like legumes (<i>Astragalus alpinus</i>, <i>Hedysarum alpinum</i>, <i>Hedysarum mackenzii</i>, <i>Oxytropis campestris</i>, <i>Oxytropis viscida</i>), <i>Salix</i> spp., <i>Phippisia algida</i>, <i>Puccinellia vaginata</i>, <i>Puccinellia langeana</i> (prolific seeder and seed in 2 years),</p>	Reclamation methods all applicable and good review article: Focus on native species; avoid exotic introductions; improve soil moisture and nutrients; consider clonal planting in wetlands

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
								<p><i>Puccinellia arctica</i> (prolific seeder and seed in 2 years); <i>Eriophorum vaginatum</i>, <i>Arctophila fulva</i> (clonal propagation), <i>Elymus arenarius</i> (clonal propagation), <i>Puccinellia phryganodes</i> (clonal propagation), <i>Artemisia</i> spp., <i>Epilobium latifolium</i>; Salt tolerant species: <i>Puccinellia langeana</i>, <i>Puccinellia arctica</i>, <i>Dupontia fisheri</i>, <i>Arctophila fulva</i>, <i>Festuca rubra</i>, <i>Potentilla egedii</i>, <i>Plantago maritima</i>, <i>Cochlearia officinalis</i>, <i>Elymus arenarius</i></p> <p><b>Site Preparation:</b> Substrates: gravel, sandy, saline soils slow to recover, wetlands faster to recover; Fertilization accelerates growth but may reduce diversity and changes community composition in upland (favouring non-natives) but promotes overall greater biomass - Objective of developing greater plant cover or greater species diversity may conflict (e.g., N fertilization); Fertilization in wetlands can support diverse wetland plant community; Tillage of compacted gravels or addition of soil amendments (e.g., finer textured soils) beneficial; Saline soils - reestablish an organic insulating layer to limit evaporation and salt deposition/accumulation at the soil surface; Salt treatment (calcium nitrate, natural flushing)</p> <p><b>Other:</b> Natural recovery extremely slow; Arctic safe sites concept critical; Snow removal</p>	
10	Hewitt, R.; Smith, J. A.; Doe, L. M.; Zhang, Q	2018	<i>Results of the Tundra Mine, NT Revegetation Trial Using Locally Harvested Pioneer Species Instead of Grass Seed and Fertilizer</i>	Research (Primary) - Presentation Abstract	Reclamation; Revegetation; Surface Preparation	Northwest Territories, Tundra Gold Mine	Subarctic Boreal–Tundra Transition; Permafrost	<p><b>Revegetation:</b> Locally harvested native pioneer species (Willow cuttings: <i>Salix athabascensis</i>); Transplant plugs: <i>Juncus stygius</i>, <i>Juncus drummondii</i>, <i>Equisetum arvense</i>, <i>Carex aquatilis</i>); 83-86% survival</p> <p><b>Site Preparation:</b> Soils mechanically loosened and had slightly higher survival than control; No soil amendments applied</p>	Reclamation methods all applicable
11	Kearns, N. B.; Jean, M.; Tissier, E. J.; Johnstone, J. F.	2015	<i>Recovery of Tundra Vegetation Three Decades after Hydrocarbon Drilling with and without Seeding of Non-Native Grasses</i>	Research (Primary)	Reclamation; Revegetation; Mining	Northwest Territories, Mackenzie Delta region, Kendall Island Bird Sanctuary, Parson's Lake	Low Arctic Tundra; Permafrost; Drilling Sump Pads; Saline Soils; Flood-influenced	<p><b>Revegetation:</b> Natural (passive) revegetation is recommended since also recovered and has lower negative risks; Active revegetation: Seeded non-native grasses (<i>Festuca rubra</i>; <i>Poa pratensis</i>) increased vegetation cover but introduced persistent non-native species after &gt;30 years (did not invade undisturbed tundra but some risk for spread if disturbed), did not prevent thermokarst; Disturbed areas in seeded and unseeded areas significantly different than undisturbed tundra &gt;30 years (dominated by pioneer species)</p>	Reclamation methods all applicable

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
								<p><b>Site Preparation:</b> Recovery inhibited since sumps are elevated and hydrological regime different than undisturbed tundra; Recommend tall shrub removal to prevent snow accumulation and warmer winter temperatures</p> <p><b>Other:</b> Erosion generally minor relative to permafrost degradation</p>	
12	Dance, A.	2015	<i>Northern Reclamation in Canada: Contemporary Policy and Practice for New and Legacy Mines</i>	Policy (Review)	Reclamation; Policy; Inuit; Mining	Canadian Arctic: Nunavut, Northwest Territories, Yukon, Northern Labrador, Nunavik	Arctic/Subarctic	<p><b>Other:</b> Reclamation reform needed; Federal programs (FCSAP, NCSP) and NOAMI improve legacy site management, but enforcement and capacity remain uneven; devolution shifts responsibilities to territories; examples include Giant, Faro, Colomac, Jericho; Table 1 summarizes the Reclamation Programs and Policies applicable to Nunavut; Reclamation rarely restores sites to pre-disturbance state; effectiveness depends on comprehensive planning, stable funding, and integration of traditional knowledge; progressive reclamation is critical; Robust securities and closure plans; clear regulatory frameworks; cumulative effects assessment and precautionary principle; cross-jurisdiction coordination; Indigenous Impact &amp; Benefit Agreements; water/land licensing requirements; Progressive reclamation embedded in approvals; adequate, enforced financial securities; Indigenous engagement &amp; TK integration; local employment and training (set-asides); transparent communication and monitoring; Weak enforcement; fragmented governance; inconsistent or insufficient securities; policy “streamlining” that reduces protective standards; inadequate planning for perpetual care.</p>	Policy overview with some applications to Nunavut: Integrate Inuit TK through formal mechanisms (e.g., IIBA); coordinate with NIRB & Nunavut Water Board
13	Keeling, A.; Potvin, V.	2025	<i>Nunavik Inuit and Raglan Mine: New approaches to closure planning (isulinnisanganut parnasimautiit)</i>	Research (Primary)	Reclamation; Inuit; Mining	Québec, Nunavik, Raglan Mine (Katinniq) & Deception Bay	Arctic Tundra; Permafrost	<p><b>Other:</b> Inuit Engagement: Lessons include sustained collaboration, documentation, and benchmarking for industry, Closure Plan Subcommittee, integration of Inuit knowledge/values; new social chapter in closure plan; Inuktitut terminology, infrastructure repurposing, importance of traditional wildlife harvesting and other land-based activities</p>	Based in Quebec, but Inuit engagement applicable to Nunavut: Establish a closure/reclamation subcommittee with Inuit partners (e.g., Kitikmeot communities), co-develop culturally relevant closure criteria, build shared terminology (Inuktitut) for closure concepts; use training, site visits, and visual tools (e.g., 3-D models) to strengthen understanding, plan for infrastructure repurposing and

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
									community benefits, document and benchmark processes
14	Kempenaar, L.; McCarron, J.K.; Marques, L.R.; McClure, T.; Rennie, D.	2013	<i>Tools for Arctic Revegetation: What's in Your Toolbox?</i>	Industry (Conference)	Reclamation; Revegetation; Topsoil Salvage; Surface Preparation; Mining	Northwest Territories, Snap Lake Mine	Subarctic Boreal-Tundra Transition; Permafrost; Substrates: gravel pads, disturbed mine surfaces	<p><b>Revegetation:</b> Natural revegetation effective on small disturbances near seed/spore sources or with seed bank; Active revegetation (seeding/transplants) needed for large disturbances; Considerations for active vs. passive reclamation: invasives, erosion risk, proximity to natural area, seed bank, site productivity, cost, site diversity, site stressors, disturbance size; Species Selection: tailor to stressors and microsites; Erosion prone areas: non-native nurse crops have been used (some sites they persist and outcompete natives)</p> <p><b>Site Preparation:</b> Site contouring; Topsoil placement or rehabilitation; Erosion control</p>	Reclamation methods all applicable
15	Kuzyk, T.; Seahra, S.; Lowey, J.; Pedlar, R.; Bequet, A.-C.	2025	<i>Continued evolution of mine closure practices: integration of Indigenous perspectives and climate change in revegetation prescriptions</i>	Research (Review)	Reclamation; Climate Change; Inuit; Mining	British Columbia, Northern (Golden Triangle)	Arctic/Subarctic; Permafrost	<p><b>Revegetation:</b> Plant species selection: climate-resilient species, diverse species, local provenance, culturally important species; Multi-phase plantings (current-adapted followed by future-adapted species, early successional then later succession shade tolerant species)</p> <p><b>Site Preparation:</b> Coarse woody debris placement to create microsites, improve moisture, and wildlife habitat</p> <p><b>Other:</b> Climate-shifted baseline to set ecosystem targets; Engage Indigenous rightsholders in closure vision - align and collaborate with Nations on their intended future use of the land; Plan for connectivity to support wildlife &amp; resilience; Tools: CCISS, ClimateBC, ClimateNA climate modeling tool (mean annual temperature, climate maps, mean annual precipitation, and climatic moisture deficit using the SSP2-4.5 climate scenario into the year 2100); Monitoring: validate climate projections and recovery, initial frequent monitoring then long-term monitoring at less frequent intervals</p>	Recommendations relevant: Develop climate-shifted baseline targets; Plant source considerations; Monitoring program and adaptive management triggers; Co-develop revegetation with Inuit partners; <i>Integrated Mine Closure: Good Practice Guide (ICMM 2025)</i>
16	Matheus, P. E.; Omtzigt, C. M.	2013	<i>Yukon Revegetation Manual: Practical Approaches and Methods</i>	Guideline	Revegetation; Topsoil Salvage; Surface Preparation; Soil Amendment; Monitoring	Yukon	Arctic/Subarctic; Alpine/Subalpine; Permafrost; Substrates: saline/acid/alkaline soils, slopes, bare mineral soils; Highway ROW; Borrow Pits; Mine Sites	<p><b>Revegetation:</b> Natural revegetation - Facilitated; Broadcast seeding densities adjust by scenario/feature (hand seeding or ATV seeding): 500–1,000 PLS/m<sup>2</sup> for tundra, ≥2,250–3,000 PLS/m<sup>2</sup> for steep slopes; Frost seeding effective (Oct) when timed to dormancy; Seed quality (PLS) &amp; certification critical; Species Selection: consider pH, moisture, salinity; Seed/Propagule collection: collecting/sowing seeds of local plants is preferred (however some northern cultivars of commercial seed exist); Native commercial seeds for tundra low nutrient: <i>Arctagrostis latifolia</i> (acidic), <i>Elymus alaskanus</i> (alkaline, saline),</p>	Guideline for Yukon but applicable to Nunavut (specifically Scenario 6), although some recommendations are for more southern Subarctic conditions (other Scenarios)

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
								<p><i>Poa glauca</i> (broad pH), <i>Deschampsia caespitosa</i> (acidic soils, wetter), <i>Poa alpina</i> (mild acidic), <i>Trisetum spicatum</i> (mild acidic, mild alkaline); Non-native nurse/cover crop for tundra (<math>\leq 10\%</math> of mix): <i>Hordeum vulgare</i> (alkaline, saline); Local Native Seed for tundra low nutrient: <i>Festuca altaica</i> (low nutrient), <i>Poa arctica</i> (acidic, alkaline), <i>Poa alpigena</i> (low nutrient), <i>Hierochloë alpina</i> (low nutrient, dry), <i>Puccinellia nuttalliana</i> (alkaline, saline, dry, low nutrient), <i>Artemisia</i> spp. (mostly dry, low nutrient), <i>Lupinus arcticus</i> (low nutrient, N-fixing), <i>Dryas</i> spp. (alkaline, low nutrient); Woody Native Stakes (wet ditches or riparian): <i>Salix</i> spp. (wet); Woody Seedlings from Local Collected Seed: <i>Betula glandulosa</i> (acidic, organic), <i>Betula nana</i> (acidic, organic), <i>Alnus crispa</i> (mild acidic, wet); Non-native nurse crops (species that only persist few years to be replaced by native plants)</p> <p><b>Site Preparation:</b> Stockpile &amp; reapply organic materials; On non-permafrost sites, tillage/deep decompaction (25–40 cm) and roughened/scarification surface (rough and loose for decompaction and microtopography) - plough, disk harrow, ripping teeth on a tracked vehicle &amp; track-walking on slopes to form catchments; calculate custom fertilizer mixes based on soil testing (typical N 40–90 kg/ha; P<sub>2</sub>O<sub>5</sub> 30–70 kg/ha; K<sub>2</sub>O 30–60 kg/ha; S up to 17 kg/ha); Prioritize soil salvage &amp; roughened microtopography; Fertilizer (N-P-K-S); Incorporation of organic material with surface sediments using harrow to 10-30cm; Organic material minimum thickness of 5 to 10 cm; Permafrost sites with shallow (2-5 cm) harrowing/raking rather than deep soil turning to prevent thermokarst; Match organic content/thickness to surrounding sites; Minimize fertilizer application (half recommended fertilizer amount, &lt;50kg N/ha); If thermokarsting, apply as much soil/organic material as possible (&gt;20 cm) in current/next spring, avoiding tillage, establish quick cover (i.e., 10% cover crop), equipment when ground frozen</p> <p><b>Other:</b> Control Invasive Plants: manage invasive species via certified seed and equipment hygiene; Restore Thermal Regimes on Permafrost Sites; Use mulches/RECPs and willow staking for erosion control; monitor percent ground cover (targets: 50–60% first season on erosion-prone slopes; 20–30% on stable flats); Includes prescriptions for treatment methods and plant descriptions</p>	

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
17	QIA (Qikiqtani Inuit Association)	2017	<i>Abandonment and Reclamation Policy for Inuit Owned Lands (Version 2.0)</i>	Policy	Reclamation; Policy; Inuit	Nunavut, Qikiqtani Region	High Arctic	<b>Other:</b> Abandonment and Reclamation Plan (A&R plan) for IOL; Defines goals for reclamation and obligations of land user: Progressive reclamation; Integration of Inuit Qaujimagatuqangit and community consultation; Physically, chemically, and biologically stable; Consistent with valued ecosystem components; Aesthetically and environmentally compatible with the surrounding undisturbed landscape; International best practices for Arctic conditions, as well as federal and territorial legislation, regulations and guidelines; Post-activity monitoring; "Nunavut Tunngavik Incorporated (NTI) and the Regional Inuit Associations require users of IOL to return the land to a safe and stable condition that maintains the ecosystem integrity and that is consistent with Inuit societal and cultural needs and aspirations."	The Goose Project is outside of Qikiqtani Region (Kitikmeot Region; therefore not directly affected by this Policy); Provides context for Inuit Values; Align A&R with IQ and CLARC expectations; prepare defensible security with line-item evidence; plan progressive works and monitoring; use concordance table.
18	Government of Northwest Territories; Presenter (Bioengineering team)	2017	<i>Revegetating Colomac Mine, NT: Bioengineering techniques for riparian areas (six-year update)</i>	Industry	Reclamation; Revegetation; Mining	Northwest Territories, Truck Lake, Colomac Mine	Subarctic; Riparian Channels and Shorelines; Substrate: Compacted, nutrient poor mineral soils; Hydrocarbon Contamination	<b>Revegetation:</b> Local native plant propagation; Planting: Trees, lupine; Riparian Areas: dormant willow cuttings (1.2 m) - soaked in water for 6 days, staked in clusters of 5 (95% cover achieved); Alder seed (~100 g/ha) - seed separated using lettuce spinner, hand-seeded, established in moist areas well; Native grass seed; Transplanting: Sedge plugs in wet areas - collected from multiple locations; Established cover in wetlands (e.g., Truck Lake wetland ~80% between 2010-2015; Steeves shoreline ~75%); Species selection: Locally collected pioneer species  <b>Site Preparation:</b> Surface Preparation: "Rough-and-loose" microsite creation increased moisture capture, seed trapping, and reduced erosion excavator to ~1 m depth across slopes stopped sheet flow; Woody debris placement; Staged surface roughening improved success and erosion control.  <b>Other:</b> Monitoring focused on % cover, survival of cuttings/plugs, biodiversity - annually first 5 years then less frequently (in August); Mycorrhizal Research; Lessons: plan early, train crews; Surface preparation in strips to allow access of machines for placement of materials (e.g., deadwood) prior to complete preparation	Recommendations mostly relevant to wetter conditions
19	Oberndorfer, E.; Broomfield, T.; Lundholm, J.; Ljubicic, G.	2020	<i>Inuit cultural practices increase local-scale biodiversity and create novel vegetation</i>	Research (Primary)	Inuit; Revegetation	Labrador, Nunatsiavut, Makkovik area	Subarctic Boreal-Tundra Transition; Coastal barrens, heath, sod houses, middens, wood houses; shallow	<b>Revegetation:</b> Natural revegetation: calciphiles and ruderal natives that occur in historically disturbed areas (e.g., <i>Montia fontana</i> , <i>Agrostis scabra</i> , <i>Elymus trachycaulus</i> , <i>Alnus viridis</i> , <i>Rubus idaeus</i> , <i>Rubus pubescens</i> , <i>Epilobium hornemannii</i> , <i>Epilobium lactiflorum</i> , <i>A. atropurpurea</i> [calciphile], <i>Draba incana</i>	Findings relevant to other Inuit landscapes: consult Inuit knowledge on species/propagules; account for legacy soils when selecting references and monitoring

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
			<i>communities in Nunatsiavut (Labrador, Canada)</i>				substrates; nutrient inputs from country foods; Natural revegetation (historical Inuit disturbance): native, disturbance-tolerant calciphiles;	<p>[calciphile], <i>Carex nigra</i> [calciphile], <i>Stellaria borealis</i>, <i>C. angustifolium</i>, <i>C. canadensis</i>)</p> <p><b>Site Preparation:</b> Soil enrichment (nutrient inputs) resulting from Inuit fishing histories - Nutrient enrichment (Ca, P, Mg) from harvesting increases calciphiles and ruderal natives; Built environments (sod houses, middens, wood houses) have distinct plant assemblages and higher local species richness per area than undisturbed patches; Soil chemistry (Ca, P2O5, Mg, pH, Fe) explains vegetation differences; mechanical disturbance + nutrient inputs drive shifts from dwarf shrubs to grasses/herbs; reference areas may hide cultural legacies; Tent rings resemble adjacent heath; Calcium enrichment near middens and sod houses of Inuit (bones, shells)</p> <p><b>Other:</b> Inuit cultural practices drive biodiversity (e.g., built environments, fishing histories, tent rings) and can increase local-scale plant species diversity (# species per unit area, but overall no difference); Management should support cultural practices; Monitor middens/sod houses for future non-native introductions as climate warms; Biodiversity islands; Calciphiles; Disturbance-tolerant species; Inuit historical disturbance results in transformation from heathland to grassland (nutrient enrichment favouring grasses)</p>	targets, Design heterogeneity and organic enrichment islands
20	Chapin, F. S., III; Chapin, M. C.	1980	<i>Revegetation of an Arctic Disturbed Site by Native Tundra Species</i>	Research (Primary)	Revegetation; Topsoil Salvage; Soil Amendment	Alaska	Arctic Tundra; Permafrost; Thermokarst; Organic Soils	<p><b>Revegetation:</b> Natural revegetation: Native sedges re-established biomass equal to undisturbed tundra within 5–10 years; Native Species: <i>Eriophorum vaginatum</i>, <i>Carex</i> spp. like <i>C. bigelowii</i>, mosses; Exotic grasses established then declined (required repeated fertilization); Seed source for <i>E. vaginatum</i> from adjacent tundra and organic soil seed bank as seed source</p> <p><b>Site Preparation:</b> Native plants in organic soils did not require fertilization, while exotics did; Topsoil source of seed bank</p> <p><b>Other:</b> Succession from exotics to natives on tundra</p>	Recommendations relevant: Prioritize native sedges and local seed sources for tundra disturbances; avoid exotics; consider modest fertilization to speed native recovery
21	Sandlos, J.; Keeling, A.	2016	<i>Aboriginal communities, traditional knowledge, and the environmental legacies of extractive development in Canada</i>	Research (Primary)	Reclamation; Inuit; Mining	Northwest Territories, Yellowknife, Giant Mine	Arctic/Subarctic; Arsenic	<p><b>Other:</b> Integrating TK beyond “flora/fauna data” to guide remediation goals and justice considerations; Highlights epistemic injustice and need for restorative approaches (compensation/apology) and long-term solutions beyond frozen block arsenic</p>	Recommendations applicable: Inuit engagement

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
22	Stuckless, B.; Brillinger, D.; Whitehead-Delong, L.; Tannas, S.	2024	<i>Revegetation with locally harvested native plant seeds at the abandoned Atlin Ruffner Mine</i>	Industry (Conference)	Reclamation; Revegetation; Erosion Control; Monitoring; Mining	British Columbia, Mount Vaughan, Atlin Ruffner Mine	Alpine Tundra; Substrate: Sand/gravel; Steep Slopes	<p><b>Revegetation:</b> Seed Collection: seed set different times of year and elevations but July most favourable, off-site stratification, and ex-situ greenhouse propagation; Planting densities from 1-3 plants per m<sup>2</sup>; Local native pioneer plant species suitable for revegetation of disturbed gravel areas with low nutrients (<i>Dryas integrifolia</i> [not N-fixing, though historically thought to be], <i>Lupinus nootkatensis</i> [N-fixing], <i>Saxifraga tricuspidata</i>, <i>Sedum lanceolatum</i>, <i>Oxytropis campestris</i> var. <i>spicata</i>) - slow growth rate prior to out planting, preferred gravels and coarse soils with frequent and heavy precipitation (well-drained but frequent watering), <i>Dryas integrifolia</i> low germination rate and susceptible to insect attacks, established variably from ~16.7-94% survival; Shelter improves survival; June planting outperforms fall; Target ~30% cover; Intervention and supplemental infill planting needed in some areas; Slopes plant from the top of the slope to the bottom; Experienced planters; Post-planting inspections to verify planting densities (Randomly selected plots 50 m<sup>2</sup> and 20% of area surveyed); Long-term monitoring (10% of area surveyed); Natural colonization of species: <i>Festuca</i> spp., <i>Calamagrostis purpurascens</i>, <i>Chamaenerion latifolium</i>, <i>Chamaenerion angustifolium</i></p> <p><b>Site Preparation:</b> Minimal Soil Amendment: Small amount of organic treated manure to deter grazing; Bituminous geomembrane liner (installed 1 m depth); Remedial cap of contaminated areas</p> <p><b>Other:</b> Plugs believed to have been pulled out by grazing but unclear (I suspect frost heave due to due to September planting [not enough time for roots to develop], and subsequent planting was in June); Remote piloted aircraft planned for steep slope monitoring; Invasive species: <i>Crepis tectorum</i></p>	Recommendations applicable: Prioritize locally adapted natives; plan for seed logistics/propagation; align root depths with cover systems; plant spring/early summer; create shelter and monitor via RPA where access is risky
23	May, D. E.; Webber, P. J.; May, T. A.	1982	<i>Success of Transplanted Alpine Tundra Plants on Niwot Ridge, Colorado</i>	Research (Primary)	Revegetation; Transplanting; Alpine	Colorado, Niwot Ridge	Alpine Tundra; Microenvironments: fellfield, snow bed, dry & moist meadows, shrub tundra	<p><b>Revegetation:</b> Transplant success to intact communities ranged 98% (<i>Deschampsia caespitosa</i>) to 17% (<i>Carex rupestris</i>); Species: <i>Deschampsia caespitosa</i> (98%), <i>Kobresia myosuroides</i> (83%), <i>Acrostichum rossii</i> (79%), <i>Carex pyrenaica</i> (70%), <i>Sibbaldia procumbens</i> (44%), <i>Carex rupestris</i> (17%); Fibrous-rooted species most resilient than rhizomatous or other rootstock species; Transplant success not guaranteed even in native microenvironment; Fellfield microenvironment inhibited transplant success; Ecological tolerance less of a determinant than root form; Transplanting methods: Careful excavation of</p>	Not directly applicable since study in alpine environment, but some overlapping species indicate effectiveness of transplant: Plug/sod transplants most effective for fibrous-rooted native graminoids on priority microsites; Avoid transplanting highly exposed dry sites unless amended; Post-transplant

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
								roots, removal of soil from roots, post-transplant watering for several weeks minimized early mortality	watering/irrigation where feasible
24	EDI Environmental Dynamics Inc.	2020	<i>2 Documents: (1) Reclamation Pilot Study: Mary River Mine Project - Revegetation Survey &amp; Preliminary Reclamation Trial; (2) Research Review Advances in Arctic Reclamation: Implications for Reclamation Practices &amp; Trials at the Mary River Mine Project</i>	Industry (Primary, Review)	Reclamation; Revegetation; Surface Preparation; Monitoring; Mining	Nunavut, North Baffin Island, Mary River Mine; Tote Road KM52 (near Katitkok Lake) & KM16 (near Phillips Creek)	High Arctic Tundra; Xeric/Subxeric; Glaciofluvial & Morainal Parent Materials; Sandy Loam, Coarse Fragments; Restrictive till layer (~20–29 cm); Polygonal Ground; Turbic Cryosols; Permafrost near-surface; High wind	<p><b>Revegetation:</b> Natural revegetation of native grasses, sedges, forbs, shrubs occurs (1, 5 year disturbance chronosequence); shrubs/bryophytes/lichen in control areas but limited in disturbed areas; no exotic species recorded; disturbed KM52 (~1 yr post-disturbance) ~4% cover vs. controls ~29% cover; disturbed KM16 (~5 yrs post-disturbance) ~51% cover vs. controls ~83% cover; early-succession graminoids/forbs dominate passive restoration (Year 1: <i>Carex fuliginosa</i> ssp. <i>misandra</i>, <i>Dryas integrifolia</i>, <i>Erysimum pallasii</i>, <i>Physaria arctica</i>; Year 5: <i>Carex membranacea</i>, <i>Bistorta vivipara</i>, <i>Oxytropis maydelliana</i> subsp. <i>melanocephala</i>, <i>Saxifraga oppositifolia</i>, <i>Saxifraga aizoides</i>, <i>Potentilla hyperctica</i>, <i>Vaccinium uliginosum</i> subsp. <i>microphyllum</i>)</p> <p><b>Site Preparation:</b> Established two configurations: (1) Rough-and-Loose decompaction, surface heterogeneity, microsites and (2) Track-packing (compaction and surface imprinting to reduce erosion, surface roughness); earthworks limited to &lt;35 cm depth to protect permafrost; CAT 345D Excavator with standard 122 cm wide 4 tooth bucket; tie-in to natural drainage patterns; trial strips georeferenced for monitoring</p> <p><b>Other:</b> Soils in both sites non-saline, low nutrients, little organic matter; recommend expanding sites, identifying indicator species, increasing replication/chronosequence; annual/biannual monitoring; different landscapes and landscape features will require potentially different and perhaps even a combination of reclamation strategies and surface configurations; Section 3 provides good condensed summary of reclamation/revegetation at Mines and in research; Section 4 provides good recommendations for how lit review informs recommendations</p>	Adopt rough-and-loose for microsites on coarse, xeric substrates; limit excavation depth to avoid permafrost impacts; target early-succession natives (graminoids/forbs) for initial cover; replicate trials across endpoints (roads, laydowns, waste rock); monitor annually/biannually
25	Cater, T. C.	2010	<i>Tundra Treatment Guidelines: A Manual for Treating Oil and Hazardous Substance Spills to Tundra (3rd ed.)</i>	Guideline	Reclamation; Revegetation; Spills; Guideline	Alaska, North Slope, Arctic Coastal Plain & Foothills	Arctic Tundra (aquatic, wet, moist, dry); Permafrost	<p><b>Revegetation:</b> Enhance natural revegetation; Transplanting native vegetation (willow live stake cuttings, sprigs of <i>Arctophila fulva</i> in wet areas, springs of <i>Leymus</i> in dry areas); Tundra sodding (transplant intact tundra soil and live plant materials prior to their loss/development, best time to harvest sod is when the soil has thawed 6–12 inches, Cutting disc [“Nuna ulu”] and excavator); Seeding (local native plants preferred, native cultivars for erosion control); Plant Species: example native plants and site conditions</p>	Spill-response context rather than reclamation, but some recommendations or best practices applicable

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
								<p><b>Site Preparation:</b> Soil amendments: Targeted fertilization where appropriate (e.g., to increase seed production), saline with gypsum or calcium nitrate (plus water), acidic with lime</p> <p><b>Other:</b> Extending growing season: Early spring snow removal, snow fencing (4-8 ft high perpendicular to wind) for snow accumulation or to prevent snow on site for early growing season; Irrigation: improve growing conditions during dry season; Brine, hydrocarbon, synthetic fluid spill reclamation (e.g., sorbents, manual removal, snow management, drainage protection, land barriers, recovery with skimmers and pumps, flooding, flushing, trenching, burning/removing contaminated vegetation, mechanical removal [scraping, trimming, brushing], excavation and off-site disposal, draining and dewatering, backfilling to stabilize thermal balance); Recommendations to minimize impacts to tundra (e.g., use plywood/rig mats/boardwalks, avoid repeated passes, respect tundra travel thresholds); Recommendations for tundra travel (e.g., winter travel, vehicle types); Snow fencing to trap snow; Remove snow for earlier growing season; Monitoring (soil/water, vegetation cover/composition, active-layer depth) essential; Tactics vary by tundra type; Caution that cleanup operations can cause more damage than contaminants</p>	
26	Canadian Mortgage and Housing Corporation (CMHC); Avens Associates Ltd.	2002	<i>Northern Landscaping: A Guide to Restoring the Plants and Soil in Northern Communities</i>	Guideline	Revegetation; Surface Preparation; Topsoil Salvage; Soil Amendment	Canadian Arctic/Subarctic: Nunavut, Northwest Territories, Yukon, Northern Labrador, Nunavik	Arctic/Subarctic; Tundra/Taiga; Substrate: Thin, coarse-textured soils; Permafrost; Erosion-prone Slopes (>5%)	<p><b>Revegetation:</b> Revegetation techniques: natural colonization, seeding, cuttings/sprigging (aboveground stem nodes, such as <i>Arctophila fulva</i>), live stake cuttings (willow/poplar), rootings, transplanting of native sods/vegetation mats, mass planting; Species Selection: Local native species, pioneer species for initial cover with trajectory to climax species, hemerophiles, provides list of native plants and site conditions (e.g., Appendix B, C, D); Storage and timing guidance for seeds; Seeding: fall or spring, local collection, direct or indirect, storage considerations; Transplant: active layer above permafrost, collection/placement in late fall after the surface of the ground is frozen, match placement site</p> <p><b>Site Preparation:</b> Site Preparations include: correcting soil problems, re-contouring, conserving topsoil/organic material, erosion control, protecting adjacent area, scarifying surface, trapping snow with snow fences to accumulate organic matter and moisture; Handle soils carefully (salvage native soils; match host soils); Protect permafrost; Recontour &amp; control erosion; Plan barriers to prevent traffic damage; Fertilizer not recommended (favours non-natives, and grasses) or should be</p>	Guideline for smaller-scale planting projects, not reclamation

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
								minimal (N) and judicious; Mulches not recommended unless in special circumstances (e.g., erosion control) <b>Other:</b> Snow Fences	
27	Indian and Northern Affairs Canada (INAC)	2002	<i>Mine Site Reclamation Policy for the Northwest Territories</i>	Policy	Reclamation; Policy; Mining	Northwest Territories	Arctic/Subarctic; Policy-level (Mine Sites; Land and Water Liabilities; Crown Lands; Mackenzie Valley regime)	<b>Revegetation:</b> Policy sets standards and expectations rather than specific revegetation prescriptions; aims for viable, self-sustaining ecosystems compatible with healthy environment & human use <b>Site Preparation:</b> Requires closure & reclamation plans for all mines; progressive reclamation; design for closure; tailings/waste rock stability <b>Other:</b> Mandates full financial security equal to outstanding liability; credits progressive reclamation; recognizes RECLAIM cost model; outlines procedures for insolvency and Crown protection; water quality standards; post-closure monitoring	Use as analog for NWT portions and for federal expectations; ensure full-cost security, progressive reclamation credits, RECLAIM inputs, and robust monitoring/updates
28	Indian and Northern Affairs Canada (INAC)	2002	<i>Mine Site Reclamation Policy for Nunavut</i>	Policy	Reclamation; Policy; Mining	Nunavut	Arctic	<b>Other:</b> Policy requirements for Mine Site Reclamation in Nunavut; Principles; Implementation Considerations	Policy requirements for Mine Site Reclamation in Nunavut
29	Indian Affairs and Northern Development (INAC); Chouinard, R.	2002	<i>Mine Reclamation Guidelines for the Northwest Territories and Nunavut</i>	Guideline	Reclamation; Policy; Guideline; Mining	Nunavut; Northwest Territories	Arctic/Subarctic	<b>Other:</b> Land Use and Aesthetics; Physical Stability; Chemical Stability; aim for walk-away outcomes (passive care acceptable; active care to be avoided for modern mines); "The selection of reclamation objectives at a project site should consider: naturally occurring bio-physical conditions, characteristics of the surrounding landscape, local community values and culturally significant or unique attributes of the land, level and scale of environmental impact, land use prior to mine development, and expected post operational land use activity."	Government Guidelines for Mine Site Reclamation in Nunavut
30	Indian and Northern Affairs Canada (INAC)	2003	<i>Northern Land Use Guidelines: Overview</i>	Guideline	Reclamation; Guideline; Government; Mining	Nunavut; Northwest Territories	Arctic/Subarctic	<b>Site Preparation:</b> Consult regulators; plan/design before construction; mitigate environmental impacts across project life; reclamation to original or suitable condition	Government Guidelines for Crown Land Use in Nunavut
31	Indian and Northern Affairs Canada (INAC)	2009	<i>Northern Land Use Guidelines: Pits and Quarries (Vol. 07)</i>	Guideline	Reclamation; Revegetation; Surface Preparation; Topsoil Salvage; Guideline; Government; Quarries	Nunavut; Northwest Territories	Arctic/Subarctic	<b>Revegetation:</b> Recommendations: Natural revegetation preferred; Seeding poses risk of invasive non-native species introduction or unsuitable species; Salvage/replace topsoil (contains native seeds and organic material to expedite vegetation growth); Where erosion is a concern - seed native grass or legume species or plant native stock like shrubs or trees (requires local seed/propagule collection) or use of a cover crop that will die back	Government Guidelines for Reclamation Practices in Nunavut (Quarries/Pits, and relevant to Mining)

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
								<p><b>Site Preparation:</b> Recommendations: Landscape reconstruction - round excavated slopes (except permafrost areas), slopes &lt; 2:1 or natural angle, steppe steep slopes, gentle slopes and rounded shapes preferable to straight lines; Recontour using stockpiled overburden with mineral soil on top (provides insulating layer for permafrost); Apply stockpiled topsoil above recontoured areas (differ depths, avoid use on steep slopes [erosion], consider undulating or irregular terrain); Prevent compaction - Use low compaction equipment (tracks), avoid soil handling when wet, roughen surface after spreading (microsites), if severe compaction use soil ripping techniques or soil amendments; Separate stockpiles; Consideration for areas of continuous permafrost</p> <p><b>Other:</b> Recommendations: Drainage and Erosion Control - maintain surrounding natural hydrology, slope grading/roughening/horizontal grooves/revegetation, if erosion severe - may need berm or swale, brush, ditches; Avoid creation of ponds/lakes in permafrost terrain - this creates warming and leads to permafrost degradation and subsidence of ground; Multi-year monitoring</p>	
32	Government of the Northwest Territories (GNWT), Department of Lands	2015a	<i>Northern Land Use Guidelines: Access—Roads and Trails</i>	Guideline	Reclamation; Revegetation; Surface Preparation; Topsoil Salvage; Erosion Control; Guideline; Government; Roads	Northwest Territories	Arctic/Subarctic; Permafrost; Eskers; Patterned ground; Fine-textured soils; Riparian	<p><b>Revegetation:</b> Recommendations: Natural revegetation preferred in stable areas; Active revegetation on erosion-prone slopes using native seed mixes and shrub cuttings (e.g., willows); Maintain vegetation in ditches to control erosion; Native seeding on slopes; Willow cuttings; Erosion-control mats</p> <p><b>Site Preparation:</b> Recommendations: Topsoil salvage and placement; Surface scarification; Restore drainage (cross ditches, drains, berms); Erosion Prone Areas: Recontouring, terracing, erosion control mats, soil binders, rock or gravel blankets</p> <p><b>Other:</b> Recommendations: Removal of culverts with streambed restoration</p>	Government Guidelines for Reclamation Practices in NWT (Roads, and relevant to Mining), but limited detail
33	Indian and Northern Affairs Canada (INAC)	2010	<i>Northern Land Use Guidelines: Access—Roads and Trails (Vol. 05)</i>	Guideline	Reclamation; Revegetation; Surface Preparation; Topsoil Salvage; Erosion Control; Guideline;	Nunavut; Northwest Territories	Arctic/Subarctic; Permafrost; Eskers; Patterned ground; Fine-textured soils; Riparian	<p><b>Revegetation:</b> Recommendations: Natural revegetation preferred in stable areas; Progressive reclamation; active revegetation with native seed mixes, willows, mats on erosion-prone slopes; remove culverts &amp; restore streambed at closure; Where erosion is a concern - active seeding or planting (e.g., live willow stakes) of native plants recommended</p> <p><b>Site Preparation:</b> Recommendations: Topsoil salvage and placement; Surface scarification; Drainage controls (ditches,</p>	Government Guidelines for Reclamation Practices in Nunavut and NWT (Roads, and relevant to Mining), but limited detail

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
					Government; Roads			cross drains, berms); Erosion Controls - mulching and spreading, erosion control mats, soil binders, rock or gravel blankets, terracing  <b>Other:</b> Recommendations: Drainage and Erosion Control; Multi-year monitoring	
34	Government of the Northwest Territories (GNWT), Department of Lands; AANDC; Environment Canada; Fisheries and Oceans Canada	2015b	<i>Northern Land Use Guidelines: Northwest Territories Seismic Operations</i>	Guideline	Reclamation; Revegetation; Erosion Control; Guideline; Government; Seismic	Northwest Territories	Arctic/Subarctic; Permafrost; Tundra; Riparian; Slopes	<b>Revegetation:</b> Natural revegetation preferred in stable areas; Active revegetation in erosion-prone sections using native seed mixes and shrub cuttings (e.g., willows); Avoid non-native plant introduction  <b>Site Preparation:</b> Erosion control: erosion blankets or tarps, cross ditches or berms; Mulching can aid recovery	Government Guideline for seismic reclamation in NWT (minimal detail)
35	Johnson, L. A.	1987	<i>Management of Northern Gravel Sites for Successful Reclamation: A Review</i>	Research (Review)	Reclamation; Topsoil Salvage; Erosion Control; Revegetation; Gravel Pits	Alaska	Arctic/Subarctic; Substrates: Gravel (low moisture/nutrients); Permafrost; Riparian vs Upland communities	<b>Revegetation:</b> Passive revegetation viable for sites with adequate soils and nearby early-successional plant sources; Active revegetation for other sites using seeding, planting, transplanting, cuttings; Use adapted native species that can aid in reconstructing soil (may be in short supply)  <b>Site Preparation:</b> Soil reconstruction most important element - Stockpile and respread topsoil (≥10–15 cm practical minimum), or if topsoil salvage and placement not possible, recreate with organics/fines; Erosion control during mining; Minimize disturbance and stockpiling time (for higher viability of plant propagules); Overburden to bury toxic materials below depth of root penetration  <b>Other:</b> Off-site impacts can extend 15–25 ha per ha mined; gravel pits may alter hydrology; Visual screening and wildlife habitat enhancement; Select sites to maximize natural reinvasion (near seed sources)	Review recommendations all applicable; Commit to ≥10–15 cm salvage/respread where feasible; design borrow pits near propagule sources; Integrate microtopography and erosion controls
36	MVLWB	2013	<i>Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories</i>	Guideline	Reclamation; Revegetation; Topsoil Salvage; Soil Amendment; Surface Preparation; Mining; Inuit	Northwest Territories, Mackenzie Valley	Arctic/Subarctic; Permafrost	<b>Revegetation:</b> Natural revegetation; Active enhanced revegetation (seeding, planting, cuttings); Recommend native plant collection and propagation methods, successional processes, and final plant communities that provide biodiversity and sustainability; Organic topsoil stockpiles as a seed bank; Transplant vegetation from areas at present risk of loss; Species selection: locally adapted native plants, low potential for metal	Government Guidelines for Reclamation Practices in NWT (also applicable to Nunavut)

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
								<p>accumulation, plants that neither attract or repel wildlife, avoid non-native except in emergency erosion control</p> <p><b>Site Preparation:</b> Re-grading and slope stabilization; Contour and scarify; Organic supplements should be used (e.g., peat, biosolids); Strip, stockpile, and properly cover organic and fine-grained soils (record volumes); Amend coarse materials (e.g., waste rock) with finer grade materials; gravel layer (capillary break) to prevent movement of contaminated materials upward to rooting zone in contaminated areas; Soil Amendments: organic materials, mulches, fertilizers, or other temporary soil amendments; Fertilizers in northern environments has the potential to impact downstream water bodies (nutrient runoff)</p> <p><b>Other:</b> Bioengineering - stabilize soils, control erosion, enhance natural revegetation: Wattle fences, live gravel bar staking, and rough and loose staking to stabilize embankments; monitor metals uptake; Wind breaks for erosion control; Local Studies: characterize the local climate, temperature, precipitation, wind; manage effects on ground thermal regime; Permafrost aggradation into soil stockpiles; Consider effect of vegetation on near-surface permafrost (e.g., tall shrubs); Post-Closure Monitoring - consider passive monitoring approaches including aerial surveillance and remote sensing; Stakeholder engagement; Robust geotechnical designs for 1000-year horizon; Inuit Engagement: Establish closure and reclamation stakeholder working group; maintain engagement record; engage Inuit in site monitoring and have regular site visits; share reporting with Inuit governments; integrate Inuit input and western science; develop 3-D model to scale of the pre-development landscape, the mine during operations, and the final closure landscape; Engagement should focus on addressing specific issues and providing input into the development of closure objectives, closure options, relevant reclamation research, and other key closure issues to produce an acceptable conceptual CRP; public meetings/face-to-face meetings/workshops</p>	
37	Nunavut RAC (Nunavut Regional Adaptation Collaborative)	2012	<i>Good Environmental Practices for Northern Mining and Necessary</i>	Guideline	Climate Change; Mining; Inuit	Nunavut, Steensby Port & Meadowbank TMF	Arctic Tundra; Permafrost; Coastal	<p><b>Revegetation:</b> Recommendations: Revegetation of downstream slopes TMFs (e.g., through encouraging natural revegetation); Revegetation of TMF caps (to establish permafrost and stability)</p> <p><b>Site Preparation:</b> TMFs with thaw-stable foundations; Summary of "Good Environmental Practice Considerations in Canadian Permafrost Regions"; Permafrost degradation is a</p>	Embed climate risk assessment in EA/CRP; design TMFs for thaw-stability; instrument dams (thermistors, piezometers); plan port logistics for short/long open-water seasons; set design

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
			<i>Infrastructure (Task 2 Report)</i>					concern (soil temperature, increasing active layer depths, increasing surface runoff, changing drainage patterns as a result of subsidence and thermokarst formations, and increasing sediment loadings and mass wasting on slopes)  <b>Other:</b> Incorporate climate adaptation; Recommended Best Management Practices for Climate Change Adaptation; Call for NIRB guidance formalizing climate risk frameworks; Continuous data collection (water levels, waves, ice, currents)	elevations for flood/erosion per 1:200 events
38	Neby, M.; Semenchuk, P.; Neby, E.; Cooper, E.J.	2022	<i>Comparison of methods for revegetation of vehicle tracks in High Arctic tundra on Svalbard</i>	Research (Primary)	Revegetation; Surface Preparation; Soil Amendment; Vehicle-tracks	Norway, Svalbard, Adventdalen	High Arctic Tundra; Cassiope/Dryas dwarf-shrub heath; Vehicle-track Disturbance; Substrate: Intact soil and seed bank	<b>Revegetation:</b> Passive revegetation effective: intact (but reduced) seed bank and small disturbance; Active revegetation: Local seed/cutting addition had limited benefit over natural revegetation; By year 8, vegetation cover still less than reference and bryophyte-dominated (composition different); No treatments successful in advocating the growth of the dwarf shrubs <i>Dryas</i> and <i>Cassiope</i>  <b>Site Preparation:</b> Treatments: C control, F fertilizer, FG fertilizer × garden cloth; G garden cloth, P plant cutting addition, S seed/bulbil addition, T tilling; Fertiliser (low NPK) most effective at increasing total vegetation cover (71% vegetation cover, of which 62% were bryophytes and 38% were vascular plant species); Garden cloth created modest microclimate benefit (~+0.3°C); Tilling had minimal effect  <b>Other:</b> Highlights importance to minimize disturbance and avoid vehicles on unfrozen tundra; Strong time effect; Risk of non-native ingress; Highlights very slow recovery of <i>Cassiope/Dryas</i> shrubs	Not directly applicable since revegetation of <del>intact</del> soil and seed bank much different than mine reclamation
39	Audet, P.; Settingington, M.A. (EDI Environmental Dynamics Inc.)	2024	<i>Challenges of Reclamation in the Canadian High Arctic: Pilot Study at an Active Mine Site on North Baffin Island, Nunavut</i>	Research (Primary)	Revegetation; Surface Preparation; Mining	Nunavut, North Baffin Island, Mary River Project	High Arctic Tundra; Xeric/Subxeric; Glaciofluvial & Morainal Parent Materials; Sandy Loam, Coarse Fragments; Restrictive till layer (~20–29 cm); Polygonal Ground; Turbic Cryosols; Permafrost near-surface; High wind; Disturbed Sites: Roadside/Abandoned airstrip	<b>Revegetation:</b> Natural revegetation of native grasses, sedges, forbs, shrubs occurs (1, 1-3, 5, >40 year disturbance chronosequence); 60–70% cover after >40 yrs (exploration activities); early colonizers present by 1–3 yrs (species list provided); lichen absent on disturbed plots across all timeframes; proximity of intact vegetative mats supports passive recovery by natural revegetation  <b>Site Preparation:</b> Surface preparations (“rough & loose”, track packing) had limited functional value (degraded within ~1 year on sandy sites); shallow earthworks (<35 cm) to avoid permafrost impacts; stability maintained	Expect slow recovery; prioritize protecting adjacent vegetation, erosion control; use shallow earthworks; consider turf transplants/bryophytes; set timelines in decades and track early colonizers (sedges/forbs)

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
								<b>Other:</b> No exotics observed; Constraints include wind erosion and substrate type; Importance of minimizing incidental disturbance	
40	CAVSI (Circumpolar Arctic Vegetation Science Initiative) Organizing Group (Walker et al.)	2025	<i>Circumpolar Arctic Vegetation Science Initiative (CAVSI): A Framework to Guide the Next Decade of Arctic Vegetation Research</i>	Guideline	Revegetation; Climate Change; Monitoring; Inuit	Circumpolar Arctic	Arctic; Polygonal Ground; Shrub Tundra; Wetlands; Permafrost	<b>Other:</b> Research Priorities include: Climate change and disturbance regimes, community engagement and indigenous; Recommendations/Guidelines: Standardized monitoring/survey methods, archives, and classification to detect Arctic vegetation change; Plot-based tracking of stratification/greening and biodiversity shifts; Indigenous Priorities – “Prioritize the inclusion of indigenous communities in research efforts, ensuring that conservation strategies align with local knowledge and values. Develop frameworks for collaboration that enhance the benefits of research for indigenous communities”	Research tools which may be applicable to northern mines (e.g., vegetation lists, vegetation monitoring methods, etc.); Indigenous Priorities
41	Kokelj, S.V.; Lantz, T.C.; Tunnicliffe, J.; Segal, R.; Lacelle, D.	2017	<i>Climate-driven thaw of permafrost preserved glacial landscapes, northwestern Canada (G38626.1)</i>	Research (Primary)	Climate Change	Northwestern Canada; Circumpolar Arctic	Arctic; Permafrost; Thermokarst	<b>Other:</b> Climate-driven geomorphic transformation expected (vegetation community change as well); Highlights sensitivity of ice-rich terrain; Avoid deep cuts that expose ground ice; Avoid actions that trigger thermokarst; Account for sediment mobilization risks;	Climate change impacts in Arctic and permafrost environments
42	ITK (Inuit Tapiriit Kanatami)	2019	<i>National Inuit Climate Change Strategy</i>	Guideline	Climate Change; Inuit	Nunavut	Arctic	<b>Other:</b> Climate change priorities include: 2) health, well-being, and the environment; 3) food systems; Permafrost thaw a concern	Climate change identified as a concern and consideration; Minimal other detail
43	Rio Tinto (Diavik Diamond Mines Inc.)	2025	<i>Diavik Final Closure &amp; Reclamation Plan</i>	Industry (Closure Plan)	Reclamation; Revegetation; Surface Preparation; Topsoil Salvage; Substrate; Mining; Inuit	Northwest Territories, Lac de Gras, Diavik Diamond Mine	Low Arctic Tundra; Waste Rock; Coarse Waste Rock; Till; Lake; Contaminated: Coarse Processed Kimberlite (CPK), Processed Kimberlite Containment Facility (PKCF), open pits, dikes, water management ponds; Non-contaminated: infrastructure areas, airstrip, roads, and laydown areas	<b>Revegetation:</b> Natural revegetation (passive colonization) in contaminated areas (e.g., PKCF, Rock Piles, WTA, fuel tank farms, etc.); Active (assisted) revegetation using native plant seeding (25 kg/ha seed, UTV-mounted seed spreader and hand seeding, rake or UTV harrow afterwards, early pioneer native species [some not local to Diavik area], 3:1 grass to forb mix from commercial seed supplier) in priority non-contaminated areas (e.g., roads, airstrip, laydowns, plant sites); Native seed effective on crushed rock, sediment, and mixes with PK; Use native plants; Shrub cuttings or seeding were not successful in trials; Seeding grasses and forbs accelerated reclamation success; Transplanting: Transplanting was not considered practical or reasonable as it would be destructive of the undisturbed ground and be a significant effort (time and cost)  <b>Site Preparation:</b> Non-contaminated areas: Scarification including recontouring and deep ripping (medium dozer [e.g.,	Reclamation methods all applicable (but location low Arctic); Seed mix species; Revegetation trial performance applicable; TK Panel; Infographic of Mine Reclamation timeline; Appendix X-9 "Revegetation Strategy Report"; Reclamation research final report (literature review, TK) in Appendix X-16 of CRP V4.1 (Naeth et al. 2018)

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
								<p>CAT D10] with plow or t-plow to a depth of 10-25 cm); Contaminated areas covered with coarse waste rock and no other treatment (natural revegetation by lichen and moss); Soil amendments: Sewage sludge mixed with till in progressive reclamation; Material: waste rock and till, CPK (Coarse Processed Kimberlite); Materials on site identified as suitable for reclamation: organic, organic over glaciolacustrine, and glaciolacustrine materials; Seeding performance was effective on crushed rock as other reclamation substrates (but best on organic amendments like salvaged soil, sewage, peat); Microtopography: improve plant establishment through scarification/deep ripping, variable rock size; Amendments: Amendments (specifically topsoil salvage and organics), while beneficial, deemed to be impractical for implementation at large scale and other amendments such as biochar not recommended based on research results; Bryophyte recovery best on crushed rock (expected recovery 5+ years)</p> <p><b>Other:</b> TK Panel: Passive revegetation preferred (but active needed in some instances), Avoid active revegetation in areas with chemical or waste storage (e.g., PKCF) and instead allow vegetation to return naturally when conditions safe (avoid attracting wildlife to contaminated area and time to heal), cap NCRP with till and rock layers and focus revegetation efforts around the water collection ponds at the base of the pile, Scarification of rock can impede wildlife and human movement (Leave wildlife movement routes when scarifying roads and laydowns); Monitoring: annually until mean 5% cover met, expected in 5-10 years, TK monitoring focus; Erosion Control: crushes rock in erosion prone areas inherently resistant, erosion blankets and jutes in high risk areas</p>	
44	Diavik Diamond Mines Inc. (Prepared by WSP)	2025	Revegetation Strategy Report	Industry (Closure Plan)	Reclamation; Revegetation; Surface Preparation; Topsoil Salvage; Substrate; Mining; Inuit	Northwest Territories, Lac de Gras, Diavik Diamond Mine	Low Arctic Tundra; Waste Rock; Coarse Waste Rock; Till; Lake; Contaminated: Coarse Processed Kimberlite (CPK), Processed Kimberlite Containment Facility (PKCF), open pits, dikes, water management ponds; Non-contaminated:	<p><b>Revegetation:</b> Natural revegetation (passive colonization) in contaminated areas (e.g., PKCF, Rock Piles, WTA, fuel tank farms, etc.); Active (assisted) revegetation using native plant seeding (25 kg/ha seed, UTV-mounted seed spreader and hand seeding, rake or UTV harrow afterwards, early pioneer native species [some not local to Diavik area], 3:1 grass to forb mix from commercial seed supplier) in priority non-contaminated areas (e.g., roads, airstrip, laydowns, plant sites); Native seed effective on crushed rock, sediment, and mixes with PK; Use native plants; Shrub cuttings or seeding were not successful in trials; Seeding grasses and forbs accelerated reclamation success; Transplanting: Transplanting was not considered</p>	Reclamation methods all applicable (but location low Arctic); Seed mix species; Revegetation trial performance applicable; TK Panel; Infographic of Mine Reclamation timeline; Appendix X-9 "Revegetation Strategy Report"; Reclamation research final report (literature review, TK) in Appendix X-16 of CRP V4.1 (Naeth et al. 2018)

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
							infrastructure areas, airstrip, roads, and laydown areas	<p>practical or reasonable as it would be destructive of the undisturbed ground and be a significant effort (time and cost)</p> <p><b>Site Preparation:</b> Non-contaminated areas: Scarification including recontouring and deep ripping (medium dozer [e.g., CAT D10] with plow or t-plow to a depth of 10-25 cm); Contaminated areas covered with coarse waste rock and no other treatment (natural revegetation by lichen and moss); Soil amendments: Sewage sludge mixed with till in progressive reclamation; Material: waste rock and till, CPK (Coarse Processed Kimberlite); Materials on site identified as suitable for reclamation: organic, organic over glaciolacustrine, and glaciolacustrine materials; Seeding performance was effective on crushed rock as other reclamation substrates (but best on organic amendments like salvaged soil, sewage, peat); Microtopography: improve plant establishment through scarification/deep ripping, variable rock size; Amendments: Amendments (specifically topsoil salvage and organics), while beneficial, deemed to be impractical for implementation at large scale and other amendments such as biochar not recommended based on research results; Bryophyte recovery best on crushed rock (expected recovery 5+ years)</p> <p><b>Other:</b> TK Panel: Passive revegetation preferred (but active needed in some instances), Avoid active revegetation in areas with chemical or waste storage (e.g., PKCF) and instead allow vegetation to return naturally when conditions safe (avoid attracting wildlife to contaminated area and time to heal), cap NCRP with till and rock layers and focus revegetation efforts around the water collection ponds at the base of the pile, Scarification of rock can impede wildlife and human movement (Leave wildlife movement routes when scarifying roads and laydowns); Monitoring: annually until mean 5% cover met, expected in 5-10 years, TK monitoring focus; Erosion Control: crushes rock in erosion prone areas inherently resistant, erosion blankets and jutes in high risk areas</p>	
45	Miller, V.S.; Naeth, M.A.; Wilkinson, S.R.	2021	<i>Microtopography and organic amendments for reclamation of waste materials at an arctic diamond mine</i>	Research (Primary)	Reclamation; Surface Preparation; Substrate; Revegetation; Mining	Northwest Territories, Lac de Gras, Diavik Diamond Mine	Low Arctic Tundra; Permafrost; Substrates: crushed rock, processed kimberlite (PK), lakebed sediment	<p><b>Revegetation:</b> Active seeding grass/forb mix applied to all substrate treatment (wild collected in NWT but not site, rate of 1g or 1,600 seeds/m<sup>2</sup>) - <i>Elymus trachycaulus</i>, <i>Poa glauca</i>, <i>Poa alpina</i>, <i>Oxytropis deflexa</i> best establishment (<i>Eriophorum angustifolium</i> natural colonization); Seeding best performance on crushed rock with incorporated sewage sludge (5-10 cm); Passive revegetation of moss/lichen (increased by year 4, best</p>	Reclamation methods all applicable (but location low Arctic): Prioritize gravel/rock substrates for covers; incorporate biosolids where permitted; create Depressions/furrows on smooth pads; plan for bryophyte/lichen

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
								<p>on crushed rock without amendments); Plant diversity low after 4 years</p> <p><b>Site Preparation:</b> Substrates: crushed rock best substrate for seeded plants (plant density 8x more than PK and 2x lake sediment) and moss/lichen; Soil Amendments: sewage sludge even at small amounts improved growth and seed head frequency of seeded species, salvaged soil incorporated at small amounts had minimal effect (capping, direct placement may have been better), moss and lichen best on crushed rock without additional amendments; Microtopography (depressions, furrows) enhance revegetation on PK (large depressions best for PK and more resistant to erosion); Soil Lynx (Anionic polymer erosion control product) ineffective on mine wastes (sandy); Erosion Control</p> <p><b>Other:</b> Apply heterogeneity and patch application (e.g., sewage); Salvaged soil less effective at low rate; PK was substrate with the poorest plant establishment and not suitable without amendment; Grazing observed</p>	trajectory; consider geotextiles/mulches for erosion
46	Naeth, M.A.	2004	<i>Revegetation of Disturbed Sites at Diavik Diamond Mine, N.W.T. – Research Proposal (Appendix L)</i>	Research (Review)	Reclamation; Surface Preparation; Substrate; Topsoil Salvage; Soil Amendment; Revegetation; Mining	Northwest Territories, Lac de Gras, Diavik Diamond Mine	Low Arctic Tundra; Permafrost	<p><b>Revegetation:</b> Synthesis of prior research: Plant species with demonstrated revegetation potential by substrate type; Native cultivars often outperform wild seed; Wild seed set can be low and cyclic in nature; Fall broadcast seeding (prior to snowfall) to leverage spring moisture; Shrub and bryophyte establishment methods still needed</p> <p><b>Site Preparation:</b> Synthesis of prior research: organic amendments (sewage, peat, topsoil) improve establishment; Research Proposal: 6 Substrate (50 cm): glacial till, processed kimberlite, glacial till and topsoil, processed kimberlite and topsoil, glacial till and processed kimberlite, and no substrate addition; 3 Amendments (10–20 cm incorporation): Sewage sludge, inorganic fertilizer; Reduced Nitrogen application rates for natives</p> <p><b>Other:</b> Kimberlite constraints; Topsoil scarcity - minimize topsoil use while maximizing benefits; Soil chemical parameters: available macro and micronutrients, total organic carbon, pH, electrical conductivity; Soil physical parameters: bulk density, penetration resistance, percent organic matter, soil moisture, temperature, temperature, moisture; Sewage Sludge Contaminants: fecal coliforms, Salmonella, heavy metals</p>	Reclamation methods all applicable (but location low Arctic): Design factorial field trials on available substrates; use fall seeding; prioritize organic amendments; tailor N rates; include bryophyte/shrub techniques

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
47	Naeth, M.A.; Wilkinson, S.R.	2014	<i>Establishment of restoration trajectories for upland tundra communities on diamond mine wastes in the Canadian Arctic</i>	Research (Primary)	Reclamation; Revegetation; Substrate; Soil Amendment; Topsoil Salvage; Mining	Northwest Territories, Lac de Gras, Diavik Diamond Mine	Low Arctic Tundra; Permafrost; Substrates (5): processed kimberlite, glacial till, gravel, mixes; Amendments (4): inorganic fertilizer, salvaged soil, sewage sludge, water treatment sludge	<p><b>Revegetation:</b> Native species seed mixes (5 - Forbs, Diverse, Non-Aggressive, Drought tolerant, Adaptable) and natural regeneration investigated; Seeding essential to establish vascular vegetation cover; Seed mix composition/diversity had no effect on plant community development after 5 years; Natural revegetation on gravel had greatest moss regeneration (but limited vascular cover); Fertilizer may favour graminoids and may prevent natural revegetation but increased cover</p> <p><b>Site Preparation:</b> Substrates (5): processed kimberlite, glacial till, gravel, mixes; Amendments (4): inorganic fertilizer, salvaged soil, sewage sludge, water treatment sludge; Processed kimberlite had high and potentially plant toxic concentrations of heavy metals chromium, cobalt, and nickel; Addition of fine textured materials (e.g., glacial till) to coarse mine wastes improved nutrient and water retention and enhanced revegetation; Sewage and inorganic fertilizer increased available nitrogen/phosphorus, plant density/cover; Soil amendment increased species richness; Topsoil in their study had limited source of propagules likely because it was stockpiled for more than 6 months and soil horizons were admixed</p>	Reclamation methods all applicable (but location low Arctic)
48	Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC)	2025	<i>Northern Abandoned Mine Reclamation Program</i>	Government Program	Reclamation; Mining	Yukon, Northwest Territories (8 sites: Faro Mine, Giant Mine, Cantung Mine, Clinton Creek Mine, United Keno Hill Mine, Mount Nansen Mine, Ketzka River Mine, Great Bear Lake)	Arctic/Subarctic	<p><b>Revegetation:</b> Faro Mine: Community-led revegetation using locally sourced tree seedlings (planting), erosion control seeding</p> <p><b>Site Preparation:</b> Faro Mine: Re-shaping, covering, establishing surface drainage on waste rock and tailings</p> <p><b>Other:</b> Collaboration with Indigenous and Territorial governments; Employment and business opportunities for impacted communities</p>	Projects are mostly sub-arctic rather than tundra; Recommendations and findings still applicable (e.g., Indigenous community engagement, progressive reclamation, integrate cultural values and local plant species in revegetation plans)
49	Lamarre, J. J. M.; Dhar, A.; Naeth, M. A.	2023	<i>Arctic ecosystem restoration with native tundra bryophytes</i>	Research (Primary)	Reclamation; Bryophyte Propagation; Substrate; Surface Preparation; Mining	Northwest Territories, Lac de Gras, Diavik Diamond Mine & Iceland, Heiðmörk	Arctic; Substrates: crushed rock, lake sediment, processed kimberlite, acidic volcanic silt loam, acidic crushed lava	<p><b>Revegetation:</b> Bryophyte propagation (small, medium, large fragments) in slurry with water apply to substrate or on top of erosion control cheese cloth; Large (2.1–40 mm) fragments and erosion control yielded highest live cover; Medium (1.1–2.0 mm) fragments without erosion control had highest density; Small (&lt;1 mm) less effective; Bryophyte collection local (within 1 km), Species occurring naturally in disturbed areas included <i>Dicranum</i> and <i>Polytricum</i> spp.; Species which had higher cover in propagation experiments was <i>Ceratodon purpureus</i> (small and large fragments) and <i>Racomitrium lanuginosum</i> (medium</p>	Bryophyte propagation and revegetation methods applicable; Surface preparation and substrate recommendations

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
								<p>fragments) [acid tolerant]; Additional bryophytes colonized trial sites naturally</p> <p><b>Site Preparation:</b> Erosion Control: Cheesecloth increased significantly increased bryophyte live cover, total cover, species occurrence, and density, and moderated soil temps; Substrates (50 cm depth over gravel pads): Heterogeneous (crushed rock/volcanic silt/lava) outperformed homogeneous (processed kimberlite/lake sediment) for bryophyte revegetation - higher live cover, density, and spontaneous colonization bryophytes with substrates with 1 to 5 cm surface variability; Homogeneous substrates have less microhabitats or areas to trap propagules and more susceptible to erosion; Retain or create microtopographic heterogeneity; Avoid overly smooth surfaces; Tailor fragment size to erosion control availability</p> <p><b>Other:</b> Gravel pads built to protect permafrost: layer of boulders over tundra, followed by a layer of small to mid-sized rocks, topped with 50 cm of gravel (Dhar et al. 2022)</p>	
50	Drozdowski, B. L.; Naeth, M. A.; Wilkinson, S. R.	2012	<i>Evaluation of substrate and amendment materials for soil reclamation at a diamond mine in the Northwest Territories, Canada</i>	Research (Primary)	Reclamation; Substrate; Soil Amendment; Topsoil Salvage; Revegetation; Mining	Northwest Territories, Lac de Gras, Diavik Diamond Mine	Arctic; Substrates (30-40 cm over 50 cm gravel): glacial till (clay to boulders >1 m in diameter), gravel, processed kimberlite (silicon, magnesium, iron [95% sand]), 50:50 processed kimberlite and till, 25:75 processed kimberlite and till (till 68% sand and 27% silt)	<p><b>Revegetation:</b> Native seed mixes; Season of seeding had not effect; <i>Poa glauca</i> dominated most treatments; <i>Elymus violaceus</i> (<i>Agropyron violaceum</i>) dominated processed kimberlite; <i>Festuca saximontana</i> dominated gravel</p> <p><b>Site Preparation:</b> Substrates (30 to 40 cm over 50 cm gravel): glacial till (clay to boulders &gt;1 m in diameter), gravel, processed kimberlite (silicon, magnesium, iron [95% sand]), 50:50 processed kimberlite and till, 25:75 processed kimberlite and till (till 68% sand and 27% silt); Amendments: salvaged topsoil, sewage sludge, inorganic fertilizer, water treatment facility sludge, none; Mixes of processed kimberlite and till enhanced soil structure and reduced adverse element concentrations; Vegetation grew on all treatments (no clear best treatment in all conditions), but plant response was most favourable in 25:75 processed kimberlite and till with sewage sludge; Amendment salvaged topsoil provided the most consistent increase in plant density among substrates (soil should be salvaged); Sewage had adverse high concentrations of high copper, molybdenum, phosphorus, selenium, sulphate and zinc; Unamended gravel performed well and among best for plant growth; Lowest plant densities occurred in unamended processed kimberlite</p>	Reclamation methods all applicable (but location low Arctic)
51	Jorgenson, M. T.; Joyce, M. R.	1994	<i>Six Strategies for Rehabilitating</i>	Research (Review)	Reclamation; Revegetation;	Alaska	Arctic Tundra; Permafrost;	<p><b>Revegetation:</b> Plant Species selection: locally adapted native species, pioneer species found in disturbed areas, N-fixing</p>	Reclamation methods all applicable (but older publication)

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
			<i>Land Disturbed by Oil Development in Arctic Alaska</i>		Topsoil Salvage; Soil Amendment; Oil		Disturbances: gravel mine sites and overburden stockpiles, gravel roads and pads, gravel spray/road dust, contaminants	<p>legumes; Seeding: native grass cultivars with fertilization on gravel pads with some success (lower diversity but facilitate soil development and increase soil moisture, but may inhibit natural colonization); Thick gravel xeric forbs: <i>Draba</i> spp., <i>Cochlearia officinalis</i>, <i>Braya purpurascens</i>, <i>Epilobium latifolium</i>) and grasses (mainly <i>Festuca baffinensis</i>); Natural colonization in wetlands facilitated by fertilization (preferred over non-local seeding); Natural colonization in areas of minor tundra disturbance suggested (e.g., off-road vehicles)</p> <p><b>Site Preparation:</b> Techniques for modifying the hydrologic balance include the creation of small berms to capture drifting snow, various soil amendments to increase water retention, mulch (e.g., straw) to reduce evaporation; Techniques for increasing nutrient availability include application of organic topsoil and sewage sludge; Gravel fill reduces plant germination (thinner fill had better plant establishment); Leaving 20-30 cm depth gravel fill to prevent permafrost degradation (removal would cause permafrost degradation and wetter conditions)</p> <p><b>Other:</b> Berms (50 cm, 1m) capture snow and increase soil moisture early summer; Pond creation: Inoculation of created pond with natural pond water and sediments to provide a medium for introducing aquatic bacteria, algae, and invertebrates; Wetlands/wet tundra easier to restore than moist or dry tundra (wetlands have early successional species, while moist and dry tundra have slower to develop vegetation structures and later successional species with slower growth rates); Remediation of contaminated soils</p>	in 1994 and improvements since then)
52	Lemay, E.; Côté, S. D.; Tremblay, J. P.	2021	<i>How will Snow Retention and Shading from Arctic Shrub Expansion Affect Caribou Food Resources?</i>	Research (Primary)	Revegetation; Snow fencing	Québec, Nunavik, Deception Bay	High Arctic Tundra; Permafrost; Dominant plants: herbaceous tundra with dwarf shrubs and grasses	<b>Other:</b> Snow fences (9 m long and 1 m high) installed perpendicular to the prevailing south-easterly winter winds for snow accumulation - Increased snow cover combined with ambient light increased foliar biomass of <i>Betula glandulosa</i> (better caribou forage), increased snow depth did not alter the nitrogen content in the leaves of plants but decreased phenolic concentrations	Snow fences have some potential for application to increase soil moisture and vegetation cover
53	USGS	2000	<i>Native Plant Revegetation Manual for Denali National Park and Preserve</i>	Guideline	Revegetation; Soil Amendment; Topsoil Salvage	Alaska, Denali National Park	Subarctic; Boreal Forest; Alpine Tundra	<b>Revegetation:</b> Natural revegetation recommended where possible; Species Selection: early colonizers, species with high density/cover/visual appeal, naturally colonize disturbed sites with harsh conditions (e.g., roadsides similar to gravel bars), density limited by propagule presence or seedling establishment, easy to ID for seed collection, Table 9 summarizes success; Seeding legume and wheatgrass native mix on well-drained,	Revegetation methods applicable (but location sub-arctic)

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
								<p>nutrient-poor soils with high gravel and sand content, direct seeding, raking to 1-2.5 cm depth following seeding, cover increases in year 3-4 (e.g., <i>Hedysarum</i>, <i>Oxytropis</i>, and (occasionally) <i>Astragalus</i>, <i>Agropyron</i> spp. [<i>Elymus</i> spp.]); Erosion control using non-native annual cover crop like <i>Lolium multiflorum</i> or installing erosion control mats or bioengineering structures (live staking, brush bars, hedge layering); Collecting native seed - late July and lasts until late August, processing; Transplanting: source tundra vegetation mats from construction area prior to disturbance, cut using Pulaski tool, store for up to several years, scarify substrate prior to transplanting; Container-grown plants; Seed collection; Willow live stake cuttings (riparian willows like <i>Salix alaxensis</i>, <i>S. arbusculooides</i>, <i>S. barclayi</i>, <i>S. planifolia</i>, <i>S. pulchra</i>)</p> <p><b>Site Preparation:</b> Topsoil salvage (active layer above permafrost, careful storage, 10-20 cm depth); Rip compacted sites to a depth of 20-50 cm; Stabilize soils (e.g., terracing, scarification); Slow release fertilizer (e.g., MagAmp 7-52-6 NPK or Osmocote 14-14-14 NPK 2-year-release form at a rate of 560 kg/ha); Nitrogen-fixing Rhizobium bacteria</p>	
54	Viereck, L. A.	1966	<i>Plant succession and soil development on gravel outwash of the Muldrow Glacier, Alaska</i>	Research (Primary)	Revegetation; Chronosequence; Plant Succession; Soil Development	Alaska, Muldrow Glacier	Subarctic Alpine Tundra; Shrub Birch Tundra; Gravel Outwash (Stands are: (1) 4 km x 1 km Pioneer; (2) 3 km x 1 km Meadow; (3) 3 km x 1 km Early Shrub; (4) Late Shrub; (5) 16 km Climax)	<p><b>Revegetation:</b> Natural revegetation - long time series, list of plant species included according to successional stage (early successional species in slightly altered coarse river gravel with some mine materials, pH 8: <i>Dryas drummondii</i>, <i>Dryas integrifolia</i>, <i>Astragalus ananaic</i>, <i>Astragalus nutzotinensis</i>, <i>Hedysarum madcenzii</i>, <i>Oxytropis gracilis</i>, <i>Ditrichum flexicaule</i>, <i>Stereocaulon paschale</i>, <i>Populus balsamifera</i>, <i>Salix alaxensis</i> [many N-fixing]; Meadow stage: <i>Elymus innovatus</i>, shrubs expand but less new establishment [i.e., shrubs establish before grasses dominate]; Shrub stages: <i>Vaccinium</i> and <i>Betula</i> replace willows and moss layer develops further; Climax: shrub birches decrease in height/grow prostrate and moss layer develops, and possible establishment of <i>Eriophorum vaginatum</i> tussocks)</p> <p><b>Other:</b> Chronosequence: 25-30 years Pioneer, 100 years Meadow, 150-200 years Early Shrub, 200-300 years Late Shrub, 5,000-9,000 years Climax Tundra; Diagram of vegetation changes through succession provided; Permafrost development leads to greater soil moisture in summer (reduces drainage); Snow accumulation as vegetation develops</p>	Successional trajectory provides information on possible natural revegetation and implications of active revegetation (e.g., species which can grow in gravel and low nutrient, early successional shrubs should seed before grasses dominate since they are inhibited by dense grass)

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
55	ABR Inc.	2007	<i>Red Dog Mine Closure and Reclamation Plan - SD F3: Revegetation Plan for the Red Dog Mine</i>	Industry	Reclamation; Revegetation; Soil Amendment; Topsoil Salvage	Alaska, DeLong Mountains, Red Dog Mine	Low Arctic Tundra	<p><b>Revegetation:</b> Natural revegetation much less cover but with more species diversity; Seeding with fertilization higher cover but less species diversity (dominated by grasses) and reduced (inhibited) natural selection - suggest seeding native grasses/forbs at low rate (20 lb/acre, generally in fall [Sept] or early spring); Species selection: locally collected native species, commercial native cultivars (Arctared fescue and Bering hairgrass not recommended), agronomic non-native species (not recommended), native legumes (N-fixing); Natural colonizers (e.g., <i>Cerastium beeringianum</i>, <i>Epilobium latifolium</i>, <i>Calamagrostis canadensis</i>, <i>Polemonium boreale</i>, <i>Carex podocarpa</i>, <i>Senecio lugens</i>, <i>Draba hirta</i>, <i>Stellaria longipes</i>, <i>Artemisia campestris</i>, <i>Lesquerella</i> sp, <i>Astragalus</i> spp, <i>Poa arctica</i>, <i>Festuca altaica</i>, <i>Artemisia arctica</i>, <i>Trisetum spicatum</i>, shrub birch, <i>Oxytropis borealis</i> wet with <i>Juncus/Eriophorum angustifolium/Equisetum arvense</i>); Areas with minor disturbance allow natural revegetation with light fertilizer (100–200 lb/acre of 20-20-10 NPK); Areas with poor revegetation potential recommended to allow natural succession and monitor what plants able to colonize poor soils; Live staking of shrub (willow) cuttings in wet areas (collected spring, stored frozen till June); Native legumes: <i>Astragalus alpinus</i>, <i>Hedysarum mackenzii</i>, <i>Oxytropis deflexa</i>, <i>O. borealis</i>, <i>O. campestris</i>, <i>O. maydelliana</i>; <i>Artemisia tilesii</i>; Seed collection: forbs in July/August, grasses/sedges in Sept; Stockpile seeding species selection: Nortran hairgrass, Tundra bluegrass, Alpine bluegrass, Spike trisetum, Thickspike wheatgrass, Polargrass Bluejoint (20 lbs/acre), Tilesy sage, Alpine milkvetch, Alpine sweetvetch, Boreal sweetvetch, Field Oxytrope, Boreal yarrow, Tall fireweed, Siberian aster, Arctic bladderpod (40 seeds/yard<sup>2</sup>)</p> <p><b>Site Preparation:</b> Recontour and scarify for decompaction; Re-establish natural drainages; Removal of contaminated soils; Acid-contaminated sites (fugitive dust) treated with pelletized dolomitic lime but results not known; Fertilizer application (e.g., 400-450 lb/acre of 20:20:10 NPK); Sewage sludge had better long-term performance of seeded native cultivars (vs. fertilizers which deplete nutrients quickly)</p> <p><b>Other:</b> Reclamation registry to record activities; Berms for snow capture; Rock or boulder placement</p>	Revegetation methods applicable

#	Author(s)	Year	Title	Source Type	Topic(s)	Geographic Location	Site Condition	Key Findings	Applicability to the Goose Project
56	Dominion Diamond Mines Ltd.	2018	<i>Ekati Diamond Mine Interim Closure and Reclamation Plan (Version 3.0)</i>	Industry	Reclamation; Revegetation; Topsoil Salvage; Soil Amendment; Surface Preparation; Mining	Nunavut, Lac de Gras, Ekati Mine	Subarctic; Substrate: Diamond mine waste materials such as processed kimberlite	<p><b>Revegetation:</b> Plant Species Trials (PK): planting of native grasses, forbs, shrubs, and sedges; Revegetation Methods (Kimberlite Waste Rock and Coarse Processed Kimberlite): Native seed mixes of grasses, forbs, and shrubs, transplanting locally harvested grasses and mosses, and planting seedlings; maintain islands of undisturbed vegetation to provide a seed source for revegetation; Successful candidates for revegetation: Hulten Bering’s tufted hairgrass (<i>Deschampsia beringensis</i>; 53%), creeping red fescue (<i>Festuca rubra</i>; 33%), tufted hairgrass (<i>Deschampsia caespitosa</i>; 16%), and alpine bluegrass (<i>Poa alpina</i>; 11%)</p> <p><b>Site Preparation:</b> Stabilization of Lowland Areas Trials (PK): mounding and ripping techniques; Rock and Cover Combination Trials (PK): boulder field creation; Surface Roughening (PK): mounding, ripping, application of coarse till material; Mycorrhizae Trials (PK): native mycorrhizae collection; Organic Matter Incorporation Trials (PK): bio pellet and compost trials; Amendments (Kimberlite Waste Rock and Coarse Processed Kimberlite): lakebed sediment, bio pellets, compost, topsoil, fertilizers; Other Amendments: sewage sludge, rock phosphate, calcium carbonate, gypsum; Sewage Sludge - evaluations for potential adverse impacts (e.g., pathogens, heavy metals, and nitrates), Winter application of sewage sludge significantly reduced the health risk associated with using a biosolid waste material as a soil amendment to 0.02% of the original fecal coliform (<i>Streptococcus</i>) and <i>Salmonella</i> levels</p>	Reclamation methods all applicable

Notes;

cm = centimetres; C/N = carbon/nitrogen; CRP = Closure and Reclamation Plan; EA = Environmental Assessment; FCSAP = Federal Contaminated Sites Action Plan; ha = hectares; kg = kilograms; lbs = pounds; m = metres; m<sup>2</sup> = square metres; N-fixing = nitrogen-fixing; NCSP = Northern Contaminated Sites Program; NPK = nitrogen, potassium, phosphorus; NWT = Northwest Territories; PK = Processed Kimberlite; PKCF = Processed Kimberlite Containment Facility; TK = traditional knowledge; TMF = Tailings Management Facility; SOM = soil organic matter

## **APPENDIX D RECLAMATION LIABILITY COST ESTIMATE**



## MEMO

TO	B2Gold Back River Corporation (B2Gold Nunavut)
FROM	Eric Denholm, ERM Consultants Canada Ltd.
DATE	24 June 2026
REFERENCE	0816045
SUBJECT	Goose Project 2026 Update of the Reclamation Liability Cost Estimate

### 1. INTRODUCTION

B2Gold Back River Corp. (B2Gold Nunavut) has identified a number of optimizations for the Goose Project (previously referred to as the Back River Project) as described in the Water Licence No: 2AM-BRP1831 (Amendment No.1) – Modification and Management Plan Updates. This update includes updates to the associated environmental management plans, notably the Water Management Plan, and the Waste Rock Management Plan.

The operational changes affect the Reclamation Liability Cost Estimate (RLCE) and, therefore, the RLCE has been updated as attached and described herein to align with the operational changes. The operational changes are specific to the Goose Mine, however, the 2026 RLCE Update continues to also include the Marine Laydown Area and the interconnecting Winter Ice Road (i.e., the Goose Project as a whole).

The 2026 RLCE update represents an operational modification that does not require changes to the costing structure. For example, closure quantities and schedules are adjusted but no new mine developments or reclamation measures are introduced that require new costing elements. Therefore, approaches and assumptions that are embedded into the current estimate are not affected by the operational changes.

The current estimate was prepared in Version 7 of the RECLAIM costing model used by the Government of Canada (GOC) as requested in the Water Licence.

The current estimate was developed and approved by the Nunavut Water Board (NWB) in 2018 with modification in 2020. To address time since the previous modification, the 2026 RLCE Update incorporates past inflation to bring costs to current (2026) dollars. The inflation factor used is the Annual Consumer Price Index for Nunavut (CPI-Nunavut) as published by the GOC.

The 2026 RLCE Update is anticipated to be submitted to the NWB for approval.

## 2. UPDATED ESTIMATE

The current security requirement in the Water Licence totals \$48.6M (original dollars). The total estimate is parsed into 12 payment stages based on development milestones. The current security requirement representing 6 payment stages is \$20.0M (original dollars).

The 2026 RLCE Update totals \$39.4M (2026 dollars) parsed over 10 payment stages (2 original stages are not required). The updated current security requirement representing the same 6 payment stages is \$19.8M (2026 dollars).

The Water Licence identifies the proportional amount of each payment stage that is to be held by the Kitikmeot Inuit Association (KIA) and by the Minister (GOC). The current proportions applied to KIA and GOC per payment stage are not changed for the 2026 RLCE Update.

Table 1 lists the 2026 RLCE Update per payment stage alongside the current estimate for comparison. The dominant change in the updated estimate results from the operational change to complete in-pit deposition of tailings, which excludes the Tailings Storage Facility (TSF). The TSF is not included in the 2026 Mine Plan and, therefore, is not appropriate for costing at this time. In-pit tailings deposition substantially reduces the area of exposed potentially acid generating waste that requires covering at any given time during operations with an accompanying reduction in costs. For example, the 2 payment stages in the current estimate that apply to the TSF total \$26.9M (original dollars), which is 55% of the total estimate and this cost does not apply to the 2026 RLCE Update. This illustrates that substantive cost is associated with the TSF that is not required for the 2026 RLCE Update.

**TABLE 1. 2026 RECLAMATION LIABILITY COST ESTIMATE UPDATE**

Payment Stage <sup>1</sup>	2026 RLCE Update (2026 dollars)	Current Estimate <sup>2</sup> (original dollars)
Initial Infrastructure	\$7,302,164 KIA=\$4,506,541 GOC=\$2,795,623	\$5,584,582 KIA=62% GOC=38%
Umwelt Underground	\$1,028,702 KIA=\$354,177 GOC=\$674,525	\$758,086 KIA=34% GOC=66%
Umwelt Open Pit	\$572,283 KIA=\$409,245 GOC=\$163,038	\$3,669,877 KIA=72% GOC=28%
TSF - Dam Construction	Excluded	\$350,850 KIA=5% GOC=95%
TSF - Tailings Deposition & Use	Excluded	\$26,584,204 KIA=16% GOC=84%
Llama Open Pit	\$6,062,658 KIA=\$4,367,114 GOC=\$1,695,544	\$5,068,882 KIA=72% GOC=28%
Goose Main Open Pit	\$17,777,304 KIA=\$7,660,957 GOC=\$10,116,347	\$420,028 KIA=43% GOC=57%
Echo Open Pit	\$480,442 KIA=\$297,239 GOC=\$183,203	\$1,163,004 KIA=62% GOC=38%

Payment Stage <sup>1</sup>	2026 RLCE Update (2026 dollars)	Current Estimate <sup>2</sup> (original dollars)
Llama Underground	\$503,006 KIA=\$239,333 GOC=\$263,673	\$344,586 KIA=48% GOC=52%
Goose Main Underground	\$861,539 KIA=\$240,023 GOC=\$621,516	\$616,487 KIA=28% GOC=72%
Echo Underground	\$461,865 KIA=\$260,409 GOC=201,456	\$311,440 KIA=56% GOC=\$44%
Mill Start Up Long Term Water Treatment	\$4,309,027 KIA=\$0 GOC=\$4,309,027	\$3,720,084 KIA=0% GOC=100%
<b>Total</b>	<b>\$39,358,990</b>	<b>\$48,592,110</b>
<b>To Be Held by KIA</b>	<b>\$18,335,038</b>	<b>\$15,816,695</b>
<b>To Be Held by GOC</b>	<b>\$21,023,953</b>	<b>\$32,775,415</b>
<b>Current Security Requirement (June 2026)<sup>3</sup></b>	<b>\$19,755,276 (6 stages)</b>	<b>\$19,964,515 (6 stages)</b>

1. Payment Stages are as stated in the Water Licence.
2. Current Estimate is as stated in the Water Licence.
3. Highlighted cells are part of the current security requirement.

### 3. COSTING NOTES

#### 3.1 COVERING PAG MATERIAL

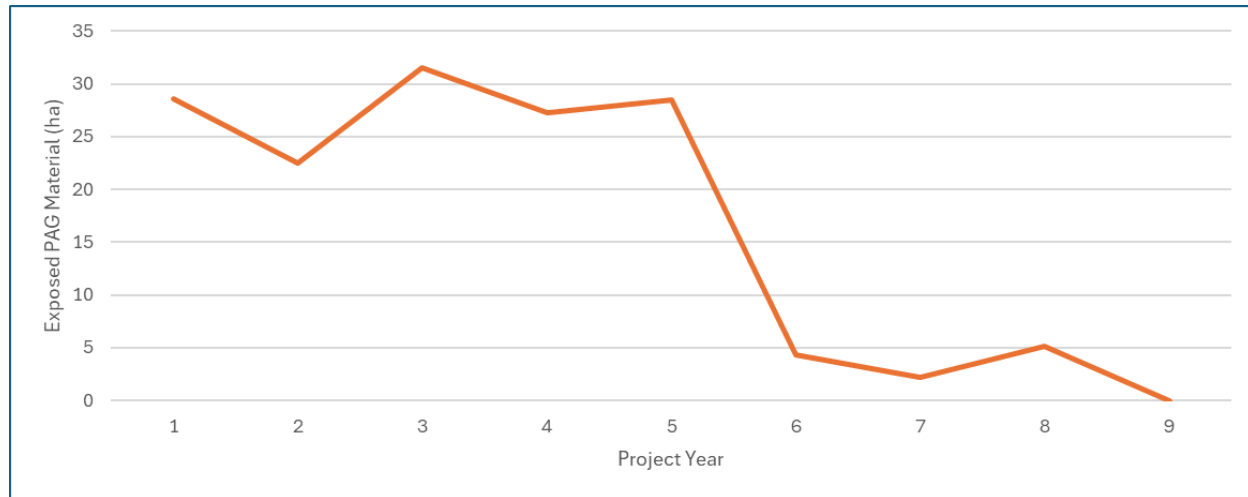
The area of exposed PAG material (waste rock and tailings) that requires covering varies over time through mine operations. For example, PAG waste rock is covered as NPAG waste rock is mined and as each lift of a WRSA is completed; however, covering is not instantaneous and there is a 'leading edge' of exposed PAG material that would require covering under sudden mine closure. The costing approach established for the current estimate costs the maximum year-end PAG exposure and this approach is carried forward for the 2026 RLCE Update.

For the 2026 RLCE Update, the 2026 Mine Plan production schedule was used to update the previous projections of annual end-of-year PAG exposures. The projections are based on modelling PAG and NPAG waste rock placement to simulate lift-by-lift construction of each WRSA according to the production schedule. Tailings placement is also modelled according to the production schedule. Figure 1 illustrates the projected end-of-year PAG exposures for the 2026 Mine Plan.

Covering PAG material remains the dominant cost in 2026 RLCE Update and is the dominant change in costs for the 2026 RLCE Update. In the current estimate, the projected maximum PAG exposure is 51.4 ha in Project Year 2 of which 73% is at the TSF and only 27% at the WRSA's. This indicates that, because the 2026 Mine Plan excludes the TSF, a large portion of the previously projected PAG exposure is excluded from the 2026 RLCE Update. The projected maximum PAG exposure for the 2026 RLCE Update is 31.5 ha in Project Year 3.

A project-specific unit rate for covering areas of exposed PAG material was established for the current estimate at \$7.00/m<sup>3</sup> (original dollars). For the 2026 RLCE Update, the unit rate is inflated to \$8.11/m<sup>3</sup> in 2026 dollars.

**FIGURE 1: PROJECTED END-OF-YEAR EXPOSURE OF PAG MATERIAL (WASTE ROCK AND TAILINGS)**



### 3.2 WATER TREATMENT

The costing approach for water treatment established for the current estimate links the water treatment cost to the year of maximum PAG exposure (Section 3.1) and this approach is carried forward for the 2026 RLCE Update. In the current estimate, the water treatment requirement in Project Year 2 was 2 million m<sup>3</sup>. For the 2026 RLCE Update, exclusion of the TSF and other operational changes in the 2026 Mine Plan result in no projected water treatment requirement for the year of maximum PAG exposure (Project Year 3) and, therefore, no water treatment is costed in this regard. However, the current estimate includes contingency treatment of 3 million m<sup>3</sup> of water and this is retained in the 2026 RLCE Update.

The RECLAIM default cost for water pumping (RECLAIM code POCL) was used for the current estimate and is carried forward for the 2026 RLCE Update at a unit rate inflated from \$0.12/m<sup>3</sup> (original dollars) to \$0.15/m<sup>3</sup> (2026 dollars). A project-specific unit rate for water treatment was established for the current estimate at \$0.65/m<sup>3</sup> (original dollars) and is inflated to \$0.75/m<sup>3</sup> (2026 dollars) for the 2026 RLCE Update.

### 3.3 PAST INFLATION

The current estimate applies a combination of RECLAIM default unit rates (initially established in 2014), project-specific unit rates established in 2017, and an additional project-specific unit rate established in 2020. The CPI-Nunavut was applied to bring the 2026 RLCE Update to 2026 dollars as listed in Table 2.

**TABLE 2. PAST INFLATION FACTORS**

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
CPI-NU	118.1	120.4	123.4	125.4	129.2	131.4	131.4	133.2	138.4	141.9	144.1	145.3
Inflation Factor 2014-2025	1.230			(RECLAIM Unit Costs)								
Inflation Factor 2017 to 2026	1.159			(Project-Specific Unit Costs, except those originating 2020)								
Inflation Factor 2020 to 2026	1.106			(Project-Specific Unit Costs originating 2020)								

ATTACHMENT A: GOOSE PROJECT MAY 2026 RECLAMATION LIABILITY COST  
ESTIMATE UPDATE RECLAIM MODEL VERSION 7

**SUMMARY OF COSTS**

CAPITAL COSTS	COMPONENT NAME	COST	LAND LIABILITY	TOTAL LIABILITY
OPEN PIT	Umwelt	\$60,120	\$0	\$60,120
	Llama	\$66,016	\$0	\$66,016
	Echo (to Project Year 4)	\$19,698	\$0	\$19,698
	Goose Main	\$102,334	\$0	\$102,334
QUARRY (under OPEN PIT TAB estimate)	Airstrip Quarry	\$4,675	\$0	\$4,675
UNDERGROUND MINE	Umwelt	\$444,319	\$0	\$444,319
	Llama	\$124,879	\$0	\$124,879
	Goose Main	\$334,323	\$0	\$334,323
	Echo	\$116,121	\$0	\$116,121
TAILINGS FACILITIES	TSF	\$0	\$0	\$0
ROCK PILE	Umwelt, Llama, Goose Main, and Echo	\$12,770,177	\$0	\$12,770,177
BUILDINGS AND EQUIPMENT		\$2,952,160	\$0	\$2,952,160
CHEMICALS AND CONTAMINATED SOIL MANAGEMEN		\$1,659,101	\$0	\$1,659,101
SURFACE AND GROUNDWATER MANAGEMENT		\$3,624,753	-	\$3,624,753
INTERIM CARE AND MAINTENANCE		\$1,160,490	-	\$1,160,490
<b>SUBTOTAL: Capital Costs</b>		<b>\$23,439,166</b>	<b>\$0</b>	<b>\$23,439,166</b>
<b>PERCENT OF SUBTOTAL</b>			<b>0%</b>	<b>100%</b>
<b>INDIRECT COSTS</b>		<b>COST</b>	<b>LAND LIABILITY</b>	<b>TOTAL LIABILITY</b>
MOBILIZATION/DEMobilIZATION		\$4,993,793	\$0	\$4,993,793
POST-CLOSURE MONITORING AND MAINTENANCE		\$2,253,539	\$0	\$2,253,539
ENGINEERING	10%	\$2,343,917	\$0	\$2,343,917
PROJECT MANAGEMENT	5%	\$1,171,958	\$0	\$1,171,958
HEALTH AND SAFETY PLANS/MONITORING & QA/QC	1%	\$234,392	\$0	\$234,392
BONDING/INSURANCE	1%	\$234,392	\$0	\$234,392
CONTINGENCY	20%	\$4,687,833	\$0	\$4,687,833
MARKET PRICE FACTOR ADJUSTMENT	0%	\$0	\$0	\$0
<b>SUBTOTAL: Indirect Costs</b>		<b>\$15,919,824</b>	<b>\$0</b>	<b>\$15,919,824</b>
<b>TOTAL COSTS</b>		<b>\$39,358,990</b>	<b>\$0</b>	<b>\$39,358,990</b>

ALL STAGES (%)

**SUMMARY OF PAYMENT STAGES**

Approximate Timing											
Y-2	Y-1	Y-1	NA	NA	Y2Q4	Y5Q1	Y-1	Y6Q2	Y10Q2	Y10Q3	Y1
Initial Infrastructure	Umwelt UG	Umwelt OP	TSF - Dam Construction	TSF - Tailings Deposition & Use	Llama OP	Goose Main OP	Echo OP (to Year 4 Only)	Llama UG	Goose Main UG	Echo UG	Mill Start up Long Term Water Treatment (LTWT)
		\$60,120			\$66,016		\$19,698				
\$4,675	\$444,319					\$102,334			\$124,879	\$334,323	\$116,121
		\$0	\$0	\$0	\$3,192,544	\$9,577,633					
\$2,784,984	\$0	\$8,955	\$0	\$0	\$0	\$135,047	\$23,174	\$0	\$0	\$0	\$0
\$696,665	\$116,844	\$116,844	\$0	\$0	\$116,844	\$144,526	\$116,844	\$116,844	\$116,844	\$116,844	\$0
\$161,376	\$34,454	\$29,383	\$0	\$0	\$18,619	\$101,402	\$2,411	\$49,517	\$47,663	\$34,454	\$3,145,275
\$580,245		\$116,049			\$116,049	\$232,098	\$116,049				
<b>\$4,227,945</b>	<b>\$595,617</b>	<b>\$331,352</b>	<b>\$0</b>	<b>\$0</b>	<b>\$3,510,272</b>	<b>\$10,293,040</b>	<b>\$278,176</b>	<b>\$291,240</b>	<b>\$498,830</b>	<b>\$267,419</b>	<b>\$3,145,275</b>
18.0%	2.5%	1.4%	0.0%	0.0%	15.0%	43.9%	1.2%	1.2%	2.1%	1.1%	13.4%
20.8%	2.9%	1.6%	0.0%	0.0%	17.3%	50.7%	1.4%	1.4%	2.5%	1.3%	
\$1,040,386	\$146,566	\$81,537	\$0	\$0	\$863,786	\$2,532,847	\$68,452	\$71,666	\$122,749	\$65,805	\$0
\$469,493	\$66,140	\$36,795	\$0	\$0	\$389,799	\$1,142,992	\$30,890	\$32,341	\$55,393	\$29,696	\$0
\$422,795	\$59,562	\$33,135	\$0	\$0	\$351,027	\$1,029,304	\$27,818	\$29,124	\$49,883	\$26,742	\$314,528
\$211,397	\$29,781	\$16,568	\$0	\$0	\$175,514	\$514,652	\$13,909	\$14,562	\$24,942	\$13,371	\$157,264
\$42,279	\$5,956	\$3,314	\$0	\$0	\$35,103	\$102,930	\$2,782	\$2,912	\$4,988	\$2,674	\$31,453
\$42,279	\$5,956	\$3,314	\$0	\$0	\$35,103	\$102,930	\$2,782	\$2,912	\$4,988	\$2,674	\$31,453
\$845,589	\$119,123	\$66,270	\$0	\$0	\$702,054	\$2,058,608	\$55,635	\$58,248	\$99,766	\$53,484	\$629,055
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>\$3,074,219</b>	<b>\$433,084</b>	<b>\$240,932</b>	<b>\$0</b>	<b>\$0</b>	<b>\$2,552,385</b>	<b>\$7,484,264</b>	<b>\$202,267</b>	<b>\$211,766</b>	<b>\$362,709</b>	<b>\$194,446</b>	<b>\$1,163,752</b>
<b>\$7,302,164</b>	<b>\$1,028,702</b>	<b>\$572,283</b>	<b>\$0</b>	<b>\$0</b>	<b>\$6,062,658</b>	<b>\$17,777,304</b>	<b>\$480,442</b>	<b>\$503,006</b>	<b>\$861,539</b>	<b>\$461,865</b>	<b>\$4,309,027</b>

**CURRENT REQUIREMENT**  
\$19,755,276 (June 2026)

5		Open Pit Name:	Umwelt			Pit #	1
ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost	
<b>CONTROL ACCESS</b>							
Fence		m		#N/A	\$0.00	\$0	
Signs	Assumed	each	4	Sabina	\$86.90	\$348	
Berm at crest	Estimated for continuous berm with 1m diameter boulders, no spacing between boulders - 0.52 m <sup>3</sup> /m - assumed 50 % done during Operations	m <sup>3</sup>	433	RR1H	\$21.84	\$9,447	
Block roads	Temporary gate installation to allow water monitoring. It includes decommissioning of gate when no longer required. Exposed area after gate has been decommissioned will be blocked with boulders (exposed area along with block of roads with boulders included in berm cost above)	allow	1	Sabina	\$5,793.46	\$5,793	
Other				#N/A	\$0.00	\$0	
<b>STABILITY STUDY</b>							
Conduct stability and setback study		allow	1	Sabina	\$19,697.77	\$19,698	
<b>STABILIZE SLOPES</b>							
Off-load crest, soil A		m <sup>3</sup>		#N/A	\$0.00	\$0	
Off-load crest, soil B		m <sup>3</sup>		#N/A	\$0.00	\$0	
Doze/trim overburden at crest		m <sup>3</sup>		#N/A	\$0.00	\$0	
Drill & blast pit crest		m <sup>3</sup>		#N/A	\$0.00	\$0	
Buttress slope		m <sup>3</sup>		#N/A	\$0.00	\$0	
Other				#N/A	\$0.00	\$0	
<b>COVER/CONTOUR SLOPES</b>							
Place fill, soil A		m <sup>3</sup>		#N/A	\$0.00	\$0	
Place fill, soil B		m <sup>3</sup>		#N/A	\$0.00	\$0	
Rip rap		m <sup>3</sup>		#N/A	\$0.00	\$0	
Vegetate slopes		ha		#N/A	\$0.00	\$0	
Vegetate pit floor		ha		#N/A	\$0.00	\$0	
Other				#N/A	\$0.00	\$0	
<b>CONSTRUCT DIVERSION DITCHES</b>							
Excavate ditches -soil		m <sup>3</sup>		#N/A	\$0.00	\$0	
Excavate ditches -rock		m <sup>3</sup>		#N/A	\$0.00	\$0	
Rip rap in channel base		m <sup>3</sup>		#N/A	\$0.00	\$0	
<b>CONSTRUCT SPILLWAY</b>							
Excavate channel	200 m long, 6 m wide and 1 m deep	m <sup>3</sup>	1,200	SB1L	\$5.29	\$6,348	
Concrete		m <sup>3</sup>		#N/A	\$0.00	\$0	
Rip rap		m <sup>3</sup>	400	RR1H	\$21.84	\$8,735	
Other	Geotextile	m <sup>2</sup>	2,304	GSTL	\$4.23	\$9,751	
<b>RECLAIM QUARRIES</b>							
Contour slopes		m <sup>3</sup>		#N/A	\$0.00	\$0	
Place overburden		m <sup>3</sup>		#N/A	\$0.00	\$0	
Vegetate		m <sup>3</sup>		#N/A	\$0.00	\$0	
<b>FLOOD PIT-Capital</b>							
Remove stationary equipment (sump pumps) and Pipeline	Umwelt TF will be used to store tailings in Years 4 to 11; it will be passively flooded with site runoff and direct precipitation throughout the end of Operations and into the Closure Phase. Recirculation treatment is planned following use as a TF.	m		#N/A	\$0.00	\$0	
Remove dewatering pipeline		m		#N/A	\$0.00	\$0	
Remove power lines		each		#N/A	\$0.00	\$0	
Construct diversion ditches		m <sup>3</sup>		#N/A	\$0.00	\$0	
-Ditch, mat'l A		m <sup>3</sup>		#N/A	\$0.00	\$0	
-Ditch, mat'l B		m <sup>3</sup>		#N/A	\$0.00	\$0	
Construct embankment/dam		m <sup>3</sup>		#N/A	\$0.00	\$0	
Supply/install pump station		each		#N/A	\$0.00	\$0	
Supply/install piping system		m		#N/A	\$0.00	\$0	
Remove pump post-closure		each		#N/A	\$0.00	\$0	
Remove pipeline post-closure		m		#N/A	\$0.00	\$0	
<b>FLOOD PIT-Annual Cost</b>							
Operate pumps (power)		m <sup>3</sup>		#N/A	\$0.00	\$0	
Maintain pump/pipeline		allow		#N/A	\$0.00	\$0	
Labour: fuel management, commissioning/decom		\$/h		#N/A	\$0.00	\$0	
Chemical addition, _____ kg/m <sup>3</sup> of water		tonne		#N/A	\$0.00	\$0	
Chemicals, purchase and shipping		tonne		#N/A	\$0.00	\$0	
Passive/biological additives		\$/ha		#N/A	\$0.00	\$0	
Passive additives purchase and shipping		tonne		#N/A	\$0.00	\$0	
Other				#N/A	\$0.00	\$0	
Annual pumping costs							
Number of years of pump flooding	passive pit flooding	years	0				
						Total pumping costs	\$0
						<b>Total</b>	\$60,120
						<b>% of Total</b>	100%

Open Pit Name:		Llama	Pit #		2	2	
ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	Total Cost
<b>CONTROL ACCESS</b>							
Fence		m		#N/A	\$0.00	\$0	\$0
Signs	Assumed	each	4	Sabina	\$86.90	\$348	\$348
Berm at crest	Estimated for berm with 1m diameter boulders, no spacing between boulders - 0.52 m3/m; berm needed only where pit edge will not abut the final flooded lake footprint.	m3	327.6	RR1H	\$21.84	\$7,154	\$7,154
Block roads	Temporary gate installation to allow water monitoring. It includes decommissioning of gate when no longer required. Exposed area after gate has been decommissioned will be blocked with boulders (exposed area along with block of roads with boulders included in berm cost above)	allow	1	Sabina	\$5,793.46	\$5,793	\$5,793
Other				#N/A	\$0.00	\$0	\$0
<b>STABILITY STUDY</b>							
Conduct stability and setback study		allow	1	Sabina	\$19,697.77	\$19,698	\$19,698
<b>STABILIZE SLOPES</b>							
Off-load crest, soil A		m3		#N/A	\$0.00	\$0	\$0
Off-load crest, soil B		m3		#N/A	\$0.00	\$0	\$0
Doze/trim overburden at crest		m3		#N/A	\$0.00	\$0	\$0
Drill & blast pit crest		m3		#N/A	\$0.00	\$0	\$0
Buttress slope		m3		#N/A	\$0.00	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0
<b>COVER/CONTOUR SLOPES</b>							
Place fill, soil A		m3		#N/A	\$0.00	\$0	\$0
Place fill, soil B		m3		#N/A	\$0.00	\$0	\$0
Rip rap		m3		#N/A	\$0.00	\$0	\$0
Vegetate slopes		ha		#N/A	\$0.00	\$0	\$0
Vegetate pit floor		ha		#N/A	\$0.00	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0
<b>CONSTRUCT DIVERSION DITCHES</b>							
Excavate ditches -soil		m3		#N/A	\$0.00	\$0	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0	\$0
<b>CONSTRUCT SPILLWAY</b>							
Excavate channel	Spillway not required; will follow natural drainage to Umwelt Lake.	m3		#N/A	\$0.00	\$0	\$0
Concrete		m3		#N/A	\$0.00	\$0	\$0
Rip rap		m3		#N/A	\$0.00	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0
<b>RECLAIM QUARRIES</b>							
Contour slopes		m3		#N/A	\$0.00	\$0	\$0
Place overburden		m3		#N/A	\$0.00	\$0	\$0
Vegetate		m3		#N/A	\$0.00	\$0	\$0
<b>FLOOD PIT-Capital</b>							
Remove stationary equipment (sump pumps) and Pipeline	Llama 1F will be used to store tailings in Years 11 to 14 (end of operations); it will be passively flooded following use as a TF with site runoff and direct precipitation throughout the end of Operations and into the Closure Phase. Water may be pumped from Goose Lake if required. At Closure, reclaim water pump will be at top of TF and pipeline leads to WTP. Costing here to remove pipeline to closure landfill; dispose of fuel in diesel day tank and oil from pump and landfill cleaned pump. Recirculation treatment may be provided following use as a TF if required (not costed here)	m	2,850	Sabina	\$11.59	\$33,023	\$33,023
Remove dewatering pipeline		m		#N/A	\$0.00	\$0	\$0
Remove power lines		each		#N/A	\$0.00	\$0	\$0
Construct diversion ditches		m3		#N/A	\$0.00	\$0	\$0
-Ditch, mat'l A		m3		#N/A	\$0.00	\$0	\$0
-Ditch, mat'l B		m3		#N/A	\$0.00	\$0	\$0
Construct embankment/dam		m3		#N/A	\$0.00	\$0	\$0
Supply/install pump station		each		#N/A	\$0.00	\$0	\$0
Supply/install piping system		m		#N/A	\$0.00	\$0	\$0
Remove pump post-closure		each		#N/A	\$0.00	\$0	\$0
Remove pipeline post-closure		m		#N/A	\$0.00	\$0	\$0
<b>FLOOD PIT-Annual Cost</b>							
Operate pumps (power)		m3		#N/A	\$0.00	\$0	\$0
Maintain pump/pipeline		allow		#N/A	\$0.00	\$0	\$0
Labour: fuel management, commissioning/decom		\$/h		#N/A	\$0.00	\$0	\$0
Chemical addition, _____ kg/m3 of water		tonne		#N/A	\$0.00	\$0	\$0
Chemicals, purchase and shipping		tonne		#N/A	\$0.00	\$0	\$0
Passive/biological additives		\$/ha		#N/A	\$0.00	\$0	\$0
Passive additives purchase and shipping		tonne		#N/A	\$0.00	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0
Number of years of pump flooding	passive pit flooding	years	0			Annual pumping costs	\$0
						Total pumping costs	\$0
						<b>Total</b>	\$66,016
						<b>% of Total</b>	100%

Open Pit Name:	Echo (to Project Year 4)	Pit #	3			
ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>CONTROL ACCESS</b>						
Fence		m		#N/A	\$0.00	\$0
Signs		each	-	Sabina	\$86.90	\$0
Berm at crest		m3	0	RR1H	\$21.84	\$0
Block roads		allow	-	Sabina	\$5,793.46	\$0
Other				#N/A	\$0.00	\$0
<b>STABILITY STUDY</b>						
Conduct stability and setback study		allow	1	Sabina	\$19,697.77	\$19,698
<b>STABILIZE SLOPES</b>						
Off-load crest, soil A		m3		#N/A	\$0.00	\$0
Off-load crest, soil B		m3		#N/A	\$0.00	\$0
Doze/trim overburden at crest		m3		#N/A	\$0.00	\$0
Drill & blast pit crest		m3		#N/A	\$0.00	\$0
Buttress slope		m3		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>COVER/CONTOUR SLOPES</b>						
Place fill, soil A		m3		#N/A	\$0.00	\$0
Place fill, soil B		m3		#N/A	\$0.00	\$0
Rip rap		m3		#N/A	\$0.00	\$0
Vegetate slopes		ha		#N/A	\$0.00	\$0
Vegetate pit floor		ha		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>CONSTRUCT DIVERSION DITCHES</b>						
Excavate ditches -soil		m3		#N/A	\$0.00	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0
<b>CONSTRUCT SPILLWAY</b>						
Excavate channel	Spillway not required.	m3		#N/A	\$0.00	\$0
Concrete		m3		#N/A	\$0.00	\$0
Rip rap		m3		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>RECLAIM QUARRIES</b>						
Contour slopes		m3		#N/A	\$0.00	\$0
Place overburden		m3		#N/A	\$0.00	\$0
Vegetate		m3		#N/A	\$0.00	\$0
<b>FLOOD PIT-Capital</b>						
Remove stationary equipment (sump pumps) and Pipeline	Echo TF will be used to store tailings in Years 1 to 4; it will be incorporated into and reclaimed as part of the Goose Main WRSA following use as a TF. Pipelines/pumps will be relocated during Operations for use in the other activities (i.e., not a closure cost).	m	-	#N/A	\$11.59	\$0
Remove dewatering pipeline		m		#N/A	\$0.00	\$0
Remove power lines		each		#N/A	\$0.00	\$0
Construct diversion ditches		m3		#N/A	\$0.00	\$0
-Ditch, mat'l A		m3		#N/A	\$0.00	\$0
-Ditch, mat'l B		m3		#N/A	\$0.00	\$0
Construct embankment/dam		m3		#N/A	\$0.00	\$0
Supply/install pump station		each		#N/A	\$0.00	\$0
Supply/install piping system		m		#N/A	\$0.00	\$0
Remove pump post-closure		each		#N/A	\$0.00	\$0
Remove pipeline post-closure		m		#N/A	\$0.00	\$0
<b>FLOOD PIT-Annual Cost</b>						
Operate pumps (power)		m3		#N/A	\$0.00	\$0
Maintain pump/pipeline		allow		#N/A	\$0.00	\$0
Labour: fuel management, commissioning/decom		\$/h		#N/A	\$0.00	\$0
Chemical addition, _____ kg/m3 of water		tonne		#N/A	\$0.00	\$0
Chemicals, purchase and shipping		tonne		#N/A	\$0.00	\$0
Passive/biological additives		\$/ha		#N/A	\$0.00	\$0
Passive additives purchase and shipping		tonne		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
Annual pumping costs						
Number of years of pump flooding	passive pit flooding	years	0			
					Total pumping costs	\$0
					<b>Total</b>	\$19,698
					<b>% of Total</b>	100%

Open Pit Name:		Goose Main		Pit # 4		
ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>CONTROL ACCESS</b>						
Fence		m		#N/A	\$0.00	\$0
Signs	Assumed	each	4	Sabina	\$86.90	\$348
Berm at crest	Estimated for continuous berm with 1m diameter boulders, no spacing between boulders - 0.52 m3/m - assumed 50 % done during Operations	m3	639.45	RR1H	\$21.84	\$13,964
Block roads	Temporary gate installation to allow water monitoring. It includes decommissioning of gate when no longer required. Exposed area after gate has been decommissioned will be blocked with boulders (exposed area along with block of roads with boulders included in berm cost above)	allow	1	Sabina	\$5,793.46	\$5,793
Other				#N/A	\$0.00	\$0
<b>STABILITY STUDY</b>						
Conduct stability and setback study		allow	1	Sabina	\$19,697.77	\$19,698
<b>STABILIZE SLOPES</b>						
Off-load crest, soil A		m3		#N/A	\$0.00	\$0
Off-load crest, soil B		m3		#N/A	\$0.00	\$0
Doze/trim overburden at crest		m3		#N/A	\$0.00	\$0
Drill & blast pit crest		m3		#N/A	\$0.00	\$0
Buttress slope		m3		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>COVER/CONTOUR SLOPES</b>						
Place fill, soil A		m3		#N/A	\$0.00	\$0
Place fill, soil B		m3		#N/A	\$0.00	\$0
Rip rap		m3		#N/A	\$0.00	\$0
Vegetate slopes		ha		#N/A	\$0.00	\$0
Vegetate pit floor		ha		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>CONSTRUCT DIVERSION DITCHES</b>						
Excavate ditches -soil		m3		#N/A	\$0.00	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0
<b>CONSTRUCT SPILLWAY</b>						
Excavate channel	100 m long, 6 m wide and 1 m deep	m3	600	SB1L	\$5.29	\$3,174
Concrete		m3		#N/A	\$0.00	\$0
Rip rap		m3	200	RR1H	\$21.84	\$4,368
Other	Geotextile	m2	1,152	GSTL	\$4.23	\$4,875
<b>RECLAIM QUARRIES</b>						
Contour slopes		m3		#N/A	\$0.00	\$0
Place overburden		m3		#N/A	\$0.00	\$0
Vegetate		m3		#N/A	\$0.00	\$0
<b>FLOOD PIT-Capital</b>						
Remove stationary equipment (sump pumps) and Pipeline	At closure, pump will be at top of Goose Reservoir. Remove pipeline to closure landfill; dispose of fuel in diesel day tank and oil from pump and landfill cleaned pump.	m	4,325	Sabina	\$11.59	\$50,113
Remove dewatering pipeline		m		#N/A	\$0.00	\$0
Remove power lines		each		#N/A	\$0.00	\$0
Construct diversion ditches		m3		#N/A	\$0.00	\$0
-Ditch, mat'l A		m3		#N/A	\$0.00	\$0
-Ditch, mat'l B		m3		#N/A	\$0.00	\$0
Construct embankment/dam		m3		#N/A	\$0.00	\$0
Supply/install pump station		each		#N/A	\$0.00	\$0
Supply/install piping system		m		#N/A	\$0.00	\$0
Remove pump post-closure		each		#N/A	\$0.00	\$0
Remove pipeline post-closure		m		#N/A	\$0.00	\$0
<b>FLOOD PIT-Annual Cost</b>						
Operate pumps (power)		m3		#N/A	\$0.00	\$0
Maintain pump/pipeline		allow		#N/A	\$0.00	\$0
Labour: fuel management, commissioning/decom		\$/h		#N/A	\$0.00	\$0
Chemical addition, _____ kg/m3 of water		tonne		#N/A	\$0.00	\$0
Chemicals, purchase and shipping		tonne		#N/A	\$0.00	\$0
Passive/biological additives		\$/ha		#N/A	\$0.00	\$0
Passive additives purchase and shipping		tonne		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
					Annual pumping costs	
Number of years of pump flooding	passive pit flooding	years	0			
					Total pumping costs	\$0
					<b>Total</b>	\$102,334
					<b>% of Total</b>	100%

Quarry Name:		Airstrip Quarry		Quarry # 1		
ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>CONTROL ACCESS</b>						
Fence		m		#N/A	\$0.00	\$0
Signs		each		#N/A	\$0.00	\$0
Berm at crest		m3		RB1H	\$20.98	\$0
Block roads		allow		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>STABILITY STUDY</b>						
Conduct stability and setback study	Not required for quarry	allow		#N/A	\$0.00	\$0
<b>STABILIZE SLOPES</b>						
Off-load crest, soil A		m3		#N/A	\$0.00	\$0
Off-load crest, soil B		m3		#N/A	\$0.00	\$0
Doze/trim overburden at crest		m3		#N/A	\$0.00	\$0
Drill & blast pit crest		m3		#N/A	\$0.00	\$0
Buttress slope		m3		#N/A	\$0.00	\$0
Other	Backhoe to pull down loose rock on bedrock backslope - assumed	hrs	20	exc-sL	\$233.76	\$4,675
<b>COVER/CONTOUR SLOPES</b>						
Place fill, soil A		m3		#N/A	\$0.00	\$0
Place fill, soil B		m3		#N/A	\$0.00	\$0
Rip rap		m3		#N/A	\$0.00	\$0
Vegetate slopes	Allow to revegetate naturally	ha		#N/A	\$0.00	\$0
Vegetate pit floor		ha		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>CONSTRUCT DIVERSION DITCHES</b>						
Excavate ditches -soil		m3		#N/A	\$0.00	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0
<b>CONSTRUCT SPILLWAY</b>						
Excavate channel	Not required. Quarry base will be graded for sheet drainage.	m3		SB1L	\$5.29	\$0
Concrete		m3		#N/A	\$0.00	\$0
Rip rap		m3		RR1L	\$16.61	\$0
Other		m2		GSTL	\$4.23	\$0
<b>RECLAIM QUARRIES</b>						
Contour slopes	Quarry will not be flooded - development will occur below water level and the areas will be contoured to drain positively	m3		#N/A	\$0.00	\$0
Place overburden		m3		#N/A	\$0.00	\$0
Vegetate		m3		#N/A	\$0.00	\$0
<b>FLOOD PIT-Capital</b>						
Remove stationary equipment (sump pumps) and Pipeline		m		#N/A	\$0.00	\$0
Remove dewatering pipeline		m		#N/A	\$0.00	\$0
Remove power lines		each		#N/A	\$0.00	\$0
Construct diversion ditches		m3		#N/A	\$0.00	\$0
-Ditch, mat'l A		m3		#N/A	\$0.00	\$0
-Ditch, mat'l B		m3		#N/A	\$0.00	\$0
Construct embankment/dam		m3		#N/A	\$0.00	\$0
Supply/install pump station		each		#N/A	\$0.00	\$0
Supply/install piping system		m		#N/A	\$0.00	\$0
Remove pump post-closure		each		#N/A	\$0.00	\$0
Remove pipeline post-closure		m		#N/A	\$0.00	\$0
<b>FLOOD PIT-Annual Cost</b>						
Operate pumps (power)		m3		#N/A	\$0.00	\$0
Maintain pump/pipeline		allow		#N/A	\$0.00	\$0
Labour: fuel management, commissioning/decom		\$/h		#N/A	\$0.00	\$0
Chemical addition, _____ kg/m3 of water		tonne		#N/A	\$0.00	\$0
Chemicals, purchase and shipping		tonne		#N/A	\$0.00	\$0
Passive/biological additives		\$/ha		#N/A	\$0.00	\$0
Passive additives purchase and shipping		tonne		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
Annual pumping costs						
Number of years of pump flooding	No flooding	years	0			
					Total pumping costs	\$0
					<b>Total</b>	<b>\$4,675</b>
					<b>% of Total</b>	<b>100%</b>

4		Underground Mine Name Umwelt			UG Mine #	1	
ACTIVITY/MATERIAL	Notes	Unit	Qty	Cost Code	Unit Cost	Total Cost	
<b>CONTROL ACCESS</b>							
Fence		m		#N/A	\$0.00	\$0	
Signs		each		#N/A	\$0.00	\$0	
Block roads		m3		#N/A	\$0.00	\$0	
Berm		m3		#N/A	\$0.00	\$0	
Backfill Portal (NPAG waste rock plug)	At least 5 m deep into 5x4.5m portal and slope at least 2:1 outside of portal	m3	150	PORL	\$23.13	\$3,469	
Backfill portal #2		m3		#N/A	\$0.00	\$0	
Cap raise # 1	Concrete plug over 4m-dia. vent raise	m3	28	SRH	\$2,623.03	\$74,232	
Cap raise #2	Concrete plug over 4m-dia. vent raise	m3	28	SRH	\$2,623.03	\$74,232	
Cap shaft #1	Concrete plug over 4m-dia. fresh air vent	m3	28	SRH	\$2,623.03	\$74,232	
Cap shaft #2		m3		#N/A	\$0.00	\$0	
Backfill adits		m3		#N/A	\$0.00	\$0	
Backfill open stope		m3		#N/A	\$0.00	\$0	
Concrete cap over open stope		m3		#N/A	\$0.00	\$0	
Other				#N/A	\$0.00	\$0	
<b>REMOVE HAZARDOUS MATERIALS</b>							
Remove hazardous materials, U/G labor	Three shifts with loader, incl. operator and fuel	manhour	30	load-sL	\$215.30	\$6,459	
Remove/decontam. stationary & elect. equip		mandays		#N/A	\$0.00	\$0	
Remove/decontam. mobile equipment		each		#N/A	\$0.00	\$0	
Remove misc. haz. mat & explosives	Dispose of up to 1 week's inventory of explosives	kg	100	Sabina	\$57.93	\$5,793	
Decommission Pipeline	Clean Umwelt UG to SWP pipeline, decommission and landfill	m	1,662	Sabina	\$11.59	\$19,257	
<b>INSTALL BULKHEADS</b>							
Bulkheads to control water flow		each		#N/A	\$0.00	\$0	
Grout bulkhead		m3		#N/A	\$0.00	\$0	
<b>FLOOD MINE</b>							
Supply/install pump	UG mine is expected to be flooded in Year 10 and active flooding will take about a year, relocation of pipelines and flooding will occur as part of operations but cost is provided as a conservative approach (see "Relocate Pipeline".)	each		#N/A	\$0.00	\$0	
Relocate Pipeline	Move SWP-Llama UG pipeline discharge to Umwelt UG	m	800	Sabina	\$11.59	\$9,270	
Operate pumps to flood workings	Accounts for Umwelt Underground Extension	m3	1,071,225	Sabina	\$0.15	\$165,788	
Decommission of pipeline				#N/A	\$0.00	\$0	
Other				#N/A	\$0.00	\$0	
<b>INSTALL GROUNDWATER COLLECTION SYSTEM</b>							
Excavate/install sumps		m2		#N/A	\$0.00	\$0	
Install pumping wells		m3		#N/A	\$0.00	\$0	
Install pumps/pipelines/power supply		LS		#N/A	\$0.00	\$0	
<b>SPECIALIZED ITEMS</b>							
Install water quality monitoring pipes		each		#N/A	\$0.00	\$0	
Install permanent pumping system		each		#N/A	\$0.00	\$0	
Assess underground stability	Rock mechanics inspection before closure	each	1	Sabina	\$11,586.92	\$11,587	
						<b>Total</b>	\$444,319
						<b>% of Total</b>	100%

Underground Mine Name Llama

UG Mine #

2

ACTIVITY/MATERIAL	Notes	Unit	Qty	Cost Code	Unit Cost	Total Cost
<b>CONTROL ACCESS</b>						
Fence		m		#N/A	\$0.00	\$0
Signs		each		#N/A	\$0.00	\$0
Block roads		m3		#N/A	\$0.00	\$0
Berm		m3		#N/A	\$0.00	\$0
Backfill Portal (NPAG waste rock plug)	At least 5 m deep into 5x4.5m portal and slope at least 2:1 outside of portal	m3	150	PORL	\$23.13	\$3,469
Backfill portal #2		m3		#N/A	\$0.00	\$0
Cap raise # 1	Concrete plug over 4m-dia. vent raise	LS	28	SRH	\$2,623.03	\$74,232
Cap raise #2		m3		#N/A	\$0.00	\$0
Cap shaft #1		m3		#N/A	\$0.00	\$0
Cap shaft #2		m3		#N/A	\$0.00	\$0
Backfill adits		m3		#N/A	\$0.00	\$0
Backfill open stope		m3		#N/A	\$0.00	\$0
Concrete cap over open stope		m3		#N/A	\$0.00	\$0
Other						
<b>REMOVE HAZARDOUS MATERIALS</b>						
Remove hazardous materials, U/G labor	Two shifts with loader, incl. operator and fuel	manhour	20	load-sL	\$215.30	\$4,306
Remove/decontam. stationary & elect. equip		mandays		#N/A	\$0.00	\$0
Remove/decontam. mobile equipment		each		#N/A	\$0.00	\$0
Remove misc. haz. mat & explosives	Mining will cease before closure	kg		#N/A	\$0.00	\$0
Decommission Pipeline	Clean Llama UG to SWP pipeline, decommission and landfill	m	2700	Sabina	\$11.59	\$31,285
<b>INSTALL BULKHEADS</b>						
Bulkheads to control water flow		each		#N/A	\$0.00	\$0
Grout bulkhead		m3		#N/A	\$0.00	\$0
<b>FLOOD MINE</b>						
Supply/install pump	UG mine is expected to be flooded in Year 5 and active flooding will take about a year, relocation of pipelines and flooding will occur as part of operations	each		#N/A	\$0.00	\$0
Supply/install piping system		m		#N/A	\$0.00	\$0
Operate pumps to flood workings		m3		#N/A	\$0.00	\$0
Decommission of pipelines				#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>INSTALL GROUNDWATER COLLECTION SYSTEM</b>						
Excavate/install sumps		m2		#N/A	\$0.00	\$0
Install pumping wells		m3		#N/A	\$0.00	\$0
Install pumps/pipelines/power supply		LS		#N/A	\$0.00	\$0
<b>SPECIALIZED ITEMS</b>						
Install water quality monitoring pipes		each		#N/A	\$0.00	\$0
Install permanent pumping system		each		#N/A	\$0.00	\$0
Assess underground stability	Rock mechanics inspection before closure	each	1	Sabina	\$11,586.92	\$11,587
					<b>Total</b>	\$124,879
					<b>% of Total</b>	100%

Underground Mine Name	Goose Main			UG Mine # 3	3	
ACTIVITY/MATERIAL	Notes	Unit	Qty	Cost Code	Unit Cost	Cost Total Cost
<b>CONTROL ACCESS</b>						
Fence		m		#N/A	\$0.00	\$0
Signs		each		#N/A	\$0.00	\$0
Block roads		m3		#N/A	\$0.00	\$0
Berm		m3		#N/A	\$0.00	\$0
Backfill Portal (NPAG waste rock plug)	At least 5 m deep into 5x4.5m portal and slope at least 2:1 outside of portal	m3	150	PORL	\$23.13	\$3,469
Backfill portal #2		m3		#N/A	\$0.00	\$0
Cap raise # 1	Concrete plug over 4m-dia. vent raise	LS	28	SRH	\$2,623.03	\$74,232
Cap raise #2		m3		#N/A	\$0.00	\$0
Cap shaft #1		m3		#N/A	\$0.00	\$0
Cap shaft #2		m3		#N/A	\$0.00	\$0
Backfill adits		m3		#N/A	\$0.00	\$0
Backfill open stope		m3		#N/A	\$0.00	\$0
Concrete cap over open stope		m3		#N/A	\$0.00	\$0
Other						
<b>REMOVE HAZARDOUS MATERIALS</b>						
Remove hazardous materials, U/G labor	Two shifts with loader, incl. operator and fuel	manhour	20	load-sL	\$215.30	\$4,306
Remove/decontam. stationary & elect. equip		mandays		#N/A	\$0.00	\$0
Remove/decontam. mobile equipment		each		#N/A	\$0.00	\$0
Remove misc. haz. mat & explosives	Mining will cease before closure	kg		#N/A	\$0.00	\$0
Decommission WTP - Goose Lake Pipeline	In Water Management tab	m		#N/A	\$0.00	\$0
<b>INSTALL BULKHEADS</b>						
Bulkheads to control water flow		each		#N/A	\$0.00	\$0
Grout bulkhead		m3		#N/A	\$0.00	\$0
<b>FLOOD MINE</b>						
Supply/install pump	UG mine is expected to be flooded in Year 10 and active flooding will take about a year, relocation of pipelines and flooding will occur as progressive reclamation but cost is provided as a conservative approach	each		#N/A	\$0.00	\$0
Supply/install piping system	Adjust pipe line to route to Goose UG in Year 10	m	4,500	Sabina	\$14.81	\$66,625
Operate pumps to flood workings		m3	391,630	Sabina	\$0.15	\$60,552
Decommission SWP to Goose UG pipeline		m	10,800	Sabina	\$11.59	\$125,139
Other				#N/A	\$0.00	\$0
<b>INSTALL GROUNDWATER COLLECTION SYSTEM</b>						
Excavate/install sumps		m2		#N/A	\$0.00	\$0
Install pumping wells		m3		#N/A	\$0.00	\$0
Install pumps/pipelines/power supply		LS		#N/A	\$0.00	\$0
<b>SPECIALIZED ITEMS</b>						
Install water quality monitoring pipes		each		#N/A	\$0.00	\$0
Install permanent pumping system		each		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>Total</b>					\$334,323	\$334,323
<b>% of Total</b>						100%

Underground Mine Name	Echo			UG Mine # 4	4		
ACTIVITY/MATERIAL	Notes	Unit	Qty	Cost Code	Unit Cost	Cost Total Cost	
<b>CONTROL ACCESS</b>							
Fence		m		#N/A	\$0.00	\$0	
Signs		each		#N/A	\$0.00	\$0	
Block roads		m3		#N/A	\$0.00	\$0	
Berm		m3		#N/A	\$0.00	\$0	
Backfill Portal (NPAG waste rock plug)	At least 5 m deep into 5x4.5m portal and slope at least 2:1 outside of portal	m3	150	PORL	\$23.13	\$3,469	
Backfill portal #2		m3		#N/A	\$0.00	\$0	
Cap raise # 1	Concrete plug over 4m-dia. vent raise	LS	28	SRH	\$2,623.03	\$74,232	
Cap raise #2		m3		#N/A	\$0.00	\$0	
Cap shaft #1		m3		#N/A	\$0.00	\$0	
Cap shaft #2		m3		#N/A	\$0.00	\$0	
Backfill adits		m3		#N/A	\$0.00	\$0	
Backfill open stope		m3	3,550	Sabina	\$6.95	\$24,680	
Concrete cap over open stope		m3		#N/A	\$0.00	\$0	
Other				#N/A	\$0.00	\$0	
<b>REMOVE HAZARDOUS MATERIALS</b>							
Remove hazardous materials, U/G labor	One shift with loader, incl. operator and fuel	manhour	10	load-sL	\$215.30	\$2,153	
Remove/decontam. stationary & elect. equip		mandays		#N/A	\$0.00	\$0	
Remove/decontam. mobile equipment		each		#N/A	\$0.00	\$0	
Remove misc. haz. mat & explosives	Mining will cease before closure	kg		#N/A	\$0.00	\$0	
Decommission Pipeline		m		#N/A	\$0.00	\$0	
<b>INSTALL BULKHEADS</b>							
Bulkheads to control water flow		each		#N/A	\$0.00	\$0	
Grout bulkhead		m3		#N/A	\$0.00	\$0	
<b>FLOOD MINE</b>							
Supply/install pump	Passive flooding of Echo UG in Year 10, complete flooding is expected to occur within a few months.	each		#N/A	\$0.00	\$0	
Supply/install piping system		each		#N/A	\$0.00	\$0	
Operate pumps to flood workings		m3		#N/A	\$0.00	\$0	
Decommission				#N/A	\$0.00	\$0	
Other				#N/A	\$0.00	\$0	
<b>INSTALL GROUNDWATER COLLECTION SYSTEM</b>							
Excavate/install sumps		m2		#N/A	\$0.00	\$0	
Install pumping wells		m3		#N/A	\$0.00	\$0	
Install pumps/pipelines/power supply		LS		#N/A	\$0.00	\$0	
<b>SPECIALIZED ITEMS</b>							
Install water quality monitoring pipes		each		#N/A	\$0.00	\$0	
Install permanent pumping system		each		#N/A	\$0.00	\$0	
Assess underground stability	Rock mechanics inspection before closure	each	1	Sabina	\$11,586.92	\$11,587	
					<b>Total</b>	\$116,121	\$116,121
					<b>% of Total</b>		100%

1

Rock Pile Name: Umwelt, Llama, Goose Main, and Echo

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>STABILIZE SLOPES</b>						
Flatten slopes with dozer		m3		#N/A	\$0.00	\$0
Flatten "bubble dump" areas		m3		#N/A	\$0.00	\$0
Divert runoff, ditch mat'l A		m3		#N/A	\$0.00	\$0
Divert runoff, ditch mat'l B		m3		#N/A	\$0.00	\$0
Toe buttress, drain mat'l		m3		#N/A	\$0.00	\$0
Toe buttress, fill mat'l A		m3		#N/A	\$0.00	\$0
Toe buttress, fill mat'l B		m3		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>COVER ROCK PILE</b>						
Subgrade preparation - doze surface		m3		#N/A	\$0.00	\$0
Soil cover - excavate,haul,spread&compact		m3		#N/A	\$0.00	\$0
Rock cover - excavate, haul & spread	Cover 3 rock piles: Umwelt, Llama, and Goose Main (incorporates Echo WRSA and Echo TF into Goose Main WRSA). WRSAs will be covered progressively by direct hauling NPAG during mining. Maximum PAG Exposure occurs end of Year 3 for 31.5 ha; 5 m cover converts this area to 1.6 Mm3.	m3	1,574,457	RBSS	\$8.11	\$12,770,177
Excavate downslope drainage channel & chute		m3		#N/A	\$0.00	\$0
Rip rap drainage channel and chute		m3		#N/A	\$0.00	\$0
Vegetate		ha		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>VERY LOW PERMEABILITY COVER (in addition to above)</b>						
Liner subgrade preparation - compact		m2		#N/A	\$0.00	\$0
Supply geomembrane		m2		#N/A	\$0.00	\$0
Install geomembrane		m2		#N/A	\$0.00	\$0
Protective cover - excavate,haul,spread&compact		m3		#N/A	\$0.00	\$0
Vegetate		ha		#N/A	\$0.00	\$0
Install infiltration/seepage instrumentation		allow		#N/A	\$0.00	\$0
<b>CONSTRUCT DIVERSION DITCHES</b>						
Excavate ditches -soil		m3		#N/A	\$0.00	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0
<b>CONSTRUCT SEEPAGE COLLECTION POND</b>						
Excavate seepage collection pond	See Water Management tab for berm breaching	m3		#N/A	\$0.00	\$0
Doze & spread excavated material		m3		#N/A	\$0.00	\$0
Vegetate spread material		ha		#N/A	\$0.00	\$0
Bedding layer		m3		#N/A	\$0.00	\$0
Supply geomembrane		m2		#N/A	\$0.00	\$0
Install geomembrane		m2		#N/A	\$0.00	\$0
Erosion protection layer		m3		#N/A	\$0.00	\$0
<b>INSTALL GROUNDWATER COLLECTION SYSTEM</b>						
Excavate/install sumps		m3		#N/A	\$0.00	\$0
Install pumping wells		m3		#N/A	\$0.00	\$0
Install pumps/pipelines/power supply		allow		#N/A	\$0.00	\$0
<b>RELOCATE DUMPS</b>						
Load, haul, dump or doze		m3		#N/A	\$0.00	\$0
Add lime		tonne		#N/A	\$0.00	\$0
Contour reclaimed area		ha		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>SPECIALIZED ITEMS</b>						
Install ground temperature monitoring cables	Will be installed during Operations to meet operational monitoring commitments	each		#N/A	\$0.00	\$0
Install permanent instrumentation, drilling		each		#N/A	\$0.00	\$0
<b>TREAT ROCK PILE SEEPAGE - see "Water Management"</b>						
<b>HEAP LEACH SEEPAGE TREATMENT - Cyanide Detox</b>						
Cyanide destruction water treatment pumping		m3		#N/A	\$0.00	\$0
Reagents		tonnes		#N/A	\$0.00	\$0
Electrician/mechanic to maintain treatment plant		allow		#N/A	\$0.00	\$0
Equipment maintenance and parts		allow		#N/A	\$0.00	\$0
					Annual treatment costs	
Number of years of treatment		years	0			
					Total treatment costs	
						\$0
<b>HEAP LEACH SEEPAGE TREATMENT - ARD/ML</b>						
Upgrade/modify pumping system - report to WTP		allow		#N/A	\$0.00	\$0
					<b>Total</b>	<b>\$12,770,177</b>
					<b>% of Total</b>	<b>100%</b>

\* For construction of passive treatment system refer to "Water Management".

1 Building / Equip Name:

Bldg / Equip #: 1

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
<b>DISPOSE MOBILE EQUIPMENT</b>						
Decontaminate and ship off-site		allow		#N/A	\$0.00	\$0
Decontaminate and dispose on-site	Drive or transport to landfill; drain fluids; NPAG cover cost below	allow	1	Sabina	\$23,173.84	\$23,174
Other				#N/A	\$0.00	\$0
<b>REMOVE BUILDINGS - see note below</b>						
Accommodation Complex	Goose Admin: Kitchen/camp. Landfill building materials and pad.	m2	1,980	BRS1L	\$55.36	\$109,621
Process Facilities		m2	6,464	BRS1H	\$79.97	\$516,928
Crusher		m2	1,630	BRS1H	\$79.97	\$130,352
Power plant		m2	2,040	BRS1H	\$79.97	\$163,140
Emergency power plant		m2	300	BRS1H	\$79.97	\$23,991
Truck Shop/Office	Goose Admin building	m2	2,349	BRS1L	\$55.36	\$130,075
Cold storage	Goose Admin building	m2	840	BRS1L	\$55.36	\$46,506
Storage Facilities	Waste oil storage Goose Site	Lot	1	Sabina	\$50,209.99	\$50,210
Storage Facility	Goose freight storage	Lot	1	Sabina	\$22,304.82	\$22,305
Water and Wastewater Treatment Facilities	Water treatment plant Goose Building	m2	647	BRS1L	\$55.36	\$35,821
Sewage Treatment Plant	Remove hazardous materials and dispose of at licensed facility, landfill building materials	Lot	1	Sabina	\$13,382.89	\$13,383
Fuel Tanks	Fuel storage and distribution Goose facility	Lot	1	Sabina	\$178,438.60	\$178,439
Offices, Repair, Lab, Warehouse	MLA infrastructure Port Office	Units	5	Sabina	\$2,711.34	\$13,557
Pipeline	MLA Infrastructure	m	10,000	Sabina	\$11.59	\$115,869
Warehouse, Shops and Others	MLA Infrastructure. Includes: Incinerator and waste management, Warehouses, Genset, Maintenance shop, water storage, WTP/STP, camp/office, freight storage area, waste area, MLA Fuel Storage Area. Cost includes grade and contour pads, disposal at designated areas, remove hazard material when applicable. Additional Cost included for MLA Fuel Transfer Area tank and liner removal.	LS	1	Sabina	\$376,702.42	\$376,702
Freshwater intakes	pipes will be capped at substrate and left in place.	m2		#N/A	\$0.00	\$0
Reclaim pumps		m2		#N/A	\$0.00	\$0
Outfall & Diffuser		m2		#N/A	\$0.00	\$0
Airstrip lighting, navigation, electrician	Accounts for Goose 6,000-ft airstrip	manhours	24	elech	\$116.88	\$2,805
Airstrip lighting, navigation, mechanical	Accounts for Goose 6,000-ft airstrip	manhours	24	mechH	\$89.63	\$2,151
Break foundation slabs		m2		#N/A	\$0.00	\$0
Consolidate & dump boneyard debris		m3		#N/A	\$0.00	\$0
Other	Remove Buildings - WIR Service/Emergency Camps, total of 3 1-ha area for 3 camps; assume all structures will be sprung structures.	LS	3	Sabina	\$82,933.79	\$248,801
<b>LANDFILL FOR DEMOLITION WASTE</b>						
Place rock cover		m3	25,000	RR3L	\$8.61	\$215,305
Place soil cover		m3		#N/A	\$0.00	\$0
Vegetate		ha		#N/A	\$0.00	\$0
<b>GRADE AND CONTOUR PADS</b>						
Accommodation Complex	Goose Admin: Kitchen/camp. no concrete foundation	ha	0.2	SCFYL	\$5,290.35	\$1,058
Process Facilities	concrete foundation demolished to ground level	m2	6,464	BRCS	\$7.38	\$47,716
Crusher	concrete foundation demolished to ground level	m2	1,630	BRCS	\$7.38	\$12,032
Power plant	no concrete foundation	ha	0.3	SCFYL	\$5,290.35	\$1,587
Emergency power plant	no concrete foundation	ha	0.10	SCFYL	\$5,290.35	\$529
Truck Shop/Office	concrete foundation demolished to ground level	m2	2,349	BRCS	\$7.38	\$17,343
Cold storage	no concrete foundation	ha	0.1	SCFYL	\$5,290.35	\$529
Water and Wastewater Treatment Facilities	no concrete foundation	ha	0.1	SCFYL	\$5,290.35	\$529
Sewage Treatment Plant	no concrete foundation	m2	33	BRCS	\$7.38	\$244
Fuel Tanks	Fuel storage and distribution Goose facility; no concrete foundation	ha	2.2	SCFYL	\$5,290.35	\$11,639
Warehouse, Shops and Other	MLA, includes all storage/laydown pads, Fuel Tank areas, airstrip, shoreline pads, and camp area	ha	20	SCFYL	\$5,290.35	\$105,807
Place rock cover		m3		#N/A	\$0.00	\$0
Vegetate		ha		#N/A	\$0.00	\$0
<b>PUNCTURE LINED SUMPS</b>						
Puncture liner and place soil cover		m3		#N/A	\$0.00	\$0
<b>RECLAIM ROADS</b>						
Restore drainage, remove culverts haul road	Restore drainage including culverts at Goose Property; no culverts at MLA. Roads will remain intact to facilitate long-term access.	m3	1,488	Sabina	\$12.75	\$18,965
Remove bridges		each		#N/A	\$0.00	\$0
Scarify and install water breaks		ha		#N/A	\$0.00	\$0
Restore drainage airstrip	Accounts for Goose 6,000ft by 200ft airstrip dimensions	m3	1,360	Sabina	\$13.90	\$18,910
Scarify airstrip area	Accounts for Goose 6,000ft by 200ft airstrip (1,829 m x 61 m = 11.2 ha)	ha	11.2	SCFYL	\$5,290.35	\$59,252
Scarify Winter Ice Roads & WIR Camps	Fill sections on land - 15 km x 10 m wide = 15.0 ha; plus 3 ha for WIR Service/Emergency Camps (1 ha/camp x 3)	ha	18	SCFYH	\$7,418.79	\$133,538
Vegetate - Subbase & WIR Camps	Potential vegetation of roads to include 18 ha of scarified subbase and camps, plus a nominal area of 3 ha for spill or other road remediation area.	ha	21	VHFL	\$4,921.25	\$103,346
Other				#N/A	\$0.00	\$0
<b>SPECIALIZED ITEMS</b>						
Dispose of misc. debris and laydown area refuse				#N/A	\$0.00	\$0
<b>Total</b>						\$2,952,160
<b>% of Total</b>						

1 Chemicals/Soil Area Name:

**Note:** The procedures, equipment and packaging for clean up and removal of chemicals or contaminated soils are highly dependent on the nature of the chemicals and their existing state of containment. Government guidelines should be consulted on an individual chemical basis. Any estimate made here should be considered very rough unless specific evaluations have been conducted.

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>HAZARDOUS MATERIALS AUDIT</b>						
Hazardous materials audit		mandays		#N/A	\$0.00	\$0
Phase 1 audit		each	1	CS1L	\$9,227.35	\$9,227
Phase 2 audit		each	1	CS2L	\$61,515.66	\$61,516
<b>BUILDING DECONTAMINATION &amp; CONSOLIDATION OF HAZARDOUS MATERIALS</b>						
Environmental technician/coordinator		mandays		#N/A	\$0.00	\$0
Decontaminate: oil, fuel		mandays		#N/A	\$0.00	\$0
Decontaminate maintenance shop		mandays		#N/A	\$0.00	\$0
Decontaminate power plant		mandays		#N/A	\$0.00	\$0
Decontaminate bulk fuel storage		mandays		#N/A	\$0.00	\$0
Decontaminate ANFO plant		mandays		#N/A	\$0.00	\$0
Decontaminate offices/warehouse/accom		mandays		#N/A	\$0.00	\$0
Removal of asbestos siding on buildings		m2		#N/A	\$0.00	\$0
Removal of friable asbestos on equipment		m2		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>HAZARDOUS MATERIALS REMOVAL</b>						
Waste oils	Consume in a waste oil burner on-site	litre	10,000	ORL	\$0.53	\$5,290
Waste fuel	Consume on-site to power an incinerator, or in a waste oil burner	litre	250,000	ORL	\$0.53	\$132,259
Waste batteries	Assumed 10 20-kg batteries generated in the final year of closure	kg	200	PCRH	\$3.08	\$615
Assay & environmental lab reagents		kg	500	PCRH	\$3.08	\$1,538
Machine shop paints, solvents etc.		litre	200	PCRH	\$3.08	\$615
Glycol		litre	5,000	PCRH	\$3.08	\$15,379
Process reagents		kg	130,000	PCRH	\$3.08	\$399,852
WTP sludge from Water Treatment	All sludge created and disposed during Operations. Conitngency 3 years of sludge disposal included (9,000 kg over 3 seasons).	kg	9,000	PCRH	\$3.08	\$27,682
Nuclear sources		allow		#N/A	\$0.00	\$0
Mobile Equipment	Remove hazardous waste from equipment not being salvaged, clean, landfill equipment	each	41	Sabina	\$2,641.82	\$108,315
<b>HAZARDOUS MATERIALS</b>						
Transportation to disposal facility	Included in hazardous materials removal cost	allow		#N/A	\$0.00	\$0
Disposal fees	Included in hazardous materials removal cost	allow		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>CONTAMINATED SOILS</b>						
Contam. soil investigation - Phase 1		LS	1	Sabina	\$8,690.19	\$8,690
Contam. soil investigation - Phase 2		LS	1	Sabina	\$57,934.61	\$57,935
<b>CONTAMINATED SOIL REMOVAL</b>						
Excavate and transport to onsite facility		m3	10,000	SB1H	\$7.26	\$72,588
Manage hydrocarbon remediation at facility		m3	10,000	CSR1	\$57.82	\$578,247
Reagents/stabilizing agent		m2		#N/A	\$0.00	\$0
Excavate and transport to offsite facility		m3		#N/A	\$0.00	\$0
Contour decontaminated area	Decommission 2 landfarms and confirmation soil sampling; estimated 6,000m3 at each of Goose and MLA sites.	m3	12,000	SB1L	\$5.29	\$63,484
<b>CONTAMINATED SOIL VERY LOW PERMEABILITY COVER</b>						
Supply geomembrane, HDPE, ES3, GCL		m2		#N/A	\$0.00	\$0
Upper and lower bedding layers		m3		#N/A	\$0.00	\$0
Install geomembrane, HDPE, ES3, GCL		m2		#N/A	\$0.00	\$0
Erosion protection layer		m3		#N/A	\$0.00	\$0
Vegetate		m2		#N/A	\$0.00	\$0
Install infiltration/seepage instrumentation		allow		#N/A	\$0.00	\$0
Other	Operate 2 landfarms: 1 at Goose, 1 at MLA	allow	2	Sabina	\$57,934.61	\$115,869
<b>OTHER</b>						
				#N/A	\$0.00	\$0
					<b>Total</b>	\$1,659,101
					<b>% of Total</b>	100%

1 Water Management

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>BREACH DYKE EMBANKMENT</b>						
Breach Llama Lake Diversion Berms	During closure.	m3	665	#N/A	\$8.46	\$5,625
Breach Llama WRSA Diversion Berm	During closure.	m3	95	#N/A	\$8.46	\$804
Breach Llama WRSA Containment Dam	During closure.	m3	95	#N/A	\$8.46	\$804
Breach Primary Pond Containment Dam	During closure.	m3	200	#N/A	\$8.46	\$1,692
Breach Umwelt WRSA Containment Dam	Dam has been removed from water management design	m3	-	#N/A	\$0.00	\$0
Breach Umwelt WRSA Diversion Berm	Berm has been removed from water management design	m3	-	#N/A	\$0.00	\$0
Breach Echo WRSA Containment Dam	Dam has been removed from water management design	m3	-	#N/A	\$8.46	\$0
Breach Echo Diversion Berm	During closure.	m3	190	#N/A	\$8.46	\$1,607
Breach Echo WRSA Diversion Berm	Berm has been removed from water management design	m3	-	#N/A	\$8.46	\$0
Breach Echo/Goose Main Containment Dam	During closure.	m3	95	#N/A	\$8.46	\$804
Breach Goose Main Diversion Berm	During closure.	m3	95	#N/A	\$8.46	\$804
Breach Plant Site Pond Containment Dam	During closure.	m3	215	#N/A	\$8.46	\$1,819
Breach SWP Containment Dam	During closure.	m3	430	#N/A	\$9.27	\$3,986
Remove Liner from all berms	Remove liner from all berms.	m2	30,700	Sabina	\$0.81	\$24,900
Contour water intake area		m3		#N/A	\$0.00	\$0
<b>STABILIZE SEDIMENT PONDS/WATER MANAGEMENT PONDS</b>						
Place soil cover		m3		#N/A	\$0.00	\$0
Doze & spread excavated material		m3		#N/A	\$0.00	\$0
Vegetate spread material		ha		#N/A	\$0.00	\$0
Rip rap in channel base		each		#N/A	\$0.00	\$0
<b>REDIRECT RUNOFF/CONSTRUCT DIVERSION DITCHES</b>						
Excavate ditches -soil		m3		#N/A	\$0.00	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0
Stabilize side slopes		m3		#N/A	\$0.00	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0
<b>BREACH DITCHES</b>						
Excavate breaches		m3		#N/A	\$0.00	\$0
Install flow dissipation		m3		#N/A	\$0.00	\$0
Vegetate remainder of ditch		m2		#N/A	\$0.00	\$0
<b>DECOMMISSION FRESH WATER SUPPLY</b>						
Breach embankment		m3		#N/A	\$0.00	\$0
Remove pump		LS		#N/A	\$0.00	\$0
Remove pipelines		m		#N/A	\$0.00	\$0
<b>DECOMMISSION WATER RECLAIM BARGE</b>						
Decommission reclaim barge from Llama TF		LS	1	Sabina	\$11,586.92	\$11,587
<b>WATER CONTROL IN RECLAMATION QUARRY</b>						
Install pumping system		LS		#N/A	\$0.00	\$0
Remove pumping system		m		#N/A	\$0.00	\$0
<b>REMOVE PIPELINES</b>						
Decommission Llama pump and pipeline		m	700	Sabina	\$21.52	\$15,063
Decommission WTP-Goose Lake pipeline		m	1,140	Sabina	\$11.59	\$13,209
Remove Saline Water Pond pump and pipeline		m	10,800	Sabina	\$12.39	\$133,829
Remove Primary Pond pump and pipeline		m	7,250	Sabina	\$12.79	\$92,695
Remove Echo WRSA Pond pump and pipeline	Has been removed from water management design	m	-	Sabina	\$11.59	\$0
Remove Echo NCW pond pump and pipeline	Has been removed from water management design	m	-	Sabina	\$27.39	\$0
Remove Plant Site Pond pump and pipeline		m	4,550	Sabina	\$11.59	\$52,720
Decommission WTP pump and pipeline		m	7,520	Sabina	\$12.62	\$94,937
Decommission WTP		LS	2	Sabina	\$11,297.25	\$22,594
Concrete plug deep pipes		m3		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>OPERATE WATER TREATMENT PLANT</b>						
Pump from TSF to WTP		m3	-	POCL	\$0.15	\$0
Treat water in WTP	No treatment required for early closure at end Year 4 (max PAG exposure). End Year 4 is transition from Echo TF to Umwelt TF.	m3	-	Sabina	\$0.75	\$0
Pump water out of WTP		m3	-	POCL	\$0.15	\$0
<b>OPERATE WATER TREATMENT PLANT</b>						
Pump to WTP		m3	3,000,000	POCL	\$0.15	\$442,913
Treat water in WTP	Water treatment (and pumping) allotment to address potential water treatment considerations during the Closure Phase.	m3	3,000,000	Sabina	\$0.75	\$2,259,450
Pump water out of WTP		m3	3,000,000	POCL	\$0.15	\$442,913
<b>GROUNDWATER COLLECTION SYSTEM</b>						
Excavate/install sumps		m3		#N/A	\$0.00	\$0
Install pumping wells		m3		#N/A	\$0.00	\$0
Install pumps/pipelines/power supply		LS		#N/A	\$0.00	\$0
<b>CONSTRUCT CONTAMINATED WATER STORAGE POND</b>						
Excavate pond		m3		#N/A	\$0.00	\$0
Doze & spread excavated material		m3		#N/A	\$0.00	\$0
Vegetate spread material		ha		#N/A	\$0.00	\$0
Bedding layer		m3		#N/A	\$0.00	\$0
Supply geomembrane		m2		#N/A	\$0.00	\$0
Install geomembrane		m2		#N/A	\$0.00	\$0
Erosion protection layer		m3		#N/A	\$0.00	\$0
<b>CONSTRUCT PASSIVE TREATMENT SYSTEM (e.g. Constructed Wetland)</b>						
Construct access roads		km		#N/A	\$0.00	\$0
Install HDPE piping system from collection pond		m		#N/A	\$0.00	\$0
Inter-cell flow structures		allow		#N/A	\$0.00	\$0
Install liners		m2		#N/A	\$0.00	\$0
Install growth media		m3		#N/A	\$0.00	\$0
Wetland vegetation		ha		#N/A	\$0.00	\$0
<b>CONSTRUCT WATER TREATMENT PLANT</b>						
Build treatment plant	Treatment Plant will be constructed as part of operations	LS		#N/A	\$0.00	\$0
Build sludge containment facility		LS		#N/A	\$0.00	\$0
					<b>Total</b>	<b>\$3,624,753</b>

For details of long-term/post-closure water treatment see "WATER TREATMENT" Worksheet; costs included in this tab.

1 Interim Care and Maintenance

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>INTERIM CARE &amp; MAINTENANCE</b>						
Camp operation	Caretaker and summer personnel	mandays	306	Sabina	127.46	\$39,002
On-site staff	Caretaker and summer personnel	manhours	3,060	ENVCO	91.24	\$279,195
extra personnel		manmonths		#N/A	0	\$0
-electrician		manmonths		#N/A	0	\$0
-mechanic		manmonths		#N/A	0	\$0
annual fuel	Fuel for vehicles; fuel for pumping included in water treatment cost	litre	5,000	FCDH	1.71	\$8,551
misc. supplies		allow	1	Sabina	23174	\$23,174
pick-up truck		each		#N/A	0	\$0
small dozer		allow		#N/A	0	\$0
small excavator		allow		#N/A	0	\$0
snow machine		allow		#N/A	0	\$0
communications		allow		#N/A	0	\$0
SNP/AEMP water sampling & reporting	Sampling and lab costs	each	1	WSH	12303	\$12,303
geotechnical assessment	Annual geotechnical inspection	each	1	RPTH	24606	\$24,606
interim water treatment	Captured under Water Treatment	each	1	#N/A	0	\$0
other		each		#N/A	0	\$0
				Annual Interim C&M Cost		\$386,830
Number of years of ICM		years	3	<b>Total</b>		<b>\$1,160,490</b>

**10 Years  
(Year 13 to 22)**

<b>ACTIVITY/MATERIAL - WEMP and TERRESTRIAL</b>	<b>Notes</b>	<b>Units</b>	<b>Quantity</b>	<b>Cost Code</b>	<b>Unit Cost</b>	<b>Total Cost</b>
<b>MONITORING &amp; INSPECTIONS</b>						
Total geotechnical inspections (1 yearly)		year		#N/A	\$0.00	\$0
Waste Rock Piles		year		#N/A	\$0.00	\$0
Pit Walls		year		#N/A	\$0.00	\$0
WR GTC Monitoring		year		#N/A	\$0.00	\$0
Survey inspection		each		#N/A	\$0.00	\$0
Regulatory costs*		year		#N/A	\$0.00	\$0
Site water monitoring		each		#N/A	\$0.00	\$0
- Active closure and flooding		each		#N/A	\$0.00	\$0
- Post pit flooding		each		#N/A	\$0.00	\$0
Wildlife Effects Monitoring Program (WEMP)	Aquatics - Non-contact water basins (10 years)	year	1	Sabina	\$5,561.72	\$5,562
Terrestrial Animal Monitoring	Terrestrial Animal Monitoring (10 years)	year	1	Sabina	\$27,808.61	\$27,809
Vegetation Monitoring		each		#N/A	\$0.00	\$0
Maintain gravel road surface		year		#N/A	\$0.00	\$0
Maintain airstrip surface		year		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>COVER MAINTENANCE</b>						
Repair erosion - infill gullies		allow		#N/A	\$0.00	\$0
Repair erosion - upgrade diversion ditches		allow		#N/A	\$0.00	\$0
Remove problem vegetation		allow		#N/A	\$0.00	\$0
Repair animal damage		allow		#N/A	\$0.00	\$0
Repair/upgrade access controls		allow		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>SPILLWAY MAINTENANCE</b>						
Repair erosion		m3		#N/A	\$0.00	\$0
Clear spillway		each		#N/A	\$0.00	\$0
<b>CWTS MAINTENANCE</b>						
Maintain flow, restore vegetation		allow		#N/A	\$0.00	\$0
<b>POST-CLOSURE WATER TREATMENT</b>						
Annual water treatment cost, from "Water Treatment"		LS		#N/A	\$0.00	\$0
Subtotal, Annual post-closure costs						\$33,370
Discount rate for calculation of net present value of post-closure cost, %				0.00%		
Number of years of post-closure activity				10	years	
<b>Present Value of payment stream</b>						\$333,703

**13 Years  
(Year 13 to 25)**

ACTIVITY/MATERIAL - Monitoring & Maintenance	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>MONITORING &amp; INSPECTIONS</b>						
Total geotechnical inspections (1 yearly)		year		#N/A	\$0.00	\$0
Waste Rock Piles	Annual inspection of WR piles from closure to post-closure (13 years)	year	1	Sabina	\$9,617.15	\$9,617
Pit Walls	Annual inspection of pit walls from closure to post-closure (13 years)	year	1	Sabina	\$4,634.77	\$4,635
WR GTC Monitoring	Umwelt, Llama, and TSF WRSA ground temp cable annual monitoring. No GTCs at Echo WRSA (13 years)	year	1	Sabina	\$16,685.17	\$16,685
Survey inspection		each		#N/A	\$0.00	\$0
Regulatory costs	annual reporting, management plans, progress reports (13 years)	year	1	Sabina	\$28,967.30	\$28,967
Site water monitoring	All pits and WR piles closure and post closure monitoring (13 years)	year	1	Sabina	\$10,567.27	\$10,567
- Active closure and flooding		each		#N/A	\$0.00	\$0
- Post pit flooding		each		#N/A	\$0.00	\$0
Wildlife Effects Monitoring Program (WEMP)		year		#N/A	\$0.00	\$0
Terrestrial Animal Monitoring		year		#N/A	\$0.00	\$0
Vegetation Monitoring		each		#N/A	\$0.00	\$0
Maintain gravel road surface	maintenance from closure to post-closure (13 years)	year	1	Sabina	\$15,816.15	\$15,816
Maintain airstrip surface	maintenance from closure to post-closure (13 years)	year	1	Sabina	\$4,518.90	\$4,519
Other				#N/A	\$0.00	\$0
<b>COVER MAINTENANCE</b>						
Repair erosion - infill gullies		allow		#N/A	\$0.00	\$0
Repair erosion - upgrade diversion ditches		allow		#N/A	\$0.00	\$0
Remove problem vegetation		allow		#N/A	\$0.00	\$0
Repair animal damage		allow		#N/A	\$0.00	\$0
Repair/upgrade access controls		allow		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>SPILLWAY MAINTENANCE</b>						
Repair erosion		m3		#N/A	\$0.00	\$0
Clear spillway		each		#N/A	\$0.00	\$0
<b>CWTS MAINTENANCE</b>						
Maintain flow, restore vegetation		allow		#N/A	\$0.00	\$0
<b>POST-CLOSURE WATER TREATMENT</b>						
Annual water treatment cost, from "Water Treatment"		LS		#N/A	\$0.00	\$0
Subtotal, Annual post-closure costs						\$90,807
Discount rate for calculation of net present value of post-closure cost, %				0.00%		
Number of years of post-closure activity				13	years	
<b>Present Value of payment stream</b>						\$1,180,487

**Beyond Post Closure (Long Term 1 to 5, 7, 10, 15, 25)**

<b>ACTIVITY/MATERIAL - Long Term Monitoring</b>	<b>Notes</b>	<b>Units</b>	<b>Quantity</b>	<b>Cost Code</b>	<b>Unit Cost</b>	<b>Total Cost</b>
<b>MONITORING &amp; INSPECTIONS</b>						
General Water Sampling and Stability Monitoring	long term general monitoring	year	1	Sabina	\$46,347.69	\$46,348
Waste Rock Piles		year		#N/A	\$0.00	\$0
Pit Walls		year		#N/A	\$0.00	\$0
WR GTC Monitoring		year		#N/A	\$0.00	\$0
Survey inspection		each		#N/A	\$0.00	\$0
Regulatory costs		each	1	RPTH	\$24,606.27	\$24,606
Site water monitoring		year		#N/A	\$0.00	\$0
- Active closure and flooding		each		#N/A	\$0.00	\$0
- Post pit flooding		each		#N/A	\$0.00	\$0
Wildlife Effects Monitoring Program (WEMP)		year		#N/A	\$0.00	\$0
Terrestrial Animal Monitoring		year		#N/A	\$0.00	\$0
Vegetation Monitoring		each		#N/A	\$0.00	\$0
Maintain gravel road surface		year		#N/A	\$0.00	\$0
Maintain airstrip surface		year		#N/A	\$0.00	\$0
Other - Site Access	Float plane access	each	1	MWH	\$11,195.85	\$11,196
<b>COVER MAINTENANCE</b>						
Repair erosion - infill gullies		allow		#N/A	\$0.00	\$0
Repair erosion - upgrade diversion ditches		allow		#N/A	\$0.00	\$0
Remove problem vegetation		allow		#N/A	\$0.00	\$0
Repair animal damage		allow		#N/A	\$0.00	\$0
Repair/upgrade access controls		allow		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>SPILLWAY MAINTENANCE</b>						
Repair erosion		m3		#N/A	\$0.00	\$0
Clear spillway		each		#N/A	\$0.00	\$0
<b>CWTS MAINTENANCE</b>						
Maintain flow, restore vegetation		allow		#N/A	\$0.00	\$0
<b>POST-CLOSURE WATER TREATMENT</b>						
Annual water treatment cost, from "Water Treatment"		LS		#N/A	\$0.00	\$0
Subtotal, Annual post-closure costs						\$82,150
Discount rate for calculation of net present value of post-closure cost, %				0.00%		
Number of years of post-closure activity				See Long Term	years	
<b>Present Value of payment stream</b>						<b>\$739,348</b>

Annual Discount Rate:		0%			
Project Phase	Annual Discount Rate:	Closure Year	Post-Closure Monitoring Year	Long Term Monitoring (GTCs, physical, water)	
				One Time Cost	Yearly Total NPV
Operations	1				\$0
	2				\$0
	3				\$0
	4				\$0
	5				\$0
	6				\$0
	7				\$0
	8				\$0
	9				\$0
	10				\$0
	11				\$0
	12				\$0
Active Closure	13	1			\$0
	14	2			\$0
Passive Closure	15	3			\$0
	16	4			\$0
	17	5			\$0
	18	6			\$0
	19	7			\$0
	20	8			\$0
Post Closure	21	9	1	\$82,150	\$82,150
	22	10	2	\$82,150	\$82,150
	23	11	3	\$82,150	\$82,150
	24	12	4	\$82,150	\$82,150
	25	13	5	\$82,150	\$82,150
Beyond Post Closure	26	14	6		\$0
	27	15	7	\$82,150	\$82,150
	28	16	8		\$0
	29	17	9		\$0
	30	18	10	\$82,150	\$82,150
	31	19	11		\$0
	32	20	12		\$0
	33	21	13		\$0
	34	22	14		\$0
	35	23	15	\$82,150	\$82,150
	36	24	16		\$0
	37	25	17		\$0
	38	26	18		\$0
	39	27	19		\$0
	40	28	20		\$0
	41	29	21		\$0
	42	30	22		\$0
	43	31	23		\$0
	44	32	24		\$0
	45	33	25	\$82,150	\$82,150
<b>Net Present Value:</b>				<b>\$739,348</b>	

1 Mobilization/Demobilization:

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
<b>MOBILIZE HEAVY EQUIPMENT</b>						
Assumes mining equipment on abandoned mine site is operable and available.						
Light duty vehicles	Purchase pickups and Vans	each		#N/A	0	\$0
Telehandlers	Purchase (standby)	each		#N/A	0	\$0
Excavators	Purchase (320 Ex)	each		#N/A	0	\$0
Dump trucks	Purchase 30T	each		#N/A	0	\$0
Dozers	Purchase (D6T)	each		#N/A	0	\$0
Grader	Purchase (140M)	each		#N/A	0	\$0
Demolition shears	For a 320 Exc	each		#N/A	0	\$0
Crane	Purchase	each		#N/A	0	\$0
Loader	Purchase (966 Loader)	each		#N/A	0	\$0
Manlifts	Purchase (standby)	each		#N/A	0	\$0
Small Equipment		LS		#N/A	0	\$0
Compactor		each		#N/A	0	\$0
<b>MOBILIZE MISC. EQUIPMENT</b>						
Assumes mining equipment on abandoned mine site is operable and available.						
Pump shipping		each		#N/A	0	\$0
Pipe shipping		m		#N/A	0	\$0
Minor tools and equipment		allow		#N/A	0	\$0
Truck tires		allow		#N/A	0	\$0
Other				#N/A	0	\$0
<b>MOBILIZE CAMP</b>						
Build 20 Person Camp	Goose Closure Camp	LS	1	Sabina	\$22,304.82	\$22,305
Build 20 Person Power Plant	Goose Closure Camp	LS	1	Sabina	\$22,304.82	\$22,305
Reclamation activities		allow		#N/A	0	\$0
Long term reclamation activities (e.g. pump flooding)		allow		#N/A	0	\$0
<b>WORKER ACCOMODATIONS</b>						
Camp operation		mandays	12,000	Sabina	\$127.46	\$1,529,474
Reclamation activities		manmonths		#N/A	0	\$0
Long term reclamation activities (e.g. pump flooding)		manmonths		#N/A	0	\$0
<b>MOBILIZE FUEL</b>						
Fuel freight - reclamation activities		litre		#N/A	0	\$0
Fuel freight - long term reclamation activities		litre		#N/A	0	\$0
Oil & Other		litre		#N/A	0	\$0
Fuel freight accommodations		litre		#N/A	0	\$0
<b>GENERAL CONSTRUCTION INDIRECT</b>						
Tooling, consumables, office & safety supplies	covered in Summary tab indirects	mandays		#N/A	0	\$0
<b>DEMOBILIZE HEAVY EQUIPMENT</b>						
Excavators		km		#N/A	0	\$0
Dump trucks		km		#N/A	0	\$0
Dozers		km		#N/A	0	\$0
Demolition shears		km		#N/A	0	\$0
Crane		km		#N/A	0	\$0
Loader		km		#N/A	0	\$0
Compactor		each		#N/A	0	\$0
Light duty vehicles		km		#N/A	0	\$0
Other		km		#N/A	0	\$0
<b>DEMOBILIZE CAMP</b>						
Food and Freight		kg	27,600	Sabina	\$13.90	\$383,759
Freight		Lot	1	Sabina	\$579,346.09	\$579,346
Mobilization		tonnes	500	Sabina	\$1,738.04	\$869,019
<b>MOBILIZE &amp; DEMOBILIZE WORKERS</b>						
Crew travel time - inbound & outbound	16 manhours per rotation	manhours	6,864	lab-sh	\$61.02	\$418,866
Crew transportation - in& outbound from Yellowknife	28 day rotations - 12,000 man days - 2/3	each	286	Sabina	\$663.30	\$189,704
Crew transportation - in& outbound from south	28 day rotations - 12,000 man days - 1/3	each	143	Sabina	\$1,339.97	\$191,616
<b>WINTER ROAD</b>						
Construction and operation	Assumes construction and maintenance of 2-160 km winter ice roads; once during Active Closure and once in approximately Year 18.	km	320	WRCL	\$2,460.63	\$787,401
Limited winter use		km		#N/A	0	\$0
Winter road tariff		km		#N/A	0	\$0
					<b>Total</b>	<b>\$4,993,793</b>

Goose Gold Closure Component Estimating

															INFLATION		15.9%			
Code	Description	NOTES	EQUIPME T NUMBER	ESTIMATE SOURCE DOCUMENT	Qty	Unit of Measure	Unit Man hrs	Prod Fact	Labour			Const Equip Use		Other		Total				
									Total Man-hrs	Unit Cost	Total Cost	Unit Cost	Total Cost	Unit Cost	Total Cost	Unit Cost	Unit Cost (plus Inflation)	Total Cost	Total Cost (plus Inflation)	
<b>Open Pit Closure</b>																				
Place Boulder Fence																				
	Umwelt Open Pit	Updated for Modification Package		x	1,583	m	0.06	1.00	95	95	9,023	175.00	16,622	-	-	16	18.77	25,645	29,714	
	Echo open pit	Not in current mine plan: item remains to keep Stage in tact.		x	750	m	0.06	1.00	45	95	4,275	175.00	7,875	-	-	16	18.77	12,150	14,078	
	Goose open pit	Updated for Modification Package		x	2,340	m	0.06	1.00	140	95	13,338	175.00	24,570	-	-	16	18.77	37,908	43,924	
	Llama open pit	Updated for Modification Package: Perimeter only required where pit edge will not abut final flooded lake footprint. (i.e. 600 m total)		x	600	m	0.06	1.00	36	95	3,420	175.00	6,300	-	-	16	18.77	9,720	11,262	
<b>Remove Pump and Pipeline</b>																				
	Umwelt pit sump	Occurs during Operations		x	1,740	m	0.04	1.00	70	95	6,612	155.00	10,788	-	-	10.00	11.59	17,400	20,161	
	Llama pit sump	Occurs during Closure		x	2,850	m	0.04	1.00	114	95	10,830	155.00	17,670	-	-	10.00	11.59	28,500	33,023	
	Goose pit sump	Occurs during Operations		x	4,325	m	0.04	1.00	173	95	16,435	155.00	26,815	-	-	10.00	11.59	43,250	50,113	
	Echo pit sump	Updated for Supplementary Adjustments		x	2,820	m	0.04	1.00	113	95	10,716	155.00	17,484	-	-	10.00	11.59	28,200	32,675	
<b>Breach Pits into Receiving Waters</b>																				
	Umwelt open pit			x	1,200	m3	0.12	1.00	144		-	5.00	6,000	-	-	5.00	5.79	6,000	6,952	
	Llama open pit	Natural drainage connection		x	-	m3	0.12	1.00	-		-	5.00	-	-	-	-	-	-	-	
	Echo open pit	Natural drainage connection		x	-	m3	0.12	1.00	-		-	5.00	-	-	-	-	-	-	-	
	Goose open pit			x	600	m3	0.12	1.00	72		-	5.00	3,000	-	-	5.00	5.79	3,000	3,476	
	Landfill Mobile Equipment																			
	Goose Site Mobile Equipment			x	41	units	24.00	1.00	984	95	93,480	-	-	-	-	2,280	2,641.82	93,480	108,315	
<b>Underground Closure</b>																				
Saline Water Pond (SWP) / WTP																				
	Relocate pipeline to Umwelt UG from Llama UG	Not in current mine plan: cost remains to keep Stage in tact.		x	800	m	0.04	1.00	32	95	3,040	155.00	4,960	-	-	10.00	11.59	8,000	9,270	
	Dewater SWP to Umwelt UG	Accounts for Umwelt Underground (650 m), and Umwelt Underground Extension (650m to 900m)		x	1,071,225	m3	1.00	1.00	153	95	14,535	-	-	0.12	128,547	0.13	0.15	143,082	165,788	
	Decommission SWP to Umwelt UG pipeline	Accounts for Umwelt Underground (650 m), and Umwelt Underground Extension (650m to 900m)		x	1,662	m	0.04	1.00	66	95	6,316	155.00	10,304	-	-	10.00	11.59	16,620	19,257	
	Adjust pipeline to route to Llama UG	Not in current mine plan: cost remains to keep Stage in tact.		x	500	m	0.03	1.00	65	95	6,175	-	-	-	-	12.35	14.31	6,175	7,155	
	Dewater SWP to Llama UG	Not in current mine plan: cost remains to keep Stage in tact.		x	324,234	m3	1.00	1.00	80	95	7,600	-	-	0.11	35,666	0.13	0.15	43,266	50,132	
	Adjust pipeline to route to Goose UG	Not in current mine plan: cost remains to keep Stage in tact.		x	4,500	m	0.04	1.00	230	95	21,850	155.00	35,650	-	-	12.78	14.81	57,500	66,255	
	Dewater SWP to Goose UG	Not in current mine plan: cost remains to keep Stage in tact.		x	391,630	m3	1.00	1.00	215	95	20,425	-	-	0.11	43,079	0.16	0.19	63,504	73,582	
	Decommission SWP to Goose UG pipelines	Not in current mine plan: cost remains to keep Stage in tact.		x	10,800	m	0.04	1.00	432	95	41,040	155.00	66,960	-	-	10.00	11.59	108,000	125,139	
	Breach SWP Diversion Berms and Containment Dams			x	430	m3	0.12	1.00	52		-	8.00	3,440	-	-	8.00	9.27	3,440	3,986	
	Decommission WTP-Goose Lake pipeline			x	1,140	m	0.04	1.00	46	95	4,332	155.00	7,068	-	-	10.00	11.59	11,400	13,209	
	Llama UG			x	2,700	m	0.04	1.00	108	95	10,260	155.00	16,740	-	-	10.00	11.59	27,000	31,285	
<b>Decommission pipeline</b>																				
	Umwelt portal			x	150	m3	0.05	1.00	8		-	6.00	900	-	-	6.00	6.95	900	1,043	
	Plug declines with waste rock			x	150	m3	0.05	1.00	8		-	6.00	900	-	-	6.00	6.95	900	1,043	
	Llama portal			x	150	m3	0.05	1.00	8		-	6.00	900	-	-	6.00	6.95	900	1,043	
	Plug declines with waste rock	Not in current mine plan: item remains to keep Stage in tact.		x	150	m3	0.05	1.00	8		-	6.00	900	-	-	6.00	6.95	900	1,043	
	Echo portal			x	150	m3	0.05	1.00	8		-	6.00	900	-	-	6.00	6.95	900	1,043	
	Plug declines with waste rock	Not in current mine plan: item remains to keep Stage in tact.		x	150	m3	0.05	1.00	8		-	6.00	900	-	-	6.00	6.95	900	1,043	
	Umwelt vent/circular backfill raises			x	1	LS	1.00	1.00	60		-	-	-	-	-	120.000	139.043	120.000	139.043	
	Plug vent raises with concrete plug			x	1	LS	1.00	1.00	60		-	-	-	-	-	50.000	57.935	50.000	57.935	
	Llama vent/circular backfill raises			x	1	LS	1.00	1.00	60		-	-	-	-	-	50.000	57.935	50.000	57.935	
	Plug vent raises with concrete plug	Not in current mine plan: item remains to keep Stage in tact.		x	1	LS	1.00	1.00	60		-	-	-	-	-	50.000	57.935	50.000	57.935	
	Echo vent/circular backfill raises			x	1	LS	1.00	1.00	60		-	-	-	-	-	50.000	57.935	50.000	57.935	
	Plug vent raises with concrete plug	Not in current mine plan: item remains to keep Stage in tact.		x	1	LS	1.00	1.00	60		-	-	-	-	-	50.000	57.935	50.000	57.935	
	Echo crown pillar			x	3,550	m3	0.05	1.00	178		-	6.00	21,300	-	-	6.00	6.95	21,300	24,680	
	Plug UG slabs	Not in current mine plan: item remains to keep Stage in tact.		x	3,550	m3	0.05	1.00	178		-	6.00	21,300	-	-	6.00	6.95	21,300	24,680	
<b>Waste Rock Stockpiles and Landfills</b>																				
WR Pile Closure																				
	Cap and Slope WR Piles	Updated Waste Rock Volume cover allotment.		x	1,200,000	m3	0.06	1.00	72,000		-	6.00	7,200,000	-	-	###	##	6.95	7,200,000	8,342,584
	Landfill Closure			x	25,000	m3	0.06	1.00	1,500		-	6.00	150,000	-	-	6.00	6.95	150,000	173,804	
<b>Water Management Structures</b>																				
Llama Structures																				
	Breach Llama Lake Diversion Berms			x	665	m3	0.06	1.00	43		-	7.30	4,855	-	-	7.30	8.46	4,855	5,625	
	Breach Llama WRSA Diversion Berm			x	95	m3	0.06	1.00	6		-	7.30	694	-	-	7.30	8.46	694	804	
	Breach Llama WRSA Containment Dam			x	95	m3	0.06	1.00	6		-	7.30	694	-	-	7.30	8.46	694	804	
	Decommission Llama pump and pipeline			x	700	m	0.04	1.00	52	95	4,940	155.00	8,060	-	-	18.57	21.52	13,000	15,063	
<b>Umwelt Structures</b>																				
	Breach Primary Pond Containment Dam			x	200	m3	0.06	1.00	13		-	7.30	1,460	-	-	7.30	8.46	1,460	1,692	
	Breach Umwelt WRSA Containment Dam	Berm has been removed from water management design		x	-	m3	0.06	1.00	-		-	7.30	-	-	-	-	-	-	-	
	Breach Umwelt WRSA Diversion Berm	Berm has been removed from water management design		x	-	m3	0.06	1.00	-		-	7.30	-	-	-	-	-	-	-	
	Remove Saline Water Pond pump and pipeline			x	10,800	m	0.04	1.00	462	95	43,890	155.00	71,610	-	-	10.69	12.39	115,500	133,829	
	Remove Primary pond pump and pipeline	Occurs during Operations		x	7,250	m	0.04	1.00	320	95	30,400	155.00	49,600	-	-	11.03	12.79	80,000	92,695	
<b>Echo Structures</b>																				
	Breach Echo WRSA Containment Dam	Not in current mine plan: item remains to keep Stage in tact.		x	190	m3	0.06	1.00	12		-	7.30	1,387	-	-	7.30	8.46	1,387	1,607	
	Breach Echo Diversion Berm (East and West)	Not in current mine plan: item remains to keep Stage in tact.		x	190	m3	0.06	1.00	12		-	7.30	1,387	-	-	7.30	8.46	1,387	1,607	
	Breach Echo WRSA Diversion Berm	Not in current mine plan: item remains to keep Stage in tact.		x	95	m3	0.06	1.00	6		-	7.30	694	-	-	7.30	8.46	694	804	
	Breach East Echo Containment Dam	Not in current mine plan: item remains to keep Stage in tact.		x	95	m3	0.06	1.00	6		-	7.30	694	-	-	7.30	8.46	694	804	
	Remove Echo WRSA Pond pump and pipeline	Not in current mine plan: item remains to keep Stage in tact.		x	2,400	m	0.04	1.00	96	95	9,120	155.00	14,880	-	-	10.00	11.59	24,000	27,809	
	Remove Echo NCW pond pump and pipeline	Not in current mine plan: item remains to keep Stage in tact.		x	220	m	0.04	1.00	21	95	1,976	155.00	3,224	-	-	23.64	27.39	5,200	6,025	
<b>Goose Structures</b>																				
	Breach Goose Main Diversion Berm			x	95	m3	1.00	1.00	95		-	7.30	694	-	-	7.30	8.46	694	804	
<b>TSF Structures</b>																				
	Breach TSF Dam			x	11,000	m3	0.05	1.00	550		-	7.30	80,300	-	-	7.30	8.46	80,300	93,043	
	Breach TSF WRSA Diversion Berm			x	285	m3	0.05	1.00	14		-	7.30	2,081	-	-	7.30	8.46	2,081	2,411	
<b>Ore Stockpile Structures</b>																				
	Remove pump and pipeline			x	4,550	m	0.04	1.00	182	95	17,290	155.00	28,210	-	-	10.00	11.59	45,500	52,720	
	Breach Plant Site Pond Containment Dam			x	215	m3	0.06	1.00	13		-	7.30	1,570	-	-	7.30	8.46	1,570	1,819	

Buildings and Equipment																			
Disassembly - Goose Plant and Crusher																			
Dismantle Plant				x	6,464	m2	1.00	1.00	3,200	95	304,000	100.00	106,667	-	-	63.53	73.61	410,667	475,836
Dismantle Crushers				x	1,630	m2	1.00	1.00	800	95	76,000	100.00	26,667	-	-	62.99	72.98	102,667	118,959
Dismantle Power Plant				x	2,040	m2	1.00	1.00	1,000	95	95,000	100.00	33,333	-	-	62.91	72.89	128,333	148,699
Dismantle Emergency Power - Fuel				x	300	m2	1.00	1.00	150	95	14,250	100.00	5,000	-	-	64.17	74.35	19,250	22,305
Dismantle Fuel Storage and Distribution				x	1	Lot	1.00	1.00	1,200	95	114,000	100.00	40,000	-	-	154,000	178,439	154,000	178,439
Goose Admin Buildings																			
Demolish Truck Shop/Office				x	2,349	m2	1.00	1.00	1,000	95	95,000	100.00	33,333	-	-	54.62	63.29	128,333	148,699
Demolish Kitchen/Camp				x	1,980	m2	1.00	1.00	900	95	85,500	100.00	30,000	-	-	58.33	67.59	115,500	133,829
Demolish Cold Storage				x	840	m2	1.00	1.00	150	95	14,250	100.00	5,000	-	-	22.92	26.55	19,250	22,305
Demolish Waste/Waste Oil Storage				x	1	Lot	1.00	1.00	100	-	-	100.00	3,333	40,000	40,000	43,333	50,210	43,333	50,210
Remove Freight Storage				x	1	Lot	1.00	1.00	150	95	14,250	100.00	5,000	-	-	19,250	22,305	19,250	22,305
Demolish Water Treatment Plant				x	647	m2	1.00	1.00	100	95	9,500	100.00	3,333	-	-	19,84	22,98	12,833	14,870
Demolish Sewage Treatment Plant				x	1	Lot	1.00	1.00	90	95	8,550	100.00	3,000	-	-	11,550	13,383	11,550	13,383
MLA Infrastructure																			
Demolish Port Office				x	5	Units	12.00	1.00	60	95	5,700	100.00	6,000	-	-	2,340	2,711	11,700	13,557
Remove Pipelines				x	10,000	m	0.04	1.00	400	95	38,000	155.00	62,000	-	-	10.00	11.59	100,000	115,869
Demolish Incinerator and Waste Management				x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297	9,750	11,297
Demolish Warehouses				x	1	Lot	1.00	1.00	30	95	2,850	100.00	3,000	-	-	5,850	6,778	5,850	6,778
Dismantle Genset				x	1	Lot	1.00	1.00	150	95	14,250	100.00	15,000	-	-	29,250	33,892	29,250	33,892
Demolish Maintenance Shop				x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297	9,750	11,297
Demolish Water Storage				x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297	9,750	11,297
Demolish WTP/STP				x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297	9,750	11,297
Demolish camp/offices				x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297	9,750	11,297
Demolish freight storage area				x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297	9,750	11,297
Demolish hazardous waste Area				x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297	9,750	11,297
Dismantle Fuel Storage	Includes MLA Fuel Storage area (60ML), and MLA Fuel Transfer Storage Area (0.5 ML)			x	1	Lot	1.00	1.00	1,728	95	164,160	100.00	57,600	-	-	221,760	256,952	221,760	256,952
Goose Closure Camp																			
Build 20 Person Camp				x	1	Lot	1.00	1.00	150	95	14,250	100.00	5,000	-	-	19,250	22,305	19,250	22,305
Build 20 Person Power Plant				x	1	Lot	1.00	1.00	150	95	14,250	100.00	5,000	-	-	19,250	22,305	19,250	22,305
Camp Operation	Over 13 years of Closure and Post-Closure			x	12,000	Man Days	1.00	1.00	-	-	-	-	-	110	1,320,000	110	127	1,320,000	1,529,474
Roads and Airstrips																			
Main Haul road																			
Maintain Road Surface				x	13	Yr	70.00	1.00	910	95	86,450	100.00	91,000	-	-	13,650	15,816	177,450	205,610
Restore Drainage	Remove Culverts			x	1,488	m3	0.06	1.00	89	-	-	11.00	16,368	-	-	11.00	12.75	16,368	18,965
Airstrips																			
Maintain Airstrip Surface				x	13	Yr	20.00	1.00	260	95	24,700	100.00	26,000	-	-	3,900	4,519	50,700	58,746
Restore Drainage	Updated for Modification Package			x	1,360	m3	0.06	1.00	82	-	-	12.00	16,320	-	-	12.00	13.90	16,320	18,910
Water Treatment																			
WTP Pipelines and Treatment Plant																			
Pump water from TSF to WTP	No treatment required during Closure; Maximum PAG Exposure in Year 2. Potential Water Treatment in this year at TSF with 2.1 Mm3 over 3 years.			x	2,100,000	m3		1.00			-	-	-	0	231,000	0.11	0.13	231,000	267,658
Treat water from TSF in WTP				x	2,100,000	m3		1.00	1,916		-	-	-	0	735,000	0.35	0.41	735,000	851,639
Pump water out of WTP				x	2,100,000	m3		1.00			-	-	-	0	231,000	0.11	0.13	231,000	267,658
Decommission WTP pump and pipeline				x	6,700	m	0.04	1.00	292	95	27,740	155.00	45,260	-	-	10,90	12.62	73,000	84,585
Decommission WTP pump and return pipeline				x	820	m	0.04	1.00	57	95	5,396	155.00	8,804	-	-	17,32	20.07	14,200	16,453
Decommission WTP				x	1	Lot		1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297	9,750	11,297
Contaminated Soil																			
Site-wide Investigation																			
Site Investigation to estimate quantity of contaminated soil	Testpit program with excavator in all parking, fuel storage, washbays truck and maintenance shops and generator areas.			x	1	Lot	1.00	1.00			-	-	-	50,000	50,000	57,935	50,000	57,935	
Treatment																			
Transport contaminated soil				x	10,000	m3	0.05	1.00	500		-	7.30	73,000	-	-	7.30	8.46	73,000	84,585
Separation plant	Purchase separation equipment			x	1	Lot	1.00	1.00			-	-	-	100,000	100,000	115,869	100,000	115,869	
Closure / Post-Closure Monitoring																			
Geotechnical Inspections																			
TSF embankments				x	8	Units	20.00	1.00	160		-	-	-	10,000	80,000	10,000	11,587	80,000	92,695
WR piles				x	13	Units	20.00	1.00	260		-	-	-	8,300	107,900	8,300	9,617	107,900	125,023
Pit walls				x	13	Units	20.00	1.00	260		-	-	-	4,000	52,000	4,000	4,635	52,000	60,252
Ground Temperature Monitoring																			
Umwelt WRSA GTC Monitoring after Closure	Monthly			x	13	Years	24.00	1.00	312	200	62,400	-	-	-	-	4,800	5,562	62,400	72,302
Llama WRSA GTC Monitoring after Closure	Monthly			x	13	Years	24.00	1.00	312	200	62,400	-	-	-	-	4,800	5,562	62,400	72,302
TSF WRSA GTC Monitoring after Closure	Monthly			x	13	Years	24.00	1.00	312	200	62,400	-	-	-	-	4,800	5,562	62,400	72,302
WQ Monitoring - Closure																			
Llama pit	Depends on Breach			x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321	14,820	17,172
Llama WR Pile				x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321	14,820	17,172
Umwelt pit	Depends on Breach			x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321	14,820	17,172
Umwelt WR Pile				x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321	14,820	17,172
Echo pit	Depends on Breach			x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321	14,820	17,172
Echo WR pile				x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321	14,820	17,172
Goose pit	Depends on Breach			x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321	14,820	17,172
TSF WR Pile				x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321	14,820	17,172
Aquatic Effects monitoring																			
Aquatic effects monitoring	Non-contact Water Basins			x	10	Years	60.00	1.00	600	80	48,000	-	-	-	-	4,800	5,562	48,000	55,617
Terrestrial Animal Monitoring																			
Terrestrial Animal Monitoring				x	10	Years	300.00	1.00	3,000	80	240,000	-	-	-	-	24,000	27,809	240,000	278,086
Total Direct Costs																			
CONSTRUCTION INDIRECTS																			
Freight & Transport																			
Food & Freight	Total Mandays factored			x	27,600	kg		1.00			-	-	-	12	331,200	12	13.90	331,200	383,759
Freight	Rental equip, offices, etc..			x	1	Lot	-	1.00			-	-	-	500,000	500,000	500,000	579,346	500,000	579,346
Mobilization				x	500	Tonnes					-	-	-	1,500	750,000	1,500	1,738	750,000	869,019
General Construction Indirects																			
Site Services Labour				x	16,000	HRS	1.00	1.00	16,000	65	1,040,000	-	-	-	-	65.00	75.31	1,040,000	1,205,040
Accommodations & Travel																			
Camp Accommodations/Operation				x	12,000	Man Days	1.00	1.00			-	-	-	110	1,320,000	110	127	1,320,000	1,529,474
Airfare & Transportation				x	429	Each	-	1.00			-	-	-	572	245,583	572	663	245,583	284,556
Contractor Profit																			
Total Component Estimate																		18,576,354	21,524,276

Unit Cost Table (for refining unit costs see "Estimator" worksheet)

Filter by unit

Inflation 2020 to 2026:	10.6%
Inflation 2017 to 2026:	15.9%
Inflation 2014 to 2026:	23.0%

ITEM	Detail	COST CODE	UNITS	LOW \$	HIGH \$	SPECIFIED \$	COMMENTS
<b>Accommodation</b>							
		ACCM	manday	123.03	215.30	-	
<b>Buildings - Decontaminate</b>							
	Asbestos	BDA	m2	31.50	62.99	-	Low: removal of asbestos siding & flooring; High: removal of insulated pipes, friable asbestos
<b>Buildings - Remove</b>							
	Wood	BRW	m2	33.83	50.44	-	
	Concrete	BRC	m2	49.21	79.97	7.38	Specified: puncture concrete foundation slabs
	Steel - teardown	BRS1	m2	55.36	79.97	-	
	Steel - for salvage	BRS2	m2	82.43	123.03	-	
<b>Concrete work</b>							
	Small pour	CSF	m3	524.73	787.09	-	Low: YK; High=1.5xLow
	Large pour	CLF	m3	434.92	652.37	2,620.57	Specified: concrete crown pillar
<b>Contaminated Soils</b>							
	ESA Phase 1	CS1	each	9,227.35	-	-	Low: small, "clean" site
	ESA Phase 1	CS2	each	61,515.66	-	-	Low: small, "clean" site
	Remediate on site	CSR	m3	57.82	179.63	-	
<b>Dozing</b>							
	doze rock piles	DR	m3	1.29	2.95	-	Low cost: doze crest off dump
	doze overburden/soil piles	DS	m3	1.17	4.68	-	High cost: push up to 300 m
<b>Excavate Rock; Low Spec's and QA/QC</b>							
	drill/blast/load/short haul	RB1	m3	14.03	20.98	-	Low:quarry operations for bulk fill
	drill/blast/load/long haul	RB2	m3	14.83	21.90	-	
	RB1 + spread and compact	RB3	m3	14.83	21.90	-	
	RB2 + spread and compact	RB4	m3	15.38	37.83	-	
	Specified activity	RBS	m3	-	-	8.11	
<b>Excavate Rock; High Spec's and QA/QC</b>							
	drill/blast/load/short haul	RC1	m3	14.83	21.90	-	(e.g. ditch/spillway excavation)
	drill/blast/load/long haul	RC2	m3	15.62	22.64	-	Low:foundation excavation;High:spillway excavation
	RC1 + spread and compact	RC3	m3	15.62	22.64	-	e.g. cover construction
	RC2 + spread and compact	RC4	m3	16.61	23.62	-	e.g. cover construction
	Specified activity	RCS	m3	-	-	215.30	Specified-drift excavation
<b>Excavate Rip Rap</b>							
	drill/blast/load/short haul/place	RR1	m3	16.61	21.84	-	High: quarry & place rip rap in channel
	drill/blast/load/long haul/place	RR2	m3	17.47	25.41	-	
	source is waste dump/short haul	RR3	m3	8.61	-	-	cost includes sorting
	source is waste dump/long haul	RR4	m3	9.35	-	-	
	Specified activity	RRS	m3	-	-	-	
<b>Excavate Soil; Low Spec's and QA/QC</b>							
	clear & grub	SBC	m2	4.18	6.15	-	
	excavate/load/short haul	SB1	m3	5.29	7.26	-	
	excavate/load/long haul	SB2	m3	5.66	8.98	-	
	SB1 + spread and compact	SB3	m3	6.27	10.95	-	Low: non-engineered; High:engineered
	SB2 + spread and compact	SB4	m3	6.77	13.53	-	Low: non-engineered; High:engineered
	Specified activity	SBS	m3	3.94	7.75	-	Low: rehandle waste rock dump by dozing; High:rehandle waste rock by hauling
	Tailings	SBT	m3	1.66	4.55	19.07	High:contour surface - wet or frozen; Specified:haul/place wet infill
<b>Excavate Soil, High Spec's and QA/QC</b>							
	excavate/load/short haul	SC1	m3	8.37	11.44	-	
	excavate/load/long haul	SC2	m3	8.74	14.46	-	
	SC1 + spread and compact	SC3	m3	10.95	17.47	-	Low: non-engineered; High:engineered
	SC2 + spread and compact	SC4	m3	11.44	28.54	-	Low: non-engineered; High:engineered (e.g. complex covers, low volume dam construction)
	Specified activity	SCS	m3	-	-	23.13	Backfill adit with waste rock
<b>Fence</b>							
		FNC	m	16.67	249.75	-	
<b>Fuel and Electricity</b>							
	Fuel cost - gas	FCG	litre	1.29	1.72	-	
	Fuel cost - diesel	FCD	litre	1.22	1.71	-	
	Fuel mobilization	FCM	litre	0.27	0.52	-	High: winter road usage
	Electricity	FCE	kW-h	0.21	0.23	0.60	Low and High:Yellowknife; Specified:diesel generator
<b>Geo-Synthetics</b>							
	geotextile	GST	m2	4.23	-	-	Supply and install
	geogrid	GSG	m2	7.07	-	-	
	liner, HDPE	GSHDPE	m2	9.78	-	-	Supply and install; large quantity
	liner, ES3	GSES3	m2	24.85	-	-	FOB Yellowknife
	geosynthetic installation	GSI	m2	3.89	17.22	-	Low:geotextile; High:ES3 or HDPE
	bentonite soil ammendment	GSBA	tonne	379.31	428.76	-	FOB Edmonton, add shipping & mixing
<b>Grouting (/m3 of rock grouted)</b>							
		grout	m3	291.03	352.79	-	High: cement, FOB Yellowknife
<b>Labour &amp; Equipment Rates</b>							
	Site manager	sman	\$/hr	153.79	187.01	-	
	Supervisor	super	\$/hr	63.98	112.99	-	
	Registered engineer	eng	\$/hr	116.88	270.67	-	
	Environmental coordinator	envco	\$/hr	91.24	159.94	-	
	Environmental technologist	envtech	\$/hr	44.29	-	-	
	Electrician	elec	\$/hr	91.04	116.88	-	
	Journeyman - various	journey	\$/hr	54.13	88.32	-	
	Labour - skilled	lab-s	\$/hr	50.44	61.02	-	
	Labour - unskilled	lab-us	\$/hr	38.14	54.11	-	
	Equipment operator	oper	\$/hr	50.44	79.97	-	
	Heavy duty mechanic	mech	\$/hr	60.29	89.63	-	
	Water treatment plant operator	oper-wt	\$/hr	50.44	73.65	-	
	Security / first aid	safety	\$/hr	44.29	82.39	-	
	Administrative staff	admin	\$/hr	46.75	71.22	-	

**Unit Cost Table (for refining unit costs see "Estimator" worksheet)**

Filter by unit

Inflation 2020 to 2026:	10.6%
Inflation 2017 to 2026:	15.9%
Inflation 2014 to 2026:	23.0%

ITEM	Detail	COST CODE	UNITS	LOW \$	HIGH \$	SPECIFIED \$	COMMENTS
Equipment rates include operator and fuel							
	Loader - 4 cu.yd (3.06m3)	load-s	\$/hr	215.30	-	-	
	Loader - 7 cu.yd (5.35m3)	load-l	\$/hr	387.55	-	-	
	Excavator - 26.76-30.84 tonnes	exc-s	\$/hr	233.76	-	-	
	Excavator - 68.95+tonnes	exc-l	\$/hr	516.73	-	-	
	Grader	grad	\$/hr	233.76	-	-	
	Dump truck off hwy 30-50 tonnes	truck-s	\$/hr	276.82	-	-	
	Dump truck off hwy 55-75 tonnes	truck-l	\$/hr	369.09	-	-	
	dozer, small	dozer-s	\$/hr	252.21	319.88	-	
	dozer, large	dozerl	\$/hr	602.85	695.13	-	
	smooth drum compactor	comp	\$/hr	190.70	-	-	
	scooptram, 6 yd3 bucket	scoop	\$/hr	209.15	-	-	
	flat bed truck with hiab	hiab	\$/hr	190.70	-	-	
	fuel truck	ftruck	\$/hr	184.55	-	-	
	water truck	wtruck	\$/hr	71.36	184.55	-	
<b>Mobilize Heavy Equipment</b>							
	Road access	MHER	kmtonne	4.18	12.61	-	
	Air access	MHEA	kmtonne	14.76	-	-	cargo rate>500lb
<b>Mobilize Camp</b>							
	Road access	MCR	each	61,515.66	-	-	refurbish existing camp
<b>Mobilize Workers</b>							
	flight	MW	each	5,536.41	11,195.85	-	Low:e.g. 8 passenger; High: Dash 7
<b>Oil Removal</b>							
	oil removal	OR	litre	0.53	1.48	-	Low:waste oil heater; High: ship offsite
<b>PCB Removal</b>							
	Remove from site	PCBR	litre	49.46	57.70	-	Low: shipping, handling & disposal from Yellowknife
<b>Pipes, small (&lt;6in dia.)</b>							
	remove/dispose on site	PSR	m	1.23	29.53	-	Low: remove/dispose on site; High: remove/re-use
	supply	PSS	m	7.50	13.66	-	Low:supply; High:supply and ship
	install	PSI	m	30.76	-	-	
<b>Pipes, large (&gt;6in dia.)</b>							
	remove/dispose on site	PLR	m	27.07	88.58	-	Low: remove/dispose on site; High: remove/re-use
	supply	PLS	m	158.71	175.93	-	Low:supply; High:supply and ship
	install	PLI	m	61.52	-	-	
<b>Power Lines</b>							
	remove/dispose on site	POWR	m	31.37	-	-	
<b>Process Chemicals</b>							
	Remove from site	PCR	kg	0.55	3.08	-	Low: shipping, handling & disposal from Yellowknife
<b>Pumps</b>							
	Pump capital cost	PC	each	239,911.09	-	-	
	Pump shipping	PS	each	3,075.78	-	-	
	Pump operating cost	POC	m3	0.15	-	-	pump operating costs should be calculated based on pump capacity, fuel costs, etc.
	Pump maintenance	PM	allow	30,757.83	-	-	
<b>Pump sand BackFill</b>							
		PBF	m3	104.58	369.09	-	
<b>Scarify - road/mine site</b>							
		SCFY	ha	5,290.35	7,418.79	2,645.17	
<b>Shaft, Raise &amp; Portal Closures</b>							
	Shaft & Raises	SR	m2	793.55	2,623.03	-	Low:pre-cast concrete slabs, little site prep. Area=shaft+>1m all around
	Portals	POR	m3	23.13	307.58	1,476.38	Low:unit cost code SCS;High:excavate & backfill collapsed portal;Spec: installed pressure plug
<b>Site Inspection Report</b>							
		RPT	each	12,303.13	24,606.27	-	
<b>SpillWay - Clear</b>							
		SW	each	3,690.94	8,612.19	-	
<b>Survey/Instrumentation</b>							
		SI	each	2,214.56	4,429.13	-	2 person crew
<b>Treatment Plant - Construct</b>							
	Small (< 1000 m3/d)	TPS	lump sum	11,072,819.64	18,454,699.41	-	
	Large (> 1000 m3/d)	TPL	lump sum	18,454,699.41	56,594,411.52	-	
	Constructed Wetland	CWTS	ha	246,062.66	369,093.99	-	
<b>Treatment Plant - Operate</b>							
		TPO	m3	0.43	2.46	-	
<b>Treatment Chemicals</b>							
	ferric sulphate	ferric	kg	1.46	-	-	
	ferrous sulphate	ferrous	kg	1.62	-	-	
	lime	lime	kg	0.69	-	-	
	hydrogen peroxide, 35%	hperox	kg	1.85	-	-	
	Sodium Metabisulfate	Nametab	kg	1.45	-	-	
	Caustic soda, 50%	caustic	kg	0.91	-	-	
	Sulfuric acid, 93%	sulfuric	kg	0.38	-	-	
	flocculant	flocc	kg	7.38	-	-	
	copper sulphate	copper	kg	-	-	-	
	shipping	shipping	kg	0.25	-	-	
<b>Vegetation</b>							
	Hydroseed, Flat	VHF	ha	4,921.25	-	-	
	Hydroseed, Sloped	VHS	ha	5,536.41	-	-	
	Veg. blanket/erosion mat	VB	ha	15,994.07	-	-	
	Tree planting	VT	ha	3,198.81	7,381.88	-	
	Wetland species	VW	ha	-	-	58.71	Specified= /m3, Wetland Growth Media Substrate mixed and installed (sand, biochar and fertilizer, woodchips)
<b>Water Sampling/Analysis/Reporting</b>							
		WS	each	8,612.19	12,303.13	-	
<b>Winter Road</b>							
	Construction	WRC	km	2,460.63	14,148.60	-	
	Usage	WRU	kmtonne	0.36	-	-	

**Unit Cost Table (for refining unit costs see "Estimator" worksheet)**

Filter by unit

Inflation 2020 to 2026:	10.6%
Inflation 2017 to 2026:	15.9%
Inflation 2014 to 2026:	23.0%

ITEM	Detail	COST CODE	UNITS	LOW \$	HIGH \$	SPECIFIED \$	COMMENTS
<b>Sabina Specific Costs</b>							
<b>OP Tab</b>	Signs		each	86.90			
<b>OP Tab</b>	Block roads		allow	5,793.46			
<b>OP Tab</b>	Conduct stability and setback study		allow	19,697.77			
<b>UG Tab</b>	Remove misc. haz. mat & explosives		kg	57.93			
<b>UG Tab</b>	Assess underground stability		each	11,586.92			
<b>Bldgs &amp; Equip Tab</b>	Decontaminate and dispose on-site		allow	23,173.84			
	Remove Buildings - WIR						
<b>Bldgs &amp; Equip Tab</b>	Service/Emergency Camps, total of 3 1-ha area for 3 camps; assume all structures will be soruno structures.		LS	82,933.79			Added during 2020 Mod Package.
<b>Chemicals Tab</b>	Contam. soil investigation - Phase 1		allow	8,690.19			
<b>Chemicals Tab</b>	Operate landfarm		allow	57,934.61			
<b>WM Tab</b>	Remove Liner from all berms		m2	0.81			
<b>WM Tab</b>	Decommission reclaim barge from Llana TF		LS	11,586.92			
<b>WT Tab</b>	Treat water in WTP		m3	0.75			
<b>ICM Tab</b>	misc. supplies		allow	23,173.84			
<b>PostClosure Tab</b>	Regulatory costs		year	28,967.30			
<b>PostClosure Tab</b>	General Water Sampling and Stability Monitoring		year	46,347.69			

**SUMMARY OF COSTS**

CAPITAL COSTS	COMPONENT NAME	COST	LAND LIABILITY	TOTAL LIABILITY
OPEN PIT	Umwelt	\$60,120	\$0	\$60,120
	Llama	\$66,016	\$0	\$66,016
	Echo (to Project Year 4)	\$19,698	\$0	\$19,698
	Goose Main	\$102,334	\$0	\$102,334
QUARRY (under OPEN PIT TAB estimate)	Airstrip Quarry	\$4,675	\$0	\$4,675
UNDERGROUND MINE	Umwelt	\$444,319	\$0	\$444,319
	Llama	\$124,879	\$0	\$124,879
	Goose Main	\$334,323	\$0	\$334,323
	Echo	\$116,121	\$0	\$116,121
TAILINGS FACILITIES	TSF	\$0	\$0	\$0
ROCK PILE	Umwelt, Llama, Goose Main, and Echo	\$12,770,177	\$0	\$12,770,177
BUILDINGS AND EQUIPMENT		\$2,952,160	\$0	\$2,952,160
CHEMICALS AND CONTAMINATED SOIL MANAGEMEN		\$1,659,101	\$0	\$1,659,101
SURFACE AND GROUNDWATER MANAGEMENT		\$3,624,753	-	\$3,624,753
INTERIM CARE AND MAINTENANCE		\$1,160,490	-	\$1,160,490
<b>SUBTOTAL: Capital Costs</b>		<b>\$23,439,166</b>	<b>\$0</b>	<b>\$23,439,166</b>
<b>PERCENT OF SUBTOTAL</b>			<b>0%</b>	<b>100%</b>
<b>INDIRECT COSTS</b>		<b>COST</b>	<b>LAND LIABILITY</b>	<b>TOTAL LIABILITY</b>
MOBILIZATION/DEMobilIZATION		\$4,993,793	\$0	\$4,993,793
POST-CLOSURE MONITORING AND MAINTENANCE		\$2,253,539	\$0	\$2,253,539
ENGINEERING	10%	\$2,343,917	\$0	\$2,343,917
PROJECT MANAGEMENT	5%	\$1,171,958	\$0	\$1,171,958
HEALTH AND SAFETY PLANS/MONITORING & QA/QC	1%	\$234,392	\$0	\$234,392
BONDING/INSURANCE	1%	\$234,392	\$0	\$234,392
CONTINGENCY	20%	\$4,687,833	\$0	\$4,687,833
MARKET PRICE FACTOR ADJUSTMENT	0%	\$0	\$0	\$0
<b>SUBTOTAL: Indirect Costs</b>		<b>\$15,919,824</b>	<b>\$0</b>	<b>\$15,919,824</b>
<b>TOTAL COSTS</b>		<b>\$39,358,990</b>	<b>\$0</b>	<b>\$39,358,990</b>

ALL STAGES (%)

**SUMMARY OF PAYMENT STAGES**

Approximate Timing											
Y-2	Y-1	Y-1	NA	NA	Y2Q4	Y5Q1	Y-1	Y6Q2	Y10Q2	Y10Q3	Y1
Initial Infrastructure	Umwelt UG	Umwelt OP	TSF - Dam Construction	TSF - Tailings Deposition & Use	Llama OP	Goose Main OP	Echo OP (to Year 4 Only)	Llama UG	Goose Main UG	Echo UG	Mill Start up Long Term Water Treatment (LTWT)
		\$60,120			\$66,016		\$19,698				
\$4,675	\$444,319					\$102,334			\$124,879	\$334,323	\$116,121
		\$0	\$0	\$0	\$3,192,544	\$9,577,633					
\$2,784,984	\$0	\$8,955	\$0	\$0	\$0	\$135,047	\$23,174	\$0	\$0	\$0	\$0
\$696,665	\$116,844	\$116,844	\$0	\$0	\$116,844	\$144,526	\$116,844	\$116,844	\$116,844	\$116,844	\$0
\$161,376	\$34,454	\$29,383	\$0	\$0	\$18,619	\$101,402	\$2,411	\$49,517	\$47,663	\$34,454	\$3,145,275
\$580,245		\$116,049			\$116,049	\$232,098	\$116,049				
<b>\$4,227,945</b>	<b>\$595,617</b>	<b>\$331,352</b>	<b>\$0</b>	<b>\$0</b>	<b>\$3,510,272</b>	<b>\$10,293,040</b>	<b>\$278,176</b>	<b>\$291,240</b>	<b>\$498,830</b>	<b>\$267,419</b>	<b>\$3,145,275</b>
18.0%	2.5%	1.4%	0.0%	0.0%	15.0%	43.9%	1.2%	1.2%	2.1%	1.1%	13.4%
20.8%	2.9%	1.6%	0.0%	0.0%	17.3%	50.7%	1.4%	1.4%	2.5%	1.3%	
\$1,040,386	\$146,566	\$81,537	\$0	\$0	\$863,786	\$2,532,847	\$68,452	\$71,666	\$122,749	\$65,805	\$0
\$469,493	\$66,140	\$36,795	\$0	\$0	\$389,799	\$1,142,992	\$30,890	\$32,341	\$55,393	\$29,696	\$0
\$422,795	\$59,562	\$33,135	\$0	\$0	\$351,027	\$1,029,304	\$27,818	\$29,124	\$49,883	\$26,742	\$314,528
\$211,397	\$29,781	\$16,568	\$0	\$0	\$175,514	\$514,652	\$13,909	\$14,562	\$24,942	\$13,371	\$157,264
\$42,279	\$5,956	\$3,314	\$0	\$0	\$35,103	\$102,930	\$2,782	\$2,912	\$4,988	\$2,674	\$31,453
\$42,279	\$5,956	\$3,314	\$0	\$0	\$35,103	\$102,930	\$2,782	\$2,912	\$4,988	\$2,674	\$31,453
\$845,589	\$119,123	\$66,270	\$0	\$0	\$702,054	\$2,058,608	\$55,635	\$58,248	\$99,766	\$53,484	\$629,055
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>\$3,074,219</b>	<b>\$433,084</b>	<b>\$240,932</b>	<b>\$0</b>	<b>\$0</b>	<b>\$2,552,385</b>	<b>\$7,484,264</b>	<b>\$202,267</b>	<b>\$211,766</b>	<b>\$362,709</b>	<b>\$194,446</b>	<b>\$1,163,752</b>
<b>\$7,302,164</b>	<b>\$1,028,702</b>	<b>\$572,283</b>	<b>\$0</b>	<b>\$0</b>	<b>\$6,062,658</b>	<b>\$17,777,304</b>	<b>\$480,442</b>	<b>\$503,006</b>	<b>\$861,539</b>	<b>\$461,865</b>	<b>\$4,309,027</b>

**CURRENT REQUIREMENT**  
\$19,755,276 (June 2026)

5		Open Pit Name:	Umwelt	Pit #	1	
ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>CONTROL ACCESS</b>						
Fence		m		#N/A	\$0.00	\$0
Signs	Assumed	each	4	Sabina	\$86.90	\$348
Berm at crest	Estimated for continuous berm with 1m diameter boulders, no spacing between boulders - 0.52 m <sup>3</sup> /m - assumed 50 % done during Operations	m <sup>3</sup>	433	RR1H	\$21.84	\$9,447
Block roads	Temporary gate installation to allow water monitoring. It includes decommissioning of gate when no longer required. Exposed area after gate has been decommissioned will be blocked with boulders (exposed area along with block of roads with boulders included in berm cost above)	allow	1	Sabina	\$5,793.46	\$5,793
Other				#N/A	\$0.00	\$0
<b>STABILITY STUDY</b>						
Conduct stability and setback study		allow	1	Sabina	\$19,697.77	\$19,698
<b>STABILIZE SLOPES</b>						
Off-load crest, soil A		m <sup>3</sup>		#N/A	\$0.00	\$0
Off-load crest, soil B		m <sup>3</sup>		#N/A	\$0.00	\$0
Doze/trim overburden at crest		m <sup>3</sup>		#N/A	\$0.00	\$0
Drill & blast pit crest		m <sup>3</sup>		#N/A	\$0.00	\$0
Buttress slope		m <sup>3</sup>		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>COVER/CONTOUR SLOPES</b>						
Place fill, soil A		m <sup>3</sup>		#N/A	\$0.00	\$0
Place fill, soil B		m <sup>3</sup>		#N/A	\$0.00	\$0
Rip rap		m <sup>3</sup>		#N/A	\$0.00	\$0
Vegetate slopes		ha		#N/A	\$0.00	\$0
Vegetate pit floor		ha		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>CONSTRUCT DIVERSION DITCHES</b>						
Excavate ditches -soil		m <sup>3</sup>		#N/A	\$0.00	\$0
Excavate ditches -rock		m <sup>3</sup>		#N/A	\$0.00	\$0
Rip rap in channel base		m <sup>3</sup>		#N/A	\$0.00	\$0
<b>CONSTRUCT SPILLWAY</b>						
Excavate channel	200 m long, 6 m wide and 1 m deep	m <sup>3</sup>	1,200	SB1L	\$5.29	\$6,348
Concrete		m <sup>3</sup>		#N/A	\$0.00	\$0
Rip rap		m <sup>3</sup>	400	RR1H	\$21.84	\$8,735
Other	Geotextile	m <sup>2</sup>	2,304	GSTL	\$4.23	\$9,751
<b>RECLAIM QUARRIES</b>						
Contour slopes		m <sup>3</sup>		#N/A	\$0.00	\$0
Place overburden		m <sup>3</sup>		#N/A	\$0.00	\$0
Vegetate		m <sup>3</sup>		#N/A	\$0.00	\$0
<b>FLOOD PIT-Capital</b>						
Remove stationary equipment (sump pumps) and Pipeline	Umwelt TF will be used to store tailings in Years 4 to 11; it will be passively flooded with site runoff and direct precipitation throughout the end of Operations and into the Closure Phase. Recirculation treatment is planned following use as a TF.	m		#N/A	\$0.00	\$0
Remove dewatering pipeline		m		#N/A	\$0.00	\$0
Remove power lines		each		#N/A	\$0.00	\$0
Construct diversion ditches		m <sup>3</sup>		#N/A	\$0.00	\$0
-Ditch, mat'l A		m <sup>3</sup>		#N/A	\$0.00	\$0
-Ditch, mat'l B		m <sup>3</sup>		#N/A	\$0.00	\$0
Construct embankment/dam		m <sup>3</sup>		#N/A	\$0.00	\$0
Supply/install pump station		each		#N/A	\$0.00	\$0
Supply/install piping system		m		#N/A	\$0.00	\$0
Remove pump post-closure		each		#N/A	\$0.00	\$0
Remove pipeline post-closure		m		#N/A	\$0.00	\$0
<b>FLOOD PIT-Annual Cost</b>						
Operate pumps (power)		m <sup>3</sup>		#N/A	\$0.00	\$0
Maintain pump/pipeline		allow		#N/A	\$0.00	\$0
Labour: fuel management, commissioning/decom		\$/h		#N/A	\$0.00	\$0
Chemical addition, _____ kg/m <sup>3</sup> of water		tonne		#N/A	\$0.00	\$0
Chemicals, purchase and shipping		tonne		#N/A	\$0.00	\$0
Passive/biological additives		\$/ha		#N/A	\$0.00	\$0
Passive additives purchase and shipping		tonne		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
Annual pumping costs						
Number of years of pump flooding	passive pit flooding	years	0			
					Total pumping costs	\$0
					<b>Total</b>	\$60,120
					<b>% of Total</b>	100%

Open Pit Name:		Llama		Pit #		2	2
ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	Total Cost
<b>CONTROL ACCESS</b>							
Fence		m		#N/A	\$0.00	\$0	\$0
Signs	Assumed	each	4	Sabina	\$86.90	\$348	\$348
Berm at crest	Estimated for berm with 1m diameter boulders, no spacing between boulders - 0.52 m3/m; berm needed only where pit edge will not abut the final flooded lake footprint.	m3	327.6	RR1H	\$21.84	\$7,154	\$7,154
Block roads	Temporary gate installation to allow water monitoring. It includes decommissioning of gate when no longer required. Exposed area after gate has been decommissioned will be blocked with boulders (exposed area along with block of roads with boulders included in berm cost above)	allow	1	Sabina	\$5,793.46	\$5,793	\$5,793
Other				#N/A	\$0.00	\$0	\$0
<b>STABILITY STUDY</b>							
Conduct stability and setback study		allow	1	Sabina	\$19,697.77	\$19,698	\$19,698
<b>STABILIZE SLOPES</b>							
Off-load crest, soil A		m3		#N/A	\$0.00	\$0	\$0
Off-load crest, soil B		m3		#N/A	\$0.00	\$0	\$0
Doze/trim overburden at crest		m3		#N/A	\$0.00	\$0	\$0
Drill & blast pit crest		m3		#N/A	\$0.00	\$0	\$0
Buttress slope		m3		#N/A	\$0.00	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0
<b>COVER/CONTOUR SLOPES</b>							
Place fill, soil A		m3		#N/A	\$0.00	\$0	\$0
Place fill, soil B		m3		#N/A	\$0.00	\$0	\$0
Rip rap		m3		#N/A	\$0.00	\$0	\$0
Vegetate slopes		ha		#N/A	\$0.00	\$0	\$0
Vegetate pit floor		ha		#N/A	\$0.00	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0
<b>CONSTRUCT DIVERSION DITCHES</b>							
Excavate ditches -soil		m3		#N/A	\$0.00	\$0	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0	\$0
<b>CONSTRUCT SPILLWAY</b>							
Excavate channel	Spillway not required; will follow natural drainage to Umwelt Lake.	m3		#N/A	\$0.00	\$0	\$0
Concrete		m3		#N/A	\$0.00	\$0	\$0
Rip rap		m3		#N/A	\$0.00	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0
<b>RECLAIM QUARRIES</b>							
Contour slopes		m3		#N/A	\$0.00	\$0	\$0
Place overburden		m3		#N/A	\$0.00	\$0	\$0
Vegetate		m3		#N/A	\$0.00	\$0	\$0
<b>FLOOD PIT-Capital</b>							
Remove stationary equipment (sump pumps) and Pipeline	Llama 1F will be used to store tailings in Years 11 to 14 (end of operations); it will be passively flooded following use as a TF with site runoff and direct precipitation throughout the end of Operations and into the Closure Phase. Water may be pumped from Goose Lake if required. At Closure, reclaim water pump will be at top of TF and pipeline leads to WTP. Costing here to remove pipeline to closure landfill; dispose of fuel in diesel day tank and oil from pump and landfill cleaned pump. Recirculation treatment may be provided following use as a TF if required (not costed here)	m	2,850	Sabina	\$11.59	\$33,023	\$33,023
Remove dewatering pipeline		m		#N/A	\$0.00	\$0	\$0
Remove power lines		each		#N/A	\$0.00	\$0	\$0
Construct diversion ditches		m3		#N/A	\$0.00	\$0	\$0
-Ditch, mat'l A		m3		#N/A	\$0.00	\$0	\$0
-Ditch, mat'l B		m3		#N/A	\$0.00	\$0	\$0
Construct embankment/dam		m3		#N/A	\$0.00	\$0	\$0
Supply/install pump station		each		#N/A	\$0.00	\$0	\$0
Supply/install piping system		m		#N/A	\$0.00	\$0	\$0
Remove pump post-closure		each		#N/A	\$0.00	\$0	\$0
Remove pipeline post-closure		m		#N/A	\$0.00	\$0	\$0
<b>FLOOD PIT-Annual Cost</b>							
Operate pumps (power)		m3		#N/A	\$0.00	\$0	\$0
Maintain pump/pipeline		allow		#N/A	\$0.00	\$0	\$0
Labour: fuel management, commissioning/decom		\$/h		#N/A	\$0.00	\$0	\$0
Chemical addition, _____ kg/m3 of water		tonne		#N/A	\$0.00	\$0	\$0
Chemicals, purchase and shipping		tonne		#N/A	\$0.00	\$0	\$0
Passive/biological additives		\$/ha		#N/A	\$0.00	\$0	\$0
Passive additives purchase and shipping		tonne		#N/A	\$0.00	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0
Number of years of pump flooding	passive pit flooding	years	0			Annual pumping costs	\$0
						Total pumping costs	\$0
						<b>Total</b>	\$66,016
						<b>% of Total</b>	100%

Open Pit Name:	Echo (to Project Year 4)	Pit #	3			
ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>CONTROL ACCESS</b>						
Fence		m		#N/A	\$0.00	\$0
Signs		each	-	Sabina	\$86.90	\$0
Berm at crest		m3	0	RR1H	\$21.84	\$0
Block roads		allow	-	Sabina	\$5,793.46	\$0
Other				#N/A	\$0.00	\$0
<b>STABILITY STUDY</b>						
Conduct stability and setback study		allow	1	Sabina	\$19,697.77	\$19,698
<b>STABILIZE SLOPES</b>						
Off-load crest, soil A		m3		#N/A	\$0.00	\$0
Off-load crest, soil B		m3		#N/A	\$0.00	\$0
Doze/trim overburden at crest		m3		#N/A	\$0.00	\$0
Drill & blast pit crest		m3		#N/A	\$0.00	\$0
Buttress slope		m3		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>COVER/CONTOUR SLOPES</b>						
Place fill, soil A		m3		#N/A	\$0.00	\$0
Place fill, soil B		m3		#N/A	\$0.00	\$0
Rip rap		m3		#N/A	\$0.00	\$0
Vegetate slopes		ha		#N/A	\$0.00	\$0
Vegetate pit floor		ha		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>CONSTRUCT DIVERSION DITCHES</b>						
Excavate ditches -soil		m3		#N/A	\$0.00	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0
<b>CONSTRUCT SPILLWAY</b>						
Excavate channel	Spillway not required.	m3		#N/A	\$0.00	\$0
Concrete		m3		#N/A	\$0.00	\$0
Rip rap		m3		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>RECLAIM QUARRIES</b>						
Contour slopes		m3		#N/A	\$0.00	\$0
Place overburden		m3		#N/A	\$0.00	\$0
Vegetate		m3		#N/A	\$0.00	\$0
<b>FLOOD PIT-Capital</b>						
Remove stationary equipment (sump pumps) and Pipeline	Echo TF will be used to store tailings in Years 1 to 4; it will be incorporated into and reclaimed as part of the Goose Main WRSA following use as a TF. Pipelines/pumps will be relocated during Operations for use in the other activities (i.e., not a closure cost).	m	-	#N/A	\$11.59	\$0
Remove dewatering pipeline		m		#N/A	\$0.00	\$0
Remove power lines		each		#N/A	\$0.00	\$0
Construct diversion ditches		m3		#N/A	\$0.00	\$0
-Ditch, mat'l A		m3		#N/A	\$0.00	\$0
-Ditch, mat'l B		m3		#N/A	\$0.00	\$0
Construct embankment/dam		m3		#N/A	\$0.00	\$0
Supply/install pump station		each		#N/A	\$0.00	\$0
Supply/install piping system		m		#N/A	\$0.00	\$0
Remove pump post-closure		each		#N/A	\$0.00	\$0
Remove pipeline post-closure		m		#N/A	\$0.00	\$0
<b>FLOOD PIT-Annual Cost</b>						
Operate pumps (power)		m3		#N/A	\$0.00	\$0
Maintain pump/pipeline		allow		#N/A	\$0.00	\$0
Labour: fuel management, commissioning/decom		\$/h		#N/A	\$0.00	\$0
Chemical addition, _____ kg/m3 of water		tonne		#N/A	\$0.00	\$0
Chemicals, purchase and shipping		tonne		#N/A	\$0.00	\$0
Passive/biological additives		\$/ha		#N/A	\$0.00	\$0
Passive additives purchase and shipping		tonne		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
Annual pumping costs						
Number of years of pump flooding	passive pit flooding	years	0			
					Total pumping costs	\$0
					<b>Total</b>	\$19,698
					<b>% of Total</b>	100%

Open Pit Name:		Goose Main		Pit # 4		
ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>CONTROL ACCESS</b>						
Fence		m		#N/A	\$0.00	\$0
Signs	Assumed	each	4	Sabina	\$86.90	\$348
Berm at crest	Estimated for continuous berm with 1m diameter boulders, no spacing between boulders - 0.52 m3/m - assumed 50 % done during Operations	m3	639.45	RR1H	\$21.84	\$13,964
Block roads	Temporary gate installation to allow water monitoring. It includes decommissioning of gate when no longer required. Exposed area after gate has been decommissioned will be blocked with boulders (exposed area along with block of roads with boulders included in berm cost above)	allow	1	Sabina	\$5,793.46	\$5,793
Other				#N/A	\$0.00	\$0
<b>STABILITY STUDY</b>						
Conduct stability and setback study		allow	1	Sabina	\$19,697.77	\$19,698
<b>STABILIZE SLOPES</b>						
Off-load crest, soil A		m3		#N/A	\$0.00	\$0
Off-load crest, soil B		m3		#N/A	\$0.00	\$0
Doze/trim overburden at crest		m3		#N/A	\$0.00	\$0
Drill & blast pit crest		m3		#N/A	\$0.00	\$0
Buttress slope		m3		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>COVER/CONTOUR SLOPES</b>						
Place fill, soil A		m3		#N/A	\$0.00	\$0
Place fill, soil B		m3		#N/A	\$0.00	\$0
Rip rap		m3		#N/A	\$0.00	\$0
Vegetate slopes		ha		#N/A	\$0.00	\$0
Vegetate pit floor		ha		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>CONSTRUCT DIVERSION DITCHES</b>						
Excavate ditches -soil		m3		#N/A	\$0.00	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0
<b>CONSTRUCT SPILLWAY</b>						
Excavate channel	100 m long, 6 m wide and 1 m deep	m3	600	SB1L	\$5.29	\$3,174
Concrete		m3		#N/A	\$0.00	\$0
Rip rap		m3	200	RR1H	\$21.84	\$4,368
Other	Geotextile	m2	1,152	GSTL	\$4.23	\$4,875
<b>RECLAIM QUARRIES</b>						
Contour slopes		m3		#N/A	\$0.00	\$0
Place overburden		m3		#N/A	\$0.00	\$0
Vegetate		m3		#N/A	\$0.00	\$0
<b>FLOOD PIT-Capital</b>						
Remove stationary equipment (sump pumps) and Pipeline	At closure, pump will be at top of Goose Reservoir. Remove pipeline to closure landfill; dispose of fuel in diesel day tank and oil from pump and landfill cleaned pump.	m	4,325	Sabina	\$11.59	\$50,113
Remove dewatering pipeline		m		#N/A	\$0.00	\$0
Remove power lines		each		#N/A	\$0.00	\$0
Construct diversion ditches		m3		#N/A	\$0.00	\$0
-Ditch, mat'l A		m3		#N/A	\$0.00	\$0
-Ditch, mat'l B		m3		#N/A	\$0.00	\$0
Construct embankment/dam		m3		#N/A	\$0.00	\$0
Supply/install pump station		each		#N/A	\$0.00	\$0
Supply/install piping system		m		#N/A	\$0.00	\$0
Remove pump post-closure		each		#N/A	\$0.00	\$0
Remove pipeline post-closure		m		#N/A	\$0.00	\$0
<b>FLOOD PIT-Annual Cost</b>						
Operate pumps (power)		m3		#N/A	\$0.00	\$0
Maintain pump/pipeline		allow		#N/A	\$0.00	\$0
Labour: fuel management, commissioning/decom		\$/h		#N/A	\$0.00	\$0
Chemical addition, _____ kg/m3 of water		tonne		#N/A	\$0.00	\$0
Chemicals, purchase and shipping		tonne		#N/A	\$0.00	\$0
Passive/biological additives		\$/ha		#N/A	\$0.00	\$0
Passive additives purchase and shipping		tonne		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
					Annual pumping costs	
Number of years of pump flooding	passive pit flooding	years	0			
					Total pumping costs	\$0
					<b>Total</b>	\$102,334
					<b>% of Total</b>	100%

Quarry Name:		Airstrip Quarry		Quarry # 1		
ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>CONTROL ACCESS</b>						
Fence		m		#N/A	\$0.00	\$0
Signs		each		#N/A	\$0.00	\$0
Berm at crest		m3		RB1H	\$20.98	\$0
Block roads		allow		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>STABILITY STUDY</b>						
Conduct stability and setback study	Not required for quarry	allow		#N/A	\$0.00	\$0
<b>STABILIZE SLOPES</b>						
Off-load crest, soil A		m3		#N/A	\$0.00	\$0
Off-load crest, soil B		m3		#N/A	\$0.00	\$0
Doze/trim overburden at crest		m3		#N/A	\$0.00	\$0
Drill & blast pit crest		m3		#N/A	\$0.00	\$0
Buttress slope		m3		#N/A	\$0.00	\$0
Other	Backhoe to pull down loose rock on bedrock backslope - assumed	hrs	20 exc-sL		\$233.76	\$4,675
<b>COVER/CONTOUR SLOPES</b>						
Place fill, soil A		m3		#N/A	\$0.00	\$0
Place fill, soil B		m3		#N/A	\$0.00	\$0
Rip rap		m3		#N/A	\$0.00	\$0
Vegetate slopes	Allow to revegetate naturally	ha		#N/A	\$0.00	\$0
Vegetate pit floor		ha		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>CONSTRUCT DIVERSION DITCHES</b>						
Excavate ditches -soil		m3		#N/A	\$0.00	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0
<b>CONSTRUCT SPILLWAY</b>						
Excavate channel	Not required. Quarry base will be graded for sheet drainage.	m3		SB1L	\$5.29	\$0
Concrete		m3		#N/A	\$0.00	\$0
Rip rap		m3		RR1L	\$16.61	\$0
Other		m2		GSTL	\$4.23	\$0
<b>RECLAIM QUARRIES</b>						
Contour slopes	Quarry will not be flooded - development will occur below water level and the areas will be contoured to drain positively	m3		#N/A	\$0.00	\$0
Place overburden		m3		#N/A	\$0.00	\$0
Vegetate		m3		#N/A	\$0.00	\$0
<b>FLOOD PIT-Capital</b>						
Remove stationary equipment (sump pumps) and Pipeline		m		#N/A	\$0.00	\$0
Remove dewatering pipeline		m		#N/A	\$0.00	\$0
Remove power lines		each		#N/A	\$0.00	\$0
Construct diversion ditches		m3		#N/A	\$0.00	\$0
-Ditch, mat'l A		m3		#N/A	\$0.00	\$0
-Ditch, mat'l B		m3		#N/A	\$0.00	\$0
Construct embankment/dam		m3		#N/A	\$0.00	\$0
Supply/install pump station		each		#N/A	\$0.00	\$0
Supply/install piping system		m		#N/A	\$0.00	\$0
Remove pump post-closure		each		#N/A	\$0.00	\$0
Remove pipeline post-closure		m		#N/A	\$0.00	\$0
<b>FLOOD PIT-Annual Cost</b>						
Operate pumps (power)		m3		#N/A	\$0.00	\$0
Maintain pump/pipeline		allow		#N/A	\$0.00	\$0
Labour: fuel management, commissioning/decom		\$/h		#N/A	\$0.00	\$0
Chemical addition, _____ kg/m3 of water		tonne		#N/A	\$0.00	\$0
Chemicals, purchase and shipping		tonne		#N/A	\$0.00	\$0
Passive/biological additives		\$/ha		#N/A	\$0.00	\$0
Passive additives purchase and shipping		tonne		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
Annual pumping costs						
Number of years of pump flooding	No flooding	years	0			
					Total pumping costs	\$0
					<b>Total</b>	<b>\$4,675</b>
					<b>% of Total</b>	<b>100%</b>

4		Underground Mine Name Umwelt					UG Mine #	1
ACTIVITY/MATERIAL	Notes	Unit	Qty	Cost Code	Unit Cost	Total Cost		
<b>CONTROL ACCESS</b>								
Fence		m		#N/A	\$0.00	\$0		
Signs		each		#N/A	\$0.00	\$0		
Block roads		m3		#N/A	\$0.00	\$0		
Berm		m3		#N/A	\$0.00	\$0		
Backfill Portal (NPAG waste rock plug)	At least 5 m deep into 5x4.5m portal and slope at least 2:1 outside of portal	m3	150	PORL	\$23.13	\$3,469		
Backfill portal #2		m3		#N/A	\$0.00	\$0		
Cap raise # 1	Concrete plug over 4m-dia. vent raise	m3	28	SRH	\$2,623.03	\$74,232		
Cap raise #2	Concrete plug over 4m-dia. vent raise	m3	28	SRH	\$2,623.03	\$74,232		
Cap shaft #1	Concrete plug over 4m-dia. fresh air vent	m3	28	SRH	\$2,623.03	\$74,232		
Cap shaft #2		m3		#N/A	\$0.00	\$0		
Backfill adits		m3		#N/A	\$0.00	\$0		
Backfill open stope		m3		#N/A	\$0.00	\$0		
Concrete cap over open stope		m3		#N/A	\$0.00	\$0		
Other				#N/A	\$0.00	\$0		
<b>REMOVE HAZARDOUS MATERIALS</b>								
Remove hazardous materials, U/G labor	Three shifts with loader, incl. operator and fuel	manhour	30	load-sL	\$215.30	\$6,459		
Remove/decontam. stationary & elect. equip		mandays		#N/A	\$0.00	\$0		
Remove/decontam. mobile equipment		each		#N/A	\$0.00	\$0		
Remove misc. haz. mat & explosives	Dispose of up to 1 week's inventory of explosives	kg	100	Sabina	\$57.93	\$5,793		
Decommission Pipeline	Clean Umwelt UG to SWP pipeline, decommission and landfill	m	1,662	Sabina	\$11.59	\$19,257		
<b>INSTALL BULKHEADS</b>								
Bulkheads to control water flow		each		#N/A	\$0.00	\$0		
Grout bulkhead		m3		#N/A	\$0.00	\$0		
<b>FLOOD MINE</b>								
Supply/install pump	UG mine is expected to be flooded in Year 10 and active flooding will take about a year, relocation of pipelines and flooding will occur as part of operations but cost is provided as a conservative approach (see "Relocate Pipeline".)	each		#N/A	\$0.00	\$0		
Relocate Pipeline	Move SWP-Llama UG pipeline discharge to Umwelt UG	m	800	Sabina	\$11.59	\$9,270		
Operate pumps to flood workings	Accounts for Umwelt Underground Extension	m3	1,071,225	Sabina	\$0.15	\$165,788		
Decommission of pipeline				#N/A	\$0.00	\$0		
Other				#N/A	\$0.00	\$0		
<b>INSTALL GROUNDWATER COLLECTION SYSTEM</b>								
Excavate/install sumps		m2		#N/A	\$0.00	\$0		
Install pumping wells		m3		#N/A	\$0.00	\$0		
Install pumps/pipelines/power supply		LS		#N/A	\$0.00	\$0		
<b>SPECIALIZED ITEMS</b>								
Install water quality monitoring pipes		each		#N/A	\$0.00	\$0		
Install permanent pumping system		each		#N/A	\$0.00	\$0		
Assess underground stability	Rock mechanics inspection before closure	each	1	Sabina	\$11,586.92	\$11,587		
						<b>Total</b>	\$444,319	
						<b>% of Total</b>	100%	

Underground Mine Name Llama

UG Mine #

2

ACTIVITY/MATERIAL	Notes	Unit	Qty	Cost Code	Unit Cost	Total Cost
<b>CONTROL ACCESS</b>						
Fence		m		#N/A	\$0.00	\$0
Signs		each		#N/A	\$0.00	\$0
Block roads		m3		#N/A	\$0.00	\$0
Berm		m3		#N/A	\$0.00	\$0
Backfill Portal (NPAG waste rock plug)	At least 5 m deep into 5x4.5m portal and slope at least 2:1 outside of portal	m3	150	PORL	\$23.13	\$3,469
Backfill portal #2		m3		#N/A	\$0.00	\$0
Cap raise # 1	Concrete plug over 4m-dia. vent raise	LS	28	SRH	\$2,623.03	\$74,232
Cap raise #2		m3		#N/A	\$0.00	\$0
Cap shaft #1		m3		#N/A	\$0.00	\$0
Cap shaft #2		m3		#N/A	\$0.00	\$0
Backfill adits		m3		#N/A	\$0.00	\$0
Backfill open stope		m3		#N/A	\$0.00	\$0
Concrete cap over open stope		m3		#N/A	\$0.00	\$0
Other						
<b>REMOVE HAZARDOUS MATERIALS</b>						
Remove hazardous materials, U/G labor	Two shifts with loader, incl. operator and fuel	manhour	20	load-sL	\$215.30	\$4,306
Remove/decontam. stationary & elect. equip		mandays		#N/A	\$0.00	\$0
Remove/decontam. mobile equipment		each		#N/A	\$0.00	\$0
Remove misc. haz. mat & explosives	Mining will cease before closure	kg		#N/A	\$0.00	\$0
Decommission Pipeline	Clean Llama UG to SWP pipeline, decommission and landfill	m	2700	Sabina	\$11.59	\$31,285
<b>INSTALL BULKHEADS</b>						
Bulkheads to control water flow		each		#N/A	\$0.00	\$0
Grout bulkhead		m3		#N/A	\$0.00	\$0
<b>FLOOD MINE</b>						
Supply/install pump	UG mine is expected to be flooded in Year 5 and active flooding will take about a year, relocation of pipelines and flooding will occur as part of operations	each		#N/A	\$0.00	\$0
Supply/install piping system		m		#N/A	\$0.00	\$0
Operate pumps to flood workings		m3		#N/A	\$0.00	\$0
Decommission of pipelines				#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>INSTALL GROUNDWATER COLLECTION SYSTEM</b>						
Excavate/install sumps		m2		#N/A	\$0.00	\$0
Install pumping wells		m3		#N/A	\$0.00	\$0
Install pumps/pipelines/power supply		LS		#N/A	\$0.00	\$0
<b>SPECIALIZED ITEMS</b>						
Install water quality monitoring pipes		each		#N/A	\$0.00	\$0
Install permanent pumping system		each		#N/A	\$0.00	\$0
Assess underground stability	Rock mechanics inspection before closure	each	1	Sabina	\$11,586.92	\$11,587
					<b>Total</b>	\$124,879
					<b>% of Total</b>	100%

Underground Mine Name	Goose Main			UG Mine # 3	3		
ACTIVITY/MATERIAL	Notes	Unit	Qty	Cost Code	Unit Cost	Cost	Total Cost
<b>CONTROL ACCESS</b>							
Fence		m		#N/A	\$0.00	\$0	\$0
Signs		each		#N/A	\$0.00	\$0	\$0
Block roads		m3		#N/A	\$0.00	\$0	\$0
Berm		m3		#N/A	\$0.00	\$0	\$0
Backfill Portal (NPAG waste rock plug)	At least 5 m deep into 5x4.5m portal and slope at least 2:1 outside of portal	m3	150	PORL	\$23.13	\$3,469	\$3,469
Backfill portal #2		m3		#N/A	\$0.00	\$0	\$0
Cap raise # 1	Concrete plug over 4m-dia. vent raise	LS	28	SRH	\$2,623.03	\$74,232	\$74,232
Cap raise #2		m3		#N/A	\$0.00	\$0	\$0
Cap shaft #1		m3		#N/A	\$0.00	\$0	\$0
Cap shaft #2		m3		#N/A	\$0.00	\$0	\$0
Backfill adits		m3		#N/A	\$0.00	\$0	\$0
Backfill open stope		m3		#N/A	\$0.00	\$0	\$0
Concrete cap over open stope		m3		#N/A	\$0.00	\$0	\$0
Other							
<b>REMOVE HAZARDOUS MATERIALS</b>							
Remove hazardous materials, U/G labor	Two shifts with loader, incl. operator and fuel	manhour	20	load-sL	\$215.30	\$4,306	\$4,306
Remove/decontam. stationary & elect. equip		mandays		#N/A	\$0.00	\$0	\$0
Remove/decontam. mobile equipment		each		#N/A	\$0.00	\$0	\$0
Remove misc. haz. mat & explosives	Mining will cease before closure	kg		#N/A	\$0.00	\$0	\$0
Decommission WTP - Goose Lake Pipeline	In Water Management tab	m		#N/A	\$0.00	\$0	\$0
<b>INSTALL BULKHEADS</b>							
Bulkheads to control water flow		each		#N/A	\$0.00	\$0	\$0
Grout bulkhead		m3		#N/A	\$0.00	\$0	\$0
<b>FLOOD MINE</b>							
Supply/install pump	UG mine is expected to be flooded in Year 10 and active flooding will take about a year, relocation of pipelines and flooding will occur as progressive reclamation but cost is provided as a conservative approach	each		#N/A	\$0.00	\$0	\$0
Supply/install piping system	Adjust pipe line to route to Goose UG in Year 10	m	4,500	Sabina	\$14.81	\$66,625	\$66,625
Operate pumps to flood workings		m3	391,630	Sabina	\$0.15	\$60,552	\$60,552
Decommission SWP to Goose UG pipeline		m	10,800	Sabina	\$11.59	\$125,139	\$125,139
Other				#N/A	\$0.00	\$0	\$0
<b>INSTALL GROUNDWATER COLLECTION SYSTEM</b>							
Excavate/install sumps		m2		#N/A	\$0.00	\$0	\$0
Install pumping wells		m3		#N/A	\$0.00	\$0	\$0
Install pumps/pipelines/power supply		LS		#N/A	\$0.00	\$0	\$0
<b>SPECIALIZED ITEMS</b>							
Install water quality monitoring pipes		each		#N/A	\$0.00	\$0	\$0
Install permanent pumping system		each		#N/A	\$0.00	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0
					<b>Total</b>	\$334,323	\$334,323
					<b>% of Total</b>		100%

Underground Mine Name	Echo			UG Mine # 4	4		
ACTIVITY/MATERIAL	Notes	Unit	Qty	Cost Code	Unit Cost	Cost Total Cost	
<b>CONTROL ACCESS</b>							
Fence		m		#N/A	\$0.00	\$0	
Signs		each		#N/A	\$0.00	\$0	
Block roads		m3		#N/A	\$0.00	\$0	
Berm		m3		#N/A	\$0.00	\$0	
Backfill Portal (NPAG waste rock plug)	At least 5 m deep into 5x4.5m portal and slope at least 2:1 outside of portal	m3	150	PORL	\$23.13	\$3,469	
Backfill portal #2		m3		#N/A	\$0.00	\$0	
Cap raise # 1	Concrete plug over 4m-dia. vent raise	LS	28	SRH	\$2,623.03	\$74,232	
Cap raise #2		m3		#N/A	\$0.00	\$0	
Cap shaft #1		m3		#N/A	\$0.00	\$0	
Cap shaft #2		m3		#N/A	\$0.00	\$0	
Backfill adits		m3		#N/A	\$0.00	\$0	
Backfill open stope		m3	3,550	Sabina	\$6.95	\$24,680	
Concrete cap over open stope		m3		#N/A	\$0.00	\$0	
Other				#N/A	\$0.00	\$0	
<b>REMOVE HAZARDOUS MATERIALS</b>							
Remove hazardous materials, U/G labor	One shift with loader, incl. operator and fuel	manhour	10	load-sL	\$215.30	\$2,153	
Remove/decontam. stationary & elect. equip		mandays		#N/A	\$0.00	\$0	
Remove/decontam. mobile equipment		each		#N/A	\$0.00	\$0	
Remove misc. haz. mat & explosives	Mining will cease before closure	kg		#N/A	\$0.00	\$0	
Decommission Pipeline		m		#N/A	\$0.00	\$0	
<b>INSTALL BULKHEADS</b>							
Bulkheads to control water flow		each		#N/A	\$0.00	\$0	
Grout bulkhead		m3		#N/A	\$0.00	\$0	
<b>FLOOD MINE</b>							
Supply/install pump	Passive flooding of Echo UG in Year 10, complete flooding is expected to occur within a few months.	each		#N/A	\$0.00	\$0	
Supply/install piping system		each		#N/A	\$0.00	\$0	
Operate pumps to flood workings		m3		#N/A	\$0.00	\$0	
Decommission				#N/A	\$0.00	\$0	
Other				#N/A	\$0.00	\$0	
<b>INSTALL GROUNDWATER COLLECTION SYSTEM</b>							
Excavate/install sumps		m2		#N/A	\$0.00	\$0	
Install pumping wells		m3		#N/A	\$0.00	\$0	
Install pumps/pipelines/power supply		LS		#N/A	\$0.00	\$0	
<b>SPECIALIZED ITEMS</b>							
Install water quality monitoring pipes		each		#N/A	\$0.00	\$0	
Install permanent pumping system		each		#N/A	\$0.00	\$0	
Assess underground stability	Rock mechanics inspection before closure	each	1	Sabina	\$11,586.92	\$11,587	
					<b>Total</b>	\$116,121	\$116,121
					<b>% of Total</b>		100%

1 Rock Pile Name: Umwelt, Llama, Goose Main, and Echo

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>STABILIZE SLOPES</b>						
Flatten slopes with dozer		m3		#N/A	\$0.00	\$0
Flatten "bubble dump" areas		m3		#N/A	\$0.00	\$0
Divert runon, ditch mat'l A		m3		#N/A	\$0.00	\$0
Divert runon, ditch mat'l B		m3		#N/A	\$0.00	\$0
Toe buttress, drain mat'l		m3		#N/A	\$0.00	\$0
Toe buttress, fill mat'l A		m3		#N/A	\$0.00	\$0
Toe buttress, fill mat'l B		m3		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>COVER ROCK PILE</b>						
Subgrade preparation - doze surface		m3		#N/A	\$0.00	\$0
Soil cover - excavate,haul,spread&compact		m3		#N/A	\$0.00	\$0
Rock cover - excavate, haul & spread	Cover 3 rock piles: Umwelt, Llama, and Goose Main (incorporates Echo WRSA and Echo TF into Goose Main WRSA). WRSAs will be covered progressively by direct hauling NPAG during mining. Maximum PAG Exposure occurs end of Year 3 for 31.5 ha; 5 m cover converts this area to 1.6 Mm3.	m3	1,574,457	RBSS	\$8.11	\$12,770,177
Excavate downslope drainage channel & chute		m3		#N/A	\$0.00	\$0
Rip rap drainage channel and chute		m3		#N/A	\$0.00	\$0
Vegetate		ha		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>VERY LOW PERMEABILITY COVER (in addition to above)</b>						
Liner subgrade preparation - compact		m2		#N/A	\$0.00	\$0
Supply geomembrane		m2		#N/A	\$0.00	\$0
Install geomembrane		m2		#N/A	\$0.00	\$0
Protective cover - excavate,haul,spread&compact		m3		#N/A	\$0.00	\$0
Vegetate		ha		#N/A	\$0.00	\$0
Install infiltration/seepage instrumentation		allow		#N/A	\$0.00	\$0
<b>CONSTRUCT DIVERSION DITCHES</b>						
Excavate ditches -soil		m3		#N/A	\$0.00	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0
<b>CONSTRUCT SEEPAGE COLLECTION POND</b>						
Excavate seepage collection pond	See Water Management tab for berm breaching	m3		#N/A	\$0.00	\$0
Doze & spread excavated material		m3		#N/A	\$0.00	\$0
Vegetate spread material		ha		#N/A	\$0.00	\$0
Bedding layer		m3		#N/A	\$0.00	\$0
Supply geomembrane		m2		#N/A	\$0.00	\$0
Install geomembrane		m2		#N/A	\$0.00	\$0
Erosion protection layer		m3		#N/A	\$0.00	\$0
<b>INSTALL GROUNDWATER COLLECTION SYSTEM</b>						
Excavate/install sumps		m3		#N/A	\$0.00	\$0
Install pumping wells		m3		#N/A	\$0.00	\$0
Install pumps/pipelines/power supply		allow		#N/A	\$0.00	\$0
<b>RELOCATE DUMPS</b>						
Load, haul, dump or doze		m3		#N/A	\$0.00	\$0
Add lime		tonne		#N/A	\$0.00	\$0
Contour reclaimed area		ha		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>SPECIALIZED ITEMS</b>						
Install ground temperature monitoring cables	Will be installed during Operations to meet operational monitoring commitments	each		#N/A	\$0.00	\$0
Install permanent instrumentation, drilling		each		#N/A	\$0.00	\$0
<b>TREAT ROCK PILE SEEPAGE - see "Water Management"</b>						
<b>HEAP LEACH SEEPAGE TREATMENT - Cyanide Detox</b>						
Cyanide destruction water treatment pumping		m3		#N/A	\$0.00	\$0
Reagents		tonnes		#N/A	\$0.00	\$0
Electrician/mechanic to maintain treatment plant		allow		#N/A	\$0.00	\$0
Equipment maintenance and parts		allow		#N/A	\$0.00	\$0
					Annual treatment costs	
Number of years of treatment		years	0			
					Total treatment costs	
						\$0
<b>HEAP LEACH SEEPAGE TREATMENT - ARD/ML</b>						
Upgrade/modify pumping system - report to WTP		allow		#N/A	\$0.00	\$0
					<b>Total</b>	<b>\$12,770,177</b>
					<b>% of Total</b>	<b>100%</b>

\* For construction of passive treatment system refer to "Water Management".

1 Building / Equip Name:

Bldg / Equip #: 1

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
<b>DISPOSE MOBILE EQUIPMENT</b>						
Decontaminate and ship off-site		allow		#N/A	\$0.00	\$0
Decontaminate and dispose on-site	Drive or transport to landfill; drain fluids; NPAG cover cost below	allow	1	Sabina	\$23,173.84	\$23,174
Other				#N/A	\$0.00	\$0
<b>REMOVE BUILDINGS - see note below</b>						
Accommodation Complex	Goose Admin: Kitchen/camp. Landfill building materials and pad.	m2	1,980	BRS1L	\$55.36	\$109,621
Process Facilities		m2	6,464	BRS1H	\$79.97	\$516,928
Crusher		m2	1,630	BRS1H	\$79.97	\$130,352
Power plant		m2	2,040	BRS1H	\$79.97	\$163,140
Emergency power plant		m2	300	BRS1H	\$79.97	\$23,991
Truck Shop/Office	Goose Admin building	m2	2,349	BRS1L	\$55.36	\$130,075
Cold storage	Goose Admin building	m2	840	BRS1L	\$55.36	\$46,506
Storage Facilities	Waste oil storage Goose Site	Lot	1	Sabina	\$50,209.99	\$50,210
Storage Facility	Goose freight storage	Lot	1	Sabina	\$22,304.82	\$22,305
Water and Wastewater Treatment Facilities	Water treatment plant Goose Building	m2	647	BRS1L	\$55.36	\$35,821
Sewage Treatment Plant	Remove hazardous materials and dispose of at licensed facility, landfill building materials	Lot	1	Sabina	\$13,382.89	\$13,383
Fuel Tanks	Fuel storage and distribution Goose facility	Lot	1	Sabina	\$178,438.60	\$178,439
Offices, Repair, Lab, Warehouse	MLA infrastructure Port Office	Units	5	Sabina	\$2,711.34	\$13,557
Pipeline	MLA Infrastructure	m	10,000	Sabina	\$11.59	\$115,869
Warehouse, Shops and Others	MLA Infrastructure. Includes: Incinerator and waste management, Warehouses, Genset, Maintenance shop, water storage, WTP/STP, camp/office, freight storage area, waste area, MLA Fuel Storage Area. Cost includes grade and contour pads, disposal at designated areas, remove hazard material when applicable. Additional Cost included for MLA Fuel Transfer Area tank and liner removal.	LS	1	Sabina	\$376,702.42	\$376,702
Freshwater intakes	pipes will be capped at substrate and left in place.	m2		#N/A	\$0.00	\$0
Reclaim pumps		m2		#N/A	\$0.00	\$0
Outfall & Diffuser		m2		#N/A	\$0.00	\$0
Airstrip lighting, navigation, electrician	Accounts for Goose 6,000-ft airstrip	manhours	24	elech	\$116.88	\$2,805
Airstrip lighting, navigation, mechanical	Accounts for Goose 6,000-ft airstrip	manhours	24	mechH	\$89.63	\$2,151
Break foundation slabs		m2		#N/A	\$0.00	\$0
Consolidate & dump boneyard debris		m3		#N/A	\$0.00	\$0
Other	Remove Buildings - WIR Service/Emergency Camps, total of 3 1-ha area for 3 camps; assume all structures will be sprung structures.	LS	3	Sabina	\$82,933.79	\$248,801
<b>LANDFILL FOR DEMOLITION WASTE</b>						
Place rock cover		m3	25,000	RR3L	\$8.61	\$215,305
Place soil cover		m3		#N/A	\$0.00	\$0
Vegetate		ha		#N/A	\$0.00	\$0
<b>GRADE AND CONTOUR PADS</b>						
Accommodation Complex	Goose Admin: Kitchen/camp. no concrete foundation	ha	0.2	SCFYL	\$5,290.35	\$1,058
Process Facilities	concrete foundation demolished to ground level	m2	6,464	BRCS	\$7.38	\$47,716
Crusher	concrete foundation demolished to ground level	m2	1,630	BRCS	\$7.38	\$12,032
Power plant	no concrete foundation	ha	0.3	SCFYL	\$5,290.35	\$1,587
Emergency power plant	no concrete foundation	ha	0.10	SCFYL	\$5,290.35	\$529
Truck Shop/Office	concrete foundation demolished to ground level	m2	2,349	BRCS	\$7.38	\$17,343
Cold storage	no concrete foundation	ha	0.1	SCFYL	\$5,290.35	\$529
Water and Wastewater Treatment Facilities	no concrete foundation	ha	0.1	SCFYL	\$5,290.35	\$529
Sewage Treatment Plant	no concrete foundation	m2	33	BRCS	\$7.38	\$244
Fuel Tanks	Fuel storage and distribution Goose facility; no concrete foundation	ha	2.2	SCFYL	\$5,290.35	\$11,639
Warehouse, Shops and Other	MLA, includes all storage/laydown pads, Fuel Tank areas, airstrip, shoreline pads, and camp area	ha	20	SCFYL	\$5,290.35	\$105,807
Place rock cover		m3		#N/A	\$0.00	\$0
Vegetate		ha		#N/A	\$0.00	\$0
<b>PUNCTURE LINED SUMPS</b>						
Puncture liner and place soil cover		m3		#N/A	\$0.00	\$0
<b>RECLAIM ROADS</b>						
Restore drainage, remove culverts haul road	Restore drainage including culverts at Goose Property; no culverts at MLA. Roads will remain intact to facilitate long-term access.	m3	1,488	Sabina	\$12.75	\$18,965
Remove bridges		each		#N/A	\$0.00	\$0
Scarify and install water breaks		ha		#N/A	\$0.00	\$0
Restore drainage airstrip	Accounts for Goose 6,000ft by 200ft airstrip dimensions	m3	1,360	Sabina	\$13.90	\$18,910
Scarify airstrip area	Accounts for Goose 6,000ft by 200ft airstrip (1,829 m x 61 m = 11.2 ha)	ha	11.2	SCFYL	\$5,290.35	\$59,252
Scarify Winter Ice Roads & WIR Camps	Fill sections on land - 15 km x 10 m wide = 15.0 ha; plus 3 ha for WIR Service/Emergency Camps (1 ha/camp x 3)	ha	18	SCFYH	\$7,418.79	\$133,538
Vegetate - Subbase & WIR Camps	Potential vegetation of roads to include 18 ha of scarified subbase and camps, plus a nominal area of 3 ha for spill or other road remediation area.	ha	21	VHFL	\$4,921.25	\$103,346
Other				#N/A	\$0.00	\$0
<b>SPECIALIZED ITEMS</b>						
Dispose of misc. debris and laydown area refuse				#N/A	\$0.00	\$0
<b>Total</b>						\$2,952,160
<b>% of Total</b>						

1 Chemicals/Soil Area Name:

**Note:** The procedures, equipment and packaging for clean up and removal of chemicals or contaminated soils are highly dependent on the nature of the chemicals and their existing state of containment. Government guidelines should be consulted on an individual chemical basis. Any estimate made here should be considered very rough unless specific evaluations have been conducted.

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>HAZARDOUS MATERIALS AUDIT</b>						
Hazardous materials audit		mandays		#/N/A	\$0.00	\$0
Phase 1 audit		each	1	CS1L	\$9,227.35	\$9,227
Phase 2 audit		each	1	CS2L	\$61,515.66	\$61,516
<b>BUILDING DECONTAMINATION &amp; CONSOLIDATION OF HAZARDOUS MATERIALS</b>						
Environmental technician/coordinator		mandays		#/N/A	\$0.00	\$0
Decontaminate: oil, fuel		mandays		#/N/A	\$0.00	\$0
Decontaminate maintenance shop		mandays		#/N/A	\$0.00	\$0
Decontaminate power plant		mandays		#/N/A	\$0.00	\$0
Decontaminate bulk fuel storage		mandays		#/N/A	\$0.00	\$0
Decontaminate ANFO plant		mandays		#/N/A	\$0.00	\$0
Decontaminate offices/warehouse/accom		mandays		#/N/A	\$0.00	\$0
Removal of asbestos siding on buildings		m2		#/N/A	\$0.00	\$0
Removal of friable asbestos on equipment		m2		#/N/A	\$0.00	\$0
Other				#/N/A	\$0.00	\$0
<b>HAZARDOUS MATERIALS REMOVAL</b>						
Waste oils	Consume in a waste oil burner on-site	litre	10,000	ORL	\$0.53	\$5,290
Waste fuel	Consume on-site to power an incinerator, or in a waste oil burner	litre	250,000	ORL	\$0.53	\$132,259
Waste batteries	Assumed 10 20-kg batteries generated in the final year of closure	kg	200	PCRH	\$3.08	\$615
Assay & environmental lab reagents		kg	500	PCRH	\$3.08	\$1,538
Machine shop paints, solvents etc.		litre	200	PCRH	\$3.08	\$615
Glycol		litre	5,000	PCRH	\$3.08	\$15,379
Process reagents		kg	130,000	PCRH	\$3.08	\$399,852
WTP sludge from Water Treatment	All sludge created and disposed during Operations. Conitngency 3 years of sludge disposal included (9,000 kg over 3 seasons).	kg	9,000	PCRH	\$3.08	\$27,682
Nuclear sources		allow		#/N/A	\$0.00	\$0
Mobile Equipment	Remove hazardous waste from equipment not being salvaged, clean, landfill equipment	each	41	Sabina	\$2,641.82	\$108,315
<b>HAZARDOUS MATERIALS</b>						
Transportation to disposal facility	Included in hazardous materials removal cost	allow		#/N/A	\$0.00	\$0
Disposal fees	Included in hazardous materials removal cost	allow		#/N/A	\$0.00	\$0
Other				#/N/A	\$0.00	\$0
<b>CONTAMINATED SOILS</b>						
Contam. soil investigation - Phase 1		LS	1	Sabina	\$8,690.19	\$8,690
Contam. soil investigation - Phase 2		LS	1	Sabina	\$57,934.61	\$57,935
<b>CONTAMINATED SOIL REMOVAL</b>						
Excavate and transport to onsite facility		m3	10,000	SB1H	\$7.26	\$72,588
Manage hydrocarbon remediation at facility		m3	10,000	CSR1	\$57.82	\$578,247
Reagents/stabilizing agent		m2		#/N/A	\$0.00	\$0
Excavate and transport to offsite facility		m3		#/N/A	\$0.00	\$0
Contour decontaminated area	Decommission 2 landfarms and confirmation soil sampling; estimated 6,000m3 at each of Goose and MLA sites.	m3	12,000	SB1L	\$5.29	\$63,484
<b>CONTAMINATED SOIL VERY LOW PERMEABILITY COVER</b>						
Supply geomembrane, HDPE, ES3, GCL		m2		#/N/A	\$0.00	\$0
Upper and lower bedding layers		m3		#/N/A	\$0.00	\$0
Install geomembrane, HDPE, ES3, GCL		m2		#/N/A	\$0.00	\$0
Erosion protection layer		m3		#/N/A	\$0.00	\$0
Vegetate		m2		#/N/A	\$0.00	\$0
Install infiltration/seepage instrumentation		allow		#/N/A	\$0.00	\$0
Other	Operate 2 landfarms: 1 at Goose, 1 at MLA	allow	2	Sabina	\$57,934.61	\$115,869
<b>OTHER</b>						
				#/N/A	\$0.00	\$0
					<b>Total</b>	\$1,659,101
					<b>% of Total</b>	100%

1 Water Management

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>BREACH DYKE EMBANKMENT</b>						
Breach Llama Lake Diversion Berms	During closure.	m3	665	#N/A	\$8.46	\$5,625
Breach Llama WRSA Diversion Berm	During closure.	m3	95	#N/A	\$8.46	\$804
Breach Llama WRSA Containment Dam	During closure.	m3	95	#N/A	\$8.46	\$804
Breach Primary Pond Containment Dam	During closure.	m3	200	#N/A	\$8.46	\$1,692
Breach Umwelt WRSA Containment Dam	Dam has been removed from water management design	m3	-	#N/A	\$0.00	\$0
Breach Umwelt WRSA Diversion Berm	Berm has been removed from water management design	m3	-	#N/A	\$0.00	\$0
Breach Echo WRSA Containment Dam	Dam has been removed from water management design	m3	-	#N/A	\$8.46	\$0
Breach Echo Diversion Berm	During closure.	m3	190	#N/A	\$8.46	\$1,607
Breach Echo WRSA Diversion Berm	Berm has been removed from water management design	m3	-	#N/A	\$8.46	\$0
Breach Echo/Goose Main Containment Dam	During closure.	m3	95	#N/A	\$8.46	\$804
Breach Goose Main Diversion Berm	During closure.	m3	95	#N/A	\$8.46	\$804
Breach Plant Site Pond Containment Dam	During closure.	m3	215	#N/A	\$8.46	\$1,819
Breach SWP Containment Dam	During closure.	m3	430	#N/A	\$9.27	\$3,986
Remove Liner from all berms	Remove liner from all berms.	m2	30,700	Sabina	\$0.81	\$24,900
Contour water intake area		m3		#N/A	\$0.00	\$0
<b>STABILIZE SEDIMENT PONDS/WATER MANAGEMENT PONDS</b>						
Place soil cover		m3		#N/A	\$0.00	\$0
Doze & spread excavated material		m3		#N/A	\$0.00	\$0
Vegetate spread material		ha		#N/A	\$0.00	\$0
Rip rap in channel base		each		#N/A	\$0.00	\$0
<b>REDIRECT RUNOFF/CONSTRUCT DIVERSION DITCHES</b>						
Excavate ditches -soil		m3		#N/A	\$0.00	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0
Stabilize side slopes		m3		#N/A	\$0.00	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0
<b>BREACH DITCHES</b>						
Excavate breaches		m3		#N/A	\$0.00	\$0
Install flow dissipation		m3		#N/A	\$0.00	\$0
Vegetate remainder of ditch		m2		#N/A	\$0.00	\$0
<b>DECOMMISSION FRESH WATER SUPPLY</b>						
Breach embankment		m3		#N/A	\$0.00	\$0
Remove pump		LS		#N/A	\$0.00	\$0
Remove pipelines		m		#N/A	\$0.00	\$0
<b>DECOMMISSION WATER RECLAIM BARGE</b>						
Decommission reclaim barge from Llama TF		LS	1	Sabina	\$11,586.92	\$11,587
<b>WATER CONTROL IN RECLAMATION QUARRY</b>						
Install pumping system		LS		#N/A	\$0.00	\$0
Remove pumping system		m		#N/A	\$0.00	\$0
<b>REMOVE PIPELINES</b>						
Decommission Llama pump and pipeline		m	700	Sabina	\$21.52	\$15,063
Decommission WTP-Goose Lake pipeline		m	1,140	Sabina	\$11.59	\$13,209
Remove Saline Water Pond pump and pipeline		m	10,800	Sabina	\$12.39	\$133,829
Remove Primary Pond pump and pipeline		m	7,250	Sabina	\$12.79	\$92,695
Remove Echo WRSA Pond pump and pipeline	Has been removed from water management design	m	-	Sabina	\$11.59	\$0
Remove Echo NCW pond pump and pipeline	Has been removed from water management design	m	-	Sabina	\$27.39	\$0
Remove Plant Site Pond pump and pipeline		m	4,550	Sabina	\$11.59	\$52,720
Decommission WTP pump and pipeline		m	7,520	Sabina	\$12.62	\$94,937
Decommission WTP		LS	2	Sabina	\$11,297.25	\$22,594
Concrete plug deep pipes		m3		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>OPERATE WATER TREATMENT PLANT</b>						
Pump from TSF to WTP		m3	-	POCL	\$0.15	\$0
Treat water in WTP	No treatment required for early closure at end Year 4 (max PAG exposure). End Year 4 is transition from Echo TF to Umwelt TF.	m3	-	Sabina	\$0.75	\$0
Pump water out of WTP		m3	-	POCL	\$0.15	\$0
<b>OPERATE WATER TREATMENT PLANT</b>						
Pump to WTP		m3	3,000,000	POCL	\$0.15	\$442,913
Treat water in WTP	Water treatment (and pumping) allotment to address potential water treatment considerations during the Closure Phase.	m3	3,000,000	Sabina	\$0.75	\$2,259,450
Pump water out of WTP		m3	3,000,000	POCL	\$0.15	\$442,913
<b>GROUNDWATER COLLECTION SYSTEM</b>						
Excavate/install sumps		m3		#N/A	\$0.00	\$0
Install pumping wells		m3		#N/A	\$0.00	\$0
Install pumps/pipelines/power supply		LS		#N/A	\$0.00	\$0
<b>CONSTRUCT CONTAMINATED WATER STORAGE POND</b>						
Excavate pond		m3		#N/A	\$0.00	\$0
Doze & spread excavated material		m3		#N/A	\$0.00	\$0
Vegetate spread material		ha		#N/A	\$0.00	\$0
Bedding layer		m3		#N/A	\$0.00	\$0
Supply geomembrane		m2		#N/A	\$0.00	\$0
Install geomembrane		m2		#N/A	\$0.00	\$0
Erosion protection layer		m3		#N/A	\$0.00	\$0
<b>CONSTRUCT PASSIVE TREATMENT SYSTEM (e.g. Constructed Wetland)</b>						
Construct access roads		km		#N/A	\$0.00	\$0
Install HDPE piping system from collection pond		m		#N/A	\$0.00	\$0
Inter-cell flow structures		allow		#N/A	\$0.00	\$0
Install liners		m2		#N/A	\$0.00	\$0
Install growth media		m3		#N/A	\$0.00	\$0
Wetland vegetation		ha		#N/A	\$0.00	\$0
<b>CONSTRUCT WATER TREATMENT PLANT</b>						
Build treatment plant	Treatment Plant will be constructed as part of operations	LS		#N/A	\$0.00	\$0
Build sludge containment facility		LS		#N/A	\$0.00	\$0
					<b>Total</b>	<b>\$3,624,753</b>

For details of long-term/post-closure water treatment see "WATER TREATMENT" Worksheet; costs included in this tab.

1 Interim Care and Maintenance

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>INTERIM CARE &amp; MAINTENANCE</b>						
Camp operation	Caretaker and summer personnel	mandays	306	Sabina	127.46	\$39,002
On-site staff	Caretaker and summer personnel	manhours	3,060	ENVCO	91.24	\$279,195
extra personnel		manmonths		#N/A	0	\$0
-electrician		manmonths		#N/A	0	\$0
-mechanic		manmonths		#N/A	0	\$0
annual fuel	Fuel for vehicles; fuel for pumping included in water treatment cost	litre	5,000	FCDH	1.71	\$8,551
misc. supplies		allow	1	Sabina	23174	\$23,174
pick-up truck		each		#N/A	0	\$0
small dozer		allow		#N/A	0	\$0
small excavator		allow		#N/A	0	\$0
snow machine		allow		#N/A	0	\$0
communications		allow		#N/A	0	\$0
SNP/AEMP water sampling & reporting	Sampling and lab costs	each	1	WSH	12303	\$12,303
geotechnical assessment	Annual geotechnical inspection	each	1	RPTH	24606	\$24,606
interim water treatment	Captured under Water Treatment	each	1	#N/A	0	\$0
other		each		#N/A	0	\$0
				Annual Interim C&M Cost		\$386,830
Number of years of ICM		years	3	<b>Total</b>		<b>\$1,160,490</b>

**10 Years  
(Year 13 to 22)**

ACTIVITY/MATERIAL - WEMP and TERRESTRIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>MONITORING &amp; INSPECTIONS</b>						
Total geotechnical inspections (1 yearly)		year		#N/A	\$0.00	\$0
Waste Rock Piles		year		#N/A	\$0.00	\$0
Pit Walls		year		#N/A	\$0.00	\$0
WR GTC Monitoring		year		#N/A	\$0.00	\$0
Survey inspection		each		#N/A	\$0.00	\$0
Regulatory costs*		year		#N/A	\$0.00	\$0
Site water monitoring		each		#N/A	\$0.00	\$0
- Active closure and flooding		each		#N/A	\$0.00	\$0
- Post pit flooding		each		#N/A	\$0.00	\$0
Wildlife Effects Monitoring Program (WEMP)	Aquatics - Non-contact water basins (10 years)	year	1	Sabina	\$5,561.72	\$5,562
Terrestrial Animal Monitoring	Terrestrial Animal Monitoring (10 years)	year	1	Sabina	\$27,808.61	\$27,809
Vegetation Monitoring		each		#N/A	\$0.00	\$0
Maintain gravel road surface		year		#N/A	\$0.00	\$0
Maintain airstrip surface		year		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>COVER MAINTENANCE</b>						
Repair erosion - infill gullies		allow		#N/A	\$0.00	\$0
Repair erosion - upgrade diversion ditches		allow		#N/A	\$0.00	\$0
Remove problem vegetation		allow		#N/A	\$0.00	\$0
Repair animal damage		allow		#N/A	\$0.00	\$0
Repair/upgrade access controls		allow		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>SPILLWAY MAINTENANCE</b>						
Repair erosion		m3		#N/A	\$0.00	\$0
Clear spillway		each		#N/A	\$0.00	\$0
<b>CWTS MAINTENANCE</b>						
Maintain flow, restore vegetation		allow		#N/A	\$0.00	\$0
<b>POST-CLOSURE WATER TREATMENT</b>						
Annual water treatment cost, from "Water Treatment"		LS		#N/A	\$0.00	\$0
Subtotal, Annual post-closure costs						\$33,370
Discount rate for calculation of net present value of post-closure cost, %				0.00%		
Number of years of post-closure activity				10	years	
<b>Present Value of payment stream</b>						<b>\$333,703</b>

**13 Years  
(Year 13 to 25)**

ACTIVITY/MATERIAL - Monitoring & Maintenance	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>MONITORING &amp; INSPECTIONS</b>						
Total geotechnical inspections (1 yearly)		year		#N/A	\$0.00	\$0
Waste Rock Piles	Annual inspection of WR piles from closure to post-closure (13 years)	year	1	Sabina	\$9,617.15	\$9,617
Pit Walls	Annual inspection of pit walls from closure to post-closure (13 years)	year	1	Sabina	\$4,634.77	\$4,635
WR GTC Monitoring	Umwelt, Llama, and TSF WRSA ground temp cable annual monitoring. No GTCs at Echo WRSA (13 years)	year	1	Sabina	\$16,685.17	\$16,685
Survey inspection		each		#N/A	\$0.00	\$0
Regulatory costs	annual reporting, management plans, progress reports (13 years)	year	1	Sabina	\$28,967.30	\$28,967
Site water monitoring	All pits and WR piles closure and post closure monitoring (13 years)	year	1	Sabina	\$10,567.27	\$10,567
- Active closure and flooding		each		#N/A	\$0.00	\$0
- Post pit flooding		each		#N/A	\$0.00	\$0
Wildlife Effects Monitoring Program (WEMP)		year		#N/A	\$0.00	\$0
Terrestrial Animal Monitoring		year		#N/A	\$0.00	\$0
Vegetation Monitoring		each		#N/A	\$0.00	\$0
Maintain gravel road surface	maintenance from closure to post-closure (13 years)	year	1	Sabina	\$15,816.15	\$15,816
Maintain airstrip surface	maintenance from closure to post-closure (13 years)	year	1	Sabina	\$4,518.90	\$4,519
Other				#N/A	\$0.00	\$0
<b>COVER MAINTENANCE</b>						
Repair erosion - infill gullies		allow		#N/A	\$0.00	\$0
Repair erosion - upgrade diversion ditches		allow		#N/A	\$0.00	\$0
Remove problem vegetation		allow		#N/A	\$0.00	\$0
Repair animal damage		allow		#N/A	\$0.00	\$0
Repair/upgrade access controls		allow		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>SPILLWAY MAINTENANCE</b>						
Repair erosion		m3		#N/A	\$0.00	\$0
Clear spillway		each		#N/A	\$0.00	\$0
<b>CWTS MAINTENANCE</b>						
Maintain flow, restore vegetation		allow		#N/A	\$0.00	\$0
<b>POST-CLOSURE WATER TREATMENT</b>						
Annual water treatment cost, from "Water Treatment"		LS		#N/A	\$0.00	\$0
Subtotal, Annual post-closure costs						\$90,807
Discount rate for calculation of net present value of post-closure cost, %				0.00%		
Number of years of post-closure activity				13	years	
<b>Present Value of payment stream</b>						\$1,180,487

**Beyond Post Closure (Long Term 1 to 5, 7, 10, 15, 25)**

<b>ACTIVITY/MATERIAL - Long Term Monitoring</b>	<b>Notes</b>	<b>Units</b>	<b>Quantity</b>	<b>Cost Code</b>	<b>Unit Cost</b>	<b>Total Cost</b>
<b>MONITORING &amp; INSPECTIONS</b>						
General Water Sampling and Stability Monitoring	long term general monitoring	year	1	Sabina	\$46,347.69	\$46,348
Waste Rock Piles		year		#N/A	\$0.00	\$0
Pit Walls		year		#N/A	\$0.00	\$0
WR GTC Monitoring		year		#N/A	\$0.00	\$0
Survey inspection		each		#N/A	\$0.00	\$0
Regulatory costs		each	1	RPTH	\$24,606.27	\$24,606
Site water monitoring		year		#N/A	\$0.00	\$0
- Active closure and flooding		each		#N/A	\$0.00	\$0
- Post pit flooding		each		#N/A	\$0.00	\$0
Wildlife Effects Monitoring Program (WEMP)		year		#N/A	\$0.00	\$0
Terrestrial Animal Monitoring		year		#N/A	\$0.00	\$0
Vegetation Monitoring		each		#N/A	\$0.00	\$0
Maintain gravel road surface		year		#N/A	\$0.00	\$0
Maintain airstrip surface		year		#N/A	\$0.00	\$0
Other - Site Access	Float plane access	each	1	MWH	\$11,195.85	\$11,196
<b>COVER MAINTENANCE</b>						
Repair erosion - infill gullies		allow		#N/A	\$0.00	\$0
Repair erosion - upgrade diversion ditches		allow		#N/A	\$0.00	\$0
Remove problem vegetation		allow		#N/A	\$0.00	\$0
Repair animal damage		allow		#N/A	\$0.00	\$0
Repair/upgrade access controls		allow		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>SPILLWAY MAINTENANCE</b>						
Repair erosion		m3		#N/A	\$0.00	\$0
Clear spillway		each		#N/A	\$0.00	\$0
<b>CWTS MAINTENANCE</b>						
Maintain flow, restore vegetation		allow		#N/A	\$0.00	\$0
<b>POST-CLOSURE WATER TREATMENT</b>						
Annual water treatment cost, from "Water Treatment"		LS		#N/A	\$0.00	\$0
Subtotal, Annual post-closure costs						\$82,150
Discount rate for calculation of net present value of post-closure cost, %				0.00%		
Number of years of post-closure activity				See Long Term	years	
<b>Present Value of payment stream</b>						<b>\$739,348</b>

Annual Discount Rate:		0%			
Project Phase	Annual Discount Rate:	Closure Year	Post-Closure Monitoring Year	Long Term Monitoring (GTCs, physical, water)	
				One Time Cost	Yearly Total NPV
Operations	1				\$0
	2				\$0
	3				\$0
	4				\$0
	5				\$0
	6				\$0
	7				\$0
	8				\$0
	9				\$0
	10				\$0
	11				\$0
	12				\$0
Active Closure	13	1			\$0
	14	2			\$0
Passive Closure	15	3			\$0
	16	4			\$0
	17	5			\$0
	18	6			\$0
	19	7			\$0
	20	8			\$0
Post Closure	21	9	1	\$82,150	\$82,150
	22	10	2	\$82,150	\$82,150
	23	11	3	\$82,150	\$82,150
	24	12	4	\$82,150	\$82,150
	25	13	5	\$82,150	\$82,150
Beyond Post Closure	26	14	6		\$0
	27	15	7	\$82,150	\$82,150
	28	16	8		\$0
	29	17	9		\$0
	30	18	10	\$82,150	\$82,150
	31	19	11		\$0
	32	20	12		\$0
	33	21	13		\$0
	34	22	14		\$0
	35	23	15	\$82,150	\$82,150
	36	24	16		\$0
	37	25	17		\$0
	38	26	18		\$0
	39	27	19		\$0
	40	28	20		\$0
	41	29	21		\$0
	42	30	22		\$0
	43	31	23		\$0
	44	32	24		\$0
	45	33	25	\$82,150	\$82,150
<b>Net Present Value:</b>				<b>\$739,348</b>	

1 Mobilization/Demobilization:

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
<b>MOBILIZE HEAVY EQUIPMENT</b>						
Assumes mining equipment on abandoned mine site is operable and available.						
Light duty vehicles	Purchase pickups and Vans	each		#N/A	0	\$0
Telehandlers	Purchase (standby)	each		#N/A	0	\$0
Excavators	Purchase (320 Ex)	each		#N/A	0	\$0
Dump trucks	Purchase 30T	each		#N/A	0	\$0
Dozers	Purchase (D6T)	each		#N/A	0	\$0
Grader	Purchase (140M)	each		#N/A	0	\$0
Demolition shears	For a 320 Exc	each		#N/A	0	\$0
Crane	Purchase	each		#N/A	0	\$0
Loader	Purchase (966 Loader)	each		#N/A	0	\$0
Manlifts	Purchase (standby)	each		#N/A	0	\$0
Small Equipment		LS		#N/A	0	\$0
Compactor		each		#N/A	0	\$0
<b>MOBILIZE MISC. EQUIPMENT</b>						
Assumes mining equipment on abandoned mine site is operable and available.						
Pump shipping		each		#N/A	0	\$0
Pipe shipping		m		#N/A	0	\$0
Minor tools and equipment		allow		#N/A	0	\$0
Truck tires		allow		#N/A	0	\$0
Other				#N/A	0	\$0
<b>MOBILIZE CAMP</b>						
Build 20 Person Camp	Goose Closure Camp	LS	1	Sabina	\$22,304.82	\$22,305
Build 20 Person Power Plant	Goose Closure Camp	LS	1	Sabina	\$22,304.82	\$22,305
Reclamation activities		allow		#N/A	0	\$0
Long term reclamation activities (e.g. pump flooding)		allow		#N/A	0	\$0
<b>WORKER ACCOMODATIONS</b>						
Camp operation		mandays	12,000	Sabina	\$127.46	\$1,529,474
Reclamation activities		manmonths		#N/A	0	\$0
Long term reclamation activities (e.g. pump flooding)		manmonths		#N/A	0	\$0
<b>MOBILIZE FUEL</b>						
Fuel freight - reclamation activities		litre		#N/A	0	\$0
Fuel freight - long term reclamation activities		litre		#N/A	0	\$0
Oil & Other		litre		#N/A	0	\$0
Fuel freight accommodations		litre		#N/A	0	\$0
<b>GENERAL CONSTRUCTION INDIRECT</b>						
Tooling, consumables, office & safety supplies	covered in Summary tab indirects	mandays		#N/A	0	\$0
<b>DEMOBILIZE HEAVY EQUIPMENT</b>						
Excavators		km		#N/A	0	\$0
Dump trucks		km		#N/A	0	\$0
Dozers		km		#N/A	0	\$0
Demolition shears		km		#N/A	0	\$0
Crane		km		#N/A	0	\$0
Loader		km		#N/A	0	\$0
Compactor		each		#N/A	0	\$0
Light duty vehicles		km		#N/A	0	\$0
Other		km		#N/A	0	\$0
<b>DEMOBILIZE CAMP</b>						
Food and Freight		kg	27,600	Sabina	\$13.90	\$383,759
Freight		Lot	1	Sabina	\$579,346.09	\$579,346
Mobilization		tonnes	500	Sabina	\$1,738.04	\$869,019
<b>MOBILIZE &amp; DEMOBILIZE WORKERS</b>						
Crew travel time - inbound & outbound	16 manhours per rotation	manhours	6,864	lab-sh	\$61.02	\$418,866
Crew transportation - in& outbound from Yellowknife	28 day rotations - 12,000 man days - 2/3	each	286	Sabina	\$663.30	\$189,704
Crew transportation - in& outbound from south	28 day rotations - 12,000 man days - 1/3	each	143	Sabina	\$1,339.97	\$191,616
<b>WINTER ROAD</b>						
Construction and operation	Assumes construction and maintenance of 2-160 km winter ice roads; once during Active Closure and once in approximately Year 18.	km	320	WRCL	\$2,460.63	\$787,401
Limited winter use		km		#N/A	0	\$0
Winter road tariff		km		#N/A	0	\$0
					<b>Total</b>	<b>\$4,993,793</b>

Goose Gold Closure Component Estimating

															INFLATION		15.9%			
Code	Description	NOTES	EQUIPME T NUMBER	ESTIMATE SOURCE DOCUMENT	Qty	Unit of Measure	Unit Man hrs	Prod Fact	Labour			Const Equip Use		Other		Total				
									Total Man-hrs	Unit Cost	Total Cost	Unit Cost	Total Cost	Unit Cost	Total Cost	Unit Cost	Unit Cost (plus Inflation)	Total Cost	Total Cost (plus Inflation)	
<b>Open Pit Closure</b>																				
Place Boulder Fence																				
	Umwelt Open Pit	Updated for Modification Package		x	1,583	m	0.06	1.00	95	95	9,023	175.00	16,422		-	16	18.77	25,645	29,714	
	Echo open pit	Not in current mine plan: item remains to keep Stage in tact.		x	750	m	0.06	1.00	45	95	4,275	175.00	7,875		-	16	18.77	12,150	14,078	
	Goose open pit	Updated for Modification Package		x	2,340	m	0.06	1.00	140	95	13,338	175.00	24,570		-	16	18.77	37,908	43,924	
	Llama open pit	Updated for Modification Package: Perimeter only required where pit edge will not abut final flooded lake footprint. (i.e., 600 m total)		x	600	m	0.06	1.00	36	95	3,420	175.00	6,300		-	16	18.77	9,720	11,262	
<b>Remove Pump and Pipeline</b>																				
	Umwelt pit sump	Occurs during Operations		x	1,740	m	0.04	1.00	70	95	6,612	155.00	10,788		-	10.00	11.59	17,400	20,161	
	Llama pit sump	Occurs during Closure		x	2,850	m	0.04	1.00	114	95	10,830	155.00	17,670		-	10.00	11.59	28,500	33,023	
	Goose pit sump	Occurs during Operations		x	4,325	m	0.04	1.00	173	95	16,435	155.00	26,815		-	10.00	11.59	43,250	50,113	
	Echo pit sump	Updated for Supplementary Adjustments		x	2,820	m	0.04	1.00	113	95	10,716	155.00	17,484		-	10.00	11.59	28,200	32,675	
<b>Breach Pits into Receiving Waters</b>																				
	Umwelt open pit			x	1,200	m3	0.12	1.00	144		-	5.00	6,000		-	5.00	5.79	6,000	6,952	
	Llama open pit	Natural drainage connection		x	-	m3	0.12	1.00	-		-	5.00	-		-	-	-	-	-	
	Echo open pit	Natural drainage connection		x	-	m3	0.12	1.00	-		-	5.00	-		-	-	-	-	-	
	Goose open pit			x	600	m3	0.12	1.00	72		-	5.00	3,000		-	5.00	5.79	3,000	3,476	
	Landfill Mobile Equipment																			
	Goose Site Mobile Equipment			x	41	units	24.00	1.00	984	95	93,480	-	-		-	2,280	2,641.82	93,480	108,315	
<b>Underground Closure</b>																				
Saline Water Pond (SWP) / WTP																				
	Relocate pipeline to Umwelt UG from Llama UG	Not in current mine plan: cost remains to keep Stage in tact.		x	800	m	0.04	1.00	32	95	3,040	155.00	4,960		-	10.00	11.59	8,000	9,270	
	Dewater SWP to Umwelt UG	Accounts for Umwelt Underground (650 m), and Umwelt Underground Extension (650m to 900m)		x	1,071,225	m3	1.00	1.00	153	95	14,535	-	-	0.12	128,547	0.13	0.15	143,082	165,788	
	Decommission SWP to Umwelt UG pipeline	Accounts for Umwelt Underground (650 m), and Umwelt Underground Extension (650m to 900m)		x	1,662	m	0.04	1.00	66	95	6,316	155.00	10,304		-	10.00	11.59	16,620	19,257	
	Adjust pipeline to route to Llama UG	Not in current mine plan: cost remains to keep Stage in tact.		x	500	m	0.03	1.00	65	95	6,175	-	-	-	-	-	12.35	14.31	6,175	7,155
	Dewater SWP to Llama UG	Not in current mine plan: cost remains to keep Stage in tact.		x	324,234	m3	1.00	1.00	80	95	7,600	-	-	0.11	35,666	0.13	0.15	43,264	50,132	
	Adjust pipeline to route to Goose UG	Not in current mine plan: cost remains to keep Stage in tact.		x	4,500	m	0.04	1.00	230	95	21,850	155.00	35,650		-	-	-	57,500	66,255	
	Dewater SWP to Goose UG	Not in current mine plan: cost remains to keep Stage in tact.		x	391,630	m3	1.00	1.00	215	95	20,425	-	-	0.11	43,079	0.16	0.19	63,504	73,582	
	Decommission SWP to Goose UG pipelines	Not in current mine plan: cost remains to keep Stage in tact.		x	10,800	m	0.04	1.00	432	95	41,040	155.00	66,960		-	10.00	11.59	108,000	125,139	
	Breach SWP Diversion Berms and Containment Dams			x	430	m3	0.12	1.00	52		-	8.00	3,440		-	8.00	9.27	3,440	3,986	
	Decommission WTP-Goose Lake pipeline			x	1,140	m	0.04	1.00	46	95	4,332	155.00	7,068		-	10.00	11.59	11,400	13,209	
	Llama UG			x	2,700	m	0.04	1.00	108	95	10,260	155.00	16,740		-	10.00	11.59	27,000	31,285	
<b>Decommission pipeline</b>																				
	Umwelt portal			x	150	m3	0.05	1.00	8		-	6.00	900		-	6.00	6.95	900	1,043	
	Plug declines with waste rock			x	150	m3	0.05	1.00	8		-	6.00	900		-	6.00	6.95	900	1,043	
	Llama portal			x	150	m3	0.05	1.00	8		-	6.00	900		-	6.00	6.95	900	1,043	
	Plug declines with waste rock	Not in current mine plan: item remains to keep Stage in tact.		x	150	m3	0.05	1.00	8		-	6.00	900		-	6.00	6.95	900	1,043	
	Echo portal			x	150	m3	0.05	1.00	8		-	6.00	900		-	6.00	6.95	900	1,043	
	Plug declines with waste rock	Not in current mine plan: item remains to keep Stage in tact.		x	150	m3	0.05	1.00	8		-	6.00	900		-	6.00	6.95	900	1,043	
	Umwelt vent/circular backfill raises			x	1	LS	1.00	1.00	60		-	-	-		-	120.000	139.043	120.000	139.043	
	Plug vent raises with concrete plug			x	1	LS	1.00	1.00	60		-	-	-		-	50.000	57.935	50.000	57.935	
	Llama vent/circular backfill raises			x	1	LS	1.00	1.00	60		-	-	-		-	50.000	57.935	50.000	57.935	
	Plug vent raises with concrete plug	Not in current mine plan: item remains to keep Stage in tact.		x	1	LS	1.00	1.00	60		-	-	-		-	50.000	57.935	50.000	57.935	
	Echo vent/circular backfill raises			x	1	LS	1.00	1.00	60		-	-	-		-	50.000	57.935	50.000	57.935	
	Plug vent raises with concrete plug	Not in current mine plan: item remains to keep Stage in tact.		x	1	LS	1.00	1.00	60		-	-	-		-	50.000	57.935	50.000	57.935	
	Echo crown pillar			x	3,550	m3	0.05	1.00	178		-	6.00	21,300		-	6.00	6.95	21,300	24,680	
<b>Plug UG Staves</b>																				
<b>Waste Rock Stockpiles and Landfills</b>																				
	WR Pile Closure			x	1,200,000	m3	0.06	1.00	72,000		-	6.00	7,200,000		-	###	##	6.95	7,200,000	8,342,584
	Cap and Slope WR Piles	Updated Waste Rock Volume cover allotment.		x	25,000	m3	0.06	1.00	1,500		-	6.00	150,000		-	6.00	6.95	150,000	173,804	
	Landfill Closure			x	25,000	m3	0.06	1.00	1,500		-	6.00	150,000		-	6.00	6.95	150,000	173,804	
	Cap and Reslope Landfills			x	25,000	m3	0.06	1.00	1,500		-	6.00	150,000		-	6.00	6.95	150,000	173,804	
<b>Water Management Structures</b>																				
<b>Llama Structures</b>																				
	Breach Llama Lake Diversion Berms			x	665	m3	0.06	1.00	43		-	7.30	4,855		-	7.30	8.46	4,855	5,625	
	Breach Llama WRSA Diversion Berm			x	95	m3	0.06	1.00	6		-	7.30	694		-	7.30	8.46	694	804	
	Breach Llama WRSA Containment Dam			x	95	m3	0.06	1.00	6		-	7.30	694		-	7.30	8.46	694	804	
	Decommission Llama pump and pipeline			x	700	m	0.04	1.00	52	95	4,940	155.00	8,060		-	18.57	21.52	13,000	15,063	
<b>Umwelt Structures</b>																				
	Breach Primary Pond Containment Dam			x	200	m3	0.06	1.00	13		-	7.30	1,460		-	7.30	8.46	1,460	1,692	
	Breach Umwelt WRSA Containment Dam	Berm has been removed from water management design		x	-	m3	0.06	1.00	-		-	7.30	-		-	-	-	-	-	
	Breach Umwelt WRSA Diversion Berm	Berm has been removed from water management design		x	-	m3	0.06	1.00	-		-	7.30	-		-	-	-	-	-	
	Remove Saline Water Pond pump and pipeline			x	10,800	m	0.04	1.00	462	95	43,890	155.00	71,610		-	10.69	12.39	115,500	133,829	
	Remove Primary pond pump and pipeline	Occurs during Operations		x	7,250	m	0.04	1.00	320	95	30,400	155.00	49,600		-	11.03	12.79	80,000	92,695	
<b>Echo Structures</b>																				
	Breach Echo WRSA Containment Dam	Not in current mine plan: item remains to keep Stage in tact.		x	190	m3	0.06	1.00	12		-	7.30	1,387		-	7.30	8.46	1,387	1,607	
	Breach Echo Diversion Berm (East and West)	Not in current mine plan: item remains to keep Stage in tact.		x	190	m3	0.06	1.00	12		-	7.30	1,387		-	7.30	8.46	1,387	1,607	
	Breach Echo WRSA Diversion Berm	Not in current mine plan: item remains to keep Stage in tact.		x	95	m3	0.06	1.00	6		-	7.30	694		-	7.30	8.46	694	804	
	Breach East Echo Containment Dam	Not in current mine plan: item remains to keep Stage in tact.		x	95	m3	0.06	1.00	6		-	7.30	694		-	7.30	8.46	694	804	
	Remove Echo WRSA Pond pump and pipeline	Not in current mine plan: item remains to keep Stage in tact.		x	2,400	m	0.04	1.00	96	95	9,120	155.00	14,880		-	10.00	11.59	24,000	27,809	
	Remove Echo NW pond pump and pipeline	Not in current mine plan: item remains to keep Stage in tact.		x	220	m	0.04	1.00	21	95	1,976	155.00	3,224		-	23.64	27.39	5,200	6,025	
<b>Goose Structures</b>																				
	Breach Goose Main Diversion Berm			x	95	m3	1.00	1.00	95		-	7.30	694		-	7.30	8.46	694	804	
<b>TSF Structures</b>																				
	Breach TSF Dam			x	11,000	m3	0.05	1.00	550		-	7.30	80,300		-	7.30	8.46	80,300	93,043	
	Breach TSF WRSA Diversion Berm			x	285	m3	0.05	1.00	14		-	7.30	2,081		-	7.30	8.46	2,081	2,411	
<b>Ore Stockpile Structures</b>																				
	Remove pump and pipeline			x	4,550	m	0.04	1.00	182	95	17,290	155.00	28,210		-	10.00	11.59	45,500	52,720	
	Breach Plant Site Pond Containment Dam			x	215	m3	0.06	1.00	13		-	7.30	1,570		-	7.30	8.46	1,570	1,819	

Buildings and Equipment																				
Disassembly - Goose Plant and Crusher																				
Dismantle Plant																				
Dismantle Crushers			x	6,464	m2	1.00	1.00	3,200	95	304,000	100.00	106,667	-	-	63.53	73.61		410,667	475,836	
Dismantle Power Plant			x	1,630	m2	1.00	1.00	800	95	76,000	100.00	26,667	-	-	62.99	72.98		102,667	118,959	
Dismantle Emergency Power - Fuel			x	2,040	m2	1.00	1.00	1,000	95	95,000	100.00	33,333	-	-	62.91	72.89		128,333	148,699	
Dismantle Fuel Storage and Distribution			x	300	m2	1.00	1.00	150	95	14,250	100.00	5,000	-	-	64.17	74.35		19,250	22,305	
Goose Admin Buildings			x	1	Lot	1.00	1.00	1,200	95	114,000	100.00	40,000	-	-	154,000	178,439		154,000	178,439	
Demolish Truck Shop/Office			x	2,349	m2	1.00	1.00	1,000	95	95,000	100.00	33,333	-	-	54.62	63.29		128,333	148,699	
Demolish Kitchen/Camp			x	1,980	m2	1.00	1.00	900	95	85,500	100.00	30,000	-	-	58.33	67.59		115,500	133,829	
Demolish Cold Storage			x	840	m2	1.00	1.00	150	95	14,250	100.00	5,000	-	-	22.92	26.55		19,250	22,305	
Demolish Waste/Waste Oil Storage			x	1	Lot	1.00	1.00	100	-	-	100.00	3,333	40,000	40,000	43,333	50,210		43,333	50,210	
Remove Freight Storage			x	1	Lot	1.00	1.00	150	95	14,250	100.00	5,000	-	-	19,250	22,305		19,250	22,305	
Demolish Water Treatment Plant			x	647	m2	1.00	1.00	100	95	9,500	100.00	3,333	-	-	19,84	22,98		12,833	14,870	
Demolish Sewage Treatment Plant			x	1	Lot	1.00	1.00	90	95	8,550	100.00	3,000	-	-	11,550	13,383		11,550	13,383	
MLA Infrastructure																				
Demolish Port Office			x	5	Units	12.00	1.00	60	95	5,700	100.00	6,000	-	-	2,340	2,711		11,700	13,557	
Remove Pipelines			x	10,000	m	0.04	1.00	400	95	38,000	155.00	62,000	-	-	10.00	11.59		100,000	115,869	
Demolish Incinerator and Waste Management			x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297		9,750	11,297	
Demolish Warehouses			x	1	Lot	1.00	1.00	30	95	2,850	100.00	3,000	-	-	5,850	6,778		5,850	6,778	
Dismantle Genset			x	1	Lot	1.00	1.00	150	95	14,250	100.00	15,000	-	-	29,250	33,892		29,250	33,892	
Demolish Maintenance Shop			x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297		9,750	11,297	
Demolish Water Storage			x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297		9,750	11,297	
Demolish WTP/STP			x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297		9,750	11,297	
Demolish camp/offices			x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297		9,750	11,297	
Demolish freight storage area			x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297		9,750	11,297	
Demolish hazardous waste Area			x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297		9,750	11,297	
Dismantle Fuel Storage	Includes MLA Fuel Storage area (60ML), and MLA Fuel Transfer Storage Area (0.5 ML)		x	1	Lot	1.00	1.00	1,728	95	164,160	100.00	57,600	-	-	221,760	256,952		221,760	256,952	
Goose Closure Camp																				
Build 20 Person Camp			x	1	Lot	1.00	1.00	150	95	14,250	100.00	5,000	-	-	19,250	22,305		19,250	22,305	
Build 20 Person Power Plant			x	1	Lot	1.00	1.00	150	95	14,250	100.00	5,000	-	-	19,250	22,305		19,250	22,305	
Camp Operation	Over 13 years of Closure and Post-Closure		x	12,000	Man Days	1.00	1.00	-	-	-	-	-	110	1,320,000	110	127		1,320,000	1,529,474	
Roads and Airstrips																				
Main Haul road																				
Maintain Road Surface			x	13	Yr	70.00	1.00	910	95	86,450	100.00	91,000	-	-	13,650	15,816		177,450	205,610	
Restore Drainage	Remove Culverts		x	1,488	m3	0.06	1.00	89	-	-	11.00	16,368	-	-	11.00	12.75		16,368	18,965	
Airstrips																				
Maintain Airstrip Surface			x	13	Yr	20.00	1.00	260	95	24,700	100.00	26,000	-	-	3,900	4,519		50,700	58,746	
Restore Drainage	Updated for Modification Package		x	1,360	m3	0.06	1.00	82	-	-	12.00	16,320	-	-	12.00	13.90		16,320	18,910	
Water Treatment																				
WTP Pipelines and Treatment Plant																				
Pump water from TSF to WTP	No treatment required during Closure; Maximum PAG Exposure in Year 2. Potential Water Treatment in this year at TSF with 2.1 Mm3 over 3 years.		x	2,100,000	m3		1.00	-	-	-	-	-	0	231,000	0.11	0.13		231,000	267,658	
Treat water from TSF in WTP			x	2,100,000	m3		1.00	1,916	-	-	-	-	0	735,000	0.35	0.41		735,000	851,639	
Pump water out of WTP			x	2,100,000	m3		1.00	-	-	-	-	-	0	231,000	0.11	0.13		231,000	267,658	
Decommission WTP pump and pipeline			x	6,700	m	0.04	1.00	292	95	27,740	155.00	45,260	-	-	10,90	12.63		73,000	84,585	
Decommission WTP pump and return pipeline			x	820	m	0.04	1.00	57	95	5,396	155.00	8,804	-	-	17,32	20.07		14,200	16,453	
Decommission WTP			x	1	Lot		1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297		9,750	11,297	
Contaminated Soil																				
Site-wide Investigation																				
Site Investigation to estimate quantity of contaminated soil	Testpit program with excavator in all parking, fuel storage, washbays truck and maintenance shops and generator areas.		x	1	Lot	1.00	1.00	-	-	-	-	-	50,000	50,000	57,935		50,000	57,935		
Treatment																				
Transport contaminated soil			x	10,000	m3	0.05	1.00	500	-	-	7.30	73,000	-	-	7.30	8.46		73,000	84,585	
Separation plant	Purchase separation equipment		x	1	Lot	1.00	1.00	-	-	-	-	-	100,000	100,000	115,869		100,000	115,869		
Closure / Post-Closure Monitoring																				
Geotechnical Inspections																				
TSF embankments			x	8	Units	20.00	1.00	160	-	-	-	-	10,000	80,000	10,000	11,587		80,000	92,695	
WR piles			x	13	Units	20.00	1.00	260	-	-	-	-	8,300	107,900	8,300	9,617		107,900	125,023	
Pit walls			x	13	Units	20.00	1.00	260	-	-	-	-	4,000	52,000	4,000	4,635		52,000	60,252	
Ground Temperature Monitoring																				
Umwelt WRSA GTC Monitoring after Closure	Monthly		x	13	Years	24.00	1.00	312	200	62,400	-	-	-	-	4,800	5,562		62,400	72,302	
Llama WRSA GTC Monitoring after Closure	Monthly		x	13	Years	24.00	1.00	312	200	62,400	-	-	-	-	4,800	5,562		62,400	72,302	
TSF WRSA GTC Monitoring after Closure	Monthly		x	13	Years	24.00	1.00	312	200	62,400	-	-	-	-	4,800	5,562		62,400	72,302	
WQ Monitoring - Closure																				
Llama pit	Depends on Breach		x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321		14,820	17,172	
Llama WR Pile			x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321		14,820	17,172	
Umwelt pit	Depends on Breach		x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321		14,820	17,172	
Umwelt WR Pile			x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321		14,820	17,172	
Echo pit	Depends on Breach		x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321		14,820	17,172	
Echo WR pile			x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321		14,820	17,172	
Goose pit	Depends on Breach		x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321		14,820	17,172	
TSF WR Pile			x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321		14,820	17,172	
Aquatic Effects monitoring																				
Aquatic effects monitoring	Non-contact Water Basins		x	10	Years	60.00	1.00	600	80	48,000	-	-	-	-	4,800	5,562		48,000	55,617	
Terrestrial Animal Monitoring																				
Terrestrial Animal Monitoring			x	10	Years	300.00	1.00	3,000	80	240,000	-	-	-	-	24,000	27,809		240,000	278,086	
Total Direct Costs																				
CONSTRUCTION INDIRECTS																				
Freight & Transport																				
Food & Freight	Total Mandays factored		x	27,600	kg		1.00	-	-	-	-	-	12	331,200	12	13.90		331,200	383,759	
Freight	Rental equip, offices, etc..		x	1	Lot	-	1.00	-	-	-	-	-	500,000	500,000	500,000	579,346		500,000	579,346	
Mobilization			x	500	Tonnes			-	-	-	-	-	1,500	750,000	1,500	1,738		750,000	869,019	
General Construction Indirects																				
Site Services Labour			x	16,000	HRS	1.00	1.00	16,000	65	1,040,000	-	-	-	-	65,000	75.31		1,040,000	1,205,040	
Accommodations & Travel																				
Camp Accommodations/Operation			x	12,000	Man Days	1.00	1.00	-	-	-	-	-</								

Unit Cost Table (for refining unit costs see "Estimator" worksheet)

Filter by unit

Inflation 2020 to 2026:	10.6%
Inflation 2017 to 2026:	15.9%
Inflation 2014 to 2026:	23.0%

ITEM	Detail	COST CODE	UNITS	LOW \$	HIGH \$	SPECIFIED \$	COMMENTS
<b>Accommodation</b>							
		ACCM	manday	123.03	215.30	-	
<b>Buildings - Decontaminate</b>							
	Asbestos	BDA	m2	31.50	62.99	-	Low: removal of asbestos siding & flooring; High: removal of insulated pipes, friable asbestos
<b>Buildings - Remove</b>							
	Wood	BRW	m2	33.83	50.44	-	
	Concrete	BRC	m2	49.21	79.97	7.38	Specified: puncture concrete foundation slabs
	Steel - teardown	BRS1	m2	55.36	79.97	-	
	Steel - for salvage	BRS2	m2	82.43	123.03	-	
<b>Concrete work</b>							
	Small pour	CSF	m3	524.73	787.09	-	Low: YK; High=1.5xLow
	Large pour	CLF	m3	434.92	652.37	2,620.57	Specified: concrete crown pillar
<b>Contaminated Soils</b>							
	ESA Phase 1	CS1	each	9,227.35	-	-	Low: small, "clean" site
	ESA Phase 1	CS2	each	61,515.66	-	-	Low: small, "clean" site
	Remediate on site	CSR	m3	57.82	179.63	-	
<b>Dozing</b>							
	doze rock piles	DR	m3	1.29	2.95	-	Low cost: doze crest off dump
	doze overburden/soil piles	DS	m3	1.17	4.68	-	High cost: push up to 300 m
<b>Excavate Rock; Low Spec's and QA/QC</b>							
	drill/blast/load/short haul	RB1	m3	14.03	20.98	-	Low:quarry operations for bulk fill
	drill/blast/load/long haul	RB2	m3	14.83	21.90	-	
	RB1 + spread and compact	RB3	m3	14.83	21.90	-	
	RB2 + spread and compact	RB4	m3	15.38	37.83	-	
	Specified activity	RBS	m3	-	-	8.11	
<b>Excavate Rock; High Spec's and QA/QC</b>							
	drill/blast/load/short haul	RC1	m3	14.83	21.90	-	(e.g. ditch/spillway excavation)
	drill/blast/load/long haul	RC2	m3	15.62	22.64	-	Low:foundation excavation;High:spillway excavation
	RC1 + spread and compact	RC3	m3	15.62	22.64	-	e.g. cover construction
	RC2 + spread and compact	RC4	m3	16.61	23.62	-	e.g. cover construction
	Specified activity	RCS	m3	-	-	215.30	Specified-drift excavation
<b>Excavate Rip Rap</b>							
	drill/blast/load/short haul/place	RR1	m3	16.61	21.84	-	High: quarry & place rip rap in channel
	drill/blast/load/long haul/place	RR2	m3	17.47	25.41	-	
	source is waste dump/short haul	RR3	m3	8.61	-	-	cost includes sorting
	source is waste dump/long haul	RR4	m3	9.35	-	-	
	Specified activity	RRS	m3	-	-	-	
<b>Excavate Soil; Low Spec's and QA/QC</b>							
	clear & grub	SBC	m2	4.18	6.15	-	
	excavate/load/short haul	SB1	m3	5.29	7.26	-	
	excavate/load/long haul	SB2	m3	5.66	8.98	-	
	SB1 + spread and compact	SB3	m3	6.27	10.95	-	Low: non-engineered; High:engineered
	SB2 + spread and compact	SB4	m3	6.77	13.53	-	Low: non-engineered; High:engineered
	Specified activity	SBS	m3	3.94	7.75	-	Low: rehandle waste rock dump by dozing; High:rehandle waste rock by hauling
	Tailings	SBT	m3	1.66	4.55	19.07	High:contour surface - wet or frozen; Specified:haul/place wet infill
<b>Excavate Soil, High Spec's and QA/QC</b>							
	excavate/load/short haul	SC1	m3	8.37	11.44	-	
	excavate/load/long haul	SC2	m3	8.74	14.46	-	
	SC1 + spread and compact	SC3	m3	10.95	17.47	-	Low: non-engineered; High:engineered
	SC2 + spread and compact	SC4	m3	11.44	28.54	-	Low: non-engineered; High:engineered (e.g. complex covers, low volume dam construction)
	Specified activity	SCS	m3	-	-	23.13	Backfill adit with waste rock
<b>Fence</b>							
		FNC	m	16.67	249.75	-	
<b>Fuel and Electricity</b>							
	Fuel cost - gas	FCG	litre	1.29	1.72	-	
	Fuel cost - diesel	FCD	litre	1.22	1.71	-	
	Fuel mobilization	FCM	litre	0.27	0.52	-	High: winter road usage
	Electricity	FCE	kW-h	0.21	0.23	0.60	Low and High:Yellowknife; Specified:diesel generator
<b>Geo-Synthetics</b>							
	geotextile	GST	m2	4.23	-	-	Supply and install
	geogrid	GSG	m2	7.07	-	-	
	liner, HDPE	GSHDPE	m2	9.78	-	-	Supply and install; large quantity
	liner, ES3	GSES3	m2	24.85	-	-	FOB Yellowknife
	geosynthetic installation	GSI	m2	3.89	17.22	-	Low:geotextile; High:ES3 or HDPE
	bentonite soil ammendment	GSBA	tonne	379.31	428.76	-	FOB Edmonton, add shipping & mixing
<b>Grouting (/m3 of rock grouted)</b>							
		grout	m3	291.03	352.79	-	High: cement, FOB Yellowknife
<b>Labour &amp; Equipment Rates</b>							
	Site manager	sman	\$/hr	153.79	187.01	-	
	Supervisor	super	\$/hr	63.98	112.99	-	
	Registered engineer	eng	\$/hr	116.88	270.67	-	
	Environmental coordinator	envco	\$/hr	91.24	159.94	-	
	Environmental technologist	envtech	\$/hr	44.29	-	-	
	Electrician	elec	\$/hr	91.04	116.88	-	
	Journeyman - various	journey	\$/hr	54.13	88.32	-	
	Labour - skilled	lab-s	\$/hr	50.44	61.02	-	
	Labour - unskilled	lab-us	\$/hr	38.14	54.11	-	
	Equipment operator	oper	\$/hr	50.44	79.97	-	
	Heavy duty mechanic	mech	\$/hr	60.29	89.63	-	
	Water treatment plant operator	oper-wt	\$/hr	50.44	73.65	-	
	Security / first aid	safety	\$/hr	44.29	82.39	-	
	Administrative staff	admin	\$/hr	46.75	71.22	-	

**Unit Cost Table (for refining unit costs see "Estimator" worksheet)**

Filter by unit

Inflation 2020 to 2026:	10.6%
Inflation 2017 to 2026:	15.9%
Inflation 2014 to 2026:	23.0%

ITEM	Detail	COST CODE	UNITS	LOW \$	HIGH \$	SPECIFIED \$	COMMENTS
Equipment rates include operator and fuel							
	Loader - 4 cu.yd (3.06m3)	load-s	\$/hr	215.30	-	-	
	Loader - 7 cu.yd (5.35m3)	load-l	\$/hr	387.55	-	-	
	Excavator - 26.76-30.84 tonnes	exc-s	\$/hr	233.76	-	-	
	Excavator - 68.95+tonnes	exc-l	\$/hr	516.73	-	-	
	Grader	grad	\$/hr	233.76	-	-	
	Dump truck off hwy 30-50 tonnes	truck-s	\$/hr	276.82	-	-	
	Dump truck off hwy 55-75 tonnes	truck-l	\$/hr	369.09	-	-	
	dozer, small	dozer-s	\$/hr	252.21	319.88	-	
	dozer, large	dozerl	\$/hr	602.85	695.13	-	
	smooth drum compactor	comp	\$/hr	190.70	-	-	
	scooptram, 6 yd3 bucket	scoop	\$/hr	209.15	-	-	
	flat bed truck with hiab	hiab	\$/hr	190.70	-	-	
	fuel truck	ftruck	\$/hr	184.55	-	-	
	water truck	wtruck	\$/hr	71.36	184.55	-	
<b>Mobilize Heavy Equipment</b>							
	Road access	MHER	kmtonne	4.18	12.61	-	
	Air access	MHEA	kmtonne	14.76	-	-	cargo rate>500lb
<b>Mobilize Camp</b>							
	Road access	MCR	each	61,515.66	-	-	refurbish existing camp
<b>Mobilize Workers</b>							
	flight	MW	each	5,536.41	11,195.85	-	Low:e.g. 8 passenger; High: Dash 7
<b>Oil Removal</b>							
	oil removal	OR	litre	0.53	1.48	-	Low:waste oil heater; High: ship offsite
<b>PCB Removal</b>							
	Remove from site	PCBR	litre	49.46	57.70	-	Low: shipping, handling & disposal from Yellowknife
<b>Pipes, small (&lt;6in dia.)</b>							
	remove/dispose on site	PSR	m	1.23	29.53	-	Low: remove/dispose on site; High: remove/re-use
	supply	PSS	m	7.50	13.66	-	Low:supply; High:supply and ship
	install	PSI	m	30.76	-	-	
<b>Pipes, large (&gt;6in dia.)</b>							
	remove/dispose on site	PLR	m	27.07	88.58	-	Low: remove/dispose on site; High: remove/re-use
	supply	PLS	m	158.71	175.93	-	Low:supply; High:supply and ship
	install	PLI	m	61.52	-	-	
<b>Power Lines</b>							
	remove/dispose on site	POWR	m	31.37	-	-	
<b>Process Chemicals</b>							
	Remove from site	PCR	kg	0.55	3.08	-	Low: shipping, handling & disposal from Yellowknife
<b>Pumps</b>							
	Pump capital cost	PC	each	239,911.09	-	-	
	Pump shipping	PS	each	3,075.78	-	-	
	Pump operating cost	POC	m3	0.15	-	-	pump operating costs should be calculated based on pump capacity, fuel costs, etc.
	Pump maintenance	PM	allow	30,757.83	-	-	
<b>Pump sand BackFill</b>							
		PBF	m3	104.58	369.09	-	
<b>Scarify - road/mine site</b>							
		SCFY	ha	5,290.35	7,418.79	2,645.17	
<b>Shaft, Raise &amp; Portal Closures</b>							
	Shaft & Raises	SR	m2	793.55	2,623.03	-	Low:pre-cast concrete slabs, little site prep. Area=shaft+>1m all around
	Portals	POR	m3	23.13	307.58	1,476.38	Low:unit cost code SCS;High:excavate & backfill collapsed portal;Spec: installed pressure plug
<b>Site Inspection Report</b>							
		RPT	each	12,303.13	24,606.27	-	
<b>SpillWay - Clear</b>							
		SW	each	3,690.94	8,612.19	-	
<b>Survey/Instrumentation</b>							
		SI	each	2,214.56	4,429.13	-	2 person crew
<b>Treatment Plant - Construct</b>							
	Small (< 1000 m3/d)	TPS	lump sum	11,072,819.64	18,454,699.41	-	
	Large (> 1000 m3/d)	TPL	lump sum	18,454,699.41	56,594,411.52	-	
	Constructed Wetland	CWTS	ha	246,062.66	369,093.99	-	
<b>Treatment Plant - Operate</b>							
		TPO	m3	0.43	2.46	-	
<b>Treatment Chemicals</b>							
	ferric sulphate	ferric	kg	1.46	-	-	
	ferrous sulphate	ferrous	kg	1.62	-	-	
	lime	lime	kg	0.69	-	-	
	hydrogen peroxide, 35%	hperox	kg	1.85	-	-	
	Sodium Metabisulfate	Nametab	kg	1.45	-	-	
	Caustic soda, 50%	caustic	kg	0.91	-	-	
	Sulfuric acid, 93%	sulfuric	kg	0.38	-	-	
	flocculant	flocc	kg	7.38	-	-	
	copper sulphate	copper	kg	-	-	-	
	shipping	shipping	kg	0.25	-	-	
<b>Vegetation</b>							
	Hydroseed, Flat	VHF	ha	4,921.25	-	-	
	Hydroseed, Sloped	VHS	ha	5,536.41	-	-	
	Veg. blanket/erosion mat	VB	ha	15,994.07	-	-	
	Tree planting	VT	ha	3,198.81	7,381.88	-	
	Wetland species	VW	ha	-	-	58.71	Specified= /m3, Wetland Growth Media Substrate mixed and installed (sand, biochar and fertilizer, woodchips)
<b>Water Sampling/Analysis/Reporting</b>							
		WS	each	8,612.19	12,303.13	-	
<b>Winter Road</b>							
	Construction	WRC	km	2,460.63	14,148.60	-	
	Usage	WRU	kmtonne	0.36	-	-	

**Unit Cost Table (for refining unit costs see "Estimator" worksheet)**

Filter by unit

Inflation 2020 to 2026:	10.6%
Inflation 2017 to 2026:	15.9%
Inflation 2014 to 2026:	23.0%

ITEM	Detail	COST CODE	UNITS	LOW \$	HIGH \$	SPECIFIED \$	COMMENTS
<b>Sabina Specific Costs</b>							
<i>OP Tab</i>	Signs		each	86.90			
<i>OP Tab</i>	Block roads		allow	5,793.46			
<i>OP Tab</i>	Conduct stability and setback study		allow	19,697.77			
<i>UG Tab</i>	Remove misc. haz. mat & explosives		kg	57.93			
<i>UG Tab</i>	Assess underground stability		each	11,586.92			
<i>Bldgs &amp; Equip Tab</i>	Decontaminate and dispose on-site		allow	23,173.84			
	Remove Buildings - WIR						
<i>Bldgs &amp; Equip Tab</i>	Service/Emergency Camps, total of 3 1-ha area for 3 camps; assume all structures will be soruno structures.		LS	82,933.79			Added during 2020 Mod Package.
<i>Chemicals Tab</i>	Contam. soil investigation - Phase 1		allow	8,690.19			
<i>Chemicals Tab</i>	Operate landfarm		allow	57,934.61			
<i>WM Tab</i>	Remove Liner from all berms		m2	0.81			
<i>WM Tab</i>	Decommission reclaim barge from Llana TF		LS	11,586.92			
<i>WT Tab</i>	Treat water in WTP		m3	0.75			
<i>ICM Tab</i>	misc. supplies		allow	23,173.84			
<i>PostClosure Tab</i>	Regulatory costs		year	28,967.30			
<i>PostClosure Tab</i>	General Water Sampling and Stability Monitoring		year	46,347.69			

**SUMMARY OF COSTS**

CAPITAL COSTS	COMPONENT NAME	COST	LAND LIABILITY	TOTAL LIABILITY
OPEN PIT	Umwelt	\$60,120	\$0	\$60,120
	Llama	\$66,016	\$0	\$66,016
	Echo (to Project Year 4)	\$19,698	\$0	\$19,698
	Goose Main	\$102,334	\$0	\$102,334
QUARRY (under OPEN PIT TAB estimate)	Airstrip Quarry	\$4,675	\$0	\$4,675
UNDERGROUND MINE	Umwelt	\$444,319	\$0	\$444,319
	Llama	\$124,879	\$0	\$124,879
	Goose Main	\$334,323	\$0	\$334,323
	Echo	\$116,121	\$0	\$116,121
TAILINGS FACILITIES	TSF	\$0	\$0	\$0
ROCK PILE	Umwelt, Llama, Goose Main, and Echo	\$12,770,177	\$0	\$12,770,177
BUILDINGS AND EQUIPMENT		\$2,952,160	\$0	\$2,952,160
CHEMICALS AND CONTAMINATED SOIL MANAGEMEN		\$1,659,101	\$0	\$1,659,101
SURFACE AND GROUNDWATER MANAGEMENT		\$3,624,753	-	\$3,624,753
INTERIM CARE AND MAINTENANCE		\$1,160,490	-	\$1,160,490
<b>SUBTOTAL: Capital Costs</b>		<b>\$23,439,166</b>	<b>\$0</b>	<b>\$23,439,166</b>
<b>PERCENT OF SUBTOTAL</b>			<b>0%</b>	<b>100%</b>
<b>INDIRECT COSTS</b>		<b>COST</b>	<b>LAND LIABILITY</b>	<b>TOTAL LIABILITY</b>
MOBILIZATION/DEMobilIZATION		\$4,993,793	\$0	\$4,993,793
POST-CLOSURE MONITORING AND MAINTENANCE		\$2,253,539	\$0	\$2,253,539
ENGINEERING	10%	\$2,343,917	\$0	\$2,343,917
PROJECT MANAGEMENT	5%	\$1,171,958	\$0	\$1,171,958
HEALTH AND SAFETY PLANS/MONITORING & QA/QC	1%	\$234,392	\$0	\$234,392
BONDING/INSURANCE	1%	\$234,392	\$0	\$234,392
CONTINGENCY	20%	\$4,687,833	\$0	\$4,687,833
MARKET PRICE FACTOR ADJUSTMENT	0%	\$0	\$0	\$0
<b>SUBTOTAL: Indirect Costs</b>		<b>\$15,919,824</b>	<b>\$0</b>	<b>\$15,919,824</b>
<b>TOTAL COSTS</b>		<b>\$39,358,990</b>	<b>\$0</b>	<b>\$39,358,990</b>

ALL STAGES (%)

**SUMMARY OF PAYMENT STAGES**

Approximate Timing											
Y-2	Y-1	Y-1	NA	NA	Y2Q4	Y5Q1	Y-1	Y6Q2	Y10Q2	Y10Q3	Y1
Initial Infrastructure	Umwelt UG	Umwelt OP	TSF - Dam Construction	TSF - Tailings Deposition & Use	Llama OP	Goose Main OP	Echo OP (to Year 4 Only)	Llama UG	Goose Main UG	Echo UG	Mill Start up Long Term Water Treatment (LTWT)
		\$60,120			\$66,016		\$19,698				
\$4,675	\$444,319					\$102,334			\$124,879	\$334,323	\$116,121
		\$0	\$0	\$0	\$3,192,544	\$9,577,633					
\$2,784,984	\$0	\$8,955	\$0	\$0	\$0	\$135,047	\$23,174	\$0	\$0	\$0	\$0
\$696,665	\$116,844	\$116,844	\$0	\$0	\$116,844	\$144,526	\$116,844	\$116,844	\$116,844	\$116,844	\$0
\$161,376	\$34,454	\$29,383	\$0	\$0	\$18,619	\$101,402	\$2,411	\$49,517	\$47,663	\$34,454	\$3,145,275
\$580,245		\$116,049			\$116,049	\$232,098	\$116,049				
<b>\$4,227,945</b>	<b>\$595,617</b>	<b>\$331,352</b>	<b>\$0</b>	<b>\$0</b>	<b>\$3,510,272</b>	<b>\$10,293,040</b>	<b>\$278,176</b>	<b>\$291,240</b>	<b>\$498,830</b>	<b>\$267,419</b>	<b>\$3,145,275</b>
18.0%	2.5%	1.4%	0.0%	0.0%	15.0%	43.9%	1.2%	1.2%	2.1%	1.1%	13.4%
20.8%	2.9%	1.6%	0.0%	0.0%	17.3%	50.7%	1.4%	1.4%	2.5%	1.3%	
\$1,040,386	\$146,566	\$81,537	\$0	\$0	\$863,786	\$2,532,847	\$68,452	\$71,666	\$122,749	\$65,805	\$0
\$469,493	\$66,140	\$36,795	\$0	\$0	\$389,799	\$1,142,992	\$30,890	\$32,341	\$55,393	\$29,696	\$0
\$422,795	\$59,562	\$33,135	\$0	\$0	\$351,027	\$1,029,304	\$27,818	\$29,124	\$49,883	\$26,742	\$314,528
\$211,397	\$29,781	\$16,568	\$0	\$0	\$175,514	\$514,652	\$13,909	\$14,562	\$24,942	\$13,371	\$157,264
\$42,279	\$5,956	\$3,314	\$0	\$0	\$35,103	\$102,930	\$2,782	\$2,912	\$4,988	\$2,674	\$31,453
\$42,279	\$5,956	\$3,314	\$0	\$0	\$35,103	\$102,930	\$2,782	\$2,912	\$4,988	\$2,674	\$31,453
\$845,589	\$119,123	\$66,270	\$0	\$0	\$702,054	\$2,058,608	\$55,635	\$58,248	\$99,766	\$53,484	\$629,055
\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>\$3,074,219</b>	<b>\$433,084</b>	<b>\$240,932</b>	<b>\$0</b>	<b>\$0</b>	<b>\$2,552,385</b>	<b>\$7,484,264</b>	<b>\$202,267</b>	<b>\$211,766</b>	<b>\$362,709</b>	<b>\$194,446</b>	<b>\$1,163,752</b>
<b>\$7,302,164</b>	<b>\$1,028,702</b>	<b>\$572,283</b>	<b>\$0</b>	<b>\$0</b>	<b>\$6,062,658</b>	<b>\$17,777,304</b>	<b>\$480,442</b>	<b>\$503,006</b>	<b>\$861,539</b>	<b>\$461,865</b>	<b>\$4,309,027</b>

**CURRENT REQUIREMENT**  
\$19,755,276 (June 2026)

5		Open Pit Name:	Umwelt	Pit #		1
ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>CONTROL ACCESS</b>						
Fence		m		#N/A	\$0.00	\$0
Signs	Assumed	each	4	Sabina	\$86.90	\$348
Berm at crest	Estimated for continuous berm with 1m diameter boulders, no spacing between boulders - 0.52 m <sup>3</sup> /m - assumed 50 % done during Operations	m <sup>3</sup>	433	RR1H	\$21.84	\$9,447
Block roads	Temporary gate installation to allow water monitoring. It includes decommissioning of gate when no longer required. Exposed area after gate has been decommissioned will be blocked with boulders (exposed area along with block of roads with boulders included in berm cost above)	allow	1	Sabina	\$5,793.46	\$5,793
Other				#N/A	\$0.00	\$0
<b>STABILITY STUDY</b>						
Conduct stability and setback study		allow	1	Sabina	\$19,697.77	\$19,698
<b>STABILIZE SLOPES</b>						
Off-load crest, soil A		m <sup>3</sup>		#N/A	\$0.00	\$0
Off-load crest, soil B		m <sup>3</sup>		#N/A	\$0.00	\$0
Doze/trim overburden at crest		m <sup>3</sup>		#N/A	\$0.00	\$0
Drill & blast pit crest		m <sup>3</sup>		#N/A	\$0.00	\$0
Buttress slope		m <sup>3</sup>		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>COVER/CONTOUR SLOPES</b>						
Place fill, soil A		m <sup>3</sup>		#N/A	\$0.00	\$0
Place fill, soil B		m <sup>3</sup>		#N/A	\$0.00	\$0
Rip rap		m <sup>3</sup>		#N/A	\$0.00	\$0
Vegetate slopes		ha		#N/A	\$0.00	\$0
Vegetate pit floor		ha		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>CONSTRUCT DIVERSION DITCHES</b>						
Excavate ditches -soil		m <sup>3</sup>		#N/A	\$0.00	\$0
Excavate ditches -rock		m <sup>3</sup>		#N/A	\$0.00	\$0
Rip rap in channel base		m <sup>3</sup>		#N/A	\$0.00	\$0
<b>CONSTRUCT SPILLWAY</b>						
Excavate channel	200 m long, 6 m wide and 1 m deep	m <sup>3</sup>	1,200	SB1L	\$5.29	\$6,348
Concrete		m <sup>3</sup>		#N/A	\$0.00	\$0
Rip rap		m <sup>3</sup>	400	RR1H	\$21.84	\$8,735
Other	Geotextile	m <sup>2</sup>	2,304	GSTL	\$4.23	\$9,751
<b>RECLAIM QUARRIES</b>						
Contour slopes		m <sup>3</sup>		#N/A	\$0.00	\$0
Place overburden		m <sup>3</sup>		#N/A	\$0.00	\$0
Vegetate		m <sup>3</sup>		#N/A	\$0.00	\$0
<b>FLOOD PIT-Capital</b>						
Remove stationary equipment (sump pumps) and Pipeline	Umwelt TF will be used to store tailings in Years 4 to 11; it will be passively flooded with site runoff and direct precipitation throughout the end of Operations and into the Closure Phase. Recirculation treatment is planned following use as a TF.	m		#N/A	\$0.00	\$0
Remove dewatering pipeline		m		#N/A	\$0.00	\$0
Remove power lines		each		#N/A	\$0.00	\$0
Construct diversion ditches		m <sup>3</sup>		#N/A	\$0.00	\$0
-Ditch, mat'l A		m <sup>3</sup>		#N/A	\$0.00	\$0
-Ditch, mat'l B		m <sup>3</sup>		#N/A	\$0.00	\$0
Construct embankment/dam		m <sup>3</sup>		#N/A	\$0.00	\$0
Supply/install pump station		each		#N/A	\$0.00	\$0
Supply/install piping system		m		#N/A	\$0.00	\$0
Remove pump post-closure		each		#N/A	\$0.00	\$0
Remove pipeline post-closure		m		#N/A	\$0.00	\$0
<b>FLOOD PIT-Annual Cost</b>						
Operate pumps (power)		m <sup>3</sup>		#N/A	\$0.00	\$0
Maintain pump/pipeline		allow		#N/A	\$0.00	\$0
Labour: fuel management, commissioning/decom		\$/h		#N/A	\$0.00	\$0
Chemical addition, _____ kg/m <sup>3</sup> of water		tonne		#N/A	\$0.00	\$0
Chemicals, purchase and shipping		tonne		#N/A	\$0.00	\$0
Passive/biological additives		\$/ha		#N/A	\$0.00	\$0
Passive additives purchase and shipping		tonne		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
Annual pumping costs						
Number of years of pump flooding	passive pit flooding	years	0			
					Total pumping costs	\$0
					<b>Total</b>	\$60,120
					<b>% of Total</b>	100%

Open Pit Name:		Llama	Pit #		2	2	
ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	Total Cost
<b>CONTROL ACCESS</b>							
Fence		m		#N/A	\$0.00	\$0	\$0
Signs	Assumed	each	4	Sabina	\$86.90	\$348	\$348
Berm at crest	Estimated for berm with 1m diameter boulders, no spacing between boulders - 0.52 m3/m; berm needed only where pit edge will not abut the final flooded lake footprint.	m3	327.6	RR1H	\$21.84	\$7,154	\$7,154
Block roads	Temporary gate installation to allow water monitoring. It includes decommissioning of gate when no longer required. Exposed area after gate has been decommissioned will be blocked with boulders (exposed area along with block of roads with boulders included in berm cost above)	allow	1	Sabina	\$5,793.46	\$5,793	\$5,793
Other				#N/A	\$0.00	\$0	\$0
<b>STABILITY STUDY</b>							
Conduct stability and setback study		allow	1	Sabina	\$19,697.77	\$19,698	\$19,698
<b>STABILIZE SLOPES</b>							
Off-load crest, soil A		m3		#N/A	\$0.00	\$0	\$0
Off-load crest, soil B		m3		#N/A	\$0.00	\$0	\$0
Doze/trim overburden at crest		m3		#N/A	\$0.00	\$0	\$0
Drill & blast pit crest		m3		#N/A	\$0.00	\$0	\$0
Buttress slope		m3		#N/A	\$0.00	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0
<b>COVER/CONTOUR SLOPES</b>							
Place fill, soil A		m3		#N/A	\$0.00	\$0	\$0
Place fill, soil B		m3		#N/A	\$0.00	\$0	\$0
Rip rap		m3		#N/A	\$0.00	\$0	\$0
Vegetate slopes		ha		#N/A	\$0.00	\$0	\$0
Vegetate pit floor		ha		#N/A	\$0.00	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0
<b>CONSTRUCT DIVERSION DITCHES</b>							
Excavate ditches -soil		m3		#N/A	\$0.00	\$0	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0	\$0
<b>CONSTRUCT SPILLWAY</b>							
Excavate channel	Spillway not required; will follow natural drainage to Umwelt Lake.	m3		#N/A	\$0.00	\$0	\$0
Concrete		m3		#N/A	\$0.00	\$0	\$0
Rip rap		m3		#N/A	\$0.00	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0
<b>RECLAIM QUARRIES</b>							
Contour slopes		m3		#N/A	\$0.00	\$0	\$0
Place overburden		m3		#N/A	\$0.00	\$0	\$0
Vegetate		m3		#N/A	\$0.00	\$0	\$0
<b>FLOOD PIT-Capital</b>							
Remove stationary equipment (sump pumps) and Pipeline	Llama 1F will be used to store tailings in Years 11 to 14 (end of operations); it will be passively flooded following use as a TF with site runoff and direct precipitation throughout the end of Operations and into the Closure Phase. Water may be pumped from Goose Lake if required. At Closure, reclaim water pump will be at top of TF and pipeline leads to WTP. Costing here to remove pipeline to closure landfill; dispose of fuel in diesel day tank and oil from pump and landfill cleaned pump. Recirculation treatment may be provided following use as a TF if required (not costed here)	m	2,850	Sabina	\$11.59	\$33,023	\$33,023
Remove dewatering pipeline		m		#N/A	\$0.00	\$0	\$0
Remove power lines		each		#N/A	\$0.00	\$0	\$0
Construct diversion ditches		m3		#N/A	\$0.00	\$0	\$0
-Ditch, mat'l A		m3		#N/A	\$0.00	\$0	\$0
-Ditch, mat'l B		m3		#N/A	\$0.00	\$0	\$0
Construct embankment/dam		m3		#N/A	\$0.00	\$0	\$0
Supply/install pump station		each		#N/A	\$0.00	\$0	\$0
Supply/install piping system		m		#N/A	\$0.00	\$0	\$0
Remove pump post-closure		each		#N/A	\$0.00	\$0	\$0
Remove pipeline post-closure		m		#N/A	\$0.00	\$0	\$0
<b>FLOOD PIT-Annual Cost</b>							
Operate pumps (power)		m3		#N/A	\$0.00	\$0	\$0
Maintain pump/pipeline		allow		#N/A	\$0.00	\$0	\$0
Labour: fuel management, commissioning/decom		\$/h		#N/A	\$0.00	\$0	\$0
Chemical addition, _____ kg/m3 of water		tonne		#N/A	\$0.00	\$0	\$0
Chemicals, purchase and shipping		tonne		#N/A	\$0.00	\$0	\$0
Passive/biological additives		\$/ha		#N/A	\$0.00	\$0	\$0
Passive additives purchase and shipping		tonne		#N/A	\$0.00	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0
Number of years of pump flooding	passive pit flooding	years	0			Annual pumping costs	\$0
						Total pumping costs	\$0
						<b>Total</b>	\$66,016
						<b>% of Total</b>	100%

Open Pit Name:	Echo (to Project Year 4)	Pit #	3			
ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>CONTROL ACCESS</b>						
Fence		m		#N/A	\$0.00	\$0
Signs		each	-	Sabina	\$86.90	\$0
Berm at crest		m3	0	RR1H	\$21.84	\$0
Block roads		allow	-	Sabina	\$5,793.46	\$0
Other				#N/A	\$0.00	\$0
<b>STABILITY STUDY</b>						
Conduct stability and setback study		allow	1	Sabina	\$19,697.77	\$19,698
<b>STABILIZE SLOPES</b>						
Off-load crest, soil A		m3		#N/A	\$0.00	\$0
Off-load crest, soil B		m3		#N/A	\$0.00	\$0
Doze/trim overburden at crest		m3		#N/A	\$0.00	\$0
Drill & blast pit crest		m3		#N/A	\$0.00	\$0
Buttress slope		m3		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>COVER/CONTOUR SLOPES</b>						
Place fill, soil A		m3		#N/A	\$0.00	\$0
Place fill, soil B		m3		#N/A	\$0.00	\$0
Rip rap		m3		#N/A	\$0.00	\$0
Vegetate slopes		ha		#N/A	\$0.00	\$0
Vegetate pit floor		ha		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>CONSTRUCT DIVERSION DITCHES</b>						
Excavate ditches -soil		m3		#N/A	\$0.00	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0
<b>CONSTRUCT SPILLWAY</b>						
Excavate channel	Spillway not required.	m3		#N/A	\$0.00	\$0
Concrete		m3		#N/A	\$0.00	\$0
Rip rap		m3		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>RECLAIM QUARRIES</b>						
Contour slopes		m3		#N/A	\$0.00	\$0
Place overburden		m3		#N/A	\$0.00	\$0
Vegetate		m3		#N/A	\$0.00	\$0
<b>FLOOD PIT-Capital</b>						
Remove stationary equipment (sump pumps) and Pipeline	Echo TF will be used to store tailings in Years 1 to 4; it will be incorporated into and reclaimed as part of the Goose Main WRSA following use as a TF. Pipelines/pumps will be relocated during Operations for use in the other activities (i.e., not a closure cost).	m	-	#N/A	\$11.59	\$0
Remove dewatering pipeline		m		#N/A	\$0.00	\$0
Remove power lines		each		#N/A	\$0.00	\$0
Construct diversion ditches		m3		#N/A	\$0.00	\$0
-Ditch, mat'l A		m3		#N/A	\$0.00	\$0
-Ditch, mat'l B		m3		#N/A	\$0.00	\$0
Construct embankment/dam		m3		#N/A	\$0.00	\$0
Supply/install pump station		each		#N/A	\$0.00	\$0
Supply/install piping system		m		#N/A	\$0.00	\$0
Remove pump post-closure		each		#N/A	\$0.00	\$0
Remove pipeline post-closure		m		#N/A	\$0.00	\$0
<b>FLOOD PIT-Annual Cost</b>						
Operate pumps (power)		m3		#N/A	\$0.00	\$0
Maintain pump/pipeline		allow		#N/A	\$0.00	\$0
Labour: fuel management, commissioning/decom		\$/h		#N/A	\$0.00	\$0
Chemical addition, _____ kg/m3 of water		tonne		#N/A	\$0.00	\$0
Chemicals, purchase and shipping		tonne		#N/A	\$0.00	\$0
Passive/biological additives		\$/ha		#N/A	\$0.00	\$0
Passive additives purchase and shipping		tonne		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
Number of years of pump flooding	passive pit flooding	years	0	Annual pumping costs		
					Total pumping costs	\$0
					<b>Total</b>	\$19,698
					<b>% of Total</b>	100%

Open Pit Name:		Goose Main		Pit # 4		
ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>CONTROL ACCESS</b>						
Fence		m		#N/A	\$0.00	\$0
Signs	Assumed	each	4	Sabina	\$86.90	\$348
Berm at crest	Estimated for continuous berm with 1m diameter boulders, no spacing between boulders - 0.52 m3/m - assumed 50 % done during Operations	m3	639.45	RR1H	\$21.84	\$13,964
Block roads	Temporary gate installation to allow water monitoring. It includes decommissioning of gate when no longer required. Exposed area after gate has been decommissioned will be blocked with boulders (exposed area along with block of roads with boulders included in berm cost above)	allow	1	Sabina	\$5,793.46	\$5,793
Other				#N/A	\$0.00	\$0
<b>STABILITY STUDY</b>						
Conduct stability and setback study		allow	1	Sabina	\$19,697.77	\$19,698
<b>STABILIZE SLOPES</b>						
Off-load crest, soil A		m3		#N/A	\$0.00	\$0
Off-load crest, soil B		m3		#N/A	\$0.00	\$0
Doze/trim overburden at crest		m3		#N/A	\$0.00	\$0
Drill & blast pit crest		m3		#N/A	\$0.00	\$0
Buttress slope		m3		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>COVER/CONTOUR SLOPES</b>						
Place fill, soil A		m3		#N/A	\$0.00	\$0
Place fill, soil B		m3		#N/A	\$0.00	\$0
Rip rap		m3		#N/A	\$0.00	\$0
Vegetate slopes		ha		#N/A	\$0.00	\$0
Vegetate pit floor		ha		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>CONSTRUCT DIVERSION DITCHES</b>						
Excavate ditches -soil		m3		#N/A	\$0.00	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0
<b>CONSTRUCT SPILLWAY</b>						
Excavate channel	100 m long, 6 m wide and 1 m deep	m3	600	SB1L	\$5.29	\$3,174
Concrete		m3		#N/A	\$0.00	\$0
Rip rap		m3	200	RR1H	\$21.84	\$4,368
Other	Geotextile	m2	1,152	GSTL	\$4.23	\$4,875
<b>RECLAIM QUARRIES</b>						
Contour slopes		m3		#N/A	\$0.00	\$0
Place overburden		m3		#N/A	\$0.00	\$0
Vegetate		m3		#N/A	\$0.00	\$0
<b>FLOOD PIT-Capital</b>						
Remove stationary equipment (sump pumps) and Pipeline	At closure, pump will be at top of Goose Reservoir. Remove pipeline to closure landfill; dispose of fuel in diesel day tank and oil from pump and landfill cleaned pump.	m	4,325	Sabina	\$11.59	\$50,113
Remove dewatering pipeline		m		#N/A	\$0.00	\$0
Remove power lines		each		#N/A	\$0.00	\$0
Construct diversion ditches		m3		#N/A	\$0.00	\$0
-Ditch, mat'l A		m3		#N/A	\$0.00	\$0
-Ditch, mat'l B		m3		#N/A	\$0.00	\$0
Construct embankment/dam		m3		#N/A	\$0.00	\$0
Supply/install pump station		each		#N/A	\$0.00	\$0
Supply/install piping system		m		#N/A	\$0.00	\$0
Remove pump post-closure		each		#N/A	\$0.00	\$0
Remove pipeline post-closure		m		#N/A	\$0.00	\$0
<b>FLOOD PIT-Annual Cost</b>						
Operate pumps (power)		m3		#N/A	\$0.00	\$0
Maintain pump/pipeline		allow		#N/A	\$0.00	\$0
Labour: fuel management, commissioning/decom		\$/h		#N/A	\$0.00	\$0
Chemical addition, _____ kg/m3 of water		tonne		#N/A	\$0.00	\$0
Chemicals, purchase and shipping		tonne		#N/A	\$0.00	\$0
Passive/biological additives		\$/ha		#N/A	\$0.00	\$0
Passive additives purchase and shipping		tonne		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
					Annual pumping costs	
Number of years of pump flooding	passive pit flooding	years	0			
					Total pumping costs	\$0
					<b>Total</b>	\$102,334
					<b>% of Total</b>	100%

Quarry Name:		Airstrip Quarry		Quarry # 1		
ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>CONTROL ACCESS</b>						
Fence		m		#N/A	\$0.00	\$0
Signs		each		#N/A	\$0.00	\$0
Berm at crest		m3		RB1H	\$20.98	\$0
Block roads		allow		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>STABILITY STUDY</b>						
Conduct stability and setback study	Not required for quarry	allow		#N/A	\$0.00	\$0
<b>STABILIZE SLOPES</b>						
Off-load crest, soil A		m3		#N/A	\$0.00	\$0
Off-load crest, soil B		m3		#N/A	\$0.00	\$0
Doze/trim overburden at crest		m3		#N/A	\$0.00	\$0
Drill & blast pit crest		m3		#N/A	\$0.00	\$0
Buttress slope		m3		#N/A	\$0.00	\$0
Other	Backhoe to pull down loose rock on bedrock backslope - assumed	hrs	20 exc-sL		\$233.76	\$4,675
<b>COVER/CONTOUR SLOPES</b>						
Place fill, soil A		m3		#N/A	\$0.00	\$0
Place fill, soil B		m3		#N/A	\$0.00	\$0
Rip rap		m3		#N/A	\$0.00	\$0
Vegetate slopes	Allow to revegetate naturally	ha		#N/A	\$0.00	\$0
Vegetate pit floor		ha		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>CONSTRUCT DIVERSION DITCHES</b>						
Excavate ditches -soil		m3		#N/A	\$0.00	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0
<b>CONSTRUCT SPILLWAY</b>						
Excavate channel	Not required. Quarry base will be graded for sheet drainage.	m3		SB1L	\$5.29	\$0
Concrete		m3		#N/A	\$0.00	\$0
Rip rap		m3		RR1L	\$16.61	\$0
Other		m2		GSTL	\$4.23	\$0
<b>RECLAIM QUARRIES</b>						
Contour slopes	Quarry will not be flooded - development will occur below water level and the areas will be contoured to drain positively	m3		#N/A	\$0.00	\$0
Place overburden		m3		#N/A	\$0.00	\$0
Vegetate		m3		#N/A	\$0.00	\$0
<b>FLOOD PIT-Capital</b>						
Remove stationary equipment (sump pumps) and Pipeline		m		#N/A	\$0.00	\$0
Remove dewatering pipeline		m		#N/A	\$0.00	\$0
Remove power lines		each		#N/A	\$0.00	\$0
Construct diversion ditches		m3		#N/A	\$0.00	\$0
-Ditch, mat'l A		m3		#N/A	\$0.00	\$0
-Ditch, mat'l B		m3		#N/A	\$0.00	\$0
Construct embankment/dam		m3		#N/A	\$0.00	\$0
Supply/install pump station		each		#N/A	\$0.00	\$0
Supply/install piping system		m		#N/A	\$0.00	\$0
Remove pump post-closure		each		#N/A	\$0.00	\$0
Remove pipeline post-closure		m		#N/A	\$0.00	\$0
<b>FLOOD PIT-Annual Cost</b>						
Operate pumps (power)		m3		#N/A	\$0.00	\$0
Maintain pump/pipeline		allow		#N/A	\$0.00	\$0
Labour: fuel management, commissioning/decom		\$/h		#N/A	\$0.00	\$0
Chemical addition, _____ kg/m3 of water		tonne		#N/A	\$0.00	\$0
Chemicals, purchase and shipping		tonne		#N/A	\$0.00	\$0
Passive/biological additives		\$/ha		#N/A	\$0.00	\$0
Passive additives purchase and shipping		tonne		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
Annual pumping costs						
Number of years of pump flooding	No flooding	years	0			
					Total pumping costs	\$0
					<b>Total</b>	<b>\$4,675</b>
					<b>% of Total</b>	<b>100%</b>

4		Underground Mine Name Umwelt			UG Mine #	1	
ACTIVITY/MATERIAL	Notes	Unit	Qty	Cost Code	Unit Cost	Total Cost	
<b>CONTROL ACCESS</b>							
Fence		m		#N/A	\$0.00	\$0	
Signs		each		#N/A	\$0.00	\$0	
Block roads		m3		#N/A	\$0.00	\$0	
Berm		m3		#N/A	\$0.00	\$0	
Backfill Portal (NPAG waste rock plug)	At least 5 m deep into 5x4.5m portal and slope at least 2:1 outside of portal	m3	150	PORL	\$23.13	\$3,469	
Backfill portal #2		m3		#N/A	\$0.00	\$0	
Cap raise # 1	Concrete plug over 4m-dia. vent raise	m3	28	SRH	\$2,623.03	\$74,232	
Cap raise #2	Concrete plug over 4m-dia. vent raise	m3	28	SRH	\$2,623.03	\$74,232	
Cap shaft #1	Concrete plug over 4m-dia. fresh air vent	m3	28	SRH	\$2,623.03	\$74,232	
Cap shaft #2		m3		#N/A	\$0.00	\$0	
Backfill adits		m3		#N/A	\$0.00	\$0	
Backfill open stope		m3		#N/A	\$0.00	\$0	
Concrete cap over open stope		m3		#N/A	\$0.00	\$0	
Other				#N/A	\$0.00	\$0	
<b>REMOVE HAZARDOUS MATERIALS</b>							
Remove hazardous materials, U/G labor	Three shifts with loader, incl. operator and fuel	manhour	30	load-sL	\$215.30	\$6,459	
Remove/decontam. stationary & elect. equip		mandays		#N/A	\$0.00	\$0	
Remove/decontam. mobile equipment		each		#N/A	\$0.00	\$0	
Remove misc. haz. mat & explosives	Dispose of up to 1 week's inventory of explosives	kg	100	Sabina	\$57.93	\$5,793	
Decommission Pipeline	Clean Umwelt UG to SWP pipeline, decommission and landfill	m	1,662	Sabina	\$11.59	\$19,257	
<b>INSTALL BULKHEADS</b>							
Bulkheads to control water flow		each		#N/A	\$0.00	\$0	
Grout bulkhead		m3		#N/A	\$0.00	\$0	
<b>FLOOD MINE</b>							
Supply/install pump	UG mine is expected to be flooded in Year 10 and active flooding will take about a year, relocation of pipelines and flooding will occur as part of operations but cost is provided as a conservative approach (see "Relocate Pipeline".)	each		#N/A	\$0.00	\$0	
Relocate Pipeline	Move SWP-Llama UG pipeline discharge to Umwelt UG	m	800	Sabina	\$11.59	\$9,270	
Operate pumps to flood workings	Accounts for Umwelt Underground Extension	m3	1,071,225	Sabina	\$0.15	\$165,788	
Decommission of pipeline				#N/A	\$0.00	\$0	
Other				#N/A	\$0.00	\$0	
<b>INSTALL GROUNDWATER COLLECTION SYSTEM</b>							
Excavate/install sumps		m2		#N/A	\$0.00	\$0	
Install pumping wells		m3		#N/A	\$0.00	\$0	
Install pumps/pipelines/power supply		LS		#N/A	\$0.00	\$0	
<b>SPECIALIZED ITEMS</b>							
Install water quality monitoring pipes		each		#N/A	\$0.00	\$0	
Install permanent pumping system		each		#N/A	\$0.00	\$0	
Assess underground stability	Rock mechanics inspection before closure	each	1	Sabina	\$11,586.92	\$11,587	
						<b>Total</b>	\$444,319
						<b>% of Total</b>	100%

Underground Mine Name Llama

UG Mine #

2

ACTIVITY/MATERIAL	Notes	Unit	Qty	Cost Code	Unit Cost	Total Cost
<b>CONTROL ACCESS</b>						
Fence		m		#N/A	\$0.00	\$0
Signs		each		#N/A	\$0.00	\$0
Block roads		m3		#N/A	\$0.00	\$0
Berm		m3		#N/A	\$0.00	\$0
Backfill Portal (NPAG waste rock plug)	At least 5 m deep into 5x4.5m portal and slope at least 2:1 outside of portal	m3	150	PORL	\$23.13	\$3,469
Backfill portal #2		m3		#N/A	\$0.00	\$0
Cap raise # 1	Concrete plug over 4m-dia. vent raise	LS	28	SRH	\$2,623.03	\$74,232
Cap raise #2		m3		#N/A	\$0.00	\$0
Cap shaft #1		m3		#N/A	\$0.00	\$0
Cap shaft #2		m3		#N/A	\$0.00	\$0
Backfill adits		m3		#N/A	\$0.00	\$0
Backfill open stope		m3		#N/A	\$0.00	\$0
Concrete cap over open stope		m3		#N/A	\$0.00	\$0
Other						
<b>REMOVE HAZARDOUS MATERIALS</b>						
Remove hazardous materials, U/G labor	Two shifts with loader, incl. operator and fuel	manhour	20	load-sL	\$215.30	\$4,306
Remove/decontam. stationary & elect. equip		mandays		#N/A	\$0.00	\$0
Remove/decontam. mobile equipment		each		#N/A	\$0.00	\$0
Remove misc. haz. mat & explosives	Mining will cease before closure	kg		#N/A	\$0.00	\$0
Decommission Pipeline	Clean Llama UG to SWP pipeline, decommission and landfill	m	2700	Sabina	\$11.59	\$31,285
<b>INSTALL BULKHEADS</b>						
Bulkheads to control water flow		each		#N/A	\$0.00	\$0
Grout bulkhead		m3		#N/A	\$0.00	\$0
<b>FLOOD MINE</b>						
Supply/install pump	UG mine is expected to be flooded in Year 5 and active flooding will take about a year, relocation of pipelines and flooding will occur as part of operations	each		#N/A	\$0.00	\$0
Supply/install piping system		m		#N/A	\$0.00	\$0
Operate pumps to flood workings		m3		#N/A	\$0.00	\$0
Decommission of pipelines				#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>INSTALL GROUNDWATER COLLECTION SYSTEM</b>						
Excavate/install sumps		m2		#N/A	\$0.00	\$0
Install pumping wells		m3		#N/A	\$0.00	\$0
Install pumps/pipelines/power supply		LS		#N/A	\$0.00	\$0
<b>SPECIALIZED ITEMS</b>						
Install water quality monitoring pipes		each		#N/A	\$0.00	\$0
Install permanent pumping system		each		#N/A	\$0.00	\$0
Assess underground stability	Rock mechanics inspection before closure	each	1	Sabina	\$11,586.92	\$11,587
					<b>Total</b>	\$124,879
					<b>% of Total</b>	100%

Underground Mine Name	Goose Main			UG Mine # 3	3	
ACTIVITY/MATERIAL	Notes	Unit	Qty	Cost Code	Unit Cost	Cost Total Cost
<b>CONTROL ACCESS</b>						
Fence		m		#N/A	\$0.00	\$0
Signs		each		#N/A	\$0.00	\$0
Block roads		m3		#N/A	\$0.00	\$0
Berm		m3		#N/A	\$0.00	\$0
Backfill Portal (NPAG waste rock plug)	At least 5 m deep into 5x4.5m portal and slope at least 2:1 outside of portal	m3	150	PORL	\$23.13	\$3,469
Backfill portal #2		m3		#N/A	\$0.00	\$0
Cap raise # 1	Concrete plug over 4m-dia. vent raise	LS	28	SRH	\$2,623.03	\$74,232
Cap raise #2		m3		#N/A	\$0.00	\$0
Cap shaft #1		m3		#N/A	\$0.00	\$0
Cap shaft #2		m3		#N/A	\$0.00	\$0
Backfill adits		m3		#N/A	\$0.00	\$0
Backfill open stope		m3		#N/A	\$0.00	\$0
Concrete cap over open stope		m3		#N/A	\$0.00	\$0
Other						
<b>REMOVE HAZARDOUS MATERIALS</b>						
Remove hazardous materials, U/G labor	Two shifts with loader, incl. operator and fuel	manhour	20	load-sL	\$215.30	\$4,306
Remove/decontam. stationary & elect. equip		mandays		#N/A	\$0.00	\$0
Remove/decontam. mobile equipment		each		#N/A	\$0.00	\$0
Remove misc. haz. mat & explosives	Mining will cease before closure	kg		#N/A	\$0.00	\$0
Decommission WTP - Goose Lake Pipeline	In Water Management tab	m		#N/A	\$0.00	\$0
<b>INSTALL BULKHEADS</b>						
Bulkheads to control water flow		each		#N/A	\$0.00	\$0
Grout bulkhead		m3		#N/A	\$0.00	\$0
<b>FLOOD MINE</b>						
Supply/install pump	UG mine is expected to be flooded in Year 10 and active flooding will take about a year, relocation of pipelines and flooding will occur as progressive reclamation but cost is provided as a conservative approach	each		#N/A	\$0.00	\$0
Supply/install piping system	Adjust pipe line to route to Goose UG in Year 10	m	4,500	Sabina	\$14.81	\$66,625
Operate pumps to flood workings		m3	391,630	Sabina	\$0.15	\$60,552
Decommission SWP to Goose UG pipeline		m	10,800	Sabina	\$11.59	\$125,139
Other				#N/A	\$0.00	\$0
<b>INSTALL GROUNDWATER COLLECTION SYSTEM</b>						
Excavate/install sumps		m2		#N/A	\$0.00	\$0
Install pumping wells		m3		#N/A	\$0.00	\$0
Install pumps/pipelines/power supply		LS		#N/A	\$0.00	\$0
<b>SPECIALIZED ITEMS</b>						
Install water quality monitoring pipes		each		#N/A	\$0.00	\$0
Install permanent pumping system		each		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>Total</b>					\$334,323	\$334,323
<b>% of Total</b>						100%

Underground Mine Name	Echo	UG Mine # 4	4			
ACTIVITY/MATERIAL	Notes	Unit Qty	Cost Code	Unit Cost	Cost	Total Cost
<b>CONTROL ACCESS</b>						
Fence		m	#N/A	\$0.00	\$0	\$0
Signs		each	#N/A	\$0.00	\$0	\$0
Block roads		m3	#N/A	\$0.00	\$0	\$0
Berm		m3	#N/A	\$0.00	\$0	\$0
Backfill Portal (NPAG waste rock plug)	At least 5 m deep into 5x4.5m portal and slope at least 2:1 outside of portal	m3 150	PORL	\$23.13	\$3,469	\$3,469
Backfill portal #2		m3	#N/A	\$0.00	\$0	\$0
Cap raise # 1	Concrete plug over 4m-dia. vent raise	LS 28	SRH	\$2,623.03	\$74,232	\$74,232
Cap raise #2		m3	#N/A	\$0.00	\$0	\$0
Cap shaft #1		m3	#N/A	\$0.00	\$0	\$0
Cap shaft #2		m3	#N/A	\$0.00	\$0	\$0
Backfill adits		m3	#N/A	\$0.00	\$0	\$0
Backfill open stope		m3 3,550	Sabina	\$6.95	\$24,680	\$24,680
Concrete cap over open stope		m3	#N/A	\$0.00	\$0	\$0
Other			#N/A	\$0.00	\$0	\$0
<b>REMOVE HAZARDOUS MATERIALS</b>						
Remove hazardous materials, U/G labor	One shift with loader, incl. operator and fuel	manhour 10	load-sL	\$215.30	\$2,153	\$2,153
Remove/decontam. stationary & elect. equip		mandays	#N/A	\$0.00	\$0	\$0
Remove/decontam. mobile equipment		each	#N/A	\$0.00	\$0	\$0
Remove misc. haz. mat & explosives	Mining will cease before closure	kg	#N/A	\$0.00	\$0	\$0
Decommission Pipeline		m	#N/A	\$0.00	\$0	\$0
<b>INSTALL BULKHEADS</b>						
Bulkheads to control water flow		each	#N/A	\$0.00	\$0	\$0
Grout bulkhead		m3	#N/A	\$0.00	\$0	\$0
<b>FLOOD MINE</b>						
Supply/install pump	Passive flooding of Echo UG in Year 10, complete flooding is expected to occur within a few months.	each	#N/A	\$0.00	\$0	\$0
Supply/install piping system		each	#N/A	\$0.00	\$0	\$0
Operate pumps to flood workings		m3	#N/A	\$0.00	\$0	\$0
Decommission			#N/A	\$0.00	\$0	\$0
Other			#N/A	\$0.00	\$0	\$0
<b>INSTALL GROUNDWATER COLLECTION SYSTEM</b>						
Excavate/install sumps		m2	#N/A	\$0.00	\$0	\$0
Install pumping wells		m3	#N/A	\$0.00	\$0	\$0
Install pumps/pipelines/power supply		LS	#N/A	\$0.00	\$0	\$0
<b>SPECIALIZED ITEMS</b>						
Install water quality monitoring pipes		each	#N/A	\$0.00	\$0	\$0
Install permanent pumping system		each	#N/A	\$0.00	\$0	\$0
Assess underground stability	Rock mechanics inspection before closure	each 1	Sabina	\$11,586.92	\$11,587	\$11,587
<b>Total</b>					\$116,121	\$116,121
<b>% of Total</b>						100%

1 Rock Pile Name: Umwelt, Llama, Goose Main, and Echo

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>STABILIZE SLOPES</b>						
Flatten slopes with dozer		m3		#N/A	\$0.00	\$0
Flatten "bubble dump" areas		m3		#N/A	\$0.00	\$0
Divert runoff, ditch mat'l A		m3		#N/A	\$0.00	\$0
Divert runoff, ditch mat'l B		m3		#N/A	\$0.00	\$0
Toe buttress, drain mat'l		m3		#N/A	\$0.00	\$0
Toe buttress, fill mat'l A		m3		#N/A	\$0.00	\$0
Toe buttress, fill mat'l B		m3		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>COVER ROCK PILE</b>						
Subgrade preparation - doze surface		m3		#N/A	\$0.00	\$0
Soil cover - excavate,haul,spread&compact		m3		#N/A	\$0.00	\$0
Rock cover - excavate, haul & spread	Cover 3 rock piles: Umwelt, Llama, and Goose Main (incorporates Echo WRSA and Echo TF into Goose Main WRSA). WRSAs will be covered progressively by direct hauling NPAG during mining. Maximum PAG Exposure occurs end of Year 3 for 31.5 ha; 5 m cover converts this area to 1.6 Mm3.	m3	1,574,457	RBSS	\$8.11	\$12,770,177
Excavate downslope drainage channel & chute		m3		#N/A	\$0.00	\$0
Rip rap drainage channel and chute		m3		#N/A	\$0.00	\$0
Vegetate		ha		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>VERY LOW PERMEABILITY COVER (in addition to above)</b>						
Liner subgrade preparation - compact		m2		#N/A	\$0.00	\$0
Supply geomembrane		m2		#N/A	\$0.00	\$0
Install geomembrane		m2		#N/A	\$0.00	\$0
Protective cover - excavate,haul,spread&compact		m3		#N/A	\$0.00	\$0
Vegetate		ha		#N/A	\$0.00	\$0
Install infiltration/seepage instrumentation		allow		#N/A	\$0.00	\$0
<b>CONSTRUCT DIVERSION DITCHES</b>						
Excavate ditches -soil		m3		#N/A	\$0.00	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0
<b>CONSTRUCT SEEPAGE COLLECTION POND</b>						
Excavate seepage collection pond	See Water Management tab for berm breaching	m3		#N/A	\$0.00	\$0
Doze & spread excavated material		m3		#N/A	\$0.00	\$0
Vegetate spread material		ha		#N/A	\$0.00	\$0
Bedding layer		m3		#N/A	\$0.00	\$0
Supply geomembrane		m2		#N/A	\$0.00	\$0
Install geomembrane		m2		#N/A	\$0.00	\$0
Erosion protection layer		m3		#N/A	\$0.00	\$0
<b>INSTALL GROUNDWATER COLLECTION SYSTEM</b>						
Excavate/install sumps		m3		#N/A	\$0.00	\$0
Install pumping wells		m3		#N/A	\$0.00	\$0
Install pumps/pipelines/power supply		allow		#N/A	\$0.00	\$0
<b>RELOCATE DUMPS</b>						
Load, haul, dump or doze		m3		#N/A	\$0.00	\$0
Add lime		tonne		#N/A	\$0.00	\$0
Contour reclaimed area		ha		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>SPECIALIZED ITEMS</b>						
Install ground temperature monitoring cables	Will be installed during Operations to meet operational monitoring commitments	each		#N/A	\$0.00	\$0
Install permanent instrumentation, drilling		each		#N/A	\$0.00	\$0
<b>TREAT ROCK PILE SEEPAGE - see "Water Management"</b>						
<b>HEAP LEACH SEEPAGE TREATMENT - Cyanide Detox</b>						
Cyanide destruction water treatment pumping		m3		#N/A	\$0.00	\$0
Reagents		tonnes		#N/A	\$0.00	\$0
Electrician/mechanic to maintain treatment plant		allow		#N/A	\$0.00	\$0
Equipment maintenance and parts		allow		#N/A	\$0.00	\$0
					Annual treatment costs	
Number of years of treatment		years	0			
					Total treatment costs	
						\$0
<b>HEAP LEACH SEEPAGE TREATMENT - ARD/ML</b>						
Upgrade/modify pumping system - report to WTP		allow		#N/A	\$0.00	\$0
					<b>Total</b>	<b>\$12,770,177</b>
					<b>% of Total</b>	<b>100%</b>

\* For construction of passive treatment system refer to "Water Management".

1 Building / Equip Name:

Bldg / Equip #: 1

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
<b>DISPOSE MOBILE EQUIPMENT</b>						
Decontaminate and ship off-site		allow		#N/A	\$0.00	\$0
Decontaminate and dispose on-site	Drive or transport to landfill; drain fluids; NPAG cover cost below	allow	1	Sabina	\$23,173.84	\$23,174
Other				#N/A	\$0.00	\$0
<b>REMOVE BUILDINGS - see note below</b>						
Accommodation Complex	Goose Admin: Kitchen/camp. Landfill building materials and pad.	m2	1,980	BRS1L	\$55.36	\$109,621
Process Facilities		m2	6,464	BRS1H	\$79.97	\$516,928
Crusher		m2	1,630	BRS1H	\$79.97	\$130,352
Power plant		m2	2,040	BRS1H	\$79.97	\$163,140
Emergency power plant		m2	300	BRS1H	\$79.97	\$23,991
Truck Shop/Office	Goose Admin building	m2	2,349	BRS1L	\$55.36	\$130,075
Cold storage	Goose Admin building	m2	840	BRS1L	\$55.36	\$46,506
Storage Facilities	Waste oil storage Goose Site	Lot	1	Sabina	\$50,209.99	\$50,210
Storage Facility	Goose freight storage	Lot	1	Sabina	\$22,304.82	\$22,305
Water and Wastewater Treatment Facilities	Water treatment plant Goose Building	m2	647	BRS1L	\$55.36	\$35,821
Sewage Treatment Plant	Remove hazardous materials and dispose of at licensed facility, landfill building materials	Lot	1	Sabina	\$13,382.89	\$13,383
Fuel Tanks	Fuel storage and distribution Goose facility	Lot	1	Sabina	\$178,438.60	\$178,439
Offices, Repair, Lab, Warehouse	MLA infrastructure Port Office	Units	5	Sabina	\$2,711.34	\$13,557
Pipeline	MLA Infrastructure	m	10,000	Sabina	\$11.59	\$115,869
Warehouse, Shops and Others	MLA Infrastructure. Includes: Incinerator and waste management, Warehouses, Genset, Maintenance shop, water storage, WTP/STP, camp/office, freight storage area, waste area, MLA Fuel Storage Area. Cost includes grade and contour pads, disposal at designated areas, remove hazard material when applicable. Additional Cost included for MLA Fuel Transfer Area tank and liner removal.	LS	1	Sabina	\$376,702.42	\$376,702
Freshwater intakes	pipes will be capped at substrate and left in place.	m2		#N/A	\$0.00	\$0
Reclaim pumps		m2		#N/A	\$0.00	\$0
Outfall & Diffuser		m2		#N/A	\$0.00	\$0
Airstrip lighting, navigation, electrician	Accounts for Goose 6,000-ft airstrip	manhours	24	elech	\$116.88	\$2,805
Airstrip lighting, navigation, mechanical	Accounts for Goose 6,000-ft airstrip	manhours	24	mechH	\$89.63	\$2,151
Break foundation slabs		m2		#N/A	\$0.00	\$0
Consolidate & dump boneyard debris		m3		#N/A	\$0.00	\$0
Other	Remove Buildings - WIR Service/Emergency Camps, total of 3 1-ha area for 3 camps; assume all structures will be sprung structures.	LS	3	Sabina	\$82,933.79	\$248,801
<b>LANDFILL FOR DEMOLITION WASTE</b>						
Place rock cover		m3	25,000	RR3L	\$8.61	\$215,305
Place soil cover		m3		#N/A	\$0.00	\$0
Vegetate		ha		#N/A	\$0.00	\$0
<b>GRADE AND CONTOUR PADS</b>						
Accommodation Complex	Goose Admin: Kitchen/camp. no concrete foundation	ha	0.2	SCFYL	\$5,290.35	\$1,058
Process Facilities	concrete foundation demolished to ground level	m2	6,464	BRCS	\$7.38	\$47,716
Crusher	concrete foundation demolished to ground level	m2	1,630	BRCS	\$7.38	\$12,032
Power plant	no concrete foundation	ha	0.3	SCFYL	\$5,290.35	\$1,587
Emergency power plant	no concrete foundation	ha	0.10	SCFYL	\$5,290.35	\$529
Truck Shop/Office	concrete foundation demolished to ground level	m2	2,349	BRCS	\$7.38	\$17,343
Cold storage	no concrete foundation	ha	0.1	SCFYL	\$5,290.35	\$529
Water and Wastewater Treatment Facilities	no concrete foundation	ha	0.1	SCFYL	\$5,290.35	\$529
Sewage Treatment Plant	no concrete foundation	m2	33	BRCS	\$7.38	\$244
Fuel Tanks	Fuel storage and distribution Goose facility; no concrete foundation	ha	2.2	SCFYL	\$5,290.35	\$11,639
Warehouse, Shops and Other	MLA, includes all storage/laydown pads, Fuel Tank areas, airstrip, shoreline pads, and camp area	ha	20	SCFYL	\$5,290.35	\$105,807
Place rock cover		m3		#N/A	\$0.00	\$0
Vegetate		ha		#N/A	\$0.00	\$0
<b>PUNCTURE LINED SUMPS</b>						
Puncture liner and place soil cover		m3		#N/A	\$0.00	\$0
<b>RECLAIM ROADS</b>						
Restore drainage, remove culverts haul road	Restore drainage including culverts at Goose Property; no culverts at MLA. Roads will remain intact to facilitate long-term access.	m3	1,488	Sabina	\$12.75	\$18,965
Remove bridges		each		#N/A	\$0.00	\$0
Scarify and install water breaks		ha		#N/A	\$0.00	\$0
Restore drainage airstrip	Accounts for Goose 6,000ft by 200ft airstrip dimensions	m3	1,360	Sabina	\$13.90	\$18,910
Scarify airstrip area	Accounts for Goose 6,000ft by 200ft airstrip (1,829 m x 61 m = 11.2 ha)	ha	11.2	SCFYL	\$5,290.35	\$59,252
Scarify Winter Ice Roads & WIR Camps	Fill sections on land - 15 km x 10 m wide = 15.0 ha; plus 3 ha for WIR Service/Emergency Camps (1 ha/camp x 3)	ha	18	SCFYH	\$7,418.79	\$133,538
Vegetate - Subbase & WIR Camps	Potential vegetation of roads to include 18 ha of scarified subbase and camps, plus a nominal area of 3 ha for spill or other road remediation area.	ha	21	VHFL	\$4,921.25	\$103,346
Other				#N/A	\$0.00	\$0
<b>SPECIALIZED ITEMS</b>						
Dispose of misc. debris and laydown area refuse				#N/A	\$0.00	\$0
<b>Total</b>						\$2,952,160
<b>% of Total</b>						

1 Chemicals/Soil Area Name:

**Note:** The procedures, equipment and packaging for clean up and removal of chemicals or contaminated soils are highly dependent on the nature of the chemicals and their existing state of containment. Government guidelines should be consulted on an individual chemical basis. Any estimate made here should be considered very rough unless specific evaluations have been conducted.

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>HAZARDOUS MATERIALS AUDIT</b>						
Hazardous materials audit		mandays		#/N/A	\$0.00	\$0
Phase 1 audit		each	1	CS1L	\$9,227.35	\$9,227
Phase 2 audit		each	1	CS2L	\$61,515.66	\$61,516
<b>BUILDING DECONTAMINATION &amp; CONSOLIDATION OF HAZARDOUS MATERIALS</b>						
Environmental technician/coordinator		mandays		#/N/A	\$0.00	\$0
Decontaminate: oil, fuel		mandays		#/N/A	\$0.00	\$0
Decontaminate maintenance shop		mandays		#/N/A	\$0.00	\$0
Decontaminate power plant		mandays		#/N/A	\$0.00	\$0
Decontaminate bulk fuel storage		mandays		#/N/A	\$0.00	\$0
Decontaminate ANFO plant		mandays		#/N/A	\$0.00	\$0
Decontaminate offices/warehouse/accom		mandays		#/N/A	\$0.00	\$0
Removal of asbestos siding on buildings		m2		#/N/A	\$0.00	\$0
Removal of friable asbestos on equipment		m2		#/N/A	\$0.00	\$0
Other				#/N/A	\$0.00	\$0
<b>HAZARDOUS MATERIALS REMOVAL</b>						
Waste oils	Consume in a waste oil burner on-site	litre	10,000	ORL	\$0.53	\$5,290
Waste fuel	Consume on-site to power an incinerator, or in a waste oil burner	litre	250,000	ORL	\$0.53	\$132,259
Waste batteries	Assumed 10 20-kg batteries generated in the final year of closure	kg	200	PCRH	\$3.08	\$615
Assay & environmental lab reagents		kg	500	PCRH	\$3.08	\$1,538
Machine shop paints, solvents etc.		litre	200	PCRH	\$3.08	\$615
Glycol		litre	5,000	PCRH	\$3.08	\$15,379
Process reagents		kg	130,000	PCRH	\$3.08	\$399,852
WTP sludge from Water Treatment	All sludge created and disposed during Operations. Conitngency 3 years of sludge disposal included (9,000 kg over 3 seasons).	kg	9,000	PCRH	\$3.08	\$27,682
Nuclear sources		allow		#/N/A	\$0.00	\$0
Mobile Equipment	Remove hazardous waste from equipment not being salvaged, clean, landfill equipment	each	41	Sabina	\$2,641.82	\$108,315
<b>HAZARDOUS MATERIALS</b>						
Transportation to disposal facility	Included in hazardous materials removal cost	allow		#/N/A	\$0.00	\$0
Disposal fees	Included in hazardous materials removal cost	allow		#/N/A	\$0.00	\$0
Other				#/N/A	\$0.00	\$0
<b>CONTAMINATED SOILS</b>						
Contam. soil investigation - Phase 1		LS	1	Sabina	\$8,690.19	\$8,690
Contam. soil investigation - Phase 2		LS	1	Sabina	\$57,934.61	\$57,935
<b>CONTAMINATED SOIL REMOVAL</b>						
Excavate and transport to onsite facility		m3	10,000	SB1H	\$7.26	\$72,588
Manage hydrocarbon remediation at facility		m3	10,000	CSR1	\$57.82	\$578,247
Reagents/stabilizing agent		m2		#/N/A	\$0.00	\$0
Excavate and transport to offsite facility		m3		#/N/A	\$0.00	\$0
Contour decontaminated area	Decommission 2 landfarms and confirmation soil sampling; estimated 6,000m3 at each of Goose and MLA sites.	m3	12,000	SB1L	\$5.29	\$63,484
<b>CONTAMINATED SOIL VERY LOW PERMEABILITY COVER</b>						
Supply geomembrane, HDPE, ES3, GCL		m2		#/N/A	\$0.00	\$0
Upper and lower bedding layers		m3		#/N/A	\$0.00	\$0
Install geomembrane, HDPE, ES3, GCL		m2		#/N/A	\$0.00	\$0
Erosion protection layer		m3		#/N/A	\$0.00	\$0
Vegetate		m2		#/N/A	\$0.00	\$0
Install infiltration/seepage instrumentation		allow		#/N/A	\$0.00	\$0
Other	Operate 2 landfarms: 1 at Goose, 1 at MLA	allow	2	Sabina	\$57,934.61	\$115,869
<b>OTHER</b>						
				#/N/A	\$0.00	\$0
					<b>Total</b>	\$1,659,101
					<b>% of Total</b>	100%

1 Water Management

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>BREACH DYKE EMBANKMENT</b>						
Breach Llama Lake Diversion Berms	During closure.	m3	665	#N/A	\$8.46	\$5,625
Breach Llama WRSA Diversion Berm	During closure.	m3	95	#N/A	\$8.46	\$804
Breach Llama WRSA Containment Dam	During closure.	m3	95	#N/A	\$8.46	\$804
Breach Primary Pond Containment Dam	During closure.	m3	200	#N/A	\$8.46	\$1,692
Breach Umwelt WRSA Containment Dam	Dam has been removed from water management design	m3	-	#N/A	\$0.00	\$0
Breach Umwelt WRSA Diversion Berm	Berm has been removed from water management design	m3	-	#N/A	\$0.00	\$0
Breach Echo WRSA Containment Dam	Dam has been removed from water management design	m3	-	#N/A	\$8.46	\$0
Breach Echo Diversion Berm	During closure.	m3	190	#N/A	\$8.46	\$1,607
Breach Echo WRSA Diversion Berm	Berm has been removed from water management design	m3	-	#N/A	\$8.46	\$0
Breach Echo/Goose Main Containment Dam	During closure.	m3	95	#N/A	\$8.46	\$804
Breach Goose Main Diversion Berm	During closure.	m3	95	#N/A	\$8.46	\$804
Breach Plant Site Pond Containment Dam	During closure.	m3	215	#N/A	\$8.46	\$1,819
Breach SWP Containment Dam	During closure.	m3	430	#N/A	\$9.27	\$3,986
Remove Liner from all berms	Remove liner from all berms.	m2	30,700	Sabina	\$0.81	\$24,900
Contour water intake area		m3		#N/A	\$0.00	\$0
<b>STABILIZE SEDIMENT PONDS/WATER MANAGEMENT PONDS</b>						
Place soil cover		m3		#N/A	\$0.00	\$0
Doze & spread excavated material		m3		#N/A	\$0.00	\$0
Vegetate spread material		ha		#N/A	\$0.00	\$0
Rip rap in channel base		each		#N/A	\$0.00	\$0
<b>REDIRECT RUNOFF/CONSTRUCT DIVERSION DITCHES</b>						
Excavate ditches -soil		m3		#N/A	\$0.00	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0
Stabilize side slopes		m3		#N/A	\$0.00	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0
<b>BREACH DITCHES</b>						
Excavate breaches		m3		#N/A	\$0.00	\$0
Install flow dissipation		m3		#N/A	\$0.00	\$0
Vegetate remainder of ditch		m2		#N/A	\$0.00	\$0
<b>DECOMMISSION FRESH WATER SUPPLY</b>						
Breach embankment		m3		#N/A	\$0.00	\$0
Remove pump		LS		#N/A	\$0.00	\$0
Remove pipelines		m		#N/A	\$0.00	\$0
<b>DECOMMISSION WATER RECLAIM BARGE</b>						
Decommission reclaim barge from Llama TF		LS	1	Sabina	\$11,586.92	\$11,587
<b>WATER CONTROL IN RECLAMATION QUARRY</b>						
Install pumping system		LS		#N/A	\$0.00	\$0
Remove pumping system		m		#N/A	\$0.00	\$0
<b>REMOVE PIPELINES</b>						
Decommission Llama pump and pipeline		m	700	Sabina	\$21.52	\$15,063
Decommission WTP-Goose Lake pipeline		m	1,140	Sabina	\$11.59	\$13,209
Remove Saline Water Pond pump and pipeline		m	10,800	Sabina	\$12.39	\$133,829
Remove Primary Pond pump and pipeline		m	7,250	Sabina	\$12.79	\$92,695
Remove Echo WRSA Pond pump and pipeline	Has been removed from water management design	m	-	Sabina	\$11.59	\$0
Remove Echo NCW pond pump and pipeline	Has been removed from water management design	m	-	Sabina	\$27.39	\$0
Remove Plant Site Pond pump and pipeline		m	4,550	Sabina	\$11.59	\$52,720
Decommission WTP pump and pipeline		m	7,520	Sabina	\$12.62	\$94,937
Decommission WTP		LS	2	Sabina	\$11,297.25	\$22,594
Concrete plug deep pipes		m3		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>OPERATE WATER TREATMENT PLANT</b>						
Pump from TSF to WTP		m3	-	POCL	\$0.15	\$0
Treat water in WTP	No treatment required for early closure at end Year 4 (max PAG exposure). End Year 4 is transition from Echo TF to Umwelt TF.	m3	-	Sabina	\$0.75	\$0
Pump water out of WTP		m3	-	POCL	\$0.15	\$0
<b>OPERATE WATER TREATMENT PLANT</b>						
Pump to WTP		m3	3,000,000	POCL	\$0.15	\$442,913
Treat water in WTP	Water treatment (and pumping) allotment to address potential water treatment considerations during the Closure Phase.	m3	3,000,000	Sabina	\$0.75	\$2,259,450
Pump water out of WTP		m3	3,000,000	POCL	\$0.15	\$442,913
<b>GROUNDWATER COLLECTION SYSTEM</b>						
Excavate/install sumps		m3		#N/A	\$0.00	\$0
Install pumping wells		m3		#N/A	\$0.00	\$0
Install pumps/pipelines/power supply		LS		#N/A	\$0.00	\$0
<b>CONSTRUCT CONTAMINATED WATER STORAGE POND</b>						
Excavate pond		m3		#N/A	\$0.00	\$0
Doze & spread excavated material		m3		#N/A	\$0.00	\$0
Vegetate spread material		ha		#N/A	\$0.00	\$0
Bedding layer		m3		#N/A	\$0.00	\$0
Supply geomembrane		m2		#N/A	\$0.00	\$0
Install geomembrane		m2		#N/A	\$0.00	\$0
Erosion protection layer		m3		#N/A	\$0.00	\$0
<b>CONSTRUCT PASSIVE TREATMENT SYSTEM (e.g. Constructed Wetland)</b>						
Construct access roads		km		#N/A	\$0.00	\$0
Install HDPE piping system from collection pond		m		#N/A	\$0.00	\$0
Inter-cell flow structures		allow		#N/A	\$0.00	\$0
Install liners		m2		#N/A	\$0.00	\$0
Install growth media		m3		#N/A	\$0.00	\$0
Wetland vegetation		ha		#N/A	\$0.00	\$0
<b>CONSTRUCT WATER TREATMENT PLANT</b>						
Build treatment plant	Treatment Plant will be constructed as part of operations	LS		#N/A	\$0.00	\$0
Build sludge containment facility		LS		#N/A	\$0.00	\$0
					<b>Total</b>	<b>\$3,624,753</b>

For details of long-term/post-closure water treatment see "WATER TREATMENT" Worksheet; costs included in this tab.

1 Interim Care and Maintenance

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>INTERIM CARE &amp; MAINTENANCE</b>						
Camp operation	Caretaker and summer personnel	mandays	306	Sabina	127.46	\$39,002
On-site staff	Caretaker and summer personnel	manhours	3,060	ENVCO	91.24	\$279,195
extra personnel		manmonths		#N/A	0	\$0
-electrician		manmonths		#N/A	0	\$0
-mechanic		manmonths		#N/A	0	\$0
annual fuel	Fuel for vehicles; fuel for pumping included in water treatment cost	litre	5,000	FCDH	1.71	\$8,551
misc. supplies		allow	1	Sabina	23174	\$23,174
pick-up truck		each		#N/A	0	\$0
small dozer		allow		#N/A	0	\$0
small excavator		allow		#N/A	0	\$0
snow machine		allow		#N/A	0	\$0
communications		allow		#N/A	0	\$0
SNP/AEMP water sampling & reporting	Sampling and lab costs	each	1	WSH	12303	\$12,303
geotechnical assessment	Annual geotechnical inspection	each	1	RPTH	24606	\$24,606
interim water treatment	Captured under Water Treatment	each	1	#N/A	0	\$0
other		each		#N/A	0	\$0
				Annual Interim C&M Cost		\$386,830
Number of years of ICM		years	3	<b>Total</b>		<b>\$1,160,490</b>

**10 Years  
(Year 13 to 22)**

<b>ACTIVITY/MATERIAL - WEMP and TERRESTRIAL</b>	<b>Notes</b>	<b>Units</b>	<b>Quantity</b>	<b>Cost Code</b>	<b>Unit Cost</b>	<b>Total Cost</b>
<b>MONITORING &amp; INSPECTIONS</b>						
Total geotechnical inspections (1 yearly)		year		#N/A	\$0.00	\$0
Waste Rock Piles		year		#N/A	\$0.00	\$0
Pit Walls		year		#N/A	\$0.00	\$0
WR GTC Monitoring		year		#N/A	\$0.00	\$0
Survey inspection		each		#N/A	\$0.00	\$0
Regulatory costs*		year		#N/A	\$0.00	\$0
Site water monitoring		each		#N/A	\$0.00	\$0
- Active closure and flooding		each		#N/A	\$0.00	\$0
- Post pit flooding		each		#N/A	\$0.00	\$0
Wildlife Effects Monitoring Program (WEMP)	Aquatics - Non-contact water basins (10 years)	year	1	Sabina	\$5,561.72	\$5,562
Terrestrial Animal Monitoring	Terrestrial Animal Monitoring (10 years)	year	1	Sabina	\$27,808.61	\$27,809
Vegetation Monitoring		each		#N/A	\$0.00	\$0
Maintain gravel road surface		year		#N/A	\$0.00	\$0
Maintain airstrip surface		year		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>COVER MAINTENANCE</b>						
Repair erosion - infill gullies		allow		#N/A	\$0.00	\$0
Repair erosion - upgrade diversion ditches		allow		#N/A	\$0.00	\$0
Remove problem vegetation		allow		#N/A	\$0.00	\$0
Repair animal damage		allow		#N/A	\$0.00	\$0
Repair/upgrade access controls		allow		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>SPILLWAY MAINTENANCE</b>						
Repair erosion		m3		#N/A	\$0.00	\$0
Clear spillway		each		#N/A	\$0.00	\$0
<b>CWTS MAINTENANCE</b>						
Maintain flow, restore vegetation		allow		#N/A	\$0.00	\$0
<b>POST-CLOSURE WATER TREATMENT</b>						
Annual water treatment cost, from "Water Treatment"		LS		#N/A	\$0.00	\$0
Subtotal, Annual post-closure costs						\$33,370
Discount rate for calculation of net present value of post-closure cost, %				0.00%		
Number of years of post-closure activity				10	years	
<b>Present Value of payment stream</b>						\$333,703

**13 Years  
(Year 13 to 25)**

ACTIVITY/MATERIAL - Monitoring & Maintenance	Notes	Units	Quantity	Cost Code	Unit Cost	Total Cost
<b>MONITORING &amp; INSPECTIONS</b>						
Total geotechnical inspections (1 yearly)		year		#N/A	\$0.00	\$0
Waste Rock Piles	Annual inspection of WR piles from closure to post-closure (13 years)	year	1	Sabina	\$9,617.15	\$9,617
Pit Walls	Annual inspection of pit walls from closure to post-closure (13 years)	year	1	Sabina	\$4,634.77	\$4,635
WR GTC Monitoring	Umwelt, Llama, and TSF WRSA ground temp cable annual monitoring. No GTCs at Echo WRSA (13 years)	year	1	Sabina	\$16,685.17	\$16,685
Survey inspection		each		#N/A	\$0.00	\$0
Regulatory costs	annual reporting, management plans, progress reports (13 years)	year	1	Sabina	\$28,967.30	\$28,967
Site water monitoring	All pits and WR piles closure and post closure monitoring (13 years)	year	1	Sabina	\$10,567.27	\$10,567
- Active closure and flooding		each		#N/A	\$0.00	\$0
- Post pit flooding		each		#N/A	\$0.00	\$0
Wildlife Effects Monitoring Program (WEMP)		year		#N/A	\$0.00	\$0
Terrestrial Animal Monitoring		year		#N/A	\$0.00	\$0
Vegetation Monitoring		each		#N/A	\$0.00	\$0
Maintain gravel road surface	maintenance from closure to post-closure (13 years)	year	1	Sabina	\$15,816.15	\$15,816
Maintain airstrip surface	maintenance from closure to post-closure (13 years)	year	1	Sabina	\$4,518.90	\$4,519
Other				#N/A	\$0.00	\$0
<b>COVER MAINTENANCE</b>						
Repair erosion - infill gullies		allow		#N/A	\$0.00	\$0
Repair erosion - upgrade diversion ditches		allow		#N/A	\$0.00	\$0
Remove problem vegetation		allow		#N/A	\$0.00	\$0
Repair animal damage		allow		#N/A	\$0.00	\$0
Repair/upgrade access controls		allow		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>SPILLWAY MAINTENANCE</b>						
Repair erosion		m3		#N/A	\$0.00	\$0
Clear spillway		each		#N/A	\$0.00	\$0
<b>CWTS MAINTENANCE</b>						
Maintain flow, restore vegetation		allow		#N/A	\$0.00	\$0
<b>POST-CLOSURE WATER TREATMENT</b>						
Annual water treatment cost, from "Water Treatment"		LS		#N/A	\$0.00	\$0
Subtotal, Annual post-closure costs						\$90,807
Discount rate for calculation of net present value of post-closure cost, %				0.00%		
Number of years of post-closure activity				13	years	
<b>Present Value of payment stream</b>						\$1,180,487

**Beyond Post Closure (Long Term 1 to 5, 7, 10, 15, 25)**

<b>ACTIVITY/MATERIAL - Long Term Monitoring</b>	<b>Notes</b>	<b>Units</b>	<b>Quantity</b>	<b>Cost Code</b>	<b>Unit Cost</b>	<b>Total Cost</b>
<b>MONITORING &amp; INSPECTIONS</b>						
General Water Sampling and Stability Monitoring	long term general monitoring	year	1	Sabina	\$46,347.69	\$46,348
Waste Rock Piles		year		#N/A	\$0.00	\$0
Pit Walls		year		#N/A	\$0.00	\$0
WR GTC Monitoring		year		#N/A	\$0.00	\$0
Survey inspection		each		#N/A	\$0.00	\$0
Regulatory costs		each	1	RPTH	\$24,606.27	\$24,606
Site water monitoring		year		#N/A	\$0.00	\$0
- Active closure and flooding		each		#N/A	\$0.00	\$0
- Post pit flooding		each		#N/A	\$0.00	\$0
Wildlife Effects Monitoring Program (WEMP)		year		#N/A	\$0.00	\$0
Terrestrial Animal Monitoring		year		#N/A	\$0.00	\$0
Vegetation Monitoring		each		#N/A	\$0.00	\$0
Maintain gravel road surface		year		#N/A	\$0.00	\$0
Maintain airstrip surface		year		#N/A	\$0.00	\$0
Other - Site Access	Float plane access	each	1	MWH	\$11,195.85	\$11,196
<b>COVER MAINTENANCE</b>						
Repair erosion - infill gullies		allow		#N/A	\$0.00	\$0
Repair erosion - upgrade diversion ditches		allow		#N/A	\$0.00	\$0
Remove problem vegetation		allow		#N/A	\$0.00	\$0
Repair animal damage		allow		#N/A	\$0.00	\$0
Repair/upgrade access controls		allow		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
<b>SPILLWAY MAINTENANCE</b>						
Repair erosion		m3		#N/A	\$0.00	\$0
Clear spillway		each		#N/A	\$0.00	\$0
<b>CWTS MAINTENANCE</b>						
Maintain flow, restore vegetation		allow		#N/A	\$0.00	\$0
<b>POST-CLOSURE WATER TREATMENT</b>						
Annual water treatment cost, from "Water Treatment"		LS		#N/A	\$0.00	\$0
Subtotal, Annual post-closure costs						\$82,150
Discount rate for calculation of net present value of post-closure cost, %				0.00%		
Number of years of post-closure activity				See Long Term	years	
<b>Present Value of payment stream</b>						<b>\$739,348</b>

Annual Discount Rate:		0%			
Project Phase	Annual Discount Rate:	Closure Year	Post-Closure Monitoring Year	Long Term Monitoring (GTCs, physical, water)	
				One Time Cost	Yearly Total NPV
Operations	1				\$0
	2				\$0
	3				\$0
	4				\$0
	5				\$0
	6				\$0
	7				\$0
	8				\$0
	9				\$0
	10				\$0
	11				\$0
	12				\$0
Active Closure	13	1			\$0
	14	2			\$0
Passive Closure	15	3			\$0
	16	4			\$0
	17	5			\$0
	18	6			\$0
	19	7			\$0
	20	8			\$0
Post Closure	21	9	1	\$82,150	\$82,150
	22	10	2	\$82,150	\$82,150
	23	11	3	\$82,150	\$82,150
	24	12	4	\$82,150	\$82,150
	25	13	5	\$82,150	\$82,150
Beyond Post Closure	26	14	6		\$0
	27	15	7	\$82,150	\$82,150
	28	16	8		\$0
	29	17	9		\$0
	30	18	10	\$82,150	\$82,150
	31	19	11		\$0
	32	20	12		\$0
	33	21	13		\$0
	34	22	14		\$0
	35	23	15	\$82,150	\$82,150
	36	24	16		\$0
	37	25	17		\$0
	38	26	18		\$0
	39	27	19		\$0
	40	28	20		\$0
	41	29	21		\$0
	42	30	22		\$0
	43	31	23		\$0
	44	32	24		\$0
	45	33	25	\$82,150	\$82,150
<b>Net Present Value:</b>				<b>\$739,348</b>	

1 Mobilization/Demobilization:

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
<b>MOBILIZE HEAVY EQUIPMENT</b>						
Assumes mining equipment on abandoned mine site is operable and available.						
Light duty vehicles	Purchase pickups and Vans	each		#N/A	0	\$0
Telehandlers	Purchase (standby)	each		#N/A	0	\$0
Excavators	Purchase (320 Ex)	each		#N/A	0	\$0
Dump trucks	Purchase 30T	each		#N/A	0	\$0
Dozers	Purchase (D6T)	each		#N/A	0	\$0
Grader	Purchase (140M)	each		#N/A	0	\$0
Demolition shears	For a 320 Exc	each		#N/A	0	\$0
Crane	Purchase	each		#N/A	0	\$0
Loader	Purchase (966 Loader)	each		#N/A	0	\$0
Manlifts	Purchase (standby)	each		#N/A	0	\$0
Small Equipment		LS		#N/A	0	\$0
Compactor		each		#N/A	0	\$0
<b>MOBILIZE MISC. EQUIPMENT</b>						
Assumes mining equipment on abandoned mine site is operable and available.						
Pump shipping		each		#N/A	0	\$0
Pipe shipping		m		#N/A	0	\$0
Minor tools and equipment		allow		#N/A	0	\$0
Truck tires		allow		#N/A	0	\$0
Other				#N/A	0	\$0
<b>MOBILIZE CAMP</b>						
Build 20 Person Camp	Goose Closure Camp	LS	1	Sabina	\$22,304.82	\$22,305
Build 20 Person Power Plant	Goose Closure Camp	LS	1	Sabina	\$22,304.82	\$22,305
Reclamation activities		allow		#N/A	0	\$0
Long term reclamation activities (e.g. pump flooding)		allow		#N/A	0	\$0
<b>WORKER ACCOMODATIONS</b>						
Camp operation		mandays	12,000	Sabina	\$127.46	\$1,529,474
Reclamation activities		manmonths		#N/A	0	\$0
Long term reclamation activities (e.g. pump flooding)		manmonths		#N/A	0	\$0
<b>MOBILIZE FUEL</b>						
Fuel freight - reclamation activities		litre		#N/A	0	\$0
Fuel freight - long term reclamation activities		litre		#N/A	0	\$0
Oil & Other		litre		#N/A	0	\$0
Fuel freight accommodations		litre		#N/A	0	\$0
<b>GENERAL CONSTRUCTION INDIRECT</b>						
Tooling, consumables, office & safety supplies	covered in Summary tab indirects	mandays		#N/A	0	\$0
<b>DEMOBILIZE HEAVY EQUIPMENT</b>						
Excavators		km		#N/A	0	\$0
Dump trucks		km		#N/A	0	\$0
Dozers		km		#N/A	0	\$0
Demolition shears		km		#N/A	0	\$0
Crane		km		#N/A	0	\$0
Loader		km		#N/A	0	\$0
Compactor		each		#N/A	0	\$0
Light duty vehicles		km		#N/A	0	\$0
Other		km		#N/A	0	\$0
<b>DEMOBILIZE CAMP</b>						
Food and Freight		kg	27,600	Sabina	\$13.90	\$383,759
Freight		Lot	1	Sabina	\$579,346.09	\$579,346
Mobilization		tonnes	500	Sabina	\$1,738.04	\$869,019
<b>MOBILIZE &amp; DEMOBILIZE WORKERS</b>						
Crew travel time - inbound & outbound	16 manhours per rotation	manhours	6,864	lab-sh	\$61.02	\$418,866
Crew transportation - in& outbound from Yellowknife	28 day rotations - 12,000 man days - 2/3	each	286	Sabina	\$663.30	\$189,704
Crew transportation - in& outbound from south	28 day rotations - 12,000 man days - 1/3	each	143	Sabina	\$1,339.97	\$191,616
<b>WINTER ROAD</b>						
Construction and operation	Assumes construction and maintenance of 2-160 km winter ice roads; once during Active Closure and once in approximately Year 18.	km	320	WRCL	\$2,460.63	\$787,401
Limited winter use		km		#N/A	0	\$0
Winter road tariff		km		#N/A	0	\$0
					<b>Total</b>	<b>\$4,993,793</b>

Goose Gold Closure Component Estimating

															INFLATION		15.9%			
Code	Description	NOTES	EQUIPME T NUMBER	ESTIMATE SOURCE DOCUMENT	Qty	Unit of Measure	Unit Man hrs	Prod Fact	Labour			Const Equip Use		Other		Total				
									Total Man-hrs	Unit Cost	Total Cost	Unit Cost	Total Cost	Unit Cost	Total Cost	Unit Cost	Unit Cost (plus Inflation)	Total Cost	Total Cost (plus Inflation)	
<b>Open Pit Closure</b>																				
<b>Place Boulder Fence</b>																				
	Umwelt Open Pit	Updated for Modification Package		x	1,583	m	0.06	1.00	95	95	9,023	175.00	16,622		-	16	18.77	25,645	29,714	
	Echo open pit	Not in current mine plan: item remains to keep Stage in tact.		x	750	m	0.06	1.00	45	95	4,275	175.00	7,875		-	16	18.77	12,150	14,078	
	Goose open pit	Updated for Modification Package		x	2,340	m	0.06	1.00	140	95	13,338	175.00	24,570		-	16	18.77	37,908	43,924	
	Llama open pit	Updated for Modification Package: Perimeter only required where pit edge will not abut final flooded lake footprint. (i.e., 600 m total)		x	600	m	0.06	1.00	36	95	3,420	175.00	6,300		-	16	18.77	9,720	11,262	
<b>Remove Pump and Pipeline</b>																				
	Umwelt pit sump	Occurs during Operations		x	1,740	m	0.04	1.00	70	95	6,612	155.00	10,788		-	10.00	11.59	17,400	20,161	
	Llama pit sump	Occurs during Closure		x	2,850	m	0.04	1.00	114	95	10,830	155.00	17,670		-	10.00	11.59	28,500	33,023	
	Goose pit sump	Occurs during Operations		x	4,325	m	0.04	1.00	173	95	16,435	155.00	26,815		-	10.00	11.59	43,250	50,113	
	Echo pit sump	Updated for Supplementary Adjustments		x	2,820	m	0.04	1.00	113	95	10,716	155.00	17,484		-	10.00	11.59	28,200	32,675	
<b>Breach Pits into Receiving Waters</b>																				
	Umwelt open pit			x	1,200	m3	0.12	1.00	144		-	5.00	6,000		-	5.00	5.79	6,000	6,952	
	Llama open pit	Natural drainage connection		x	-	m3	0.12	1.00	-		-	5.00	-		-	-	-	-	-	
	Echo open pit	Natural drainage connection		x	-	m3	0.12	1.00	-		-	5.00	-		-	-	-	-	-	
	Goose open pit			x	600	m3	0.12	1.00	72		-	5.00	3,000		-	5.00	5.79	3,000	3,476	
	Landfill Mobile Equipment																			
	Goose Site Mobile Equipment			x	41	units	24.00	1.00	984	95	93,480	-	-		-	2,280	2,641.82	93,480	108,315	
<b>Underground Closure</b>																				
<b>Saline Water Pond (SWP) / WTP</b>																				
	Relocate pipeline to Umwelt UG from Llama UG	Not in current mine plan: cost remains to keep Stage in tact.		x	800	m	0.04	1.00	32	95	3,040	155.00	4,960		-	10.00	11.59	8,000	9,270	
	Dewater SWP to Umwelt UG	Accounts for Umwelt Underground (650 m), and Umwelt Underground Extension (650m to 900m)		x	1,071,225	m3	1.00	1.00	153	95	14,535	-	-	0.12	128,547	0.13	0.15	143,082	165,788	
	Decommission SWP to Umwelt UG pipeline	Accounts for Umwelt Underground (650 m), and Umwelt Underground Extension (650m to 900m)		x	1,662	m	0.04	1.00	66	95	6,316	155.00	10,304		-	10.00	11.59	16,620	19,257	
	Adjust pipeline to route to Llama UG	Not in current mine plan: cost remains to keep Stage in tact.		x	500	m	0.03	1.00	65	95	6,175	-	-	-	-	-	12.35	14.31	6,175	7,155
	Dewater SWP to Llama UG	Not in current mine plan: cost remains to keep Stage in tact.		x	324,234	m3	1.00	1.00	80	95	7,600	-	-	0.11	35,666	0.13	0.15	43,266	50,132	
	Adjust pipeline to route to Goose UG	Not in current mine plan: cost remains to keep Stage in tact.		x	4,500	m	0.04	1.00	230	95	21,850	155.00	35,650		-	-	-	57,500	66,255	
	Dewater SWP to Goose UG	Not in current mine plan: cost remains to keep Stage in tact.		x	391,630	m3	1.00	1.00	215	95	20,425	-	-	0.11	43,079	0.16	0.19	63,504	73,582	
	Decommission SWP to Goose UG pipelines	Not in current mine plan: cost remains to keep Stage in tact.		x	10,800	m	0.04	1.00	432	95	41,040	155.00	66,960		-	10.00	11.59	108,000	125,139	
	Breach SWP Diversion Berms and Containment Dams			x	430	m3	0.12	1.00	52		-	8.00	3,440		-	8.00	9.27	3,440	3,986	
	Decommission WTP-Goose Lake pipeline			x	1,140	m	0.04	1.00	46	95	4,332	155.00	7,068		-	10.00	11.59	11,400	13,209	
	Llama UG			x	2,700	m	0.04	1.00	108	95	10,260	155.00	16,740		-	10.00	11.59	27,000	31,285	
<b>Decommission pipeline</b>																				
	Umwelt portal			x	150	m3	0.05	1.00	8		-	6.00	900		-	6.00	6.95	900	1,043	
	Plug declines with waste rock			x	150	m3	0.05	1.00	8		-	6.00	900		-	6.00	6.95	900	1,043	
	Llama portal			x	150	m3	0.05	1.00	8		-	6.00	900		-	6.00	6.95	900	1,043	
	Plug declines with waste rock	Not in current mine plan: item remains to keep Stage in tact.		x	150	m3	0.05	1.00	8		-	6.00	900		-	6.00	6.95	900	1,043	
	Echo portal			x	150	m3	0.05	1.00	8		-	6.00	900		-	6.00	6.95	900	1,043	
	Plug declines with waste rock	Not in current mine plan: item remains to keep Stage in tact.		x	150	m3	0.05	1.00	8		-	6.00	900		-	6.00	6.95	900	1,043	
	Umwelt vent/circular backfill raises			x	1	LS	1.00	1.00	60		-	-	-		-	120.000	139.043	120.000	139.043	
	Plug vent raises with concrete plug			x	1	LS	1.00	1.00	60		-	-	-		-	50.000	57.935	50.000	57.935	
	Llama vent/circular backfill raises			x	1	LS	1.00	1.00	60		-	-	-		-	50.000	57.935	50.000	57.935	
	Plug vent raises with concrete plug	Not in current mine plan: item remains to keep Stage in tact.		x	1	LS	1.00	1.00	60		-	-	-		-	50.000	57.935	50.000	57.935	
	Echo vent/circular backfill raises			x	1	LS	1.00	1.00	60		-	-	-		-	50.000	57.935	50.000	57.935	
	Plug vent raises with concrete plug	Not in current mine plan: item remains to keep Stage in tact.		x	1	LS	1.00	1.00	60		-	-	-		-	50.000	57.935	50.000	57.935	
	Echo crown pillar			x	3,550	m3	0.05	1.00	178		-	6.00	21,300		-	6.00	6.95	21,300	24,680	
<b>Waste Rock Stockpiles and Landfills</b>																				
<b>WR Pile Closure</b>																				
	Cap and Slope WR Piles	Updated Waste Rock Volume cover allotment.		x	1,200,000	m3	0.06	1.00	72,000		-	6.00	7,200,000		-	###	##	6.95	7,200,000	8,342,584
<b>Landfill Closure</b>																				
	Cap and Reslope Landfills			x	25,000	m3	0.06	1.00	1,500		-	6.00	150,000		-	6.00	6.95	150,000	173,804	
<b>Water Management Structures</b>																				
<b>Llama Structures</b>																				
	Breach Llama Lake Diversion Berms			x	665	m3	0.06	1.00	43		-	7.30	4,855		-	7.30	8.46	4,855	5,625	
	Breach Llama WRSA Diversion Berm			x	95	m3	0.06	1.00	6		-	7.30	694		-	7.30	8.46	694	804	
	Breach Llama WRSA Containment Dam			x	95	m3	0.06	1.00	6		-	7.30	694		-	7.30	8.46	694	804	
	Decommission Llama pump and pipeline			x	700	m	0.04	1.00	52	95	4,940	155.00	8,060		-	18.57	21.52	13,000	15,063	
<b>Umwelt Structures</b>																				
	Breach Primary Pond Containment Dam			x	200	m3	0.06	1.00	13		-	7.30	1,460		-	7.30	8.46	1,460	1,692	
	Breach Umwelt WRSA Containment Dam	Berm has been removed from water management design		x	-	m3	0.06	1.00	-		-	7.30	-		-	-	-	-	-	
	Breach Umwelt WRSA Diversion Berm	Berm has been removed from water management design		x	-	m3	0.06	1.00	-		-	7.30	-		-	-	-	-	-	
	Remove Saline Water Pond pump and pipeline			x	10,800	m	0.04	1.00	462	95	43,890	155.00	71,610		-	10.69	12.39	115,500	133,829	
	Remove Primary pond pump and pipeline	Occurs during Operations		x	7,250	m	0.04	1.00	320	95	30,400	155.00	49,600		-	11.03	12.79	80,000	92,695	
<b>Echo Structures</b>																				
	Breach Echo WRSA Containment Dam	Not in current mine plan: item remains to keep Stage in tact.		x	190	m3	0.06	1.00	12		-	7.30	1,387		-	7.30	8.46	1,387	1,607	
	Breach Echo Diversion Berm (East and West)	Not in current mine plan: item remains to keep Stage in tact.		x	190	m3	0.06	1.00	12		-	7.30	1,387		-	7.30	8.46	1,387	1,607	
	Breach Echo WRSA Diversion Berm	Not in current mine plan: item remains to keep Stage in tact.		x	95	m3	0.06	1.00	6		-	7.30	694		-	7.30	8.46	694	804	
	Breach East Echo Containment Dam	Not in current mine plan: item remains to keep Stage in tact.		x	95	m3	0.06	1.00	6		-	7.30	694		-	7.30	8.46	694	804	
	Remove Echo WRSA Pond pump and pipeline	Not in current mine plan: item remains to keep Stage in tact.		x	2,400	m	0.04	1.00	96	95	9,120	155.00	14,880		-	10.00	11.59	24,000	27,809	
	Remove Echo NW pond pump and pipeline	Not in current mine plan: item remains to keep Stage in tact.		x	220	m	0.04	1.00	21	95	1,976	155.00	3,224		-	23.64	27.39	5,200	6,025	
<b>Goose Structures</b>																				
	Breach Goose Main Diversion Berm			x	95	m3	1.00	1.00	95		-	7.30	694		-	7.30	8.46	694	804	
<b>TSF Structures</b>																				
	Breach TSF Dam			x	11,000	m3	0.05	1.00	550		-	7.30	80,300		-	7.30	8.46	80,300	93,043	
	Breach TSF WRSA Diversion Berm			x	285	m3	0.05	1.00	14		-	7.30	2,081		-	7.30	8.46	2,081	2,411	
<b>Ore Stockpile Structures</b>																				
	Remove pump and pipeline			x	4,550	m	0.04	1.00	182	95	17,290	155.00	28,210		-	10.00	11.59	45,500	52,720	
	Breach Plant Site Pond Containment Dam			x	215	m3	0.06	1.00	13		-	7.30	1,570		-	7.30	8.46	1,570	1,819	

Buildings and Equipment																			
Disassembly - Goose Plant and Crusher																			
Dismantle Plant				x	6,464	m2	1.00	1.00	3,200	95	304,000	100.00	106,667	-	-	63.53	73.61	410,667	475,836
Dismantle Crushers				x	1,630	m2	1.00	1.00	800	95	76,000	100.00	26,667	-	-	62.99	72.98	102,667	118,959
Dismantle Power Plant				x	2,040	m2	1.00	1.00	1,000	95	95,000	100.00	33,333	-	-	62.91	72.89	128,333	148,699
Dismantle Emergency Power - Fuel				x	300	m2	1.00	1.00	150	95	14,250	100.00	5,000	-	-	64.17	74.35	19,250	22,305
Dismantle Fuel Storage and Distribution				x	1	Lot	1.00	1.00	1,200	95	114,000	100.00	40,000	-	-	154,000	178,439	154,000	178,439
Goose Admin Buildings																			
Demolish Truck Shop/Office				x	2,349	m2	1.00	1.00	1,000	95	95,000	100.00	33,333	-	-	54.62	63.29	128,333	148,699
Demolish Kitchen/Camp				x	1,980	m2	1.00	1.00	900	95	85,500	100.00	30,000	-	-	58.33	67.59	115,500	133,829
Demolish Cold Storage				x	840	m2	1.00	1.00	150	95	14,250	100.00	5,000	-	-	22.92	26.55	19,250	22,305
Demolish Waste/Waste Oil Storage				x	1	Lot	1.00	1.00	100	-	-	100.00	3,333	40,000	40,000	43,333	50,210	43,333	50,210
Remove Freight Storage				x	1	Lot	1.00	1.00	150	95	14,250	100.00	5,000	-	-	19.250	22,305	19,250	22,305
Demolish Water Treatment Plant				x	647	m2	3.00	1.00	100	95	9,500	100.00	3,333	-	-	19.84	22.98	12,833	14,870
Demolish Sewage Treatment Plant				x	1	Lot	1.00	1.00	90	95	8,550	100.00	3,000	-	-	11,550	13,383	11,550	13,383
MLA Infrastructure																			
Demolish Port Office				x	5	Units	12.00	1.00	60	95	5,700	100.00	6,000	-	-	2,340	2,711	11,700	13,557
Remove Pipelines				x	10,000	m	0.04	1.00	400	95	38,000	155.00	62,000	-	-	10.00	11.59	100,000	115,869
Demolish Incinerator and Waste Management				x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297	9,750	11,297
Demolish Warehouses				x	1	Lot	1.00	1.00	30	95	2,850	100.00	3,000	-	-	5,850	6,778	5,850	6,778
Dismantle Genset				x	1	Lot	1.00	1.00	150	95	14,250	100.00	15,000	-	-	29,250	33,892	29,250	33,892
Demolish Maintenance Shop				x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297	9,750	11,297
Demolish Water Storage				x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297	9,750	11,297
Demolish WTP/STP				x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297	9,750	11,297
Demolish camp/offices				x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297	9,750	11,297
Demolish freight storage area				x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297	9,750	11,297
Demolish hazardous waste Area				x	1	Lot	1.00	1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297	9,750	11,297
Dismantle Fuel Storage	Includes MLA Fuel Storage area (60ML), and MLA Fuel Transfer Storage Area (0.5 ML)			x	1	Lot	1.00	1.00	1,728	95	164,160	100.00	57,600	-	-	221,760	256,952	221,760	256,952
Goose Closure Camp																			
Build 20 Person Camp				x	1	Lot	1.00	1.00	150	95	14,250	100.00	5,000	-	-	19,250	22,305	19,250	22,305
Build 20 Person Power Plant				x	1	Lot	1.00	1.00	150	95	14,250	100.00	5,000	-	-	19,250	22,305	19,250	22,305
Camp Operation	Over 13 years of Closure and Post-Closure			x	12,000	Man Days	1.00	1.00	-	-	-	-	-	110	1,320,000	110	127	1,320,000	1,529,474
Roads and Airstrips																			
Main Haul road																			
Maintain Road Surface				x	13	Yr	70.00	1.00	910	95	86,450	100.00	91,000	-	-	13,650	15,816	177,450	205,610
Restore Drainage	Remove Culverts			x	1,488	m3	0.06	1.00	89	-	-	11.00	16,368	-	-	11.00	12.75	16,368	18,965
Airstrips																			
Maintain Airstrip Surface				x	13	Yr	20.00	1.00	260	95	24,700	100.00	26,000	-	-	3,900	4,519	50,700	58,746
Restore Drainage	Updated for Modification Package			x	1,360	m3	0.06	1.00	82	-	-	12.00	16,320	-	-	12.00	13.90	16,320	18,910
Water Treatment																			
WTP Pipelines and Treatment Plant																			
Pump water from TSF to WTP	No treatment required during Closure; Maximum PAG Exposure in Year 2. Potential Water Treatment in this year at TSF with 2.1 Mm3 over 3 years.			x	2,100,000	m3		1.00	-	-	-	-	-	0	231,000	0.11	0.13	231,000	267,658
Treat water from TSF in WTP				x	2,100,000	m3		1.00	1,916	-	-	-	-	0	735,000	0.35	0.41	735,000	851,639
Pump water out of WTP				x	2,100,000	m3		1.00	-	-	-	-	-	0	231,000	0.11	0.13	231,000	267,658
Decommission WTP pump and pipeline				x	6,700	m	0.04	1.00	292	95	27,740	155.00	45,260	-	-	10.90	12.63	73,000	84,585
Decommission WTP pump and return pipeline				x	820	m	0.04	1.00	57	95	5,396	155.00	8,804	-	-	17.32	20.07	14,200	16,453
Decommission WTP				x	1	Lot		1.00	50	95	4,750	100.00	5,000	-	-	9,750	11,297	9,750	11,297
Contaminated Soil																			
Site-wide Investigation																			
Site Investigation to estimate quantity of contaminated soil	Testpit program with excavator in all parking, fuel storage, washbays truck and maintenance shops and generator areas.			x	1	Lot	1.00	1.00	-	-	-	-	-	50,000	50,000	57,935	50,000	57,935	
Treatment																			
Transport contaminated soil				x	10,000	m3	0.05	1.00	500	-	-	7.30	73,000	-	-	7.30	8.46	73,000	84,585
Separation plant	Purchase separation equipment			x	1	Lot	1.00	1.00	-	-	-	-	-	100,000	100,000	115,869	100,000	115,869	
Closure / Post-Closure Monitoring																			
Geotechnical Inspections																			
TSF embankments				x	8	Units	20.00	1.00	160	-	-	-	-	10,000	80,000	10,000	11,587	80,000	92,695
WR piles				x	13	Units	20.00	1.00	260	-	-	-	-	8,300	107,900	8,300	9,617	107,900	125,023
Pit walls				x	13	Units	20.00	1.00	260	-	-	-	-	4,000	52,000	4,000	4,635	52,000	60,252
Ground Temperature Monitoring																			
Umwelt WRSA GTC Monitoring after Closure	Monthly			x	13	Years	24.00	1.00	312	200	62,400	-	-	-	-	4,800	5,562	62,400	72,302
Llama WRSA GTC Monitoring after Closure	Monthly			x	13	Years	24.00	1.00	312	200	62,400	-	-	-	-	4,800	5,562	62,400	72,302
TSF WRSA GTC Monitoring after Closure	Monthly			x	13	Years	24.00	1.00	312	200	62,400	-	-	-	-	4,800	5,562	62,400	72,302
WQ Monitoring - Closure																			
Llama pit	Depends on Breach			x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321	14,820	17,172
Llama WR Pile				x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321	14,820	17,172
Umwelt pit	Depends on Breach			x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321	14,820	17,172
Umwelt WR Pile				x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321	14,820	17,172
Echo pit	Depends on Breach			x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321	14,820	17,172
Echo WR pile				x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321	14,820	17,172
Goose pit	Depends on Breach			x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321	14,820	17,172
TSF WR Pile				x	13	Years	12.00	1.00	156	95	14,820	-	-	-	-	1,140	1,321	14,820	17,172
Aquatic Effects monitoring																			
Aquatic effects monitoring	Non-contact Water Basins			x	10	Years	60.00	1.00	600	80	48,000	-	-	-	-	4,800	5,562	48,000	55,617
Terrestrial Animal Monitoring																			
Terrestrial Animal Monitoring				x	10	Years	300.00	1.00	3,000	80	240,000	-	-	-	-	24,000	27,809	240,000	278,086
Total Direct Costs																			
CONSTRUCTION INDIRECTS																			
Freight & Transport																			
Food & Freight	Total Mandays factored			x	27,600	kg		1.00	-	-	-	-	-	12	331,200	12	13.90	331,200	383,759
Freight	Rental equip, offices, etc..			x	1	Lot	-	1.00	-	-	-	-	-	500,000	500,000	579,346	500,000	579,346	
Mobilization				x	500	Tonnes								1,500	750,000	1,500	1,738	750,000	869,019
General Construction Indirects																			
Site Services Labour				x	16,000	HRS	1.00	1.00	16,000	65	1,040,000	-	-	-	-	65.00	75.31	1,040,000	1,205,040
Accommodations & Travel																			
Camp Accommodations/Operation				x	12,000	Man Days	1.00	1.00	-	-	-	-	-	110	1,320,000	110	127	1,320,000	1,529,474
Airfare & Transportation				x	429	Each	-	1.00	-	-	-	-	-	572	245,583	572	663	245,583	284,556
Contractor Profit																			
Total Component Estimate																		18,576,354	21,524,276

Unit Cost Table (for refining unit costs see "Estimator" worksheet)

Filter by unit

Inflation 2020 to 2026:	10.6%
Inflation 2017 to 2026:	15.9%
Inflation 2014 to 2026:	23.0%

ITEM	Detail	COST CODE	UNITS	LOW \$	HIGH \$	SPECIFIED \$	COMMENTS
<b>Accommodation</b>							
		ACCM	manday	123.03	215.30	-	
<b>Buildings - Decontaminate</b>							
	Asbestos	BDA	m2	31.50	62.99	-	Low: removal of asbestos siding & flooring; High: removal of insulated pipes, friable asbestos
<b>Buildings - Remove</b>							
	Wood	BRW	m2	33.83	50.44	-	
	Concrete	BRC	m2	49.21	79.97	7.38	Specified: puncture concrete foundation slabs
	Steel - teardown	BRS1	m2	55.36	79.97	-	
	Steel - for salvage	BRS2	m2	82.43	123.03	-	
<b>Concrete work</b>							
	Small pour	CSF	m3	524.73	787.09	-	Low: YK; High=1.5xLow
	Large pour	CLF	m3	434.92	652.37	2,620.57	Specified: concrete crown pillar
<b>Contaminated Soils</b>							
	ESA Phase 1	CS1	each	9,227.35	-	-	Low: small, "clean" site
	ESA Phase 1	CS2	each	61,515.66	-	-	Low: small, "clean" site
	Remediate on site	CSR	m3	57.82	179.63	-	
<b>Dozing</b>							
	doze rock piles	DR	m3	1.29	2.95	-	Low cost: doze crest off dump
	doze overburden/soil piles	DS	m3	1.17	4.68	-	High cost: push up to 300 m
<b>Excavate Rock; Low Spec's and QA/QC</b>							
	drill/blast/load/short haul	RB1	m3	14.03	20.98	-	Low:quarry operations for bulk fill
	drill/blast/load/long haul	RB2	m3	14.83	21.90	-	
	RB1 + spread and compact	RB3	m3	14.83	21.90	-	
	RB2 + spread and compact	RB4	m3	15.38	37.83	-	
	Specified activity	RBS	m3	-	-	8.11	
<b>Excavate Rock; High Spec's and QA/QC</b>							
	drill/blast/load/short haul	RC1	m3	14.83	21.90	-	(e.g. ditch/spillway excavation)
	drill/blast/load/long haul	RC2	m3	15.62	22.64	-	Low:foundation excavation;High:spillway excavation
	RC1 + spread and compact	RC3	m3	15.62	22.64	-	e.g. cover construction
	RC2 + spread and compact	RC4	m3	16.61	23.62	-	e.g. cover construction
	Specified activity	RCS	m3	-	-	215.30	Specified-drift excavation
<b>Excavate Rip Rap</b>							
	drill/blast/load/short haul/place	RR1	m3	16.61	21.84	-	High: quarry & place rip rap in channel
	drill/blast/load/long haul/place	RR2	m3	17.47	25.41	-	
	source is waste dump/short haul	RR3	m3	8.61	-	-	cost includes sorting
	source is waste dump/long haul	RR4	m3	9.35	-	-	
	Specified activity	RRS	m3	-	-	-	
<b>Excavate Soil; Low Spec's and QA/QC</b>							
	clear & grub	SBC	m2	4.18	6.15	-	
	excavate/load/short haul	SB1	m3	5.29	7.26	-	
	excavate/load/long haul	SB2	m3	5.66	8.98	-	
	SB1 + spread and compact	SB3	m3	6.27	10.95	-	Low: non-engineered; High:engineered
	SB2 + spread and compact	SB4	m3	6.77	13.53	-	Low: non-engineered; High:engineered
	Specified activity	SBS	m3	3.94	7.75	-	Low: rehandle waste rock dump by dozing; High:rehandle waste rock by hauling
	Tailings	SBT	m3	1.66	4.55	19.07	High:contour surface - wet or frozen; Specified:haul/place wet infill
<b>Excavate Soil, High Spec's and QA/QC</b>							
	excavate/load/short haul	SC1	m3	8.37	11.44	-	
	excavate/load/long haul	SC2	m3	8.74	14.46	-	
	SC1 + spread and compact	SC3	m3	10.95	17.47	-	Low: non-engineered; High:engineered
	SC2 + spread and compact	SC4	m3	11.44	28.54	-	Low: non-engineered; High:engineered (e.g. complex covers, low volume dam construction)
	Specified activity	SCS	m3	-	-	23.13	Backfill adit with waste rock
<b>Fence</b>							
		FNC	m	16.67	249.75	-	
<b>Fuel and Electricity</b>							
	Fuel cost - gas	FCG	litre	1.29	1.72	-	
	Fuel cost - diesel	FCD	litre	1.22	1.71	-	
	Fuel mobilization	FCM	litre	0.27	0.52	-	High: winter road usage
	Electricity	FCE	kW-h	0.21	0.23	0.60	Low and High:Yellowknife; Specified:diesel generator
<b>Geo-Synthetics</b>							
	geotextile	GST	m2	4.23	-	-	Supply and install
	geogrid	GSG	m2	7.07	-	-	
	liner, HDPE	GSHDPE	m2	9.78	-	-	Supply and install; large quantity
	liner, ES3	GSES3	m2	24.85	-	-	FOB Yellowknife
	geosynthetic installation	GSI	m2	3.89	17.22	-	Low:geotextile; High:ES3 or HDPE
	bentonite soil ammendment	GSBA	tonne	379.31	428.76	-	FOB Edmonton, add shipping & mixing
<b>Grouting (/m3 of rock grouted)</b>							
		grout	m3	291.03	352.79	-	High: cement, FOB Yellowknife
<b>Labour &amp; Equipment Rates</b>							
	Site manager	sman	\$/hr	153.79	187.01	-	
	Supervisor	super	\$/hr	63.98	112.99	-	
	Registered engineer	eng	\$/hr	116.88	270.67	-	
	Environmental coordinator	envco	\$/hr	91.24	159.94	-	
	Environmental technologist	envtech	\$/hr	44.29	-	-	
	Electrician	elec	\$/hr	91.04	116.88	-	
	Journeyman - various	journey	\$/hr	54.13	88.32	-	
	Labour - skilled	lab-s	\$/hr	50.44	61.02	-	
	Labour - unskilled	lab-us	\$/hr	38.14	54.11	-	
	Equipment operator	oper	\$/hr	50.44	79.97	-	
	Heavy duty mechanic	mech	\$/hr	60.29	89.63	-	
	Water treatment plant operator	oper-wt	\$/hr	50.44	73.65	-	
	Security / first aid	safety	\$/hr	44.29	82.39	-	
	Administrative staff	admin	\$/hr	46.75	71.22	-	

**Unit Cost Table (for refining unit costs see "Estimator" worksheet)**

Filter by unit

Inflation 2020 to 2026:	10.6%
Inflation 2017 to 2026:	15.9%
Inflation 2014 to 2026:	23.0%

ITEM	Detail	COST CODE	UNITS	LOW \$	HIGH \$	SPECIFIED \$	COMMENTS
Equipment rates include operator and fuel							
	Loader - 4 cu.yd (3.06m3)	load-s	\$/hr	215.30	-	-	
	Loader - 7 cu.yd (5.35m3)	load-l	\$/hr	387.55	-	-	
	Excavator - 26.76-30.84 tonnes	exc-s	\$/hr	233.76	-	-	
	Excavator - 68.95+tonnes	exc-l	\$/hr	516.73	-	-	
	Grader	grad	\$/hr	233.76	-	-	
	Dump truck off hwy 30-50 tonnes	truck-s	\$/hr	276.82	-	-	
	Dump truck off hwy 55-75 tonnes	truck-l	\$/hr	369.09	-	-	
	dozer, small	dozer-s	\$/hr	252.21	319.88	-	
	dozer, large	dozerl	\$/hr	602.85	695.13	-	
	smooth drum compactor	comp	\$/hr	190.70	-	-	
	scooptram, 6 yd3 bucket	scoop	\$/hr	209.15	-	-	
	flat bed truck with hiab	hiab	\$/hr	190.70	-	-	
	fuel truck	ftruck	\$/hr	184.55	-	-	
	water truck	wtruck	\$/hr	71.36	184.55	-	
<b>Mobilize Heavy Equipment</b>							
	Road access	MHER	kmtonne	4.18	12.61	-	
	Air access	MHEA	kmtonne	14.76	-	-	cargo rate>500lb
<b>Mobilize Camp</b>							
	Road access	MCR	each	61,515.66	-	-	refurbish existing camp
<b>Mobilize Workers</b>							
	flight	MW	each	5,536.41	11,195.85	-	Low:e.g. 8 passenger; High: Dash 7
<b>Oil Removal</b>							
	oil removal	OR	litre	0.53	1.48	-	Low:waste oil heater; High: ship offsite
<b>PCB Removal</b>							
	Remove from site	PCBR	litre	49.46	57.70	-	Low: shipping, handling & disposal from Yellowknife
<b>Pipes, small (&lt;6in dia.)</b>							
	remove/dispose on site	PSR	m	1.23	29.53	-	Low: remove/dispose on site; High: remove/re-use
	supply	PSS	m	7.50	13.66	-	Low:supply; High:supply and ship
	install	PSI	m	30.76	-	-	
<b>Pipes, large (&gt;6in dia.)</b>							
	remove/dispose on site	PLR	m	27.07	88.58	-	Low: remove/dispose on site; High: remove/re-use
	supply	PLS	m	158.71	175.93	-	Low:supply; High:supply and ship
	install	PLI	m	61.52	-	-	
<b>Power Lines</b>							
	remove/dispose on site	POWR	m	31.37	-	-	
<b>Process Chemicals</b>							
	Remove from site	PCR	kg	0.55	3.08	-	Low: shipping, handling & disposal from Yellowknife
<b>Pumps</b>							
	Pump capital cost	PC	each	239,911.09	-	-	
	Pump shipping	PS	each	3,075.78	-	-	
	Pump operating cost	POC	m3	0.15	-	-	pump operating costs should be calculated based on pump capacity, fuel costs, etc.
	Pump maintenance	PM	allow	30,757.83	-	-	
<b>Pump sand BackFill</b>							
		PBF	m3	104.58	369.09	-	
<b>Scarify - road/mine site</b>							
		SCFY	ha	5,290.35	7,418.79	2,645.17	
<b>Shaft, Raise &amp; Portal Closures</b>							
	Shaft & Raises	SR	m2	793.55	2,623.03	-	Low:pre-cast concrete slabs, little site prep. Area=shaft+>1m all around
	Portals	POR	m3	23.13	307.58	1,476.38	Low:unit cost code SCS;High:excavate & backfill collapsed portal;Spec: installed pressure plug
<b>Site Inspection Report</b>							
		RPT	each	12,303.13	24,606.27	-	
<b>SpillWay - Clear</b>							
		SW	each	3,690.94	8,612.19	-	
<b>Survey/Instrumentation</b>							
		SI	each	2,214.56	4,429.13	-	2 person crew
<b>Treatment Plant - Construct</b>							
	Small (< 1000 m3/d)	TPS	lump sum	11,072,819.64	18,454,699.41	-	
	Large (> 1000 m3/d)	TPL	lump sum	18,454,699.41	56,594,411.52	-	
	Constructed Wetland	CWTS	ha	246,062.66	369,093.99	-	
<b>Treatment Plant - Operate</b>							
		TPO	m3	0.43	2.46	-	
<b>Treatment Chemicals</b>							
	ferric sulphate	ferric	kg	1.46	-	-	
	ferrous sulphate	ferrous	kg	1.62	-	-	
	lime	lime	kg	0.69	-	-	
	hydrogen peroxide, 35%	hperox	kg	1.85	-	-	
	Sodium Metabisulfate	Nametab	kg	1.45	-	-	
	Caustic soda, 50%	caustic	kg	0.91	-	-	
	Sulfuric acid, 93%	sulfuric	kg	0.38	-	-	
	flocculant	flocc	kg	7.38	-	-	
	copper sulphate	copper	kg	-	-	-	
	shipping	shipping	kg	0.25	-	-	
<b>Vegetation</b>							
	Hydroseed, Flat	VHF	ha	4,921.25	-	-	
	Hydroseed, Sloped	VHS	ha	5,536.41	-	-	
	Veg. blanket/erosion mat	VB	ha	15,994.07	-	-	
	Tree planting	VT	ha	3,198.81	7,381.88	-	
	Wetland species	VW	ha	-	-	58.71	Specified= /m3, Wetland Growth Media Substrate mixed and installed (sand, biochar and fertilizer, woodchips)
<b>Water Sampling/Analysis/Reporting</b>							
		WS	each	8,612.19	12,303.13	-	
<b>Winter Road</b>							
	Construction	WRC	km	2,460.63	14,148.60	-	
	Usage	WRU	kmtonne	0.36	-	-	

**Unit Cost Table (for refining unit costs see "Estimator" worksheet)**

Filter by unit

Inflation 2020 to 2026:	10.6%
Inflation 2017 to 2026:	15.9%
Inflation 2014 to 2026:	23.0%

ITEM	Detail	COST CODE	UNITS	LOW \$	HIGH \$	SPECIFIED \$	COMMENTS
<b>Sabina Specific Costs</b>							
<i>OP Tab</i>	Signs		each	86.90			
<i>OP Tab</i>	Block roads		allow	5,793.46			
<i>OP Tab</i>	Conduct stability and setback study		allow	19,697.77			
<i>UG Tab</i>	Remove misc. haz. mat & explosives		kg	57.93			
<i>UG Tab</i>	Assess underground stability		each	11,586.92			
<i>Bldgs &amp; Equip Tab</i>	Decontaminate and dispose on-site		allow	23,173.84			
	Remove Buildings - WIR						
<i>Bldgs &amp; Equip Tab</i>	Service/Emergency Camps, total of 3 1-ha area for 3 camps; assume all structures will be soruno structures.		LS	82,933.79			Added during 2020 Mod Package.
<i>Chemicals Tab</i>	Contam. soil investigation - Phase 1		allow	8,690.19			
<i>Chemicals Tab</i>	Operate landfarm		allow	57,934.61			
<i>WM Tab</i>	Remove Liner from all berms		m2	0.81			
<i>WM Tab</i>	Decommission reclaim barge from Llana TF		LS	11,586.92			
<i>WT Tab</i>	Treat water in WTP		m3	0.75			
<i>ICM Tab</i>	misc. supplies		allow	23,173.84			
<i>PostClosure Tab</i>	Regulatory costs		year	28,967.30			
<i>PostClosure Tab</i>	General Water Sampling and Stability Monitoring		year	46,347.69			