BACK RIVER PROJECT
Tailings Management Plan

April 2022

BACK RIVER PROJECT
TAILINGS MANAGEMENT PLAN

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Revision Log

Date	Section	Page	Revision
November 2015	All	All	Supporting Document for Final Environmental Impact Statement; submitted to Nunavut Impact Review Board (NIRB).
October 2017	All	All	Supporting Document for Type A Water Licence Application; submitted to Nunavut Water Board (NWB).
November 2020	All	All	Revisions to address requirements and commitments of Project Certificate, No. 007, and Water Licence, 2AM-BRP1831 and updated to reflect Type A Water Licence Amendment Application to the NWB.
April 2022	1; 2.1; References		Revisions to addresses commitment made during the technical review of the amendment application for Water Licence 2AM-BRP1831 to include a section on additional approved development analogous to other Back River management plans.

Acronyms

ARD	acid rock drainage
CDA	Canadian Dam Association
FEIS	Final Environmental Impact Statement
GCL	geosynthetic clay liner
HDPE	high-density polyethylene
ICRP	Interim Closure and Reclamation Plan
MAC	Mining Association of Canada
MDMER	Metal and Diamond Mining Effluent Regulations
ML	metal leaching
Mt	million tonnes
NIRB	Nunavut Impact Review Board
NPAG	non-potentially acid generating
NWB	Nunavut Water Board
OMS	Operation, Maintenance, and Surveillance
PAG	potentially acid generating
PGA	peak ground accelerations
Project	Back River Project
ROM	run-of-mine
Sabina	Sabina Gold & Silver Corp.
TF	Tailings Facility
TMP or Plan	Tailings Management Plan
TSF	Tailings Storage Facility
TSM	Towards Sustainable Mining
WRSA	Waste Rock Storage Area

Executive Summary

This Tailings Management Plan describes Sabina's approach to managing tailings that will be produced in the development and operation of the Project. The main environmental concerns related to tailings storage are the potential for dust to spread to the surrounding land and water, as well as potential effects of runoff and seepage on local water quality. This plan ensures that: 1) potential adverse environmental effects are identified and promptly mitigated 2) mitigation measures are proven successful, and 3) relevant laws and regulations are complied with. This plan does not address discharge from the tailings storage facilities which will occur at Project Closure; those activities are addressed in other plans.

Uyaraktaqnikut Aulatauni Parnaut (TMP) Ataniqnut Nainaqhimayuq

Una parnaut unniqtuqtai Sabina-kut pityuhi aulaninut kuviraqvit hanayauyukhat atuqtitlugu tamna pivaliatitni aulatauni taphuma Havaguhia. Tamna aturniqhaq avatiliqutit piyai turangani kuviraqviknut tutqumavia atuqtitlugu una pivikha pityutaulat puyuqnut hiamaknia avatigiyainut nunat immatlu tapkualuttauq aktualaqni kuukviunit maqinitlu nunagiyaini imaq nakuunai. Una parnaut hugiangitai kuvititauni talvanga kuviraqviuyuq tutqumavik havagutai tapkuat atuqniat talvani Havaguhia Umikniq; tahapkuat huliniit hugiaqtauyut ahiini parnautit. Una Parnaut atuqpiaqtai tapkuat 1) ihuityutaulat avatiliqutinut aktuanit naunaiqtauyut qilamiklu ihuaqhigiaqtauyut 2) ihuaqhigiaqni piyauyut naunaiqtauyutlu atuttiaqni tamnalu 3) turangayut maligait maligauyutlu katitauyut tapkununga.

TMP ᐃᓯᒪᑕᐅᓂᕐᓂᑦ ᓇᐃᓈᖅᓯᒪᔪᖅ

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1. Introduction

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

The Project is comprised of two main areas with interconnecting winter ice roads; the Goose Property and the Marine Laydown Area (MLA). The majority of annual Project resupply will be completed via sealift using the MLA situated along the western shore of southern Bathurst Inlet, which is connected seasonally to Goose Property by an approximately 160-km long Winter Ice Road. Both the Goose Property and the MLA make use of a local networks of all-weather roads.

The Tailings Management Plan (Plan or TMP) outlines the approach for managing and monitoring tailings produced at the Goose Property. No tailings will be generated at the MLA.

The Plan has been constructed in consideration of all applicable guidelines and requirements, including those of the Type A Water Licence, 2AM-BRP1831, and Project Certificate, No. 007 as well as the Metal and Diamond Mining Effluent Regulations (MDMER). This Plan revision specifically addresses commitments made during the technical review of the amendment application for Water Licence 2AM-BRP1831. This plan will be reviewed and updated as needed to reflect changes in regulatory requirements, facility operation and/or technology, approach, monitoring results, management reviews, incident investigations, best practice updates or other Project specific protocols.

Any updates to this plan will be filed with the Nunavut Water Board (NWB) and the Nunavut Impact Review Board (NIRB) as per the requirements of the Project Certificate, No. 007 and Water Licence, 2AM-BRP1831.

It should be noted that the scope of this plan prescribed by the NWB overlaps with the scope and content of a future Operation, Maintenance, and Surveillance (OMS) Manual that Sabina will develop as a member of the Mining Association of Canada (MAC) and in consideration of the requirements of the International Cyanide Management Code. It is Sabina's preference to replace this plan with a future OMS Manual that is compliant with MAC requirements as well as any relevant requirements of the Type A Water Licence, 2AM-BRP1831. This future OMS Manual will be provided 60 days prior to operation of any tailings management facility.

2. Scope and Objectives

This Plan is one of the documents that forms part of Sabina's overall Waste Management Program developed for the Project. This plan describes Sabina's approach to managing tailings that will be produced in the development and operation of the Project. This Plan includes details on the Back River Projects Tailings Management Facilities. This Plan includes where and how tailings will be stored and managed, tailings characteristics, and details related to the design, operation, closure, and monitoring. This runoff and associated monitoring are addressed in Sabina's Water Management Plan and closure approach is addressed in Sabina's Closure and Reclamation Plan.

The Plan applies to the Construction and Operations phases of the Project during which time tailings will be produced and has relevance to the Closure/Post-Closure phases as tailings will be permanently disposed of on the Property. The purpose of the Plan is to document the tailings management approach for the Project so that potential adverse environmental effects are identified and promptly mitigated, mitigation measures are proven successful, and relevant laws and regulations are complied with. Closure and reclamation of the tailings management facilities are addressed in detail in the Interim Closure and Reclamation Plan (ICRP).

The main environmental concerns related to tailings storage are the potential for dust to spread to the surrounding land and water, as well as potential effects of runoff and seepage on local water quality. The measures identified in this plan are intended to protect groundwater and permafrost, and the Project's Valued Ecosystem Components including air quality, surface water, water quality, sediment quality, aquatic habitat, fish, migratory birds, and terrestrial mammals.

2.1 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 and approved by NIRB, 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, NIRB's 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, dated 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:

- Llama Underground;
- Goose Main Underground;
- Tailings Storage Facility (TSF);
- Any associated Underground laydown pads, water pumps and pipelines;
- All associated water or tailings pumps and pipelines, and diversion berms and ponds, including but not limited to:

- Umwelt WRSA Containment Dam; Umwelt WRSA Diversion Berm;
- Saline Water Pond Diversion Berm; Saline Water Pond East Containment Dam;
- West Llama Reservoir Diversion Berm; East Llama Reservoir Diversion Berm; South-West Llama Reservoir Diversion Berm, South Llama Reservoir Diversion Berm; Llama WRSA Diversion Channel; and
- Ore Stockpile Diversion Berm; Tailings Storage Facility (TSF) WRSA Pond.

Should Sabina choose to reintegrate any of these components into the mine plan 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.

2.2 RELATED PLANS AND STUDIES

This Plan is to be implemented in conjunction with various other Sabina management, mitigation, and monitoring plans. Plans that have relevance to this Plan include:

- Environmental Management and Protection Plan;
- Water Management Plan;
- Waste Rock Management Plan;
- Interim Closure and Reclamation Plan;
- Aquatic Effects Management Plan;
- Air Quality Monitoring and Management Plan; and
- Thermal and Geotechnical Monitoring Plan (*in prep.)*.

The following reports and studies have also informed the development of this Plan:

- Tailings Management System Design Report (Sabina 2017a, Appendix F-4);
- Waste Rock Storage Area (WRSA) Design Report (Sabina 2017a, Appendix F-3);
- Geochemical Characterization Report (Sabina 2017a, Appendix E-3);
- Water and Load Balance Report (Sabina 2017a, Appendix E-2);
- Site Wide Water Management Report (Sabina 2017a, Appendix F-1);
- Multiple Accounts Analysis, submitted during FEIS Information Requests (Sabina 2016);
- Back River Project: Considering Climate Change in Tailings Storage Facility and Waste Rock Storage Areas Closure Strategy (Sabina 2017b, Appendix V4-3D); and
- Peer Review of the Back River Project Waste Rock and Tailings Closure Strategy (Sabina 2017b, Appendix V4-3E).

This plan is based on the tailings management system design report submitted as part of the Water Licence submission package (Sabina 2017a, Appendix F-4), which includes the following design details:

- Site Description, including topography, geology, climate, permafrost, hydrology, hydrogeology, and seismicity;

- Tailings Management System Concept, including storage requirements, and tailings physical and geochemical properties;
- TSF Containment Dam Design Criteria, including dam hazard classification, design life, tailings beach slope, stability criteria, inflow design flood, wave run-up, and freeboard and earthquake design;
- TSF Containment Dam Design, including foundation conditions, containment concept, geomembrane liner choice, and containment dam geometry;
- TSF Containment Dam components, including construction material specifications, seepage collection, and monitoring instrumentation;
- TSF Design Studies and considerations, including stability analysis, seepage analysis, thermal analysis, consolidation analysis, settlement, deformation (creep), dam break, and TSF water balance;
- Construction of TSF Containment Dam and South Dyke, including equipment, scheduling, material quantities and material geochemistry;
- Operation of the TSF and mined-out open pits used as TF, including a tailings deposition plan for the TSF; and
- Closure and reclamation of the Tailings Management Facilities.

3. Applicable Legislation and Guidelines

The TMP has been prepared to comply with existing regulations and follow the applicable guidelines provided by the federal government and the Government of Nunavut. The applicable regulations include:

- *Fisheries Act* (1985), including the *Metal and Diamond Mining Effluent Regulations* (SOR/2002-22);
- *Nunavut Environmental Protection Act* (1988);
- *Nunavut Land Claim Agreement Act* (1993);
- *Nunavut Waters and Nunavut Surface Rights Tribunal Act*, S.C. 2002, c 10 (Canada 2002); and
- *Nunavut Waters Regulations* (2013).

The Project is also bound by the requirements of Project Certificate, No. 007 and Type A Water Licence, 2AM-BRP1831.

In addition, Sabina commits to meeting the requirements of the Towards Sustainable Mining (TSM) Initiative. A component of the TSM Initiative is adherence to the TSM Tailings Management Protocol, which includes the following elements:

- Development of a tailings management policy and commitment (either as a stand-alone policy or as part of an overall environmental policy);
- Development of a tailings management system;
- Assignment of accountability and responsibility for tailings management;
- Conducting an annual tailings management inspection; and
- Preparation of an OMS Manual.

Sabina will also refer to the following Guidance Documents during Project development:

- TSM Tailings Management Protocol (MAC 2019a);
- A Guide to the Management of Tailings Facilities (MAC 2019b);
- A Guide to Audit and Assessment of Tailings Facility Management (MAC 2011c);
- 2013 Canadian Dam Safety Guidelines (Canadian Dam Association [CDA] 2013);
- 2014 Application of Dam Safety Guidelines to Mining Dams (CDA 2014); and
- Developing an Operation, Maintenance, and Surveillance Manual for Tailings and Water Management Facilities (MAC 2011d).

4. Roles and Responsibilities

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

The General Manager along with his/her direct reports is responsible for specifics of this Plan including:

- Overall management and execution of the Plan;
- Operational aspects; and
- Internal reporting.

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

- Monitoring;
- External reporting; and
- Verifying compliance and adaptive management.

Further definition of the site management structure, organizational chart, and a list of designated personnel responsible for aspects of this Plan will be provided in future revisions of the Plan or a replacement OMS Manual in compliance with MAC requirements.

5. Planning and Implementation

5.1 TAILINGS PRODUCTION AND STORAGE

Approximately 18.7 Mt of tailings will be produced over the 15-year LOM. All tailings will be deposited as slurry. Initially, tailings will be deposited in the Echo TF, then transition to Umwelt Open Pit and Llama Open Pit once mining operations have ceased in each location (called Umwelt TF and Llama TF, respectively). The Operations Phase is described in three stages according to the tailings storage and water management plans, as follows:

- Echo Tailings Facility (Echo TF) – For the first two years of Operations (Years 1 to 2), the mined-out Echo Open Pit will be used for tailings deposition;
- Umwelt Tailings Facility (Umwelt TF) – From Years 2 to 6, the mined-out Umwelt Open Pit will be used for tailings deposition;
- Llama Tailings Facility (Llama TF) – From Year 7 onward, tailings will be disposed of in the mined-out Llama Open Pit.

The Echo TF will be covered with waste rock and overburden material once tailings deposition is complete. Water covers with a minimum water depth of 5 m will be used for closure of the Umwelt TF and Llama TF.

Table 5.1-1. Back River Property Tailings Management System Storage Requirements

Location	Period (Quarter and Year)	Tailings (M-m3)	Location
Echo TF	Y1, Q1to Y3, Q2	2.22	Echo TF
Umwelt TF	Y3, Q3 to Y6, Q3	5.23	Umwelt TF
Llama TF	Y6, Q4to Y15, Q4	8.14	Llama TF

5.1.1 Tailings Physical Characteristics

Physical properties of the tailings include the following:

- Solids Content: 49% solids (by weight);
- Tailings Solids Specific Gravity: 2.9;
- Settled Density: 1.2 t/m^3;
- Plasticity: non-plastic; and
- Particle size (P_{80}): approximately 50 µm.

5.1.2 Tailings Geochemical Characteristics

Tailings geochemical characterization confirms that tailings will be PAG and metal leaching (ML) (Sabina 2017b, Appendix E-3). The projected lag to onset of acid generation is anticipated to be greater than 10 years in site-specific conditions; nonetheless, tailings will be managed to reduce the potential for acid rock drainage (ARD) and manage ML. Process water discharged as supernatant water with the tailings has the potential to contain elevated metal concentrations, including arsenic (As), copper (Cu) and iron (Fe). There is currently no planned discharge of tailings supernatant water during Operations. Should a controlled discharge be required during Operations the requirements for doing so will include the development of a Temporary Tailings Effluent Discharge Plan to be submitted 120 days prior to release as required by Part F, Item 16 of the Licence and discussed in Section 8.

Exposed tailings beaches may be an ongoing source of sulphate and arsenic leaching; pH changes may result in increased concentrations of other trace elements if tailings are left exposed for an extended period of time (estimated to be decades). However, the development of acidic conditions is expected to be delayed considerably by the cold temperatures, with the alkalinity from the deposition of fresh tailings helping to maintain neutral pH conditions. In addition, exposed tailings beach runoff accounts for approximately 8 to 11% of the water entering the tailings supernatant pond, and therefore it is expected to have a relatively small effect on pond water quality. At Closure, NPAG waste rock will be used to cover tailings material in the tailings facilities. The resulting aggradation of permafrost will minimize infiltration and development of ML/ARD conditions.

Sabina commits to test a mixture of tailings and water treatment plant sludges to evaluate the potential for remobilization of arsenic from this material. Tests will be conducted in the first year that water treatment plant sludges are produced. Sabina commits to provide their proposed testing method to the KIA for review and approval prior to initiating these tests, and will provide the results of the testing in the annual monitoring report.

5.2 TAILINGS FACILITIES IN OPEN PITS

Exhausted open pits will be converted into a TF and be used for the storage of tailings.

5.2.1 Tailings Facility Construction and Operation

The open pits will be readily convertible to store tailings and will operate similarly to conventional above-ground tailings storage facilities.

Tailings will be deposited subaqueously in the mined-out open pits by using a single spigot discharge point. This discharge location within the TF will be changed over the life of deposition so that a near struck tailings surface is created. A reclaim barge will be located within each TF during its operation; water (supernatant) contained in the TF will be reclaimed and reused in the Process Plant.

5.2.2 Tailings Facility Closure

Closure approach and activities are described in the Interim Closure and Reclamation Plan. The closure will entail a permanent water cover of 5 m which is deemed sufficient to limit resuspension of tailings solids due to wave action, surge following storm events, and ice scour. Water treatment is expected to only be necessary during Operations. Tailings facilities may also be used to store non-hazardous waste from the final mine closure activities; further details can be found in the ICRP.

6. Environmental Protection Measures

6.1 EFFLUENT DISCHARGES

Supernatant water contained in the TF will be reclaimed and reused in the Process Plant.

Water treatment details, reclaim rates, discharge criteria, and Post-Closure discharges from the TF are discussed in the Water Management Plan and the ICRP.

6.2 DUST MANAGEMENT

The possible sources of dust related to tailings management during the construction, operation, and closure of the tailings management facilities include:

- Vehicle traffic dislodging fine particles from the TF associated service and haul roads; and
- Placement of closure and capping layers.

Dust suppression measures typical of the current mine practices (i.e., Meliadine Project and Meadowbank Mine), and consistent with best management practices, will be considered through the Construction, Operations, and Closure phases of the Project to control dust. Dust will be monitored and managed to the best extent possible through Sabina's Air Quality Management and Monitoring Plan (AQMMP).

7. Monitoring Program

Routine inspections of the TFs during the construction and operations of the facility will include:

- Regular monitoring of the tailings disposal and tailings beach formation;
- Regular monitoring of the tailings supernatant water level;
- Visual inspections of the tailings embankment including seepage, during periods of flow, etc.;
- Grab sampling of tailings and treatment sludges as they are produced to confirm the potential for remobilization of arsenic from these materials remains within predicted levels; and
- An annual third-party geotechnical inspection of all earthworks including the TF is included under the Thermal and Geotechnical Monitoring Plan.

All testing will be completed in a certified laboratory and appropriate quality assurance/quality control measures will be applied.

Additional details on monitoring frequency, inspection plans, mine site water quality monitoring and receiving water quality monitoring can be found in the Water Management Plan, Appendix B.

Runoff water quality monitoring will be conducted as described in the Water Management Plan and prescribed in the Type A Water Licence. For details on TFs monitoring during Closure, please refer to the ICRP.

8. Contingencies, Mitigation, and Adaptive Management

The mine design, including the Tailings Facilities' designs, has been carefully prepared taking into consideration 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. There is therefore a high level of comfort that the plans are viable and realistic. It is however understood that mining activities by nature have inherent uncertainty. Additional mitigation or adaptive management may be required as an outcome of conditions observed during the monitoring activities described in Section 7. This may include changes to TF operation as a result of operational, engineering, and environmental monitoring.

Possible tailings scenarios that could be encountered during Operations, and possible contingency strategies to address are outlined Table 8-1. Additional details on TSF WRSA closure and waste rock were included in the contingency strategies as the TSF may be constructed at a later date.

Table 8-1. Tailings Management Contingency Strategies

Possible Scenario	Contingency Strategy
The total volume of tailings might be greater than expected.	There is contingency built into the TSF capacity and additional capacity is available in the open pits to accommodate greater volumes of tailings.
The slope of the tailings beach might be different than expected.	Additional tailings discharge (spigot) points may be considered.
The tailings dry density may be different than expected.	Less dense tailings will occupy more space; however the TSF has contingency storage and additional capacity is available in the open pits.
The total volume of seepage might be greater than expected.	Larger return pumps may be considered. The tailings deposition plan may be modified to push the pond away from the TSF Dam to reduce seepage.
The impact to the underlying permafrost might be greater than expected from thermal modelling.	Retroactive design changes to the TSF Dam could include tailings deposition upstream of the dam, placement of GCL over original ground upstream of the dam to lengthen the seepage path through the foundation, and/or installation of vertical thermosiphons.
The tailings material might oxidize faster than expected.	Some additional water treatment may be required until the tailings freeze.

Should contingency measures be implemented in the form of using other open pits as TFs, Sabina intends to provide the NWB at least 60 days' notice prior to the disposal of waste in the TFs and will present the following information: waste disposal quantities, volumes, disposal timing, maximum pit capacity, effects to pit closure, and appropriate mitigation and monitoring plans.

Should temporary discharge be required from a tailings facility to the environment for any reason, a Temporary Tailings Effluent Discharge Plan would be submitted to the NWB at least 120 days prior to this discharge, as required by Part F, Item 16 of the Licence. This plan would include the following: justification for temporary discharge; volume, rate, and quality of discharge; final discharge point and characteristics of the receiving environment; proposed effluent quality limits; and mitigation options to avoid future discharges.

9. Environmental Reporting

Monitoring results will be reported in the annual reports filed with the NIRB and the NWB. Results of water quality or waste monitoring required under the Water Licence will be reported monthly and/or annually to the NWB, in accordance with the requirements of Water Licence 2AM-BRP1831.

10. References

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