Sabina
GOLD & SILVER CORP.

The BACK RIVER PROJECT

Methodology, Effects of Environment on Project, Accidents and Malfunctions

Volume 9

Prepared by:

Rescan™
an ERM company

December 2013

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Back River Project Fact Sheet

December 2013

Location

- Located in the western Kitikmeot Region of Nunavut at approximately 65° north latitude, and 106° west longitude. About 400 km south of Cambridge Bay and 525 km northeast Yellowknife.
- Primary communities: Kugluktuk, Cambridge Bay, Gjoa Haven, Kugaaruk and Taloyoak
- The closest community areas to the Project are Kingaok, located approximately 160 km north of the Goose Property, and Omingmaktok, located approximately 250 km northeast of the Goose Property

Reserves

- Six mining areas within the Goose and George Properties. Three locations at the Goose Property (Goose, Umwelt, and Llama) and three locations at the George Property (Locale 1, Locale 2, and LCP North).

Site Preparation and Construction Phase

- Site preparation may begin in 2014 (winter roads, fuel depots, laydown areas)
- Full construction of the project could commence as early as 2016 – two years to complete construction
- Approximately $605 M initial capital investment

Operational Phase

- Goose Property: open pit at Llama, Umwelt and Goose deposits; underground at Umwelt deposit
- George Property: Open pits at Locale 1, Locale 2, LCP North

Production

- Production Rate (Ore): 15.0 million tonnes of mill feed for life of mine
- Projected annual 300,000 ounces of gold for about up to 10 years

Processing

- 5,000 tonnes per day
- Standard gravity separation and cyanide leaching circuit
- Tailings facility at Goose Property

Transport

- Gold doré bars shipped out by aircraft

Access Roads

- All-weather roads within George and Goose properties
- Winter road between George and Goose properties
- Winter road to link properties to the Marine Laydown Area at Bathurst Inlet
- Short term winter road link to Tibbett-Contwoyto Winter Road

Re-supply

- Marine supply via open water seasonal shipping (max of 10 ships, average of 3 to 5 per year)
- Year-round by aircraft
- Winter road to the Marine Laydown Area
- Winter road connection to Yellowknife (short term)

Environment

- Extensive baseline studies including terrestrial environment, wildlife (particularly caribou), marine environment, freshwater environment, air quality and resource utilization
- Traditional knowledge information collected and analyzed through an Inuit owned major study - Naonaiyaotit Traditional Knowledge Project
- Will form the foundation of Environmental Impact Statement , and provide information for development of mitigation and management plans

Employment

- Fly-in/fly-out operation
- Direct construction employment up to 1200 person years over a two year period
- Direct operations employment up to 4442 person years for 10 years

Social and Economic Benefits

- Inuit Impact Benefits Agreement with the Kitikmeot Inuit Association
- Opportunities for local businesses
- Royalties and taxes to governments

Closure and Post-closure Phase

- Closure will ensure that the former operational footprint is both physically and chemically stable in the long term for protection of people and the natural environment
- Post closure environmental monitoring will continue sufficient to verify that reclamation has successfully met closure and reclamation objectives

BACK RIVER PROJECT

DRAFT ENVIRONMENTAL IMPACT STATEMENT Supporting Volume 9: Methodology, Effects of Environment on Project, Accidents and Malfunctions

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Prepared for:

Sabina Gold & Silver Corp.

Prepared by:

Rescan Environmental Services Ltd., an ERM company
Vancouver, British Columbia

Executive Summary

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Executive Summary

This volume includes the General Methodology for Project Effects Assessment, Cumulative Effects Assessment, and Transboundary Effects Assessment (Chapter 1), the Effects of the Environment on the Project (Chapter 2), and Accidents and Malfunctions (Chapter 3).

General Assessment Methodology

The scoping of potential Valued Ecosystem Components (VECs) and Valued Socio-economic Components (VSECs) involved Sabina-led public consultations, the use of Traditional Knowledge (TK), regulator consultations and regulatory considerations, and recommendations presented in the NIRB EIS guidelines (NIRB 2013). The *Inuit Traditional Knowledge of Sabina Gold & Silver Corp., Back River (Hannigayok) Project, Naonaiyaotit Traditional Knowledge Project* report (KIA 2012) was consulted extensively for TK information. Based on these sources, the following VECs and VSECs and Subjects of Note were identified:

Atmospheric Environment (Volume 4)

- VECs: Air Quality, Noise and Vibration
- Subject of Note: Climate and Meteorology

Terrestrial Environment (Volume 5)

- VECs: Vegetation and Special Landscape Features, Caribou, Grizzly Bear, Muskox, Wolverine and Furbearers, Migratory Birds, Raptors
- Subject of Note: Geology, Permafrost, Landforms and Soils

Freshwater Environment (Volume 6)

- VECs: Hydrology, Water Quality, Sediment Quality, Fish/Aquatic Habitat, Fish Community
- Subject of Note: Groundwater, Limnology and Bathymetry

Marine Environment (Volume 7)

- VECs: Water Quality, Sediment Quality, Fish/Aquatic Habitat, Fish Community, Seabirds/Seaducks, Ringed Seals
- Subject of Note: Physical Processes

Human Environment (Volume 8)

- VECs: Archaeology, Socio-Economics, Land Use, Country Foods
- Subject of Note: Paleontology, Human Health and Environmental Risk Assessment

All VECs and VSECs were assessed over spatial and temporal scales. Spatially, potential effects were evaluated within a Local Study Area (LSA) and a larger Regional Study Area (RSA). Temporal, potential effects were considered during the Site Preparation, Construction, Operations, Reclamation and Closure, and Post-closure Project phases. Specific legislation was considered during the assessment, including appropriate federal and territorial objectives/standards.

The Project-related potential effects assessment consisted of the following steps:

- establishing the Scope of the Effects Assessment, which included the selection of VECs and VSECs and defining spatial and temporal boundaries;
- identifying potential interactions with the Project and VECs/VSECs;
- characterizing the potential effects;
- identifying mitigation and management measures to eliminate or reduce potential effects;
- characterizing residual effects (those effects predicted to remain after the application of mitigation and management measures); and
- determining the significance of residual effects.

The cumulative effects assessments conducted were consistent with the requirements of Section 12.5.2 of the Nunavut Land Claim Agreement (NLCA) and the Nunavut Impact Review Board (NIRB) final Guidelines for the Preparation of an Environmental Impact Statement (EIS guidelines [NIRB 2013]) for the Project.

The potential for cumulative effects to occur arises when the residual effects of a project affect (i.e., overlap and interact with) the same resource/receptor (VECs and VSECs) that is affected by the residual effects of *other* past, existing or reasonably foreseeable projects or activities.

The potential cumulative effects assessment (CEA) was carried out in compliance with Section 7.11 of the final EIS guidelines (NIRB 2013). As per the final EIS guidelines, consideration was given to the following factors when conducting the CEA:

- a larger spatial boundary (RSA rather than LSA);
- a longer temporal scale;
- alternatives analysis;
- consideration of effects on VECs and VSECs; and
- evaluation of significance.

Potential cumulative effects assessments were conducted for each VEC or VSEC that had an identified Project-related residual effect. There were no significant Project-related residual effects identified (see Chapter 6 of this Main Volume), but all non-significant Project-related residual effects were subjected to a potential cumulative effects assessment. The details of all of the assessments can be found in the VEC and VSEC chapters in Supporting Volumes 4 through 8 (Volume 4: Atmospheric Environment; Volume 5: Terrestrial Environment; Volume 6: Freshwater Environment; Volume 7: Marine Environment; and Volume 8: Human Environment). There were no significant cumulative residual effects identified.

The NIRB guidelines define transboundary effects as those effects that occur outside the Nunavut Settlement Area (NSA) which are directly linked to the Project inside the NSA. These effects may occur across provincial, territorial, or international boundaries. Although the Project is located entirely within the NSA, transboundary effects from the Project can occur when animals move across jurisdictional boundaries (e.g., caribou and birds migrating) or when project activities themselves, or their zone of influence, cross jurisdictional boundaries (e.g., transportation and economic benefits). Transboundary effects of the Project have the potential to act cumulatively with other projects and activities outside the NSA.

For the Back River Project, transboundary effects are outlined by the Minister of Aboriginal Affairs and Northern Development Canada's decision, and focus on the effects upon affected communities and groups that depend on the Bathurst Caribou herd. Hence, the transboundary effects assessment focused on these key areas. In addition, potential transboundary effects were considered for all identified residual effects. There were no significant transboundary effects identified.

<u>Effects of the Environment on the Project</u>

Extreme weather events such as storms, elevated rainfall or snowfall, frigid temperatures and geotechnical hazards such as seismicity, ground and slope instabilities, all have the potential to affect Project infrastructure and in turn represent concerns for human safety and the environment. These factors may affect the integrity of the key facilities, particularly the TIA, water retention dykes, pit wall stability, road operation, and waste rock storage areas. These structures must be built to withstand local environmental conditions to ensure uninterrupted Project operations, maintenance of Project assets, and safety of personnel. Sabina has assessed these potential environmental effects and incorporated them into the Project design.

An Engineering Hazard Assessment was conducted to identify risk factors and mitigation measures, including design strategies that were planned to avoid or minimize the likelihood and severity of the changes or effects. These hazards have been assessed in terms of their likelihood of occurrence, their anticipated effect on the proposed Project's infrastructure and production, and Sabina's potential response should one or all of these environmental hazards occur.

Included in the context of extreme weather is the potential for global climate change to affect the Project. The flat terrain and permanently frozen subsoil also add to the engineering challenges which the Project must surmount. Climate change may result in an environment that is different from current conditions; less severe winters, changing precipitation patterns or other considerations may impact future operations and effect the operation of infrastructure associated with the Project.

Preliminary design to mitigate these environmental effects is presented. This design is based on best management practices, similar operations, and general climate change predictions as site-specific thermal models are not available at this level of engineering. Thermal models will be developed for the Final Environmental Impact Statement, and the results will be incorporated into all relevant aspects of engineering. Sabina has completed a qualitative assessment of how global climate change could affect climate parameters and a risk matrix is presented to identify climate change risk factors that may affect the Project, those that are unlikely to have an impact on the Project, and those with an unknown impact on the Project. Possible future effects of a changing climate on the Project include:

- Changing sea ice conditions, sea level rise, and coastal erosion may impact inbound and outbound shipping of fuel and product at Bathurst Inlet.
- Warming temperatures may affect permafrost in the vicinity of the Project site, potentially leading to an increased active layer thickness. This could directly affect infrastructure at the Project site in the long-term.

The specific interactions between the climate risk factors identified above and Project infrastructure or operations are discussed in individual impact assessments elsewhere in the DEIS. However, based on the Project lifespan, it is anticipated that the effects of a potentially changing climate on the Project are not significant.

Accidents and Malfunctions

Despite an ongoing effort to identify and manage risks, major accidents and malfunctions may occur through natural events, breakdown of mitigation measures, or human error. Understanding the factors that govern whether such risks are likely is essential to a proactive environmental management approach. Sabina will seek to minimize the risk of accidents and malfunctions, along with ensuing consequences to people and the environment. Management systems will mitigate most risks and limit consequences through:

- prevention of accidents and malfunctions via training, awareness, education and equipment maintenance;
- assessment of the risk of accidents and malfunctions throughout the design phase;
- employment of adaptive management procedures to ensure continual appraisal of risks; and
- design and implementation of effective emergency response plans and contingency plans.

Sabina's risk assessment methodology involved a rating system derived from: identification of environmental aspects that could impact the site; determination of likelihood and consequence of a worst credible mishap on personnel, environment and facilities, assuming that emergency planning and management controls are in place; identification of additional management measures and controls, and applying risk category for each hazard based on probability and consequences. This was followed by an evaluation of residual risk, monitoring and review.

Management controls for treating risk were assessed considering: personnel safety; potential benefits; effectiveness; implementation cost; and stakeholder objectives.

The list of potential malfunctions or accidents events associated with Project facilities and activities, included: spills, vehicle accidents, helicopter crash, uncontrolled discharges, fires, explosions, and sediment releases.

For all of the accidents or malfunction events screened to interact with the Project, the residual human and ecological effects were assessed to be minor, not detrimental, or the effects are considered manageable contingent upon the application of the precautionary approach in design and implementation of the management plans detailed in Volume 10.

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ᑖᓇ ᑎᑎᕋᖅᑕᐅᓯᒪᔪᓂ ᐃᓚᖃᖅᑐᖅ ᑕᒪᐃᓐᓄᑦ ᖃᓄᐃᓕᐅᕈᑎᒋᕙᒃᑕᕆᓐᓂᒃ ᐱᓕᕆᐊᕐᒥ ᓴᖅᑭᔪᑕᐅᔪᓄᑦ ᖃᐅᔮᓴᐃᓂᕐᒥᒃ, ᑲᑎᑉᐹᓪᓕᐊᔪᓂ ᓴᖅᑭᔪᑕᐅᔪᓄᑦ ᖃᐅᔮᓴᐃᓂᕐᒥᒃ, ᐊᒻᒪᓗ ᑭᒡᓕᖃᕐᓂᕐᒧᑦ ᐊᖅᑯᔮᕐᕕᐅᕙᒃᑐᑦ ᓴᖅᑭᔪᑕᐅᔪᓂᒃ ᖃᐅᔮᓴᐃᓂᕐᒥᒃ (ᑎᑎᕋᖅᓯᒪᓂᖅ 1), ᓴᖅᑭᔪᑕᐅᔫᑦ ᐊᕙᑎᒥ ᐱᓕᕆᐊᕐᒥ (ᑎᑎᕋᖅᓯᒪᓂᖅ 2), ᐊᒻᒪᓗ ᐱᕿᑐᐊᕐᑭᓂᕐᒧᑦ ᓯᕐᑯᒥᑦᑐᓄᑦ (ᑎᑎᕋᖅᓯᒪᓂᖅ 3).

<u>ᑕᒪᐃᓐᓄᑦ ᖃᐅᔮᓴᐃᓂᕐᒧᑦ ᖃᓄᐃᓕᐅᕈᑕᐅᓃᑦ</u>

ᖃᓄᐃᓕᖓᓂᖏᑦ ᐱᓐᓇᕆᔭᐅᓂᐊᕋᓱᒋᔭᐅᔫᑦ ᐆᒪᔫᑦ ᓇᔪᕐᕕᖏᓐᓂᒃ ᐃᓗᓕᖏᑦ ᐱᓐᓇᕆᔭᐅᔫᑦ ᐆᒪᔫᑦ ᓇᔪᕐᕕᒋᕙᒃᑕᖏᑦ ᐊᒻᒪᓗ ᓇᔪᕐᕕᒋᕙᒃᑕᖏᑦ ᐊᒻᒪ ᐱᓐᓇᕆᔭᐅᔫᑦ ᐃᓅᓯᓕᕆᔾᔪᑎᑦ-ᑮᓇᐅᔾᔭᕁᓴᐅᑎᓅᖓᔫᑦ ᐃᓗᓕᖏᑦ ᐃᓚᖃᓚᐅᖅᑐᖅ ᓴᕿᓇᒃᑯᓐᓄᑦ ᐊᐅᓚᑕᐅᔪᒥᒃ ᑭᒃᑯᓕᒫᓂ ᐅᖃᖃᑎᖃᕐᓂᕐᒥᒃ, ᐊᑐᕐᓂᕐᒥᒃ ᖃᐅᔨᒪᔭᐅᔪᑐᖃᕐᓂ, ᒪᓕᒐᓕᐊᓕᕆᓂᕐᒧᑦ ᐅᖃᖃᑎᖃᕐᓂᖅ ᐊᒻᒪ ᒪᓕᒐᓕᐊᓂ ᐃᓱᒪᒃᓴᖅᓯᐅᖅᑕᐅᔫᑦ, ᐊᒻᒪᓗ ᐊᑐᓕᕐᑯᔭᐅᓯᒪᔫᑦ ᓴᖅᑭᑕᐅᓂᖏᑦ ᓄᓇᕗᑦ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᕿᒥᕐᕈᓃᑦ ᑲᑎᒪᔩᖏᑦ ᐊᒃᑐᐊᓂᕆᔭᐅᓂᐊᕋᓱᒋᔭᐅᓂᕐᒧᑦ ᐅᖃᐅᓯᖏᓐᓂ ᐊᑐᕚᒃᓴᐃᑦ (ᓄᓇᕗᑦ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᕿᒥᕐᕈᓃᑦ ᑲᑎᒪᔩᖏᑦ). *ᐃᓄᐃᑦ ᖃᐅᔨᔭᑐᖃᖏᑦ ᓴᐱᓇᒃᑯᑦ ᒎᓗᓕᕆᔩᑦ ᓴᕕᕋᔭᓕᕆᔩᑦ ᑎᒥᖓᑦ, ᕼᐊᓐᓂᖓᔪᕐᒥ ᐱᓕᕆᐊᖅ, ᓴᐅᓇᐃᔭᐅᑎᑦ ᖃᐅᔨᒪᔭᐅᔪᑐᖃᖏᓐᓂ ᐱᓕᕆᐊᑉ ᐅᓂᒃᑳᓕᐊᕆᓯᒪᔪᖅ* (ᕿᑎᕐᒥᐅᑦ ᐃᓄᐃᑦ ᑲᑐᔾᔨᖃᑎᒌᖏᑦ 2012) ᐅᖃᐅᓯᐅᑲᑦᑎᓯᒪᔪᖅ ᖃᐅᔨᒪᔭᐅᔪᑐᖃᖅᑕᓄᑦ ᑐᑭᓯᒋᐊᕈᑕᐅᓂᕐᒧᑦ. ᑐᙵᕕᒋᓪᓗᒋᑦ ᑕᒃᑯᐊ ᐱᕕᒃᓴᐃᑦ, ᑕᒃᑯᐊ ᐱᓐᓇᕆᔭᐅᔫᑦ ᐆᒪᔫᑦ ᓇᔪᕐᕕᒋᕙᒃᑕᖏᑦ ᐊᒻᒪᓗ ᓇᔪᕐᕕᒋᕙᒃᑕᖏᑦ ᐊᒻᒪᓗ ᐱᓐᓇᕆᔭᐅᔫᑦ ᐃᓅᓯᓕᕆᔾᔪᑎᑦ-ᑮᓇᐅᔾᔭᕁᓴᐅᑎᓅᖓᔫᑦ ᐃᓗᓕᖏᑦ ᐊᒻᒪᓗ ᐅᖃᐅᓯᔪᓂᒃ ᐃᖅᑲᐅᒪᔾᔪᑎᐅᔪᖅ ᓇᓗᓇᐃᖅᑕᐅᓚᐅᖅᐳᑦ:

<u>ᐊᓂᖅᑎᕈᑎᐅᑉ ᐊᕙᑎᖓ (ᑎᑎᕋᖅᓯᒪᓂᖅ 4)</u>

- ᐱᓐᓇᕆᔭᐅᔫᑦ ᐆᒪᔫᑦ ᓇᔪᕐᕕᒋᕙᒃᑕᖏᑦ: ᐊᓂᖅᑎᕈᑎᐅᑉ ᖃᓄᐃᓐᓂᖓ, ᓂᐱᖃᕐᓂᖓ ᐊᒻᒪ ᐊᐅᓚᔾᔭᑲᑕᖃᑦᑕᕐᓂᖓ
- ᐅᖃᐅᓯᐅᔪᖅ ᐃᖅᑲᐅᒪᔾᔪᑎ: ᐊᕙᑎᐅᑉ ᐆᓇᕐᓂᖅ/ᓂᒡᓚᓇᕐᓂᖅ ᐊᒻᒪ ᓯᓚᓇᓂᖅ

<u>ᓄᓇᒥ ᐊᕙᑎᖓ (ᑎᑎᕋᖅᓯᒪᓂᖅ 5)</u>

- ᐱᓐᓇᕆᔭᐅᔫᑦ ᐆᒪᔫᑦ ᓇᔪᕐᕕᒋᕙᒃᑕᖏᑦ: ᐱᕈᖅᑐᑦ ᐊᒻᒪᓗ ᐊᔾᔨᐅᙱᓐᓂᑖᑦ ᓄᓇᐅᑉ ᖃᓄᐃᓕᖓᓂᖏᑦ, ᑐᒃᑐᑦ, ᐊᒃᓚᐃᑦ, ᐅᒥᖕᒪᐃᑦ, ᖃᕝᕕᑦ ᐊᒻᒪ ᒥᖅᑯᖃᖅᑐᑦ, ᑎᖕᒥᐊᑦ, ᑎᖕᒥᔾᔭᐃᑦ ᐆᒪᔪᖅᑐᕌᑦ
- ᐅᖃᐅᓯᐅᔪᓄᑦ ᐃᖅᑲᐅᒪᔾᔪᑦ: ᓄᓇᓕᓐᓂᖅ, ᐊᐅᓚᓇᖏᑦᑐᖅ ᓄᓇᐅᑉ ᐃᑭᐊᓂ, ᓄᓇᐃᑦ ᖃᓄᐃᓕᖓᓂᖏᑦ ᐊᒻᒪᓗ ᐃᐸᔪᐃᑦ

<u>ᐃᒪᑦᑎᐊᕙᐃᑦ ᐊᕙᑎᖏᑦ (ᑎᑎᕋᖅᓯᒪᔪᖅ 6)</u>

- ᐱᓐᓇᕆᔭᐅᔫᑦ ᐆᒪᔫᑦ ᓇᔪᕐᕕᒋᕙᒃᑕᖏᑦ: ᐃᒪᓕᓇᓂᖅ, ᐃᒪᐅᑉ ᖃᓄᐃᓂᖓᑦ, ᐃᓱᕐᓂᖓ, ᐃᖃᓗᑦ/ᐃᒪᕐᒥᐅᑕᑦ ᓇᔪᕐᕕᖏᑦ, ᐃᖃᓗᐃᑦ ᓇᔪᕐᕕᖏᑦ
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<u>ᑕᓇᐅᕐᒥᐅᑕᑦ ᐊᕙᑎᖏᑦ (ᑎᑎᕋᖅᓯᒪᓂᒪᖅ 7)</u>

- ᐱᓐᓇᕆᔭᐅᔫᑦ ᐆᒪᔫᑦ ᓇᔪᕐᕕᒋᕙᒃᑕᖏᑦ: ᐃᒪᐅᑉ ᖃᓄᐃᓂᖓᑦ, ᐃᓱᕐᓂᖓ, ᐃᖃᓗᑦ/ᐃᒪᕐᒥᐅᑕᑦ ᓇᔪᕐᕕᖏᑦ, ᐃᖃᓘᖅᑲᑎᒋᑦ, ᑎᖕᒥᐊᑦ ᑕᓇᐅᕐᒦᓱᑦ/ᒥᑏᑦ, ᓇᑦᑏᑦ

- ᐅᖃᐅᓯᐅᔪᒧᑦ ᐃᖅᑲᐅᒪᔾᔪᑦ: ᑎᒥᐅᑉ ᖃᓄᐃᓕᖅᐸᓪᓕᐊᓂᖓᑦ

<u>ᐃᓄᖕᓄᑦ ᐊᕙᑎ (ᑎᑎᕋᖅᓯᒪᓂᖅ 8)</u>

- ᐱᓇᓇᓱᐅᔪᑦ ᐆᒪᔪᑦ ᓇᔪᕐᕖᑦ ᕿᓄᐊᓇᕆᐊᖃᑎᑦ: ᐃᑦᑕᕐᓂᑕᓕᕆᓂᖅ, ᐃᓅᓯᓕᕆᓂᖅ–ᑮᓇᐅᔾᔭᒃᓴᓕᕆᓂᖅ, ᓄᓇᒥ ᐊᑐᕐᓂᖅ, ᓂᕿᑦᑎᐊᕙᕆᔭᐅᔪᑦ
- ᐅᖃᐅᓯᐅᔪᒧᑦ ᐃᖅᑲᐅᒪᔾᔪᑦ: ᓇᔪᕖᖖᓂᓕᕆᓂᖅ, ᐃᓄᖕᓄᑦ ᐋᓐᓂᐊᕐᑲᕐᓇᖏᑦᑐᓕᕆᓂᖅ ᐊᒻᒪᓗ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᐅᓗᕆᐊᓇᕈᑕᐅᔪᓂᒃ ᖃᐅᔨᓴᐃᓂᖅ

ᑕᒪᕐᒥ ᐱᓇᓇᓱᐅᔪᑦ ᐆᒪᔪᑦ ᓇᔪᕐᕖᑦ ᕿᓄᐊᓇᕆᐊᖃᑎᑦ ᐊᒻᒪᓗ ᐱᓇᓇᓱᐅᔪᑦ ᐃᓅᓯᓕᕆᓂᕐᒧᑦ-ᑮᓇᐅᔾᔭᒃᓴᓕᕆᓂᕐᒧᑦ ᐃᓗᓕᖕᒋᑦ ᖃᐅᔨᓴᖅᑕᐅᓚᐅᖅᑐᑦ ᐃᓛᒃᑰᖅᑐᓂ ᐊᒻᒪ ᐃᓛᓐᓂᒃᑰᕐᑲᑦᑕᖅᖢᑎᒃ. ᐃᓛᒃᑯᑦ, ᓴᖅᑮᔪᑕᐅᑐᐃᓐᓇᓇᐊᓖᑦ ᖃᐅᔨᓴᖅᑕᐅᓚᐅᖅᑐᑦ ᓄᓇᓕᖕᒥ ᖃᐅᔨᓴᖅᑕᐅᕝᕕᐅᔪᒥᒃ ᐊᒻᒪᓗ ᐊᖏᓂᖕᓴᒥᒃ ᓄᓇᓕᖕᒥ ᐊᕕᒃᑐᖅᓯᒪᓂᐅᑉ ᐃᓗᐊᓂ ᖃᐅᔨᓴᖅᑕᐅᕝᕕᐅᔪᒥᒃ. ᐃᓛᓐᓂᒃᑰᕐᑲᑦᑕᕐᓂᖅ, ᓴᖅᑮᔪᑕᐅᑐᐃᓐᓇᓇᐊᓖᑦ ᐃᓱᒪᒋᔭᐅᕐᑲᑦᑕᓚᐅᖅᐳᑦ ᐃᓂᒥ ᐋᖅᑭᒃᓱᐃᑎᓪᓗᒋᑦ, ᐋᖅᑭᒃᓱᐃᑎᓪᓗᒋᑦ, ᐊᐅᑦᑎᑎᓪᓗᒋᑦ, ᐅᑎᖅᑎᓂᖅᑲᖅᑎᓪᓗᒋᑦ ᐊᒻᒪᓗ ᒪᑐᓯᑎᓪᓗᒋᑦ, ᐊᒻᒪᓗ ᒪᑐᓯᒪᔪᖅᑲᓕᖅᑎᓪᓗᒍ ᐱᓕᕆᐊᖃᖅᐸᒃᖢᑎᒃ ᐃᓛᒃᑰᖅᓯᒪᔪᓂᒃ. ᓇᓗᓇᐃᔭᑦᑎᐊᖅᓯᒪᔪᑦ ᐱᕐᑯᔭᒃᓴᖅ ᐃᓱᒪᒋᔭᐅᓚᐅᖅᐳᖅ ᖃᐅᔨᓴᕐᓂᖅᑲᖅᑎᓪᓗᒋᑦ, ᐃᓚᖃᖅᖢᒍ ᓈᒻᒪᑦᑎᐊᖅᑐᒥ ᖓᕙᒪᑐᖃᒃᑯᑦ ᐊᒻᒪ ᐊᕕᒃᑐᖅᓯᒪᔫᑉ ᖓᕙᒪᖏᑦᑕ ᑐᕌᖓᕐᖏᓐᓂᒃ/ᐊᑐᖓᒃᓴᓕᐊᖏᓐᓂᒡᒍ.

ᐱᓕᕆᐊᕐᔫᖓᔪᑦ ᓴᖅᑮᔪᑕᐅᑐᐃᓐᓇᓇᐊᓖᑦ ᖃᐅᔨᓴᐃᓂᖅ ᐃᓚᖃᓚᐅᖅᐳᖅ ᐅᑯᓂᖓ ᒪᓕᒍᑎᔪᓂᒃ:

- ᓴᖅᑭᑦᑎᓂᖅ ᖃᓄᐃᓕᖓᓂᕆᔭᖏᑦᑕ ᓴᖅᑮᔪᑕᐅᔪᓂᒃ ᖃᐅᔨᓴᐃᓂᕐᒥᒃ, ᐃᓚᖃᕐᒥᔪᖅ ᓂᕈᐊᖅᓯᓂᕐᒥᒃ ᐱᓇᓇᓱᐅᔪᑦ ᐆᒪᔪᑦ ᓇᔪᕐᕖᑦ ᕿᓄᐊᓇᕆᐊᖃᑎᑦ ᐊᒻᒪᓗ ᐱᓇᓇᓱᐅᔪᑦ ᐃᓅᓯᓕᕆᔾᔪᑎᑦ–ᑮᓇᐅᔾᔭᒃᓴᐅᑎᓄᑦ ᐃᓗᓕᖕᒋᓐᓂᒃ ᐊᒻᒪᓗ ᓇᓗᓇᐃᔭᐃᓂᖅ ᐃᓛᒃᑰᖅᑐᓂ ᐊᒻᒪᓗ ᐃᓛᓐᓃᒃᑰᖅᑐᓂᒃ ᑭᒡᓕᓕᐊᖑᔪᑦ;
- ᓇᓗᓇᐃᔭᐃᓂᖅ ᖃᓄᐃᓕᖅᑲᑎᒌᒍᑕᐅᔪᑦ ᐱᓕᕆᐊᕐᒥᒃ ᐊᒻᒪᓗ ᐱᓇᓇᓱᐅᔪᑦ ᐆᒪᔪᑦ ᓇᔪᕐᕖᑦ ᕿᓄᐊᓇᕆᐊᖃᑎᑦ/ᐱᓇᓇᓱᐅᔪᑦ ᐃᓅᓯᓕᕆᔾᔪᑎᑦ–ᑮᓇᐅᔾᔭᒃᓴᐅᑎᓄᑦ ᐃᓗᓕᖕᒋᓐᓂᒃ;
- ᓇᓗᓇᐃᔭᐃᑦᑎᐊᕐᓂᖅ ᓴᖅᑮᔪᑕᐅᑐᐃᓐᓇᓇᐊᓖᑦ;
- ᓇᓗᓇᐃᖅᓯᓂᖅ ᐋᖅᑮᔪᑕᐅᓂᖅ ᐊᒻᒪᓗ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᑲᒪᒋᔾᔪᑎᑦ ᐲᖅᓯᔾᔪᑕᐅᓂᐊᕐᓗᓂ ᐅᕝᕙᓘᓐᓃᑦ ᒥᑭᓕᑎᐊᕈᑕᐅᓂᐊᕐᓗᓂ ᓴᖅᑮᔪᑕᐅᔪᒃᓴᒥᒃ;
- ᓇᓗᓇᐃᔭᐃᑦᑎᐊᕐᓂᖅ ᓴᖅᑮᔪᑕᐅᓂᕐᓂᖕᒐᖅᑐᑦ (ᑕᐃᒃᑲ ᓴᖅᑮᔪᑕᐅᓃᑦ ᓯᓚᐅᓂᐊᖅᑐᑦ ᐊᑐᖅᑕᐅᕆᓂᒃᓯᒪᓕᖅᑎᓪᓗᒋᑦ ᐋᖅᑮᔪᑕᐅᓂᖅ ᐊᒻᒪᓗ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᑲᒪᒋᔾᔪᑎᑦ); ᐊᒻᒪᓗ
- ᓇᓗᓇᐃᔭᐃᓗᓂ ᐱᒻᒪᕆᐅᓂᖃᖅᑐᑦ ᓴᖅᑮᔪᑕᐅᓂᕐᓂᖕᒐᖅᑐᑦ.

ᑲᑎᑉᐸᓪᓕᐊᔪᑦ ᓴᖅᑮᔪᑕᐅᔪᓄᑦ ᖃᐅᔨᓴᖅᑕᐅᓚᐅᖅᑐᑦ ᒪᓕᒍᑎᓚᐅᖅᐳᑦ ᒪᓕᒋᐊᖃᖅᑎᑕᐅᔪᓂᒃ ᐃᓚᖓᓂᒃ 12.5.2–ᒥ ᓄᓇᕗᑦ ᓄᓇᑖᕐᓂᕐᒧᑦ ᐊᖏᕈᑎᒥ ᐊᒻᒪᓗ ᓄᓇᕗᒻᒥ ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᑲᑎᒪᔨᖏᓐᓄᑦ ᑭᖑᓪᓕᖅ ᐊᑐᖓᖏᓐᓂ ᐋᖅᑭᒃᓯᐃᓂᕐᒧᑦ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᐊᒃᑐᖅᑕᐅᓂᕐᒧᑦ ᐅᖃᐅᓯᖓᓂᒃ (ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᐊᒃᑐᖅᑕᐅᓂᕐᒧᑦ ᐅᖃᐅᓯᖓᓂᒃ [ᓄᓇᕗᒻᒥ ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᑲᑎᒪᔨᖏ 2013] ᐱᓕᕆᐊᕐᒧᑦ.

ᑲᑎᖅᓱᖅᓯᒪᔪᑦ ᓴᖅᑮᔪᑕᐅᑐᐃᓐᓇᓇᐊᓖᑦ ᓴᖅᑭᖃᑦᑕᖅᐳᑦ ᓴᖅᑭᑉᔪᑕᐅᓂᕐᓂᖕᒐᖅᑐᑦ ᐱᓕᕆᐊᕐᒥ ᐊᒃᑐᖅᓯᖃᑦᑕᖅᐳᑦ (ᓰᕐᓗ,ᖅᑳᖓᔫᕈᑎᔪᑦ ᐊᒻᒪᓗ ᐊᒃᑐᐊᕈᑎᖃᑦᑕᖅᑐᑦ) ᐊᔾᔨᒌᒃᑐᓂ ᐱᕙᒃᓴᖅᑖᕐᕕᓂ/ᐱᕙᑖᓰᑦ (ᐱᓇᓇᓱᐅᔪᑦ ᐆᒪᔪᑦ ᓇᔪᕐᕖᑦ ᕿᓄᐊᓇᕆᐊᖃᑎᑦ ᐊᒻᒪᓗ ᐱᓇᓇᓱᐅᔪᑦ ᐃᓅᓯᓕᕆᓂᕐᒧᑦ-ᑮᓇᐅᔾᔭᒃᓴᓕᕆᓂᕐᒧᑦ ᐃᓗᓕᖕᒋᑦ) ᐊᒃᑐᖅᑕᐅᓂᖅᑲᖅᑐᑦ ᐊᓯᖕᒋᓇᓄᑦᑭᖑᓂᕐᒥ, ᐱᑕᖄᓂᒃᑐᑦ ᐅᕝᕙᓘᓐᓃᑦ ᓂᕆᐅᒋᔭᐅᔫᒃᓴᑦ ᐱᓕᕆᐊᕐᒧᑦ ᐅᕝᕙᓘᓐᓃᑦ ᖃᓄᐃᓕᐅᕈᑕᐅᔪᓄᑦ.

ᑲᑎᑉᐸᓪᓕᐊᔪᑦ ᐊᒃᑐᖅᑕᐅᔾᔪᑎᓄᑦ ᖃᐅᔨᓴᐃᓂᖅ ᑲᒪᒋᔭᐅᓚᐅᖅᑐᖅ ᒪᓕᒃᑐᒍ ᐃᓚᖓᑦ 7.11 ᑭᖑᓪᓕᖅᐹᕐᒥ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᐊᒃᑐᖅᓯᓂᕐᒧᑦ ᐅᕝᑲᐅᓯᕐᒥ ᐊᑐᖓᕐᓂ (ᓄᓇᕗᒻᒥ ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᑲᑎᒪᔨᖏ 2013). ᒪᓕᒡᒍᒍ ᑭᖑᓪᓕᖅ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᐊᒃᑐᖅᑕᐅᓂᕐᒧᑦ ᐅᕝᑲᐅᓯᖓᓂᒃ ᐊᑐᖓᖏᑦ, ᐃᓱᒪᒋᔭᐅᓂᕐᑲᓚᐅᖅᑐᖅ ᑕᒪᒃᑯᐊ ᐱᔾᔪᑎᐅᔪᑦ ᑲᒪᒋᔭᕐᑲᖅᑎᓪᓗᒋᑦ ᑲᑎᑉᐸᓪᓕᐊᔪᑦ ᐊᒃᑐᖅᑕᐅᔾᔪᑎᓄᑦ ᖃᐅᔨᓴᐃᓂᕐᒧᑦ:

- ᐊᖏᓂᖅᓴᒥᒃ ᐃᓂᒥᒃ ᑭᒡᓕᕐᑲᕐᓂᖅ (ᓄᓇᓕᖕᒥ ᐊᕕᒃᑐᖅᓯᒪᓂᐅᑉ ᐃᓗᐊᓂ ᖃᐅᔨᓴᖅᑕᐅᕙᐅᔪ ᓄᓇᓕᖕᒥ ᖃᐅᔨᓴᖅᑕᐅᕙᐅᔪᒥᖕᒫᖑᙱᑦᑐᒥ);
- ᐊᑯᓂᐅᓂᖅᓴᒥ;
- ᐊᓯᐊᒎᑦ ᖃᐅᔨᓴᕐᑲᑦᑕᕐᓂᖅ;
- ᐃᓱᒪᒋᔭᕐᑲᕐᓂᖅ ᐊᒃᑐᐊᓂᐅᔪᓂᒃ ᐱᓇᓇᔭᐅᔪᑦ ᐆᒪᔪᑦ ᓇᔪᕝᕕᒋᕙᒃᑕᖏᑦ ᐊᒻᒪᓗ ᐱᓇᓇᔭᐅᔪᑦ ᐃᓅᓯᓕᕆᓂᕐᒧᑦ-ᑮᓇᐅᔾᔭᒃᓴᓕᕆᓂᕐᒧᑦ ᐃᓗᓕᖏᑦ; ᐊᒻᒪᓗ
- ᐅᔾᔨᕐᓇᒻᒪᕆᒃᑐᓂ ᖃᐅᔨᓴᕐᓂᖅ.

ᑲᑎᑉᐸᓪᓕᐊᑐᐃᓐᓇᕆᐊᓖᑦ ᐊᒃᑐᖅᑕᐅᔾᔪᑎᓄᑦ ᖃᐅᔨᓴᐃᓂᕆᔭᐅᔪᑦ ᑲᒪᒋᔭᐅᓚᐅᖅᑐᑦ ᐃᓛᒃᑰᖅᑐᓂᒃ ᐱᓇᓇᔭᐅᔪᑦ ᐆᒪᔪᑦ ᓇᔪᕝᕕᒋᕙᒃᑕᖏᑦ ᐅᕙᓗᓐᓃᑦ ᐱᓇᓇᔭᐅᔪᑦ ᐃᓅᓯᓕᕆᓂᕐᒧᑦ-ᑮᓇᐅᔾᔭᒃᓴᓕᕆᓂᕐᒧᑦ ᐃᓗᓕᖏᑦ ᓇᓗᓇᐃᕈᑕᐅᓚᐅᖅᑐᑦ ᐱᓕᕆᐊᕐᔫᖓᔪᓂ ᐊᒃᑐᖅᑕᐅᔾᔪᑎᓂ. ᐅᔾᔨᕐᓇᒻᒪᕆᒃᑐᕐᑲᓚᐅᙱᑦᑐᖅ ᐱᓕᕆᐊᕐᔫᖓᔪᓂ ᐊᒃᑐᖅᑕᐅᔾᔪᑎ (ᑕᑯᒋᐊᕐᓗᒍ ᑎᑎᕋᖅᓯᒪᓂᖅ 6 ᑖᔅᓯᒪ ᑎᑎᕋᖅᑕᐅᕙᐅᓪᓗᐊᖅᑐᒥ), ᑭᓯᐊᓂ ᑕᒪᕐᒥ ᐅᔾᔨᕐᓇᓗᐊᙱᓐᓂᓖᑦ ᐱᓕᕆᐊᕐᔫᖓᔪᑦ ᐊᒃᑐᐊᓂᐅᔪᑦ ᐱᓕᕆᐊᕆᔭᐅᓂᕐᑲᓚᐅᙱᑦᑐᑦ ᑲᑎᑉᐸᓪᓕᐊᑐᐃᓐᓇᕆᐊᓕᖏᓂᒃ ᐊᒃᑐᖅᑕᐅᔾᔪᑎᓄᑦ ᖃᐅᔨᓴᐃᓂᕐᕆᔭᐅᔪᒧᑦ. ᓇᓗᓇᐃᔭᑦᑎᐊᖅᓯᒪᔪᑦ ᑕᒪᒃᑭᖅ ᖃᐅᔨᓴᖅᑕᐅᔪᑦ ᓇᓂᔭᐅᔪᓐᓇᖅᑐᑦ ᐱᓇᓇᔭᐅᔪᑦ ᐆᒪᔪᑦ ᓇᔪᕝᕕᒋᕙᒃᑕᖏᑦ ᐊᒻᒪᓗ ᐱᓇᓇᔭᐅᔪᑦ ᐃᓅᓯᓕᕆᓂᕐᒧᑦ-ᑮᓇᐅᔾᔭᒃᓴᓕᕆᓂᕐᒧᑦ ᐃᓗᓕᖏᓐᓂ ᑎᑎᕋᖅᓯᒪᓂᐅᔪᓂᒃ ᐃᑲᔪᕈᑕᐅᔾᔪᑎᓂ ᑎᑎᑕᐅᓯᒪᔪᖅ 4-ᒥ ᑎᑭᐅᑎᒍᒍ 8-ᒧᑦ (ᑎᑎᕋᖅᓯᒪᓂᖅ 4: ᐊᓂᖅᑎᕈᑎᐅᑉ ᐊᕙᑎᖓ; ᑎᑎᕋᖅᓯᒪᓂᖅ 5: ᓄᓇᒥ ᐊᕙᑎᖓ; ᑎᑎᕋᖅᓯᒪᓂᖅ 6: ᐃᒪᑦᑎᐊᕙᐃᑦ ᐊᕙᑎᖏᑦ; ᑎᑎᕋᖅᓯᒪᓂᖅ 7: ᑕᓇᐅᕐᒥᐅᑕᑦ ᐊᕙᑎᖏᑦ; ᐊᒻᒪᓗ ᑎᑎᕋᖅᓯᒪᓂᖅ 8: ᐃᓄᖕᓄ ᐊᕙᑎ). ᐅᔾᔨᕐᓇᖅᑐᒻᒪᑎᕐᑲᓚᐅᙱᑦᑐᖅ ᑲᑎᖅᓱᖅᐸᓪᓕᐊᔪᓂᒃ ᐊᒃᑐᐊᓂᐅᔪᓂᒃ ᓇᓗᓇᐃᖅᑕᐅᓯᒪᔪᓂᒃ.

ᓄᓇᕗᒻᒥ ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᑲᑎᒪᔨᖏᑦᑕ ᐊᑐᖓᖏᑦ ᓇᓗᓇᐃᖅᓯᕗᖅ ᑭᒡᓕᑦ ᐊᖅᑯᓵᕐᕕᑦ ᐊᒃᑐᐊᓂᐅᔪᑦ ᐊᒃᑐᐊᓂᕐᑲᖅᐸᒃᑐᑦ ᓯᓚᑖᓂ ᓄᓇᕗᑦ ᓄᓇᓕᕐᑯᑎᒋᔭᖏᑦᑕ ᐃᓂᖏᓐᓂᒃ ᐊᒃᑐᖅᑕᐅᓯᒪᓂᕐᑲᓪᓚᓯᑦ ᐱᓕᕆᐊᕐᒧᑦ ᐃᓗᐊᓂ ᓄᓇᕗᑦ ᓄᓇᕗᑦ ᓄᓇᓕᕐᑯᑎᒋᔭᖏᑦ ᐃᓂᖏᓐᓂ. ᑕᒪᒃᑯᐊ ᐊᒃᑐᐊᓂᕐᑲᑐᐃᓐᓇᓇᐊᕐᑲᖅᑐᑦ ᐊᕕᒃᑐᖅᓯᒪᓂᕐᒥ, ᐅᑭᐅᖅᑕᖅᑐᒥ ᐊᕕᒃᑐᖅᓯᒪᓂᕐᒥ, ᐅᕙᓗᓐᓃᖅ ᓄᓇᓖᑦᔪᐊᑦ ᐊᓯᖏᓐᓂᒃ ᑭᒡᓕᖏᓐᓂᒃ. ᐱᓕᕆᐊᖅ ᐃᓂᕐᑲᕋᓗᐊᖅᑎᓪᓗᒍ ᓄᓇᕗᑦ ᓄᓇᓕᖏᓐᓂᒃ ᐃᓂᖓᓂᒃ, ᑭᒡᓕᑦ ᐊᖅᑯᓵᕿᕕᐅᔪᓂ ᐊᒃᑐᐊᓃᑦ ᐱᓕᕆᐊᕐᒥ ᐱᑖᕐᑲᕈᓇᕐᒪᑕ ᓂᕐᔪᑎᑦ ᐃᖏᕐᕋᓂᕐᑲᖅᑎᓪᓗᒋᑦ ᐊᓯᖏᓐᓄᑦ ᐊᐅᓚᑦᑎᕝᕕᐅᔪᑦ ᑭᒡᓕᖏᓐᓂᒃ (ᓲᕐᓗ, ᑐᒃᑐᑦ ᐊᒪᓗ ᑎᖕᒥᐊᑦ ᐅᑎᖅᑕᖅᐸᒃᑐᑦ) ᐅᕝᕙᓘᓐᓃᖅ ᐱᓕᕆᐊᑉ ᖃᓄᐃᓕᐅᕐᓂᕆᕙᒃᑕᖏᑦᑎᒍᑦ, ᐅᕝᕙᓘᓐᓃᖅ ᐃᓂᒋᔭᖅ ᐃᓛᒃᑰᖅᓯᒪᓂᕆᔭᖓᓂᒃ ᐱᔾᔪᑕᐅᔪᖅ, ᐊᖅᑯᓵᕐᓂᖅ ᐱᔪᓐᓇᕐᓂᕆᔭᐅᔪᒥ ᑭᒡᓕᖓᓂᒃ (ᓲᕐᓗ, ᐃᖏᕐᕋᔾᔪᑎᑦ ᐊᒻᒪ ᑮᓇᐅᔾᔭᒃᓴᐅᑎᓄᑦ ᐃᑲᔫᑎᑦ). ᐊᖅᑯᓵᕐᓂᕐᒧᑦ ᑭᒡᓕᓂ ᐊᒃᑐᖅᓯᓃᑦ ᑕᐃᑲᙵᓕᑦ ᐱᓕᕆᐊᕐᒥ ᐱᑦᑎᖅᐸᓪᓕᐊᔪᓐᓇᕐᓂᕐᑲᕐᒪᑕ ᐊᓯᖏᓐᓂ ᐃᓚᕐᑲᕐᑐᑎᒃ ᐱᓕᕆᐊᓂᒃ ᐊᒻᒪ ᖃᓄᐃᓕᐅᑦᑕᐅᔪᓂᒃ ᓯᓚᑖᓂ ᓄᓇᕗᑦ ᓄᓇᓕᐅᔪᓂᒃ ᐃᓂᖓᓂᒃ.

Hᐊᓐᓂᖓᔪᕐᒥ ᐱᓕᕆᐊᕐᒧᑦ, ᑭᒡᓕ ᐊᖅᑯᓵᕈᑕᐅᓂᕐᒧᑦ ᐊᒃᑐᐊᓃᑦ ᓇᓗᓇᐃᖅᑕᐅᓯᒪᔪᑦ ᒥᓂᑦᑕᒧᑦ ᐃᓄᓕᕆᔾᔪᑦᑲᒃᑯᓐᓂ ᐃᓱᒪᓕᐊᕆᔭᖓᓐᓂᒃ, ᐊᒻᒪᓗ ᐅᔾᔨᕈᓱᖕᓂᖅᓴᐅᓪᓗᓂ ᐊᒃᑐᐊᓂᕆᔭᐅᔪᓂ ᓄᓇᓕᖕᓂ ᐊᒻᒪ ᐃᓅᕐᑲᑎᒌᖑᔪᓂᒃ ᑕᑎᕐᑲᖅᐸᒃᑐᓂ ᕿᖓᐅᑉ ᑐᒃᑐᕐᑯᑎᖏᓐᓂᒃ. ᑕᐃᒪᐃᒻᒪᑦ, ᑭᒡᓕᑦ ᐊᖅᑯᓵᖅᑕᐅᕙᒃᑐᑦ ᐊᒃᑐᕐᑲᑦᑕᕐᓂᖏᓐᓄᑦ ᖃᐅᔨᓴᕐᓂᖅ ᐅᔾᔨᕈᓱᖕᓂᖅᓴᐅᕗᖅ ᑕᒪᒃᑯᓄᖓ ᐱᒻᒪᕆᐅᓂᕆᔭᐅᔪᓂᒃ ᐃᓂᐅᔪᓂᒃ. ᐊᒻᒪᒃᑲᓐᓂᖅ, ᑭᒡᓕᑦ ᐊᖅᑯᓵᖅᑕᐅᕙᒃᑐᑦ ᐊᒃᑐᐊᓂᕆᑐᐃᓐᓇᕆᐊᕐᑲᖅᑕᖏᑦ ᐃᓱᒪᒋᔭᐅᓚᐅᖅᐳᑦ ᑕᒪᑮᓄᑦ ᐊᒃᑐᐊᓂᐅᔪᓂᙶᕋᔭᖅᑐᓂᒃ. ᐅᔾᔨᕐᓇᕐᓂᕐᑲᓚᐅᙱᑦᑐᖅ ᑭᓕᑦ ᐊᖅᑯᓵᖅᑕᐅᕙᒃᑐᓂ ᐊᒃᑐᖅᑕᐅᓂᐅᔪᓂᒃ.

ᐊᒃᑐᖅᑕᐅᓃᑦ ᐊᕙᑎᒧᑦ ᐱᓕᕆᐊᕐᒥ

ᓯᓚᑦᑎᐊᕙᐅᙱᓐᓃᑦ ᓲᕐᓗ ᐱᖅᓯᕐᓃᑦ, ᒪᕐᑯᓗᐊᕐᓃᑦ ᖃᓐᓂᓗᐊᕐᓃᓪᓘᓐᓃᑦ, ᓂᒡᓚᓯᓗᐊᕐᓃᑦ ᐊᒻᒪ ᓄᓇᒥ ᐊᒃᑐᐊᓂᓕᖕᓂ ᐋᖅᑭᒃᓯᐃᓂᕐᒧᑦ ᐅᓗᕆᐊᓇᕈᑎᑦ ᓲᕐᓗ ᓴᔪᒃᐱᑦᓚᖕᓂᖅ, ᓄᓇᐅᑉ ᐊᒻᒪᓗ ᐅᕝᕙᓗᐊᕐᓂᖏᑦ, ᑕᒪᒃᑭᖅ ᐊᒃᑐᕐᓂᖅᑲᕈᓐᓇᕐᒪᑕ ᐱᓕᕆᐊᑉ ᖃᓄᐃᓕᖓᓂᓇᔭᖕᒐᓐᓂᒃ ᐊᒻᒪᓗ ᐃᓱᒫᓘᑕᒃᓴᐅᔪᓐᓇᖅᑐᓂ ᐃᓄᖕᓄ ᐊᑦᑕᓇᖅᑕᐃᓕᒪᔾᔪᑎᖏᓐᓄᑦ ᐊᒻᒪᓗ ᐊᕙᑎᒧᑦ. ᑕᒪᒃᑯᐊ ᐱᔾᔪᑎᑦ ᐊᒃᑐᕐᓂᖅᑲᕈᓐᓇᕐᒪᑕ ᐋᖅᑭᒃᓱᖅᓯᒪᓂᕆᔭᕆᓚᑕ ᐃᒡᓗᕐᑯᑎᕆᔭᐅᔪᓂᒃ ᐱᒻᒪᕆᐅᓂᖅᑕᖅᑐᑦ, ᐱᓗᐊᖅᑐᒍ ᖃᐅᔨᒪᔭᐅᔪᑎᓂ ᖃᐅᔨᓴᕈᑎᓂᒃ, ᐃᒪᖅᑲᖅᑲᐃᑦ, ᐅᔭᕋᖕᓂᖅᑲᐅᒃ, ᐊᑭᓐᓇᖕᒐ ᒪᑭᒪᑦᑎᐊᕐᓂᖕᒐ, ᐊᑐᓇᑦ ᐊᐅᓚᑕᐅᔪᑎᖕᒋᑦ, ᐊᒻᒪᓗ ᐅᔭᕋᐃᑦ ᓴᓂᖅᑯᐃᑦ ᐃᓂᖕᒋᑦ. ᑕᒪᒃᑯᐊ ᒪᑭᑕᐅᓯᒪᔪᑦ ᒪᑭᑕᐅᑎᑦᑎᐊᓇᐊᖏᑦ ᐊᕙᑎᒥ ᖃᐅᔨᓴᐃᑎᐅᓂᐅᕙᒃᑐᓂ ᐃᓯᒪᕆᔭᖅᑐᑎᒃ ᐱᓕᕆᐊᕐᒥ ᓱᒃᑲᐃᑎᖅᑎᑦᑎᑕᐃᑎᔭᑕᐅᓂᐊᖅᑭᓚᑕ, ᐋᖅᑭᐅᒪᑎᑦᑎᓂᖅ ᐱᓕᕆᐊᑉ ᐱᖁᑎᖏᓐᓂᒃ, ᐊᒻᒪ ᐊᑦᑕᓇᖅᑐᕌᑎᑦᑎᑕᐅᑎᓪᓗᑎᒃ ᐃᖅᑲᓇᐃᔭᖅᑎᓂᒃ. ᓴᐃᓇᒃᑯᑦ ᐅᔾᔭᓚᐅᖅᑐᑦ ᐊᕙᑎᒧᑦ ᐊᒃᑐᐊᓂᖅᑲᖅᓃᑦ ᐊᒻᒪᓗ ᐃᓚᓕᐅᔾᔨᓪᓗᑎᒃ ᐱᓕᕆᐊᑉ ᐋᖅᑭᐅᒪᓂᖓᓐᓄᑦ.

ᐋᖅᑭᒃᓯᐃᔾᔪᓂᕐᒧᑦ ᐅᓗᕆᐊᓇᕐᓂᕐᒧᑦ ᖃᐅᔨᓴᕐᓂᖅᑲᓚᐅᖅᐳᖅ ᓇᓗᓇᐃᖅᓯᔾᔪᑕᐅᓂᐊᕐᓗᓂ ᐅᓗᕆᐊᓇᕈᑕᐅᓇᔭᖅᑐᑦ ᐊᒻᒪᓗ ᐋᖅᑮᒍᑎᒋᓇᔭᖅᑕᖏᓐᓂᒃ, ᐃᓚᓕᐅᑎᓗᒍ ᐋᖅᑭᒃᓯᐃᓂᕐᒧᑦ ᐅᐸᓗᖓᐃᔭᐅᑎᓄᑦ ᐸᕐᓇᒃᑕᐅᓚᐅᖅᑐᑦ ᐱᑎᑦᑕᐃᓕᒪᓂᕐᒧᑦ ᐅᕙᓃᓐᓂᑦ ᒥᑭᒡᓕᕆᐊᖅᓯᐊᖅᓯᐊᕐᓗᒍ ᐊᑐᖅᑕᐅᑐᑐᐃᓐᓇᓇᐊᓕᖕᒥ ᐊᒻᒪᓗ ᐱᒻᒪᓇᐅᓂᓇᑐᐃᓐᓇᓇᐊᓕᖕᒋᑦ ᐊᓯᔾᔨᓂᐅᔪᓄᑦ ᐅᕙᓃᓐᓂᑦ ᐊᒃᑐᐃᓂᐅᓇᔭᖅᑐᑦ. ᑕᒪᒃᑯᐊ ᐅᓗᕆᐊᓇᕐᓂᐅᓇᔭᖅᑐᑦ ᖃᐅᔨᓴᖅᑕᐅᓚᐅᖅᑐᑦ ᑕᐅᑐᒃᓗᒋᑦ ᐊᑐᖅᑕᐅᑐᑐᐃᓐᓇᓇᐊᓕᖕᒋᑦ, ᐊᒃᑐᐃᓂᑎᓇᔭᙳᐊᖅᑕᖏᑦ ᐱᓕᕆᐊᖑᓕᐊᕈᒪᔪᒧᑦ ᒪᑭᑎᑕᐅᓯᒪᔪᓄᑦ ᐊᒻᒪ ᓴᖅᑭᑎᑕᐅᕙᓪᓕᐊᔪᓂᒃ, ᐊᒻᒪᓗ ᓴᐃᓇᒃᑯᑦ ᖃᓄᐃᓕᐅᕈᑎᒋᓇᔭᖅᑕᖏᑦ ᐊᑕᐅᓯᖅ ᐅᕙᓃᓐᓂᑦ ᑕᒪᒃᑮᑦ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᐅᓗᕆᐊᓇᕈᑏᑦ ᓴᖅᑭᓐᓂᕈᑎᒃ.

ᐃᓚᒋᖅᑲᑕᐅᓗᒍ ᖃᓄᐃᓕᖓᓂᖃᓇᔭᖅᑕᖓᓐᓂ ᓯᓚᖅᑰᓇᔭᖅᑐᖅ ᓯᓚᐅᑉ ᐊᓯᔾᔨᖅᓯᓂᖓᓐᓂ ᐊᒃᑐᐊᓂᖃᓇᔭᖅᑕᖓᓐᓂ ᐱᓕᕆᐊᕐᒧᑦ. ᒪᓂᔭᕐᒥ ᓄᓇᒥᒃ ᐊᒻᒪᓗ ᖁᖅᑮᖅᓇᐅᔭᖅᐸᒃᑐᖅ ᐃᑭᐊᑕ ᓄᓇᐅᑉ ᐋᖅᑭᒃᓯᐃᓂᕐᒧᑦ ᐊᔪᕐᓇᕈᑕᐅᕙᒃᐳᑦ ᐱᓕᕆᐊᒃ ᐊᑐᐊᓂᒋᐊᖅᑲᖅᑕᖏᑦ. ᓯᓚᐅᑉ ᐊᓯᔾᔨᖅᐸᓪᓕᐊᓂᖓ ᐱᔾᔪᑎᒋᓗᒍ ᐊᕙᑎᒥ ᐊᔭᐅᖅᑎᑦᑐᒥ ᒫᓐᓇᐅᔪᖅ ᖃᓄᐃᓕᖓᓂᐅᔪᒥᒃ; ᐅᑭᐅᑉ ᐃᒃᑮᖅᓇᙱᓐᓂᖅᓴᐅᓂᖏᑦ, ᒪᖅᑯᙳᖅᐸᓪᓕᐊᓂᖏᑦ ᐅᕙᓃᓐᓂᑦ ᐊᓯᖏᑦ ᐃᓱᒪᒋᔭᐅᔭᓇᓱᐊᓕᐊᑕ ᐊᒻᒪ ᐊᒃᑐᐊᓂᖅ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᒪᑭᑎᑕᐅᓯᒪᔪᓂᒃ ᑐᕌᖓᔪᑦ ᐱᓕᕆᐊᕐᒧᑦ.

ᐱᒋᐊᕈᑕᐅᓕᓛᖅᑐᖅ ᐋᖅᑭᒃᓯᓂᕐᒥᒃ ᐋᖅᑭᒋᐊᖅᓯᓂᕐᒥᒃ ᑕᒪᒃᑯᓂᖓ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᐊᒃᑐᐊᓃᑦ ᓴᖅᑭᑕᐅᕗᑦ. ᑖviiiᓐᓇ ᐋᖅᑭᓱᖅᓯᒪᓂᖅ ᑐᙵᕕᖅᑲᖅᑐᖅ ᐱᐅᓂᖅᐹᒥᒃ ᐊᐅᓚᑦᑎᔾᔪᑎᔾᔪᑎᓂᒃ, ᐊᔾᔨᐸᓗᐃᑦ ᐊᐅᓚᑦᑎᔾᔪᑎᑦ, ᐊᒻᒪᓗ ᑕᒪᐃᓐᓄᑦ ᓯᓚᐅᑉ ᐊᓯᔾᔨᖅᐸᓪᓕᐊᓂᖓ ᓇᓚᐅᑦᑖᖅᑕᐅᓯᒪᔪᑦ ᐃᓂᖕᒐᓚᑦᑐᓂᒃ ᐅᓇᖅᑐᖅᑲᐅᑎᓕᖕᓂ ᐊᑐᐃᓐᓇᐅᕖᖅᑐᑦ ᐋᖅᑭᒃᓯᐃᔾᔪᑎᐅᓂᖓ ᑕᒪᒃᑯᓂᖓ. ᐅᓇᖅᑐᖅᑲᐅᑎᓃᖕᒪᑦ ᓴᖅᑭᑕᐅᓂᐊᖅᑐᑦ ᑭᖑᓪᓕᖅ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᐊᒃᑐᐃᓂᕐᒧᑦ ᐅᖅᑲᐅᓯᓕᐊᕐ, ᐊᒻᒪᓗ ᖃᓄᐃᓕᐅᖅᑕᐅᓂᒃ ᐃᓚᓕᐅᑎᔭᐅᓗᑎᒃ ᐃᓗᐊᓄᑦ ᐊᒃᑐᐊᓂᓕᖕᓄᑦ ᐋᖅᑭᒃᓯᐃᓂᕐᒧᑦ. ᓴᐃᓇᒃᑯᑦ ᐱᔭᕇᓚᐅᖅᑐᑦ ᐱᕖᑎᑦᑎᓂᕐᒥᒃ ᖃᐅᔨᓴᕐᓂᕐᒥᒃ ᖃᓄᖅ ᓯᓚᕙᐊᕐᒥ ᓯᓚᐅᑉ ᐊᓯᔾᔨᖅᓯᓂᕐᒧᑦ ᐊᒃᑐᐊᓂᖃᖅᑐᓄᑦ ᓯᓚᔫᑎᕙᐊᖓ ᐊᒻᒪᓗ ᐅᓗᕆᐊᓇᕐᓂᖏᑦ ᓴᖅᑭᑕᐅᓯᒪᔪᑦ ᓇᓗᓇᐃᔭᐅᓂᐊᕐᓗᑎᒃ ᓯᓚᐅᑉ ᐊᓯᔾᔨᖅᐸᓪᓕᐊᓂᖓᓂ ᐅᓗᕆᐊᓇᕈᑕᐅᔪᑦᑐᓂᒃ ᐱᓕᕆᐊᕐᒧᑦ, ᑖᒃᑯᐊ ᐊᒃᑐᐊᓂᖅᑲᓗᐊᓂᐊᖃᓯᒋᐊᕐᓂᐊᖅᑐᑦ ᐱᓕᕆᐊᕐᒧᑦ, ᐊᒻᒪᓗ ᑖᒃᑯᐊ ᖃᐅᔨᒪᔭᐅᕐᒥᑦᑐᑦ ᐊᒃᑐᐊᓂᐅᓇᔭᖅᑐᑦ ᐱᓕᕆᐊᕐᒧᑦ. ᓯᕗᓂᒥ ᐊᒃᑐᖅᑕᐅᔭᕐᑕᐅᑐᐃᓐᓇᓇᐊᖅᑕᖏᑦ ᐊᓯᔾᔨᕐᐸᓪᓕᐊᓂᖏᑦ ᓯᓚᐅᑉ ᐱᓕᕆᐊᕐᒧᑦ ᐃᓚᖅᑲᖅᐳᖅ ᐅᑯᓂᖓ:

- ᐊᓯᙳᖅᐸᓪᓕᐊᓂᖏᑦ ᑕᓯᐅᑉ ᓯᑯᙳᖅᓂᖏᑦ, ᑕᓯᐅᑉ ᖁᑦᑎᒃᓯᕙᓪᓕᐊᓂᖓ, ᐊᒻᒪᓗ ᓯᓪᓯᐅᑉ ᐃᒡᕙᓪᓕᐊᓂᖏᑦ ᐊᒃᑐᐊᓂᖅᑐᑦᑕᐅᓇᔭᕐᓂᑦ ᑎᑭᑉᐸᓪᓕᐊᔪᓂᒃ ᐊᒻᒪᓗ ᐊᐅᓪᓚᖅᐸᓪᓕᐊᔪᓂᒃ ᐅᖅᓱᐊᓗᙳᐊᕐᓂ ᐊᒻᒪᓗ ᐱᖁᑎᓂᒃ ᕿᙵᐅᒪ.
- ᐅᓇᖅᓯᕙᓪᓕᐊᓂᖅ ᐊᒃᑐᐊᓂᖅᑐᑦᑕᐅᓇᔭᕐᓂᑦ ᓄᓇᐅᑉ ᖁᐊᖅᓯᒪᓂᖓᓂᒃ ᐃᓂᖓᓂᒃ ᐱᓕᕆᐊᑉ, ᐊᐅᓚᓂᖅᑲᖅᓂᖅᓴᐅᔪᑦ ᓄᓇᐅᑉ ᐃᓗᐊᓂ. ᑕᒪᓇ ᐊᒃᑐᐊᓂᖅᑐᑦᑕᐅᓇᐊᖅᑲᐅᔪᓂ ᒪᑭᑎᑕᐅᓯᒪᔪᓂᒃ ᐱᓕᕆᐊᕐᒧᑦ ᐊᑯᓂᐅᔪᒧᑦ.

ᓇᓗᓇᐃᑦᑎᐊᖅᓯᒪᔪᑦ ᖃᐅᔨᓴᐃᑎᐅᔪᑦ ᐊᑯᓐᓂᖓᓂᒃ ᓯᓚᐅᑉ ᐅᓗᕆᐊᓇᕈᑕᐅᔪᖅᓂᖏᑦ ᓇᓗᓇᐃᖅᑕᐅᓯᒪᔪᑦ ᖁᑮᓂ ᐊᒻᒪᓗ ᐱᓕᕆᐊᑉ ᒪᑭᑎᑕᐅᓯᒪᔪᖅᑯᑎᖏᑦ ᐅᕙᓃᓐᓂᑦ ᐊᐅᓚᑕᐅᔪᑦ ᐅᖅᑲᐅᓯᐅᕗᑦ ᐃᑖᒃᑯᖅᓯᒪᔪᓂᒃ ᐊᒃᑐᖅᑕᐅᓂᖏᑦ

ᖃᐅᔨᓴᕈᑎᓂᒃ ᐊᓯᐊᓂ ᑎᑎᕋᕐᕆᐅᑎᒥ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᐊᒃᑐᖅᑕᐅᓂᕐᒧᑦ ᐅᖃᐅᓯᕐᒥ. ᑭᓯᐊᓂᖅᑕᐅᖅ, ᑐᙵᕝᕕᒋᓪᓗᒍ ᐱᓕᕆᐊᑉ ᑲᔪᓰᓐᓇᐅᔾᔪᓂᖓ, ᓂᕆᐅᒋᔾᔪᕗᖅ ᐊᒃᑐᖅᑕᐅᓯᒪᓂᕆᔾᔪᑐᐃᓐᓇᕆᐊᓖᑦ ᐊᓯᔾᔨᖅᐸᓪᓕᐊᓂᕐᒧᑦ ᓯᓚᐅᑉ ᐱᓕᕆᐊᕐᒧᑦ ᐊᕐᒋᓂᖃᑐᐊᕐᒋᒻᒪᑕ.

<u>ᐱᕈᑐᐊᕿᓃᑦ ᐊᒻᒪᓗ ᐊᔪᓕᖅᓯᒪᔪᑦ</u>

ᑲᔪᓯᓂᖃᕋᑐᐊᖅᑎᓪᓗᒋᑦ ᓇᓗᓇᐃᖅᓯᔾᔪᑎᑦ ᐊᒻᒪᓗ ᐊᐅᓚᑦᑎᓂᖅ ᐅᓗᕆᐊᓇᖅᑐᓂᒃ, ᐱᕈᑐᐊᕿᕐᔪᐊᓂᖃᑐᐃᓐᓇᕆᐊᖃᕐᒪᑦ ᐊᒻᒪᓗ ᐊᔪᓕᕆᐊᖃᑐᐃᓐᓇᕆᐊᖃᕐᒪᑦ ᓇᒻᒥᓂᖅ ᖃᓄᐃᓕᐅᓂᖃᖅᑐᒥᒃ, ᓱᕈᖅᐸᓪᓕᐊᔪᓂᒃ ᐋᖅᑭᑑᑎᑎᒍᑦ, ᐅᕙᓗᓐᓃᑦ ᐃᓅᑉ ᑕᒻᒪᕈᑎᒋᔾᔮᕐᑎᒍᑦ. ᑐᑭᓯᐅᒪᓂᖅ ᐱᔾᔪᑕᐅᔾᔪᑎᓂᒃ ᐊᐅᓚᑦᑎᔪᑦ ᐅᓗᕆᐊᓇᕋᔭᖅᑐᑦ ᐋᑎᖃᒻᒪᕆᒃᐳᖅ ᑲᔪᓰᓐᓇᐅᔭᖅᑐᒥᒃ ᖃᓄᐃᓕᐅᕈᑎᖃᕐᓂᕐᒥᒃ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᐊᐅᓚᑦᑎᔾᔪᑎᓂᒃ. ᓴᐲᓇᒃᑯᑦ ᕿᓂᕐᓂᐊᖅᑐᑦ ᒥᑭᓪᓕᑎᑦᑎᓂᕐᒥᒃ ᐅᓗᕆᐊᓇᖅᑐᖅᓴᓂᒃ ᐱᕈᑐᐊᕿᓂᕐᒥᒃ ᐊᒻᒪᓗ ᐊᔪᓕᖅᓯᒪᔪᓂᒃ, ᐃᓚᖃᖃᑕᐅᓗᓂ ᖃᐅᔨᒋᐊᕐᒋᓐᓇᐅᔭᕐᓗᒋᑦ ᖃᓄᐃᓕᔾᔪᑕᐅᔪᑦ ᐃᓄᖕᓂ ᐊᒻᒪᓗ ᐊᕙᑎᒥᒃ. ᐊᐅᓚᑦᑎᔾᔪᑎᑦ ᐋᖅᑮᔾᔪᑕᐅᓂᐊᖅᑐᑦ ᐅᓗᕆᐊᓇᕐᓂᖅᐹᑦ ᐊᒻᒪᓗ ᑮᓪᓕᖃᖅᑎᑕᐅᓗᑎᒃ ᖃᓄᐃᓕᔾᔫᑕᐅᔪᑦ ᐃᒫᒃ:

- ᐱᕈᑐᐊᕿᑎᑦᑎᑦᑕᐃᓕᓂᖅ ᐊᒻᒪᓗ ᐊᔪᓕᖅᓯᒪᔪᓂᒃ ᐊᔪᕈᓐᓃᖅᓴᐃᓂᒃᑯᑦ, ᐅᔾᔨᕈᓯᑎᒃᑎᑦᑎᓂᒃᑯᑦ, ᐊᒻᒪᓗ ᐃᓕᓐᓂᐊᖅᑎᑦᑎᓂᒃᑯᑦ ᐊᒻᒪᓗ ᐱᖁᑎᓂᒃ ᐋᖅᑭᐅᒪᑎᑦᑏᓐᓇᐅᔭᕐᓂᒃᑯᑦ;
- ᖃᐅᔨᓴᕐᓂᖅ ᐅᓗᕆᐊᓇᕈᑕᐅᓇᔭᖅᑐᑦ ᐱᕈᑐᐊᕿᔾᔪᑎᓂᒃ ᐊᒻᒪᓗ ᐊᔪᓕᖅᑐᒃᓴᓂᒃ ᑕᒪᙵᓂ ᐋᖅᑭᒃᓱᕐᓂᖅᑲᖅᑎᓪᓗᒍ;
- ᐊᑐᖅᑎᑦᑎᓂᖅ ᐊᑐᖅᑕᐅᔫᓐᓇᑦᑎᐊᖅᑐᓂᒃ ᐊᐅᓚᑎᑦᔪᑎᓄᑦ ᐊᑐᖅᑕᐅᔾᔪᑎᓂᒃ ᐅᓗᕆᐊᓇᕐᓂᖅᑲᕐᓂᐊᙱᒻᒪᑦ; ᐊᒻᒪᓗ
- ᐋᖅᑭᒃᓱᐃᓂᖅ ᐊᒻᒪᓗ ᐊᑐᓕᖅᑎᑦᑎᓂᖅ ᐊᕈᑎᖃᑦᑎᐊᖅᑐᒥᒃ ᑐᐊᕕᕐᓇᖅᑐᓕᕆᔾᔪᑎᓄᑦ ᐸᕐᓇᐅᑎᓂᒃ ᐊᒻᒪᓗ ᐊᑐᖅᑕᐅᑐᐃᓐᓇᕆᐊᓕᖕᓂ ᐸᕐᓇᐅᑎᓂᒃ.

ᓴᐲᓇᒃᑯᑦ ᐅᓗᕆᐊᓇᖅᑐᒥ ᖃᐅᔨᓴᕈᑎᖏᑦ ᐃᓚᖅᐳᖅ ᓇᓗᓇᐃᔭᐃixᔾᔪᑎᒥᒃ ᐅᑯᓂᖓ ᐱᔭᐅᕙᒃᑐᓂᒃ: ᓇᓗᓇᐃᔭᐃᓂᖅ ᐊᕙᑎᓕᕆᓂᕐᒥᙲᕋᔭᖅᑐᑦ ᐊᒃᑐᐊᓂᖃᑐᐃᓐᓇᕆᐊᓖᑦ ᐃᓂᒧᑦ; ᓇᓗᓇᐃᖅᓯᓂᖅ ᐊᑐᖅᑕᐅᙳᐊᕋᔭᖅᑐᑦ ᐊᒻᒪᓗ ᐱᔾᔪᑕᐅᙳᐊᕋᔭᖅᑐᑦ ᐱᕈᑐᐊᕿᔾᔪᑕᐅᙳᐊᖃᔭᖅᑐᖅ ᐃᖅᑲᓇᐃᔭᖅᑎᒧᑦ, ᐊᕙᑎᒧᑦ ᐊᒻᒪᓗ ᐃᓪᓗᖁᑎᒧᑦ, ᐃᓱᒪᒋᔭᖃᙳᐊᓗᓂ ᑐᐊᕕᖃᖅᑐᖃᖅᓂᖏᑦ ᐸᕐᓇᐃᓂᖏᑦ ᐊᒻᒪᓗ ᐊᐅᓚᑦᑎᔾᔪᑎᖃᓂᐊᓗᓂ ᐱᑕᖃᕋᓗᐊᕐᒪᖔᑕ; ᓇᓗᓇᐃᖅᓯᓂᖅ ᐃᓚᒃᑲᓐᓂᕐᕆᓐᓂᒃ ᐊᐅᓚᑦᑎᔾᔪᑎᓂᒃ ᐊᒻ ᐊᐅᓚᔾᔪᑎᓂᒃ, ᐊᒻᒪᓗ ᐊᑐᓗᓂ ᐅᓗᕆᐊᓇᖅᑐᒥᒃ ᓇᓗᓇᐃᔭᐃᓂᕐᒥᒃ ᐃᓛᒃᑯᑦ ᐊᑐᖅᑕᐅᙳᐊᕋᔭᖅᑐᒥᒃ ᐊᒻᒪᓗ ᐱᔾᔪᑕᐅᙳᐊᕋᔭᖅᑐᓂᒃ. ᑕᒪᓐᓇ ᒪᓕᒃᑕᐅᕗᖅ ᖃᐅᔨᓴᕐᓂᕐᒥᒃ ᐅᓗᕆᐊᓇᖅᑐᓂᙳᐊᑐᓂᒃ ᓴᖅᑭᑐᓂᒃ, ᖃᐅᔨᓴᐅᔭᕐᓂᖅ ᐊᒻ ᕿᒥᕈᓂᖅ.

ᐊᐅᓚᑦᑎᔾᔪᑎᑦ ᑲᒪᒋᔭᖃᕐᓂᐊᕐᓗᓂ ᐅᓗᕆᐊᓇᖅᑐᒥᒃ ᖃᐅᔨᓴᖅᑕᐅᓚᐅᖅᑐᑦ ᐅᔾᔨᕆᓪᓗᒋᑦ ᐅᑯᐊ: ᐃᖅᑲᓇᐃᔭᖅᑎᑦ ᐊᑦᑕᓇᖅᑐᒦᑦᑕᐃᓕᒪᑎᑦᑎᓂᖅ; ᐃᑲᔪᕈᑕᐅᑦᑎᐊᕋᔭᖅᑐᑦ; ᐊᑑᑎᖃᑦᑎᐊᕐᓂᕐᒋᑦ; ᐊᑐᓕᖅᑎᑦᑎᓂᖅ ᐊᑭᓂᒃ; ᐊᒻᒪᓗ ᐸᐸᑦᑎᔨᐅᖃᑕᐅᔪᑦ ᑐᕌᖓᕐᒋᓐᓂᒃ.

ᑎᑎᕋᖅᑕᐅᓯᒪᔪᑦ ᐊᔪᓕᕈᑕᐅᑐᐃᓐᓇᕆᐊᓖᑦ ᐅᕙᓘᓐᓃᑦ ᐱᕈᑐᐊᕈᑕᐅᓇᔭᖅᑐᑦ ᐊᒃᑐᐊᓂᖃᖅᑐᑦ ᐱᓕᕆᐊᕐᒧᑦ ᐃᓪᓗᖁᑎᕐᒋᓐᓂᒃ ᐊᒻᒪᓗ ᖃᓄᐃᓕᐅᕈᑎᓂᒃ, ᐃᓚᖃᓚᐅᖅᑐᑦ: ᑯᕕᓂᖅ, ᓄᓇᓯᐅᑎᑎᒍᑦ ᐱᕈᑐᐊᕿᓃᑦ, ᖁᓕᒥᒎᓕᕐᒥ ᑲᑦᑐᖃᕐᓂᖅ, ᐊᐅᓚᑕᐅᓂᖃᙱᑦᑐᓂᒃ ᖄᖅᑐᓂᒃ, ᐃᑯᐊᓪᓚᕐᓃᑦ, ᐊᒻᒪᓗ ᐃᓱᕐᓃᑦ ᓴᖅᑭᐸᓪᓕᐊᔪᑦ.

ᑕᒻᒃᑭᖅ ᐱᕈᑐᐊᕿᓃᑦ ᐅᕙᓘᓐᓃᑦ ᐊᔪᓕᖅᑐᖃᕐᓂᕈᓂ ᖃᐅᔨᓴᖅᑕᐅᓯᒪᔪᑦ ᖃᓄᐃᓕᕈᑕᐅᔾᔪᑎᖃᕐᓗᓂ ᐱᓕᕆᐊᕐᒧᑦ, ᐃᓄᖕᒧᑦ ᐊᒃᑐᖅᑕᐅᓂᖅ ᐊᒻᒪᓗ ᓄᓈᕐᒐᔪᓂ ᐊᒃᑐᖅᑕᐅᔾᔪᑎᑦ ᖃᐅᔨᔭᐅᓯᒪᕗᑦ ᒥᑭᓗᐊᕐᓂᖃᕐᓂᕐᒋᓐᓄᑦ, ᐅᓗᕆᐊᓇᕐᓂᖃᙱᑦᑐᑦ, ᐅᕙᓘᓐᓃᑦ ᐊᒃᑐᓐᒋᑦ ᐊᐅᓚᑕᐅᔫᓐᓇᕐᓂᕐᒋᓐᓄᑦ ᐊᑐᖅᑕᐅᔭᕆᐊᖃᕐᓕᖅᑎᓪᓗᒋᑦ ᐊᑦᑕᓇᖅᑕᐃᓕᒪᑎᑦᑎᓂᒃᑯᑦ ᐋᖅᑭᒃᑕᐅᓯᒪᔪᓂᒃ ᐊᒻᒪᓗ ᐊᑐᓕᖅᑎᑦᑎᓂᕐᒥᒃ ᐊᐅᓚᑦᑎᔾᔪᑎᓂᒃ ᐸᕐᓴᐅᑎᓂᒃ ᓇᓗᓇᐃᔭᖅᑕᐅᓯᒪᔪᑦ ᑎᑎᕋᖅᓯᒪᔪᒥ 10-ᒥ.

Aulapkaiyini Naittuq

Una titiraqhimayuq ilaliutihimayuq Maligakhaq Havauhikhaq Pipkaitjutingit Naunaiyainiq, Angikliyuumiqniq Pipkaitjutingit Naunaiyainiq, unalu Ikaarniq kaanatap kiklinganut Pipkaitjutingit Naunaiyainiq (Titiraqhimaninngani 1), tamna Pipkaitjutingit uumannga Avatinganut uumanin Havauhikhaq (Titiraqhimaninngani 2), unalu Aaniqtuqarniq unalu Ahiruqniq (Titiraqhimaninngani 3).

Naunaiyaininnganut Maligakhaq

Ihivriuqninnga piniaruknaqhiyuq Itqurhimayuq Avatinga Ilanganit (VEC-ngit) unalu Itqurhimayuq Inuknut-maniliurniq Ilanganit (VSEC-ngit) ilaliutipkaqtaat Sabina-mit pihimayuq inuknut tuhaqtipkaitjutinik, aturninnga Qangaraaluknitamit Ilihimaniq (TK), munaqtiuyukhanik katimatjutikhaq unalu munaqtiuyukhanikkut ihumagiyauyut, pitquyangitlu titiraqhimayumi NIRB EIS malirutinginni (NIRB 2013). Tamna *Inuit Qangaraaluknitamit Ilihimaniq ukunanik Sabina Gold & Silver Corp., Back River-mi (Hannigayok) Havauhikhaq, Naonaiyaotit Qangaraaluknitamit Ilihimaniq Havauhikhaq* taiguagakhaq (KIA 2012) apiriyauyut akhuraaluk TK-mik naunaitkutikhanganik. Piyuq hapkunanit naunaitkutinit, hapkuat VEC-ngit unalu VSEC-ngit Apirhuutauyuq Titiraqhimayumut ilitariyauyut:

Nunaryuaptikni Avatinganut (Makpiraangani 4)

- VEC-ngit: Aniqhaaptaptiknik Qanurittaakhaanik, Nipi Ingutaarninngalu
- Apirhuutauyuq Titiraqhimayumut: Hilakput Anuringalu

Nunami Avatinganut (Makpiraangani 5)

- VEC-ngit: Nunami Nauhimayut Utiqattarviinnaqtullu Nuna, Tuktu, Akhaq, Umingmak, Qalvik Mitqulgitlu, Tingmiat Manningillu, Ukpiit, qupanuaqpait, kilgaviit
- Apirhuutauyuq Titiraqhimayumut: Ihivriuqningit nunaryuap qanuqtutlu itjutinga, Qiqiniq Nuna, kingingniq, naqhat nunalu

Tariungittuq Imaq Avatinganut (Makpiraangani 6)

- VEC-ngit: ihivriuqninga nunap imanga, Imaup Qanurittaarninga, Ilakungit Qanrittaarninnga, Iqaluit/Imarmiutat Nayugaat, Iqalungit
- Apirhuutauyuq Titiraqhimayumut: Imaup Imanga, Naunaiyainiq Tahinik unalu aktikkulaanga imaup itikninga

Imarmiutat Avatinganut (Makpiraangani 7)

- VEC-ngit: Imaup Qanurittaarninga, Ilakungit Qanrittaarninnga, Iqaluit/Imarmiutat Nayugaat, Iqalungit, Tariuqmi Qupanuangit/Tariuqmi Tingmiangit, Nattiit
- Apirhuutauyuq Titiraqhimayumut: Akhuurniq Havauhikhat

Inungnut Avatinganut (Makpiraangani 8)

- VEC-ngit: Initurlingit, Inuknut-maniliurningit, Nunanganik Aturniq, Niqainnait

- Apirhuutauyuq Titiraqhimayumut: Ingilraaqnitat Uyaranngugtut, Inungnut Aaniaqtailiniq unalu Avatinganut Qayangnaqningit Naunaiyainiq

Tamaita VEC-ngit ukuatlu VSEC-ngit ihivriuqtauyut pingahuuyunut piqaqtunut qangaraalukninngalu naunaitkutainnik. Piliqmat, piniaruknaqhiyuq pipkaitjutingit naunaiqtauyut uumani Nunanngani Naunaiyaivingani (qablunaatitut taiyauyuq naittumik LSA) angitqiyauyumiklu Avikturhimayumi Naunaiyaivingani (qablunaatitut taiyauyuq naittumik RSA). Qangaraaluknitaq, piniaruknaqhiyuq pipkaitjutingit ihumagiyauyut pitillugu Nayugangani Upalungaiyarniq, Igluqpiliurniq, aulapkainiq, Piffaarniq Umikvinganiklu, Umikhaaqtumilu Havauhikhaq pitillugu. Ihuatqiat maligangit ihumagiyauyut pitillugu naunaiyainiq, ukuatlu ihuaqtut kanatami avikturhimayumilu atugakhaitlu/tikitaunahuaqtangit.

Tamna Havauhikhaq-ittut piniaruknaqhiyuq pipkaitjutingit naunaiyainiq piqaqtuq hapkuninnga talvanngaanit havaariyakhat:

- piliurlugu Aktikkulaanga Pipkaitjutingit Naunaiyaininnganik, ilaliutiyuq katitirninnga VEC-ngit unalu VSEC-ngit naunaiyaininngalu pingahuuyunut piqaqtunut qangaraalukninngalu naunaitkutainnik;
- ilitarilugit piniaruknaqhiyuq piqutigiyangit Havauhikhamut uumunngalu VEC-ngit/VSEC-ngit;
- naunaiyarlugit piniaruknaqhiyuq pipkaitjutingit;
- ilitarlugit ikiklivallianginnik munariniqmullu naunaiyainit piiriami mikhigiamiluuniit piniaruknaqhiyuq pipkaitjutingit;
- naunaiyarlugit ilakungit pipkaitjutingit (tahapkuat pipkaitjutingit itqurnarutingit ittaagiamini talvannga iliuraininnga ikiklivallianginnik munariniqmut naunaiyaininnganik); unalu
- ihumaliurlugu akhuurutininnga ilakungit pipkaitjutingit.

Tamna Angikliyuumiqniq pipkaitjutingit naunaiyainiit piyangit aatjikutariyut piyakhanginnut piyakhanginnut Titiraqhimaninngani 12.5.2 uumani Nunavunmi Nunataarutit Angirutinginnit (qablunaatitut naittumik taiyauyuq NLCAmik) unalu Nunavut Kanogilivalianikot Elittohailioplotik Katimayiinginni (qablunaatitut naittumik taiyauyuq NIRB-mik) kingulliqpaanga Malirutinginni Upalungaiyarninnganut Avatinganutanut Pipkaitjutigiyuq Naunaitkutaq (EIS malirutinginni [NIRB 2013]) Havauhikhamut.

Tamna piniaruknaqhiyuq Angikliyuumiqninnganut pipkaitjutingit piliraikpat tamna ilakungit pipkaitjutingit havauhikhamut pipkaitjutigiyuq (ukunatitut, qaliriikhimayuq pipkaitjutigiyuqlu ukununnga) aatjikutaanut ikayuutimut/pipkaitjutigiyumut (VEC-ngit unalu VSEC-ngit) pipkaitjutigiyauyuq ilakunginnit ilakungit pipkaitjutingit *aatlat* qangaraalukmit, ittut takunnaqtulluuniit havauhikhat hulilukaarutitluuniit.

Tamna piniaruknaqhiyuq Angikliyuumiqniq pipkaitjutingit naunaiyainiq (qablunaatitut naittumik taiyauyuq CEA-mik) pipkaitjutauyuq angirutinganut Titiraqhimaninngani 7.11 kingulliqpaanganit EIS malirutinginni (NIRB 2013). Titiraqhimayumi kingulliqpaangani EIS malirutinginni, ihumagininnga tuniyauyuq hapkununnga ihumaalutigiyauyut piliraangamitku CEA-nga:

- angitqiyauyumik pingahuuyunut piqaqtunut naunaiyainiq (RSA-mik unaulluangittumik LSA);
- akuniraalukmik qangaraaluknitamik naunaitkut;
- himmautikhat ihivriuqninnga;
- ihumagilluaqlugu pipkaitjutingit VEC-ngit unalu VSEC-ngit; unalu

- naunaiyainiq akhuurutinganik.

Piniaruknaqhiyuq Angikliyuumiqniq pipkaitjutingit naunaiyainiit havaktauyut tamarmiknut VEC unaluuniit VSEC ilitariyauyumik piqaqtuq Havauhikhamut-piyuq ilakungit pipkaitjutigiyuq. Piqangittuq akhuurutauyuq Havauhikhamut piyuq ilakungit pipkaitjutingit ilitariyauyumik (takulugu Titiraqhimaninngani 6 uumani Makpiraalluangani), kihimi tamaita akhuurutaunngittut Havauhikhamut piyuq ilakungit pipkaitjutingit pipkaitjutauyuq piniaruknaqhiyuq Angikliyuumiqniq pipkaitjutingit naunaiyainiq. Qanuriliurningit tamaita naunaiyainiit takuinnarialgit uumani VEC uumanilu VSEC Titiraqhimaninnganit Ikayuutiutingani Makpiraanganis 4mit 8mut (Makpiraangani 4: Nunaryuaptikni Avatinganut; Makpiraangani 5: Nunami Avatinganut; Makpiraangani 6: Tariunngittumi Imaq Avatinganut; Makpiraangani 7: Imarmiutami Avatinganut; unalu Makpiraangani 8: Inungnut Avatinganut). Piqangittuq akhuurutauyuq Angikliyuumiqniq ilakungit pipkaitjutingit ilitariyauyumik.

Tamna NIRB malirutinginni naunaiyaqta Ikaarniq kaanatap kiklinganut pipkaitjutingit tahapkunanik pipkaitjutingit piyut hilataanit Nunavut Nunallaanginnit (qablunaatitut naittumik taiyauyuq NSA-mik) atayut Havauhikhamut iluani NSA. Hapkuat pipkaitjutingit piyut tamainni qablunaat nunagiyangani, avikturhimayuni, nunayuaptikniluuniit kiklinganit. Havauhikhaq ittuugaluaq tamainni iluani NSA, Ikaarniq kaanatap kiklinganut pipkaitjutingit Havauhikhamit pittaaqtut huratjat nuuliraangata nunanginnit kiklinganit (ukunatitut, tuktut tingmiat tingmiliraangata) unaluuniit havauhikhaq hulilukaarniit inmik, nayugangitluuniit pipkaitjutiyunik, ikaarumik nunangat kiklinganit (ukunatitut, ingilratjutingit maniitluuniit ikayuutit). Ikaarniq kaanatap kiklinganut pipkaitjutingit havauhikhap piniaruknaqhigiami angikliyuumiqninnga aatlanut havauhikhat hulilukaarutitlu hilataanit NSA-mit.

Back River Havauhikhanganut, Ikaarniq kaanatap kiklinganut pipkaitjutingit naunaiqtauyuq Ministauyumit Nunaqaqqaaqhimayuliriyikkunnut unalu Ukiuqtaqtumi Pivallianiq Kaaantap ihumaliuqtaminik, ihumagilluaqlugit pipkaitjutingit uumunnga pipkaitjutigiyut nunallaangit katimayiillu piyut Qingaup Tuktungit. Talvuuna, Ikaarniq kaanatap kiklinganut pipkaitjutingit naunaiyainiq ihumagilluaqtaik hapkuat akhuurutaulluaqtamiknik. Unalu, piniaruknaqhiyuq Ikaarniq kaanatap kiklinganut pipkaitjutingit ihumagiyauyut tamainnut ilitariyauyumik ilakungit pipkaitjutingit. Piqangittuq akhuurutauyuq Ikaarniq kaanatap kiklinganut pipkaitjutingit ilitariyauyumik.

<u>Pipkaitjutingit Avatinganut Havauhikhamut</u>

Qayangnaqtut hilaqlut piqtutut, nipalukpallaaqtuq qanniqpallaqtuqluuniit, alappaaqnaqpallaaqtuqluuniit unaluuniit qayangnarutit ukunatitut nuna ingutaarutikpat, nuna naqhallu nalunaiqqata, tamaita piqaqtut piniaruknaqhiyuq pipkaitjutigiyuq Havauhikhaq aulakaitjutingit talvani ihumaalutigiyauyuq Inungnut aaniqtailininnganut unalu Avatinganut. Hapkuat ihumaalutigiyauyut pipkaitjutigiyuq naunaiqninnga akhuurutauyut igluqpait, unalluamut TIA, imaqaqtut iluqhait, iluqhangit haniraa ingutaalairninnga, apqutit aturninnga, ilakutlu uyaraqvingit. Hapkuat tunngaviit piliurhimayukhat ahiruqtaulimaigiami avangintat taimaa naunairiami piyaungittut Havauhikhaq aulapkainingit, munarininnga Havauhikhaq puqutit, aaniqtailininngit havaktingit. Sabina ihivriuqtait hapkuat piniaruknaqhiyuq Avatinganut pipkaitjutingit ilaliutiyaitlu havauhikhamut piliurninnganut.

Hanauyukhanik Titirauyaqtiuyuq Qayangnarutingit Naunaiyainiq havaktaat naunaiyariami qayangnarutingit unalu ikiklivallianginnik, ukuatlu piliuqtamiknik ihumaliuqhimayut pipkaitjutingigiami ikikliyuumiriamiluuniit piniaruknaqhiumik akhuurninnga aallangurninngit pipkaitjutiyulluuniit. Hapkuat qayangnarutit ihivriuqtauyut piplugit piniaruknaqhiunit, ihumagiyauyut pipkaitjutigiyuq pipkainiarutinganik Havauhikhap aulapkaitjutingit piliurninnganiklu, Sabiinap piniaruknaqhiyuq kiutjutinga atauhiq tamaitaluuniit hapkuat avatinganik qayangnarutinga pikpat.

Ilaliutihimayuq tunngavingani qayangnaqtuq anuringa una piniaruknaqhiyuq nunapta hila aatlanguqninnga pipkaitjutigiyuq Havauhikhamut. Natirnaa qiqiumainnaqtuqlu nunaa pivaktuqlu havaktunut akhuurutingit taimaa havauhikhaq pinahuaqtuq. Hila aatlangurninnga pipkaitjutiniaqtuq avatiinganut aatlanguyuq nutaamit qanuritaakhaanganik; amigaivallaangittunik alappaaqnaqpallaaqtuq ukiumi, aatlanguqtuq nipalukninnga aatlatluuniit ihumagiyauyuq ayurhautiginiaqtuq hivuniptikni aulapkaitjutinginnik pipkaitjutilunilu aulapkaininnganik piyut havauhikhamut.

Hivulliqpaami piliurhimayuq ikikliyuumiriami hapkuat avatinganut pipkaitjutigiyauyuq itpat. Una piliurniq piliurhimayuq nakuutqianik munariniqmut atuinnaqtainnik, aatjikutaanik aulapkaitjutinik, hila aatlangurninnganiklu itqurnarutingit uyarakhiurvikmi ittut uuktuutit pilimaitpata uumani pitjutingani havaktunik. Nutaat uuktuutit piliuqtauniaqtut uumunnga Kingulliqpaanga Avatinganut Ayurhautigiyuq Titiraq, qanuriliurutinga ilaliutiniaqtuq tamainnut akhuurutauyuq pitjutingit havaamut. Sabina iniqtiqtaat qanuritaakhaanik naunaiyainiq qanuqtut nunaryuaptikni hila aatlangurninga pipkaitjutauniaqtuq hilaup kiklingit qayangnarninngalu tunngavia tuniyauyuq naunaiyariami hila aatlangurninnga qayangnarutinga pipkaitjutiniaqtuq havauhikhamut, hapkuat pilimaittut ayurhautiyumi havauhikhamut, tahapkuatlu ilihimangittunik ayurhautigiyauniq havauhikhamut. Hivuniqmikiaq pipkaitjutingit aatlanguqtumik hila havauhikhamut ilaliutihimayuq:

- Aatlanguliqtuq tariup hikunga, tariuq itinninga angikliyumiqtuq nunalu ahiruqtiliqtuq ayurhautiniaqtuq qaiyunut aullaqtiqtunut umiaq urhuqyualik hunavalukniklu Qingaukmi.
- Hila uunaqpallaqninnga pipkaitjutigiyuq Qiqiniq Nuna havauhikhami, piniaruknaqhiyuq piliqtuq angikliyuumiqtumut qaanga hilikninnga. Una pipkaitjutiginiaqtuq aulapkaininnganut havauhikhami akuniraalukmi.

Ihuaqtuq piqutigiyangit ukunanit hilaup qayangnaqninnganut ayurhautiginiaqtuq ilitariyauyumik qaanganit Havauhikhaq aulapkaitjutikhaptiknik aulapkaitjutikhanikluuniit uqaqtauyut avaluutumut ayurhautigiyauyuq naunaiyainiit DEISmi. Kihimi, piyuq uumani Havauhikharaalunganut, ihumagiyauyuq pipkaitjutingit piniaruknaqhiyumut aatlanguqtuq hila havauhikhamut akhuurutaungittut.

<u>Aaniqtuqarniq unalu Ahiruqniq</u>

Pingitillugu akhuurhimmaaqniq ilitarigiami munarigiamilu qayangnautingit, angiyut Aaniqtuqarniq unalu ahiruqniq piniaruknaqhiuq inmikkut piyunit, mikhilaaqhimayut ikiklivallianginnik aktikkulaangit, uumunngaluuniit Inungnut ihuirutingit. Kangirhilugu ayurhautiginiaqtuq munariyait kitut qayangnarutit ihariaginiaqtuq nakuuyumut Avatinganut munariniqmik piluni. Sabina qiniqhianiaqtuq ikikliyuumiriami qayangnarutinga ukunanik Aaniqtuqarniq unalu ahiruqniq, unalu naunairiami pipkaitjutiyut inuknut avatinganutlu. Munariningit ikikliyuumiqniaqtaik amihut qayangnautit ikikliyuumiqlugitlu pipkaitjutingit hapkunuuna:

- pittailininnga Aaniqtuqarniq unalu ahiruqniq ayuirhaqluni, ilihimaluni, ilihaqluni hunavalutingit munarilugit;
- naunaiyainiq qayangnaqninnga Aaniqtuqarniq unalu ahiruqniq piliurninnganut;
- havaktiliqlugit atuqtaarningit munariniqmut pitjutingit naunairiami ihivriuqhimmaaqninnga qayangnaqtunik; unalu
- piliuqlugu atuliqtitaulugu pipkaitjutigiyq qilamiuqtuqaqqat kiutjutikhamut ihumaliurutingit qilamiuqtuqaqqatlu ihumaliurutit.

Sabinaup qayangnarninnga naunaiyainiq maligakhaq ilaliutiyuq naunaiyaininnganik piliurhimayuq ukunanit: ilitariniq Avatinganut pitjutingit ayurhautigniaqtuq uyarakhiurvinganut; inmimut ihumaginiq piniaruknaqhiyumut pipkaitjutingalu nakuungitqiyauyumik aanirumik havaktut, Avatinga igluqpingitlu, pigumi qilamiuqtuqaqqat ihumaliurniq munariniqmutlu munariyait; ilitariniq aatlanik munariniqmut piyut munariyauyutlu, pipkailugit qayangnaqtut pininngit tamarmiknut qayangnaqtunut piyut piniaruknaqhiumut pipkaitjutigiyumullu. Talvannga ihivriuqtut ilakunginnik qayangnaqtut, munariniq ihivriuqniqlu.

Atanguyat munariyukhat ihuarhigiami qayangnarningit ihivriuqtauyut ihumagiyauyunik: havaktut aaniqtailiniq; piniaruknaqhiyuq ikayuutikhaq; pipkaitjutigiyuq; iniqtiriniqmut akinga; tigumiaqtitauyutlu tikinnahuarutingit.

Titiraqhimayuq piniaruknaqhiyuq ahiruqniq unaluuniit Aaniqtuqarniqat piyut havauhikhamut igluqpingit hulilukaarutingitlu, ilaliutihimayuq: kuviqtuqaqqat, akhaluutikkut aaniqtuqaqqat, halikaapta iukkaqqat, munarilimaitamiknik kuviniq, ikualaaqtuqaqqat, qaraqtaut qaraqqat, unalu ilakungit kuvikpat.

Tamainnut Aaniqtuqarniq ahiruqtaqaqqatluuniit ihivriuqtauyuq pigiami havauhikhamut, tamna ilakungit Inungnut avatimutlu pipkaitjutingit ihivriuqtauyut mikkauyut, qayangnaittuq, unaluuniit pipkaitjutingit ihumagiyauyut munariyaaqtait piliqqata qayagiyakhangit piyut piliurninngani iniqtiqninnganut munariniqmut ihumaliuqtamiknik titiraqhimayumi Makpiraangani 10.

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BACK RIVER PROJECT

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1. General Methodology for Project Effects Assessment, Cumulative Effects Assessment, and Transboundary Effects Assessment

1.1 INTRODUCTION

This volume describes the effect assessment methodology that was used to identify and assess the potential environmental and socio-economic effects of the Back River Project (the Project) and is consistent with the requirements of Section 12.5.2 of the Nunavut Land Claim Agreement (NLCA) and the Nunavut Impact Review Board (NIRB) final Guidelines for the Preparation of an Environmental Impact Statement (EIS guidelines [NIRB 2013a]) for the Project.

Environmental effects are changes to the current environmental or socio-economic conditions that occur as the result of a project. An effects assessment is the process of identifying and quantifying the effects of a proposed project (i.e., its components and related physical activities) on environmental conditions.

As specified in the EIS guidelines (Section 7, Effect Assessment Methodology), details of public consultation, community engagement, and government engagement are described in *Volume 3: Public Consultation, Government Engagement, and Traditional Knowledge* of this DEIS. In addition, the details of Traditional Knowledge (TK) collection methodology, along with the detailed report generated by the Kitikmeot Inuit Association, Lands and Environment Department (KIA 2012), are also provided in Volume 3 of this DEIS.

Both public consultation and TK were used in multiple areas of the overall assessment methodology. The selection of potential Valued Ecosystem Components (VECs) and Valued Socio-economic Components (VSECs) was based on the NIRB scoping process which involved consultation with all potentially affected communities. The scoping and refining of the potential VEC/VSEC list was based on Sabina Gold and Silver Corp. (Sabina) -led public consultation (where a potential list of VECs/VSECs was presented to the communities for feedback and input), the TK report (KIA 2012), consultation with regulatory agencies, and regulatory considerations. The final list was provided to NIRB for inclusion in the draft EIS guidelines, so that they were available for review and comment by all interested parties. The final list as indicated in the Sabina submission of April 8, 2013 for the final EIS guidelines are the VECs/VSECs included in this DEIS.

The results of the *Inuit Traditional Knowledge of Sabina Gold & Silver Corp., Back River (Hannigayok) Project, Naonaiyaotit Traditional Knowledge Project (NTKP) report* (KIA 2012) were used for scoping and refining the potential VEC/VSEC list. The KIA report presents clear maps of valued animal species, environmental components, and traditional land use activities. This information was used to determine if these valued aspects potentially interacted with the proposed Project, and if so, they were included in the VEC/VSEC list. The information in the KIA report was also used to help determine appropriate spatial study areas for baseline data collection and potential effects assessment.

This document presents the overall assessment methodology that was utilized for the following:

- Potential Project-related Effects Assessment;
- Potential Cumulative Effects Assessment; and
- Potential Transboundary Effects Assessment.

Additional methodology details pertaining to each individual VEC or VSEC are provided in the Supporting Volumes: Volume 4: Atmospheric Environment; Volume 5: Terrestrial Environment; Volume 6: Freshwater Environment; Volume 7: Marine Environment; and Volume 8: Human Environment.

1.2 POTENTIAL PROJECT-RELATED EFFECTS ASSESSMENT METHODOLOGY

This section provides details on the assessment methodology used for the main potential Project-related effects assessment. The following information is provided in the text below:

- the objectives of the effect assessment process;
- a description of how baseline information was integrated into the DEIS;
- a description of the scoping process used to identify VECs and VSECs;
- the approach used for selecting spatial and temporal assessment boundaries;
- the method used to predict and assess effects;
- an overview of the types of mitigation used to reduce the potential for significant adverse effects; and
- the identification of criteria and process used to determine the significance of residual effects.

1.2.1 Effect Assessment Objectives

The objectives of the environmental effect assessment for the Project are to:

- identify potential effects on VECs and VSECs resulting from the Project;
- apply mitigation measures to avoid, reduce, control, eliminate, offset, or compensate for potential effects;
- identify whether there are residual effects that cannot be mitigated;
- determine the significance of residual effects;
- assess the potential for residual project-related effects to interact cumulatively with the residual effects of other projects or human activities (addressed in Section 3 Potential Cumulative Effects Methodology); and
- determine the significance of residual cumulative effects (addressed in Section 3 Potential Cumulative Effects Methodology).

1.2.2 Baseline Information Collection

Baseline studies were conducted to: 1) understand existing conditions in the local and regional area of the Project; 2) identify potential environmental effects that were likely to result from Project components and activities; 3) to provide a benchmark (i.e., before-after-control-effect (BACI) approach) for evaluating the potential effects of the Project and to characterize pre-disturbance conditions for the purpose of reclamation activities; and 4) to support predictive modelling for effect analysis.

Baseline studies were conducted using a tiered approach beginning with a desk-based review of available information, including information from government sources, scientific studies, and publically-available information from other projects in the West Kitikmeot region of Nunavut. Site-specific baseline studies were conducted sporadically over the years prior to the acquisition of the Back River Property by Sabina. These studies were typically limited in geographical scope and focused on a select few aspects of the biophysical environment.

Comprehensive baseline field programs began in 2009, and extensive programs were conducted in 2010, 2011, 2012, and 2013 to support the Project. These comprehensive programs initially focused on the Goose Property area, but were expanded to include the George Property Area and the Marine Laydown Area in 2012 and 2013. Table 1.2-1 provides a high-level summary of the field baseline programs that have been conducted for various subject areas.

Table 1.2-1. Summary of Field-collected Baseline Information for the Back River Project

Assessment Subject Area and Component	VEC, VSEC, or Subject of Note	Years of Available Data
Atmospheric Environment		
Air Quality	VEC	2011, 2012, 2013
Noise and Vibration	VEC	2012
Meteorology and Climate	Subject of Note	2006-2013
Terrestrial Environment		
Geology	Subject of Note	1982-85,1987,1989, 1990-94,1997, 1999, 2000-2013
Geochemistry	Subject of Note	2007, 2010, 2011, 2012, 2013
Permafrost	Subject of Note	2007-2013
Landforms and Soils	Subject of Note	2012
Vegetation and Special Landscape Features	VEC	2012
Caribou	VEC	2007, 2010-2013
Grizzly Bear	VEC	2012-2013
Muskox	VEC	2007, 2010
Wolverine/Furbearers	VEC	2012-2013
Migratory Birds (Upland Birds and Waterfowl)	VEC	2007, 2011-2013
Raptors	VEC	2007, 2011-2013
Freshwater Environment		
Hydrology	VEC	2007, 2010-2013
Groundwater	Subject of Note	2012, 2013
Limnology and Bathymetry	Subject of Note	1994, 2006, 2007, 2010-2013
Water Quality	VEC	1993, 1997, 2006-2007, 2010-2013
Sediment Quality	VEC	2007, 2010-2013
Fish/Aquatic Habitat	VEC	2007, 2010-2013
Fish Community	VEC (lake trout; Arctic grayling)	1990, 1996, 2006, 2010-2013
Marine Environment		
Physical Processes	Subject of Note	2001, 2007, 2008, 2010, 2012, 2013
Water Quality	VEC	2001, 2007, 2008, 2010, 2012, 2013
Sediment Quality	VEC	2001, 2002, 2007, 2010, 2012, 2013
Fish/Aquatic Habitat	VEC	2001, 2007, 2010, 2012, 2013
Fish Community	VEC (Arctic char)	2001, 2010, 2012, 2013
Seabirds/Seaducks	VEC	2010, 2013
Ringed Seals	VEC	2007, 2009, 2012, 2013

(continued)

Table 1.2-1. Summary of Field-collected Baseline Information for the Back River Project (completed)

Assessment Subject Area and Component	VEC, VSEC, or Subject of Note	Years of Available Data
Human Environment		
Archaeology	VSEC	2001, 2003, 2010-2013
Paleontological	Subject of Note	2012
Non-Traditional Land and Resource Use	VSEC	2012
Socio-economics	VEC (Economic Development, Business Opportunities, Employment, Education and Training)	2012
Health, Safety, and Community Well-being	VSEC	2012
Subsistence Economy and Land Use	VSEC	2012
Country Foods/Human Health	VSEC	2012

Detailed descriptions of available baseline information, as required in Section 7.3 of the EIS guidelines, for all VECs, VSECs, and Subjects of Note are presented in each of the Supporting Volumes: Volume 4: Atmospheric Environment; Volume 5: Terrestrial Environment; Volume 6: Freshwater Environment; Volume 7: Marine Environment; and Volume 8: Human Environment. The "Baseline Information" requirements outlined for each subject area in Section 8 of the EIS guidelines are also provided in the Supporting Volumes 4 through 8. A summary of this information is also provided in Chapter 5 of the Main Volume of the DEIS for the VECs and VSECs.

1.2.3 Establishing the Scope of the Effect Assessment

Issues scoping is fundamental to focusing the EIS on those issues where there is the greatest potential to cause significant adverse effects. Through this scoping exercise potential effects of the Project that are likely to affect specific VEC and VSEC receptors are identified and potential interactions or cause-effect pathways of project activities are analysed so that they can be better understood.

Spatial and temporal boundaries are then determined based on the location and distribution of VECs, and the spatial extent of potential Project effects.

The scope of the EIS is determined as part of the NIRB process. NIRB consulted with the public and interested parties in the Kitikmeot Region and Yellowknife in February of 2013 (as well as ongoing information and correspondence) to determine the scope of the EIS. A "Public Scoping Meetings Summary Report" was issued by NIRB in March of 2013, and the "Final Scope List for the NIRB's Assessment of the Back River Project" can be found as Appendix B in the EIS guidelines.

The scope of NIRB's assessment is based on the requirements of Section 12.5.2 of the Nunavut Land Claims Agreement (NLCA), NIRB's 10 Minimum EIS Requirements, and the Back River Project Proposal which was submitted on June 15, 2012.

1.2.3.1 Selecting Valued Ecosystem Components and Valued Socio-economic Components

VECs and VSECs are specific attributes of the biophysical and socio-economic environments that have scientific, economic, social or cultural significance. VECs may be identified on the basis of perceived or real public or scientific concerns regarding their value and their potential to be effected by a human activity. The value of a component not only relates to its role in the ecosystem, but also to the value placed on it by humans. Consideration of certain valued components may also be a legislated requirement, or known to be a concern because of previous project experience.

The definitions provided in the glossary of the EIS guidelines (NIRB 2013a) are as follows:

> *Valued Ecosystem Components (VECs): Those aspects of the environment considered to be of vital importance to a particular region or community, including:*
>
> *a) Resources that are either legally, politically, publically, or professionally recognized as important, such as parks, land selections, and historical sites;*
>
> *b) Resources that have ecological importance; and*
>
> *c) Resources that have social importance (NIRB, 2007).*
>
> *Valued Socio-Economic Components (VSECs): Those aspects of the socio-economic environment considered to be of vital importance to a particular region or community, including components relating to the local economy, health, demographics, traditional way of life, cultural well-being, social life, archaeological resources, existing services and infrastructure, and community and local government organizations (NIRB, 2007).*

Section 7.6 of the EIS guidelines provides further information and requirements for the selection of VECs and VSECs for the DEIS. Sections 7.6.1 and 7.6.2 provide a comprehensive list of potential VECs and VSECs for consideration.

The VECs and VSECs for the DEIS were selected based on the potential list provided by NIRB in the EIS guidelines (Sections 7.6.1 and 7.6.2), and other information and processes as described below. The VECs and VSECs were selected based on the following information:

- Potential Interaction with the Proposed Project;
- Consultation with Communities;
- Available Traditional Knowledge Information;
- Consultation with Regulatory Agencies;
- Regulatory Considerations; and
- Practicality of Measuring and Monitoring.

Table 1.2-2 presents the information used in the VEC/VSEC scoping process to determine the final VEC/VSECs for the EIS. The final list of VECs and VSECs was submitted to NIRB on April 8, 2013 as part of the submissions for the EIS guidelines. The following text provides more details on the VEC/VSEC scoping process.

It should be noted that all proposed VECs/VSECs from the NIRB guidelines are included in Supporting Volumes 4-8 regardless of whether they were selected for VECs/VSECs or Subjects of Note. Those selected for VECs/VSECs were subjected to an effects assessment, while those selected for Subjects of Note have all of the requested information provided in the supporting volume.

<u>Potential Interaction with Project</u>

In order for a potential VEC or VSEC to be selected, there had to be a potential for that VEC/VSEC to interact with the proposed Project.

The spatial or temporal characteristics of the VEC/VSEC needed to overlap with the spatial or temporal characteristics of the proposed Project. For example, for a wildlife species to be selected as a VEC, it had to have a geographical distribution, including migration, that overlaps with the proposed Project.

The only potential VECs/VSECs that did not have the potential to interact with the proposed Project were polar bears and brown bears. The ranges of these species do not overlap with the proposed Project footprint and activities, the wildlife Local Study Area (LSA), or the wildlife Regional Study Area (RSA).

Consultation with Communities

VECs and VSECs were also selected using input from public consultation activities conducted with local communities. Sabina's public consultation program began in June 2012 and has included the communities of Cambridge Bay, Kugluktuk, Kingaok, Omingmaktok, Gjoa Haven, Taloyoak, Kugaaruk, and Yellowknife. Consultation activities have included public meetings, meetings with key community stakeholder groups (e.g., Hunter Trapper Organizations and Hamlets), meetings with community advisory groups in Cambridge Bay and Kugluktuk, and other forms of engagement (e.g., radio shows, social media, newsletters, trade show booths). Minutes of all formal meetings were taken by Sabina representatives and entered into Sabina's public consultation database. Copies of these meeting minutes are provided in Volume 3.

NIRB additionally held public scoping meetings for the Project in February 2013 where the communities of Cambridge Bay, Kugluktuk, Gjoa Haven, Taloyoak, Kugaaruk, and Yellowknife were visited. Sabina representatives attended the public scoping meetings in each community and were available to answer questions NIRB or the public had. Detailed notes from these meetings were produced by NIRB and are included in the NIRB document *Public Scoping Meetings Summary Report* which was issued by NIRB in March of 2013. The *Final Scope List for the NIRB's Assessment of the Back River Project* can be found as Appendix B in the EIS guidelines.

Common themes, issues, and concerns that emerged through Sabina's public consultation activities and during NIRB's public scoping meetings were identified by Company representatives and helped inform the selection of VECs and VSECs for the Project. Sabina will continue to track public issues and concerns in its public consultation database throughout the life of the Project.

Traditional Knowledge

The results of the *Inuit Traditional Knowledge of Sabina Gold & Silver Corp., Back River (Hannigayok) Project, Naonaiyaotit Traditional Knowledge Project (NTKP) report* (KIA 2012) were used for scoping and refining the potential VEC/VSEC list. The KIA report presents summary information and clear maps of valued animal species, environmental components, and traditional land use activities. This information was used to determine if these valued aspects potentially interacted with the proposed Project, and if so, they were included in the VEC/VSEC list.

It is important to note the KIA (2012) report is not a comprehensive account of all traditional knowledge or all valued components in the Kitikmeot Region. However, it does provide a valuable source of existing traditional knowledge information. Additional traditional knowledge work is currently being conducted by Sabina in cooperation with the KIA to help address prominent data gaps.

Table 1.2-2. Valued Ecosystem Component and Valued Socio-economic Component Scoping Process Information

Subject Area	Potential VEC/VSEC of the Project Identified from Revised Draft Guidelines (NIRB, March 2013)	Anticipated Ecosystemic and Socio-economic Impacts of the Project from Final Scope (NIRB, March 2013)	Potential Interaction with Project	Consultation with Communities [1] and TK Information [2]	Consultations with Regulatory Agencies[3] and Regulatory Considerations[4]	VEC, VSEC, or other[5,6] within EIS
Atmospheric Environment	Air quality	Air quality	Yes	Few or no comments expressed	Moderate to significant comments expressed Moderate regulatory considerations	Atmospheric VEC - Air Quality
Atmospheric Environment	Climate and meteorology	Climate and meteorology	Yes	Few or no comments expressed	Few or no comments expressed Low regulatory considerations	Subject of Note *Climate change will be included in Individual Assessment Areas
Atmospheric Environment	Noise and vibration	Noise and vibration	Yes	Few or no comments expressed	Few or no comments expressed Moderate regulatory considerations	Atmospheric VEC - Noise and Vibration
Freshwater Environment	Water quantity	Water quantity	Yes	Few or no comments expressed	Moderate to significant comments expressed Significant regulatory considerations	Freshwater VEC - Water Quantity
Freshwater Environment	Hydrogeology	Hydrogeology	Yes	Few or no comments expressed	Few or no comments expressed Low regulatory considerations	Subject of Note
Freshwater Environment	Groundwater quality	Groundwater quality	Yes	Moderate to significant comments expressed	Few or no comments expressed Low regulatory considerations	Subject of Note
Freshwater Environment	Surface water quality	Surface water quality	Yes	Moderate to significant comments expressed	Few or no comments expressed Moderate regulatory considerations	Freshwater VEC - Water Quality
Freshwater Environment	Sediment quality	Sediment quality	Yes	Few or no comments expressed	Moderate to significant comments expressed Significant regulatory considerations	Freshwater VEC - Sediment Quality
Freshwater Environment	Aquatic ecology	Aquatic ecology	Yes	Moderate to significant comments expressed	Moderate to significant comments expressed Significant regulatory considerations	Included in Individual Assessment Areas
Freshwater Environment	Aquatic biota: representative fish as defined in the Fisheries Act, benthic invertebrates, other aquatic organisms	Aquatic biota including representative fish as defined in the Fisheries Act, aquatic macrophytes, benthic invertebrates and other aquatic organisms	Yes	Moderate to significant comments expressed	Moderate to significant comments expressed Significant regulatory considerations	Included in Individual Assessment Areas
Freshwater Environment	Habitat including fish habitat as defined in the Fisheries Act	Habitat including fish habitat as defined in the Fisheries Act	Yes	Moderate to significant comments expressed	Moderate to significant comments expressed Significant regulatory considerations	Freshwater VEC - Fish Habitat
Freshwater Environment	Commercial, recreational and Aboriginal fisheries as defined in the Fisheries Act	Commercial, recreational and Aboriginal fisheries as defined in the Fisheries Act	Yes	Moderate to significant comments expressed	Moderate to significant comments expressed Significant regulatory considerations	Freshwater VEC - Arctic Grayling
Freshwater Environment	Commercial, recreational and Aboriginal fisheries as defined in the Fisheries Act	Commercial, recreational and Aboriginal fisheries as defined in the Fisheries Act	Yes	Moderate to significant comments expressed	Moderate to significant comments expressed Significant regulatory considerations	Freshwater VEC - Lake Trout
Marine Environment	Seabirds	Seabirds	Yes	Few or no comments expressed	Moderate to significant comments expressed Significant regulatory considerations	Marine VEC - Marine Seabirds
Marine Environment	Marine ecology	Marine ecology	Yes	Few or no comments expressed	Moderate to significant comments expressed Moderate regulatory considerations	Included in Individual Assessment Areas
Marine Environment	Marine water quality	Marine water and sediment quality	Yes	Few or no comments expressed	Few or no comments expressed Moderate regulatory considerations	Marine VEC - Water Quality
Marine Environment	Marine sediment quality	Marine water and sediment quality	Yes	Few or no comments expressed	Moderate to significant comments expressed Moderate regulatory considerations	Marine VEC - Sediment Quality
Marine Environment	Marine biota including fish and Species at Risk	Marine biota including fish and benthic flora and fauna	Yes	Few or no comments expressed	Moderate to significant comments expressed Significant regulatory considerations	Included in Individual Assessment Areas
Marine Environment	Marine habitat	Marine habitat	Yes	Few or no comments expressed	Moderate to significant comments expressed Significant regulatory considerations	Marine VEC - Fish Habitat

(continued)

Table 1.2-2. Valued Ecosystem Component and Valued Socio-economic Component Scoping Process Information (continued)

Subject Area	Potential VEC/VSEC of the Project Identified from Revised Draft Guidelines (NIRB, March 2013)	Anticipated Ecosystemic and Socio-economic Impacts of the Project from Final Scope (NIRB, March 2013)	Potential Interaction with Project	Consultation with Communities [1] and TK Information [2]	Consultations with Regulatory Agencies[3] and Regulatory Considerations[4]	VEC, VSEC, or other[5,6] within EIS
Marine Environment	Commercial, recreational and Aboriginal fisheries as defined in the Fisheries Act	Commercial, recreational and Aboriginal fisheries as defined in the Fisheries Act	Yes	Few or no comments expressed	Moderate to significant comments expressed Significant regulatory considerations	Marine VEC - Arctic Char
Marine Environment	Marine wildlife (marine mammals)	Marine wildlife	Yes	Few or no comments expressed	Moderate to significant comments expressed Moderate regulatory considerations	Marine VEC - Ringed Seals
Terrestrial Environment	-	Terrestrial and marine species at risk	Yes	Few or no comments expressed	Moderate to significant comments expressed Moderate regulatory considerations	Included in Individual Assessment Areas
Terrestrial Environment	Terrestrial ecology	Terrestrial ecology	Yes	Moderate to significant comments expressed	Few or no comments expressed Low regulatory considerations	Included in Individual Assessment Areas
Terrestrial Environment	Landforms and soils	Landforms and soils	Yes	Few or no comments expressed	Few or no comments expressed Low regulatory considerations	Subject of Note; Terrestrial VEC - Special Landscape Features
Terrestrial Environment	Permafrost and ground stability	Permafrost and ground stability	Yes	Few or no comments expressed	Moderate to significant comments expressed Low regulatory considerations	Subject of Note
Terrestrial Environment	Geological Features (Geology and Geochemistry)	Geological features including discussion of geology and geochemistry	Yes	Few or no comments expressed	Few or no comments expressed Low regulatory considerations	Subject of Note
Terrestrial Environment	Vegetation	Terrestrial vegetation	Yes	Few or no comments expressed	Moderate to significant comments expressed Moderate regulatory considerations	Terrestrial VEC - Vegetation
Terrestrial Environment	Representative terrestrial mammals to include caribou, caribou habitat and behaviour	Representative terrestrial mammals to include caribou, caribou habitat migration and behaviour, muskoxen, wolverine, grizzly bears, polar bears, wolves and less conspicuous species that may be maximally exposed to contaminants	Yes	Moderate to significant comments expressed	Moderate to significant comments expressed Significant regulatory considerations	Terrestrial VEC - Caribou
Terrestrial Environment	Muskox	Representative terrestrial mammals to include caribou, caribou habitat migration and behaviour, muskoxen, wolverine, grizzly bears, polar bears, wolves and less conspicuous species that may be maximally exposed to contaminants	Yes	Moderate to significant comments expressed	Moderate to significant comments expressed Moderate regulatory considerations	Terrestrial VEC - Muskox
Terrestrial Environment	Wolverine	Representative terrestrial mammals to include caribou, caribou habitat migration and behaviour, muskoxen, wolverine, grizzly bears, polar bears, wolves and less conspicuous species that may be maximally exposed to contaminants	Yes	Moderate to significant comments expressed	Moderate to significant comments expressed Moderate regulatory considerations	Terrestrial VEC - Wolverine/Furbearers
Terrestrial Environment	Polar Bears	Representative terrestrial mammals to include caribou, caribou habitat migration and behaviour, muskoxen, wolverine, grizzly bears, polar bears, wolves and less conspicuous species that may be maximally exposed to contaminants	No	-	-	-
Terrestrial Environment	Brown Bears (brown and grizzly)	Representative terrestrial mammals to include caribou, caribou habitat migration and behaviour, muskoxen, wolverine, grizzly bears, polar bears, wolves and less conspicuous species that may be maximally exposed to contaminants	Brown No	Moderate to significant comments expressed	Few or no comments expressed Moderate regulatory considerations	Terrestrial VEC - Grizzly Bears

(continued)

Table 1.2-2. Valued Ecosystem Component and Valued Socio-economic Component Scoping Process Information (continued)

Subject Area	Potential VEC/VSEC of the Project Identified from Revised Draft Guidelines (NIRB, March 2013)	Anticipated Ecosystemic and Socio-economic Impacts of the Project from Final Scope (NIRB, March 2013)	Potential Interaction with Project	Consultation with Communities [1] and TK Information [2]	Consultations with Regulatory Agencies[3] and Regulatory Considerations[4]	VEC, VSEC, or other[5,6] within EIS
Terrestrial Environment	Wolves	Representative terrestrial mammals to include caribou, caribou habitat migration and behaviour, muskoxen, wolverine, grizzly bears, polar bears, wolves and less conspicuous species that may be maximally exposed to contaminants	Yes	Moderate to significant comments expressed	Few or no comments expressed Moderate regulatory considerations	Terrestrial VEC - Wolverine/Furbearers
Terrestrial Environment	Less conspicuous species that maybe be maximally exposed to contaminants	Representative terrestrial mammals to include caribou, caribou habitat migration and behaviour, muskoxen, wolverine, grizzly bears, polar bears, wolves and less conspicuous species that may be maximally exposed to contaminants	Yes	Moderate to significant comments expressed	Few or no comments expressedModerate regulatory considerations	Terrestrial VEC - Wolverine/Furbearers
Terrestrial Environment	-	Wildlife migration routes and crossings	Yes	Moderate to significant comments expressed	Moderate to significant comments expressed Low regulatory considerations	Included in Individual Assessment Areas
Terrestrial Environment	Raptors	Raptors	Yes	Few or no comments expressed	Moderate to significant comments expressed Moderate regulatory considerations	Terrestrial VEC - Raptors
Terrestrial Environment	Migratory Birds	Migratory birds	Yes	Few or no comments expressed	Moderate to significant comments expressed Significant regulatory considerations	Terrestrial VEC - Migratory Birds
Human Environment	Employment	Employment	Yes	Moderate to significant comments expressed	Moderate to significant comments expressed Low regulatory considerations	Human VSEC - Employment
Human Environment	Land use and mobility	Land use	Yes	Moderate to significant comments expressed	Moderate to significant comments expressed Moderate regulatory considerations	Human VSEC - Subsistence Economy and Land Use
Human Environment	Food security	Food security	Yes	Moderate to significant comments expressed	Moderate to significant comments expressed Moderate regulatory considerations	Human VSEC - Subsistence Economy and Land Use
Human Environment	Food security	Food security	Yes	Moderate to significant comments expressed	Moderate to significant comments expressed Moderate regulatory considerations	Human VSEC - Country Foods / Human Health
Human Environment	Language	Language	Yes	Few or no comments expressed	Moderate to significant comments expressed Moderate regulatory considerations	Subject of Note
Human Environment	Cultural and community harvesting	Cultural and commercial harvesting	Yes	Moderate to significant comments expressed	Moderate to significant comments expressed Moderate regulatory considerations	Human VSEC - Subsistence Economy and Land Use
Human Environment	Non-traditional land use and resource use	Non-traditional land use and resource use	Yes	Few or no comments expressed	Few or no comments expressed Moderate regulatory considerations	Human VSEC - Subsistence Economy and Land Use
Human Environment	Archeology	Archeology	Yes	Moderate to significant comments expressed	Few or no comments expressed Moderate regulatory considerations	Human VSEC - Archeology
Human Environment	Palaeontology	Palaeontology	Yes	Few or no comments expressed	Few or no comments expressed Low regulatory considerations	Subject of Note
Human Environment	Cultural Resources	Cultural	Yes	Few or no comments expressed	Few or no comments expressed Moderate regulatory considerations	Human VSEC - Archeology
Human Environment	Family and community cohesion	Family and community cohesion	Yes	Moderate to significant comments expressed	Moderate to significant comments expressed Low regulatory considerations	Human VSEC - Health and Community Well-being
Human Environment	Potential indirect effects of project on frequency and types of crime incidents	-	Yes	Few or no comments expressed	Moderate to significant comments expressed Low regulatory considerations	Included in Individual Assessment Areas
Human Environment	Community infrastructure and public service, including housing	Community infrastructure and public services	Yes	Few or no comments expressed	Moderate to significant comments expressed Low regulatory considerations	Human VSEC - Health and Community Well-being

(continued)

Table 1.2-2. Valued Ecosystem Component and Valued Socio-economic Component Scoping Process Information (completed)

Subject Area	Potential VEC/VSEC of the Project Identified from Revised Draft Guidelines (NIRB, March 2013)	Anticipated Ecosystemic and Socio-economic Impacts of the Project from Final Scope (NIRB, March 2013)	Potential Interaction with Project	Consultation with Communities [1] and TK Information [2]	Consultations with Regulatory Agencies[3] and Regulatory Considerations[4]	VEC, VSEC, or other[5,6] within EIS
Human Environment	Economic development and opportunities	Economic development opportunities	Yes	Moderate to significant comments expressed	Moderate to significant comments expressed Low regulatory considerations	Human VSEC - Economic Development
Human Environment	Contracting and business opportunities	Contracting and business opportunities	Yes	Moderate to significant comments expressed	Moderate to significant comments expressed Low regulatory considerations	Human VSEC - Business Opportunities
Human Environment	Benefits and revenues (tax, royalties, etc.)	Benefits and revenues (tax, royalties, etc.)	Yes	Few or no comments expressed	Moderate to significant comments expressed Low regulatory considerations	Subject of Note
Human Environment	Education and training	Education and training	Yes	Moderate to significant comments expressed	Moderate to significant comments expressed Low regulatory considerations	Human VSEC - Education and Training
Human Environment	Population demographics	Population demographics	Yes	Few or no comments expressed	Moderate to significant comments expressed Low regulatory considerations	Subject of Note
Human Environment	Individual and community wellness	Individual and community wellness	Yes	Moderate to significant comments expressed	Moderate to significant comments expressed Low regulatory considerations	Human VSEC - Health and Community Well-being
Human Environment	Health and safety including employee and public safety	Health and safety including employee and public safety	Yes	Moderate to significant comments expressed	Moderate to significant comments expressed Low regulatory considerations	Human VSEC - Health and Community Well-being

Notes:

1. Community consultation information reflects information from Back River Project consultations up to February, 2013. A full analysis will be provided in the Draft EIS submission.

2. TK Information refers to the contents of the Inuit Traditional Knowledge of Sabina Gold & Silver Corp: Back River (Hannigayok) Project, Naonaiyaotit Traditional Knowledge Project (NTKP) (KIA. December, 2012)

3. Government engagement information reflects information from Back River Project consultations up to February, 2013.

4. Regulatory considerations are a high level view of the legislation in place to address potential impacts.

5. Table entries labelled as "Included in Individual Assessment Areas" refer to topics that will be addressed in context, within one or more other assessments

6. Table entries labelled as "Subject of Note" refer to unique topics addressed as a subsection within a specific assessment.

Consultation with Regulatory Agencies

Government consultation was launched early in 2012 with the Resource Development Advisory Group meeting hosted by Northern Project Management Office and attended by all major permitting or reviewing departments.

Through 2012 and 2013 Sabina met frequently with officials at both headquarters and regions of all major federal Departments and territorial governments. Sabina also hosted site tours to increase overall understanding of the Project and the Project's spatial extent. In all these meetings Sabina discussed the key components of the Project and explored the potential Project interactions with key components of the environment. Where relevant Sabina also explored the key socio-economic considerations.

The proposed VEC and VSEC list was distributed widely to all government regulators and reviewers on April 15 as part of the submission to NIRB by Sabina on the Final Guidelines. All parties were invited to comment on these lists. In addition, the Northern Project Management Office undertook a proactive process to solicit comments on the VEC and VSEC proposed lists from federal departments, territorial governments and the Kitikmeot Inuit Association.

Comments received from government agencies indicated a general acceptance of the proposed VEC/VSEC list. Departments or agencies requested some minor clarifications as to the scope or intent of a proposed VEC and Sabina responded to all of their questions.

Regulatory Considerations

Legislation and regulation exist to protect a number of potential VECs. For example, important fish species in the region were selected as VECs as the protection of these fisheries will be regulated under S35 of the Fisheries Act. As well, water quality was selected as a VEC and protection of water quality will be considered under regulation including the Metal Mining Effluent Regulations. Migratory birds were also selected as a VEC as migratory birds are subject to the Migratory Bird Act. Migratory birds include shorebirds, upland birds, and seabirds.

Species at Risk are of special concern and whether an organism was federally or otherwise listed was considered when selecting the wildlife VECs (including birds).

Practicality of Measuring and Monitoring

In addition to all of the scoping methods described above, it is important that a VEC or VSEC can actually be measured and/or monitored.

Clear cause-effect pathways that are measureable must exist (i.e., there is an understood relationship between the proximal cause of an effect and its receptor) so that an accurate characterization of the Project's direct and indirect effects on a VEC or VSEC can be made. In addition, adequate data and analytical tools must be available to measure potential effects.

Some potential VECs/VSECs may be broad subject areas, and in order to be able to predict the potential effects of the Project on the potential VEC/VSEC, a more specific aspect of the topic might need to be utilized.

It is also important to consider information that is being collected in the West Kitikmeot as part of government monitoring programs or other regional initiatives, and to try and align the VEC/VSECs with these programs as much as possible to provide the best and most robust future monitoring programs for the Project.

1.2.3.2 Assessment Boundaries

For the Project-related effect assessment, distinct spatial boundaries are defined for each VEC and VSEC and these are described in detail in Supporting Volumes 4 to 8 (Volume 4: Atmospheric Environment; Volume 5: Terrestrial Environment; Volume 6: Freshwater Environment; Volume 7: Marine Environment; and Volume 8: Human Environment), along with a rationale describing how the boundaries were delineated. Spatial and temporal boundaries define the maximum limit within which the environmental assessment is conducted.

Temporal boundaries are defined for each Project phase. Details about the proposed Project phases and timelines can be found in Supporting Volume 2: Project Description and Alternatives.

<u>Spatial Boundaries</u>

As specified in Section 7.5.1 of the EIS guidelines, spatial boundaries for the Project-related effects assessment were determined on the basis of the following criteria:

- the physical or socio-economic extent of project activities;
- the extent of ecosystems potentially affected by the Project;
- the extent to which traditional and contemporary land and resource use, including protected areas, and other harvesting activities could potentially be affected by the Project; and
- the size, nature and location of past, present, and reasonably foreseeable projects and activities which could interact with the items listed above.

The following general spatial boundaries are used in the DEIS:

- **Project Footprint –** includes all physical structures and activities that comprise the Project.
- **Local Study Area (LSA) –** The LSA includes the Project footprint area plus additional area depending on the VEC/VSEC. The definition of the LSA provided in the glossary of the EIS guidelines is as follows: That area where there exists the reasonable potential for immediate effects due to project activities, ongoing normal activities, or to possible abnormal operating conditions.
- **Regional Study Area (RSA) –** The RSA includes the LSA plus additional area depending on the VEC/VSEC. The definition of the RSA provided in the glossary of the EIS guidelines is as follows: The area within which there is the potential for indirect or cumulative biophysical and socio-economic effects.

The specific LSAs and RSAs for each VEC and VSEC are provided as maps in the Supporting Volumes 4 through 8 (Volume 4: Atmospheric Environment; Volume 5: Terrestrial Environment; Volume 6: Freshwater Environment; Volume 7: Marine Environment; and Volume 8: Human Environment). Additional information for each study area specific to each VEC and VSEC is also provided in Volumes 4 through 8.

<u>Temporal Boundaries</u>

Section 7.5.2 of the EIS guidelines require that the following Project phases have defined temporal boundaries: construction, operation, maintenance, temporary closure, final closure, and post-closure periods, including planned exploration.

The temporal boundaries for the Project phases were defined as follows:

- Site Preparation: 2 years
- Construction phase: 2 years
- Operational phase: 10 years
- Reclamation and Closure phase: 10 years
- Post-closure phase: 5 years
- other potential phases:
  - Temporary Closure: less than 2 years
  - Care and Maintenance Phase: 2 to 10 years
  - Exploration: included in Construction and Operational phases.

The other aspect of temporal boundaries is the boundaries used for the VECs and VSECs.

The temporal boundaries used for each VEC and VSEC were defined in relation to planned activities over the lifetime of the Project within which a reasonable expectation of interaction with environmental or socio-economic components can be predicted. These were adjusted as appropriate to reflect seasonal variations or life-cycle requirements of biological receptors, or forecasted trends in socio-economic receptors.

As required in Section 7.5.2 of the EIS guidelines, a rationale and justification for the spatial boundaries used for each VEC and VSEC is provided in the Supporting Volumes 4 through 8 (Volume 4: Atmospheric Environment; Volume 5: Terrestrial Environment; Volume 6: Freshwater Environment; Volume 7: Marine Environment; and Volume 8: Human Environment).

1.2.4 Effects Assessment Methodology

The EIS guidelines state that the DEIS shall assess the direct, indirect, short-term, and long term effects of the Project on the biophysical and socio-economic environments, and the interactions between them, focusing on the anticipated response of the VECs and VSECs.

In addition, Section 7.9 of the EIS guidelines indicate that the following information should be presented in any effect predictions:

- explain how scientific, engineering, community and TK was used;
- document model assumptions, study methodologies and sensitivity analyses;
- document data collection methods and limitations thereof;
- support analyses, interpretation of results and conclusions with reference to appropriate literature;
- describe how uncertainty in effect predictions have been dealt with;
- specify and reference sources for any contributions based on TK;
- identify which studies included the assistance of communities and individuals, who was involved (if the information can be made public), and how participants were selected;
- identify all proposed mitigation measures and adaptive management strategies if applicable; and
- describe the potential residual effects and explain their significance.

The above information is included in the detailed Project-related Effects Assessment sections of Supporting Volumes 4 through 8 (Volume 4: Atmospheric Environment; Volume 5: Terrestrial Environment; Volume 6: Freshwater Environment; Volume 7: Marine Environment; and Volume 8: Human Environment).

The following text provides a general overview for the project-related effects assessment methodology.

The effect assessment process comprises a number of steps that collectively assess the manner in which the Project will interact with elements of the atmospheric, terrestrial, freshwater, marine or human environment to produce effects to the VECs and VSECs.

The Project-related effects assessment process can be summarized as follows:

1. Identify potential interactions between the Project and the VECs/VSECs.
2. Characterize the potential effects that could result from the interactions. This could involve numerical modelling or other methods to help predict or describe the potential effects.
3. Identify mitgation or management measures that could be taken to eliminate or reduce the potential effects.
4. Characterize any residual effects (potential effects that would remain after mitigation and management measures have been applied).
5. Determine the significance of potential residual effects.

1.2.4.1 Identify Potential Interactions with Project and Valued Ecosystem Components/Valued Socio-economic Components

The first step was to identify the potential interactions between the Project and the VECs and VSECs. Table 1.2-3 presents a matrix showing various components of the Project by Phases along with the VECs and VSECs. This matrix was completed based on professional judgement and experience at other similar projects in Nunavut and the Northwest Territories, and was based on the initial matrix provided in the Project Description.

1.2.4.2 Characterization of Potential Effects

The next step was to characterize the potential effects that would result from these interactions. Prediction of effects is essentially an objective exercise to determine what could potentially happen as a result of the Project's interaction with the VECs and VSECs, including all related and ancillary facilities without which the Project cannot proceed. A wide range of characterization and prediction methods were used, including quantitative, semi-quantitative and qualitative techniques. For some VECs or VSECs, modelling was used to predict and characterize aspects of the interactions. Subjects where modelling was used include:

- Air Quality Modelling;
- Noise Modelling;
- TIA Water Quality Modelling;
- Marine Spill Modelling;
- Bathurst Caribou Herd Resource Function Modelling; and
- Economic Modelling.

Table 1.2-3. Valued Ecosystem Component and Valued Socio-economic Component Interaction with Project-Matrix

	Back River Project PROJECT ACTIVITIES	ENVIRONMENTAL COMPONENTS																																					
		Atmospheric Environment	air quality	noise and vibration	climate and meteorology	Terrestrial Environment	surface and bedrock geology	permafrost	eskers and other unique or fragile landscapes	vegetation	Caribou, including habitat and migration patterns	Grizzly Bear, including habitat and migration patterns	Muskox, including habitat and migration patterns	Wolverine/Furbearers, including habitat and migration patterns	birds, including habitat and migration patterns	raptors	Freshwater Environment	hydrology/ limnology	groundwater	limnology and bathymetry	water quality	sediment quality	fish/aquatic habitat	fish community (lake trout, Arctic grayling)	Marine Environment	physical processes	water quality	sediment quality	fish/aquatic habitat	fish community (Arctic char)	seabirds/seaducks	ringed seals	Human Environment	archaeological and cultural historic sites	paleontological	non-traditional land and resource use	socio-ec: business and economic development	socio-ec: employment	health, safety and community well-being	subsistence economy and land use	country foods/human health
CONSTRUCTION	Camps and mill facility construction, local site roads, airstrip, equipment laydown areas, pad areas		M	M			M	M		N	M	M	M	M	M	M					M	M			M									M		M	P	P		M	M
	Quarry Development		M	M			M	M		N	M	M	M	M	M	M					M	M			M													P			
	Water Use																	M		M			M	M					M	M											
	Tailings Management Area/Dam or Dyke Construction at Goose Property		M	M			M	M		N	M	M	M	M	M	M		M			M	M			M									M		M	P	P		M	M
	Pit Pre-stripping, Waste Rock Pile Construction, Headframe and Underground Development		M	M			M	M		N	M	M	M	M	M	M			M		M	M			M									M		M	P	P		M	M
	Winter Road construction and use from Bathurst Inlet to Goose and George properties, between Goose and George, southern access winter road		M	M						M	M	M	M	M	M	M		M			M	M			M									M		M	P	P		M	
	Machinery and Vehicle Refueling/Fuel Storage and Handling																				M	M			M																
	Machinery and Vehicle Emissions		M		M																																				
	Diesel Power Generation		N	M	N																																				
	Air Transport of Personnel and Goods		N	M	N						M	M	M	M	M	M																					P	P			
	Sewage Treatment Plant and discharge									M											M	M			M																
	Landfill Construction/ Solid Waste Management			M				M		N	M	M	M	M	M	M					M	M			M													P			
	Incinerator		M		M																																				
	Chemical and Hazardous Material Storage and Management																				M	M			M																M
	Explosives Storage and Handling																				M	M			M																
	Marine Laydown Area: on-land laydown areas/fuel storage			M			M	M		N	M	M	M	M	M	M					M	M			M		M	M			M	M		M		M	P	P		M	
	Marine Laydown Area: in-water infrastructure			M							M	M	M	M	M	M					M	M	M	M	M	M	M	M	M	M	M	M						P			
	Marine Transport of Goods		N	M	N						M	M	M	M	M	M					M	M	M	M	M		M	M	M	M	M	M					P	P			
	Environmental and Socio-economic Monitoring		P	P	P						P	P	P	P	P	P		P			P	P	P	P	P		P	P	P	P	P	P					P	P	P		
	Hiring and Managing Labour and Construction Workforce																																				P	P	P		
	Taxes, Contracts, Purchases																																				P	P	P		

(continued)

Table 1.2-3. Valued Ecosystem Component and Valued Socio-economic Component Interaction with Project-Matrix (continued)

	Back River Project PROJECT ACTIVITIES	ENVIRONMENTAL COMPONENTS																																							
		Atmospheric Environment	air quality	noise and vibration	climate and meteorology	Terrestrial Environment	surface and bedrock geology	permafrost	eskers and other unique or fragile landscapes	vegetation	Caribou, including habitat and migration patterns	Grizzly Bear, including habitat and migration patterns	Muskox, including habitat and migration patterns	Wolverine/Furbearers, including habitat and migration patterns	birds, including habitat and migration patterns	raptors	Freshwater Environment	hydrology/ limnology	groundwater	limnology and bathymetry	water quality	sediment quality	fish/aquatic habitat	fish community (lake trout, Arctic grayling)	Marine Environment	physical processes	water quality	sediment quality	fish/aquatic habitat	fish community (Arctic char)	seabirds/seaducks	ringed seals	Human Environment	archaeological and cultural historic sites	paleontological	non-traditional land and resource use	socio-ec: business and economic development	socio-ec: employment	health, safety and community well-being	subsistence economy and land use	country foods/human health
OPERATION	Camps and Mill Facility (Goose)		M	M				M		M	M	M	M	M	M	M							M	M					M	M								P			
	Open Pits: Drilling, Blasting, Excavation		M	N			N	M			M	M	M	M	M	M					M																	P			
	Underground: Drilling, Blasting, Excavation		M	N			N	M			M	M	M	M	M	M			M		M																	P			
	Waste Rock Piles		M					M		M	M	M	M	M	M	M		M			M		M	M	M				M	M											M
	Tailings Storage							M			M	M	M	M	M	M		M			M		M	M	M				M	M											M
	In-Pit and Surface Water Management									M					M	M		M	M		M	M	M	M	M				M	M											M
	Road and Airstrip Use and Maintenance		M	M				M		M	M	M	M	M	M	M					M	M	M	M	M				M	M								P			
	Winter Road construction and use between Goose and George		M	M						M	M	M	M	M	M	M		M			M	M			M													P			
	Water Use														M	M		M		M			M	M					M	M											
	Diesel Power Generation		N		N																																				
	Incinerator		M		M																																				
	Sewage Treatment Plant and discharge																				M	M	M	M	M				M	M											
	Equipment Maintenance/ Fuel Storage and Handling																				M	M			M													P			
	Chemical and Hazardous Material Storage and Management																				M	M			M																M
	Explosives Storage and Handling																				M	M	M	M	M				M	M											
	Air Transport of Personnel and Goods		N	N	N						M	M	M	M	M	M																					P	P			
	Machine and Vehicle Emissions		M		M																										M	M									
	Marine Laydown Area: Fuel Storage and Handling									M											M	M			M		M	M			M	M									
	Marine Transport of Goods		N	N	N						M	M	M	M	M	M					M	M	M	M	M		M	M	M	M	M	M					P	P			M
	Environmental and Socio-economic Monitoring		P	P	P													P			P	P			P		P	P			P	P					P	P	P		
	Hiring and Managing Operations Work Force																																				P	P	P		
	Taxes, Contracts, Purchases																																				P	P	P		P

(continued)

Table 1.2-3. Valued Ecosystem Component and Valued Socio-economic Component Interaction with Project-Matrix (completed)

Back River Project PROJECT ACTIVITIES		Atmospheric Environment	air quality	noise and vibration	climate and meteorology	Terrestrial Environment	surface and bedrock geology	permafrost	eskers and other unique or fragile landscapes	vegetation	Caribou, including habitat and migration patterns	Grizzly Bear, including habitat and migration patterns	Muskox, including habitat and migration patterns	Wolverine/Furbearers, including habitat and migration patterns	birds, including habitat and migration patterns	raptors	Freshwater Environment	hydrology/ limnology	groundwater	limnology and bathymetry	water quality	sediment quality	fish/aquatic habitat	fish community (lake trout, Arctic grayling)	Marine Environment	physical processes	water quality	sediment quality	fish/aquatic habitat	fish community (Arctic char)	seabirds/seaducks	ringed seals	Human Environment	archaeological and cultural historic sites	paleontological	non-traditional land and resource use	socio-ec: business and economic development	socio-ec: employment	health, safety and community well-being	subsistence economy and land use	country foods/human health
DECOMMISSIONING	Camps and Mill Facility (Goose)									P	P	P	P	P																						P				P	
	Open Pits						N	M										M			M															P				P	
	Underground Mines						N	M										M	M		M															P				P	
	Tailings Storage							M										M			M				M											P				P	P
	Waste Rock Piles							M										M			M				M											P				P	P
	Road Reclamation of site roads		M	M						P	P	P	P	P	P	P		M			M	M	P	P	M				P	P						P				P	
	Airstrip Reclamation		M	M						P	P	P	P	P	P	P					M	M			M											P				P	
	Machine and Vehicle Emissions		M		M																																				
	Removal or Treatment of Contaminated Soils							M		P											P	P			P											P				P	P
	Waste Incineration		M		M																																				
	Landfill Closure																				M				M																
	Quarry Decommissioning							M		P											M																				
	Marine Laydown Area			M											P	P					M	M	P	P	M	M	M	M	P	P	P	P				M				M	
	Post-closure Environmental and Socio-economic Monitoring									P	P	P	P	P	P	P		P			P	P	P	P	P		P	P	P	P	P	P					P	P	P		
	Hiring and Managing Decommissioning and Closure Work Force																																				P	P	P		
	Taxes, Contracts, Purchases																																				P	P	P		P

Column groups: all component columns fall under ENVIRONMENTAL COMPONENTS.

Notes:
Please indicate in the matrix cells whether the interaction causes an impact and whether the impact is:
P: Positive
N: Negative and non-mitigatable
M: Negative and mitigatable
U: Unknown
If no impact is expected then please leave the cell blank

The specific methods used for each VEC and VSEC are described in the Supporting Volumes 4 through 8 (Volume 4: Atmospheric Environment; Volume 5: Terrestrial Environment; Volume 6: Freshwater Environment; Volume 7: Marine Environment; and Volume 8: Human Environment).

For each potential effect on a VEC or VSEC, the nature of that effect was characterized in as much detail as possible, and using some of the attributes that would later be used to describe the significance of any residual effects, such as magnitude, geographic extent, duration, frequency, reversibility, resiliency, ecological context, and probability. A discussion of any shortcomings or uncertainty in the characterization was also included.

It is important to note that the effect prediction took into account any embedded controls (i.e., physical or procedural controls that are already planned as part of the Project design). An example of an embedded control is a standard acoustic enclosure that is designed to be installed around a piece of major equipment. This avoids the situation where an effect is assigned a magnitude based on a hypothetical version of the Project that considers none of the embedded controls.

1.2.4.3 Identification of Mitigation and Management Measures

Mitigation measures involve taking a tangible conservation action to avoid, minimize, restore on-site, or offset effects on VECs or VSECs resulting from a project or activity. Mitigation measures are supplemented by the use of additional considerations, for example considering alternative siting locations, changes in Project design, or best management practices. Mitigation measures that are recommended for use to reduce an adverse effect are considered to be technically, environmentally, and economically feasible. Key approaches to avoid, reduce, control, eliminate, offset, or compensate potential effects include:

- **Optimizing Alternatives:** Preventing or reducing adverse environmental effects by changing an aspect of the Project (e.g., choosing a new access route).
- **Design Changes:** Preventing or reducing adverse environmental effects by redesigning aspects of the Project (e.g., changing from a solid stream crossing to an open-bottomed culvert).
- **Best Achievable Control Technology (BACT):** Eliminating, minimizing, controlling, or reducing adverse effects through the use of proven and economically achievable technological applications (e.g., high density sludge water treatment plants).
- **Management Practices:** Eliminating, minimizing, controlling, or reducing adverse effects on VECs and VSECs through management practices (e.g., managing water intake requirements to avoid adversely affecting water levels and hence fish/aquatic habitat).
- **Follow-Up Monitoring and Adaptive Management:** Monitoring the implementation of mitigation measures where uncertainty exists, and adjusting mitigation based on monitoring results (e.g., Wildlife Mitigation and Monitoring Plan).
- **Compensation:** Offsetting remaining effects that cannot be prevented or reduced through remedial or compensatory actions, so that the net effect on the community or ecosystem is neutral or beneficial (e.g., enhancement of similar habitat in another area, enhancement of other social/economic/cultural benefits).
- **Enhancement:** Providing measures to enhance a beneficial effect. Enhancement generally applies to socio-economic effects.

For each of the VECs and VSECs, a description was provided of any mitigation or management measures that could be used to eliminate or reduce potential negative interactions with the Project.

The measures included in the detailed Volumes 4 through 8 (Volume 4: Atmospheric Environment; Volume 5: Terrestrial Environment; Volume 6: Freshwater Environment; Volume 7: Marine Environment; and Volume 8: Human Environment) are measures that have been shown to work in other similar situations in the Arctic. Sabina is committed to implement these effective mitigation measures and to use adaptive management approaches to ensure mitigation measures are optimized.

1.2.4.4 Characterization of Residual Effects

If the proposed mitigation measure(s) were not sufficient to eliminate a potential effect, a residual effect was identified. If the implementation of mitigation measures completely eliminated a potential effect, then the effect was not carried forward, and no additional analysis was undertaken. Residual effects of the Project can occur directly, indirectly, or cumulatively. Direct effects result from specific Project/environment interactions throughout the Project footprint. Indirect effects are the result of direct effects on the environment that lead to other effects such as increased consumption of goods and services. Cumulative effects result when the Project's residual effects add to the effects of other past, present or future projects such as mines, roads/railways or port facilities. The methodology for assessing cumulative effects is discussed in more detail in Section 3.

For each residual effect on a VEC/VSEC that was identified, standard ecological risk assessment frameworks that categorize the levels of detail and quality of the data required for the effect assessment were used. These tiers are as follows:

- **Tier 1:** Qualitative (expert opinion, including traditional and local knowledge, literature review, and existing site information, if available);
- **Tier 2:** Semi-quantitative (measured site-specific data and existing site information); and,
- **Tier 3:** Quantitative (recent field surveys, detailed quantitative methods, e.g., predictive modelling).

Detailed characterization was conducted for VEC/VSECs for which a residual effect was predicted in order to assess how significant the effect will be. Wherever possible, these studies included statistical analysis or mathematical modeling. The specific modeling studies are reported in the appendices of the respective effect assessment volumes. Where data are lacking, professional judgment was used to determine the extent of potential effects. The methodologies and underlying assumptions and data limitations are presented in the detailed Volumes 4 through 8 (Volume 4: Atmospheric Environment; Volume 5: Terrestrial Environment; Volume 6: Freshwater Environment; Volume 7: Marine Environment; and Volume 8: Human Environment).

1.2.4.5 Determining the Significance of Residual Effects

The Canadian Environmental Assessment Agency's *Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects* (1992) is used as guidance in evaluating the significance of the adverse residual effects for the Back River Project. The significance of residual effects of the Project is based on a comparison of the current environment without the Project with the predicted state of the environment with the Project, after mitigation measures are applied. The residual effects identified in Volumes 4 through 8 were subjected to the following analysis to determine the potential for significant adverse effects:

- determine the direction of the residual effects (i.e., positive, neutral, negative);
- rate the adverse residual effect to determine whether they are potentially significant;
- determine whether the adverse residual effect is likely to occur (i.e., probability of occurrence); and

- evaluate whether the likely adverse residual effect is significant.

An evaluation of the significance of residual effects is based on a consideration of the following criteria, defined below in Table 1.2-4.

Table 1.2-4. Attributes Used to Evaluate Significance of Residual Effects

Attribute	Definition and Rationale	Role in Significance Determination[2]
Direction and Nature[1]	The ultimate long-term trend of an environmental effect - positive, neutral, or negative.	Qualifier Only negative effects are assessed for significance
Magnitude[1]	The amount or degree of change in a measurable parameter or variable relative to existing conditions (the exposed population).[3] This attribute can also consider complexity - the number of interactions (Project phases and activities) contributing to a specific effect.	Primary Criterion High magnitude= high significance Secondary Criterion If magnitude and geographic extent are related, the higher the potential significance
Extent[1]	The geographic area over which the interaction will occur.	Secondary Criterion The larger the zone of influence, the higher the potential significance
Frequency[1]	The number of times during a project or a project phase that an interaction or environmental effect can be expected to occur.	Secondary Criterion Greater the frequency of occurrence, the higher the potential significance
Timing	The Project Phase within which the environmental effect will occur.	Qualifier Provides context
Duration[1]	The period over which the environmental effect will occur.	Secondary Criterion The longer the duration of an interaction the higher the potential significance
Reversibility[1]	The likelihood that a VEC/VSEC or Indicator will recover from an environmental effect, including consideration of active management techniques. Reversibility is considered for biological VECs at the population level. Therefore, although an effect like mortality is irreversible, the effect at the population level might be reversible.	Primary Criterion The greater the potential to reverse an effect, the lower its potential significance
Probability[1]	The likelihood that an interaction and a consequent effect will, in fact occur.	Qualifier (considered only for potentially significant effects) The higher the probability of occurrence, the greater the significance
Certainty[1]	The level of confidence in the knowledge or analysis that supports the prediction, in particular with respect to limitations in overall understanding of the ecosystem, and limitations in the ability to foresee future events or conditions.	Qualifier (considered only for potentially significant effects) The lower the certainty of occurrence, the more conservative the approach to prediction of significance
Ecological/Socio-economic context/value[1]	The general characteristics of the area in which the Project is located, as indicated by existing levels of human activity and associated types of disturbance. Interpreted to mean the basis for assigning "value" to the particular VEC.	Qualifier VECs/ VSECs and Indicators have been identified as "valued" as described in Section 2.3

(continued)

Table 1.2-4. Attributes Used to Evaluate Significance of Residual Effects (completed)

Attribute	Definition and Rationale	Role in Significance Determination[2]
Environmental Sensitivity[1]	Environmental sensitivity of the area likely to be potentially affected. Refers to areas of heightened sensitivity that will be identified where applicable in relation to the Project (i.e., areas sensitive to spills; caribou calving areas).	Qualifier The Magnitude of an effect within an area of environmental sensitivity will be greater; therefore environmental sensitivity is considered in the discussion and rating of the Magnitude attribute.
Historical, cultural, archaeological significance[1]	To be considered within the geographic area to be potentially affected	Qualifier (see Extent - above) Historic, cultural and archaeological significance is evaluated within the archaeology effects assessment (Volume 8, Chapter 1)
Human and wildlife populations, and the size of the affected wildlife populations and related habitat[1]	The size of the potentially affected human populations; and the size of the potentially affected wildlife populations and related habitat.	Qualifier (See Extent - above)
The extent of the effects of the project on other regional human populations and wildlife populations, including the extent of the effects on Inuit harvesting activities[1]	The Project might have the potential to affect other human and wildlife population, if there are residual effects to marine wildlife or socio-economic benefits that extend outside Nunavut.	Qualifier Consider within the Transboundary Effects Assessment (Section 1.4 of this volume)
The potential for cumulative adverse effects given past, present and future relevant events[1]	The Project might have the potential for cumulative effects where residual effects from the Project are expected to occur.	Qualifier Consider in the Cumulative Effects Assessment (Section 1.3 of this volume)
Ecosystem function and integrity[1]	Ecosystem function and integrity is important to identified VECs and humans.	Qualifier Outcome of the significance determination
The effect on the capacity of resources to meet present and future needs (sustainability)[1]	The sustainability of this Project, and any major industrial project, is an important element to assess.	Qualifier Outcome of the significance determination
Value[1]	The value attached to the affected VEC or VSEC by those who identified them. An environmental or socio-economic component was identified as "valued" and was addressed in the EIS if it was found to have a high value to communities.	Qualifier Addressed as part of Issues Scoping where the "value" of each component is considered. The value attached to a VEC or VSEC is more or less equivalent to "Sensitivity" described above.

Notes:
1. Specifically required by NIRB guidelines.
2. Criterion - directly contributes to the determination of significance. Primary criteria are given greater weight than secondary criteria. Qualifier - acts as a modifier to be considered when assigning values/rankings to assessment criteria.
3. In the majority of cases there is either a poor or no estimate available of the total population. However for the purpose of undertaking an environmental assessment, an effects prediction can be made by making reasonable assumptions. The most common approach is to take an area that is less than the full range of a population and, often on the basis of density estimates (or by using habitat as an indicator), a conservative prediction is possible, i.e., if the effect is calculated for a portion of the population and it results in a magnitude of effect that is beneath a defined threshold, then it is reasonable to predict the effect on the entire population, even in the absence of a total population estimate. This approach is not greatly different from that used by resource managers that have the mandate to manage wildlife populations, who are challenged to develop harvest quotas, even where they do not have an accurate or complete population estimate available to support these decisions.

Definitions of each of these attributes may be VEC/VSEC specific and may vary accordingly. Where available, quantitative thresholds (e.g., freshwater aquatic life guidelines or ambient air criteria), are used to assist with evaluating the significance of residual effects. Other assessment end-points, such as the ability to meet or impair land and resource management planning objectives may also be used to assist in the determination of significance. Table 1.2-5 indicates how the attributes are rated for biophysical effects.

Rating of Residual Biophysical Effects

Table 1.2-5 provides the ratings and classifications for determine the significance of a residual effect. Each of the criteria contributes to the determination of significance.

Table 1.2-5. Rating Criteria for Evaluating Residual Biophysical Effects

Criteria	**Classification**	
Magnitude (Specific to the VEC and the effect)	Negligible	No change on the exposed indicator/VEC
	Low	An effect on the exposed indicator/VEC that results in a change that is not distinguishable from natural variation and is within regulated values
	Moderate	An effect that results in some exceedance of regulated values and/or results in a change that is measurable but allows recovery within one to two generations
	High	An effect predicted to exceed regulated values and/or results in a reduced population size or other long-lasting effect on the subject of assessment
Extent The physical extent of the effect, relative to study area boundaries	Project footprint	Confined to the Project footprint
	Local	Beyond the Project footprint and within the LSA
	Regional	Beyond the LSA and within the RSA
	Beyond Regional	Beyond the RSA
Frequency How often the effect occurs	Once	Infrequent
	Sporadic	Intermittent
	Continuous	Frequent or continuous
Duration The length of time over which a Project effect will occur	Short	Short term (effect lasts up to 4 years [site prep and construction phase])
	Medium	Medium term (greater than 4 years and up to 24 years [4 years site prep/construction, 10 years operation, 10 years closure])
	Long	Long term (beyond the life of the Project) or permanent
Reversibility The likelihood of the VEC to recover from the effect	Reversible	Fully reversible
	Reversible with effort	Reversible with cost/effort
	Irreversible	Irreversible
Qualifiers		
Certainty Limitations in the overall understanding of the ecosystem and ability to predict future conditions	High	Baseline data are comprehensive; predictions are based on quantitative data; effect relationship is well understood
	Medium	Intermediate degree of confidence between high and low
	Low	Baseline data are limited; predictions are based on qualitative data; effect relationship is not well understood
Probability The likelihood that the predicted effect/residual effect will occur	Unlikely	Less than 20% likelihood of occurrence
	Moderate	Between 20 and 60% likelihood of occurrence
	Likely	Over 60% likelihood of occurrence

The assessment of residual effects and their significance is summarized for each VEC and VSEC in Volumes 4 through 8. An example summary is provided in Table 1.2-6 below.

Table 1.2-6. Example Template of Summary of Residual Effects and Overall Significance Rating

Description of Residual Effects	Significance Criteria			Likelihood of Occurrence			Overall Significance Rating		
	Direction (*positive*, *neutral*, *negative*)	Magnitude (*low*, *moderate*, *high*)	Duration (*short*, *medium*, *long*)	Frequency (*once*, *sporadic*, *continuous*)	Geographic Extent (*footprint*, *local*, *regional*, *beyond regional*)	Reversibility (*reversible*, *reversible with effort*, *irreversible*)	Probability (*unlikely*, *moderate*, *likely*)	Confidence (*low*, *medium*, *high*)	***Not significant (N); Significant (S); Positive (P)***

Notes:
Certainty around the assignment of Likelihood (only applicable to significant effects)
Level of confidence in the Significance Rating

Qualifier 1 - Likelihood

The likelihood parameter is assigned a probability dimension as well as a level of certainty (confidence), to qualify significance rankings relative to the likelihood that the predicted effects will actually occur. **"Unlikely"** indicates a low probability of occurrence, **"Moderate"** a moderate probability, and **"Likely"** a high probability. For example, where effects are associated with unplanned accidental releases against which mitigation and emergency response protocols are in place, the probability is low. Certainty is assigned to indicate the relative level of confidence in the probability prediction. Collectively, the probability and certainty assignments indicate the overall likelihood of an effect.

Qualifier 2 - Level of Confidence

The level of confidence with predictions is an important qualifier in that a low level of confidence will require a conservative approach to each of the evaluation criteria. Level of confidence is related to limitations in the overall understanding of the ecosystem and limitations in accurately foreseeing future events or conditions. Uncertainties associated with each prediction are described in each effects assessment at a level of detail that corresponds to the relative uncertainty (i.e., where effects predictions have greater certainty, more emphasis was placed on articulating the uncertainties). A level of confidence is assigned to qualify significance rankings relative to the quality and confidence in the data used and the evaluation methodology.

"Low" is assigned where there is a low degree of confidence in the inputs, **"Medium"** when there is moderate confidence, and **"High"** when there is a high degree of confidence in the inputs. Where rigorous field baseline data were collected and scientific analysis performed, the degree of confidence will generally be high.

<u>Rating of Residual Socio-economic Effects</u>

Similar criteria were applied to the socio-economic effects assessment with some modification and additional criteria in consideration of the nature, complexity, and multiple perspectives associated with socio-economic issues. For the attributes (criteria and qualifiers) identified as the determinants of significance of socio-economic effects, see Table 1.2-7.

Table 1.2-7. Rating Criteria for Evaluating Residual Socio-economic Effects

Criteria	Classification
Direction	Positive Variable Negative
Geographic Extent	Local Study Communities Regional Study Communities Description of the area and communities most affected
Equity	Equitable Neutral Inequitable
Magnitude Intensity of the effect	Low Moderate High
Frequency How often the effect occurs	Infrequent Intermittent Continuous

(continued)

Table 1.2-7. Rating Criteria for Evaluating Residual Socio-economic Effects (completed)

Criteria	Classification
Duration Length of time over which a Project effect will occur	Short term (effect lasts up to 4 years [site prep and construction phase]) Medium term (great than 4 years to 24 years, for the life of the Project [4 years site prep/construction, 10 years operation, 10 years closure]) Long term (beyond the life of the Project) or permanent
Reversibility Likelihood of recovery from effect	Reversible Partly reversible with cost/effort Irreversible

Additional description of each criterion follows:

Direction. This criterion considers whether an effect is "positive" or "negative". The perceived direction of a given socio-economic effect is sometimes a subjective assessment that can vary across the population, so a "variable" option is also included in the classification. Determination of "direction" is based on values expressed during the community research and through existing documentation such as community economic development plans.

Geographical Extent. This attribute identifies whether the effect will be experienced in the LSA communities or the RSA communities. Some effects might be relevant to specific communities, so a "community-specific" classification is included.

Equity. "Equity" considers the distribution and evenness of the effect across different social groups, and identifies those most likely to experience an effect. This could include children, youth, women, family, or the entire community. This criterion seeks to provide insight into how equitable the benefits and adverse effects are distributed.

Magnitude. "Magnitude" is the level of change relative to the appropriate baseline, rated as low, moderate, or high. These magnitude ratings are linked to measurable parameters where appropriate. Measurable parameters may be applied in a conceptual sense.

Frequency. The "frequency" of an effect provides an indication of how commonly the effect will occur during the Project, and is rated as low, intermittent, or continuous. Unless otherwise indicated the following definitions are associate with these levels:

- **Infrequent -** Occurring only occasionally;
- **Intermittent -** Occurring during periodic points in the project; and
- **Continuous -** Occurring throughout the project life.

Duration. "Duration" refers to how long an effect will continue to affect those who experience it. It is rated using the following definitions:

- **Short term -** Over a period of 4 years;
- **Medium term -** Within the life of the project (25 years); and
- **Long term -** Beyond the project life.

Reversibility. The "reversibility" criterion considers the likelihood of recovery from an effect, including consideration of the active management interventions that may be required to bring the residual effect to an acceptable level.

Three definitions are used in considering reversibility:

- **Immediately Reversible -** Effect reverses within an acceptable time frame with no intervention;
- **Reversible with a cost/effect. Management required -** Active intervention is required to bring the effect to an acceptable level; and
- **Irreversible -** Effect will not be reversed.

Overall Evaluation of Significance

The definition of significance determination included in the EIS guidelines (NIRB 2013a) is as follows: "Impact significance is based on comparing the predicted state of the environment with and without the Project and expressing a judgment as to the importance of the changes identified."

NIRB directed that the EIS shall present the residual effects assessment of the Project so that the reader can clearly understand the real consequences of the Project, the degree of mitigation of effects, and which effects cannot be mitigated or compensated for.

NIRB also directed that the dynamic change of ecosystems and their components be considered in determining significance.

The overall significance of an effect is derived from the experience and professional judgment of the environmental practitioners who prepared the assessment, considering the rankings of the contributing attributes of significance. While substantially based on professional judgment, the following are general rules of thumb applied in determining significance:

- If the magnitude of the effect is low, then the predicted effect is "not significant," recognizing that magnitude includes consideration of sensitive species, habitats or populations. If effects on measurable components such as air or water quality meet applicable performance criteria, standards or guidelines, then the magnitude of the effect is negligible to moderate, and therefore the prediction will be for an effect that is "not significant."
- If the geographic extent of the effect is confined to the Project footprint or LSA, then the predicted effect is likely to be "not significant."
- If the extent of a negative socio-economic effect is limited to individuals who also receive a corresponding positive benefit, then the predicted effect is likely to be "not significant."
- If the effect has a moderate to high reversibility, the predicted effect is likely to be "not significant."
- If the duration of the effect is short term (e.g., site preparation and construction period only) then the effect prediction is also likely to be "not significant."

1.3 POTENTIAL CUMULATIVE EFFECTS ASSESSMENT METHODOLOGY

1.3.1 Definitions and Conformity

The potential for cumulative effects to occur arises when the residual effects of a project affect (i.e., overlap and interact with) the same resource/receptor that is affected by the residual effects of *other* past, existing or reasonably foreseeable projects or activities.

The most recent NIRB technical guide series (NIRB 2013b) provides the following definition of Cumulative Effects Assessment (CEA):

> *The assessment of effects on the biophysical and socio-economic environment that results from the incremental effects of a development when added to other past, present, and reasonably foreseeable future developments, regardless of what agency or person undertakes such other developments. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.*

Section 7.11 of the final EIS guidelines (NIRB 2013a) provides the following definition:

> *A cumulative effect (or effect) can be defined as the effect on the environment that results from the incremental effect of the action when added to other past, present and reasonably foreseeable future actions (Tilleman, 2005).*

The CEA was carried out in compliance with Section 7.11 of the final EIS guidelines (NIRB 2013a). As per the final EIS guidelines, consideration was given to the following factors when conducting the CEA:

- a larger spatial boundary (RSA rather than LSA);
- a longer temporal scale;
- alternatives analysis;
- consideration of effects on VECs and VSECs; and
- evaluation of significance

The CEA also complies with the following requirements outlined in Section 7.11 of the final EIS guidelines (NIRB 2013a):

> *As per the identified objectives and methodologies for a CEA, the Proponent shall:*
>
> - *vi. Justify the environmental components that will constitute the focus of the CEA. The Proponent's assessment should emphasize the cumulative effects on the main VECs/VSECs that could be affected by the Project;*
> - *vii. Present a justification for the spatial and temporal boundaries for the CEA. It should be noted that these boundaries can vary depending on the VECs or VSECs assessed. The Proponent shall give due consideration to the potential for cumulative effects that may be transboundary in nature;*
> - *viii. Discuss and justify the choice of projects, components and selected activities for the CEA. These shall include past activities and projects, those currently being carried out and any reasonably foreseeable project or activity. Activities should not be limited to exploration and mining-related activities but include other factors not related to mining (e.g., wildfires, roads/airstrips developed for non-mining activities, etc.); and*
> - *ix. Discuss the mitigation measures that are technically and economically feasible, and determine the significance of the cumulative effects. If any effect is identified and verified beyond the Proponent's sole responsibility or capacity, the Proponent shall make best efforts to identify how its mitigation measures may contribute toward any collective mitigation undertaken by other responsible parties.*

1.3.2 Approach to Cumulative Effects Assessment

Similar to the project-related effects assessment methodology described above, a CEA is comprised of the following activities (Figure 1.3-1) and generally follows the methodology as described in the Cumulative Effects Assessment Practitioners' Guide (Hegmann et al. 1999):

1. Undertaking a scoping exercise to identify the potential for project-related residual effects to interact with residual effects from other human activities and projects within specified assessment boundaries.
2. Identifying and predicting potential cumulative effects that may occur and implementing additional mitigation measures to minimize the potential for cumulative effects.
3. Identifying cumulative residual effects after the implementation of mitigation measures.
4. Determining the significance of any cumulative residual effects. A key task in the CEA is to understand the contribution of the Project to the overall cumulative effect on VEC/VSEC (i.e., how much of the cumulative effect can be apportioned to the Project as compared to other projects and activities)?

1.3.3 Types of Cumulative Effects

Cumulative effects can manifest through a number of cause-effect pathways, including:

Physical-chemical transport: where a physical or chemical constituent is transported away from a Project site and then interacts with physical or chemical constituents generated by another project or activity (e.g., air emissions, waste water effluent, sediment).

Nibbling loss: the gradual disturbance and loss of land and habitat (e.g., clearing of land for a new mine development and clearing of land for construction of access roads into a forested area). The *Draft Nunavut Land Use Plan* (Nunavut Planning Commission 2012) was reviewed to identify whether any development restrictions or thresholds have been set in the vicinity of the Project to prevent nibbling loss effects.

Spatial and temporal crowding: cumulative effects occur when there are too many activities within too small an area in too brief a period of time. A threshold may be exceeded and the environment may not be able to recover to pre-disturbance conditions. Effects can occur quickly or gradually over a long period of time before the consequences become apparent. Spatial crowding results in an overlap of effects from multiple activities (e.g., noise from a highway adjacent to an industrial site or close proximity of timber harvesting, wildlife habitat, and recreational use in a park). Temporal crowding may occur if effects from different activities overlap or occur before the VC has recovered.

Growth-inducing potential: where a new project (e.g., the development of a power transmission line into a previously unserviced area) supports the potential for other types of development activities (e.g., mining operations that require a stable, secure power supply) thereby creating a positive feedback cycle. Such activities may be considered “reasonably foreseeable actions” (CEA Agency 1992).

Interacting projects and activities may combine to create additive or synergistic effects. An additive effect increases the effect in a linear way (e.g., two projects both remove foraging habitat for the same caribou herd which increases foraging pressure nearby). A synergistic effect may result in an effect greater than the sum of the two actions (e.g., two projects remove foraging habitat for the same caribou herd which shifts the herd’s foraging activities to an area where the herd is susceptible to increased predation, resulting in reduced calving success and impairing population viability).

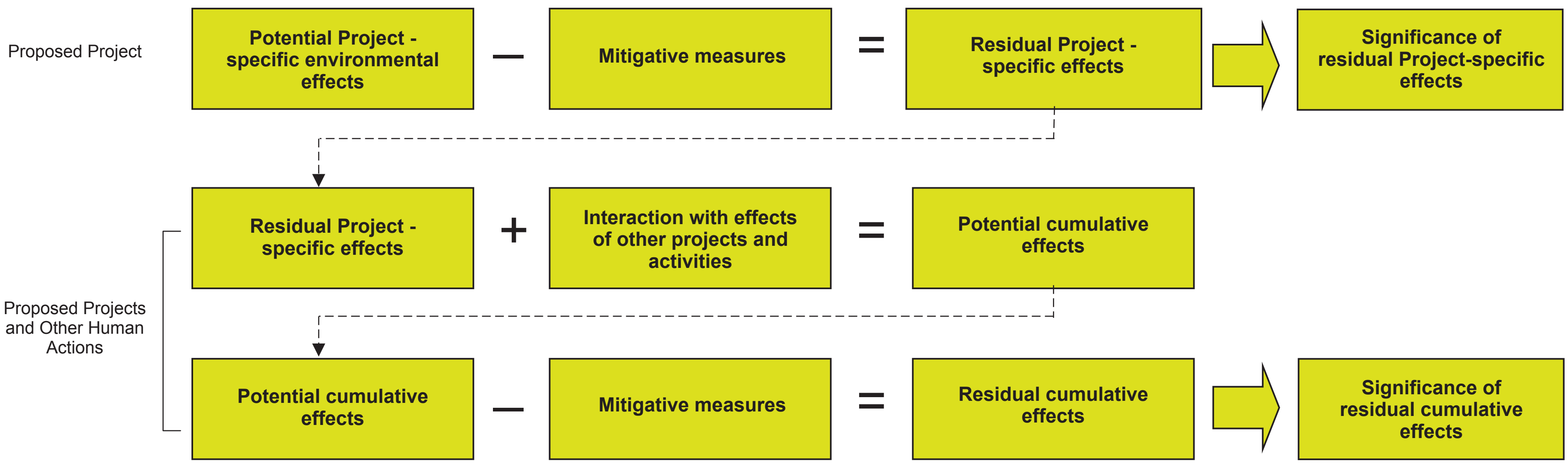

Figure 1.3-1

Steps to Cumulative Effects Assessment

1.3.4 Establishing the Scope of the Cumulative Effects Assessment

Projects and activities to be considered in the CEA for the Back River Project were defined as:

- *past* (i.e., historical, closed) projects and activities occurring within the outer geographical limit of possible interaction with the Project;
- *existing* (i.e., current active and inactive) projects and activities occurring within the outer geographical limit of possible interaction with the Project; and
- *reasonably foreseeable future* (i.e., formally accepted into a regulatory approvals process) projects and activities occurring within the outer geographical limit of possible interaction with the Project.

Key potential residual effects associated with past, existing, and reasonably foreseeable future projects were identified using publicly available information or, where data was unavailable, professional judgment was used (based on previous mining experience in similar geographical locations) to approximate expected environmental conditions.

1.3.4.1 Projects and Activities Considered

Past, existing, and reasonably foreseeable major projects with potential residual effects that occur within the outer geographical limit of possible interaction with the Back River Project are listed in Table 1.3-1. The list includes projects located within Nunavut and the Northwest Territories, in order to consider the outermost potential boundaries to encompass potential transboundary effects for some VSECs and the Bathurst Caribou Herd.

The list of projects included in Table 1.3-1 reflects a comprehensive list of potential projects that may interact with select VECs or VSECs from the Back River Project. Each VEC/VSEC has different characteristics and any residual effects may potentially interact with a small subset of the listed projects or a greater number of projects.

As per the final EIS guidelines, the list of projects considered in Table 1.3-1 conforms with the requirement to consider a larger spatial boundary for CEA, as well as a longer temporal scale. This list also conforms with the requirement to consider transboundary issues for the Bathurst Caribou Herd and other VECs and VSECs as appropriate.

Figure 1.3-2 shows the proximity of the projects listed in Table 1.3-1 to the Back River Project. Approximate distances provided are from the existing Goose exploration camp.

The following on-line database sources and websites were reviewed to compile the Project list: Infomine.com, draft Nunavut Land Use Plan (NPC, 2011/2012), registered exploration mining permits, active projects on NIRB's website, projects listed on Mackenzie Valley Environmental Effect Review Board (MVEIRB) website, Canadian Centre for Energy Information, Natural Resources Canada website, Indian and Northern Affairs Canada website, Northwest Territories and Nunavut Chamber of Mines, and individual resource development company websites.

In addition to major mining development projects, land use activities were also considered, as required under Section 7.11, bullet viii of the EIS guidelines (activities should not be limited to exploration and mining-related activities but include other factors not related to mining [e.g., wildfires, roads/airstrips developed for non-mining activities, etc.]).

Figure 1.3-2

Proximity of Past, Existing, and Reasonably Foreseeable Future Projects to the Back River Project

Sabina GOLD & SILVER CORP.

Rescan an ERM company

Table 1.3-1. Past, Existing, and Reasonable Foreseeable Future Projects with the Potential to Interact with the Back River Project

Phase	Location	Project	Development Type	Company /Organization	Location / Coordinates	Distance to Goose Property	Description	Operational Period	Status
Past	Nunavut	Lupin	Gold mine	Elgin Mining	65°46'N; 111o15'W	226 km	Underground mine and mill, tailings containment	1982 to 2005	Surface infrastructure remains in place - potential for this to be used if the Ulu deposit is developed.
	Nunavut	Jericho	Diamond mine	Shear Diamonds Ltd.	65°59'N; 111°28'W	238 km	Former diamond mine located 255 km SSE of Kugluktuk	2006 to 2008	Currently in care and maintenance. All work on project has been halted.
	Nunavut	Roberts Bay and Ida Bay	Silver mine	Quantum Murray LP	68°10'45"N; 106°33'20"W	321 km	Mine openings, equipment, waste rock and tailings pond	1973 to 1975	Remediation work being coordinated by AANDC. Expected to be complete by 2010
	Northwest Territories	Tundra	Gold mine	Indian and Northern Affairs Canada	64°11'N; 111°33'W	290 km	Underground mine workings, mill, tailings containment	1964 to 1968; re-opened briefly in 1990s	Care and maintenance. Remediation plan is being developed.
	Northwest Territories	Salmita	Gold mine	Giant Yellowknife Mines Limited	64°36'N; 114°21'W	297 km	Underground mine workings	1984 to 1989	Remediated.
Existing	Nunavut	Doris North (Hope Bay Belt)	Gold mine	TMAC Resources	68°09'N; 106°40'W	279 km	Airstrip, accommodation buildings, dock for shipping, tailings facility	Mine site construction 2009 to 2011	Currently in care and maintenance
	Northwest Territories	EKATI	Diamond mine	Dominion Diamond Ekati Corporation (Dominion Diamonds, Chuck Fipke and Stu Blusson)	64°44'N	226 km	Canada's first and largest diamond mine, 310 km. NE of Yellowknife. Open pit and underground. Mine life to 2019. Workforce approximately 1,500.	1998 to 2020	News release updated Q1 results for Dominion. Chantal Lavoie appointed new President. Reserves released April 24.
	Northwest Territories	Diavik	Diamond mine	Rio Tinto and Dominion Diamonds	64°30'N; 110°20'W	211 km	Canada's largest diamond producer, 300 km NE of Yellowknife. Mine life to 2023. Became all underground mine in 2012. Workforce approximately 1,000.	2003 to 2025	Diavik produced 1.9 million carats from 0.5 million tonnes of ore in Q4, bringing 2012 production to 7.2 million carats from 2.1 million tonnes of ore processed (up from 6.7 million carats from 2.2 million tonnes of ore processed in 2011. Rio Tinto has cancelled plans to sell diamonds business.
	Northwest Territories	Snap Lake	Diamond mine	De Beers Canada Inc.	63°35'N; 111°15'W	310 km	Canada's first all underground diamond mine. 220 kilometres NE of Yellowknife. Mine life to 2028. Workforce approximately 750.	Construction began in 2005; Mine officially opened on July 25, 2008; 22 year mine life	Commenced commercial production on January 16, 2008 and the Official Mine Opening took place on July 25, 2008.
Future	Nunavut	Bathurst Inlet Port and Road	All-weather road and port facilities (Bathurst Inlet)	BIPR Company	66°50'N; 108°2'W to 65°40'N; 110°40'W	75 km	211 km all-weather road; port facilities for 50,000 tonne ice-vessels and barges	Construction expected to begin in 2017. Operation for 20 years	In NIRB process: updated DEIS to be submitted in 2013
	Nunavut	Hackett River	Base metal mine; ~25 km spur road to BIPR road	GlencoreXstrata	65°55'N; 108°30'W	94 km	Proposed open pit mine. One of largest undeveloped VMS massive sulphide deposits in the world. 104 km SSW of Bathurst Inlet.Access road from BIPR; estimated construction jobs: 900; estimated mine jobs: 500	estimated 15 year mine life	Pre-feasibility and environmental baseline studies; DEIS submission currently on hold
	Nunavut	Hope Bay Belt (Phase 2)	Gold Mine-Extension of Doris North Gold Mine	TMAC Resources	68°09'N; 106°40'W	279 km	Proposed gold mines 130 m S of Cambridge Bay; covers the majority of the Hope Bay Greenstone Belt. Estimated mine jobs: 300	~15 years of operation	Project Description submitted 2011; DEIS guidelines issued 2012; TMAC entered into MOU with DIA, March 14, 2013; NIRB confirms reassignment of Project Certificate for Doris North to TMAC on April 11, 2013
	Nunavut	Izok Corridor Project (with High Lake & Hood River deposits)	Copper, Zinc, Gold, Silver	MMG Resources Inc.	65°27'N; 115°5'W (Izok Lake); 67°22'46"N; 110°50'39"W (High Lake); 67°48'19"N; 110°52'9"W (Dock)	288 km (to Izok Mine and High Lake Mine); 309 km (to Grays Bay Port)	High Lake is 1710 Hectare, copper-zinc-silver-gold property; 190 km ESE of Kugluktuk. Izok is high-grade zinc-copper-lead-silver deposit, 255 km SW of Kugluktuk. Estimated construction jobs: 1,140. Estimated mine jobs: 710.	Estimated 14 + years mine life; 7-10 years of closure and reclamation	Feasibility study initiated in 2012; NIRB process suspended while Project Description updated; MMG is examine alternative designs to reduce costs, add value, and improve economic viability of the project, and will provide a revised project description to BIPR by December 2013.
	Nunavut	Canadian High Arctic Research Station (CHARS)	Arctic science and technology research	Aboriginal Affairs and Northern Development Canada (Government of Canada)	69°7'1.153"N; 105°4'11.132"W	403 km	Proposed world-class research station in Canada's Arctic. To be located in Cambridge Bay. Estimated science and technology program jobs: 33 full-time, up to 150 seasonal.	Design and construction 2011 - 2017. Operations 2017 and onwards	Government of Canada announced commitment to a world class high Arctic research station in November 2007. Feasibility study issued in March 2011. Cambridge Bay community met with the Project architects in June 2013.
	Northwest Territories	Gaucho Kué	Diamond mine	De Beers and Mountain Province	63°30'N; 109°30'W	257 km	Proposed open-pit diamond mine approximately 180 km ENE of Yellowknife, NT. Estimated mine jobs: 360	Construction expected to begin in 2014. Estimated 11 year mine life.	Gaucho Kué Joint Venture and NWT Gov't signed socio-economic agreement June 28.
	Northwest Territories	Courageous Lake (Tundra)	Gold mine	Seabridge Gold	64°11'N	290 km	Proposed open pit mine 240 km northeast of Yellowknife. 6.5 million oz. proven and probable reserves. (Positive Preliminary Feasibility Study July 2012)	Prefeasibility	New 5-year land use permit issued December 28 to allow up to 700 drill holes.

Land-use activities in the area were identified by review of the *Draft Nunavut Land Use Plan* (Nunavut Planning Commission 2012), the land use baseline study conducted for the Project (Rescan 2013) and traditional knowledge baseline studies (*Inuit Traditional Knowledge of Sabina Gold & Silver Corp. Back River (Hannigayok) Project, Naonaiyaotit Traditional Knowledge Project (NTKP)*; KIA 2012). Major land use activities are:

- subsistence harvesting of fish and marine and terrestrial wildlife;
- commercial harvesting of fish and wildlife and sale of game and pelts;
- ecotourism, including lodges, kayaking, wildlife and bird viewing, dog-sledding, cruise ship stopovers, and Inuit and northern culture and history;
- sports hunting and fishing, including guided hunting and fishing excursions; and
- mineral and diamond exploration.

1.3.4.2 Summary of Other Projects

Past Projects

Five past projects have the potential to interact with the residual effects of the Back River Project.

Lupin Mine was a gold mine in Nunavut located on the west shore of Contwoyto Lake, 80 km south of the Arctic Circle. It produced approximately 3 million ounces of gold between 1982 and 2005. Product was shipped to market via the Lupin Winter Road (now known as the Tibbitt to Contwoyto Winter Road); employees were transported to/off site using an airstrip. The mine is currently under care and maintenance. Plans are ongoing to use the production plant to operate a proposed mine at Izok Lake, located to the south west near the Nunavut and Northwest Territories border. Lupin may also be reopened to recover the last available ore reserves.

Jericho Diamond Mine was an open-pit diamond mine located 420 km northeast of Yellowknife, Northwest Territories and is accessible by air all year and by the Tibbitt to Contwoyto Winter Road from Yellowknife. The project was mined from 2006 to 2008, and produced 780,000 carats (156 kg [344 lb]) of diamonds from 1,200,000 tonnes of kimberlite. Due to the remoteness of the site the mine was part of the impetus for a proposal to build a port near the community of Bathurst Inlet with a road to both Diavik Diamond Mine and Ekati Diamond Mine. Although the NIRB issued a certificate to re-open the mine, the responsible company has not been able to finance the project.

Roberts Bay and Ida Bay was a silver mine located approximately 115 kilometres southwest of Cambridge Bay, Nunavut. Mining at the site occurred from 1974 to 1975, with ongoing exploration until the mid-1990s, producing 74,500 ounces and 10,000 ounces of silver from Roberts Bay and Ida Bay respectively. The site was abandoned in the mid-1990s. The tailings pond is relatively small at 40 m diameter and shallow depths; the largest waste rock pile is roughly 6 m in height. Remediation work was undertaken from 2007 to 2010; site monitoring will continue for 25 years.

Tundra Mine was an underground gold mine located 240 km northeast of Yellowknife, Northwest Territories. It operated from 1962 to 1968, producing 104,476 troy ounces (3,250 kg) of gold from 187,714 tons of ore. Remediation work began in 2006, including wildlife deterrent devices and a water treatment plant to treat and discharge water from the tailings facility.

Salmita Mine was a gold producer located 240 km northeast of Yellowknife, Northwest Territories, approximately 7 km south of Tundra Mine. It operated from 1983 to 1987. The mine used the old camp and milling plant of the abandoned Tundra Mine and produced 179,906 troy ounces (5,596 kg) of gold from the milling of 238,177 tons of ore. It is accessible by air or winter road. Remediation has been ongoing since the 1980s.

Existing Projects

Four existing projects have the potential to act cumulatively with the residual effects of the Back River Project.

Doris North (Hope Bay Belt) is planned to be a 2 year underground gold mine located in Nunavut, 75 km northeast of Omingmaktok and 110 km southwest of Cambridge Bay. Construction of the mine occurred from 2008 to 2001. In 2012 the Project was moved to care and maintenance. Active water management and monitoring are currently occurring at the Project site.

Ekati is a surface and underground diamond mine located 310 km northeast of Yellowknife, Northwest Territories. The mine began operating in 1998 and is expected to operate until 2018/19. The mine's current annual production is estimated to be approximately 7.5 million carats (1,500 kg) of diamonds; to 2009, the mine produced 40 million carats (8,000 kg) of diamonds out of six open pits. Currently, there is one underground and one open pit in operation. Mined ore is transported to an 18,000 tonne per day process plant where it is crushed, scrubbed, and ground to release the diamonds from the surrounding kimberlite. Transport of product is via winter road and air. To date, 314 ha of tundra habitat have been used for construction of the mine and 611 ha of the total lease area of 10,960 ha has been affected by the operation.

Diavik began as an open pit diamond mine and transitioned to an underground mine by 2012. It is located about 300 kilometres north of Yellowknife, Northwest Territories. The mine opened in January 2003 and is expected to operate for 16 to 20 years. It produces approximately 7.5 million carats (1,500 kg) of diamonds annually. The mine site (approx. 9 km^2 footprint) includes a kimberlite processing plant, accommodation complex, maintenance shop, diesel fuel storage tanks, boiler house, sewage treatment plant, water treatment plant, and power house. Elevated arctic corridors carry services and provide enclosed walkways connecting buildings and dykes surround the open pits. The underground mine required 20 km of tunnels, including vertical tunnels for ventilation and heated air, and water removal. On surface new crusher and paste backfill plants were constructed and water treatment plant and electrical power capacity doubled. Diamonds are automatically separated from waste by using X-ray systems. The mine is accessible by an ice road and Diavik Airport with a 1,596 m gravel runway that regularly accommodates Boeing 737 jet aircraft. On mine closure, the area will be flooded and the dikes will then be breached to return them as islands in Lac de Gras.

Snap Lake is an underground diamond mine located about 220 km northeast of Yellowknife, Northwest Territories. It began operations in 2008 and is expected to operate for 22 years, with 1.4 million carats annually (3,000 tonne/day capacity). The mine area, including surface processing facilities, covers an area of 500 hectares. Travel to the site is only possible by airplane for all but six to eight weeks of the year, when a seasonal ice road is used to re-supply the mine. The underground mine requires tunnels, including vertical tunnels for ventilation and heated air, and water removal. The site includes a crusher, scrubber and paste backfill plant. Diamonds are automatically separated from waste by using X-ray systems. Part of the processed rock is dewatered, mixed with cement and pumped back underground to fill mining voids. Tailings are deposited in the North Pile containment area. The company won an ISO 14001 certification for its environmental stewardship during the planning and construction of the mine.

Reasonably Foreseeable Future Projects

There are seven future projects in either the NIRB process or in the Mackenzie Valley Environmental Impact Review Board process. It is important to note that the design or implementation of future projects may change due to their conceptual nature, thus, leading to some uncertainty in predicting the potential for cumulative effects.

Bathurst Inlet Port and Road consists of a port on Bathurst Inlet connected to the mines and mineral deposits in Nunavut and Northwest Territories by a new 217 km all-weather road to Contwoyto Lake, and the existing Tibbitt to Contwoyto Winter Road. The port facility will include a wharf for 50,000-tonne ice-class vessels, a 200-person camp, and a 1,200 m airstrip. It is anticipated that 18 trucks per day (except during caribou migration) will operate on the road. The proposed project is currently in the NIRB review process.

Hackett River is a planned open pit and underground metals mine located 75 km south of Bathurst Inlet. Annual production is predicted to be 324.7 million pounds of zinc, 12.4 million ounces of silver, 20.7 million pounds of copper, 37 million pounds of lead, and 17.2 thousand ounces of gold over a mine life of 14 years. The project is currently being reviewed by NIRB and a decision on the project is expected within five years. The project includes facilities capable of processing 10,000 tonnes/day of ore, reducing to 7,000 tonnes/day by year seven. A small airstrip will also be included. If the Bathurst Inlet Port and Road Project is approved by NIRB, then an all-season 23-km spur road will connect with that road; otherwise, a gravel all-weather road and a new port facility at Bathurst Inlet will be constructed as part of the Hackett River Project.

Hope Bay Belt (Phase II) Mine is an expanded development in the Hope Bay Belt which would include the Madrid, Patch, and Boston mining districts. It is located 125 km southwest of Cambridge Bay, 279 km north of the Goose Property of the Back River Project, and includes expanded deep sea and shallow water port facilities in Roberts Bay, airstrips, winter roads, and all-weather roads. It is anticipated that, once opened, the mine will operate for 15 years. The project is currently undergoing review in the NIRB process. The Doris Mine site, part of this project, has been in care and maintenance since 2012. The mine may begin operating by 2015/16.

Izok Corridor is a composite project consisting of open pit and underground metals mines at the Izok and High Lake mine sites, a processing plant at the Izok mine site, a port at Grays Bay on the Coronation Gulf, and a 347 km all-season road linking all the sites. The Project is variously located between approximately 250 km northwest (High Lake) and 200 km west (Izok) of the Back River Project. The mine facilities are expected to produce zinc, some copper, and minor amounts of lead concentrate for approximately 12 years, beginning in 2017. The Project will affect 1,138 hectares of land and 22 hectares at the port facility.

CHARS. The Canadian High Arctic Research Station (CHARS) is a planned (Government of Canada) world-class facility for science and technology located in Cambridge Bay, Nunavut. It will complement and anchor the smaller regional facilities in the North, and will provide services and facilities including a technology development centre, a traditional knowledge centre, and advanced laboratories. The Project feasibility study was produced in March 2011, and the project is currently in the design phase (2011 to 2015). In June 2013, the community of Cambridge Bay met with the project architects to provide design feedback. Construction is scheduled for 2014 to 2017, and operations from 2017 onwards (Government of Canada 2013).

Gahcho Kué is a proposed open pit diamond mine in the Northwest Territories, 85 km southeast of the Snap Lake Diamond Mine Project and approximately 280 km east northeast of Yellowknife. The site is served by an ice runway, Gahcho Kue Aerodrome, and a spur of the Tibbitt to Contwoyto Winter Road from Lupin Mine. If it proceeds to an operating mine, it is expected to annually mine 3,000,000 tonnes of kimberlite, and to produce 4,500,000 carats (900 kg) per year over an 11 year life. The project is currently being reviewed by the Mackenzie Valley Environmental Impact Review Board and a decision on the project is expected in July 2013.

Courageous Lake (Tundra) Mine was an underground gold mine located 240 km northeast of Yellowknife, Northwest Territories. Year-round access is possible by air only, either by fixed wing aircraft to the airstrip at Salmita, located 6 km to the south, or by fixed wing aircraft equipped with skis or floats to nearby lakes. In addition, access in mid-winter is possible over a 32 km winter road which branches off the main winter road from Yellowknife to the Lupin Mine. Current drilling exploration has located sufficient gold reserves to warrant a pre-feasibility study.

A summary of all relevant potential residual effects are included in the individual VEC/VSEC assessment sections in Supporting Volumes 4 through 8, and these residual effects were considered and analyzed for each valued component where the potential for a cumulative effect to occur has been identified. This analysis is supported by Table 1.3-2 (shown here for illustrative purposes). For each valued component, the analysis narrowed the scope of the CEA to focus only on those projects and activities where there is an anticipated cumulative interaction with the residual effects from the Back River Project. A description of the type of cumulative effect that is expected is also provided.

Table 1.3-2. Example Template for Interaction of Residual Effects from the Back River Project with Other Projects

	Description of Residual Effect
Back River Project	
Name of Past Project or Activity	
Name of Existing Project or Activity	
Name of Reasonably Foreseeable Future Project or Activity	
Type of Potential Cumulative Effect (physical-chemical transport, nibbling loss, spatial crowding, temporal crowding, synergistic, additive, growth inducing)	

1.3.4.3 Assessment Boundaries

The CEA considers the spatial and temporal extent of Project-related residual effects on VECs combined with the anticipated residual effects from other projects and activities to assist with analyzing the potential for a cumulative effect to occur.

Spatial Boundaries

Past, existing, and reasonably foreseeable major projects with potential residual effects that occur within the outer geographical limit of possible interaction with the Back River Project were considered as listed in Table 1.3-1. The list includes projects located within Nunavut and the Northwest Territories, in order to consider the outermost potential boundaries to encompass potential transboundary effects for some VSECs and the Bathurst Caribou Herd.

The list of projects included in Table 1.3-1 reflects a comprehensive list of potential projects that may interact with select VECs or VSECs from the Back River Project. Each VEC/VSEC has different characteristics and any residual effects may potentially interact with a small subset of the listed projects or a greater number of projects.

As per the final EIS guidelines, the list of projects considered in Table 1.3-1 conforms with the requirement to consider a larger spatial boundary for CEA, as well as a longer temporal scale. This list also conforms with the requirement to consider transboundary issues for the Bathurst Caribou Herd and other VECs and VSECs as appropriate.

Temporal Boundaries

The expected timing and duration of Project-related residual effects is compared with that of residual effects from other past, existing and future projects or activities to identify temporal overlap. As identified in the NIRB Guidelines, a longer timeline than just the development and operation phases of the Project must be considered.

The following periods were identified and evaluated as part of the CEA.

- **Past:** The year 2001 was selected as the past temporal boundary, representing a time when rigorous baseline studies and activities first occurred in the CEA study areas. Effects of past activities are captured in baseline studies.
- **Existing:** Includes projects and activities undergoing construction or operating concurrently with the Project.
- **Foreseeable Future:** future boundaries are VEC/VSEC specific and are based on the predicted length of time it would take for the VEC/VSEC to recover to baseline conditions, if possible. The future boundaries are stated for each VEC/VSEC in Volumes 4 to 8 and summarized in the discussion of potential cumulative effects.

1.3.5 Potential Cumulative Effects, Mitigation, and Residual Effects

Projects and activities with the potential to cause a cumulative effect with the Back River Project are identified and discussed for each affected valued component in Volumes 4 to 8, and additional mitigation measures to minimize cumulative effects are presented if they exist.

1.3.5.1 Identifying Potential Cumulative Effects

The CEA applies best practice methods to predict the nature and extent of cumulative effects that may result from the Project in combination with other projects and activities. The potential for cumulative residual effects is explored through either qualitative or quantitative means. It is understood that published information on past, existing and future projects is limited mainly to previous and current NIRB reviews, and public information available on company websites. Greater reliance is placed on professional judgment and traditional knowledge in assessing cumulative effects. The type of potential cumulative effect is described.

1.3.5.2 Implementing Mitigation Measures for Cumulative Effects

Mitigation measures for cumulative effects involves taking further action, where possible, to avoid or minimize cumulative effects on valued environmental and socio-economic components. Because cumulative effects typically result from the combined effects of multiple developments, responsibility for their prevention and management is shared among the various developments that contribute to them. It is usually beyond the capability of any one party to implement all of the measures needed to reduce or eliminate cumulative effects; therefore, collaborative efforts will likely be needed. Implementation of additional mitigation measures for cumulative effects is somewhat confounded by the involvement of and lack of control over operators of other projects and activities. Proposed mitigation measures must take technical, environmental, and economical feasibility into consideration as well as the ability to influence the independent operators of other projects and activities. Key approaches to avoid, reduce, control, eliminate, offset, or compensate for potential cumulative effects include:

- **Optimizing Alternatives**: Preventing or reducing adverse cumulative environmental effects by changing an aspect of the Project (e.g., choosing Bathurst Inlet Port and Road over a new access route).
- **Design Changes**: Preventing or reducing adverse cumulative environmental effects by redesigning aspects of the Project (e.g., minimizing or removing spatial overlap with other projects and activities).
- **Management Practices**: Eliminating, minimizing, controlling, or reducing adverse cumulative effects on VEC/VSECs through management practices (e.g., shutting down traffic on all-weather road during caribou migration).
- **Compensation**: Offsetting remaining cumulative effects that cannot be prevented or reduced through remedial actions, so that the net effect on the community or ecosystem is neutral or beneficial (e.g., enhancement of similar habitat in another area, enhancement of other social/economic/cultural benefits).
- **Enhancement**: Providing measures to enhance a beneficial effect. Enhancement generally applies to socio-economic effects (e.g., working with another operator to minimize peaks/troughs in employment).

1.3.5.3 Summary of Cumulative Residual Effects

If the proposed mitigation measure(s) are not sufficient to eliminate a cumulative effect, a cumulative residual effect is identified and described and the specific projects and activities contributing to the cumulative residual effect are discussed. The methodologies and underlying assumptions and data limitations are presented in the accompanying text. A summary of cumulative residual effects on each affected VEC or VSEC will be provided in the cumulative effects assessment chapters in Volumes 4 to 8.

Two assessment scenarios are analyzed to understand the Project's incremental contribution to the cumulative residual effect:

Future case without the Project - A consideration of residual effects from all other past, existing, and future projects and activities *without* the Back River Project. This analysis is designed to answer the following question: given the current status of baseline conditions (which already reflects effects from past and existing projects), how significantly will VECs/VSECs be affected by the residual effects from other reasonably foreseeable projects and activities in the absence of the Back River Project? The results of baseline data used in the project-related effect assessment will be used to facilitate this discussion.

Future case with the Project - A consideration of all residual effects from past, existing, and future projects and activities *with* the Back River Project. This scenario is designed to answer the question: when combined with other project and activities, does the Back River Project serve to act as a trigger that pushes a VEC/VSEC beyond critical conditions thereby being responsible for creating a significant, adverse cumulative residual effect?

The cumulative residual effects – only those for the Future case with the Project - are described using the same criteria applied in the Project-related effect assessment methodology (Section 2.4 above): direction, magnitude, duration, frequency, geographic extent, reversibility, probability of occurrence, and confidence in the analyses and conclusions. Areas where insufficient data are available to provide an assessment are highlighted, with the potential cumulative effects being described as uncertain in these instances. Using a weight of evidence and relative ranking approach, combined with best professional judgment, the cumulative residual effect is characterized as either significant (S), not significant (N), or positive (P). The evaluation of significance will be completed by comparing cumulative effects against thresholds, standards, trends or objectives relevant to the VEC/VSEC and as defined in each assessment chapter.

Cumulative residual effects on a VEC/VSEC are assessed for significance in Volumes 4 to 8 as per Table 1.3-3. Completed summary tables are included in applicable cumulative effects assessment chapters in Volumes 4 through 8.

1.4 POTENTIAL TRANSBOUNDARY EFFECTS ASSESSMENT METHODOLOGY

The NIRB guidelines define transboundary effects as those effects that occur outside the Nunavut Settlement Area (NSA) which are directly linked to the Project inside the NSA. These effects may occur across provincial, territorial, or international boundaries. The concept of transboundary effects is based on Principle 21 of the 1974 Stockholm Convention:

> *States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or areas beyond the limits of national jurisdiction* (UNEP 2003).

Although the Project is located entirely within the NSA, transboundary effects from the Project can occur when animals move across jurisdictional boundaries (e.g., caribou and birds migrating) or when project activities themselves, or their zone of influence, cross jurisdictional boundaries (e.g., transportation and economic benefits). Transboundary effects of the Project have the potential to act cumulatively with other projects and activities outside the NSA.

For the Back River Project, transboundary effects are outlined by the Minister of Aboriginal Affairs and Northern Development Canada's decision, and focus on the effects upon affected communities and groups that depend on the Bathurst Caribou herd. Hence, the transboundary effects assessment focused on these key areas.

1.4.1 Inclusion of Valued Ecosytem Components/Valued Socio-economic Components for Potential Transboundary Effects Assessment

Section 7.12 of the final EIS guidelines (NIRB 2013a) provides clear direction on what should be included in the Transboundary Effects Assessment from the Minister of Aboriginal Affairs and Northern Development Canada's letter (dated December 17, 2012) as described below:

- *Impacts associated with proposed Project infrastructure (including any associated transportation) on wildlife species such as caribou that have a large migration range, and the resulting socio-economic impacts to communities and groups that rely on these wildlife resources;*
- *Impacts to the local, regional and territorial health system on the Northwest Territories as a result of reliance on medical services; and*
- *Impacts to employment and business within the region affected by the Project.*

Table 1.3-3. Example Template of Summary of Cumulative Residual Effects and their Significance

Cumulative Residual Effects	Evaluation Criteria			Likelihood of Occurrence of Cumulative Residual Effects			Significance of Cumulative Residual Effects		
	Direction (positive, neutral, negative)	Magnitude (low, moderate, high)	Duration (short, medium, long)	Frequency (once, sporadic, continuous)	Geographic Extent (local, regional, beyond regional)	Reversibility (reversible, reversible with effort; irreversible)	Probability (unlikely, moderate, likely)	Confidence (low, medium, high)	Not significant (N), Significant (S) Positive (P)

Notes:
Certainty around the assignment of Likelihood (only applicable to significant effects)
Level of confidence in the Significance Rating

Details on the caribou transboundary effects assessment can be found in Volume 5, and details on the health system, medical services, employment and business can be found in Volume 8.

In addition to the direction provided by the Aboriginal and Northern Development Canada Minister's decision on focusing on the Bathurst Caribou herd, other VECs and VSECs were also evaluated for inclusion in transboundary effects assessment.

The following systematic process was used to determine which VECs and VSECs would be included in the transboundary effects assessment:

- Identify any residual adverse effects of the Project on a VEC/VSEC, after mitigation measures are applied, that may result in transboundary effects.
- Determine whether the residual effects of the Project may operate cumulatively in a transboundary context with the environmental effects of projects or activities located in other jurisdictions. Assess whether the Project will interact cumulatively in a meaningful way (i.e., is "likely" to heighten effects).
- Describe mitigation measures, where feasible, that may be applied where measurable effects are described.

If a VEC or VSEC had a residual effect with the potential to interact with projects and activities outside of the NSA, a transboundary assessment chapter was included for that VEC/VSEC in Volumes 4 to 8. The transboundary discussion includes identifying the potential jurisdictional interaction, along with the rational for inclusion in the transboundary analyses.

As required in the final EIS guidelines (NIRB 2013a), for VECs/VSECs that have residual effects with transboundary characteristics a discussion is included that describes any predictions, effects assessment, proposed mitigation and monitoring plans.

2. Effects of Environment on Project Design

2. Effects of Environment on Project Design

2.1 INTRODUCTION

The environment has the potential to affect the design, operation, and closure of the Project. Extreme weather (storms, extreme rainfall or snowfall, extreme low temperatures) and geo-hazards (seismicity, ground and slope instabilities) have the potential to affect Project infrastructure and in turn represent concerns for human safety and the environment. Included in the context of extreme weather is the potential for global climate change to affect the Project. The flat terrain and permanently frozen subsoil also add to the engineering challenges which the Project must surmount. These must be seen in the context of changing climate. The details of these factors are reviewed in the sections below.

2.2 GEOTECHNICAL HAZARDS

2.2.1 Slope Stability

Slope stability has been and will continue to be a design consideration for multiple infrastructure components including open pits, Tailings Impoundment Area (TIA), Waste Rock Storage Areas (WRSA), and overburden slopes. While all designs are currently in the preliminary stage, in general these risks will be assessed through geotechnical and hydrological investigations, and mitigated with engineering design, and maintenance programs including ongoing monitoring and remediation; the engineering hazard assessment for these infrastructure components with respect to slope stability are detailed in Table 2.2-1.

For open pit design, a series of stability analyses was carried out, including 2D numerical modelling and kinematic analyses. Potential hazards associated with structure and low quality zones were identified in some pit walls. In the absence of major structure, most walls show very low likelihood of instability due to the strong rock mass and relatively small pit size. The identification and characterization of geological structure could potentially be a deficiency in the current design and may need to be addressed in future work.

Due to the generally good rock mass quality and relatively shallow depth of the open pits, the current approach has been to limit the bench height and steepen bench face angles while providing sufficient berm widths to contain a structurally controlled failure. This preliminary design assumes that final pit walls will include pre-split blasting to reduce effects on final pit wall stability. Minimum width geotechnical berms are recommended at set intervals of pit depth to provide additional catchment capacity. In all cases, the open pit haul roads intersect the pit walls within these recommended intervals and, as such, haul roads can be used in place of additional berms.

For the initial TIA design, a simplified model was created to run Slope/W stability analyses for static and seismic loading conditions. Factors of Safety calculated in the models satisfy the minimum required value of 1.5 for long-term static stability as specified in the 2007 Canadian Dam Association (CDA) guidelines. Further detailed design will be implemented as the Project progresses.

In the current design, the waste rock intended for the WRSA and the overburden generated from mining activities will be stored in surficial waste dumps, a portion of which is currently slated for reuse as underground mine backfill. Geotechnical information that has been collected at the proposed WRSA indicates bedrock on surface with little to no organic material present and the upper few metres of rock is expected to be frost shattered.

To provide stability, the preliminary design of the WRSA outlines that the initial lift of waste rock over previously uncovered areas will be completed while the ground is frozen. After this initial lift, all subsequent lifts will be placed with one full year between lift placements to allow the lower lift to properly freeze.

For overburden slope design, an analysis of historical data was completed as well as a 2013 field program including diamond drilling and test pits. An analysis of this data is not yet available but will be upon submission of the Final Environmental Impact Statement (FEIS); additional characterization may be required in order to provide definitive soil slope angles.

2.2.2 Underground Stability

The effects of underground instability will need to be considered for the Umwelt Underground in Goose Property Area; the engineering hazard assessment for underground stability is detailed in Table 2.2-1. A preliminary geotechnical analysis has been completed to provide recommendations on long-term development, vertical development, intersections, and room support. The current mining method selected for the lower portion of the Umwelt deposit is post pillar cut-and-fill (PPC&F). This method takes into consideration geometry, dip angle, continuity and grade distribution, rock mass strength and competency, in-situ value of mineralized material at the Umwelt deposit.

To evaluate underground stability, 3D numerical modelling for the Umwelt deposit was completed using Flac3D™ software. This modelling was preliminary in nature and consistent with the current stage of the Project. Initial design for the underground support requirements has been completed, however the anticipated rock mass qualities will ultimately have to be verified once mining commences.

2.2.3 Frost Heave

Frost heave is the uplift of soil or ground surface due to the expansion of groundwater at depth upon freezing. This process results in perpendicular uplift of the ground surface during freezing; during thaw, the uplifted material settles vertically leading to some lateral displacement on sloping surfaces. Frost heave occurs when three conditions are satisfied: the presence of frost susceptible soils, water in sufficient quantities, and freezing temperatures at depth. In soils, frost susceptibility is related to a smaller particle size; clays, silts and fine sands will heave while coarse-grained sands and gravels will not heave.

In the Project Development Area (PDA), the overburden is generally sparse and limited to glacial-type deposits consisting of occasional alluvium deposits and esker deposits of sand and gravel. If frost susceptible soils are identified under infrastructure foundations, engineering measures will be applied which could include the removal of finer grained soils and replacement with coarser structural fill or drainage to divert water from the areas susceptible to frost heave.

2.2.4 Ice Scour

Ice scours are long narrow ditches in the seabed caused when sea ice drifts into shallower waters and gouges the sea bottom. At the Marine Laydown Area (MLA) in southern Bathurst Inlet some ice scour is present along the deeper shorelines where pack ice moves during spring thaw. Engineering design of port foundations will account for ice scour and potential ice movement.

2.2.5 Coastal Erosion and Sea Level Trends

Coastal erosion is a factor that will be reviewed for the construction of the MLA, which is located approximately 130 km north-northwest of the Goose Property Area in Bathurst Inlet.

Table 2.2-1. **Engineering Hazard Assessment – Goose and George Property Areas**

Engineering Hazard	Hazard Description	Potential Consequences	Risk Factor	Consequence Factor	Mitigation Measures
Permafrost / Thaw Susceptible Soils	• Construction over ice-rich or thaw sensitive permafrost ground causing technical issues with project infrastructure foundations. • Problems potentially leading to environmental impacts.	• Heavy structures experiencing creep settlement over ice-rich permafrost. • Thaw weakening of surficial soils causing failure or movement of foundations. • Melting of massive deposits below or adjacent to structures causing settlement or movement.	Moderate	High	• Where possible, found most significant structures on bedrock and locate structures to avoid problem areas. • Excavations in overburden materials and disturbance of natural ground will be avoided where feasible. • If excavation is required, natural materials will be over excavated and backfilled with an insulating cover of thaw stable granular fill materials of a minimum thickness to protect against thaw and instability in the underlying ice-rich overburden soils. • Embankments or granular fill pads will be constructed with side slopes sufficient to protect underlying permafrost. • Design and construct with insulation to control and limit effects of heat and restricted cooling.
Seismicity	• Significant earthquake event subjecting structures to dynamic loading. • Low seismicity of region.	• Pit slope failure. • Failure of waste stockpile or tailings slopes. • Failure of infrastructure.	Low	Moderate to high	• Concerns mitigated through seismic hazard assessment and understanding load potential. • Side slopes and foundations built to meet seismic design parameters. • Monitoring during operations for indicators of potential problems. • Impact of seismicity on structures in permafrost is low.
Flooding / Hydrology	• Although not expected to have significant impact, runoff and water pooling could impact thermal regime. • Significant runoff event exceeds capacity of access road culverts. • Icing of culverts reduces capacity for normal flows. • Debris build-up causes reduced capacity for flows.	• Surface water induced thermal degradation leading to thaw settlement or weakening of soils/foundations. • Overtopping of roads causing failure and potential downstream sediment issues.	Moderate	Low	• Hydrology baseline studies have progressed. • Where surface water collection or diversion is required, the thermal impact of runoff will be considered. Interception ditches will be employed to redirect surface water flows. These may have to be built by over-excavation and replacement with thaw stable processed rock fill material. • Maintain grading and drainage of all areas near infrastructure. • All bridges and culverts current design 1-in-50-year flood event. • Regular monitoring of culverts to identify icing or other debris blockages.
Open Pit Stability	• Overall slope stability. • Rock fall potential. • Freeze/thaw cycles within the active zone will cause or accelerate the deterioration of the bench faces and increasing the chances of rock falls. • Ground water inflow could have an impact on slope stability. • Open pits could extend close to, or potentially below, the base of the talik zone.	• Rock falls, groundwater inflows or an overall slope stability issue resulting in material impacting men or equipment working at lower elevations within the pit. • Temporary shutdown of open pit operations.	Moderate	Moderate to high	• Bench face angles selected to reduce instabilities. • Catch benches to be incorporated into design to reduce impact of small scale instabilities. • Inter-ramp and overall slope angles selected to achieve target FoS against multi-bench or overall slope failures. • Bench maintenance program will be developed that will include a monitoring program, scaling, and the cleaning of accumulated debris from the catch benches. • Groundwater inflows are expected to be negligible as a result of permafrost conditions. • Waterbodies that could cause a potential stability impact will be managed early, either through partial dewatering or diversion via temporary berm.
Open Pit Overburden Slope Stability	• Failure of natural overburden slope above open pit. • Piping and undercutting of toe due to groundwater seepage.	• - Slope failure could impact men or equipment working at lower elevations within the pit. • Thermal degradation could lead to increased sediment reporting to open pit.	Moderate	Moderate	• Geotechnical investigations have been progressed. • Cut slopes will be designed to address stability issues. • Ice-rich slope will be protected with thermal and erosion barrier (e.g., rock cover). • Diversion ditches may be utilized to control surface run-off where seasonal flows can affect the slope.

(continued)

Table 2.2-1. Engineering Hazard Assessment – Goose and George Property Areas (completed)

Engineering Hazard	Hazard Description	Potential Consequences	Risk Factor	Consequence Factor	Mitigation Measures
Waste Rock Stockpile Stability	• Stability problems associated with stockpiles of waste rock and waste overburden material.	• Covering of unfrozen ground with waste materials could lock in heat, thus changing the thermal conditions and possibly thawing ice-rich foundation soils. • Weakening of thaw sensitive soils during summer dumping. • Weakening of thaw sensitive soils due to surface water flows impacting thermal regime outer slope failure. • Presence of ice-rich foundations leading to the development of cracks within the stockpile and at the stockpile surface. • Acid rock drainage.	High	High	• Current design is maximum 2:1 side slopes. • PAG waste rock will be placed in a manner to prevent basal permafrost degradation and promote aggregation of the permafrost into the waste rock. • Ground disturbance will be minimized prior to placement of the thermal barrier. Only surface ice and snow to be removed from the footprint during the winter prior to placement of waste rock. • In order to enhance thermal protection, management of stockpile surface runoff will be facilitated through the construction of ditches and/or toe berms. • Ongoing monitoring of slopes. Any cracks that develop will be monitored and repaired as required to minimize inflow of surface water and subsequent ice wedge formation within the stockpiles. • Encapsulate PAG waste materials in NPAG waste rock to maintain frozen state to protect the PAG waste rock from seasonal thawing (i.e. contain the active layer) and prevent the release of ARD. • Encapsulate ice-rich materials in waste rock to maintain frozen state and prevent release of sediment.
Tailings Impoundment Area Stability	• Stability problems associated with tailings deposition and storage.	• Slope failure could impact men or equipment in the area. • Presence of ice-rich foundations leading to the development of cracks within the rockfill embankments.	Moderate	High	• Geotechnical investigations of foundation ground conditions have been progressed. • Embankments raised via downstream construction for increased stability. • Berm and staged construction selected to achieve target FoS against partial or overall slope failures. • Maintenance program to be developed including a monitoring and inspection program. • TIA current design 1-in-2,500 year seismic event and 1-in-1,100 flood, 24-hour storm event.
Underground Stability	• Failure of roof and walls. • Rock falls. • Groundwater inflows.	• Wall failure, rock falls or groundwater inflow could impact men or equipment working at depth. • Temporary shutdown of underground operations.	Moderate	High	• Geotechnical investigations will be undertaken. • Declines and pillars will be engineered to address stability. • Hydrological investigations have been progressed. • Water management systems designed to manage maximum potential inflow rates. • Underground maintenance program will be developed that will include a monitoring program, scaling and inflow inspection.

In 2007, the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment estimated that global sea level rise could range from 0.18 to 0.59 metres by 2090–2099 (relative to 1980–1999 levels) under a range of future GHG emission scenarios based on physical climate models. More recent studies that have looked at past levels of sea level rise in response to warming have projected higher levels of global sea rise, ranging from 0.3 to over 2 metres by 2100 compared to 1990 levels, although sea level rise at the high end of this range is unlikely (Rahmstorf 2010).

Please note that the IPCC Fifth Assessment is currently only available in working draft form that should not be cited or quoted; for the FEIS, Sabina will include updated references from this Fifth Assessment.

While these changes are significant, the speed of this change is very slow, and given the brief lifespan of the Project, Sabina is of the opinion that both changes in sea level trends and coast erosion will have minimal impact on the Project.

2.2.6 Seismic Activity

A preliminary assessment of the regional seismicity has been carried out to assist in earthquake design for the TIA and other Project facilities. A summary of seismicity with respect to Project infrastructure is detailed in Tables 2.2-1, 2.2-2 and 2.2-3.

A review of historical earthquake records and regional tectonics indicates that the Project is located in a region of very low seismicity surrounded by large regions of sparse, diffuse seismicity. The Natural Resources Canada (NRCan) historical earthquake database for events since 1985 (of magnitudes greater than 3.0) indicates that there have been only seven earthquakes recorded within 500 km of the Property since 1985. The largest of these events was a magnitude 4.5 earthquake in 2001, located approximately 340 km to the west. The closest of these events was a magnitude 3.6 earthquake in 1995, at a distance of approximately 225 km to the southeast.

A probabilistic seismic hazard analysis was carried out using the NRCan database to provide seismic ground motion parameters for design. The results are summarized in Table 2.2-4 in terms of earthquake return period, probability of exceedance (for a 10-year design operating life), median peak ground acceleration (PGA), and estimated mean PGA. It is recommended in the CDA Dam Safety Guidelines (2007) to use the mean PGA for the design of geotechnical structures such as dams, where the mean PGA is likely to be approximately 15% to 20% greater than the median value. Both the median and estimated mean PGA values are provided in Table 2.2-2

A reasonable design earthquake for this stable region of the Canadian Shield is a magnitude 6.0 event. There is potential for larger earthquakes to occur, but rarely. A Maximum Credible Earthquake (MCE) of magnitude 7.0 is recommended by Adams and Halchuk (2003) for the region of the Canadian Shield. Such an event would have a very low probability of occurrence.

For on-site infrastructure design, a PGA of 0.036 *g* is used for the seismic load at the Project with 2% probability of exceedance in 50 years as per the National Building Code of Canada. Structures and susceptible facilities will have this PGA applied to their foundation or related design.

2.3 UNFAVOURABLE GEOLOGICAL CONDITIONS

Unfavourable geological conditions, such as weak zones and faults, are factors that need to be addressed in open pit and underground mine design. Sabina Gold & Silver Corp. (Sabina) has engaged multiple engineering consultants to complete detailed geotechnical programs. These have included a review of historical geotechnical data, geotechnical drilling at Goose Property Area in 2012, and additional drilling at both Goose and George Property Areas in 2013. Preliminary open pit and underground design parameters have been assessed at that point; as the Project moves forward, there may be continued investigation through additional geotechnical drilling and analysis to further refine these design requirements. Further details can be found in Section 2.2 Geotechnical Hazards.

2.4 PERMAFROST

The Project is situated within a zone of continuous permafrost with basal permafrost depths ranging from 400 to 500 metres below ground (mbg) at the Goose Property Area and 200 mbg at the George Property Area. The thickness of the active layer at Goose Property Area has been measured up to 1.65 mbg, and at the George Property Area the characterized depth up to 2.4 mbg as interpreted from the adjacent Hackett River Project.

The Marine Laydown Area is approximately 100 km north of the George Property Area. The active layer may extend deeper during the summer months due to increased rainfall, otherwise permafrost conditions would be similar to those observed at the Goose and George Property Areas. A similar permafrost thickness of approximately 500 mbg is expected at the MLA and along the winter road alignments.

Further details on these values can be found in Volume 5, Chapter 2, Permafrost.

2.4.1 Thaw Settlement and Subsidence

Thaw settlement or subsidence can be induced by the loading or disturbance of ice-rich permafrost, sensitive overburden soils, and surface vegetation. There are also risks associated with surface runoff and pooling water affecting the thermal regime and could lead to thaw settlement or weakening of foundations.

The effects of thaw settlement and subsidence on Project components can include structural failures, creep settlement, thermokarst development under infrastructure, and general embankment instability. These risks will be mitigated through design that will maintain the thermal conditions; this could include interception ditches and the overdesign of culvert capacity, as well as active monitoring. The considerations of permafrost and thaw susceptible soils for Project infrastructure are further detailed in Tables 2.2-1, 2.2-2 and 2.2-3.

2.5 HYDROLOGICAL CONDITIONS

The potential effects of hydrological conditions, namely, low precipitation years and low flow river conditions, need to be considered for Project infrastructure. As the Project is located in the vicinity of the Arctic Circle, the area experiences relatively low amounts of precipitation, but due to sub-zero temperatures for the majority of the year, the area also experiences high snow accumulation.

At this time, it is assessed that low precipitation years and low flow river conditions will have little impact on the Project. Further details can be found in the Site Water Monitoring and Management Plan. Based on meteorological data for the region, the PDA has experienced drier seasons than climate normals. In addition, the likely response to climate change in these two factors will be an increase in both precipitation and flow; details on severe weather events can be found below, in Section 2.6.

Table 2.2-2. Engineering Hazard Assessment – All-weather Roads and Airstrip

Engineering Hazard	Hazard Description	Potential Consequences	Risk Factor	Consequence Factor	Mitigation Measures
Permafrost / Thaw Susceptible Soils	• Massive ice or ice-rich soils at depth below higher embankments or in areas of cut. • Thaw sensitive soils near ground surface below low embankments.	• High embankments may experience creep settlement over time. • Settlement and heave of road surface due to thawing and freezing of ice-rich soils; higher risk in cut areas. • Construction disturbance or new ponding of water could impact thermal regime causing settlement, thermokarst development and potentially impact stability of road. • Poor aesthetics.	Moderate	Low	• Geotechnical investigations have been progressed. • Design embankments with minimum fill thickness for thermal protection and implement flatter slopes in problem areas. • Embankment construction will be employed (i.e. no cuts into permafrost) wherever the road passes over overburden soils to avoid disturbing sensitive overburden soils and surface vegetation. • Maintain grading and drainage from borrow areas. • Runoff and sediment control measures. • On-going inspections and maintenance.
Seismicity	• Significant earthquake event subjecting structures to dynamic loading. • Low seismicity of region.	• Failure of bridge structures along road alignment. • Sudden failure of road embankment. • Landslide, overburden/bedrock cut slope instability impacting road. Liquefaction of clay-rich soils.	Low	Moderate	• Side slopes and surfaces built to meet seismic design parameters. • Use stable fill materials, modern construction practices and QA/QC procedures. • Monitoring during operations for indicators of potential problems. • Impact of seismicity on structures in permafrost is low.
Flooding / Hydrology	• Significant runoff event exceeds capacity of culverts or other water crossings. • Icing of culverts reduces capacity or normal flows. • Debris build-up causes reduced capacity for flows.	• Overtopping of road leading to operational shutdown, repairs and environmental impacts due to high downstream sediment loading. • Ponded water impacting thermal regime and overall stability of structures.	High	Low to moderate	• Hydrology baseline studies have progressed. • All bridges and culverts current design 1-in-50-year storm event. • Regular monitoring of culverts to identify icing or other debris blockages.
Road Embankment Stability	• Sudden failure of road embankment due to physical failure of embankment fill or underlying foundations.	• Failure causing operational shutdown. • Costs of repairs. • Environmental impacts due to high downstream sediment loading.	Low	Moderate	• All side slopes will be constructed at 3H:1V; safety berms required for embankments higher than 3 m. • Embankment and road material will come from rock quarry sources near existing road alignment. • Use stable fill materials, modern construction practices and QA/QC procedures. • - Monitoring during operations for indicators of potential problems.
Landform Stability	• Large scale landslide or slope instability outside footprint of road. • Medium or large scale landslide through embankment footprint leading to subsidence in road bed.	• Sudden failure of road embankment • Blockage of culverts. • Impact to thermal regime effecting longer term integrity of embankment permafrost foundations. • Temporary shutdown of road operations.	Low	Moderate	• Avoiding areas of major concern. • Monitoring of potential problem areas. • Overall topography is low relief which reduces overall risk.
Bridge Stability	• Failure of bridge structures. • Bridge abutment failure due to thawed areas or impacts of flows on thermal regime. • Erosion of abutment or foundations by water flows causing failure.	• Failure of bridge causing operational shutdown. • Costs of repairs. • Injury or fatality. • Environmental impacts.	Low	High	• Geotechnical investigations have been progressed. • Design for thermal projection and abutment stability; maximize use of bedrock. • All bridges and culverts current design 1-in-50-year storm event. • Scour protection around abutments and piers. • Instrumentation and monitoring for notification in event of potential failure.

Table 2.2-3. Engineering Hazard Assessment - Marine Laydown Area

Engineering Hazard	Hazard Description	Potential Consequences	Risk Factor	Consequence Factor	Mitigation Measures
Permafrost / Thaw Susceptible Soils	• Construction over ice-rich or thaw sensitive permafrost ground causing technical issues with project infrastructure foundation. • Problems potentially leading to environmental impacts.	• Heavy structures experiencing creep settlement over ice-rich permafrost. • Thaw weakening of surficial soils causing failure or movement of foundations. • Melting of massive deposits below or adjacent to structures causing settlement or movement.	Moderate	Moderate	• Geotechnical investigations to understand ground conditions. • Where possible, found most significant structures on bedrock and locate structures to avoid problem areas. • Excavations in overburden materials and disturbance of natural ground will be avoided where feasible. • If excavation is required, natural materials will be over excavated and backfilled with an insulating cover of thaw stable granular fill materials of a minimum thickness to protect against thaw and instability in the underlying ice-rich overburden soils. • Embankments or granular fill pads will be constructed with a side slopes sufficient to protect underlying permafrost.
Seismicity	• Significant earthquake event subjecting structures to dynamic loading. • Low seismicity of the Port region.	• Failure of infrastructure or dock foundations.	Low	High	• Concerns mitigated through seismic hazard assessment and understanding loading potential. • Structures and dock piers built to meet seismic design parameters. • Use stable fill materials, modern construction practices and QA/QC procedures. • Monitoring during operations for indicators of potential problems. • Impact of seismicity on structures in permafrost is low.
Flooding / Hydrology	• Although not expected to have significant impact, runoff and water pooling could impact thermal regime. • Significant runoff event exceeds capacity of access road culverts (i.e., icing of culverts or debris reduces capacity).	• Surface water induced thermal degradation leading to thaw settlement or weakening of soils/foundations. • Overtopping of roads causing failure and potential downstream sediment issues.	Low	Moderate	• Where surface water collection or diversion is required, the thermal impact of runoff will be considered. Interception ditches will be employed to redirecting surface water flows. These may have to be built by over-excavation and replacement with thaw stable processed rock fill material. • Maintain grading and drainage of all areas near infrastructure. • All culverts current design is 1-in-50-year event. • Regular monitoring of culverts to identify icing or other debris blockages.

Table 2.2-4. Summary of Probabilistic Seismic Hazard Analysis

Return Period (years)	Probability of Exceedance[1] (%)	PGA[2]	
		Median PGA[3,4] (g)	Estimate Mean PGA[5] (g)
100	10	0.003	0.004
500	2	0.01	0.01
1,000	1	0.02	0.02
2,500	0.4	0.04	0.05
5,000	0.2	0.07	0.08
10,000	0.1	0.12	0.14

Notes:
[1]Probably of exceedance calculated for a design life of 10 years, where q = (L/T) (q = probability of exceedance; L = design life in years; T = return period in years).
[2]PGAs are for "soft rock/very dense soil" (Vs_{30} = 360 to 760 m/sec) site conditions.
[3]Median PGAs for return periods up to 2,500 years obtained from NRCAN's seismic hazard database.
[4]Median PGAs for return periods up to 5,000 and 10,000 years obtained by extrapolation of NRCAN seismic hazard data.
[5]Mean PGA values estimated as 1.2 x median values.

2.6 SEVERE WEATHER EVENTS

2.6.1 Extreme Precipitation Events

The main factors which influence precipitation variation include local topography, proximity to sources of moisture, and land characteristics. Generally, precipitation is greater in areas which are mountainous, close to a source of moisture such as a large waterbody, and in areas which experience convective heating. The precipitation experienced in the PDA is primarily caused by convective activity, such as thunderstorms, during the summer, and from frontal weather systems during the winter. Precipitation due to convective activity has high spatial variation due to the distribution of individual convective cells, whereas precipitation caused by frontal weather systems is more evenly distributed over an area.

Extreme 24-hour precipitation values for the Project were estimated on the basis of annual maximum daily precipitation data measured at Lupin from 1982 to 2012. The maximum daily precipitation values were converted to 24-hour values by multiplying them by a value of 1.13, which accounts for potential reduction in total storm precipitation from the arbitrary division of a single storm between two calendar days. The values were then increased to account for the potential for greater rainfall in the PDA using the ratio of PDA to Lupin mean annual precipitation.

These values were then used to estimate extreme rainfall for other durations, according to information provided in the Rainfall Frequency Atlas of Canada (RFAC) (Hogg and Carr, 1985). The 24-hour Probable Maximum Precipitation (PMP) value was estimated to be 242 mm using the Herschfield (1961) equation, which is also presented in the RFAC.

Civil design criteria used to engineer drainage management systems will be based on PMP and Peak Flow Analysis, the latter of which follows below.

2.6.2 Peak Flow Analysis

In continental Nunavut, peak instantaneous flows on larger rivers occur nearly exclusively as a result of snowmelt during the spring freshet period; this is due to the fact that convective rainfall events common to the region in the summer months are too locally isolated within the large watersheds to result in much of a net increase in runoff. However, on smaller streams, such as many of those in the PDA, a convective storm event may cover an entire watershed with rainfall resulting in peak instantaneous flows occurring either during the freshet as a result of snowmelt or in the late summer or early autumn due to intense rain on largely impermeable ground. Because of the potential for much higher intensity of convective rainfall in comparison to snowmelt intensity in the Arctic, it is assumed that longer return period runoff events in the PDA likely result from rainfall or rainfall plus snowmelt events. Further details on peak flows can be found in Volume 6, Chapter 4, Freshwater Water Quality.

2.6.3 Snow Drifts and Snow Banks

Potential for significant snowdrifts exists in highly exposed and hilly areas. Significant volumes of snow may exceed what was naturally collected by the existing terrain on the downwind sides of hills, especially when cut to accommodate transportation links such as roads. Changes in snow accumulation will have an indirect effect on runoff, slope stability and erosion.

A detailed snowdrift assessment of designs is recommended where the terrain is higher than a transportation corridor within a lateral distance of 75 m. Passive mitigation measures include snow fencing, terracing, and raised road surfaces. Active mitigation measures include the use of snow berms, and the shaping of snow banks to minimize drifting. In addition, building design and layout will consider and minimize the effects of snowdrifts forming downwind of infrastructure.

2.7 SEA ICE CONDITIONS

Sea ice conditions will be one factor considered in the design of the MLA. Changing sea level trends, as well as global climate change, will be influencing factors to be reviewed in Bathurst Inlet during the Feasibility Study. Changes in ambient temperatures could cause volumetric changes in the ice cover, which in turn could result in the generation of ice loads on the off-shore structures in the MLA.

Volume 7, Chapter 1, Marine Physical Processes notes that observational evidence from the last few decades indicates that sea ice in the Arctic has been thinning and retreating earlier than historical reports. Most ice concentration records in the last 8 years have been lower than historical averages. The strongest changes occurred in the summer for the more northern straits, with several ice-free periods recently recorded where ice used to be present year-round. In 2012, Arctic sea ice was at the lowest recorded levels since ice monitoring by satellite began three decades ago. However, Arctic ice concentrations rebounded during the 2013 summer with over 60% more ice cover than the previous year, although the coverage was still much lower than historical averages.

2.8 ICE RIDE-UP AND PILE-UP

Ice ride-up and pile-up will be factors under review for all infrastructure designed in Bathurst Inlet. When a drifting ice sheet or ice floe comes in contact with a slope, such as a shoreline, it begins to bend where it is pushed up on the slope. If the driving forces are sufficiently large, the ice will break and the ice sheet will continue to push shards up the slope. These may either form an ice pile-up or continue to ride up and eventually overtop the shoreline. This phenomenon will be a factor in design of wetted components at the Marine Laydown Area.

2.9 ISOSTATIC REBOUND

Isostatic rebound is the slow uplift of land masses that were previously depressed by ice sheets during the last glaciation. This phenomenon needs to be considered at the MLA in Bathurst Inlet. It is known that isostatic rebound occurring in the Bathurst Inlet area will (over time) allow the land level to rise with the side effect that water levels may effectively decrease. This has the potential to make passage through existing navigable waters more challenging. Isostatic rebound is known to be a very slowly occurring event and will likely cause water levels to change in the order of millimetres and not meters over the life of the Project. Consequently, Sabina is of the opinion that isostatic rebound will not substantially impact shipping or offloading at the MLA over the Project life.

2.10 CLIMATE CHANGE

Climate change refers to any significant change in the climatic conditions, such as temperature, precipitation or wind patterns, that occur over several decades or longer (US EPA 2013). Climate change may be due to natural internal processes such as ocean variability, external forces such as orbital variations and solar output, or persistent anthropogenic changes in the composition of the atmosphere or land use (IPCC 2007). Since the mid-twentieth century, however, the burning of fossil fuels and changes in land use patterns have been the dominant cause of climatic changes observed (Lemmen et al 2008). Anthropogenic climatic changes are predicted to continue over the next few decades leading to further warming and changes in the global climate system (IPCC 2007).

2.10.1 Historic Climate Change Patterns

Global observations through the twentieth century show climatic changes, including increased average surface temperature, precipitation, frequency of heavy precipitation events, and cloud cover, together with reductions in the length of the freeze season, the frequency of extreme low temperatures, and the extent of snow cover and mountain glaciers (Parry et al 2007).

In Canada increases in temperature and precipitation have been experienced across most of the country over the past century. During the period 1948 to 2006 average national temperature increased by 1.3ºC, which is more than double the increase in mean global surface temperature during the same time interval. In Nunavut annual precipitation has increased by 25 to 45% in the same time period (Lemmen et al 2008). Changes in temperature and precipitation have led to changes in other variables including sea ice, snow cover, permafrost, evaporation and sea level (Lemmen et al 2008).

The vast majority of the Back River Project area is located in the Southern Arctic Ecozone. The Arctic Climate Impact Assessment (ACIA), which was the first comprehensive, integrated assessment of climate change across the entire Arctic region, provides a scientific synthesis of available information about observed and projected changes in climate (Arctic Council and International Arctic Science Committee; ACIASC 2005). It states that the Arctic, together with the Antarctic Peninsula, experienced the greatest regional warming on earth in recent decades, due to various feedback processes such as changes in ice albedo. Between 1950 and 2005 average annual temperatures have risen by about 2 to 3ºC, which is more than double the Canadian average, and winter temperatures by up to 4ºC. The warming has been accompanied by increases in precipitation of up to 20% in parts of northern Canada during the period 1965 to 2005.

2.10.2 Climate Change Predictions and Future Scenarios

For future climate trends, recent literature suggests an increase in mean annual temperature in Canada's North by as much as 6.0ºC degrees by 2100 (Lemmen et al 2008). Over the same period, projections suggest that total annual precipitation could increase as much as 30% in the region. The environmental manifestations of these increases will likely include alterations to sea, river, and lake ice regimes, and winter snow pack, especially during shoulder seasons of spring and fall.

Potential interactions with the Project include changes in temperature and precipitation and the associated potential impacts on permafrost, active layer depth, and snow depth. The life of the Project is relatively short (estimated 10 years of operations), and while climate change within this period may still have an effect on the Project, the magnitude of these impacts can be managed through engineering design that will be detailed in the upcoming Feasibility Study.

2.10.3 Climate Change Prediction Uncertainties

There is a high level of uncertainly associated with climate change predictions from global climate models as they involve relatively simple representations of complex processes. The spatial and temporal scales over which these changes occur make it difficult to assess climate change effects on the Project.

For the Draft Environmental Impact Statement (DEIS), these general predictions in climate change have provided guidance in preliminary engineering. For the FEIS, more specific predictions will be calculated from thermal models to help refine the final engineering design.

2.11 IMPACTS OF CLIMATE CHANGE ON ENVIRONMENTAL FACTORS

2.11.1 Permafrost

Details of the current permafrost regime in the Project area can be found in Section 2.4 Permafrost.

The long term effects of increased average temperatures and more frequent freeze thaw cycles have the potential to affect the land in the PDA. The surficial geology is characterized largely by rolling lowlands shaped by thick ice sheets during the Pleistocene glaciation. The exposed bedrock outcrops have undergone extensive frost action which has led to the widespread development of felsenmeer. Overburden is generally sparse and limited to glacial-type deposits consisting of occasional alluvium deposits and esker deposits of sand and gravel. Soils can be ice-rich, with the amounts of ground ice varying significantly from site to site.

Although the Back River Project is projected to remain within the zone of continuous permafrost, it is predicted that the active layer thickness could increase by 50% (Arctic Council and the International Arctic Science Committee, 2005). The engineering hazard assessments for permafrost and thaw susceptible soils in Project infrastructure can be found in Tables 2.2-1, 2.2-2 and 2.2-3.

2.11.2 Hydrological Regime

The impacts of climate change on the hydrological regime, including freshwater and groundwater regimes, can be considered in the amount of precipitation the area receives.

Average annual precipitation is expected to rise in the northern regions; the IPCC projects an increase in annual mean precipitation in the north of up to 20% by 2100 (2007). Lenman et al (2008) predict that total annual precipitation could increase from 5 to 8% for the climate normal period 2010 to 2030 and 15 to 30% for the climate normal period 2070 to 2100, compared to 1961 to 1990 baseline.

This increase in precipitation will likely increase the groundwater table, increase the annual snowfall and, subsequently, increase the high flow period during freshet. The engineering hazard assessments for the impacts of hydrology on Project infrastructure can be found in Tables 2.2-1, 2.2-2 and 2.2-3.

2.12 SENSITIVE FEATURES

2.12.1 Sensitive Ecosystem Features

The effect on sensitive ecosystem features within the terrestrial, freshwater, and marine ecosystems must be considered in the PDA. Sensitive ecosystems were classified as such due to their value as wildlife habitat or the higher likelihood to support rare plants or culturally valued plant species. Within the PDA, this includes esker complexes, shrubby riparian ecosystems, sedge and shrub-dominated wetlands, marsh ecosystems, shallow open water, bedrock cliffs, and bedrock-lichen veneers.

At this time the full effects of climate change on sensitive ecosystems is not fully understood. It is known that climate is one of many factors influencing these features in addition to local microclimate, soil drainage, nutrient availability, local soil type, and snow cover. Many of these factors are also influenced by climate change and thus will affect sensitive ecosystems indirectly.

At this phase of Project planning, efforts have been made to minimize potential impacts on these sensitive ecosystem features through engineering and design. The following mitigation measures will reduce the potential for loss of vegetation and sensitive ecosystem features:

- The Project has been designed to employ winter road-only access corridors that travel primarily over lakes and rivers, thereby minimizing potential negative effects on terrestrial vegetation and limiting dust emissions.
- Infrastructure, WRSA, and the TIA at the Goose Property have been confined to the local watersheds where the deposits are located, and do not extend to the regional Upper Back River Watershed, thereby confining the Project footprint and minimizing the disturbance to the terrestrial environment.
- Infrastructure and WRSA at the George Property have been confined to the local watersheds where the deposits are located, thereby confining the Project footprint and minimizing the disturbance to the terrestrial environment.
- The clearing of vegetation and removal of soil from unique landscape features will be optimized, including eskers, wetlands, exposed bedrock, cliffs etc., which often provide high value habitat to wildlife and may support sensitive vegetation communities and growth forms. Exceptions to this management will only be considered after assessing and weighing all implications.

2.12.2 Sensitive Land Features

Sensitive land features have the potential to be affected by climate change on permafrost within the Project area and by stability of Project components. These features, including Canadian Heritage Rivers, territorial and national parks, were considered in the preliminary Project design phase. Within the Regional Study Area (RSA), the only watercourse to potentially meet this criterion is the Back River, which is currently under proposal to be considered as a heritage river. While no formal nomination for the Back River has been put forward thus far, the Project has been designed to avoid impact to the Back River water system. There are no territorial or national parks within the RSA.

2.13 EFFECTS OF CLIMATE CHANGE ON MEAN AND EXTREME CLIMATE PARAMETERS

2.13.1 Mean Climate Parameters

A qualitative assessment of how global climate change could affect climate parameters has been completed. Table 2.13-1 presents a climate risk matrix for the Project based on the climate predictions described in previous sections. This table identifies which climate change risk factors may impact the Project, those that are unlikely to have an impact on the Project, and those with an unknown impact on the Project. It is notable that these trends will manifest slowly over very long timescales relative to the Project mine life, and, as such, these trends will normalize to minimal increases and decreases over the length of the Project.

Table 2.13-1. Climate Risk Matrix

Climate Factor	Trend	Justification
Frequency of Drought	Unknown	Trend is unclear due to unknown distribution of rain events in future projections
Freeze-Thaw Cycles	Increasing	Slight increase based on increasing winter precipitation and average temperatures
High Humidity Periods	Unknown	Trend unclear due to unknown distribution of rain events in future projections
Frequency of Extreme Temperatures	Unknown	Possible increase in extreme temperatures but strength of trend is unknown
Frequency of Rainfall	Unknown	Trend is unclear due to unknown distribution of rain events in future projections
Heavy Rain	Increasing	Slight increase based on higher rainfall volume in the summer season
Total Rainfall	Increasing	Increase of up to 30% total annual precipitation above historic baseline
Freezing Rain	Increasing	Slight increase in temperature will create a vertical profile that is conducive to freezing rain events
Rain on Snow Events	Increasing	Slight increase in temperature will create a vertical profile that is conducive to rain on snow events
Flash Freeze Event (Rain/Freeze- Thaw)	Unknown	Trend is unclear due to unknown distribution of rain events in future projections
Snow Accumulation	Unknown	Trend is unclear due to unknown distribution of precipitation events in future projections
Snowmelt	Qualitative	Trend is unclear due to unknown distribution of precipitation events in future projections
Sunny days	Unknown	Trend is unclear due to lack of information on future dynamics (cloud cover)
Extreme Heat	Increasing	Slight increase based on increase in average summer temperatures
Extreme Cold	Decreasing	Slight decrease based on increase in average winter temperatures
Cooling Degree Days	Increasing	Very slight increase based on increase in average summer temperatures
Heating Degree Days	Decreasing	Slight decrease based on increase in average winter temperatures
Average Temperature	Increasing	Recent literature suggests an increase in temperature to a maximum of 6°C by 2100

2.13.2 Extreme Climate Parameters

The trend in extreme climate parameters, such as floods and storms, is currently unknown. However, with projected increases in total annual precipitation from 5 to 8% for the climate normal period 2010 to 2030 (Lenman et al, 2008), it is reasonable to predict that such extreme phenomena might show increasing trends. However, it is unlikely that these trends will manifest in any significant magnitude over the life of the Project.

2.14 EFFECTS OF EXTREME METEOROLOGICAL EVENTS ON THE PROJECT

2.14.1 Extreme Temperature and Precipitation Events

Details of the anticipated magnitude of extreme temperature and precipitation events can be found in Section 2.6 Severe Weather Events.

In general, there are risks related to extreme meteorological events. High runoff events can lead to elevated flows beyond the capacity of certain hydraulic structures established along road alignments and those within Project areas. There are some minor hydrological risks associated with surface runoff and water pooling that could impact the thermal regime. These risks are further increased by the combination of spring freshet and the potential ice blockage of culverts, reducing flow capacity and leading to overtopping and washouts of road sections. This condition may also contribute to high sediment loading to the downstream environment and increased erosion.

The current design outlines that diversion ditches and culverts will be engineered to a 1-in-50-year storm event to manage these risks; Tables 2.2-1, 2.2-2 and 2.2-3 outline mitigation measures associated with extreme flood and hydrological events pertaining to specific Project components.

2.14.2 High Winds and Waves

Site specific wind and wave conditions are discussed in Volume 7, Chapter 1. Preliminary MLA design was based on the information below. Further wind and wave studies of Bathurst Inlet at the MLA site may be warranted in the future.

The general wind design requirements from Environment Canada and the National Building Code are:

- Prevailing wind from NW quadrant;
- Hourly wind pressure of 0.33 kPa for a 10-year return period;
- Hourly wind pressure of 0.42 kPa for a 30-year return period; and
- 30-year wind velocity of 92 km/h (50 knots).

In addition to these general requirements, preliminary wind and wave analyses have been performed to determine the wave climate in Bathurst Inlet and in Roberts Bay. This additional information is provided for comparison purposes in Table 2.14-1 and shows the results of wind and wave analysis for a 100-year return period.

Table 2.14-1. Wind and Wave Conditions

Reference	Wind Speed (m/s)	Effective Fetch (km)	Wave Height [m]	Wave Period (s)
Bathurst Inlet	30.5	18	3.0	6.4
Roberts Bay	28.9	22	2.2	5.4

The results in Table 2.14-1 are based on storm events for the entire year. This assumption may give conservative results since it also includes the period of November to June (a period with the strongest winds) during which the inlet is ice covered.

For current wind design requirements at the Goose and George Properties, infrastructure design criteria apply an hourly wind pressure of 0.48 kPa for the 1-in-50-year event.

2.14.3 Extreme Ocean Water Levels

Extreme ocean water levels, meaning the maximum and minimum expected elevations, are subject to the tides and currents present in Bathurst Inlet and are factors in the design of the MLA.

The measured tidal heights for Bathurst Inlet were small, with a maximum tidal range for spring tides (new and full moon) of around 0.4 m, and between 0.1 and 0.3 m for neap tides (first and third quarter moons). For preliminary engineering design, a factor of safety is applied to this maximum value to ensure potential future fluctuations in tide have been accounted for, as such, a tidal range of 0.7m will be assumed. Further details on tides and current can be found in Volume 7, Chapter 1, Physical Processes.

2.14.4 White-out Conditions

White out conditions offer operational challenges and scheduling impacts. These conditions occur in polar regions when illumination from snow on the ground and heavily falling or blowing snow obscures the landscape and reduces visibility.

This has a potential to impede all aspects of daily operations where transportation or mobility outside is required. In case of white out conditions, site safety protocols will be activated to ensure the impacts to personnel and operations is mitigated.

2.15 EFFECTS OF CLIMATE CHANGE ON PROJECT DESIGN

The design of Project components and the planning of activities with respect to the effects of climate change is an important stage in the upcoming process; this will be addressed in more detail in the FEIS. Initial engineering design is based on preliminary conservative design factors and detailed design will be completed once thermal models for the Project are available.

Geotechnical investigations and studies have been progressed at the Goose Property to identify areas of concern related to permafrost and potential geo-hazards that could impact Project infrastructure. Potential impacts include changes in the active layer, drainage patterns (resulting from subsidence and thermokarst formation), increased sediment loadings, and mass wasting on sensitive slopes. In general, the location of infrastructure has been optimized to avoid potential problem areas to the maximum extent possible. Problem areas that cannot be avoided will be constructed with conservatively designed permafrost protection measures and thermal barriers.

Table 2.15-1 provides design measures that may be implemented to protect Project structures from the impacts of construction, operations, and potential changes to the climate. In general, conservative assumptions are used as the way to address potential effects of climate change. As design progresses, these design measures could be modified to reflect updated information available.

2.15.1 Ice Formation Timing

The potential changes associated with the timing of ice formation could affect operational components and ongoing field investigations. Although considered manageable, delayed ice formation could potentially impact operational components such as ice-based airstrips and winter roads.

The Project in its current design relies on a system of ice roads to connect the Goose Property Area, the George Property Area and the MLA. These ice roads, constructed each winter season, are used to transport mined ore and to supply the mine with technical resources and diesel fuel necessary for the next production year. Climate change could cause the delayed formation of lake ice or early melting of shorelines or ice roads that could lead to a shortened operational use of this infrastructure. A shortened seasonal use of such components could lead to logistical and operational delays associated with transportation of freight as well as the movement of ore, resources, and fuel between the Goose Property Area, George Property Area, and the MLA. These risks can be mitigated by construction criteria that address the potential increased temperatures due to climate change. In addition, logistics, planning, and potential equipment fleet adjustments will be implemented to address changes in operational ice road seasons.

Table 2.15-1. Design Measures for Project Structures to Account for Climate Change

Project Structure	Design Measures
Marine Laydown Area	Dock will account for the fluctuation in sea levels (higher or lower) due to climate change. Water depth in Bathurst Inlet will be sufficient for ships utilizing the MLA.
Goose and George Property Areas	Future foundation design will account for construction on permafrost as well as account for anticipated temperature impacts due to climate change.
Airstrip and All Weather Roads	Thermal barrier (non-frost/thaw sensitive fill) thickness increased to account for increases in active layer depth.
All Weather Road - water crossings	A 1-in- 50-year storm event is currently applied to the design of all water crossings (culverts and bridges).
Ice Roads	Sufficient construction design specifications and ice thickness to account for temperature increases as a result of climate change.
Open Pit Mines	Thermal barriers (e.g. rock cover) on ice-rich overburden slopes will be of adequate breadth to account for increase in active layer thickness.
Underground Mine	Underground design will be conservative to account for changes in permafrost conditions and potential change in drainage patterns.
Waste Rock Stockpiles	Potentially acid-generating (PAG) rock is currently designed to be covered with a non-potentially acid-generating (NPAG) layer sufficient to account for increases in active layer thickness.
Tailings Impoundment Area	Storage facility design will account for construction on permafrost as well as account for anticipated temperature impacts due to climate change.

An early ice formation in the latter part of the year could potentially lead to a shortened season for water-based field programs that require open water for data collection.

2.16 CLOSURE AND CLIMATE CHANGE LONG-TERM EFFECTS

It is predicted that as a consequence of a long-term increase in surface temperature of up to 6°C by 2100, the thickness of the active layer will gradually increase, however the magnitude of this increase cannot be projected without Project specific thermal models for reference.

Such a long-term increase in surface temperature, and corresponding re-equilibration of the geothermal gradient, is not predicted to occur during the operational lifespan of the Project. However, the effects that such a scenario would have on the Project infrastructure remaining after closure and decommissioning could include a deepening of the active layer within WRSA, and within the cover material placed over the TIA. The foundations of the WRSA and TIA are expected to remain frozen under such a long-term warming trend; however, the longer term closure strategies for the waste rock and tailings will need to consider the potential deepening of the active layer. For the WRSA, the current design considers a 4 m cover of NPAG sufficient to contain active layer fluctuations associated with climate change. For TIA, the current design proposes a 2 m of NPAG material for final cover; this thickness is consistent with other northern projects and is based on their model findings. This design may be refined once site specific thermal models are obtained; this will be concurrent with the submission of the FEIS.

Decommissioned roads and airstrips will not be significantly impacted by such a long-term warming trend as they will be constructed only from geochemically stable material.

In accordance with the CEAA 2003 guidelines, the projected greenhouse gas (GHG) emissions associated with the Project can be found in Volume 4, Chapter 3, Climate and Meteorology.

3. Accidents and Malfunctions

3. Accidents and Malfunctions

3.1 INTRODUCTION

Sabina is committed to protecting the health and safety of all its workers, the local community, and the environment and ecosystems, and adheres strictly to legislated safety standards, as well as its own stringent procedures and standards. These are reinforced by employee and contractor training and education as well as regular monitoring and environmental audits.

Emergency response procedures include the requirement to maintain trained personnel and the necessary resources on site to enact a rapid and efficient response and prevent injury to individuals and degradation of the environment.

Accidents and malfunctions may occur during any phase of the mine life. The primary environmental concern resulting from accidents and malfunctions is the possibility for spills, release of chemicals, reagents, petroleum products or process materials onto the land or water. Fire presents another risk resulting from vehicle accidents, damage to electrical systems or accidental explosions.

Shipping presents further risk potential. Ship damage through collision with other vessels or grounding may result in harm to aquatic life and the coastal environment through possible diesel spills along the shipping route. The potential for a coastal spill is presented in Appendix V9-3A, which presents a Bathurst Inlet Marine Diesel Fuel Spill Modelling report. The report analyses two spill scenarios, one for a 5 ML, and one for a 20,000 L potential spill event.

Management of risks and contingency planning are integral to Sabina's approach to the proposed project. A comprehensive evaluation of the potential risks is essential in order to meet regulations, as well as Sabina's health, safety, and environmental objectives. The process for identifying and managing risk, as well as the appropriate mitigation measures in the event of accident or malfunction involves:

- Identification of hazards;
- Assessment of the risk;
- Evaluation of existing controls;
- Implementation of additional risk controls; if required and
- Monitoring and review.

While there exists the possibility of accidents and malfunctions, Sabina's objective is to minimize the likelihood of such incidents and the associated consequences that might affect people and the environment.

Management systems that incorporate effective adaptive management practices shall be designed to mitigate risks and limit consequences. These strategies include personnel training, education, regular inspections, monitoring and maintenance of equipment, and learning from incidents to improve performance.

Effective emergency response and contingency plans will be supported through the implementation of the Environmental Management Plan along with directed component plans. Specifically, contingency planning is addressed in the following Volume 10 chapters:

- Chapter 3, Risk Management and Emergency Response Plan;
- Chapter 5, Spill Contingency Plan;

- Chapter 6, Oil Pollution Emergency Plan; and
- Chapter 15, Shipping Management Plan;
- Chapter 25, Occupational Health and Safety Plan.

3.2 RISK ASSESSMENT

Sabina's risk assessment methodology consists of a four step process:

1. Identify hazards – itemize all possible natural and human-made hazards that could impact the site of operations;
2. Evaluate frequency (probability) - the degree of risk posed by each hazard (Table 3.2-1);
3. Evaluate consequences (severity) - select the category which best describes the effects of a credible mishap on personnel, environment and facilities, assuming that emergency planning and management controls are in place (Table 3.2-2); and
4. Evaluate risk – for each hazard, select its risk category based on probability and consequences (Table 3.2-3).

Risk was derived from the average of probability and consequences. Risks in the highest category are considered non-routine and would receive additional planning, employee training and management scrutiny as appropriate.

3.2.1 Risk Assessment Methodology

Table 3.2-1. Likelihood

Likelihood	Description in Context of Full Operating Life of the Facility	Frequency
Almost Certain	Consequence expected to occur in most circumstances	High frequency of occurrence - occurs more than once per year
Likely	Consequence will probably occur in most circumstances	Event does occur, has a history, occurs once every 1 to 10 years
Possible	Consequence could occur at some time	Occurs once every 10 to 100 years
Unlikely	Consequence may occur at some time	Occurs once every 100 to 1,000 years
Rare	Consequence may occur at some time	Occurs once every 1,000 to 10,000 years

Table 3.2-2. Consequence Severity

Consequence	Definition
Critical	*Major uncontrolled event or inefficiency with uncertain and perhaps prohibitively costly remediation.* Health and Safety: Fatality. Production: More than six month production loss or expenditure. Cost: >$500,000,000 damage or additional costs. Environmental Impact/Compliance: Very serious environmental impacts with impairment on landscape/ marine ecology. Long-term, widespread effects on significant environment. Corporate Image: Corporate image tarnished internationally. Community Affairs: Noncompliance with existing community agreement. Extreme and widespread community concerns with international exposure/influence.

(continued)

Table 3.2-2. Consequence Severity (completed)

Consequence	Definition
Major	*Significant event or inefficiency that can be addressed but with great effort.* Health and Safety: Lost-time injury(s) potentially resulting in permanent disability. Production: Three to six months production loss or expenditure. Cost: $100,000,000 to $500,000,000. Environmental Impact/Compliance: Serious environmental impacts with impairment on ecosystems. Relatively widespread long-term effects. Regulatory approval withdrawn for a few months. Corporate Image: Corporate image tarnished in North America. Community Affairs: High local community concerns with national exposure/influence.
Moderate	*Moderate event or inefficiency that might need physical attention and certainly engineering review.* Health and Safety: Lost-time injury (no permanent disability). Production: One to three months production loss or expenditure. Cost: $1,000,000 to $100,000,000 damage or additional costs. Environmental Impact/Compliance: Some impairment on ecosystem function. Displacement of species. Moderate short-term widespread effects. Regulatory orders with significant cost implications. Corporate Image: Corporate image tarnished in Nunavut. Community Affairs: Moderate local community concern with potential permanent damage to relations.
Minor	*Minor incident or inefficiency that might require engineering review and is easily and predictably remediated.* Health and Safety: Injury (no lost time). Production: Less than one month production loss or expenditure. Cost: $100,000 to $1,000,000 damage or additional costs. Environmental Impact/Compliance: Minor effects on biological or physical environment. Minor short-term damage to small areas. Corporate Image: Corporate image not affected, written complaint or concern dealt with internally. Community Affairs: Minimal local community concern with no lasting damage to relations.
Insignificant	*Minor incident or inefficiency of little or no consequence.* Health and Safety: No injury or lost time. Production: One to two weeks production loss or expenditure. Cost: <$100,000 damage or additional costs. Environmental Impact/Compliance: No lasting impacts. Low-level effects on biological or physical environment. Limited damage to minimal area of low significance. Corporate Image: Corporate image not affected or verbal complaint dealt with internally. Community Affairs: No community concern

Table 3.2-3. Risk Matrix

	Likelihood				
Consequence	Rare	Unlikely	Possible	Likely	Almost Certain
Critical	Moderate	Moderate	High	Extreme	Extreme
Major	Low	Moderate	Moderate	High	Extreme
Moderate	Low	Moderate	Moderate	Moderate	High
Minor	Very Low	Low	Moderate	Moderate	Moderate
Insignificant	Very Low	Very Low	Low	Low	Moderate

Table 3.2-4 provides a summary of potential project related effects associated with accidents and malfunctions that may occur during the life of the project. Mitigation measures designed to prevent such accidents and malfunctions from occurring are noted in ensuing sections.

Table 3.2-4. Major Accidents and Malfunctions Risk Summary

Project Sector	Issue of Concern	Consequence	Likelihood	Risk Rating
George Property	Open pit and waste rock stockpile – slope failure causing production delay or human injury	Moderate	Unlikely	Moderate
	Explosive accidents (accidental detonation of explosives) causing human injury or fatality	Major to Critical	Rare	Low - Moderate
	Hazardous material release resulting in contamination of environment	Moderate	Unlikely	Moderate
	Vehicle accidents resulting in human injuries or fatalities	Major	Possible	Moderate
	Open Pit flooding resulting in a production delay	Minor	Unlikely	Low
	Open Pit flooding resulting in a human injury	Major	Unlikely	Moderate
	Fire at the camp facilities and infrastructure resulting in human injuries or fatalities	Major	Possible	Moderate
	Failure of power supply	Major	Rare	Low - Moderate
	Failure of waste water treatment plant (WWTP) resulting in environmental contamination	Minor	Unlikely	Low
	Diesel refueling truck accidents causing spill or explosion	Moderate	Possible	Moderate
	Contamination or interruption of water supply resulting in effects on human health	Moderate	Rare	Low
Winter Road Linking George Property to Goose Property	Road embankment failure/collapse of water crossing resulting in environmental degradation	Insignificant	Likely	Low
	Hazardous material release resulting in environmental contamination	Moderate	Possible	Moderate
	Vehicle accidents resulting in human injuries	Moderate	Possible	Moderate
	Collision with other users resulting in human injuries or fatalities	Major	Possible	Moderate
	Weather related stranding resulting in human injuries	Major	Possible	Moderate
	Collision with wildlife resulting in injury to Wildlife	Moderate	Unlikely	Low

(continued)

Table 3.2-4. Major Accidents and Malfunctions Risk Summary (continued)

Project Sector	Issue of Concern	Consequence	Likelihood	Risk Rating
Goose Property	Open pit and waste rock stockpile – slope failure causing production delay or human injury	Moderate	Possible	Moderate
	Explosive accidents (accidental detonation of explosives) causing human injury or fatality	Major to Critical	Rare	Low - Moderate
	Hazardous material release resulting in contamination of environment	Moderate	Possible	Moderate
	Vehicle accidents resulting in human injuries or fatalities	Major	Possible	Moderate
	Open Pit flooding resulting in a production delay	Minor	Unlikely	Low
	Open Pit flooding resulting in a human injury	Major	Unlikely	Moderate
	Fire at the camp facilities and infrastructure resulting in human injuries or fatalities	Major	Possible	Moderate
	Failure of power supply	Major	Rare	Low - Moderate
	Diesel refueling truck accident causing spill or explosion	Moderate	Possible	Moderate
	Failure of WWTP resulting in environmental contamination	Minor	Unlikely	Low
	Contamination or interruption of water supply resulting in effects on human health	Moderate	Rare	Low
Winter Road Linking George Property / Goose Property to Marine Laydown	Road embankment failure/collapse of water crossing resulting in environmental degradation	Insignificant	Likely	Low
	Hazardous material release resulting in environmental contamination	Minor	Rare	Very Low
	Truck accident resulting in human injuries	Moderate	Likely	Moderate
	Diesel truck overturn with spill or fire	Moderate	Possible	Moderate
	Collision with other users resulting in human injuries or fatalities	Major	Possible	Moderate
	Weather related stranding resulting in human injuries	Major	Possible	Moderate
	Diesel refueling truck accident causing spill or explosion	Moderate	Possible	Moderate
	Collision with wildlife resulting in injury to wildlife	Moderate	Unlikely	Low
Marine Laydown Area	Diesel spill during ship to shore transfer resulting in contamination of the marine environment	Moderate	Possible	Moderate
	Fire at the camp facilities and infrastructure resulting in human injuries or fatalities	Major	Possible	Moderate

(continued)

Table 3.2-4. Major Accidents and Malfunctions Risk Summary (completed)

Project Sector	Issue of Concern	Consequence	Likelihood	Risk Rating
Marine Laydown Area *(cont'd)*	Failure of power supply	Major	Rare	Moderate
	Failure of WWTP resulting in harm to human health or the environment	Minor	Unlikely	Low
	Contamination or interruption of water supply resulting in an effect on human health	Minor	Possible	Low
	Congestion at Port resulting in damage to vessels, possible spills, production delay	Moderate	Possible	Moderate
	Hazardous material release resulting in environmental contamination	Moderate	Possible	Moderate
	Introduction of invasive species (marine and terrestrial)	Moderate	Likely	Low
Air traffic	Aircraft or helicopter crash resulting in human injuries or fatalities	Major	Unlikely	Moderate
Shipping	Collision with marine mammals resulting in harm to marine mammals	Rare	Rare	Very Low
	Ship engine failure resulting in a delay in shipping	Moderate	Possible	Moderate
	Ship grounding resulting in damage to ship or possible harm to aquatic life	Major	Unlikely	Moderate
	Collision with other vessels resulting in damage to ship, possible harm to aquatic life and/or habitat	Major	Possible	Moderate
	Major diesel spill along the shipping route resulting in contamination of marine and coastal environment along shipping lane	Major	Possible	Moderate

The following sections discuss accidents or malfunctions by phase and accident type for construction, operations, closure and post-closure.

3.3 RISK MITIGATION MEASURES

Mitigation strategies to reduce the probability and consequences of any accidents and malfunctions during the construction, operations, and closure periods include:

- Reducing probability of occurrence of the event (e.g. reinforcement of structures);
- Reducing consequences of the event (e.g., increased setbacks from sensitive sites);
- Developing system redundancies (e.g., backup systems);

Sabina will implement the following mitigation actions to prevent spills from occurring and to minimize impacts when such events occur:

- Systematic Risk Assessment Approach
  - The results of hazard identification and risk assessment are the basis for establishing and documenting:
    - Environmental, health and safety objectives;

    - Environmental, health and safety performance targets; and
    - Actions to achieve the established objectives and targets.
  - Each hazard classified as representing a priority risk requires an action plan with recommendations to control the risk. Recommendations include consideration for:
    - Operational controls;
    - Training and awareness; and
    - Performance measurement and monitoring.
  - The action plan and recommendations are forwarded to the area management responsible for the follow-up. In all cases, the action plan and recommendations are communicated to the interested and affected employees (and others as required). Typically, the recommendations are implemented in consultation with interested and affected employees (and others as required).
- Employee training programs:
  - Sabina will develop a training program for those involved in handling specific hazardous materials. Training will focus on handling procedures, spill prevention and clean-up.
- Inspection and Maintenance Program
  - Sabina will implement routine inspection and maintenance program for its equipment, facilities, and, hazardous material storage facilities. Equipment containing hazardous materials will be kept in good repair. Worn or damaged transfer equipment, e.g. valves and hoses, will be replaced or repaired promptly.
- Emergency Response
  - The Emergency Response and Spill Contingency Plans will take into account the possible scenarios for major accidents and malfunctions.
  - Suitable spill kits will be maintained at all transfer points for hazardous materials;
  - An on-site Emergency Response Team (ERT) will be established. The ERT will be trained to respond to likely spill scenarios. Field exercises and classroom training will be undertaken on an annual basis.
  - Detailed procedures for handling and disposal of spill contaminated materials will be developed.
- Environmental Monitoring
  - Sabina will development an Environmental Protection Plan for the Construction period;
  - Employees and contractors will receive a site induction program during which they will be made aware of the site environmental sensitivities and reporting requirements for unsafe or hazardous situations.
  - Sabina will employ site-based environmental personnel during construction to monitor contractor performance to ensure that suitable environmental precautions and standards are being followed.
- Adaptive Management
  - All incidents and accidents will be investigated and reported.
  - Lessons learned from these investigations will inform revisions to work procedures and response techniques.

3.4 CONSTRUCTION PERIOD

During construction, the risks of major accidents and malfunctions are associated with the following activities:

- Spills of Arctic diesel or jet-A fuel resulting from:
  - Refueling of construction equipment;
  - Transportation and transfer of fuel to and from storage tanks;
  - Fuel spill during ship-to-shore transfer of fuel;
  - Fuel spill along the shipping route;
- Transportation, handling, storage and use of ammonium nitrate and explosives;
- Transportation, handling and storage of hazardous chemicals (mill reagents, solvents, etc.);
- Discharge of off-spec effluent from treatment ponds;
- Power outages;
- Fires;
- Accidental explosions;
- Motor vehicle accident;
- Weather related stranding; and
- Airplane accidents.

3.4.1 Fuel Spills

3.4.1.1 Spills of Diesel Fuel

Arctic diesel will be used for power generation and by construction equipment. Three large tank farms will be constructed at the MLA, Goose property and the George Property. Diesel fuel will be delivered by tanker to the MLA during the open water season and transported to the Goose Property tank farm over the winter road (January to April annually). A number of smaller storage tanks (day storage consisting of double wall iso-containers of up to 100,000 L) will be installed at various work site locations on both the Goose Property and the George Property. Tanker trucks will be used to transport and transfer fuel from the tank farms to local storage tanks and to refuel field equipment.

Spills of diesel could occur during the following activities:

- Field refuelling of construction equipment; and
- Transportation and transfer of fuel to and from storage tanks.

Risk rating is Moderate. Emergency response and spill contingency training, equipment and materials will be maintained. Procedures will be established for on-site refueling of construction equipment. Temporary storage of petroleum products may employ double-walled “enviro-tanks” with leak detection. Any accidental spills would be cleaned up immediately. Contaminated material will be stockpiled in a temporary transfer area to await safe removal or on-site disposal/remediation. More detailed procedures are presented in the Spill Contingency Plan, Oil Pollution Emergency Plan, and Fuel Management Plan.

3.4.1.2 Ship-to-shore Transfer of Fuel

Fuel will be delivered to the MLA by tanker ships during the open water season. The transfer of fuel from the ship to the MLA on-shore tank farm will be made by the “floating hose method” which is common practice throughout the Arctic.

As required by the Oil Handling Facility Regulation, Sabina will develop an Oil Pollution Emergency Plan (refer to Volume 10, Chapter 6). The OPEP outlines specific procedures for ship to shore transfer, the training requirements for personnel, and, required emergency response equipment.

Spills of fuel during ship to shore transfer are usually less than 7 m^3 in volume and can be readily contained. The risk rating is moderate.

3.4.1.3 Fuel Spill along the Shipping Route

Shipping activities are highly regulated. An overview of the Canadian regulatory framework for shipping is presented in Volume 10, Chapter 15. Some of the key regulatory requirements include:

- All vessel must have a Safety Management System (SMS)
  - Must incorporate the requirements of the International Safety Management Code
  - SMS provides an international standard for safely managing and operating vessels and for preventing pollution.
- Navigation Safety
  - Vessels must have the appropriate navigation equipment, follow navigational rules and procedures, and have effective means of communications for safety.
  - Vessels must also have up-to-date nautical charts and, for each voyage, a passage plan that takes into account relevant information for safe navigation and protection of the environment and that will ensure the progress of the vessel can be closely monitored.
- Seafarers Certification/Crewing
  - To achieve the desired level of marine safety, it is essential that properly trained, qualified and competent ship officers and crew operate vessels.
  - All vessels involved in the Project, if under the Canadian flag, must comply with the *Marine Personnel Regulations* Part 1 Certification and Part 2 Crewing.
  - Foreign vessels are required to meet the requirements of th*e International Convention on Standards of Training, Certification and Watchkeeping for Seafarers* and the requirements specified in Part 2 of the *Marine Personnel Regulations* for foreign vessels.
- Pollution Prevention
  - All vessels must comply with the requirements of *Arctic Waters Pollution Prevention Act* (AWPPA).
  - Fuel tankers must be double-hulled, must have anti-collision devices.
  - Ships equipped with dual back-up systems such as twin engine and radar, redundant navigational and communication systems.
  - All vessels must have a Shipboard Oil Pollution Emergency Plan (SOPEP) approved by flag state or reviewed by Transport Canada.
  - Includes training requirements for marine-based spill response.
  - Polluter-pays principle - ship owner must carry liability and compensation insurance as required by the *Marine Liability Act* (MLA).

In consideration of the "Rules of the Road" for shipping where:

- The Ship Master's responsibility is to navigate with caution;
- The Shipping operators must abide by the established regulatory framework;
- The Ship must sail within the established shipping corridor; and
- The Ship must have a SOPEP.

The risk of a fuel spill along the shipping route is considered low.

3.4.2 Spill of Ammonium Nitrate and Explosives

Risk rating is Moderate. Spills will be controlled by adhering to measures outlined in the Risk Management and Emergency Response Plan. Spills of ammonium nitrate could result in impacts to aquatic organisms.

3.4.3 Spill of Hazardous Chemicals other than Fuel

Risk rating is Moderate. Spills will be controlled by adhering to measures outlined in the Risk Management and Emergency Response Plan. Spills of chemicals could result in impacts to aquatic organisms. The proposed process chemicals are of relatively low toxicity when diluted, with short-term effects. The risk of spills from motor vehicle accidents is small, but the potential for environmental damage or safety hazards exists.

3.4.4 Discharge of Off-spec Effluent from Treatment Ponds

Risk rating is Low. The sewage treatment plant will be a construction-phase treatment plant, operated and monitored according to defined standard operating procedures, with any off-specification discharge addressed immediately. More detailed procedures are presented in both the Landfill and Waste Management Plan and Site Water Monitoring and Management Plan.

3.4.5 Power Outages

Risk rating is Low. Standby generators will be maintained for system critical facilities (e.g., communications, heat, light, emergency response facilities, sewage plant, etc.) in the event of shutdown for routine maintenance or mechanical failure.

3.4.6 Fires

Risk rating is Moderate. The Risk Management and Emergency Response Plan details Sabina's fire-fighting procedures. A heat traced water tank will be constructed early, and would supply water to fight fires of any origin (buildings, vegetation, ignition of inflammable materials including fuel, or vehicle collision). Buildings will have fire alarms, fire suppression and/or fire-fighting equipment. Designated mine staff will be trained in firefighting. Fires will be addressed by the mine's Emergency Response Team.

3.4.7 Accidental Explosions

Risk rating is Moderate. Standard operating procedures will be developed for handling inflammable substances (e.g., propane, gasoline, Jet B fuel, explosives and blasting accessories), including protocols for evacuation of sensitive areas of the mine site and emergency coordination. Medevac would be initiated, if required for injured personnel. Only trained staff will handle inflammable substances. Further details are provided in both the Explosives Management Plan and the Risk Management and Emergency Response Plan.

3.4.8 Motor Vehicle Accidents

Risk rating is Moderate. All access and haul roads will be regularly maintained, with speed limits enforced. Motor vehicle accidents at the mine site would be dealt with by the mine Emergency Response Team. Potential impacts include injury or death of vehicle operators, fuel spills, and vehicle fires. Vehicles would be fueled with diesel, which is less inflammable than gasoline. All mine vehicles would be radio-equipped. All employees driving vehicles will receive a thorough safety orientation. Any fuel spill from an accident will be cleaned up immediately if safe, with contaminated soil disposed. More detailed procedures are presented in the Road Management Plan, Spill Contingency Plan, Oil Pollution Emergency Plan, and Fuel Management Plan.

3.4.9 Weather Realated Stranding

Risk rating is Low. Detailed procedures will be established for dispatching of convoy on the winter roads. Position markers will be set up along the winter road and truck drivers will carry radio. Refuge stations will be constructed approximately every 50 km along the winter road corridor.

3.4.10 Aircraft Use

The use of both fixed-wing aircraft and helicopters is an important part of the project and will continue through construction and operation into closure because of the isolated nature of the site.

The worst hazard arising from the use of aircraft would be a crash on the site, resulting in fire, explosion, multiple fatalities, fuel spill and environmental damage. This would particularly be the case with a passenger flight carrying a crew rotation. The consequences would be “Critical”; the likelihood is “Unlikely” thus, the risk rating is “Moderate.”

Sabina will do its utmost to guard against such an event by using only well-established and safety-conscious air carriers and by providing a well-maintained landing strip with an acceptable provision of marking, lighting, electronic beacons and weather reporting services defined by consultation with air carriers. Sabina would respond to a plane crash scenario by mobilizing all response resources immediately available. More detailed procedures are presented in Risk Management and Emergency Response Plan.

3.5 OPERATIONS PERIOD

In addition to the accidents and malfunctions scenarios identified for the Construction Period, the following accident and malfunction scenarios can occur during the Operation Period.

3.5.1 Failure of Containment Ponds

A failure of a water management structure has the potential to affect external waterbodies. Any breaks would be repaired immediately. The risk of catastrophic dyke or embankment failure is low. The structures will be engineered as detailed in the Site Water Monitoring and Management Plan and in Volume 11, Appendix 4C, Waste and Water Management Report.

3.5.2 Waste Stockpiles Stability

Waste rock stockpiles will be engineered structures with high factors of safety. Minor slumping is possible, following heavy rain or caused by freeze-thaw. The nature of the material will be such that it will not flow, even in the event of a slope failure. Detailed procedures are presented in the Waste Rock and Tailings Management Plan. The risk rating for this event is Low

3.5.3 Waste Water Release from the Tailings Impoundment Area

Spills of process water and tailings would occur within the TIA contained area such that fluids would drain by gravity into the impoundment. Spills from the TIA seepage pump back lines would drain back into the collection ditches and ponds. Lines would be repaired and the seepage pumped back to the TIA.

Dam failure could be caused by high water flows, slope instability, internal erosion and piping, or earthquake. The dam will be designed with these possibilities in mind. In the event of a major dam failure, potentially large volumes of water and tailings could be released. Impacts of a large tailings spill would be mostly irreversible, except in areas where complete cleanup is possible. The probability of failure is very low but the consequence major. Impending failures can usually be detected before they occur through regular inspection. If an impending failure is detected, processing will be shut down to allow the situation to stabilize and appropriate remedial action will be taken. Processing will not restart until there is no further risk of failure. A dam hazard classification and hazard analysis is presented in Volume 11, Appendix 4C: Waste and Water Management Report.

Risk rating for this event is Low.

3.5.4 Tailings Pipeline Leakage

Tailings pipes will be inspected frequently. If a leak is detected, processing will be shut down until the leak has been repaired. See also Volume 11, Appendix 4C: Waste and Water Management Report. The risk rating for this event is Low.

3.6 CLOSURE PERIOD AND POST-CLOSURE PERIOD

After mining, the risk of accidents and malfunctions will be largely diminished. Once the initial site reclamation has been completed (two years post operations), site activities will be limited to environmental inspections, monitoring and periodic maintenance. The types of accidents and malfunctions that could occur during the closure and post-closure periods are the same as the Construction Period.

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Rescan™
an ERM company

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