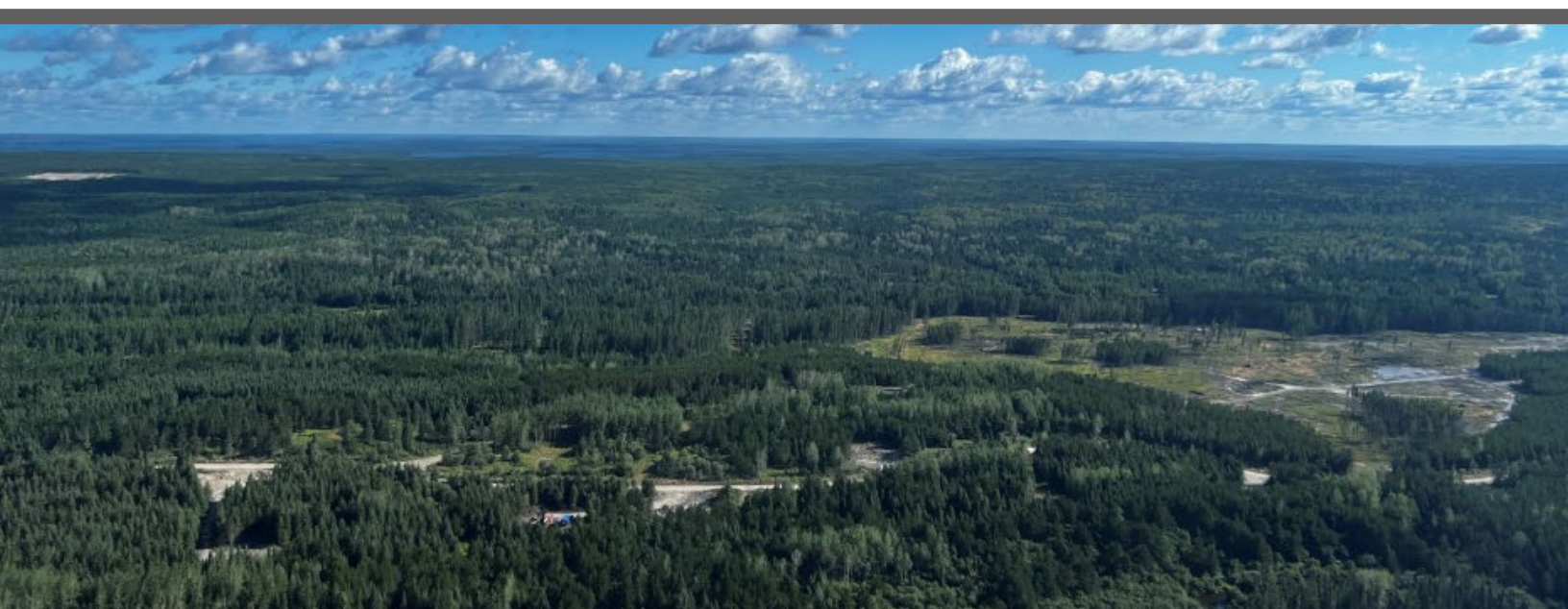


**KINROSS**

**Great Bear**

# **Great Bear Gold Project Impact Statement**

## **Section 16: Effects of Potential Malfunctions and Accidents**



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## Figures

There are no figures for this section.

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## Acronyms and Abbreviations

C	Construction phase (as used in subsection titles)
CI	Closure phase (as used in subsection titles)
CWP	Collection water pond
Project	Great Bear Project
Great Bear Resources	Great Bear Resources Ltd.
H : V	Horizontal : vertical
HPC	Hazard potential classification
LGO	Low grade ore stockpile
MRS	Mine rock stockpile
MWP	Mine water pond
NPAG	Non-potentially acid generating
O	Operations phase (as used in subsection titles)
OVB	Overburden stockpile
PA	Project area
PAG	Potentially acid generating
TMF	Tailings management facility
VMF	Viggo management facility

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## 16.0 Effects of Potential Accidents and Malfunctions

### 16.1 Introduction and Approach

The Great Bear Project (Project) has been designed to meet or exceed applicable safety and environmental regulations and incorporate best management practices. While professional engineering designs and mitigation controls have been integrated into the Project from the earliest of planning stages, the Tailored Impact Statement Guidelines (Appendix A-1) require that the Impact Statement consider and describe how environmental conditions, including credible natural hazards and extreme environmental events could adversely affect the Project, and how this could result in potential environmental, health, social and economic effects including effects to Indigenous peoples. Credible hazards and events that have a reasonable probability of occurrence, and that without careful management could result in major environmental, health, social and economic effects including effects to Indigenous peoples are considered in this section.

Accidents and malfunctions can include structural and operations failures and / or accidents caused by human error. Their consideration is important to validate the engineering design and mitigation controls for the Project. Project design and performance monitoring are key to safeguarding the Project against the risk of an accident or malfunction. The Project has been designed with full consideration of its natural surroundings, and in accordance with accepted engineering design standards. Safety margins such as: design events, factors of safety, contingency planning, have been applied as appropriate for the consideration of environmental stresses as discussed in the following sections.

The consideration of the accidents and malfunctions were developed in a stepwise manner, outlined as follows:

- Proposed design contingency, operational safeguards and mitigation measures are described briefly to eliminate or reduce potential effects
- Potential environmental effects are assessed after mitigation
- Residual risk for each malfunction and accident is determined, considering likelihood and consequence (Section 16.21).

For each credible accident and malfunction scenario, the potential effects to the environment (biophysical and human environment) were assessed based on a reasonable worst case scenario. Occurrences where potential effects are only likely to arise through situations that are practically impossible to obtain have not been considered in the accidents and malfunctions. For almost all circumstances, potential effects to physical and human environment are contained within the Project Area (PA). No broad scale social effects are expected. Potential effects outside the PA are specifically identified where applicable.

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## 16.2 Spatial and Temporal Boundaries

The majority of the potential accidents and malfunctions assessed in this section would occur and have a potential effect only within the PA. As defined in Section 6, the PA is the Project footprint including all temporary and permanent areas associated with the mine site development, as well as an outside buffer to allow flexibility for design optimizations prior to construction and over the mine life (Figure 6.4-1). The area of potential effect is described with the potential accident or malfunction.

The same temporal boundaries are applied as used throughout the Impact Statement:

- Construction phase (Years -3 to -1)
  - Representing the primary period of Project construction
- Operations phase (Years 1 to 26):
  - Underground mine and ore processing will occur over the entire period
  - Open pit mining in the LP Central pit will be completed in about nine years
- Closure phase:
  - Active closure period: Year 27 to Year 29, 3 years in length
  - Passive closure period: at least one additional year until filling of mine workings is complete
  - Final closure period (removal of water management infrastructure): less than one additional year after passive discharge to the environment is approved.

### 16.3 Project Setting

The Project will consist of two open pits (LP Central pit and Viggo pit), underground mining activities, onsite ore process plant, associated operations and administrative activities. The Viggo pit will be fully developed during construction to provide rock for construction and provide early ore access to allow the depleted Viggo pit to be re-used for the storage of concentrate tailings, reject solution from the membrane filtration process and contact water management from the start of operations. The location and scale of key Project facilities are illustrated in Figure 5.2-1 and Figure 5.2-2.

The environmental setting of the PA is typical of northern Ontario and the area is characterized by a number of named and unnamed watercourses and waterbodies. Section 2 provides a summary of the environmental setting by environmental discipline. Further detail is provided in the environmental baseline reports included as appendices to the Impact Statement.

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## 16.4 Influence of Consultation

Engagement input was incorporated into the accident and malfunctions section consistent with the Tailored Impact Statement Guidelines. Key comments provided by government agencies and Indigenous communities are summarized below. Additional information regarding consultation and engagement activities is provided in Section 3.

Engagement activities that included presenting or discussion of accidents and malfunctions were initiated in 2024 and continued to be part of engagement activities in 2025:

- Anishinaabe-Led Impact Assessment Kick Off Meeting Lac Seul First Nation (LSFN) and Wabauskang First Nation (WFN), November 5, 2024
- Environmental Management Committee Meeting, January 16, 2025
- Letter Responses to Asubpeeschoseewagong Netum Anishinabek (ANA), January 20, 2025
- Environmental Management Committee minutes and email follow up, February 12, 2025
- Environmental Management Committee email follow up, February 27, 2025
- Environmental Management Committee Meeting, March 20, 2025
- Environmental Management Committee Meeting, April 8, 2025
- Interests workshops with LSFN and WFN, April 23, 2025
- Interests workshops with LSFN and WFN, April 24, 2025
- Interests workshops with LSFN and WFN, April 25, 2025
- Technical meeting with LSFN and WFN advisors, May 12, 2025
- Technical meeting with LSFN and WFN advisors, May 25, 2025.

As part of the engagement process, Indigenous Nations have expressed the following concerns related to potential accidents and malfunctions for the Project:

- Both LSFN and WFN expressed interest in understanding how the proposed Project would affect the surrounding lands and ecosystems. Potential accidents and malfunctions, particularly related to a potential tailings management facility (TMF) dam failure and spills were raised as topics of concern in confidential Indigenous knowledge reports prepared on behalf of LSFN and WFN.
- WFN has expressed concerns about the potential for toxic runoff, sedimentation, tailings leakage, and accidental spills that could affect lakes, rivers and groundwater systems that in turn could affect traditional foods, such as otters, muskrat and beaver, and drinking water sources. They expressed uncertainty about how changing water chemistry associated with the Project treated effluent could affect plant growth, particularly in sensitive wetland ecosystems, and whether traditional harvesting areas will be safe to use in the future.
- ANA has also expressed concerns regarding the potential for changes to groundwater and surface water, and in particular water quality in the receiving environment as a result of the Project including from potential spills.

- The Northwestern Ontario Métis Community (NWOMC) expressed concerns in a confidential Indigenous knowledge report, related to the potential impact of the Project on traffic levels on Highway 105 and debris on the highway. NWOMC have also expressed a concern about the potential for spills related to the Project that could affect the environment.

These topics raised of potential concern and others are considered in this section. Potential for TMF dam failure and consequences are described in Section 16.8. Spills can result from a variety of different accidents and malfunction failure modes. The potential types of accidents and malfunctions that could result in a spill are considered in the following sections:

- Dam failures (Section 16.8 and Section 16.9): potential release of tailings and / or contact water
- Pipeline failure and / or ditch failure (Section 16.11 and Section 16.12): potential failure of tailings and / or contact water
- Pit lake overtopping (Section 16.15): potential release of contact water prior to proven suitable water quality objectives at closure
- Chemical release (16.19): potential release of chemical such as release due to breach of storage facility.

During engagement activities the use of cyanide was also raised as a potential concern. Cyanide use and destruction is explained in the Section 5.6.2. Weak acid dissociable cyanide concentrations of less than 50 mg/L are considered to be safe for wildlife exposure (Donato et al. 2007). The same threshold has been adopted as being protective of birds, other wildlife and livestock by the International Cyanide Management Institute as part of the International Cyanide Management Code (ICMI 2021). The potential for release of cyanide was evaluated in the accidents and malfunctions in Section 16.18.

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## 16.5 Identification of Malfunctions and Accidents

Specific and important malfunctions and accidents that could have a material environmental effect, and that have a reasonable probability of occurring during the life of the Project were considered. Where appropriate other topics that have been raised during consultation and engagement or are expected to be of interest, are also covered. Medical and similar emergencies while important are unlikely to have an environmental impact and will be addressed through a Project emergency response plan.

The following potential malfunctions and accidents were identified for effects assessment based on the requirements of the Tailored Impact Statement Guidelines, feedback gained through consultation and engagement and professional experience:

- Structural failures and malfunctions: LP Central pit slope, Viggo pit slope, TMF dam, other dam and berm stability, Dixie Creek flood protection berm, pipeline (fresh water, contact water and tailings) failure, ditch overtopping water, mine rock stockpile (MRS) and low grade ore (LGO) slope, overburden stockpile (OVB) slope, pit lake overtopping, potentially acid generating (PAG) MRS cover failure
- Accidents: explosives, materials release from vehicular accident and chemical release from storage or dispensing areas and fires (Project-related).

None would result in a large source of greenhouse gas emissions. For each topic, the subsection heading indicates which Project phase the subsection refers to as per the following:

- Construction phase (C)
- Operations phase (O)
- Closure phase (Cl).

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## 16.6 LP Central Pit Slope Stability (C, O)

The LP Central pit will be excavated through the existing overburden and into the native bedrock where the ore is located. The stability of the rock and overburden in the LP Central pit area has been assessed by geotechnical investigations, and this information was used by qualified geotechnical engineers to develop safe side slopes for the overburden and rock in the LP Central pit. Potential failure of the LP Central pit slopes is considered for the construction and operations phase. At closure, the LP Central pit will be filled with water and this failure mode is not considered for that Project phase.

### 16.6.1 Design and Operational Safeguards

Overburden side slopes around the perimeter of the LP Central pit are designed for stability and are in the range of 3Horizontal (3H): 1Vertical (1V) to 8H: 1V, depending on the overburden depth. Side slopes in overburden may be steeper and range from 3H: 1V to 4H: 1V if buttresses are implemented for stability purposes. The majority of the LP Central pit is anticipated to be developed in rock and the pit is expected to be designed with average pit slopes in rock of about 46°, depending on the rock unit (WSP 2023a).

Design of the LP Central pit will be continuously refined by a qualified geotechnical and mine persons during pit development and operations to confirm the open pit designs meet or exceed industry standards for stability. Design seismic events were developed to support evaluation of the LP Central pit side slopes, the Maximum Design Earthquake proposed for the LP Central pit is the 1: 2,475 year seismic event (WSP 2023a,b).

### 16.6.2 Contingency Planning and Mitigation

The bedrock pit wall angles have been established based on geotechnical drilling investigations and designs by qualified geotechnical persons. Geotechnical monitoring will be established to identify potential instabilities in the LP Central pit and mitigation measures will be put in place before an issue arises. Monitoring of the LP Central pit wall stability including using equipment as appropriate will be directed by qualified persons. Prism-based surveying and slope stability radar, or similar, will be implemented to monitor for changes in position to identify potential areas of instability and ground movements.

In the unlikely event of a predicted slope failure, work will cease and workers will be evacuated from LP Central pit per the emergency response plan, until mitigation can be implemented.

Depending on the scale of the issue, once the failure area is secured, remediation measures will be employed as needed to allow stability measures to be implemented and monitoring and mining to continue safely. Minor remediation efforts may include re-sloping of the pit walls and provision of additional slope support (such as mesh or revegetation). Failure material will be relocated to the appropriate stockpile if mining is planning to progress. A setback is present around the pit perimeter for safety purposes. However, nearby infrastructure that could potentially be affected by a slope failure includes: roads, ditching and sumps dewatering infrastructure. Affected infrastructure will be repaired or replaced as appropriate. Once the area is remediated and safe to return to mining, extraction of ore from LP Central pit will recommence.

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### 16.6.3 Potential Effects to the Environment

During operations there are two primary slope failure modes for the LP Central pit that were considered as part of the accidents and malfunctions assessment:

- Slope failure in overburden soils (i.e., gravitational, liquefaction or uncontrolled erosion)
- Global slope failure in rock slope (i.e., anomalous geologic conditions and / or improper operational procedures).

A larger failure of the rock face in LP Central pit could increase the diameter of the LP Central pit at the top of the rock in a localized area. Slope stability failure may require recontouring of the pit walls for stability which may expand the surface perimeter and footprint of the LP Central pit. A similar outward expansion of the LP Central pit surface area and perimeter could result from erosion of the overburden pit slopes. Failure due to erosion would likely be water related erosion from either surface runoff and / or groundwater seepage into the LP Central pit from the overburden layer.

A failure of the overburden slope in close proximity to the Dixie Creek flood protection berm could potentially result in damage to the berm. This could pose a potential risk of water from Dixie Creek inadvertently flowing into LP Central pit due to flooding from a storm event if the timing was coincidental. This is not considered a likely scenario but is discussed further in Section 16.10.

No material environmental effects are expected from failure of the LP Central pit. There are no nearby waterbodies or watercourses, Dixie Creek is the nearest receptor and is situated about 100 m south of the LP Central pit. The surface extent of a pit slope failure is restricted to a limited area at the LP Central pit and effects to the terrestrial environment (including wildlife and vegetation) are anticipated to be negligible.

Failure of the LP Central pit slope could pose a safety hazard to workers in the area and potentially result in the loss of life if workers are present. With the proposed design, operational safeguards and slope stability monitoring, it is unlikely that advanced warning could not be given to workers in LP Central pit and the surrounding area. Potential effects to worker health are considered to be very low.

Temporary cessation of mining in the affected area of the pit and efforts required to remediate a slope failure, is not anticipated to materially affect the Project economics.

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## 16.7 Viggo Pit Slope Stability (C)

Viggo pit will be excavated through the existing overburden and into the native bedrock where the ore and construction mine rock are located. The stability of the rock and overburden in the Viggo pit area has been assessed by geotechnical investigations, and this information was used by qualified persons to develop safe side slopes for the overburden and rock. The slope stability failure mode for the Viggo pit is only considered for the construction phase of the Project.

During operations the Viggo pit will be repurpose for concentrate tailings, contact water and reject solution storage. Failure of pit slopes during those operations would be the same as during Viggo pit operations. There would be no additional environmental or operational effect, as it is anticipated that complete containment of the contents would occur should a portion of the pit wall fail. There would be no potential for worker injury unless the failure occurred at surface, which is unlikely.

### 16.7.1 Design and Operational Safeguards

Overburden side slopes around the perimeter of the Viggo pit are designed for stability and are anticipated to be in the range of 3H: 1V to 6H: 1V, depending on the depth of the overburden. Steeper side slopes maybe be achieved in the range of 4H: 1 V if buttresses are included for stability (WSP 2023a). The majority of the Viggo pit is expected to be excavated in rock. The average side slopes in hard rock are anticipated to be 46° varying for rock type and geotechnical stability assessment. Design seismic events were developed to support evaluation of the pit wall side slopes, the Maximum Design Earthquake proposed for the open pit is the 1: 2,475 year seismic event (WSP 2023a,b).

The potential failure modes and effects resulting in a slope failure of the Viggo pit during construction will be the same as described for the LP Central pit in Section 16.6.1.

### 16.7.2 Contingency Planning and Mitigation

Similar measures will be in place for the Viggo pit as described for the LP Central pit in Section 16.6.2. Geotechnical monitoring will identify potential instabilities and mitigation measures will be put in place before an issue arises. In the unlikely event of a predicted slope failure, work will cease and workers will be evacuated per the emergency response plan, until mitigation can be implemented.

A setback is present around the pit perimeter for safety purposes. Nearby infrastructure that could potentially be affected by a slope failure includes: roads, ditching and sumps dewatering infrastructure. Affected infrastructure will be repaired or replaced as appropriate.

### 16.7.3 Potential Effects

The remediation and potential effects from a slope failure of the Viggo pit will be the same as described for LP Central pit in Section 16.6.3, except that the Viggo pit does not require a protection berm from Dixie Creek flooding, and the Dixie Creek protection berm would not be affected by a Viggo pit slope failure. No material environmental effects are expected from failure of the Viggo pit.

## 16.8 Tailings Management Facility Stability (O, CI)

During construction phase the starter dams for the TMF will be constructed. Once operations commence, tailings will be produced and the desulphurized tailings are expected to be contained in a surface TMF. The desulphurized tailings will be contained by natural topography and three constructed dams built during the construction phase. The TMF was sited in a natural depression to minimize dam requirements, for both length and height, to support the required surface storage of the desulphurized tailings. Additionally, Great Bear Resources has selected a tailings dewatering technology of high-density thickened tailings, which further reduces dam heights and water management requirements compared to a slurry or thickened tailings. Contact water from the TMF is anticipated to be collected in the TMF pond, located downgradient of the TMF. Later in operations, a mine water pond (MWP) may be constructed downgradient from the TMF pond. The MWP is anticipated to be required to provide supplemental water storage, if necessary, and therefore has not been included in the hypothetical dam breach scenarios as it is a contingency facility. Following closure, the TMF will be seeded for vegetation. The TMF pond and MWP will be breached, areas will be seeded and flows will be naturalized.

The TMF and TMF pond are located in close proximity and share a dam between the two facilities, and therefore some of their potential risks are combined. The potential risks associated with the construction and operations of these dams includes:

- TMF pond dam breach and release of contact water to the environment (early operations)
- TMF and TMF pond dam breach releasing desulphurized tailings and contact water to the environment
- TMF west dam or north dam breach releasing tailings to the environment.

Accidents and malfunctions associated with TMF dam breach are considered herein. Project water ponds are described in Section 16.9.

### 16.8.1 Design and Operational Safeguards

Geotechnical investigations were undertaken in the area of the TMF dam alignments to support engineering designs. The geotechnical investigations encountered overburden thicknesses ranging from 0.1 to 14.7 m at the TMF dam foundation sites. An inferred overburden stratigraphy was developed and includes the following units (WSP 2023):

- Organic material between 0.1 to 2.6 m in thickness
- Sand to silt up to 4.6 m thick (not observed in all locations)
- Non-cohesive and cohesive silts and clays (Glaciolacustrine unit) up to 5.8 m thick (unit not observed in all locations)
- Sand to silt and sand up to 14.6 m thick (not observed in all locations)
- Glacial till consisting of varying amounts of sand, gravel, silt and clay with occasional cobbles and boulders ranging from 0.5 to 6.3 m thick.

The TMF (and TMF pond) dams will be designed in accordance with the Kinross internal Tailings Standard which aligns with best practices including: the Mining Association of Canada's (MAC) Tailings Management Protocol (MAC 2019), Technical Bulletin: Application of Dam

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Safety Guidelines to Mining Dams (CDA 2019), Geotechnical Design and Factors of Safety – Technical Bulletin (MNR 2011).

In Ontario, there is a dam Hazard Potential Classification (HPC) system that is used to identify dam risks based on the potential incremental losses that could result from an uncontrolled release from a facility due to a dam failure. When identifying the hazard potential for a dam using the classification system, consideration is given to respect of life, environmental, cultural and built heritage systems (MNR 2011). The HPC system is used to provide guidance for the design of dams and includes additional guidance for higher classified dams. The TMF dams seismic design criteria were conservatively evaluated with a Very High and Extreme Consequence Classification per the HPC system for the current stage of the Project (WSP 2024). The dam has not however, been formally classified yet (as the required analyses are pending completion) and likely will not be designated an Extreme hazard potential rating.

The TMF (and TMF pond) dams will be designed to meet the factors of safety required by regulatory agencies, based on the HPC. Stability analyses for the TMF dams were considered for the long-term static loading, static loading as well as pseudo-static loading conditions. Stability analyses were conservatively evaluated for the maximum credible earthquake which was assumed to be the seismic event with a 1:10,000 year return period. The seismic design criteria will be updated following completion of a formal dam hazard potential rating noted previously. The geotechnical investigations completed along the TMF dam alignment were used to establish the foundation conditions for the stability analyses. The presence of a soft foundation at the TMF south dam and results from the stability analyses required this dam to have flatter sides slopes of 10H: 1V to achieve the design criteria factors of safety. The TMF north and west dams are situated on more favourable foundations and are anticipated to have steeper side slopes of 2H: 1V and 3H: 1V respectively (WSP 2024). The TMF east dam is anticipated to have steeper side slopes of 2H: 1V and 3H: 1V respectively (WSP 2024).

The TMF dams are expected to be constructed with granular fills. Mine rock used for the construction of the dams will be a non-potentially acid generating (NPAG) mine rock, which will be used to provide the overall slope required for the dam stability. Granular fill layers will be designed to contain the desulphurized tailings, let water pass through the embankment and allow the desulphurized tailings to consolidate. The granular fill dams will be designed to allow water to pass through the TMF dam, draining to the TMF pond located immediately south of the TMF south dam. Runoff from the TMF will be routed to the TMF pond via a spillway. The TMF spillway will be conservatively sized for the greater of the probable maximum flood or 1:10,000 year event (WSP 2024).

The Project will have a qualified person dedicated to the design, supervision and safe construction and operation of the TMF and TMF pond facilities. In addition to the dedicated team member, the Project is subjected to third party review by members of the Kinross Independent Tailings Review Panel, with the purpose of providing independent technical review of the design, construction, operation, performance and closure planning of the TMF. The Panel was put into place during the early planning stages for the Project and are proposed to continue to provide advice over the Project life.

Inspection and monitoring will be required for the TMF dams providing both security and safeguard measures for these facilities. The dams will be regularly supervised and visually inspected by site personnel during operations. The following monitoring activities are anticipated based on the current engineering designs (WSP 2024):

- Surveying the dam crests, exposed slopes, and toes to measure the extent of movements that may occur
- Surveying the tailings beach surface to monitor the beach slopes and configuration
- Bathymetric survey of the sulphide concentrate tailings pond to assist with deposition
- Piezometers installed at selected strategic locations within the foundations of the dams, stockpiles, and open pit slopes to monitor pore pressures during and following loading, and rates of dissipation if excess pore pressures are generated.
- Inclinometers installed at selected strategic locations through the dam and dam foundations, at stockpile toes and through open pit slopes to monitor vertical and horizontal deformations during and following loading
- Settlement plates installed to measure vertical deformation or settlement of the dam foundation
- Monitoring wells installed downstream of the dams and stockpiles to measure the phreatic surface level and obtain samples to observe trends in the groundwater chemistry.

#### 16.8.2 Contingency Planning and Mitigation

Two primary tailings streams are proposed to be produced as part of the precautionary approach to managing ML / ARD at the Project site:

- High density, thickened desulphurized tailings which are NPAG, to be stored in the TMF
- Residual, concentrate slurry tailings which are PAG and will be stored in the east Viggo Management Facility (VMF)
- A small portion of the tailings prior to the desulphurization circuit will be used in backfill underground.

Desulphurized tailings are tailings that have been processed, via flotation, to remove most of the sulphide minerals to produce an NPAG tailings stream. Static testing and kinetic testing were conducted on synthetic tailings samples and found that desulphurized tailings samples have a low total sulphur content (median 0.18%), primarily present as sulphides (pyrite) and are NPAG. As a result of the desulphurization process, the desulphurized tailings had no potential for net acidic leachates and low metal release rates based on humidity cell testing. Mercury concentrations in test leachates were below or at the analytical detection limit throughout testing. Solid phase metal concentrations were low and were usually below screening values. Details of these investigations and the results of ongoing testing are provided in Appendix J.

The desulphurized tailings will account for approximately 94% of the tailings produced at the Project. Production of a larger desulphurized tailings stream will improve the long-term water quality, limit environmental liability and simplify reclamation. The desulphurization of the tailings stored in the TMF will limit the long-term potential adverse environmental effects.

Information collected during dam inspections and monitoring will be used to assess the TMF dam performance and safety, and to verify that the actual conditions are consistent with the design assumptions and intentions. Prior to the construction of the TMF dams, Great Bear Resources will develop a trigger action response plan for the dam instrumentation. The inspections, monitoring and trigger action response plan will be used to warn of potential

impending risks, and provide sufficient time to implement remedial measures, and warnings as may be required (WSP 2024).

The initial response in the unlikely event of a dam failure will be to support worker and human safety and environmental protection in accordance with the emergency response plan. The emergency response plan will include appropriate notifications to government, Indigenous communities, local communities, as well actions for remediation and / or emergency repairs.

Any required spill containment and repair will be facilitated and expedited, by having the required equipment already at the Project site. An event-specific remedial action plan will be developed in the unlikely event of a dam breach or spill. The remediation effort following a TMF dam breach would involve repairs to the affected dams and associated infrastructure (seepage collection sumps, ditches, etc.) and cleanup along the dam breach footprint. Rehabilitation will be undertaken for effected terrestrial areas, waterbodies and watercourses depending on the location of the dam breach. These efforts would be followed by seeding and other applicable measures to support re-establishment of aquatic and terrestrial habitats.

### 16.8.3 Potential Effects

In the unlikely event of a tailings dam breach, it is possible that desulphurized tailings, contact water, engineered fills and mine rock from dam construction could be released to the surrounding environment. This would pose a risk to worker and public safety as well as to the surrounding environment. Preliminary dam breach analyses were used to consider the potential environmental effects from a breach of the TMF and TMF pond. The dam breach analyses considered the following conditions:

- TMF south dam (including TMF pond): fair-weather failure
- TMF south dam (including TMF pond): flood-induced failure
- TMF north dam: fair-weather failure
- TMF west dam: fair-weather failure.

A detailed assessment of a TMF dam breach is provided in Appendix U-1 with a summary of the findings of the study provided below:

- A dam failure originating from the TMF south dam and TMF pond dam for the fair-weather scenario, could result in desulphurized tailings and contact water from the TMF and TMF pond entering Unnamed Waterbody 2, continuing into Unnamed Watercourse 1, and then flowing downstream to Dixie Creek. The deposition of entrained tailings solids in Dixie Creek will cease approximately south of the proposed LP Central pit location. The water component continues downstream mixing with the water of Dixie Creek and the Chukuni River before entering Pakwash Lake. To the southwest, failure could result in desulphurized tailings and associated waters entering Dixie Creek flowing downstream towards the Chukuni River and backing up towards Dixie Lake.. Desulphurized tailings are not anticipated to reach Chikuni River. It was estimated that for the flood-induced event, desulphurized tailings and contact water will be fully mixed and are estimated to reach the Chukuni River, Unnamed Waterbody 6 and Dixie Lake.
- In the event of failure of the TMF north dam or west dam failure for a fair-weather scenario, it was estimated that the desulphurized tailings and contact water will be

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bound by natural topography and extend north to Gullrock Lake via Unnamed Watercourse 8, crossing Highway 105.

A dam breach could result in rapid flows and a mixture of the desulphurized tailings and contact water flowing above the normal water level along the flow paths indicated above. During rapid flows, it is anticipated that naturally occurring sediment and soil in the waterbodies, watercourses and the surrounding terrestrial environment may be potentially washed out.

Under extreme and highly improbable circumstances, a partial or complete breach of a TMF dam, desulphurized tailings (and potentially associated waters if related to the TMF south dam and TMF pond dam) would be released into the surrounding environment. In the immediate near term, the uncontained discharge would cover terrestrial and riparian (aquatic) habitat if present, damaging or destroying plants and animals (if any) in the path. There would be a potential reduction in the plant communities and animal species, and localized biodiversity in the immediate areas where tailings were deposited. The tailings release could increase the sediment load to the downstream watercourses and waterbodies, either directly or indirectly through erosion until remediation can be completed. A spill would also have the potential to affect groundwater as leachate could infiltrate the ground underlying the tailings spill.

If the breach were to occur under frozen ground conditions, the impact would be lessened as the tailings and frozen water could be removed prior to the snowmelt, thereby limiting the smothering effect on vegetation. If waterways are frozen, tailings slurry would not be able to enter a watercourse, which could negate the aquatic impact and prevent rapid downstream transport.

During a dam breach, the immediate health effects would be related to worker safety in the potential flow path for a southern dam break (South dam and TMF pond). The immediate health effects would be to the public for a potential dam break to the north or west, in the event that the tailings cross Highway 105. Workers in the TMF area would be at greatest risk for potential adverse health effects, including the risk of loss of life. The purpose of the Dixie Creek flood protection berm is to prevent flows entering the LP Central pit during a dam breach, as such providing a safeguard to workers in LP Central pit from an eastern flow path.

Great Bear Resources will have design and operational safeguards and monitoring of the TMF and TMF pond dams, and it is anticipated that there will be sufficient warning to remove all workers from the area prior to a potential tailings dam breach and to close Highway 105, depending on the dam breach scenario. It is anticipated that the risk to human health would be considered low.

In the unlikely occurrence of a full breach of a TMF dam, desulphurized tailings and ponded water if present at the dam location, would exit the breach and spread out primarily downslope. The desulphurized tailings would settle out of the flow, and would be deposited closest to the dam breach location, while ponded water would continue downstream. There would be a release of high suspended sediment loads to the local area, which would result in adverse effects to the aquatic and terrestrial environment in the flow path. Further downstream beyond the tailings deposition area, the residual cyanide stored within the tailings mass released to local waters, may be in a concentration that would be acutely toxic to fish in Dixie Creek and the Chukuni River. As cyanides are inherently unstable and are readily volatilized to the atmosphere or converted to the much less toxic cyanate form, this effect would dissipate rapidly, and recolonization of Dixie Creek and the Chukuni River by fish and invertebrates would be expected to occur quickly.

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Potential spilled water will continue downstream mixing with natural flows to reach Pakwash Lake. As the released water disperses into Pakwash Lake, it will continue to mix with the substantially larger lake volume and naturally degrade, reducing concentrations as it moves away from the Chukuni River outlet. Short-term localized reduced water quality effects are possible near the Chukuni River outlet immediately following a breach, but natural degradation and natural mixing would lead to a steady and predictable improvement in water quality with increasing distance from the Chukuni River outlet. Additional details regarding the dam breach and water quality estimates are provided in Appendix U-1.

Local residents and cottagers residing on the affected waterbodies and watercourses may experience a short period where there are limitations to recreational pursuits such as fishing and water sports until the breach pulse is assimilated.

Operations will cease following a dam breach, until the dams can be rehabilitated for continued operation and approval to re-commence operations is received. The costs for the associated environmental remediation and dam rehabilitation would be high, including the potential employment losses and profit from the shutdown of operations. The remediation plan would include water quality and biological monitoring for aquatic and vegetation. Risks associated with a potential TMF dam breach would be communicated to the public and Indigenous communities as soon as practical, therefore, minimizing any potential health related risks associated with consumption of potential traditional food sources in the area.

## 16.9 Other Dam and Berm Stability (C, O)

Contact water will be collected using ditches, sumps and minor ponds during the construction and operations phases. Ponds will be sited to reduce dam requirements and where practical the ponds will be excavated. The design currently includes three primary contact water ponds that require dams: the TMF pond, MWP and the collection water pond (CWP). As described in Section 16.8, the MWP is a contingency facility and as such is not considered in the accidents and malfunctions, although the safeguards and effects will be similar for that facility.

A number of small dams and berms may be present on the site, including in association with the primary proposed fish habitat compensation pond (East pond). The main role of the berm west of the pond (East pond dam) is to support fisheries compensation measures, and separate the pond from the MRS contact water ditching. With planned monitoring and inspection activities, failure of these facilities is considered a credible malfunction and is not assessed.

During the closure phase of the Project, all dams will be breached and no longer retain water. As such, malfunctions and accidents for other dams and berms were not considered for the closure phase.

### 16.9.1 Design and Operational Safeguards

Dam designs will be developed according to industry standard and best management practices. Additionally, all dams at the Project will have an inspection and monitoring program including instrumentation to monitor for signs of a potential slope stability or overtopping issue.

The TMF Pond Dam and CWP are anticipated to be constructed with a low permeability element to limit seepage. Rockfill will be used in the shell of the structures. Both the TMF pond dams and CWP dam will be constructed on top of overburden consisting of a thin organic material, over top of sands and silt (TMF pond), and glaciolacustrine silts and clays, and glacial till. Current designs are as follows:

- TMF pond: maximum dam height of about 5.0 m and expected to be constructed with side slopes of 1.5H: 1V. Sheet piles are anticipated to be driven through a sand core into the underlying foundation to minimize contact water losses (WSP 2024).
- CWP: maximum height of about 5.0 m and are anticipated to be constructed with 5H: 1V upstream side slopes and 2H: 1V downstream slopes. Toe berms may be constructed to further flatten the side slopes of the CWP dam (WSP 2024).

The Project will have inspection and monitoring requirements associated with all water-retaining dams to provide security and safeguard measures. Dams will be regularly supervised and visually inspected by site personnel during day to day operations. Monitoring activities may include the following:

- Surveying the dam crests, exposed slopes, and toes to measure the extent of movements that may occur
- Piezometers installed at selected strategic locations within the foundations of the dams, stockpiles, and open pit slopes to monitor pore pressures during and following loading
- inclinometers installed at selected strategic locations through the dam and dam foundations, at stockpile toes and through open pit slopes to monitor deformations during and following loading

- Settlement plates installed to measure vertical deformation or settlement of the dam foundation
- Monitoring wells installed downstream of the dams and stockpiles to measure the phreatic surface level and obtain samples to observe trends in the groundwater chemistry
- Water levels in reservoirs will be monitored with staff gauges or equivalent.

### 16.9.2 Contingency Planning and Mitigation

In the event of a failure of a contact water containing pond dam, an emergency repair will occur immediately. Appropriate spill control equipment will be stored at the Project at all times. Silt fences, temporary earth or snow dams, and other erosion and sediment control measures will be deployed as needed to prevent contact water and sediments from entering a natural waterbody.

A breach of the TMF pond dam is considered with the TMF south dam failure discussed in Section 16.8 and Appendix U-1.

### 16.9.3 Potential Effects

Contact water may be released to the environment in an uncontrolled manner from the following potential failure modes:

- Stability failure of a dam
- Blockage of the spillway or a storm event exceeding the design criteria resulting in overtopping of the dam.

The potential effects related to the failure of the CWP will depend on the stored water volume and potential energy being retained by the dam.

#### 16.9.3.1 Collection Water Pond Dam

A breach of the CWP dam could potentially release contact water to the surrounding environment, however this would be highly localized with minimal effects to the surrounding environment. In the event of either overtopping of the CWP or breach of the CWP dam, the water will flow towards LP Central pit and will be contained within the open pit. A small area between the CWP and LP Central pit will have small environmental effects such as erosion, but this area is contained within the PA and is used for supporting infrastructure such as haul roads.

Following a breach of the CWP at a maximum storage capacity, a shutdown of operations for a short period could be required. During a dam breach workers in the CWP and LP Central pit area are at the greatest risk for adverse health effects. However, the design and operational safeguards as well as the monitoring of the CWP dam that will be in place, it is anticipated that all workers will be removed from the area prior to a potential CWP dam breach.

The water from the CWP may be fully retained within the surrounding internal road infrastructure or could potentially flow to LP Central pit. Underground mining may cease until the water can be removed from the LP Central pit and the contact water management system is re-instated. Remediation following failure of the CWP may include repairing the dam and / or recontouring disturbed areas, including repairing any damaged or lost roads from the failure. The associated costs are anticipated to be moderate.

In the unlikely event that the CWP dam breach releases water to LP Central pit and there are workers present, this could potentially result in loss of life although this is considered unlikely.

As the extents of a CWP failure are expected to remain within a small portion of the PA between the CWP and LP Central pit, no social effects are anticipated.

Following failure of the CWP, remediation efforts for disturbed areas and reconstruction of lost infrastructure such as dams and roads will be required. This may result in a temporary cessation or relocation of mining within the pit. Water in LP Central pit will also be pumped out and treated prior to discharge. Accordingly, the effects on the Project economics are anticipated to be moderate as the Project plans to have stockpiles to feed the process plant if mining operations are temporarily paused.

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## 16.10 Dixie Creek Flood Protection Berm Stability (C, O)

The Dixie Creek flood protection berm is anticipated to be constructed as a contingency measure, to prevent water from Dixie Creek flowing into LP Central pit during a natural flooding event of Dixie Creek. Additionally, the Dixie Creek flood protection berm elevation was developed to prevent filling of water in LP Central pit in the unlikely event of a catastrophic failure of the TMF south dam and TMF pond towards Dixie Creek. A robust design will be developed for the berm to reduce risks to workers and interruption of mining activities during operations, and the potential for a portion of Dixie Creek being diverted into the LP Central pit.

### 16.10.1 Design and Operational Safeguards

The Dixie Creek flood protection berm is expected to be designed and maintained in accordance with applicable environmental approvals. Following review of the potential high water levels in Dixie Creek from a severe storm event, it was identified that there was a risk that a portion of the creek could flow into the LP Central pit during a flood event. To provide the protection to the environment and highest protection to workers, Great Bear Resources has considered the Timmins flood event to establish the crest height and location for the berm. The Dixie Creek flood protection berm is proposed to be constructed to a maximum elevation of 353 masl, which includes a 2 m freeboard above the Timmins flood line and the sunny dam TMF south dam failure. The berm is expected to be constructed with 3H:1V side slopes and include rip rap protection on the flooded side of the berm for erosion protection.

### 16.10.2 Contingency Planning and Mitigation

The Dixie Creek flood protection berm will be maintained in a good condition. During high rain or flooding events the berm will be inspected more frequently. Should the berm become damaged or eroded, an emergency repair or reinforcement will occur immediately. Appropriate repair equipment and materials will be maintained at the Project site.

### 16.10.3 Potential Effects

Failure of the Dixie Creek flood protection berm during a Dixie Creek flood event is not considered a likely scenario as erosion protection will be added to the creek side of the berm. Failure at other times of the year would not have an environmental effect.

Although this scenario is not considered plausible, capture of a portion of Dixie Creek in the LP Central pit under a creek flood condition would reduce the flood condition flows downstream. Fish present in the waters could be impacted by the drop into the pit. The water would be pumped out for treatment as needed before mining would resume. Other material environmental effects are not anticipated.

Capturing of a portion of the Dixie Creek flood waters in the LP Central pit could pose a safety hazard to workers nearby, including at the base of the pit if present. With the dam monitoring in place, it is anticipated that workers would be removed from the LP Central pit prior to a dam breach. Economic effects associated with the repair of the Dixie Creek flood protection berm and pumping out of the LP Central waters are not considered material.

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## 16.11 Integrated Water Management System (pipelines) (C, O, CI)

Freshwater, contact water and tailings are anticipated to be transferred within the Project site during operations via a series of pipelines including:

- Chukuni River to camp and process plant (freshwater; operations and closure)
- Process plant to TMF (desulphurized tailings; operations)
- Process plant to east lobe of the VMF (concentrate tailings; operations)
- Membrane filtration to west lobe of the VMF (reject solution; operations)
- Process plant to paste backfill pant (tailings and reject solution; operations)
- TMF to process plant (reclaim water; operations)
- Viggo pit / VMF to water treatment plant (contact water; construction and operations)
- CWP to VMF (contact water; operations)
- TMF pond to membrane filtration (contact water; operations)
- MWP to the water treatment plant (contact water; operations)
- Water treatment plant / membrane filtration to the advanced exploration treated water pond to Chukuni River (treated effluent; construction, operations and closure).

The majority of pipelines are located within the main site area and are bounded by site roads and ditches that provide passive secondary containment even where designed secondary containment is not present.

### 16.11.1 Design and Operational Safeguards

Prior to construction, Great Bear Resources will develop a pipeline safety and surveillance plan. This is proposed to include inspection of all active tailings and contact water pipelines during each shift, along with incidental inspections. Visual inspections are important to identify minor leaks that cannot be identified remotely.

Leak detection systems are expected to be designed and installed for the tailings pipelines, that will conform to or exceed the industry standards and practices. This may include remote monitored flow in and out, and pressure differential measurements. Secondary containment is anticipated to be provided at and near watercourse crossings, for pipelines containing contact water and tailings. The Project design concept for these tailings pipelines includes placing the pipeline within a lined ditch. The lined ditch will have low points to allow for any spill to be contained and pumped safely back to the TMF, VMF or process plant. The site has been designed to minimize pipeline crossings of watercourses.

### 16.11.2 Contingency Planning and Mitigation

A spill prevention and response plan will be developed to address potential onsite spill scenarios including from pipelines. The spill prevention and response plan will consider potential onsite spill scenarios, including prevention, contingency planning and reporting practices for the timely and effective response.

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### 16.11.3 Potential Effects

The worst case pipeline failure scenario from an environmental perspective, is the complete rupture of a tailings pipeline during the operations phase at a location where secondary containment is not present. Tailings will be hydraulically conveyed through pipelines to the TMF, VMF and paste backfill plant. The desulphurized and concentrate tailings pipelines will be placed on surface in a lined ditch, and failure of this pipeline are considered the worst case scenario in the unlikely event of a pipeline failure. While the pipelines to the Chukuni River are more remote, failure of the more remote freshwater or treated water pipelines to the Chukuni River are not considered a worst case scenario. Failure may cause localized erosion until flow ceases, but are not expected to have a material environmental effect.

The sudden rupture of a tailings pipeline where secondary containment is not present outside the TMF, could result in a release of tailings until pumping stops and gravity outflow from the tailings pipeline ceases. Catastrophic rupture of a pipeline is considered highly unlikely to occur. The leak detection system will be designed for an automatic shutdown in the case of a catastrophic break. The leak detection system is proposed to include remote monitoring of flow in and out, and pressure differentials.

Release of tailings from a pipeline rupture would have differing environmental effects depending on the time of the year, the location of the spill and the volume spilled. If the spill occurred when the ground was frozen, spilled material could be readily cleaned up and no environmental impact would be expected. During the remainder of the year, the spill would have a smothering effect on the immediate surroundings. The liquid portion of the tailings would exit the pipeline and eventually flow by gravity downslope at the point of rupture. The majority of the solids are anticipated to settle within the pipeline or remain in proximity to the point of rupture.

A credible worst case spill scenario has been defined as a complete failure of the tailings pipeline during operation between the process plant and the top of the TMF dam, resulting in the release of tailings until pumping ceases and partial loss of pipeline contents thereafter (total contents estimated as 135 m<sup>3</sup> slurry, 54 m<sup>3</sup> liquid and 81 m<sup>3</sup> solids). With a catastrophic break, pumping will cease immediately. Once pumping is stopped, the coarse solids and fines will settle out of solution quickly within the pipeline, while a larger proportion of water will continue to be released. The spill is therefore estimated as an uncontrolled loss of approximately 50% of liquid content remaining in the pipeline and 25% of solids, or 20 m<sup>3</sup> of liquid and 27 m<sup>3</sup> of liquid. There is no reasonable scenario where this spill would reach a local watercourse or waterbody given the proposed pipeline routing, except east of the TMF north dam. Additional controls may be put into place at this location during detailed design, such as secondary containment in the form of a lined ditch that will collect the spill.

There may be a short period where the mill is not operational in order to repair the tailings pipeline rupture. This remediation is not anticipated to have a material effect on the Project economics.

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## 16.12 Integrated Water Management System (channel and ditches) (C, O, CI)

A robust integrated water management system has been developed for the Project. Gravity drainage ditches are expected to be used during construction, operations and closure as the primary means to passively convey water across the Project site. During closure, the ditching will be progressively reclaimed in parallel with the associated facilities and areas.

The system is expected to include the following primary contact water collection channels and ditches network:

- Main collection channel
- MRS ditching
- OVB ditching
- LGO ditching
- TMF ditching.

### 16.12.1 Design and Operational Safeguards

The contact water management conveyance system (channels and ditches) is designed for an Environmental Design Flood, defined as the 100-year return period events during the operations and closure phases. A 1:100 return period refers to a flooding event with a likelihood of being exceeded occurring once in a 100-year period. These are typical water management design criteria in the mining industry. A rain event greater than this design event could potentially result in overtopping of conveyance ditches, however in that circumstance, it is wider scale flooding may be present which result is dilution of any overflow.

### 16.12.2 Contingency Planning and Mitigation

All ditches will be inspected and in the event of a disruption of the ditch, an emergency repair will occur immediately. Appropriate equipment to repair the ditch and spill control equipment will be kept at the Project at all times. Silt fences, temporary earth or snow dams, and other erosion and sediment control measures will be deployed as needed to prevent contact water and / or sediments from entering a waterbody.

### 16.12.3 Potential Effects

The worst case scenario for a ditch failure is overtopping of the main collection channel during operations. The main collection channel is anticipated to collect contact water via gravity from OVB1, OVB2, MRS, CWP, drainage ditch from Unnamed Waterbody 5 and water from the LP Central pit to the VMF. The main collection channel was designed to convey the 1 in 100 year storm event without overtopping. Overtopping of the channel under an extreme rain event, is not expected to have a material environmental effect. Wider scale flooding would be present which result is dilution of partially treated overflow. As the channel is located on the north side of a haul road, it is expected that overtopping would flow by gravity along the road, ponding in place except where cross culverts are present in the road bed.

Due to the planned design and operational safeguards which will include regular inspections of the main collection channel, it is anticipated that failure of the main collection channel is unlikely. The main collection channel will drain via gravity to the VMF and the water quantity that might overtop the main collection channel would be small such that environmental effects are

anticipated to be low and would remain within Unnamed Watercourse 6A-01 or Unnamed Watercourse 6A-02. Unnamed Watercourse 6A-02 was found to be not fish occupied during aquatic baseline studies (WSP, 2025). Unnamed Watercourse 6A-01 was found to be fish occupied and overtopping from the main collection channel may disrupt fish habitat and have a minor effect on aquatic species in this tributary. Water quality and biological monitoring will be incorporated into the remediation in the event of a failure of the main collection channel to monitor for potential environmental effects. The potential effects to water quality, fish and fish habitat are anticipated to be low. As the extents of the failure are anticipated to remain within the general area of the Project, no health, social effects or effects on Indigenous peoples are anticipated.

### **16.13 Mine Rock and Low Grade Ore Stockpile Slope Stability (C, O, CI)**

During construction and operations mine rock and low grade ore will be extracted from the LP Central pit and Viggo pit. Mine rock is anticipated to be classified as either NPAG or PAG mine rock. Mine rock not used for construction purposes, and will be stored in the MRS, located north of LP Central pit. Low grade ore will be stored in the LGO which was sited to be in close to the LP Central pit and process plant. The low grade ore will be processed during operations and only the MRS is expected to remain at closure.

#### **16.13.1 Design and Operational Safeguards**

The MRS and LGO will be designed by a qualified person using suitable safety factors for short-term and long-term stability. The designs for the MRS and LGO will take into consideration foundation materials to support the development of the side slopes and heights of the MRS and LGO.

The MRS is anticipated cover an area of approximately 170 ha with a maximum height of approximately 120 m. The PAG portion of the stockpile is anticipated to be created by end dumping on a NPAG rock pad compacted via haul truck traffic, to provide trafficability and a buffer between the PAG stockpile and the overburden below. A perimeter ditch is expected to be established around the stockpile to collect runoff and drainage. The MRS designs includes an overall slope of 3H:1V to 7H:1V, with lift heights of 10 m and a berm width of 7 m. Compaction of the mine rock surface will occur by haul truck traffic and dozers operating on the MRS.

LGO1 and LGO2 are expected to be approximately 50 m and 25 m high respectively. An overall slope of between 3H:1V and 7H:1V is proposed depending on foundation soil conditions, with lift heights of 10 m and a berm width of 7 m.

#### **16.13.2 Contingency Planning and Mitigation**

An appropriate setback around the both the MRS and LGO is anticipated to be left undeveloped to accommodate minor slumping or sloughing that typically occurs during stockpile management. Any additional overrun is expected to be captured in the perimeter ditching which will be periodically cleared as necessary to maintain ditch efficacy.

#### **16.13.3 Potential Effects**

The MRS and LGO are anticipated to contain relatively coarse and dry material, therefore, slope failure from the LGO and MRS are considered to likely be small-scale sloughing or slumping and would be limited to the immediate vicinity of either the MRS or LGO.

In the event of a failure, the area of the failure will be secured and when safe to do so, remediation measures will be implemented. Remediation is anticipated of the failed MRS or LGO is anticipated to included recontouring of the stockpile to safe side slopes, or re-arrangement of ditching to surround the expanded stockpile area if more appropriate. Disturbed material will likely relocated into the main stockpile (MRS or LGO). Other potential remediation measures may include excavating material that may have reached ditches, roads or the CWP. No environmental effects are anticipated.

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## **16.14 Overburden Stockpile Slope Stability (C, O, CI)**

During the construction phase, where practicable, overburden material and organics will be collected and stored in stockpiles around the Project. These materials are expected to be stored in approximately six OVB across the site, with the majority of the material being stored in the two OVB located to the east and west of the MRS. A large portion of the stored overburden and organic material is anticipated to be used during progressive and final reclamation activities.

### **16.14.1 Design and Operational Safeguards**

The OVB will be designed by a qualified person using suitable safety factors for short-term and long-term stability. The designs for the OVB will take into consideration foundation materials to support the development of the side slopes and heights. The current OVB designs includes an overall slope of 3H:1V when underlain by outwash, to 10: 1V when within the glaciolacustrine deposition area. The 10H: 1V side slopes applies to OVB1 and OVB2 stockpiles which are anticipated to be limited to less than 25 m in height.

### **16.14.2 Contingency Planning and Mitigation**

The OVB is anticipated to be more susceptible to erosion compared to the MRS given the finer nature of the material. This is anticipated to be mitigated by the designed shallower side slopes and periodic seeding. OVB will be monitored on a regular basis and materials will be available at the Project to manage evidence of erosion or small slope failures. This may include recontour and seeding as needed.

### **16.14.3 Potential Effects**

Large scale failure of the OVB is not considered a viable scenario. Failure will likely be small-scale sloughing or slumping and would be limited to the immediate vicinity of the OVB. The overburden release could enter the perimeter ditching, which could interfere with ditch flows, increase the sediment loading in the contained waters, or temporarily block the ditch. Ditch water would be managed in the integrated water management system as part of the contact water collection. The associated failure of a blocked ditch is discussed in Section 16.12. Accordingly, other than an increase the footprint of the affected stockpile, no environmental effects are anticipated.

Following failure of the OVB slope, work in the area will cease and if debris from the OVB accumulates in the ditch, the ditch will be repaired and the material will be relocated to the OVB. The affected OVB slope will be secured, recontoured and seeded as needed.

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## 16.15 Pit Lake Overtopping (CI)

Great Bear Resources proposes to reduce the length of time until pit lakes in the LP Central pit and Viggo pit reaches a stable water level by active and passive filling. The water levels will be maintained at a lower level sufficient to manage storm events (approximately 343 masl) by treating and pumping excess water to the Chukuni River, until such time as all regulatory requirements are met. Therefore, the only potentially feasible overtopping failure is an extreme storm event that exceeds the Environment Design Flood prior to pit lake quality meeting regulatory requirements.

### 16.15.1 Design and Operational Safeguards

The re-purposing of the Viggo pit, minimizes the surface storage requirements for the tailings, reject solution and contact water. Pit storage is an inherently stable storage solution. During operations the water level in the west VMF and east VMF are anticipated to be maintained to allow for sufficient storage to contain the Environment Design Flood without overtopping the pit rim, but returning water within the integrated water management system.

During the closure phase, the water level in the Viggo pit and LP Central pit will rise and be stabilized below the pit rims by pumping excess water to the Chukuni River as needed. Overtopping of LP Central pit is highly unlikely to occur, but could potentially occur if the pit lake was at its highest maintained level (passive closure period, prior to establishment of the pit lake spillway), and an extreme rain event that exceeds the design criteria occurred (i.e., if the flood exceeds the 100 years flood event). The Viggo pit lake water level (prior to the final closure period) will be maintained to allow for storage of the Environmental Design Flood by pumping excess water to the Chukuni River following treatment. The water-filled Viggo pit is expected to remain as an isolated pit lake in the long term based on current hydrogeological modelling including with respect to climate change predictions. If determined to be needed later in the mine life, a channel will be constructed connecting the Viggo pit lake to the LP Central pit lake to control the Viggo pit lake level so that it will not overflow directly to the environment, including under extreme conditions. Overtopping of the Viggo pit lake is highly unlikely.

### 16.15.2 Contingency Planning and Mitigation

During closure the water levels and water quality will be monitored in both the LP Central pit lake and Viggo pit lake. As such, the water quality and water levels are anticipated to be well understood and in the event of a severe storm event that could result in overtopping to assist with remediation efforts.

### 16.15.3 Potential Effects

Overtopping of LP Central pit and Viggo pit lake is highly unlikely to occur, but could potentially occur if the pit lakes were at it highest maintained level, and an extreme rain event occurred. Overtopping under an extreme rain event, is not expected to have a material environmental effect. Wider scale flooding would be present which result is dilution of overflow, including if it were to enter Dixie Creek.

Following the event, monitoring will be undertaken for water quality and aquatic species as needed in Dixie Creek.

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## **16.16 PAG Mine Rock Stockpile Cover Stability (CI)**

During operations, the PAG MRS is anticipated to be progressively reclaimed by placing a cover designed to reduce infiltration and oxygen ingress into the underlying PAG mine rock. One of the objectives of placing this cover during operations is to limit the onset of acid of the mine rock and support water quality objectives for the Project during closure.

### **16.16.1 Design and Operational Safeguards**

The PAG portion of the MRS will be covered earlier during the operations phase of the Project and will be in place for about 10 years prior to closure. As such, there will be over 10 years of cover monitoring information to evaluate the MRS cover performance prior to the closure phase, providing an opportunity to make any cover adjustments during operations and to support closure water quality objectives.

### **16.16.2 Contingency Planning and Mitigation**

The PAG portion of the MRS is expected to be covered earlier in operations. Ongoing cover monitoring during operations, will allow the evaluation of performance prior to the closure phase, providing an opportunity to make required cover design adjustments during operations and to support closure water quality objectives.

### **16.16.3 Potential Effects**

Failure of the PAG MRS cover during closure, could initially occur from erosion of the cover resulting in a loss of cover material, that may increase total suspended solids and potentially result in sediment deposition in the surrounding ditches (Section 16.12). The release of MRS cover material is not anticipated to have an environmental effect.

In the event that there is substantial erosion or a loss of cover, the cover may no longer perform as designed. The loss of material may result in an increase in both oxygen to the underlying mine rock and an increase in infiltration through the cover. This may support an increase in acidic conditions at closure producing a poorer water quality in the seepage and runoff from affected areas. The most conservative accident and malfunction scenario will occur during the post-closure phase of the Project, when there is no longer water treatment at the Project and poor water quality may discharge to the environment in the event of failure of the MRS cover.

The Project has been designed, so that seepage and runoff from the PAG MRS will report primarily to the LP Central pit. Poorer quality seepage and runoff could adversely affect the water quality in the pit lake. In the event of a cover failure, the pit lake will be monitored and any changes to the water quality will be promptly addressed with appropriate remediation measures, which could include in-pit water treatment. Environmental effects are not anticipated as the water quality would be managed in LP Central pit prior to discharge to the environment.

## 16.17 Explosives Accident (C, O)

Explosives will be required for mine construction and operations. Explosives used at the Project are expected to be ammonium nitrate / fuel oil, but could include emulsion or emulsion-blend explosives types. The explosive components are not individually reactive and will only react if mixed in appropriate proportions, placed under certain confined conditions and detonated with an external device. The explosives storage facility and related explosives magazine will be built at a safe distance away from other facilities and public access, in compliance with the *Explosives Act* and other regulatory guidance. Pre-packaged explosives may be used at times and will be managed in accordance with regulations.

### 16.17.1 Design and Operational Safeguards

Explosives at the Project will be stored, handled, transported and manufactured in accordance with applicable regulatory requirements, including the Explosives Regulations, 2013 (SOR/2013-211) or as amended. The onsite explosives manufacturing area and storage magazines will be located in accordance with the Explosives Regulations and guidelines including the National Standard of Canada Standard CAN/BNQ 2910-510/2015 (Bureau de Normalisation du Québec 2015).

The Project will use an explosives company that is well versed in the *Explosives Act* requirements and associated regulatory instruments. The transportation of explosives is controlled by the Explosives Regulatory Division of Natural Resources of Canada and the Transportation of Dangerous Goods Regulations from Transport Canada. Companies that transport explosives materials for the Project are required to comply with the requirements of these agencies.

All personnel who handle explosives for the Project will have appropriate training and all other individuals will be restricted from accessing the explosive storage facility and explosives magazine areas. A blast and vibration management plan will be developed that will include management considerations, offset distances, clearing procedure and specifics for both open pit and underground operations. Destruction of explosives (such as those unfit for use) and misfire procedures will be according to applicable regulatory requirements and guidance and undertaken by qualified personnel.

### 16.17.2 Contingency Planning and Mitigation

Improper handling of explosives can cause injury or worse. By contracting an experienced explosives firm, following the regulatory requirements and ensuring good housekeeping in general, explosives will be well managed with minimal likelihood of inadvertent detonation or other accidents.

Damage to facilities and infrastructure could be possible but would generally only occur in association with use at the open pit during mining. Part of the safety prevention protocols includes evacuation of workers and equipment from areas that could be potentially impacted by blasting activities (fly rock, blast gases and dust). The mine site emergency response team will be trained in response measures associated with the use of explosives.

### 16.17.3 Potential Effects

Explosives require an external detonation device and cannot be inadvertently detonated. Blasting will be a regular occurrence required within the open pits to access rock and ore during

the construction and operations phases. An uncontrolled explosion, though highly unlikely, could occur as a result of improper management and / or inadvertent detonation.

The potential environmental effects from an uncontrolled explosion could potentially create a larger blast resulting in a more noise and vibration than a regularly planned / controlled blast. The additional noise and vibration from an uncontrolled explosion would be a short duration but could cause a temporary localized disturbance. No ongoing adverse effects are anticipated unless the uncontrolled explosion triggers another malfunction and accident.

## 16.18 Vehicular Accident (materials release) (C, O, CI)

All materials required to construct, operate and close the Project are expected to be transported to the Project via Highway 105 and Tuzyk's Road to the main access road. Once on site, vehicles transporting materials are expected to generally avoid haul roads, which will be designed for the movement of ore, mine rock and overburden in large haul trucks. This will include shipment of fuel, process chemicals (including reagents such as cyanide), and other hazardous and non-hazardous materials.

There is anticipated to be limited shipment off site, but it would include domestic and industrial waste materials in highway vehicles.

### 16.18.1 Design and Operational Safeguards

To minimize the potential for vehicular accidents on the trucking routes for the Project, the following operational procedures are anticipated to be incorporated into contracts where appropriate for shipments of both hazardous and non-hazardous materials:

- Regular maintenance of trucks
- Strict adherence to all speed limits, including Project speed limits
- Strict adherence to national trucking hour limits and other applicable requirements
- Requirements for drivers to meet all applicable regulatory training requirements, be trained in spill response procedures for materials they transport, and carry the appropriate safety data sheets
- Requirements for all vehicles transporting materials to the Project to maintain a supply of emergency response equipment, including communication equipment, first aid materials and fire extinguishers
- Penalties for infractions.

Hazardous materials are commonly shipped with secondary containment or in a format that is environmentally protective which provide an additional safeguard. For example, cyanide will be delivered to the Project by truck in the form of sodium cyanide, and will be transported in solid brickettes in sealed ISOtainers. In addition, shipments to and from the Project will follow regulatory requirements, including the *Transportation of Dangerous Goods Act* and associated regulations. The need for compliance with this Act and other regulatory requirements will be reinforced in all applicable contracts and vendor agreements.

Additional requirement that are expected to be applied for shipments carrying hazardous goods will include as applicable:

- Complying with applicable regulatory requirements for the transportation of dangerous goods
- Confirming vehicles and drivers are licensed and trained in the transportation of dangerous goods
- Confirming appropriate transportation containers are used by transport companies
- Regularly reviewing local shipment operations and reporting all incidents, including near misses

- Establishing communications with drivers, which could include tracking during transportation of cyanide and / or check-ins, particularly if transportation occurs during poor weather conditions.

### 16.18.2 Contingency Planning and Mitigation

Emergency and spill response procedures will be established and are expected to include the following: medical response, notification, containment of spill, removal of spill, treatment of affected environment, monitoring of environment and learning from the accident.

Companies contracted to transport hazardous materials for the Project will be required to have an emergency response plan or equivalent for the materials being carried, and a protocol for managing spills in the unlikely event of a vehicular accident resulting in a spill. In the event of a hazardous materials spill from a vehicular accident, the Project team will support the transport company as needed with the implementation of their recovery plan.

The primary goal in any collision will be to support public and worker health and safety. Potential ignition sources will be removed in the event of a spill of flammable or combustible materials if possible, and the spill will be stopped or slowed using available equipment. Appropriate corporate and external personnel will be notified, and an assessment will be conducted to determine the best means to prevent immediate environmental effects. Spill countermeasures may include the use of absorbent materials, establishment of a collection trench and setting containment booms on ponded water. Contained materials will be disposed of in an approved facility.

The affected environment will be rehabilitated as needed. Clean-up and remediation will support restoration of the affected area. After any major spill or accident, a review will be conducted to confirm that the required design changes, procedures and appropriate monitoring measures are in place so that the incident will not be repeated.

### 16.18.3 Potential Effects

Despite reasonable safeguards, there is a potential for spills during transport due to collisions, accidents related to poor weather conditions, or other mishaps. A spill could potentially contaminate the soil or snow at the incident site. The consequences of any spill are expected to be localized and recoverable, and will depend on the type and quantity of the material spilled, as well as the location and time of the spill.

Spills of non-hazardous materials are unlikely to have an environmental effect beyond the immediate footprint of the incident. Any effects will be temporary in nature and readily remediated as needed. This would also apply to spilled hazardous material that remain contained.

A worst case scenario would be an accident at a water crossing involving the spilling of a considerable volume of liquid, such as diesel fuel, into the watercourse. This is considered a highly unlikely scenario given the volume of fuel shipped to site compared to across Ontario, and infrequency of this occurrence across the province. Clean-up and potentially remediation will support long-term environmental impacts are reduced to the extent practical.

## **16.19 Chemical Release from Containment or Dispensing Facilities (C, O, CI)**

The bulk of the liquid fuel used at the Project is anticipated to be diesel needed for the heavy equipment fleet. A fuelling station will be established at the service and administration complex outside the blast radius of the LP Central pit and Viggo pit / VMF, but readily accessible by heavy equipment, particularly haul trucks. Storage tanks will be sized for ongoing operational needs and to allow for transport disruptions (currently anticipated as five days total storage).

Lower volumes of gasoline are also anticipated, and are expected to be stored in a double-walled Enviro tank or equivalent at the Project for use by small vehicles, all-terrain vehicles, snowmobiles, boats and gas-powered tools. Propane will also be stored onsite properly design containers, stored in cages or protected from collision.

Reagents that will be used in ore processing and for water treatment at the site are typical of Ontario gold mines. Process reagents will be stored according to supplier and safety guidance, including in separated and contained areas as applicable, either within buildings or in designated exterior yards.

### **16.19.1 Design and Operational Safeguards**

Chemicals will be transported, stored and handled in accordance with applicable regulations and good management practice. Tanks will be protected against possible vehicular collisions as appropriate and secondary containment will be provided as applicable. Care will be taken that incompatible materials are not stored in proximity within the warehouse or other areas. Chemicals will not be stored in close proximity to watercourses and waterbodies, and high traffic areas. Where storage near vehicle movement cannot be avoided, bollards or other protection will be provided to prevent collision and potential spills.

All chemicals including fuel and liquid and solid reagents which pose a potential risk to the environment will be stored, and as practical, used within contained areas, with sealed floors and sumps or drains reporting to facilities which will provide for retrieval of the spilled materials. Secondary containment will be provided at storage and dispensing areas.

Reagent mixing systems will be located in the process plant within containment areas, designed to contain any upsets and prevent incompatible reagents from mixing. Storage tanks will be equipped with level indicators, instrumentation and alarms. All of the chemicals will be handled and stored according to all applicable regulatory requirements.

### **16.19.2 Contingency Planning and Mitigation**

Copies of the safety data sheets used on the Project site will be maintained in accessible locations, in order to comply with health and safety best practices in the industry, and to provide relevant regulatory standards for the safe use of these materials. Measures related to chemicals used at the Project will have continual reviews and updates in order to remain current, and will form part of the health and safety training of site personnel.

Proposed operational procedures to minimize the potential of accidents or malfunctions will be incorporated into the environmental management system. A spill response plan will also be prepared and maintained current for the chemicals present on the Project site.

Tanks will allow for expansion due to temperature changes. Chemical tanks volumes will be confirmed, using a dip check or other method, with the result logged for comparison and record

keeping. Measurements different from anticipated volumes will immediately be investigated to support identification of low-level leaks. Other operation procedures are expected to include:

- No smoking in the vicinity of the chemical storage and dispensing facilities
- At least daily inspections of all fuel storage and chemical locations
- Formal weekly inspections using a protocol checklist to check for leakage and other operational problems

The procedures will be regularly reviewed as part of the environmental management system.

Appropriate spill kits containing spill response equipment and absorbent materials will be stored on site at strategic locations across the Project. In the event that a chemical is released to the environment the spill response plan will be employed, with an initial primary focus on ensuring human health and safety. The area will first be secured, and containment area sealed if possible. Absorbent materials used to contain the spill will be collected as well as the spilled material if appropriate, will be handled according to regulatory requirements.

### **16.19.3 Potential Effects**

In the event that a breach of the contaminant and / or dispensing facility goes undetected by the monitoring system or surpasses secondary containment, the underlying soil could be affected. Remediation will be undertaken to manage and rehabilitate soils. This may include localized excavation or other remediation technologies such as pump back wells to control local groundwater movement. Groundwater quality will be monitored in existing or dedicated wells nearby to confirm successful remediation.

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## **16.20 Project Related Fires (C, O, CI)**

Fires can result from either natural causes (e.g., lightning) or anthropogenic causes (e.g., operator error, equipment malfunctions or accidents). Natural fires (wildfires) are considered in Section 17.4.

### **16.20.1 Design and Operational Safeguards**

The Project is being designed to meet all applicable fire protection system requirements and codes. This includes: presence of sufficient water supplies, fire detection and suppression systems, sprinkler systems, fire extinguishers and other firefighting equipment. Remote buildings will be equipped with portable extinguishers as required. A fire pumper truck will be present at the Project and equipped with a foam generation system for use as required.

Appropriate buffer areas have been established around facilities to prevent the spread of any fires, recognizing the overall intent to maintain a compact footprint to minimize environmental disturbance.

### **16.20.2 Contingency Planning and Mitigation**

Regular fire drills will occur to confirm that all workers are familiar with fire response procedures, as dictated within the environmental management system. All workers and visitors at the Project will receive an orientation which includes fire reporting and response procedures.

Emergency response measures will also be in place for a timely and effective response to fires.

### **16.20.3 Potential Effects**

Fires present a hazard to health and property, with the extent of concern dependant on the location of the fire, nearby facilities and its severity. Priorities for fire response will be to protect human health and to keep the fire from spreading. A trained Project fire response crew will provide the initial fire fighting response, with assistance from local municipal fire fighting services potentially being requested.

A major fire at the Project could pose a serious health and safety concern, and could cause property damage and operations interruptions. Environmental impacts will include a temporary reduction of air quality and localized terrestrial habitat loss. Longer-term environmental effects are not anticipated.

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## 16.21 Risk Assessment

Each credible malfunction and accident discussed above was assessed according to the likelihood of occurrence and consequence of occurrence. The credible malfunctions and accidents were given a ranking of their likelihood and consequence of occurrence of failure, with the ranking referring to a row or column to identify a cell within the risk matrix as shown in Table 16.21-1. As shown in the risk matrix, increased risk is associated with malfunctions and accidents having a greater likelihood of occurrence and increased level of consequence.

To be intuitive to the reader, a qualitative approach has been applied to the risk assessment. The likelihood of occurrence has been defined as:

- Rare: not expect to occur over the life of the mine (1/1,000 to 1/10,000 events per year)
- Unlikely: limited potential to occur over the life of the mine (1/100 to 1/1,000 events per year)
- Possible: may occur over the life of the mine (1/10 to 1/100 events per year)
- Likely: expected to occur of the life of the mine (less than 1/10 events per year)
- Almost certain: almost certain to occur over the life of the mine (1 to 1/10 events per year).

The consequences of the occurrence are important from the environment, social, health, economic and effects on Indigenous peoples perspective. The range of malfunctions and accidents considered and the varied sensitivities to the environment, social, economic and effects on Indigenous peoples do not lend themselves to a typical ranking criteria. As a result, a surrogate measure of environmental consequence was used with a combination of duration, extent and remediation costs was developed to consider effects to: the environment, social, economic and effect on Indigenous peoples. The consequence ranking was defined as:

- Insignificant:
  - Scale: localized effect (within the PA)
  - Effects and recovery: negligible to minimal environmental effects, as may be observed within the natural variation of the surrounding PA and anticipated recovery within weeks
  - Remediation: very low remediation costs in the \$10,000s range
- Minor:
  - Scale: localized effect (within the PA)
  - Effects and recovery: short-term environmental effects with anticipated recovery less than two years
  - Remediation: low remediation costs in the \$100,000s range

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- Moderate:
    - Scale: PA and immediate vicinity
    - Effects and recovery: medium-term environmental effects with anticipated recovery within the life of the Project between 2 to 26 years
    - Remediation: moderate remediation costs in the \$1,000,000s range
  - High:
    - Scale: regional and recoverable
    - Effects and recovery: long-term environmental effects with anticipated recovery greater than the life of the Project (i.e., greater than 26 years)
    - Remediation: high remediation costs in the \$10,000,000s range
  - Catastrophic:
    - Scale: regional and unrecoverable
    - Effects and recovery: unlikely to be completely remediated with very long-term environmental effects anticipated to be more than the life of the Project (i.e., greater than 26 years)
    - Remediation: very high remediation costs in the \$100,000,000s range.

Where a range of risk ratings could be variable, a conservative approach whereby the highest risk ranking associated with the credible occurrence was used. A summary of the residual ranking is presented in Table 16.21-2 and the results of the risk assessment are provided in Table 16.21-3. The results of the risk assessment indicate that as a result of the Project design and responses measures, the residual risk of a malfunction or accident were generally found to be very low or low.

**Table 16.21-1: Malfunctions and Accidents Risk Matrix**

Index		Likelihood				
		Rare	Unlikely	Possible	Likely	Almost Certain
Consequences	Catastrophic	Low	Moderate	High	Extreme	Extreme
	High	Low	Moderate	Moderate	High	Extreme
	Moderate	Very Low	Low	Moderate	High	High
	Minor	Very Low	Low	Low	Moderate	Moderate
	Insignificant	Very Low	Very Low	Low	Low	Low

**Table 16.21-2: Residual Risk Ranking**

Legend	Description
Very Low	Risks are considered negligible (i.e., effect would be within the natural variation of the environment and economics) and can be effectively managed through application of engineering standards and standard mitigation (e.g., best practices and management activities).
Low	Risks are low and considered acceptable (e.g., below thresholds and guidelines). Risk can be effectively managed through application of engineering standard and standard mitigation (e.g., best practices and management activities).
Moderate	Risks may be acceptable depending on the circumstances / nature of the risks. Additional appropriate risk mitigation may need to be implemented to reduce the risk.
High	Risks are high and likely unacceptable. Appropriate risk mitigation will be implemented to reduce the risk.
Extreme	Risk to the environment is imminent and unacceptable. Mitigation needs to be applied, and a long-term risk reduction plan developed and implemented.



**Table 16.21-3: Assessment of Risks from Credible Accidents and Malfunctions**

Malfunction / Accident	Primary Issue of Concern and Planned Mitigation Measures	Project Phase	Risk Ranking		
			Likelihood	Consequence	Ranking
LP Central pit slope failure	An uncontrolled release of rock and / or overburden to the open pit floor resulting in an increase in the open pit footprint. Design and operational safeguards will include engineering design to support safe slope and stability of the open pit and geotechnical monitoring of the pit walls.	Construction and Operations	Rare	Moderate	Very Low
Viggo pit slope failure	An uncontrolled release of rock and / or overburden to the open pit floor resulting in an increase in the open pit footprint. Design and operational safeguards will include engineering design to support safe slope and stability of the open pit and geotechnical monitoring of the pit walls.	Construction	Rare	Insignificant	Very Low
TMF slope failure	Failure of the TMF dam (with failure to the south including a cascade effect from the TMF pond) would result in the release of tailings solids, contact water and / or mine rock to the surrounding environment if not contained. Should the materials migrate towards the surrounding waterbodies and watercourses (Gullrock Lake to the north; Dixie Creek to the south), with potential effects to the surrounding terrestrial habitat, fish habitat and aquatic life. Design and operational safeguards will include best practices and engineering designs, compliance with regulatory requirements and geotechnical monitoring.	Operations and Closure	Rare	High	Low
Other Dam and Berm Stability	Failure of the water pond may result in dam failure and / or overtopping of a pond resulting in flooding, localized erosion and the potential release contact water that could affect the surrounding terrestrial environment. Failure or overtopping of a water pond dam could pose a risk to worker safety in the area. Design and operational safeguards will include best management practices and monitoring.	Construction and Operations	Rare	Moderate	Very Low



Malfunction / Accident	Primary Issue of Concern and Planned Mitigation Measures	Project Phase	Risk Ranking		
			Likelihood	Consequence	Ranking
Dixie Creek flood protection berm failure	Failure of the Dixie Creek flood protection berm may result in sloughing of the berm having a minor effect on the local terrestrial environment. In the event that failure of the berm coincides with an extreme flooding event, water from Dixie Creek may flow into LP Central pit, requiring treatment and potential loss of fish that enter the LP Central pit during the flood event. Design and operational safeguards will include best management practices, and the Project will maintain equipment need for an emergency repair of the berm.	Construction and Operations	Rare	Insignificant	Very Low
Pipeline failure	The worst case scenario for failure of pipeline at the Project considers the rupture or failure of a tailings pipeline and a release of tailings to the environment. The release of tailings is anticipated to be small as the pipelines will be equipped with automatic shutdown in the event of a pipeline failure and alarm systems and the spill is anticipated to remain within the secondary containment system. Design and operational safeguards will include best management practices, automatic shutoff, secondary containment and visual inspections.	Operations	Unlikely	Insignificant	Very Low
Ditch failure	Failure of a ditch resulting in flooding, localized erosion and the potential release of sediments or contact water that could affect the surrounding terrestrial and aquatic environments. Project ditches will be designed for best management practices.	Construction, Operations and Closure	Rare	Minor	Low
MRS and LGO slope failure	Failure of either the MRS or LGO are anticipated to be small and include sloughing and / or slumping. Effects are anticipated to be limited to the PA. Design and operational safeguards for the MRS and LGO will include best practices, engineering designs and monitoring.	Construction, Operations and Closure	Rare	Insignificant	Very Low



Malfunction / Accident	Primary Issue of Concern and Planned Mitigation Measures	Project Phase	Risk Ranking		
			Likelihood	Consequence	Ranking
OVB slope failure	Uncontrolled erosion from the surficial soil stockpile or overburden stockpiles may release additional soils to the perimeter ditches or a small sloughing of a side slopes. Effects are anticipated to be limited to the PA. Design and operational safeguards for the OVB will include best practices, engineering design and monitoring.	Construction and Operations	Unlikely	Insignificant	Very Low
Pit lake overtopping	Overtopping of the pit lake at closure could occur for a storm event greater than the design event and may result discharge to the environment. This is only a concern when the pit lake water level has risen, and the water quality pit lake does not meet regulatory requirements. During a storm event the discharge from the pit lake will be minor, due to the increased flows in the local tributaries associated with the storm event. Design and operational safeguards for the pit lake to prevent overtopping will include best practices, engineering design and monitoring.	Closure	Unlikely	Minor	Low
PAG MRS cover failure	Uncontrolled erosion of the PAG MRS cover may release additional soils and / or sediments to the environment and create pathways for oxygen and water that could adversely affect the water quality draining to LP Central pit during closure. Design and operational safeguards for the MRS cover will include best practices, engineering design and monitoring. Water quality monitoring will indicate if there are problems to allow for rehabilitation.	Closure	Unlikely	Moderate	Low
Explosives accident	Inadvertent detonation of explosives could result in local noise and vibration disturbance. Explosives will be supported by a larger company that is well versed in the Canadian explosives regulatory framework. All Project staff will be appropriately trained prior to working with explosives.	Construction and Operations	Rare	Minor	Very Low



Malfunction / Accident	Primary Issue of Concern and Planned Mitigation Measures	Project Phase	Risk Ranking		
			Likelihood	Consequence	Ranking
Vehicular accident (non-hazardous or non-hazardous materials release)	A vehicular accident involving transportation of fuel or chemicals that report to a waterbody resulting in affects to the environment. All shipments to the Project will be compliant with regulatory requirements and training, vehicles will be maintained regulatory, speed limits will be posted on site and adhered to and vehicles transporting materials will carry appropriate safety data sheets and basic emergency response equipment.	Construction, Operations and Closure	Rare	Minor	Very Low
Chemical release from contaminant or dispensing facility	In the event that a breach of the contaminant and / or dispensing facility, could surrounding soils could be affected. Chemicals will be transported, stored and handled in accordance with regulatory requirements. Best management practices will include using chemicals in contained areas, secondary containment systems, etc.	Construction, Operations and Closure	Rare	Moderate	Very Low
Project-related fires	A major fire at the Project could result in serious health safety risk, damage of property, and operating interruptions. To mitigate the risk of Project fires, all facilities will be designed to meet the applicable fire protection system requirements.	Construction, Operations and Closure	Unlikely	Insignificant	Very Low

## 16.22 Emergency Planning

Emergency planning was described for each credible accident and malfunction considered. Prior to construction of the Project, Great Bear Resources has developed an emergency response plan for current site activities and will update this plan to develop an emergency response plan for the accidents and malfunctions. The emergency response plan will provide a reference to the Project staff to support their actions and responses to a Project emergency. A draft spill and emergency response plan for the Project is provided in Appendix U-2.

The emergency response plan includes:

- Identification of emergency planning and document procedures to facilitate rapid responses in the event of an emergency including:
  - Identification of emergency zones and evacuation measures and areas
  - Spill response plan
  - Emergency details for shelter in place and evacuation
  - Routes for evacuation
  - Waste management plan and potential accident and malfunction related to waste management
- Outline of clear actions and responsibilities for Great Bear Project staff, this may include potential training requirements
- Communication of plans and contact numbers for Project staff, corporate staff regulatory contacts, Indigenous people and local communities, as may be required for each type of accident and malfunctions. This will include immediate urgent contact list and will incorporate:
  - Document modes of communication (e.g., phone, website, etc.)
  - Document longer-term communication plans
- Documentation of any staff training required to support the emergency response plan
- Identification of potential remediation efforts, contingency measures, materials and equipment that may be used to support an emergency response
- Identification of reporting requirements in alignment with corporate policies and regulatory requirements, as required.

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## 16.23 References

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