PART D – FEDERAL INFORMATION REQUIREMENTS

15.0 REQUIREMENTS FOR FEDERAL ENVIRONMENTAL ASSESSMENTS

This section of BRUNCO Aggregate Mine Project's Application for an Environmental Assessment Certificate (the Application) under the British Columbia *Environmental Assessment Act* (BCEAA) provides an overview of the federal requirement for the Proposed Project under the former *Canadian Environmental Assessment Act* (CEAA). When possible, other Parts of the Application are reference to avoid redundancy.

15.1 Introduction

As stated in Volume 1, Part A - Section 2.4 and 3.0, the BURNCO Aggregate Project is subject to a transitional review under former *Canadian Environmental Assessment Act* (CEAA 1992). Based on the Project Description submitted by the proponent, the Canadian Environmental Assessment Agency (the Agency) determined that the Proposed Project triggered a federal review under the former CEAA as it is anticipated to require authorizations from Fisheries and Oceans Canada (DFO). The CEA Agency also determined that the Proposed Project is subject to a comprehensive study under the former CEAA as the proposed production capacity of the Proposed Project exceeds the threshold (>1,000,000 tonnes per year or more) specified in the *Comprehensive Study List Regulations* (1994). The CEA Agency will exercise the powers and will perform the duties and functions of the responsible authority (RA) for the Proposed Project. A list of all federal agencies involved in the Proposed Project is provided in Volume 1, Part A - Section 3.0.

15.1.1 Environmental Changes and Effects

Under the former CEAA the "environment" is described as the components of the Earth, and includes:

a) Land, water and air, including all layers of the atmosphere;

b) All organic and inorganic matter and living organisms; and

c) The interacting natural systems that include components referred to in paragraphs (a) and (b).

Under the former CEAA (Section 2), "environmental effect" means, in respect to the Proposed Project:

a) any change that the project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the *Species at Risk Act*;

b) any effect of any change referred to in paragraph (a) on

   i) Health and socio-economic conditions;

   ii) Physical and cultural heritage;

   iii) The current use of lands and resources for traditional purposes by aboriginal persons; or

iv) Any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

c) Any change to the project that may be caused by the environment, whether any such change or effect occurs within or outside Canada.

The assessment of potential effects of the Proposed Project on the environmental are presented in Volume 2, Part B – Sections 5.1 through 9.2 of the Application. Volume 1, Part A - Section 2.0 and 3.0 of the Application summarizes the scope of the federal assessment for the Proposed Project and the potential environmental effects to be considered for the federal portion of the EA as per Section 16 (1) and (2) of the former CEAA as well as effects that all comprehensive study-type EAs must consider. Table 15-1 provides a cross-reference list to where the assessments of changes to the environment and their potential effects have been addressed in the Application for each effect identified in the federal scope of the assessment. All of the sections referenced are provided in Volume 2, Part B of the Application.

Table 15-1: Cross-reference list of where the federal scope of factors for Environmental Change and Effect is addressed in the Application

Federal Scope of Factors for Environmental Change and Potential Effect	Relevant VC(s)	Addressed in Section(s)
Any change that the Proposed Project may cause to the following Valued Components:		
Environmental conditions including climate	Air Quality Indicators; Climate Change; Noise Levels; and Marine Water and Sediment Quality.	5.7 5.8 9.2 5.2
Surface water quality and quantity	Surface Water Flow; and Surface Water Quality.	5.5
Groundwater quality	Groundwater Flow; and Groundwater Quality.	5.6
Hydrogeology	Groundwater Flow; and Surface Water Flow.	5.6 5.5
Air quality (dustfall and particulate matter)	Air Quality Indicators.	5.7
Soils, including terrain and geology	Earthquakes and Tsunamis; and Terrain Stability.	5.4
Mammals and their habitat	Marine Mammals; Roosevelt Elk; and Grizzly Bear.	5.2 5.3 5.3
Migratory birds, raptors, bats and their habitats	Marbled murrelet; Band-tailed pigeon; Northern goshawk; Common nighthawk; Sensitive Ecosystems; Ecosystems at Risk; and Plant Species at Risk.	5.3

Federal Scope of Factors for Environmental Change and Potential Effect	Relevant VC(s)	Addressed in Section(s)
Vegetation	Sensitive Ecosystems; Ecosystems at Risk; and Plant Species at Risk.	5.3
Fish populations and fish habitat	Anadromous Chum, Coho, Pink and Cutthroat Trout and their habitats; Resident Cutthroat Trout and their habitats; and Marine Fish.	5.1 5.2
Amphibians	Amphibian species at risk (e.g., red-legged frog, western toad, Pacific tailed frog).	5.3
Terrestrial invertebrates	Effects to terrestrial invertebrate species habitat that may be present in the Proposed Project Area will be covered in the assessment of other terrestrial VCs (e.g., Sensitive Ecosystems, Ecosystems at Risk, and Plant Species at Risk).	5.3
Rare and sensitive ecological communities including wetlands	Sensitive Ecosystems; Ecosystems at Risk; and Plant Species at Risk.	5.3
Species at risk, its critical habitat or residences as defined in the *Species at Risk Act*	Marbled murrelet T-1; Band-tailed pigeon SC-1; Northern goshawk T-1; Northern goshawk T-1; Western screech-owl SC-1; Amphibians: ▪ Red-legged frog SC-1; ▪ Western toad SC-1; ▪ Coastal tailed frog SC-1; Sensitive Ecosystems; Ecosystems at Risk; and Plant Species at Risk.	5.3
	Marine Mammals: ▪ Southern resident killer whale E-1; ▪ Harbour porpoise SC-1; ▪ Humpback whale T-1; ▪ Grey whale SC-1; and ▪ Steller sea lion SC-1. Marine Birds: ▪ Marbled murrelet T-1.	5.2
The effect of any change to the environment on:		
Human health (for example from changes to air quality, noise and vibration, water quality, light, country foods)	Air Quality Indicators; Noise Levels; Surface Water Quality; Groundwater Quality; People; Harvesting Fish and Wildlife; Visual Quality; and Marine Navigation.	5.7 9.2 5.5 5.6 9.1 7.3 7.4 7.2

Federal Scope of Factors for Environmental Change and Potential Effect	Relevant VC(s)	Addressed in Section(s)
Local and regional socio-economic conditions	Housing and Accommodation; and Emergency Services (including ambulance, hospital, fire, wildfire management, police, water rescue, oil spill services).	7.1
	Labour Market; Regional Economic Development; Local Government Revenue; and Real Estate.	6.1
	Forestry; Harvesting Fish and Wildlife; Recreation and Tourism; and Minerals and Industrial Development.	7.3
	Aboriginal and/or Treaty Rights; Aboriginal Interests; and Aboriginal Consultation.	Volume 3, Part C - Sections 10, 11, 12, and 13.
	Marine Navigation	7.2
Physical and cultural heritage	Visual Resources; and Heritage Resources.	7.4 8.1
	Aboriginal and/or Treaty Rights Aboriginal Interests Aboriginal Consultation	Volume 3, Part C - Sections 10, 11, 12, and 13.
Archaeological, historical, paleontological or architectural resources including structures and sites of significance	Visual Resources; and Heritage Resources.	7.4 8.1
	Aboriginal and/or Treaty Rights; Aboriginal Interests; and Aboriginal Consultation.	Volume 3, Part C - Sections 10, 11, 12, and 13.

a. SC = Special Concern, T = Threatened, 1 = listed under Schedule 1 of SARA

Table 15-2 outlines other federal requirements that are not necessarily linked to a Valued Component(s) but are addressed within another section of the EAC.

Table 15-2: Any change that the Proposed Project may cause to the following Other Factors and Relevant Matters

Federal Scope of Factors for Environmental Change and Potential Effect	Addressed in Section(s)
Current use of lands and resources for traditional purposes by Aboriginal persons.	Volume 3, Part C - Sections 10.0, 11.0, 12.0, and 13.0
The need for and purpose of the Proposed Project.	Volume 1, Part A - Section 2.0
Comments from the public that are received in accordance with the CEAA and regulations.	Volume 1, Part A – Section 3.1

The other federal requirements for the Proposed Project are addressed in the sections below:

- Change to the Proposed Project that may be caused by the environment (i.e., natural hazards, seismic events, extreme weather events) (Section 15.1.3);
- Environmental effects from accidents and malfunctions (Section 15.1.4);
- Measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the Proposed Project (Section 15.1.5);
- The significance of the environmental effects of the Proposed Project (Section 15.1.6);
- Cumulative environmental effects that are likely to result from the residual impacts from the Proposed Project (that remain after the implementation of mitigation measures) in combination with other projects or activities that have been or will be carried out (Section 15.1.7);
- The need for and the requirements of any follow-up program (Section 15.1.8);
- Alternative means of carrying out the Proposed Project (Section 15.1.9); and
- Capacity of renewable resources that are likely to be significantly affected by the Proposed Project to meet the needs of the present and those of the future (Section 15.1.10).

15.1.2 Species at Risk

Table 15-3 summarizes all wildlife and plant species listed under schedule 1 of the *Species at Risk Act* (SARA) and their critical habitats that have been identified in the assessment to potentially interact with the Proposed Project. In addition, Table 15-3 provides a cross-reference list to where the assessments of potential effects on federal species at risk have been addressed in the Application.

Table 15-3: Summary of Federal Species at Risk and their and Critical Habitat Identified in the Assessment to Potentially Interact with the Proposed Project

Species Common Name	Latin Name	SARA[a] Designation	Critical Habitat in Proposed Project Area, LSA or RSA	Addressed in Section(s)
Marine Resources				**Volume 2, Part B**
Southern resident killer whale	*Orcinus orca*	E-1	No. Critical habitat identified in the Southern Strait of Georgia from the mouth of the Fraser River to Haro Strait, Boundary Pass and the eastern portion of the Strait of Juan de Fuca.	5.2
Harbour porpoise	*Phocoena phocoena*	SC-1	No	5.2
Humpback whale	*Megaptera novaeangliae*	T-1[1]	No	5.2

Species Common Name	Latin Name	SARA[a] Designation	Critical Habitat in Proposed Project Area, LSA or RSA	Addressed in Section(s)
Grey whale	*Eschrichtius robustus*	SC-1	No	5.2
Steller sea lion	*Eumetopias jubatus*	SC-1	No	5.2
Terrestrial Wildlife and Vegetation				**Volume 2, Part B**
Coastal tailed frog	*Ascaphus truei*	SC-1	No	5.3
Northern red-legged frog	*Rana aurora*	SC-1	No	5.3
Great blue heron	*Ardea herodias fannini*	SC-1	No	5.3
Northern goshawk	*Accipiter gentilis laingi*	T-1	No	5.3
Marbled murrelet	*Brachyramphus marmoratus*	T-1	Critical nesting habitat has been identified within the LSA but not within the Proposed Project Area and no direct loss of critical marbled murrelet nesting habitat is expected. Critical marine habitat has not yet been identified.	5.3
Band-tailed pigeon	*Patagioenas fasciata*	SC-1	No	5.3
Western screech-owl	*Megascops kennicottii kennicottii*	SC-1	No	5.3
Common nighthawk	*Chordeiles minor*	T-1	No	5.3
Olive-sided flycatcher	*Contopus cooperi*	T-1	No	5.3

Notes: a. E= Endangered, T = Threatened, SC = Special Concern, 1 = Schedule 1.

15.1.3 Effects of the Environment on the Project

Under the former CEAA, environmental assessments are required to include an assessment of the effects of the environmental on the Proposed Project. There are several environmental factors that may affect the Proposed Project throughout its lifetime including:

- Natural seismic events (earthquakes and tsunamis);
- Wildfire;
- Geohazards (terrain stability, snow avalanche);
- Extreme weather events (heavy precipitation, flooding, drought, storms, snow levels); and
- Climate change.

The following section provides information on how these factors could affect the integrity of Proposed Project infrastructure.

The assessment considered:

- The likelihood of the potential event and the severity of the changes or effects;
- Mitigation measures, including design or construction strategies, planned to avoid or limit the likelihood and severity of the changes or effects; and
- The sensitivity of the Proposed Project to long-term climate variability and effects.

15.1.3.1 Methods

Representative historical and baseline wildfire, geotechnical related hazards (seismic and tsunami hazards), natural hazards (terrain stability related to land based mass movement events), weather and climate conditions of the Proposed Project Area were characterized through literature reviews and in some instances field studies. Baseline and historical wildfire and some extreme weather information is provided in the section below. Baseline reports for geohazards, terrain stability and avalanche, weather and climate conditions are provided in the following sections of the EAC:

- Volume 2, Part B – Section 5.8 – Climate Change;
- Volume 2, Part B – Section 5.4 – Geotechnical and Natural Hazards; and
- Volume 4, Part G – Section 22.0: Appendix 5.5-A – Surface Water Baseline Report.

Historical and baseline information was combined with Project design elements and mitigation tools to understand how the environment condition could cause adverse effects to the Proposed Project.

The likelihood of potential effects occurring was characterized for each environmental condition using appropriate quantitative or qualitative terms, with sufficient description of how conclusions were reached. The following scale was use, for the assessment of likelihood:

- Unlikely (0-50%); and
- Likely (51-100%).

Likelihood may be influenced by a variety of factors, such as the likelihood of the environmental condition and/or the likelihood of mitigation being successful.

The severity of the effect of the environmental condition on the Proposed Project was also characterized. The event was considered severe if it resulted in one or more of the following:

- Delay in Proposed Project construction of more than four weeks;
- Interruption in Proposed Project operations of more than two weeks;
- Damage to Proposed Project facilities that would not be technically or economically feasible to repair or that results in site personnel safety issues; and/or

- Endangering public and site personnel safety.

15.1.3.2 Seismic Hazards

Seismic hazards were assessed for their potential to cause damage or distress to Proposed Project facilities. This includes earthquake-related ground movements (seismic activity) that could lead to liquefaction, settlement, ground surface ruptures, submarine based landslide initiation, and tsunami generation (discussed in section below). Earthquakes could also increase the risk of landslides or rockslides on landslide prone terrain (unstable or potentially unstable terrain).

The Proposed Project Area is located within the zone of moderate to high earthquake risk of coastal British Columbia (BC), along the shoreline of Howe Sound, and within the McNab Creek watershed, with active and historic mass wasting events and potentially unstable terrain. Detailed descriptions of the geotechnical and associated terrain stability conditions are presented in Volume 2, Part B – Section 5.4.

Soils susceptible to liquefaction and potentially hazardous ground movements characteristically consist of loose granular uniformly and well graded, rounded to angular particles that can be densified during seismic shaking. To ascertain if and where these soils exist in the LSA, subsurface data from previous geotechnical and geophysical programs were reviewed, and are presented in greater detail in Volume 2, Part B – Section 5.4 of the assessment.

Geotechnical drilling and geophysical programs for the Proposed Project were originally undertaken to assess and evaluate aggregate suitability and potential production volumes. The drilling program consisted of boreholes (up to 50 m in depth) and test pits within the onshore Proposed Project Area. Data obtained from this program in conjunction with geophysical seismic refraction line data and visual mapping information indicated that the valley slopes are underlain by coarse textured and granular materials, with thickness of aggregate bearing units ranging from less than a few centimeters to several meters. Sand and sand and gravel units extending to depths in excess of 25 m were commonly encountered throughout much of the proposed aggregate pit area. In general, minimal silt and fine textured sediment was observed, with the exception of a discontinuous zone of silt encountered within the upper 10 m. Subsurface geologic data indicates that the upper portion of the gravel deposit is characterized as very coarse granular material.

The coarse textured and granular units appear to correspond to glaciofluvial, fluvial floodplain and fan-delta deposits. Under static loading conditions, these slopes, as well as constructed slopes are likely to remain stable. However, the surficial material could undergo liquefaction induced loss of strength when subjected to large earthquake events (BC Building Code 1 in 2,475 year design event criteria).

Major earthquake events could induce liquefaction of less dense fills and natural fluvial and fan-delta deposits, and introduce the risk of excessive settlements, lateral ground movements and slope instability within both the onshore and offshore areas of the Proposed Project Area. During these large earthquake events, slumping and instability of the submarine fan-delta front slopes, potentially unstable land based constructed slopes within or adjacent to the Proposed Project may occur.

15.1.3.3 Tsunami Hazards

Tsunami events have the potential to increase the extent of shoreline erosion and instability, cause damage or distress to Proposed Project facilities and endanger site personnel.

There is no evidence of large earthquakes or submarine landslides in the Strait of Georgia causing tsunamis. Historical underwater slope failures of deltas and large sudden landslides from steep slopes in Howe Sound have not produced noticeable tsunamis (Westmar 2005). Large tsunamigenic subduction events are estimated to occur about once every 500 years off the west coast of Vancouver Island (Clague 2001 in Westmar 2005). If a tsunami wave were to be generated off the west coast of Vancouver Island, it would likely be reduced in height from 15 m to 2 m by the time it reaches Lions Bay (approximately 16 km south of the Proposed Project Area). A 2 m wave height could result in damage to terminal structures if it coincided with higher high water or large tide events. The probability of a tsunami wave event occurring at the same time as a higher high water or large tide event is considered very low.

Mitigation Measures

Mitigative measures to prevent damage as a result of earthquake or tsunami events include:

- Proposed Project facilities will be built to the BC Building Code 1 in 2,475 year earthquake design criteria;
- Detailed, site-specific geotechnical investigations will be conducted to determine:
  - The need for ground improvement (e.g., soil densification);
  - Selection of suitable building locations to prevent excessive loadings or ground movement;
- Mitigation measures will be designed by qualified and experienced professionals; and
- Proposed Project facilities will be designed and constructed to achieve life safety and performance criteria of the National and BC Building Codes, or as otherwise required for the Proposed Project.

Based on the BC Building Code earthquake design criteria, the likelihood of an earthquake causing damage during the development and lifetime of the Proposed Project (19 Years) is estimated to be unlikely, considering the 2% probability of a major earthquake (e.g., a 1 in 2,475 year earthquake) occurrence in 50 years. The distance (>500 m) to the steep fan-delta slopes and the gently sloping surfaces between these slopes and Proposed Project facilities reduces the potential for damage and distress, limiting the severity of the effect.

The likelihood of seismic hazards (liquefaction induced loss of strength, settlements and lateral spreading) would likely only be associated with a large earthquake event, such as a BC Building Code 1 in 2,475 year event. Due to the low frequency of such large earthquake events, seismic hazards are considered unlikely to cause adverse effects to Proposed Project infrastructure. With the application of mitigation measures, damage resulting from earthquakes is not considered severe.

Based on the historical evidence of lack of tsunamis in Howe Sound and the magnitude study conducted by Westmar (2005) it is considered unlikely that a tsunamis would cause damage to Proposed Project facilities. If a tsunami did occur it would likely be about 2 m in height and unlikely to cause severe damage to Proposed Project facilities since the Proposed Project offices, processing facilities and area will be constructed at or above the existing ground surface elevation at 3 to 5 m chart datum and approximately 50 m inland from the shoreline.

15.1.3.4 Wildfire

In BC wildfires are caused by people and lightning. An average of 1,908 fires are reported annually, based on data for the period 2003 to 2012; of these 38.6% were caused by people and 61.4% were caused by lightning (Government of BC 2015). On the south coast, synoptic weather patterns are generally dominated by winds from the west (westerlies) which bring moist weather systems from the Pacific Ocean. The generally moist conditions of the south coast may reduce the risk of wildfires in Howe Sound relative to the Province as a whole.

Climate trend factors presented in Volume 2, Part B - Section 5.8 estimate an increase in annual rainfall and precipitation, potentially reducing the risk of wildfires overall; however, trends show potential increases in the number of high temperature events during the summer which may increase the risk of wildfires during the dry season. During the summer months thunderstorms are not infrequent and tend to travel north up the sound (Klock and Mullock 2001).

From historical fire records there have been approximately 38 fires on the sunshine coast between the Squamish-Lillooet and Sunshine Coast border and Port Mellon and within approximately 5 km of the coast since 1951. Ten of these have been within 4 km of the Proposed Project offices and welfare facilities; 6 of which were started by people and 4 of which were started by lightning. The majority of these fires have been less than 0.5 ha in size, with only three being larger fires of 2, 3 and 7 ha (Government of BC 2015).

Increased human activity in the area due to the Proposed Project may result in higher risks of fires. All Proposed Project activities will comply with the BC *Wildfire Act and Regulation* and the *Forest Fire Prevention and Suppression Regulation* (Government of BC 1995) under the *Forest Range Practices Act* (Government of BC 2002). Specific mitigation measures that may be used include:

- Management of the Proposed Project Area by maintaining good housekeeping practices, keeping spaces clean and free of equipment and materials that are not being used, and maintaining well-mowed access roads edges, keep vegetation cleared around Proposed Project structures;
- Management of fuels and oily materials to avoid spontaneous combustions particularly during the dry season;
- Reviewing fire hazard ratings throughout the summer dry season and managing activities that may increase the risk of a fire during high risk periods;
- Communicate with BC Ministry of Forest, Land and Natural Resource Operations Wildfire Branch to identify any wildfire threats particularly during the summer dry season;
- Development of a fire response plan (including an evacuation procedure). BURNCO's fire response plan is provided in Volume 4, Part G – Section 22.0: Appendix 16-B; and
- Maintaining and inspecting fire suppression equipment in good working order and training on-site staff in fire suppression.

With the application of mitigation measures, the likelihood and severity of potential effects associated with wildfires were characterized.

Wildfires in hot and dry conditions can spread quickly and have been noted close to the Proposed Project Area. If left unmitigated or if a wildfire spreads too quickly for site personnel or firefighters to manage, severe damage to Proposed Project facilities could result. This could result in delays in the Proposed Project schedule, the inability to repair the damages incurred or even endanger site personnel. With the application of mitigation, the likelihood of a wildfire causing severe damage to Proposed Project facilities or endangering site personnel is considered unlikely.

15.1.3.5 Terrain Stability Hazards

Terrain and terrain stability mapping and a comprehensive desktop study was conducted for the Proposed Project Area and surrounding environment in order to determine the likelihood and severity of potential effects on the Proposed Project related to terrain stability hazards (land based mass moments such as debris slides and debris flows and snow avalanches). The result of the mapping and desktop study are summarized here and presented in greater detail in Volume 2, Part B – Section 5.4 of the assessment.

Results from the terrain base mapping assessment generally correlate with existing surficial geology maps and information from previous site reports from the desktop study.

Interpretation of the terrain and terrain stability mapping were used to identify areas susceptible to unstable or potentially unstable terrain conditions where land based mass movement events such as debris slides, debris flows, rockslides, and snow avalanches could affect the Proposed Project Area and surrounding environment. The results showed that terrain stability conditions, both recent and historic, do not appear to directly affect the Proposed Project Area or facility locations.

Terrain stability Class IV and V, unstable and potentially unstable terrain, was identified in the regional area surrounding the Proposed Project Area. This type of terrain was mapped further up the valley and not directly connected to the Proposed Project Area or Proposed Project facilities. Naturally occurring snow avalanches, rockslides, debris slides and debris flows along valley sidewalls and tributary systems have historically occurred and are currently occurring in this area. Possible large scale debris flows may be initiated along valley tributary systems (i.e., Box Canyon Creek) and could reach McNab Creek, which is indirectly connected to the Proposed Project Area.

In the past (greater than ~ 200 years based on estimates of forest stand age), landslide-related debris has been deposited in McNab Creek and likely affected downstream conditions of the channel. If such an event occurs during the lifetime of the Proposed Project, it is possible that an influx of sediment could be transported downstream towards the LSA and may lead to shifting avulsion patterns, active erosion of unstable channel side banks and initiation of debris slides/flows or slumps along the channel side banks.

Landslides and snow avalanches can transport debris and sediment to creeks, increase water volumes, increase fine sediment transport and, in some cases, debris jams can cause outburst floods (as seen with debris flood events). Evidence of large debris flows and debris floods (including outburst floods) were not identified in this desktop assessment. There is a possibility that such events may have originated upstream of the Proposed Project Area; however, there does not appear to be any evidence of recent (i.e., <100 years ago based on estimated tree stand ages) scour or debris jams to indicate periodic debris flood events. Further investigation and assessment

will be required to evaluate the debris flood/debris flow potential and determine if engineering designs are required to mitigate potential hazards.

Forestry cut block related roads, both active and deactivated, have been subject to debris slides and ongoing ravelling. It does not appear that large debris slides or debris flows have been initiated, as the evidence shows that mass movement events run out along lower gradient slopes or at the base of steep slopes before entering a tributary or reaching the Proposed Project Area. Existing debris slides located along road fill and cut slopes are likely to continue to occur. These potential events can be managed with detailed site reviews and recommendations.

Mitigation Measures

In order to minimize the potential effects of terrain stability hazards on the Proposed Project the following mitigation measures will be implemented:

- Task specific detailed geotechnical investigations such as subsurface drilling and geophysics imaging will be conducted as input to detailed analyses and design of preventive and mitigative measures to minimize the potential effects of terrain stability hazards and those related to potential alterations of the subsurface environment or constructed slopes;
- Prepare approved engineered design and plans to achieve Proposed Project performance requirements and for mitigation, such as;
  - the National and British Columbia Building Codes (BCBC) will be followed, since the BCBC Code directive requires slope stability assessments to be addressed for the 1:2,475 year earthquake;
  - Aggregate Operators Best Management Practices Handbook for BC (Ministry of Energy and Mines 2002); and
  - Other relevant Best Management Practices (BMPs) such as APEGBC Guidelines for Legislated Landslide Assessments.
- Conduct appropriate onsite assessments to identify connectivity of site earth works to watercourses;
- Conduct onsite assessment of terrain stability conditions along watercourse banks and connectivity to planned site activities;
- Conduct appropriate debris flow/ flood hazard and effect assessments including hydrotechnical assessments that would include peak discharge and sediment concentration estimates; and
- Prepare engineered designs and plans by qualified and experienced professionals for mitigation (e.g. diversion and catchment structures), as required.

With the application of mitigation measures, the likelihood and severity of potential effects associated with terrain were characterized.

Although snow avalanches, debris slides, and rock slides are common in the McNab Creek watershed, they are not expected to directly affect the Proposed Project facilities. Proposed Project facilities are located on level to undulating valley bottom terrain, outside of areas identified as being unstable or potentially unstable, and are not located in landslides or snow avalanche run out zones. Due to this, likelihood of land based mass movement events are considered unlikely to impact Proposed Project facilities and potential damage to Proposed Project facilities is not considered severe.

15.1.3.6 Extreme Weather Events

Weather is the short-term (day-to-day or week-to-week) state of the atmosphere and its variation. Weather represents a set of meteorological elements in a given atmosphere at a given time, and usually includes the following elements:

- Air temperature;
- Precipitation;
- Snow depth;
- Solar radiation;
- Atmospheric pressure; and
- Wind speed and direction.

Extreme weather events will require the Proponent to apply adaptive management techniques throughout the Proposed Project life and after closure to mitigate potential impacts to the Proposed Project and the environment. The sections below described the potential extreme weather events and suggest adaptive management technique that could be applied.

Extreme weather events assessed for the Proposed Project include:

- Snow Levels
- Heavy Precipitation – Flooding
- Drought

The climate of the McNab valley is characterized by heavy precipitation from late-fall to winter and the dry, warm summers with occasional rainy periods. In the winter, most of the precipitation falls as rain at the lower altitudes, with some falling as snow at higher elevations. Historical data collected near Gibsons (for the 40 year period from 1971 through 2010) provides an annual average precipitation of 1337.8 mm with the highest monthly average precipitation (493.1 mm) occurring in the winter months. The climate baseline setting of the Proposed Project Area, including the characterization of temperature, precipitation, evapotranspiration and evaporation is described in Volume 2, Part B - Section 5.8 and in Volume 4, Part G – Section 22.0: Appendix 5.5-A.

15.1.3.6.1 Snow Levels

In the Proposed Project Area there may be some winters that produce above average snow falls and others that are mild with less snow and heavy rains. Due to the relatively low elevations of influence of coastal climatic conditions in the Proposed Project Area, there is a low likelihood of heavy snow falls and accumulation causing adverse effects in the Proposed Project Area to Proposed Project facilities. In the event that the Proposed Project Area experiences winters with above average snow falls it could take greater effort to keep access roads safe and passable, and potentially increase fuel and maintenance costs. The severity of a heavy snow fall in the Proposed Project Area events is considered low. High precipitation levels in the region combined with the Coast Mountains physiography support deep snowpacks at high elevations outside the Proposed Project Area and may lead to increased avalanche risks which are discussed above.

Heavy precipitation events in the Proposed Project Area could result in extreme high flows in McNab Creek which, if large enough, could reach the pit lake and result in overflows and potentially cause flooding of down gradient Proposed Project facilities (i.e., substation, processing area, and offices; Figure 2-1 in Volume 1, Part A – Section 2.0). In order to characterize the likelihood and severity of extreme high flows in McNab Creek, a rainfall-runoff model (HEC-HMS[2]) was used to determine 200-year high flows in McNab Creek using 200-year extreme precipitation estimates (see Volume 4, Part G – Section 22.0: Appendix 5.5-A). The estimated 200-year peak flow in McNab Creek was checked against the estimated extreme high flows from nearby regional hydrometric stations with similar watershed characteristics; Chapman Creek above Sechelt Diversion Station (#08GA060) and Clowhom River near Clowhom Lake Station (#08GB013). The flood profile was estimated using one-dimensional hydraulic model HEC-RAS (developed by the US Army Corp of Engineers), details of the analysis is provided in Volume 4, Part G – Section 22.0: Appendix 5.5-A and 5.4-C.

15.1.3.6.2 Precipitation

The result of the model indicated that, in the absence of a dyke or other flood control measures, the estimated design flood would result in overland flow within the Proposed Project Area. Specifically, flooding would occur at the right bank of McNab Creek on the north side of the Proposed Project Area over approximately 50 m (Volume 4, Part G – Section 22.0: Appendix 5.4-C, Figure 2). The modelled cross-sectional average flow velocity in McNab Creek along the northern side of the Proposed Project Area was in the range of 3.3 m/s and the max depth was predicted to be 3.3 m above the bed of the channel. The model results suggested that the flood profile would not reach the elevation of the ground surface in the Proposed Project Area along the east side of the Proposed Project Area.

In order to mitigate the potential for extreme high flows of McNab creek overwhelming the pit lake, a setback dyke is proposed to be constructed along the north side of the pit that can withstand the 200-year extreme high flow event in McNab Creek. The McNab Creek Flood Protection Dyke will be designed in accordance with the provincial flood protection design guidelines, current public design standards and the Provincial Dike Construction Guidelines

(APEGBC 2012; Ministry of Water, Land & Air Protection 2003). A conceptual alignment and design of the dyke is provided in Volume 1, Part A – Section 2.0: Figure 2-7 and is summarized below:

- Approximately 750 m long;
- A crest approximately 4 m wide with 2H:1V sideslopes;
- Setback from McNab Creek by approximately 35 m; and
- Minimum crest elevation with a 0.6 m freeboard above the modelled 1 in 200-year flood water surface elevation.

The dyke would be built over an area that was previously impacted logging and an old logging road and is not expected to impact any riparian areas or watercourses. Provisions for the operations and maintenance of the dyke after the closure of the Proposed Project will be provided in the Reclamation and Effective Closure Plan (See Volume 4, Part G - Section 22.0: Appendix 4). With the implementation of the dyke, the likelihood of flooding due to the extreme flows from McNab Creek are considered low. Potential effects could be flooding of the Proposed Project processing Area, offices or substation resulting in potential damage to buildings or power being lost for a short period of time, the event is considered not severe.

15.1.3.6.3 Drought

Drought involves the deficiency of precipitation over an extended period of time that can result in water shortages. Drought can result in extreme low flows to watercourses. Potential effect of extreme low flows is discussed in detail in Volume 2, Part B - Section 5.5.

In addition to extreme low flows, hot and dry conditions may require increased vigilance to guard against wildfires caused by lightning strikes or anthropogenic sources. During this time water shortage may further complicate fighting against wildfires during drought conditions. Adaptive management strategies will be required to manage wildfire without the use of the groundwater well or stream water (from water licence in Harlequin Creek). This may include the use of an emergency marine water pump during drought conditions to fight on-site fires. The potential effects of wildfire effects on the Proposed Project are discussed above.

Water shortages could also reduce the amount of water available as make-up wash water that is necessary for processing. Should water become that scarce, adaptive management strategies would be implemented. This may include reduced processing of washed products during periods of drought. With the implementation of project design elements (e.g. processing of aggregate includes the recycling of wash water) and adaptive management strategies, the potential effects resulting from a drought event on the Proposed Project are considered not severe.

Under predicted climate change conditions, the frequency of a drought conditions will likely increase over the duration of the Proposed Project (see Volume 2, part B – Section 5.8.5.1). However, specific quantified estimates of how climate change may affect drought (e.g., number of events, likelihood of occurrence, magnitude) over the life of the project (relative near-term of the next approximately twenty years) cannot be predicted.

15.1.3.7 Climate Change

There is a potential for climate change to affect the Proposed Project. Changes to rainfall, temperature and extreme events (e.g., storms) that may affect the operation of infrastructure associated with the Proposed Project. Given the coastal location of the Proposed Project, how potential future sea level rise as a result of changing climate may affect the Proposed Project has also been considered. A qualitative assessment of how the changing climate may affect the Proposed Project aspects is provided in Volume 2, Part B - Section 5.8.

15.1.4 Accidents and Malfunctions

The following potential accidents, malfunctions, and unplanned events were considered during the effects assessment:

- Geohazards: Factors of safety for the side slopes are considered in the Volume 4, Part G – Section 22.0: Appendix 5.4-Q where sloughing or slope failure could cause retrogression of the pit crest to a degree that could impact on the safety of mine personnel;
- Power outages;
- Accidental discharge of sediment into watercourses from erosion/loss of containment of aggregate pit;
- Accidental Hazardous Material Spills (e.g., motor vehicle accidents or other accidents causing land-based or marine based spills are considered); and
- Vessel and barge accidents causing aggregate spill (e.g., from barge capsizing).

Wildfire and flooding causing loss of containment of the aggregate pit were considered part of the assessment of the environment on the Proposed Project and are discussed above in Section 15.1.3.

The assessment considered:

- That the event could occur in any phase of the Proposed Project;
- The likelihood and circumstances under which these events could occur;
- The environmental effects that may result from such events, assuming contingency plans are not fully effective; and
- How each event would be managed or mitigated.

Accidents and malfunctions were considered throughout the effects assessment (Part B). Table 15-4 summarizes the likelihood, circumstance and mitigation related to each accident and malfunction and provides a cross referenced list of where the each is addressed in Part B of the Application. Table 15-5 summarizes the environmental effect on relevant VCs related to each accident and malfunction and provides a cross referenced list of where the each is addressed in Part B of the Application.

Table 15-4: Summary of Potential Accidents and Malfunctions as result of the Project

Accidents and Malfunction	Likelihood and Circumstance
Geohazards: 1. Earthquake-related ground movements 2. Land based mass movement events	1. Low likelihood of occurrence. Increasing earthquake-related ground movements, increasing shoreline erosion and offshore debris deposition during a tsunami event (generated by landslide and/or earthquake activity), and initiation of submarine landslides from Proposed Project activities. 2. Low likelihood of occurrence. Initiation of land based mass movement events or increasing the potential for unstable conditions to arise as a result of Proposed Project activities (e.g., landslides, snow avalanches, debris flows, debris floods)
Power Outages	Moderate likelihood of occurrence. Mitigation includes presence of backup generators on-site and emergency lighting. No environmental effects are anticipated as a result of a power outage.
Accidental discharge of sediment or fines into watercourses: 1. From loss of containment of aggregate pit 2. Exposing of fines to the north of the pit lake to chemical dissolution	1. Low likelihood of occurrence. Major release of sediments could occur if containment of the aggregate pit is lost. 2. Low likelihood of occurrence. Exposing of fines to the north of the pit lake to chemical dissolution if they were not sufficiently reclaimed in a progressive manner. Failure of the overflow structure was also considered with respect to groundwater flows.
Accidental Hazardous Material Spills – Land based	Low likelihood of occurrence. Deleterious substances may be introduced to environmentally sensitive ecosystems as a result of an accidental spill. Spills may occur from any mechanical equipment, during refuelling, and during transportation of fuels and solid waste.
Accidental Hazardous Material Spills – Marine based	Low likelihood of occurrence. Releases of a hazardous material could occur due to equipment malfunction or improper maintenance, containment breach or storm water runoff. Major accidents could result in the release of larger quantities of hazardous materials into the marine environment under the following circumstances: vessel sinking, vessel running aground or collision with another vessel or shoreline facility (terminal structures), fuel truck rollover near the foreshore environment, fire, and/or explosion.
Vessel and barge accidents (e.g. barge capsizing). – Aggregate Spill	Low likelihood of occurrence. Aggregate spill could occur during barge loading or loss of barge containment during shipping due to an accident.

Table 15-5: Summary of Potential Environmental Effects as a Result of Project Related Accidents and Malfunctions

Accident and Malfunction	Relevant VC(s)	Federal Scope of Factors	Potential Effect	Key Mitigation Measures	Residual Effect	Significance Analysis of Residual Effect	Sections Addressed in Application
Accidental discharge of sediment or fines into watercourses	Groundwater Quality	Groundwater quality	Changes to Groundwater Quality as a result of: ▪ Chemical dissolution of fines that have not be reclaimed appropriately; and ▪ Loss of containment of aggregate pit.	▪ Progressive reclamation; ▪ Adherence to the Reclamation and Effective Closure Plan (provided in Volume 4, Part G – Section 22.0: Appendix 4); and ▪ Implementation of a groundwater monitoring program including monitoring wells and adaptive management techniques (comparing monitoring data with assessment predictions).	Changes to Groundwater Quality	Negligible – Not Significant	5.6
Loss of containment of aggregate pit – failure of overflow structures	Groundwater Flow	Hydrogeology	Changes in Groundwater Flow	▪ Implementation of a groundwater monitoring program including monitoring wells to monitor groundwater levels (up-stream and down-stream of the open pit as well as levels in the pit lake) ▪ Implementing adaptive management techniques (comparing monitoring data with assessment predictions). Data will be reviewed and compared to the predictions of groundwater quantities. If observed water flows are less than predicted, than corrective action will be undertaken; and ▪ Construction of an overflow structure at an elevation of about 5.2 m to maintain baseline groundwater levels.	Reductions in Groundwater Quantity	Negligible – Not Significant	5.6
Geohazards	Earthquakes and Tsunamis	Soils, including terrain and geology	Increased ground movement during earthquake event.	▪ Conduct detailed geotechnical subsurface investigations; ▪ Prepare approved engineered design and plans to achieve Proposed Project engineering design and performance requirements and for mitigation, as required by provincial and federal accepted standards; and ▪ Monitor performance during operations and update or modify designs if required to achieve Proposed Project performance requirements and for mitigation, as required.	Post mitigation Proposed Project-related increase in earthquake-related Ground Movements (liquefaction, settlement, lateral movement, rupture)	Not Significant	5.4
Geohazards	Earthquakes and Tsunamis	Soils, including terrain and geology	Increased shoreline erosion and offshore debris deposition during earthquake or landslide generated tsunami.	▪ Conduct detailed geotechnical subsurface investigations; ▪ Prepare approved engineered design and plans to achieve Proposed Project engineering design and performance requirements and for mitigation, as required by provincial and federal accepted standards; and ▪ Monitor performance during operations and update or modify designs if required to achieve Proposed Project performance requirements and for mitigation, as required.	Post mitigation Proposed Project-related increase in earthquake or tsunami related Shoreline Erosion and Debris Deposition	Negligible- Not Significant	5.4
Geohazards	Earthquakes and Tsunamis	Soils, including terrain and geology	Initiation of submarine landslides	▪ Conduct detailed geotechnical subsurface investigations; ▪ Prepare approved engineered design and plans to achieve Proposed Project engineering design and performance requirements and for mitigation, as required by provincial and federal accepted standards; and ▪ Monitor performance during operations and update or modify designs if required to achieve Proposed Project performance requirements and for mitigation, as required.	Post mitigation Proposed Project-related initiation of Submarine Landslides	Negligible- Not Significant	5.4
Geohazards	Terrain Stability	Soils, including terrain and geology	Land-based Mass Movement - Terrain Stability: changes to slope morphology or drainage conditions.	▪ Conduct appropriate detailed investigations of terrain stability and geotechnical conditions; ▪ Prepare approved engineered design and plans to achieve Proposed Project performance requirements and for mitigation, as required; ▪ Conduct assessments to identify connectivity of site earth works to watercourses; ▪ Conduct site assessment of terrain stability conditions and soil erosion plans based on stockpile location and earth works; ▪ For potential debris flow / flood catchment structures, conduct appropriate decommissioning or ongoing monitoring of structures where warranted; and ▪ As required, prepare engineered designs and plans by qualified and experienced professionals for removal or ongoing mitigation of site.	Proposed Project initiation of Land-based Mass Movement	Negligible- Not Significant	5.4

Accident and Malfunction	Relevant VC(s)	Federal Scope of Factors	Potential Effect	Key Mitigation Measures	Residual Effect	Significance Analysis of Residual Effect	Sections Addressed in Application
Geohazards	Terrain Stability	Soils, including terrain and geology	Land-based Mass Movement - Terrain Stability: changes to debris flow-debris flood transport or run out zones.	■ Conduct onsite assessment of terrain stability conditions along watercourse banks and connectivity to planned site activities; ■ Conduct appropriate debris flow/ flood hazard and effect assessments including hydrotechnical assessments that would include peak discharge and sediment concentration estimates; ■ Prepare engineered designs and plans by qualified and experienced professionals for mitigation (e.g., diversion and catchment structures), as required; ■ Conduct recommended monitoring and ongoing debris flow/ flood hazard assessments of watercourse side banks and drainage of changing site conditions were warranted. ■ Conduct site assessment of terrain stability conditions and soil erosion plans based on stockpile location and earth works; ■ For potential debris flow / flood catchment structures, conduct appropriate decommissioning or ongoing monitoring of structures where warranted; and ■ As required, prepare engineered designs and plans by qualified and experienced professionals for removal or ongoing mitigation of site.	Proposed Project initiation of Land-based Mass Movement	Negligible- Not Significant	5.4
Accidental Hazardous Material Spills – Land based	Amphibian Species at Risk	Amphibians Rare and sensitive ecological communities including wetlands Species at risk, its critical habitat or residences as defined in the *Species at Risk Act*	Indirect habitat loss (Potential for alteration of habitat quality)	■ Implementation of a Spill Prevention and Emergency Response Plan; ■ Refueling will not be done adjacent to environmental buffers or waterways; ■ Avoid clearing during sensitive amphibian breeding and migration/ dispersal windows; ■ Implementation of BMPs for Amphibians and Reptiles in Urban and Rural Environments in BC; ■ Construction activities will be restricted to daylight hours;	Indirect habitat loss (Potential for alteration of habitat quality)	Not Significant	5.3
Accidental discharge of sediment into watercourses	Amphibian Species at Risk	Amphibians Rare and sensitive ecological communities including wetlands Species at risk, its critical habitat or residences as defined in the *Species at Risk Act*	Indirect habitat loss (Potential for alteration of habitat quality)	■ Implementation of an Erosion and Sediment Control Plan (provided in Volume 4, Part G – Section 22.0: Appendix 3); ■ Avoid clearing during sensitive amphibian breeding and migration/ dispersal windows; ■ Implementation of BMPs for Amphibians and Reptiles in Urban and Rural Environments in BC; ■ Where feasible, buffers of undisturbed native vegetation, a minimum of 30 m in width, will be maintained around Ponds 1, 3, 4, 6, and 7 as well as ephemeral streams; and ■ Construction activities will be restricted to daylight hours.		Not Significant	5.3
Accidental Hazardous Material Spills – Land based	Environmentally Sensitive Ecosystems Ecosystems at Risk Plant Species at Risk	Vegetation Rare and sensitive ecological communities including wetlands	Introduction of Deleterious Substances (Potential mortality)	■ Implementation of a Spill Prevention and Emergency Response Plan.	Introduction of Deleterious Substances (Potential mortality)	Negligible	5.3

Accident and Malfunction	Relevant VC(s)	Federal Scope of Factors	Potential Effect	Key Mitigation Measures	Residual Effect	Significance Analysis of Residual Effect	Sections Addressed in Application
Accidental Hazardous Material Spills – Land and Marine based	Heritage Resources	Physical and cultural heritage Archaeological, historical, paleontological or architectural resources including structures and sites of significance	Changes to heritage resources	▪ Development of an appropriate management strategy in consultation with the Archaeology Branch, the *Sḵwx̱wú7mesh* (Squamish) First Nation, and the Tsleil-Waututh Nation in the event of impact to heritage resources; ▪ Tide tables, current tables and weather reports will be consulted prior to commencing work to avoid adverse environmental interactions such as vessel grounding.	Changes to heritage resources	Not Significant	8.1
Aggregate Spills	Marine Benthic Communities	Fish populations and fish habitat	Change in habitat quality (i.e. change in sediment composition or reduced water quality) due to accidental release of aggregate materials. Potential mortality from smothering / crushing due to accidental release of aggregate materials.	▪ Marine contractors will comply with regulations of *Canada Shipping Act* governing navigation safety; ▪ Implementation of Workplace Hazardous Materials Information Systems (WHMIS); ▪ Transport and handling of any hazardous material will be in compliance with the *Transportation of Dangerous Goods Act*; ▪ The proponent will ensure that the vessels and machinery will arrive on site in a clean/good condition and are to be maintained free of fluid leaks and invasive species; ▪ Proper storage and transfer of fuel tanks, lubricants and chemical storage containers and components; ▪ Vessels and equipment will be inspected daily. The logged records of inspections will be maintained; ▪ No refuelling and washing of machinery or equipment will take place at the marine foreshore; ▪ Implementation of a Spill Prevention and Emergency Response Plan and Emergency Response Plan; ▪ Tide tables, current tables and weather reports will be consulted prior to commencing work to avoid adverse environmental interactions such as vessel grounding. Works at the foreshore will not take place during times when adverse environmental conditions are present; ▪ General waste materials are to be contained on-site for appropriate off-site disposal; ▪ In a case of a spill of a toxic or deleterious material, all efforts will be made to contain and recover the substance and act according to the Spill Prevention and Emergency Response Plan and procedures that will encompass different scenarios of potential spills. The level of response will depend on the circumstances of the spill. ▪ In a case of reportable spill, the closest Canadian Coast Guard Station (1-800-889-8852) or Emergency Coordination Centre (1-800-OILS-911) will be contacted. The Spill Prevention and Emergency Response Plan will list the amounts and types of reportable substances.	Change in habitat quality Potential mortality	Negligible	5.2
Accidental Hazardous Material Spills – Marine based	Marine Benthic Communities	Fish populations and fish habitat	Change in habitat quality (i.e. reduced water quality) due to release of toxic and hazardous materials. Potential mortality from toxic / chronic effects due to interaction with hazardous material spill.		Change in habitat quality Potential mortality	Not Significant	5.2
Accidental Hazardous Material Spills – Marine based	Marine Fish	Fish populations and fish habitat	Change in habitat quality (i.e. reduced water quality) due to release of toxic and hazardous materials. Mortality from toxic / chronic effects due to interaction with hazardous material spill.		Change in habitat quality Potential mortality	Not Significant	5.2
Accidental Hazardous Material Spills – Marine based	Marine Mammals	Mammals and their habitat Species at risk, its critical habitat or residences as defined in the *Species at Risk Act*	Change in habitat quality (i.e. reduced water quality) due to release of toxic and hazardous materials. Potential mortality (chronic / toxic effects) due to direct interaction with hazardous materials. Potential reduced prey availability as a result of reduced water quality due to release of toxic and hazardous materials.		Change in habitat quality Potential mortality Reduced Prey availability	Not Significant	5.2

Accident and Malfunction	Relevant VC(s)	Federal Scope of Factors	Potential Effect	Key Mitigation Measures	Residual Effect	Significance Analysis of Residual Effect	Sections Addressed in Application
Accidental Hazardous Material Spills – Marine based	Marine Birds	Migratory birds, raptors, bats and their habitats	Change in habitat quality (i.e. reduced water quality) due to release of toxic and hazardous materials. Potential mortality (chronic / toxic effects) due to direct interaction with hazardous materials. Potential reduced prey availability as a result of reduced water quality due to release of toxic and hazardous materials.		Change in habitat quality Potential mortality Reduced Prey availability	Not Significant	5.2
Accidental Hazardous Material Spills – Land based	Surface Water Quality Aquatic Health	Surface water quality	Changes to Water Quality	■ Implementation of Materials Storage, Handling and Waste Management Plan(s); ■ Implementation of Spill Prevention and Emergency Response Plan(s); ■ Environmental Construction Specifications (ECS) will be developed as performance-based standards and recommendations to be met during the construction and operation of the Proposed Project; ■ All machinery used on-site would be in good repair and power washed prior to its arrival onsite; ■ Appropriate measures will be taken to prevent any fuels, lubricants or construction wastes from entering any watercourse or water supply well; ■ No discharge of wash water to the ground or to surface watercourses at the site from trucks and equipment related to Proposed Project activities; ■ Hazardous materials will be stored and handled to avoid loss and allow containment and recovery in the event of a spill; ■ Maintenance operations will be confined to specific areas such that spills can be contained and collected before contaminants reach any watercourses; ■ Designated areas will be identified for the transfer and limited temporary storage of hazardous materials and wastes, as required; ■ Hazardous wastes and hazards materials not in active use would be removed promptly from the site; ■ Proper Workplace Hazardous Material Information Systems (WHMIS) labels and Material Safety Data Sheets (MSDS) will be maintained for any hazardous materials used and stored on site; ■ Any Special Waste generated will be disposed of in compliance with the British Columbia Special Waste Regulations; and ■ All equipment and the designated hazardous material storage site(s) will be inspected daily.	Changes in Water Quality from accidental spills of hazardous materials.	Negligible - Not Significant	5.5

Accident and Malfunction	Relevant VC(s)	Federal Scope of Factors	Potential Effect	Key Mitigation Measures	Residual Effect	Significance Analysis of Residual Effect	Sections Addressed in Application
Accidental discharge of sediment into watercourses	Surface Water Quality Aquatic Health	Surface water quality	Changes to Water Quality	▪ Implementation of a Sediment, Erosion and Drainage Control Plans; ▪ No work will be undertaken within riparian areas (i.e. 15 m from top of bank) of any existing stream or watercourse except in favorable weather and low water conditions; ▪ Erosion prevention measures, such as silt fences, filter fabric, straw bales, gravel filter dykes, sedimentation ponds, or other preventative measures implemented will be monitored, maintained and repaired as required; ▪ Construction wastes, overburden, soil, or any other substances potentially deleterious to riparian or aquatic habitat will be stored and/or disposed of in such a manner as to prevent entry to riparian areas, or any streams or watercourses; ▪ No materials will be stockpiled within 15 m of the top of bank of any watercourse. Soil stockpiles will be dyked, sloped and seeded or tarped to minimize erosion. If temporary stockpiles are constructed, then appropriate erosion and sediment control mitigation measures will be installed and regularly maintained until these stockpiles are decommissioned or seeded; ▪ Vegetation cover will be maintained wherever possible. Buffer strips will be left around watercourses; ▪ Surface drains and ditches constructed as part of the Proposed Project will be graded and vegetated or otherwise stabilized by placing biodegradable, straw or coconut fiber erosion control blankets along the channel; ▪ Disturbed areas adjacent to watercourses will be re-vegetated as soon as possible; and ▪ Water quality will be monitored for turbidity in adherence to the BC water quality guidelines for the protection of aquatic life.	Changes in Water Quality from Increases in Suspended Sediments	Negligible - Not Significant	5.5
Toxic and Hazardous Material Spills– Land based	Anadromous Chum, Coho, Pink Salmon and Anadromous and Resident Cutthroat Trout and their habitats	Fish populations and fish habitat	Change in habitat quality (i.e. reduced water quality) due to release of toxic and hazardous materials. Mortality from toxic / chronic effects due to interaction with hazardous material spill.	▪ Implementation of a Fisheries Habitat Protection and Mitigation Plan; ▪ Implementation of a Pile Construction Management Plan; ▪ Implementation of an Erosion and Sediment Control Plans; ▪ Implementation of a Spill Prevention and Emergency Response Plans; ▪ All machinery should be operated on land above the HWM in a manner that minimizes disturbance to the banks of the watercourse; ▪ Machinery should arrive on site in clean condition and be maintained free of leaks; ▪ Vehicles should be washed, refueled, and serviced at locations away from the water; ▪ pH should be monitored in surrounding waterbodies during concrete pouring. ▪ BMPs should be implemented during setting, mixing, and pouring of concrete to ensure activities meet requirements of applicable legislation; ▪ Pre-cast concrete structures whenever possible; ▪ Keep carbon dioxide tank with regulator, hose, and gas diffuser readily available during concrete works; and ▪ Isolation of curing area to prevent escapement of alkaline run-off.	Change in habitat quality Potential mortality	Negligible- Not Significant	5.1
Loss of containment of aggregate pit – failure of overflow structures	Anadromous Chum, Coho, Pink Salmon and Anadromous and Resident Cutthroat Trout and their habitats	Fish populations and fish habitat	Change in habitat quality due to accidental release of water and sediment as a result of loss of containment of the aggregate pit. Potential mortality from smothering / crushing due to release of sediment.	▪ Implementation of a Fisheries Habitat Protection and Mitigation Plan; ▪ Implementation of an Erosion and Sediment Control Plans; ▪ Implementation of an Emergency Response Plan; ▪ Implementation of an environmental effects monitoring program; and ▪ Implementing adaptive management techniques (comparing monitoring data with assessment predictions). If observed habitat values are less than predicted, then corrective action will be undertaken.	Change in habitat quality Potential mortality	Negligible- Not Significant	5.1

15.1.5 Mitigation Measures

As part of the federal requirements for the EAC Application/EIS in accordance with the former CEA Act, the proponent must identify mitigation measures that are technically and economically feasible that would avoid and limit the environmental effects described in Volume 2, Part B - Sections 5.1 through 9.2.

Part B Section 5.1 through 9.3 provides a detailed discussion regarding the suggested mitigation measures related to each environmental effect for each VC. Table 15-6 to Table 15-23 provides a summary of all mitigation measures that have been addressed in the EAC Application/EIS, including a description of the effectiveness of the mitigation and how it can be monitored with linkages to the Environmental Monitoring and Follow-up Program presented in Section 16.0 and 17.0, where appropriate.

All mitigation measures described in Table 15-6 to Table 15-23 are considered technically and economically feasible and were selected based on their suitability for the Proposed Project activities and the appropriateness for application at the Proposed Project site.

The mitigation strategy outlined below forms the basis for the commitments for the Proposed Project. A detailed list of all commitments of the Proposed Project are provided in Volume 3, Part F – Section 19.0.

Table 15-6: Summary of Proposed Measures for Mitigating Potential Effects to Fisheries and Freshwater Habitat

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Construction					
Anadromous Chum, Coho, Pink Salmon and Anadromous and Resident Cutthroat Trout and their habitats	Fish populations and fish habitat	Changes to Surface Water Quality – Suspended Sediments	▪ Disturbed areas should be vegetated as soon as possible and where possible by planting and seeding with native trees, shrubs, and grasses. ▪ Disturbed areas adjacent to watercourses should be covered with mulch for sediment control. ▪ Placement of erosion control measures to keep soil in place. ▪ Sediment and erosion control measures should be maintained until re-vegetation is achieved.	Predicted effectiveness of proposed mitigation is expected to be high due to: • Commitment for environmental monitoring to be conducted by a qualified EM; • Adherence to component EMPs and EPPs that will be prepared in accordance with applicable provincial and federal guidelines and BMPs (e.g., monitoring TSS); and, • Mitigation is widely used and proven effective (e.g., re-vegetation, silt fencing, wet processing to reduce dust etc.).	Compliance monitoring will be conducted through the implementation of the: ▪ Erosion and Sediment Control Plan; ▪ Air Quality and Dust Control Plan; ▪ Fisheries Habitat Protection and Mitigation Plans; ▪ Reclamation and Effective Closure Plan Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Fish and Fish Habitat Monitoring Program; ▪ Surface Water Quality Monitoring Program; and ▪ Air Quality and Meteorological Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.
Anadromous Chum, Coho, Pink Salmon and Anadromous and Resident Cutthroat Trout and their habitats	Fish populations and fish habitat	Changes to Surface Water Quality - Cementitious (alkaline) Material	▪ Complete isolation of work area is required to ensure waterbodies do not become more alkaline. ▪ pH should be monitored in surrounding waterbodies during concrete pouring. ▪ BMPs should be implemented during setting, mixing, and pouring of concrete to ensure activities meet requirements of applicable legislation. ▪ Pre-cast concrete structures whenever possible. ▪ Keep carbon dioxide tank with regulator, hose, and gas diffuser readily available during concrete works.	Predicted effectiveness of proposed mitigation is expected to be high due to: • Ability to avoid the potential effect is considered high due to implementation of technically and economically feasible measures such as pre-cast and isolation of curing concrete; • Commitment for environmental monitoring to be conducted by a qualified EM; and • Adherence to component EMPs and EPPs that will be prepared in accordance with applicable provincial and federal guidelines and BMPs (e.g., monitoring pH).	Compliance monitoring will be conducted through the implementation of the: ▪ Fisheries Habitat Protection and Mitigation Plan. Details provided in Volume 3, Part E - Section 17.0.
Anadromous Chum, Coho, Pink Salmon and Anadromous and Resident Cutthroat Trout and their habitats	Fish populations and fish habitat	Effects of Artificial Lighting	▪ Lighting for the purposes of the aggregate mining will not be permitted between dusk to dawn at seasonally appropriate times. ▪ All lighting nearby waterbodies will have baffles to direct light away from the water surface. ▪ Limited lighting will be maintained through the night only for safety purposes.	Predicted effectiveness of proposed mitigation is expected to be high due to: • Ability to avoid the potential effect is considered high due to the limited use of artificial nighttime lighting; and • Baffles will help reduce glare away from water surfaces.	Compliance monitoring will be conducted through the implementation of the: ▪ Fisheries Habitat Protection and Mitigation Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Fish and Fish Habitat Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Operations					
Anadromous Chum, Coho, Pink Salmon and Anadromous and Resident Cutthroat Trout and their habitats	Fish populations and fish habitat	Loss of Habitat	▪ Extension of the lower segment WC 2 will collect surface flow diverted through loss of the upper segment and will increase the wetted area within the extension and the lower segment of WC 2. ▪ Designing the pit lake such that lake elevation can be used to manage hydrostatic pressure through the course of operations so changes to groundwater flow does not lead to a loss of flow within McNab Creek. ▪ Similarly, the elevation of the pit lake will be used to manage baseflows in the natural groundwater watercourses below the pit lake.	Predicted effectiveness of proposed mitigation is expected to be high due to: • Habitat offset plan (e.g., assessment of habitat losses) are based on detailed field studies; • The potential effects associated with reduced baseflow are well understood; and, • Proposed offsetting is using the lower segment of WC 2, which is known to be functioning as fish habitat, as a template to construct the offset habitat.	Compliance monitoring will be conducted through the implementation of the: ▪ Fish Habitat Offset Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Fish and Fish Habitat Monitoring Program; ▪ Fish Habitat Offset Plan; and ▪ Groundwater Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.
Anadromous Chum, Coho, Pink Salmon and Anadromous and Resident Cutthroat Trout and their habitats	Fish populations and fish habitat	Changes to Surface Water Quality – Suspended Sediments	▪ Fines/silt cakes stored in the Fines Storage Area will be vegetated as soon as and where possible by planting and seeding with native trees, shrubs, and grasses. ▪ Placement of erosion control measures to prevent dust. ▪ Sediment and erosion control measures should be maintained at all times around the crushing areas and until vegetation is established on the Pit Lake Containment Berm, the McNab Creek Flood Control Dyke, the Fines Storage Area, and the Processing Area Dirt Berm. ▪ Crushing area should receive water-misting during dry weather events to reduce dust release.	Predicted effectiveness of proposed mitigation is expected to be high due to: • Commitment for environmental monitoring to be conducted by a qualified EM; • Adherence to component EMPs and EPPs that will be prepared in accordance with applicable provincial and federal guidelines and BMPs (e.g., monitoring TSS); • Mitigation is widely used and proven effective (e.g., re-vegetation, silt fencing, wet processing to reduce dust etc.); and • Plan to reclaim the fines storage area in a progressive manner.	Compliance monitoring will be conducted through the implementation of the: ▪ Erosion and Sediment Control Plan; ▪ Air Quality and Dust Control Plan; ▪ Fisheries Habitat Protection and Mitigation Plans; ▪ Reclamation and Effective Closure Plan Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Fish and Fish Habitat Monitoring Program; ▪ Surface Water Quality Monitoring Program; and ▪ Air Quality and Meteorological Details provided in Volume 3, Part E - Section 17.0.
Anadromous Chum, Coho, Pink Salmon and Anadromous and Resident Cutthroat Trout and their habitats	Fish populations and fish habitat	Effects of Artificial Lighting	▪ Lighting for the purposes of the aggregate mining will not be permitted between dusk to dawn at seasonally appropriate times. ▪ All lighting nearby waterbodies will have baffles to direct light away from the water surface. ▪ Limited lighting will be maintained through the night only for safety purposes.	Predicted effectiveness of proposed mitigation is expected to be high due to: • Ability to avoid the potential effect is considered high due to the limited use of artificial nighttime lighting; and • Baffles will help reduce glare away from water surfaces.	Compliance monitoring will be conducted through the implementation of the: ▪ Fisheries Habitat Protection and Mitigation Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Fish and Fish Habitat Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.
Reclamation and Closure					
Anadromous Chum, Coho, Pink Salmon and Anadromous and Resident Cutthroat Trout and their habitats	Fish populations and fish habitat	Loss of Habitat	▪ Implementation of the Fish Habitat Offset Plan (Volume 4, Part G – Section 22.0: Appendix 5.1-B). Extension of the lower segment WC 2 will collect surface flow diverted through loss of the upper segment and will increase the wetted area within the extension and the lower segment of WC 2. ▪ Designing the pit lake such that lake elevation can be used to manage hydrostatic pressure through closure so changes to groundwater flow does not lead to a loss of flow within McNab Creek. ▪ Similarly, the elevation of the pit lake will be used to manage baseflows in the natural groundwater watercourses below the pit lake.	Predicted effectiveness of proposed mitigation is expected to be high due to: • Habitat offset plan (e.g., assessment of habitat losses) are based on detailed field studies; • The potential effects associated with reduced baseflow are well understood; and, • Proposed offsetting is using the lower segment of WC 2, which is known to be functioning as fish habitat, as a template to construct the offset habitat.	Compliance monitoring will be conducted through the implementation of the: ▪ Fish Habitat Offset Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Fish and Fish Habitat Monitoring Program; ▪ Fish Habitat Offset Plan; and ▪ Groundwater Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Anadromous Chum, Coho, Pink Salmon and Anadromous and Resident Cutthroat Trout and their habitats	Fish populations and fish habitat	Changes to Surface Water Quality – Suspended Sediments	▪ Disturbed areas should be vegetated as soon as possible and where possible by planting and seeding with native trees, shrubs, and grasses. ▪ Disturbed areas adjacent to watercourses should be covered with mulch for sediment control. ▪ Placement of erosion control blankets to keep soil in place. ▪ Sediment and erosion control measures should be maintained until re-vegetation is achieved. ▪ Implementation of a Erosion and Sediment Control Plan. ▪ Implementation of an Air Quality and Dust Control Plan.	Predicted effectiveness of proposed mitigation is expected to be high due to: • Commitment for environmental monitoring to be conducted by a qualified EM; • Adherence to component EMPs and EPPs that will be prepared in accordance with applicable provincial and federal guidelines and BMPs (e.g., monitoring TSS); • Mitigation is widely used and proven effective (e.g., re-vegetation, silt fencing, wet processing to reduce dust etc.); and • Plan to reclaim the fines storage area in a progressive manner.	Compliance monitoring will be conducted through the implementation of the: ▪ Erosion and Sediment Control Plan; ▪ Air Quality and Dust Control Plan; ▪ Fisheries Habitat Protection and Mitigation Plans; ▪ Reclamation and Effective Closure Plan Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Fish and Fish Habitat Monitoring Program; ▪ Surface Water Quality Monitoring Program; and ▪ Air Quality and Meteorological Details provided in Volume 3, Part E - Section 17.0.
Anadromous Chum, Coho, Pink Salmon and Anadromous and Resident Cutthroat Trout and their habitats	Fish populations and fish habitat	Effects of Artificial Lighting	▪ Lighting for the purposes of the aggregate mining will not be permitted between dusk to dawn at seasonally appropriate times. ▪ All lighting nearby waterbodies will have baffles to direct light away from the water surface. ▪ Limited lighting will be maintained through the night only for safety purposes.	Predicted effectiveness of proposed mitigation is expected to be high due to: • Ability to avoid the potential effect is considered high due to the limited use of artificial nighttime lighting; and • Baffles are commonly used and will be designed to help reduce glare away from water surfaces.	Compliance monitoring will be conducted through the implementation of the: ▪ Fisheries Habitat Protection and Mitigation Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Fish and Fish Habitat Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.
Accidents and Malfunctions					
Anadromous Chum, Coho, Pink Salmon and Anadromous and Resident Cutthroat Trout and their habitats	Fish populations and fish habitat	Toxic and Hazardous Material Spills	▪ Adherence to Spill Prevention and Emergency Response Plan (SERP) ▪ Adherence to Material Storage, Handling and Waste Management Plan.	Predicted effectiveness of proposed mitigation is expected to be high due to: • Use of electricity to power many pieces of equipment reduces the need for fuels on-site; and • Adherence to component EMPs and EPPs that will be prepared in accordance with applicable provincial and federal guidelines and BMPs regarding spill preparedness and spill response measures; and • Location of the site and barge-route allows for quick response and assistance if needed by the Canadian Coast Guard and the Western Canada Marine Response Corporation.	Compliance monitoring will be conducted through the implementation of the: ▪ Spill Prevention and Emergency Response Plan (SERP); and ▪ Material Storage, Handling and Waste Management Plan. Details provided in Volume 3, Part E - Section 16.0.

Table 15-7: Summary of Proposed Measures for Mitigating Potential Effects to Marine Resources

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
			Construction		
Marine Water and Sediment Quality, Benthic Communities, Marine Fish, Marine Mammals, Marine Birds	Fish populations and fish habitat Mammals and their habitat Species at risk, its critical habitat or residences as defined in the Species at Risk Act Migratory birds, raptors, bats and their habitats	Habitat Loss / Change in Habitat Quality	▪ Mitigation through design: - Utilize existing disturbed features - installation of barge load-out jetty in low value habitat (existing log dump) - Use of piles instead of fill to reduce seabed disturbance - Height and orientation of walkway/conveyor designed to maximize ambient light penetration - Maintain tree buffer on foreshore to limit noise and dust emissions to marine environment. ▪ Develop a Fish Habitat Offset Plan to offset unavoidable permanent alteration or destruction of fish habitat from Project works. ▪ Environmental monitoring by a qualified EM. ▪ Prevent release of construction debris and deleterious substances into the marine environment. ▪ Adherence to BMP for Pile Driving and Related Operations (DFO 2003). ▪ Adherence to Erosion and Sediment Control Plan during road and other facilities construction, maintenance and upgrade. ▪ Optimal use of pre-cast concrete for construction and installatiFon of facilities within the intertidal and subtidal zones. ▪ Concrete will be poured during suitable tides. ▪ Concrete is not to be poured directly into tidal waters. ▪ Pumping hoses will be equipped with a shut-off valve to stop flow should a spill occur. ▪ Short term portable concrete batch plant will be constructed onsite, so no concrete pumping will be conducted by barge. ▪ Use of tight-fitting formwork that is lined (e.g., with polyethylene) and that has gasket joints to prevent contact between concrete and tidal water. ▪ Barriers will be used as appropriate to prevent splashing of the concrete over the forms and into the water or intertidal area during pouring. ▪ Fast curing concrete intended/formulated for marine applications will be used. ▪ Following placement of concrete, forms will be left in place isolating the concrete from tidal waters for a minimum of 24 h or time required for the particular material used such that the concrete is cured before it is exposed to tidal waters. ▪ Wash down of equipment and tools that have come into contact with concrete will be conducted in a designated area away from intertidal drainages so that concrete products are prevented from entering watercourses. ▪ Excess or spilled concrete will be immediately cleaned up / removed from the intertidal area. ▪ During removal and storage of creosote pilings, adherence to DFO BMP “Guidelines to Protect Fish and Fish Habitat from Treated Wood Used in Aquatic Environments in the Pacific Region”. ▪ Vessels involved in in-water works will be positioned in a manner to prevent disturbance to benthic communities and benthic habitats. ▪ Work crews will monitor the position of barges and account for height of tidal waters, magnitude of prevailing winds, and direction of tidal currents or other factors that may influence vessel positioning.	Predicted effectiveness of proposed mitigation is expected to be high due to: • Proposed Project marine facilities have been designed to avoid and reduce potential effects; • Commitment for environmental monitoring to be conducted by a qualified EM during in-water works; • Adherence to component EMPs and EPPs that will be prepared in accordance with applicable provincial and federal guidelines and BMPs (e.g., TSS monitoring, pH motoring); • Baseline surveys indicate that the area potentially affected will occur in pre-disturbed areas associated with historical log sort operations; and • Proposed offsetting is using the lower segment of WC 2, which is known to be functioning as fish habitat, as a template to construct the offset habitat.	Compliance monitoring will be conducted through the implementation of the: ▪ Construction Environmental Management Plan; ▪ Pile Construction Management Plan; ▪ Erosion and Sediment Control Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Fish and Fish Habitat Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
			▪ Manoeuvring of vessels in shallow areas will be minimized in order to avoid propeller scour and potential re-suspension of sediments or physical disturbance to shallow submerged marine vegetation. ▪ All equipment will be maintained in proper conditions to prevent leaking or spilling of hydrocarbons and other potentially toxic substances in the marine environment. ▪ All hydrocarbon products, fuelling equipment and other chemical substances will be stored and handled in accordance with all applicable legislation, guidelines and BMP's to prevent their release and toxic effect in the marine environment. ▪ During in-water works with potential to result in increased turbidity or suspended sediment, specific water quality performance objectives (based on BC WQG) will be applied at set distances from in-water works. In-water works will be halted if objectives are not achieved. Where objectives cannot be practically met, work areas will be isolated from tidal waters with silt curtains or other silt control measures.		
Marine Fish, Marine Mammals	Fish populations and fish habitat Mammals and their habitat Species at risk, its critical habitat or residences as defined in the Species at Risk Act	Injury / Disturbance from Underwater Noise	▪ Implementation of ramp-up / soft-start procedure during impact pile driving ▪ Avoid concurrent multiple underwater noise generating activities (sequence where possible). Noise mitigation for fish: ▪ Impact pile driving should not exceed 30 kPa at 10 m from pile. Otherwise, additional mitigation will be implemented such as the use of a vibratory hammer in place of an impact hammer or installation of bubble curtains around the wetted pile. ▪ Impact pile driving activities will be temporarily suspended if aggregations of fish (e.g., herring or salmonids) are spotted within the immediate work area or if any herring spawn is observed attached to equipment or structures in the water. Noise mitigation for MM: ▪ Monitoring for MM during all impact pile driving activities by a qualified and experienced MMO. ▪ Implementation of a MM Safety Zone based on injury threshold criteria (180 dB re 1 µPa SPLrms for cetaceans and 190 dB re 1 µPa SPLrms for pinnipeds). The occurrence of MM within the safety zone will trigger specific mitigation actions (e.g., shut-downs). ▪ Shut-down procedures – impact pile driving will be temporarily suspended when a MM is located within the safety zone until which time it moves outside the safety zone. ▪ Conduct a pre-operational search for MM prior to start-up of active impact pile driving. If a MM is spotted within the safety zone during the pre-ops search, the ramp-up procedure will be delayed 20 minutes from the time the MM left the safety zone, or was last sighted in the safety zone ▪ MMO will periodically verify underwater sound levels in the field using a hydrophone and a real-time sound monitor to confirm that sound levels at the modeled safety zone radius are below the established injury thresholds for MM. If necessary, the safety zone distance will be adjusted accordingly. ▪ Plan operations during daylight hours to maximize detection ability of MM in Project Area. ▪ Avoid peak seasonal timing when MMs are most likely to be in or adjacent to the Project Area.	Predicted effectiveness of proposed mitigation is expected to be high for mitigation against injury due to: • Injury zones modeled were based on conservative acoustic injury criteria (NMFS thresholds); and • Given the availability of accepted mitigation and monitoring measures and their known effectiveness (e.g., bubble curtains, marine mammal monitoring of a defined safety zone, shut-down and ramp-up procedures, sound verification monitoring). Predicted effectiveness of proposed mitigation is expected to be moderate for mitigation against behavioral disturbance due to: • Disturbance zones modeled are based on conservative acoustic disturbance criteria (NMFS thresholds); and • Lack of species-specific information regarding the long-term effects of increased vessel traffic on behaviour reduced the effectiveness rating to moderate.	Compliance monitoring will be conducted through the implementation of the: ▪ Pile Construction Management Plan; and ▪ Marine Transportation Management Plan. Details provided in Volume 3, Part E - Section 16.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Marine Birds	Migratory birds, raptors, bats and their habitats	Disturbance from In-Air Noise	▪ Refer to Volume 2, Part B - Section 9.2 (Noise).	Predicted effectiveness of proposed mitigation is expected to be moderate for mitigation against behavioral disturbance due to: • Implementation of known and effective mitigation measures as described in Volume 2, Part B - Section 9.2 (Noise); and • Even with the application of mitigation, some birds will likely be disturbed from the in-air noise.	Compliance monitoring will be conducted through the implementation of the: ▪ Noise Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Marine Mammals	Mammals and their habitat Species at risk, its critical habitat or residences as defined in the Species at Risk Act	Mortality/Injury from Vessel Strikes	▪ Speed restrictions for tug-assisted barges in RSA (<12 knots). ▪ Vessels will follow established shipping lanes/navigational routes in RSA. ▪ Vessels will maintain a constant course and constant speed in RSA. ▪ Project vessels will not approach within 100 m of any MM. ▪ If MMs approach within 100 m of a Project vessel, the vessel will reduce its speed and, if possible, cautiously move away from the animal. If it is not possible for a vessel to move away from or detour around a stationary MM or group of MM, the vessel will reduce its speed and wait until the animal(s) moves at least 100 m from the vessel prior to resuming speed.	Predicted effectiveness of proposed mitigation is expected to be high due to: • Based on literature, vessel-marine mammal collisions unlikely given size of vessels and restricted travelling speeds in LSA; and • Implementation of known and effective mitigation measures (e.g., avoidance of marine mammals, vessel speed restrictions).	Compliance monitoring will be conducted through the implementation of the: ▪ Marine Transport Management Plan. Details provided in Volume 3, Part E - Section 16.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Operations					
Marine Water and Sediment Quality, Benthic Communities, Marine Fish, Marine Mammals, Marine Birds	Fish populations and fish habitat Mammals and their habitat Species at risk, its critical habitat or residences as defined in the Species at Risk Act Migratory birds, raptors, bats and their habitats	Habitat Loss / Change in Habitat Quality	▪ Mitigation through design: - Utilize existing disturbed features - installation of barge load-out jetty in low value habitat (existing log dump) - Use of piles instead of fill to reduce seabed disturbance - Height and orientation of walkway/conveyor designed to maximize ambient light penetration - Maintain tree buffer on foreshore to limit noise and dust emissions to marine environment. ▪ Prevent release of debris and deleterious substances into the marine environment. ▪ Adherence to BMP for Erosion and Sediment Control Plan (Volume 4, Part G – Section 22.0: Appendix 3) during road and facilities maintenance and upgrade. ▪ Vessels involved in in-water works will be positioned in a manner to prevent disturbance to benthic communities and benthic habitats. ▪ Work crews will monitor the position of barges and account for height of tidal waters, magnitude of prevailing winds, and direction of tidal currents or other factors that may influence vessel positioning. ▪ Manoeuvring of vessels in shallow areas will be minimized in order to avoid propeller scour and potential re-suspension of sediments or physical disturbance to shallow submerged marine vegetation. ▪ All equipment will be maintained in proper conditions to prevent leaking or spilling of hydrocarbons and other potentially toxic substances in the marine environment. ▪ All hydrocarbon products, fuelling equipment and other chemical substances will be stored and handled in accordance with all applicable legislation, guidelines and BMP's to prevent their release and toxic effect in the marine environment. ▪ A Spill Prevention and Emergency Response Plan will be developed and implemented for managing hydrocarbons and other chemicals during operational activities.	Predicted effectiveness of proposed mitigation is expected to be high due to: • Proposed Project marine facilities have been designed to avoid and reduce potential effects; • Commitment for environmental monitoring to be conducted by a qualified EM during in-water works; • Adherence to component EMPs and EPPs that will be prepared in accordance with applicable provincial and federal guidelines and BMPs (e.g., TSS monitoring, pH motoring); • Baseline surveys indicate that the area potentially affected will occur in pre-disturbed areas associated with historical log sort operations; and • Proposed offsetting is using the lower segment of WC 2, which is known to be functioning as fish habitat, as a template to construct the offset habitat.	Compliance monitoring will be conducted through the implementation of the: ▪ Construction Environmental Management Plan; ▪ Pile Construction Management Plan; ▪ Fish Habitat Offset Plan; and ▪ Erosion and Sediment Control Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Fish and Fish Habitat Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.
Marine Fish, Marine Mammals	Fish populations and fish habitat Mammals and their habitat Species at risk, its critical habitat or residences as defined in the Species at Risk Act	Disturbance from Underwater Noise	▪ No additional measures are proposed.	Predicted effectiveness of proposed mitigation is expected to be high for mitigation against injury due to: • Injury zones modeled were based on conservative acoustic injury criteria (NMFS thresholds); and • Given the availability of accepted mitigation and monitoring measures and their known effectiveness (e.g., bubble curtains, marine mammal monitoring of a defined safety zone, shut-down and ramp-up procedures, sound verification monitoring). Predicted effectiveness of proposed mitigation is expected to be moderate for mitigation against behavioral disturbance due to: • Disturbance zones modeled are based on conservative acoustic disturbance criteria (NMFS thresholds); and • Lack of species-specific information regarding the long-term effects of increased vessel traffic on behaviour reduced the effectiveness rating to moderate.	Compliance monitoring will be conducted through the implementation of the: ▪ Pile Construction Management Plan; and ▪ Marine Transportation Management Plan. Details provided in Volume 3, Part E - Section 16.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Marine Birds	Migratory birds, raptors, bats and their habitats	Behavioral Disturbance from In-Air Noise	▪ Refer to Volume 2, Part B - Section 9.2 (Noise).	Predicted effectiveness of proposed mitigation is expected to be moderate for mitigation against behavioral disturbance due to: • Implementation of known and effective mitigation measures as described in Volume 2, Part B - Section 9.2 (Noise); and • Even with the application of mitigation, some birds will likely be disturbed from the in-air noise.	Compliance monitoring will be conducted through the implementation of the: ▪ Noise Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Marine Mammals	Mammals and their habitat Species at risk, its critical habitat or residences as defined in the Species at Risk Act	Mortality/Injury from Vessel Strikes	▪ Maintain mitigation measures implemented during construction.	Predicted effectiveness of proposed mitigation is expected to be high due to: • Based on literature, vessel-marine mammal collisions unlikely given size of vessels and restricted travelling speeds in LSA; and • Implementation of known and effective mitigation measures (e.g., avoidance of marine mammals, vessel speed restrictions).	Compliance monitoring will be conducted through the implementation of the: ▪ Marine Transport Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Reclamation and Closure					
Marine Water and Sediment Quality, Benthic Communities, Marine Fish, Marine Mammals, Marine Birds	Fish populations and fish habitat Mammals and their habitat Species at risk, its critical habitat or residences as defined in the Species at Risk Act Migratory birds, raptors, bats and their habitats	Habitat Loss / Change in Habitat Quality	▪ Maintain mitigation measures implemented during construction.	Predicted effectiveness of proposed mitigation is expected to be high due to: • Proposed Project marine facilities have been designed to avoid and reduce potential effects; • Commitment for environmental monitoring to be conducted by a qualified EM during in-water works; • Adherence to component EMPs and EPPs that will be prepared in accordance with applicable provincial and federal guidelines and BMPs (e.g., TSS monitoring, pH motoring); • Baseline surveys indicate that the area potentially affected will occur in pre-disturbed areas associated with historical log sort operations; and • Proposed offsetting is using the lower segment of WC 2, which is known to be functioning as fish habitat, as a template to construct the offset habitat.	Compliance monitoring will be conducted through the implementation of the: ▪ Construction Environmental Management Plan; ▪ Pile Construction Management Plan; ▪ Fish Habitat Offset Plan; and ▪ Erosion and Sediment Control Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Fish and Fish Habitat Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.
Marine Fish, Marine Mammals	Fish populations and fish habitat Mammals and their habitat Species at risk, its critical habitat or residences as defined in the Species at Risk Act	Disturbance from Underwater Noise	▪ No additional measures are proposed.	Predicted effectiveness of proposed mitigation is expected to be high for mitigation against injury due to: • Injury zones modeled were based on conservative acoustic injury criteria (NMFS thresholds); and • Given the availability of accepted mitigation and monitoring measures and their known effectiveness (e.g., bubble curtains, marine mammal monitoring of a defined safety zone, shut-down and ramp-up procedures, sound verification monitoring). Predicted effectiveness of proposed mitigation is expected to be moderate for mitigation against behavioral disturbance due to: • Disturbance zones modeled are based on conservative acoustic disturbance criteria (NMFS thresholds); and Lack of species-specific information regarding the long-term effects of increased vessel traffic on behaviour reduced the effectiveness rating to moderate.	Compliance monitoring will be conducted through the implementation of the: ▪ Pile Construction Management Plan; and ▪ Marine Transportation Management Plan. Details provided in Volume 3, Part E - Section 16.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Marine Birds	Migratory birds, raptors, bats and their habitats	Disturbance from In-Air Noise	▪ Refer to Volume 2, Part B - Section 9.2 (Noise).	Predicted effectiveness of proposed mitigation is expected to be moderate for mitigation against behavioral disturbance due to: • Implementation of known and effective mitigation measures as described in Volume 2, Part B - Section 9.2 (Noise); and • Even with the application of mitigation, some birds will likely be disturbed from the in-air noise.	Compliance monitoring will be conducted through the implementation of the: ▪ Noise Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Marine Mammals	Mammals and their habitat Species at risk, its critical habitat or residences as defined in the Species at Risk Act	Mortality/Injury from Vessel Strikes	▪ Maintain mitigation measures implemented during construction.	Predicted effectiveness of proposed mitigation is expected to be high due to: • Based on literature, vessel-marine mammal collisions unlikely given size of vessels and restricted travelling speeds in LSA; and • Implementation of known and effective mitigation measures (e.g., avoidance of marine mammals, vessel speed restrictions).	Compliance monitoring will be conducted through the implementation of the: ▪ Marine Transport Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Accidents and Malfunctions					
Marine Water and Sediment Quality, Benthic Communities, Marine Fish, Marine Mammals, Marine Birds	Fish populations and fish habitat Mammals and their habitat Species at risk, its critical habitat or residences as defined in the Species at Risk Act Migratory birds, raptors, bats and their habitats	Toxic and Hazardous Material Spills	▪ Adherence to Spill Prevention and Emergency Response Plan (SERP)	Predicted effectiveness of proposed mitigation is expected to be high due to: • Use of electricity to power many pieces of equipment reduces the need for fuels on-site; and • Adherence to component EMPs and EPPs that will be prepared in accordance with applicable provincial and federal guidelines and BMPs regarding spill preparedness and spill response measures; and • Location of the site and barge-route allows for quick response and assistance if needed by the Canadian Coast Guard and the Western Canada Marine Response Corporation.	Compliance monitoring will be conducted through the implementation of the: ▪ Spill Prevention and Emergency Response Plan (SERP); and ▪ Material Storage, Handling and Waste Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Marine Water and Sediment Quality, Benthic Communities	Fish populations and fish habitat Migratory birds, raptors, bats and their habitats	Aggregate Spills	▪ Adherence to SERP	Predicted effectiveness of proposed mitigation is expected to be high due to: • Adherence to component EMPs and EPPs that will be prepared in accordance with applicable provincial and federal guidelines and BMPs regarding spill preparedness and spill response measures	Compliance monitoring will be conducted through the implementation of the: ▪ Spill Prevention and Emergency Response Plan (SERP); and ▪ Material Storage, Handling and Waste Management Plan. Details provided in Volume 3, Part E - Section 16.0.

Table 15-8: Summary of Proposed Measures for Mitigating Potential Effects to Terrestrial Wildlife

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Construction					
Amphibian species at risk, avifauna, Roosevelt elk and grizzly bear	Mammals and their habitat Migratory birds, raptors, bats and their habitats Amphibians Species at risk, its critical habitat or residences as defined in the Species at Risk Act	Habitat Loss	▪ Identify and retain, where feasible, wildlife habitat features ▪ Utilize existing disturbed areas ▪ Maintain riparian vegetation, vegetation buffers and other important habitat features ▪ Minimize clearing through Project planning ▪ Develop a Vegetation Management Plan including an Invasive Plant Species Management Plan ▪ Avoid clearing wildlife habitat during sensitive wildlife periods such as breeding and calving periods, bird nesting periods, and Roosevelt elk overwintering ▪ Restrict construction to daylight hours ▪ Limit Proposed Project Area access to a single point, and to employees and contractors ▪ Manage noise through implementation of BMPs and mitigation outlined in Volume 2, Part B - Section 9.2 ▪ Maintain vegetation linkages and buffers ▪ Demarcate habitat features to be retained. ▪ Identify habitat feature (i.e., woody debris) to retain ▪ Develop a Spill Prevention and Emergency Response Plan ▪ Develop an Erosion and Sediment Control Plan ▪ Follow appropriate BMPs ▪ Fall trees away from sensitive habitat ▪ Develop a Wildlife Management Plan ▪ Mature forest to be cleared will be surveyed for tree cavities that may provide suitable nesting opportunities for Western screech-owl. A density of potentially suitable nest trees will be estimated for the mature forest that will be cleared. ▪ Construct and install nest boxes for Western screech-owl in nearby forest habitat, where appropriate. ▪ Implement the Fish Habitat Offset Plan habitat compensation measure for amphibian breeding habitat.	▪ Anticipated to be effective for avifauna and grizzly bear VCs. ▪ Amphibian species at risk habitat will be temporarily lost in the Proposed Project Area during construction. It is likely that the Fish Habitat Offset Plan will provide effective compensatory breeding habitat for amphibians at year 1 during construction. ▪ The creation of a pit lake during the reclamation and closure phase will provide additional potential habitat for amphibian breeding. ▪ 36.7 ha of Roosevelt elk winter habitat will be permanently lost due to the creation of the pit lake after closure and reclamation.	Compliance monitoring will be conducted through the implementation of the: ▪ Spill Prevention and Emergency Response Plan; ▪ Fish Habitat Offset Plan; ▪ Erosion and Sediment Control Plan; ▪ Vegetation Management Plan including an Invasive Plant Species Management Plan; and ▪ Wildlife Management Plan. Follow-up monitoring will be conducted through the implementation of the: ▪ Wildlife Monitoring Plan. Details provided in Volume 3, Part E - Section 17.0.
Amphibian species at risk, and Roosevelt elk	Mammals and their habitat Amphibians Species at risk, its critical habitat or residences as defined in the Species at Risk Act	Barriers to movement	▪ Store equipment in designated areas ▪ Design and establish amphibian passageways, where appropriate ▪ Maintain vegetation linkages and buffers ▪ Bury linear features.	▪ Mitigation measures are anticipated to be effective and include the application of standard provincial best management practices.	Compliance monitoring will be conducted through the implementation of the: ▪ Vegetation Management Plan; and ▪ Wildlife Management Plan. Follow-up monitoring will be conducted through the implementation of the: ▪ Wildlife Monitoring Plan; and ▪ Vegetation Monitoring Plan. Details provided in Volume 3, Part E - Section 17.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Amphibian species at risk, avifauna, Roosevelt elk and grizzly bear	Mammals and their habitat Migratory birds, raptors, bats and their habitats Amphibians Species at risk, its critical habitat or residences as defined in the Species at Risk Act	Change in Mortality	▪ Develop Erosion and Sediment Control Plan and Material Storage, Handling and Waste Management Plan ▪ Prohibit harassment and feeding of wildlife by Project employees ▪ Report wildlife observations ▪ Develop a Wildlife Management Plan ▪ All employees and contractors will be prohibited from hunting, including Roosevelt elk and grizzly bear, within the LSA. ▪ Install amphibian isolation fencing along roadways ▪ Clear during avifauna least risk windows; avoid clearing during sensitive wildlife periods ▪ Control traffic speeds on roads ▪ Develop and implement a wildlife monitoring program with the objective of measuring the effectiveness of mitigation and restoration measures on wildlife VCs within the LSA. ▪ Train staff to be Bear Aware™ ▪ Post educational signage ▪ Conduct a pre-clearing salvage of amphibians in amphibian ponds within the Proposed Project Area	▪ Mitigation measures are anticipated to be effective and include the application of standard provincial best management practices.	Compliance monitoring will be conducted through the implementation of the: ▪ Erosion and Sediment Control Plan; ▪ Wildlife Management Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Wildlife Monitoring Plan. Details provided in Volume 3, Part E - Section 17.0.
		Operations			
Amphibian species at risk, avifauna, Roosevelt elk and grizzly bear	Mammals and their habitat Migratory birds, raptors, bats and their habitats Amphibians Species at risk, its critical habitat or residences as defined in the Species at Risk Act	Habitat Loss	▪ Maintain mitigation measures implemented during construction ▪ Develop and implement a progressive Reclamation and Effective Closure Plan ▪ Develop and implement a water quality monitoring program in remaining amphibian breeding ponds ▪ Develop and implement a wildlife monitoring program with the objective of measuring the effectiveness of mitigation and restoration measures on wildlife VCs within the LSA. ▪ Minimize fugitive dusts from exposed soil, equipment and Project facilities ▪ Monitor water quality in the pit lake ▪ Limit operational hours to daylight hours. Limit nighttime lighting to where lighting is required for safety and security ▪ Night time lights will be fitted with shades to direct light towards the ground ▪ Monitor water quality in the Pit Lake and other water bodies in and around the Proposed Project Area ▪ Implement the Fish Habitat Offset Plan habitat compensation measure for amphibian breeding habitat.	▪ Anticipated to be effective for avifauna and grizzly bear VCs ▪ Amphibian species at risk habitat will be temporarily lost in the Proposed Project Area during construction. It is likely that the Fish Habitat Offset Plan will provide effective compensatory breeding habitat during year 1 of construction. ▪ The creation of a pit lake during the reclamation and closure phase will provide additional potential habitat for amphibian breeding. ▪ Roosevelt elk winter habitat (36.7 ha) will be permanently lost due to the creation of the pit lake after closure and reclamation.	Compliance monitoring will be conducted through the implementation of the: ▪ Spill Prevention and Emergency Response Plan; ▪ Fish Habitat Offset Plan; ▪ Erosion and Sediment Control Plan; ▪ Vegetation Management Plan including an Invasive Plant Species Management Plan; and ▪ Wildlife Management Plan. Follow-up monitoring will be conducted through the implementation of the: ▪ Wildlife Monitoring Plan. Details provided in Volume 3, Part E - Section 17.0.
Amphibian species at risk, and Roosevelt elk	Mammals and their habitat Amphibians Species at risk, its critical habitat or residences as defined in the Species at Risk Act	Barriers to movement	▪ Maintain mitigation measures implemented during construction	▪ Mitigation measures are anticipated to be effective and include the application of standard provincial best management practices.	Compliance monitoring will be conducted through the implementation of the: ▪ Vegetation Management Plan; and ▪ Wildlife Management Plan. Follow-up monitoring will be conducted through the implementation of the: ▪ Wildlife Monitoring Plan; and ▪ Vegetation Monitoring Plan. Details provided in Volume 3, Part E - Section 17.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Amphibian species at risk, avifauna, Roosevelt elk and grizzly bear	Mammals and their habitat Migratory birds, raptors, bats and their habitats Amphibians Species at risk, its critical habitat or residences as defined in the Species at Risk Act	Change in Mortality	▪ Maintain mitigation measures implemented during construction ▪ Restrict public access to the Proposed Project Area ▪ Develop a wildlife mortality reporting program ▪ Obtain a yearly permit to salvage amphibians ▪ Limit nighttime road travel ▪ Maintain vegetative buffers around all raptor nests and other active bird nests ▪ Design the perimeter of the pit lake to allow for an escape route for large mammals ▪ Develop a Material Storage, Handling and Waste Management Plan	▪ Mitigation measures are anticipated to be effective and include the application of standard provincial best management practices.	Compliance monitoring will be conducted through the implementation of the: ▪ Erosion and Sediment Control Plan; ▪ Wildlife Management Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Wildlife Monitoring Plan. Details provided in Volume 3, Part E - Section 17.0.
Reclamation and Closure					
Amphibian species at risk, avifauna, Roosevelt elk and grizzly bear	Mammals and their habitat Migratory birds, raptors, bats and their habitats Amphibians Species at risk, its critical habitat or residences as defined in the Species at Risk Act	Habitat Loss	▪ Develop and implement compensation plans to address the loss of Roosevelt elk habitat ▪ Implement the Fish Habitat Offset Plan habitat compensation measure for amphibian breeding habitat. ▪ Reclaim the Proposed Project Area to enhance wildlife habitat ▪ Develop and implement a progressive Reclamation and Effective Closure Plan	▪ Mitigation measures are anticipated to be effective and include the application of standard provincial best management practices.	Compliance monitoring will be conducted through the implementation of the: ▪ Spill Prevention and Emergency Response Plan; ▪ Fish Habitat Offset Plan; ▪ Erosion and Sediment Control Plan; ▪ Vegetation Management Plan including an Invasive Plant Species Management Plan; and ▪ Wildlife Management Plan. Follow-up monitoring will be conducted through the implementation of the: ▪ Wildlife Monitoring Plan. Details provided in Volume 3, Part E - Section 17.0.

Table 15-9: Summary of Proposed Measures for Mitigating Potential Effects to Terrestrial Vegetation

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Construction					
Rare and sensitive ecological communities including wetlands Vegetation Species at risk, its critical habitat or residences as defined in the Species at Risk Act	Environmentally Sensitive Ecosystems Ecosystems at Risk Plant Species at Risk	Loss of Extent	▪ Project design aims to utilize disturbed areas and avoid sensitive ecosystems. ▪ Activities will be contained within surveyed Project boundary. ▪ Standing vegetation will be retained for as long as possible. ▪ Reclamation planning will aim to re-establish functional listed ecosystems at the same proportion at which they were removed, where final design allows. ▪ Ecological units will be created during the reclamation phase similar to those present prior to Project construction. ▪ Develop and implement a vegetation monitoring program to assess the success of mine reclamation.	▪ Project design reduces the magnitude of the effect. ▪ Loss of riparian ecosystem and wetlands will occur. ▪ It is likely that the Fish Habitat Offset Plan will provide effective compensatory riparian and wetland habitat during year 1 of construction. ▪ Riparian habitat will also be constructed around the pit lake during reclamation. ▪ Loss of extent of five ecosystems at risk will occur and will include temporary and permanent loss.	Compliance monitoring will be conducted through the implementation of the: ▪ Vegetation Management Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Vegetation Monitoring Plan. Details provided in Volume 3, Part E - Section 17.0.
Rare and sensitive ecological communities including wetlands Vegetation	Environmentally Sensitive Ecosystems Ecosystems at Risk	Surface Runoff	▪ An Erosion and Sediment Control Plan will be developed and implemented for the Project. ▪ An independent Environmental Monitor (EM) will be onsite during sensitive works.	▪ Application of mitigation should control this effect.	Compliance monitoring will be conducted through the implementation of the: ▪ Erosion and Sediment Control Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Surface Water Quality Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.
Rare and sensitive ecological communities including wetlands Vegetation	Environmentally Sensitive Ecosystems Ecosystems at Risk	Introduction of Dust	▪ An Air Quality and Dust Control Management Plan will be prepared and implemented during construction, operations and reclamation. ▪ Progressive reclamation to be conducted during operations to reduce ambient dust.	▪ Mitigation is expected to reduce but not eliminate the effect.	Compliance monitoring will be conducted through the implementation of the: ▪ Air Quality and Dust Control Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Air Quality and Meteorological Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.
Rare and sensitive ecological communities including wetlands Vegetation	Environmentally Sensitive Ecosystems Ecosystems at Risk	Invasive Species	▪ A site specific Invasive Plant Management Plan will be developed. ▪ Progressive reclamation to be conducted during operation to reduce risk of invasive species establishment.	▪ Application of mitigation should control this effect during construction and reclamation. ▪ Mitigation is expected to reduce but not eliminate the effect during operations.	Compliance monitoring will be conducted through the implementation of the: ▪ Vegetation Management Plan including an Invasive Plant Species Management Plan; and ▪ Reclamation and Effective Closure Plan including soil management. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Vegetation Monitoring Plan. Details provided in Volume 3, Part E - Section 17.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Rare and sensitive ecological communities including wetlands Vegetation	Environmentally Sensitive Ecosystems Ecosystems at Risk	Soil Disturbance	▪ A Soil Management Plan, including the Reclamation and Effective Closure Plan, will be developed and implemented during construction. ▪ The Soil Management Plan will be employed during reclamation and closure.	▪ Mitigation is expected to reduce but not eliminate the effect.	Compliance monitoring will be conducted through the implementation of the: ▪ Reclamation and Effective Closure Plan including soil management. Details provided in Volume 3, Part E - Section 16.0.
Rare and sensitive ecological communities including wetlands Vegetation	Environmentally Sensitive Ecosystems Ecosystems at Risk	Windthrow	▪ Trees susceptible to windthrow will be removed from treeline edges. ▪ Sensitive receptors (i.e., streams) will be buffered so that impacts are minimized. ▪ Monitoring of treeline edges will be conducted in order to evaluate potential windthrow effects and adaptive management will be employed, if necessary.	▪ Mitigation is expected to reduce but not eliminate the effect.	Compliance monitoring will be conducted through the implementation of the: ▪ Vegetation Management Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Vegetation Monitoring Plan. Details provided in Volume 3, Part E - Section 17.0.
Operations					
Rare and sensitive ecological communities including wetlands Vegetation	Ecosystems at Risk	Loss of Extent	▪ Project design aims to utilize disturbed areas and avoid sensitive ecosystems. ▪ Activities will be contained within surveyed Project boundary. ▪ Standing vegetation will be retained for as long as possible. ▪ Reclamation planning will aim to re-establish functional listed ecosystems at the same proportion at which they were removed, where final design allows. ▪ Ecological units will be created during the reclamation phase similar to those present prior to Project construction. ▪ Develop and implement a vegetation monitoring program to assess the success of mine reclamation.	▪ Project design reduces the magnitude of the effect. ▪ Loss of riparian ecosystem and wetlands will occur. ▪ It is likely that the Fish Habitat Offset Plan will provide effective compensatory riparian and wetland habitat during year 1 of construction. ▪ Riparian habitat will also be constructed around the pit lake during reclamation. ▪ Loss of extent of five ecosystems at risk will occur and will include temporary and permanent loss.	Compliance monitoring will be conducted through the implementation of the: ▪ Vegetation Management Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Vegetation Monitoring Plan. Details provided in Volume 3, Part E - Section 17.0.
Rare and sensitive ecological communities including wetlands Vegetation	Environmentally Sensitive Ecosystems Ecosystems at Risk	Surface Runoff	▪ An Erosion and Sediment Control Plan will be developed and implemented for the Project. ▪ An independent Environmental Monitor (EM) will be onsite during sensitive works.	▪ Application of mitigation should control this effect.	Compliance monitoring will be conducted through the implementation of the: ▪ Erosion and Sediment Control Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Surface Water Quality Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.
Rare and sensitive ecological communities including wetlands Vegetation	Environmentally Sensitive Ecosystems Ecosystems at Risk	Introduction of Dust	▪ An Air Quality and Dust Control Management Plan will be prepared and implemented during construction, operations and reclamation. ▪ Progressive reclamation to be conducted during operations to reduce ambient dust.	▪ Mitigation is expected to reduce but not eliminate the effect.	Compliance monitoring will be conducted through the implementation of the: ▪ Air Quality and Dust Control Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Air Quality and Meteorological Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Rare and sensitive ecological communities including wetlands Vegetation	Environmentally Sensitive Ecosystems Ecosystems at Risk	Invasive Species	▪ A site specific Invasive Plant Management Plan will be developed. ▪ Progressive reclamation to be conducted during operation to reduce risk of invasive species establishment.	▪ Application of mitigation should control this effect during construction and reclamation. ▪ Mitigation is expected to reduce but not eliminate the effect during operations.	Compliance monitoring will be conducted through the implementation of the: ▪ Vegetation Management Plan including an Invasive Plant Species Management Plan; and ▪ Reclamation and Effective Closure Plan including soil management. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Vegetation Monitoring Plan. Details provided in Volume 3, Part E - Section 17.0.
Rare and sensitive ecological communities including wetlands Vegetation	Environmentally Sensitive Ecosystems Ecosystems at Risk	Soil Disturbance	▪ A Soil Management Plan, including the Reclamation and Effective Closure Plan, will be developed and implemented during construction. ▪ The Soil Management Plan will be employed during reclamation and closure.	▪ Mitigation is expected to reduce but not eliminate the effect.	Compliance monitoring will be conducted through the implementation of the: ▪ Reclamation and Effective Closure Plan including soil management. Details provided in Volume 3, Part E - Section 16.0.
Rare and sensitive ecological communities including wetlands Vegetation	Environmentally Sensitive Ecosystems Ecosystems at Risk	Windthrow	▪ Trees susceptible to windthrow will be removed from treeline edges. ▪ Sensitive receptors (i.e., streams) will be buffered so that impacts are minimized. ▪ Monitoring of treeline edges will be conducted in order to evaluate potential windthrow effects and adaptive management will be employed, if necessary.	▪ Mitigation is expected to reduce but not eliminate the effect.	Compliance monitoring will be conducted through the implementation of the: ▪ Vegetation Management Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Vegetation Monitoring Plan. Details provided in Volume 3, Part E - Section 17.0.
Reclamation and Closure					
Rare and sensitive ecological communities including wetlands Vegetation	Environmentally Sensitive Ecosystems Ecosystems at Risk	Introduction of Dust	▪ An Air Quality and Dust Control Management Plan will be prepared and implemented during construction, operations and reclamation. ▪ Progressive reclamation to be conducted during operations to reduce ambient dust.	▪ Mitigation is expected to reduce but not eliminate the effect.	Compliance monitoring will be conducted through the implementation of the: ▪ Air Quality and Dust Control Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Air Quality and Meteorological Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.
Rare and sensitive ecological communities including wetlands Vegetation	Environmentally Sensitive Ecosystems Ecosystems at Risk	Invasive Species	▪ A site specific Invasive Plant Management Plan will be developed. ▪ Progressive reclamation to be conducted during operation to reduce risk of invasive species establishment.	▪ Application of mitigation should control this effect during construction and reclamation. ▪ Mitigation is expected to reduce but not eliminate the effect during operations.	Compliance monitoring will be conducted through the implementation of the: ▪ Vegetation Management Plan including an Invasive Plant Species Management Plan; and ▪ Reclamation and Effective Closure Plan including soil management. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Vegetation Monitoring Plan. Details provided in Volume 3, Part E - Section 17.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Rare and sensitive ecological communities including wetlands Vegetation	Environmentally Sensitive Ecosystems Ecosystems at Risk	Soil Disturbance	▪ A Soil Management Plan, including the Reclamation and Effective Closure Plan, will be developed and implemented during construction. ▪ The Soil Management Plan will be employed during reclamation and closure.	▪ Mitigation is expected to reduce but not eliminate the effect.	Compliance monitoring will be conducted through the implementation of the: ▪ Reclamation and Effective Closure Plan including soil management. Details provided in Volume 3, Part E - Section 16.0.
Accidents and Malfunctions					
Rare and sensitive ecological communities including wetlands Vegetation	Environmentally Sensitive Ecosystems Ecosystems at Risk Plant Species at Risk	Introduction of Deleterious Substances	▪ A Construction Environment Management Plan (CEMP) will be developed which will include regular inspections of equipment. ▪ A Spill Prevention and Response Plan will be prepared. ▪ An independent Environmental Monitor (EM) will be onsite. ▪ An Operation Environmental Management Plan will be prepared that includes regular scheduled equipment inspections.	▪ Mitigation will reduce the likelihood of this effect.	Compliance monitoring will be conducted through the implementation of the: ▪ Construction Environment Management Plan (CEMP); ▪ Operation Environmental Management Plan; ▪ Spill Prevention and Emergency Response Plan (SERP); and ▪ Material Storage, Handling and Waste Management Plan. Details provided in Volume 3, Part E - Section 16.0.

Table 15-10: Summary of Proposed Measures for Mitigating Potential Geotechnical and Natural Hazards Effects

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Construction					
Earthquakes and Tsunamis	Soils, including terrain and geology	Increased ground movement during earthquake event.	▪ Conduct detailed geotechnical subsurface investigations (drilling and geophysical programs) where required; ▪ Prepare approved engineered design and plans to achieve Proposed Project engineering design and performance requirements and for mitigation, as required by provincial and federal accepted standards	Predicted effectiveness of proposed mitigation is expected to be high due to: ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored by professional engineers and geoscientist; and ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored following provincial and federal accepted standards.	Compliance monitoring will be conducted through the implementation of the: ▪ Geotechnical and Pit Slope Stability Monitoring Plan Details provided in Volume 3, Part E - Section 17.0.
Earthquakes and Tsunamis	Soils, including terrain and geology	Increased shoreline erosion and offshore debris deposition during earthquake or landslide generated tsunami.	▪ Conduct detailed geotechnical subsurface investigations (drilling and geophysical programs) where required; ▪ Prepare approved engineered design and plans to achieve Proposed Project engineering design and performance requirements and for mitigation, as required by provincial and federal accepted standards	Predicted effectiveness of proposed mitigation is expected to be high due to: ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored by professional engineers and geoscientist; and ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored following provincial and federal accepted standards.	Compliance monitoring will be conducted through the implementation of the: ▪ Geotechnical and Pit Slope Stability Monitoring Plan Details provided in Volume 3, Part E - Section 17.0.
Earthquakes and Tsunamis	Soils, including terrain and geology	Initiation of submarine landslides	▪ Conduct detailed geotechnical subsurface investigations (drilling and geophysical programs) where required; ▪ Prepare approved engineered design and plans to achieve Proposed Project engineering design and performance requirements and for mitigation, as required by provincial and federal accepted standards	Predicted effectiveness of proposed mitigation is expected to be high due to: ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored by professional engineers and geoscientist; and ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored following provincial and federal accepted standards.	Compliance monitoring will be conducted through the implementation of the: ▪ Geotechnical and Pit Slope Stability Monitoring Plan Details provided in Volume 3, Part E - Section 17.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Terrain Stability	Soils, including terrain and geology	Land-based Mass Movement - Terrain Stability: changes to slope morphology or drainage conditions.	▪ Conduct appropriate detailed investigations of terrain stability and geotechnical conditions; ▪ Prepare approved engineered design and plans to achieve Proposed Project performance requirements and for mitigation, as required; and ▪ Conduct appropriate onsite assessments to identify connectivity of site earth works to watercourses.	Predicted effectiveness of proposed mitigation is expected to be high: ▪ On site terrain stability assessments conducted by professional engineers and geoscientist; ▪ On site terrain stability assessments will follow accepted standards and guidelines. ▪ Baseline terrain/terrain stability studies, and cursory hydrologic and hydrotechnical assessments indicate that there are no significant land based mass movement concerns ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored by professional engineers and geoscientist; and ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored following provincial and federal accepted standards.	Compliance monitoring will be conducted through the implementation of the: ▪ Geotechnical and Pit Slope Stability Monitoring Plan Details provided in Volume 3, Part E - Section 17.0.
Terrain Stability	Soils, including terrain and geology	Land-based Mass Movement - Terrain Stability: changes to debris flow-debris flood transport or run out zones.	▪ Conduct onsite assessment of terrain stability conditions along watercourse banks and connectivity to planned site activities; ▪ Conduct appropriate debris flow/ flood hazard and effect assessments including hydrotechnical assessments that would include peak discharge and sediment concentration estimates; and ▪ Prepare engineered designs and plans by qualified and experienced professionals for mitigation (e.g., diversion and catchment structures), as required.	Predicted effectiveness of proposed mitigation is expected to be high: ▪ On site terrain stability assessments conducted by professional engineers and geoscientist; ▪ On site terrain stability assessments will follow accepted standards and guidelines. ▪ Baseline terrain/terrain stability studies, and cursory hydrologic and hydrotechnical assessments indicate that there are no significant land based mass movement concerns ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored by professional engineers and geoscientist; and ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored following provincial and federal accepted standards.	Compliance monitoring will be conducted through the implementation of the: ▪ Geotechnical and Pit Slope Stability Monitoring Plan Details provided in Volume 3, Part E - Section 17.0.
Operations					
Earthquakes and Tsunamis	Soils, including terrain and geology	Increased ground movement during earthquake event.	▪ Conduct operations in conformance with detailed geotechnical designs; and ▪ Monitor performance during operations and update or modify designs if required to achieve Proposed Project performance requirements and for mitigation, as required.	Predicted effectiveness of proposed mitigation is expected to be high due to: ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored by professional engineers and geoscientist; and ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored following provincial and federal accepted standards.	Compliance monitoring will be conducted through the implementation of the: ▪ Geotechnical and Pit Slope Stability Monitoring Plan Details provided in Volume 3, Part E - Section 17.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Earthquakes and Tsunamis	Soils, including terrain and geology Soils, including terrain and geology	Increased shoreline erosion and offshore debris deposition during earthquake or landslide generated tsunami.	▪ Conduct operations in conformance with detailed geotechnical designs; and ▪ Monitor performance during operations and update or modify designs if required to achieve Proposed Project performance requirements and for mitigation, as required.	Predicted effectiveness of proposed mitigation is expected to be high due to: ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored by professional engineers and geoscientist; and ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored following provincial and federal accepted standards.	Compliance monitoring will be conducted through the implementation of the: ▪ Geotechnical and Pit Slope Stability Monitoring Plan Details provided in Volume 3, Part E - Section 17.0.
Earthquakes and Tsunamis	Soils, including terrain and geology	Initiation of Submarine Landslides	▪ Conduct operations in conformance with detailed geotechnical designs, monitor performance during operations and update or modify designs if required to achieve Proposed Project performance requirements and for mitigation, as required.	Predicted effectiveness of proposed mitigation is expected to be high due to: ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored by professional engineers and geoscientist; and ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored following provincial and federal accepted standards.	Compliance monitoring will be conducted through the implementation of the: ▪ Geotechnical and Pit Slope Stability Monitoring Plan Details provided in Volume 3, Part E - Section 17.0.
Terrain Stability	Soils, including terrain and geology	Land-based Mass Movement - Terrain Stability: changes to slope morphology or drainage conditions.	▪ Conduct appropriate monitoring and ongoing investigations of terrain stability and geotechnical conditions to achieve Proposed Project performance requirements and for mitigation, as required.	Predicted effectiveness of proposed mitigation is expected to be high: ▪ On site terrain stability assessments conducted by professional engineers and geoscientist; ▪ On site terrain stability assessments will follow accepted standards and guidelines. ▪ Baseline terrain/terrain stability studies, and cursory hydrologic and hydrotechnical assessments indicate that there are no significant land based mass movement concerns ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored by professional engineers and geoscientist; and ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored following provincial and federal accepted standards.	Compliance monitoring will be conducted through the implementation of the: ▪ Geotechnical and Pit Slope Stability Monitoring Plan Details provided in Volume 3, Part E - Section 17.0.
Terrain Stability	Soils, including terrain and geology	Land-based Mass Movement - Terrain Stability: changes to debris flow-debris flood transport or run out zones.	▪ Conduct recommended monitoring and ongoing debris flow/ flood hazard assessments of watercourse side banks and drainage of changing site conditions were warranted.	Predicted effectiveness of proposed mitigation is expected to be high.: ▪ On site terrain stability assessments conducted by professional engineers and geoscientist; ▪ On site terrain stability assessments will follow accepted standards and guidelines. ▪ Baseline terrain/terrain stability studies, and cursory hydrologic and hydrotechnical assessments indicate that there are no significant land based mass movement concerns ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored by professional engineers and geoscientist; and	Compliance monitoring will be conducted through the implementation of the: ▪ Geotechnical and Pit Slope Stability Monitoring Plan Details provided in Volume 3, Part E - Section 17.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
				▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored following provincial and federal accepted standards.	
Reclamation and Closure					
Earthquakes and Tsunamis	Soils, including terrain and geology	Increased Ground Movement during earthquake event	▪ Conduct reclamation and closure in conformance based on detailed geotechnical designs, monitor performance during reclamation and update or modify designs if required to achieve Proposed Project performance requirements and for mitigation, as required.	Predicted effectiveness of proposed mitigation is expected to be high due to: ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored by professional engineers and geoscientist; and ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored following provincial and federal accepted standards.	Compliance monitoring will be conducted through the implementation of the: ▪ Geotechnical and Pit Slope Stability Monitoring Plan Details provided in Volume 3, Part E - Section 17.0.
Earthquakes and Tsunamis	Soils, including terrain and geology	Increased Shoreline Erosion and Offshore Debris Deposition during Earthquake or Landslide Generated Tsunami	▪ Conduct reclamation and closure in conformance based on detailed geotechnical designs, monitor performance during reclamation and update or modify designs if required to achieve Proposed Project performance requirements and for mitigation, as required	Predicted effectiveness of proposed mitigation is expected to be high due to: ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored by professional engineers and geoscientist; and ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored following provincial and federal accepted standards.	Compliance monitoring will be conducted through the implementation of the: ▪ Geotechnical and Pit Slope Stability Monitoring Plan Details provided in Volume 3, Part E - Section 17.0.
Earthquakes and Tsunamis	Soils, including terrain and geology	Initiation of Submarine Landslides	▪ Conduct reclamation and closure in conformance based on detailed geotechnical designs, monitor performance during reclamation and update or modify designs if required to achieve Proposed Project performance requirements and for mitigation, as required	Predicted effectiveness of proposed mitigation is expected to be high due to: ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored by professional engineers and geoscientist; and ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored following provincial and federal accepted standards.	Compliance monitoring will be conducted through the implementation of the: ▪ Geotechnical and Pit Slope Stability Monitoring Plan Details provided in Volume 3, Part E - Section 17.0.
Terrain Stability	Soils, including terrain and geology	Land-based Mass Movement - Terrain Stability: changes to slope morphology or drainage conditions and changes to debris flow-debris flood transport or run out zones	▪ Based on stockpile location and earth works affecting or indirectly connected to side banks of watercourses, conduct site assessment of terrain stability conditions and soil erosion plans. ▪ Includes conducting appropriate onsite assessments to identify connectivity of site earth works to watercourses. For potential debris flow / flood catchment structures, conduct appropriate decommissioning or ongoing monitoring of structures where warranted. ▪ As required, prepare engineered designs and plans by qualified and experienced professionals for removal or ongoing mitigation of site.	Predicted effectiveness of proposed mitigation is expected to be high: ▪ On site terrain stability assessments conducted by professional engineers and geoscientist; ▪ On site terrain stability assessments will follow accepted standards and guidelines. ▪ Baseline terrain/terrain stability studies, and cursory hydrologic and hydrotechnical assessments indicate that there are no significant land based mass movement concerns ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored by professional engineers and geoscientist; and ▪ Earthworks and land and marine based facilities and structures will be planned, designed and monitored following provincial and federal accepted standards.	Compliance monitoring will be conducted through the implementation of the: ▪ Geotechnical and Pit Slope Stability Monitoring Plan Details provided in Volume 3, Part E - Section 17.0.

Table 15-11: Summary of Proposed Measures for Mitigating Potential Effects to Surface Water Resources

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Construction					
Surface Water Quality	Surface Water Quality	Changes to Water Quality – Suspended Sediments	▪ Proposed Project design elements ▪ Adherence to an Erosion and Sediment Control Plan	▪ Mitigation is expected to be effective Commitment for environmental monitoring to be conducted by a qualified EM; ▪ Adherence to component EMPs and EPPs that will be prepared in accordance with applicable provincial and federal guidelines and BMPs (e.g., monitoring TSS); and ▪ Mitigation is widely used and proven effective (e.g., re-vegetation, silt fencing, wet processing to reduce dust etc.).	Compliance monitoring will be conducted through the implementation of the: ▪ Erosion and Sediment Control Plan; ▪ Fisheries Habitat Protection and Mitigation Plan; and ▪ Air Quality and Dust Control Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Fish and Fish Habitat Fisheries Monitoring Plan; and ▪ Air Quality and Meteorological Monitoring Program Details provided in Volume 3, Part E - Section 17.0.
Operations					
Surface Water Quality	Surface Water Quality	Changes to Water Quality – Suspended Sediments	▪ Proposed Project design elements ▪ Adherence to an Erosion and Sediment Control Plan.	▪ Mitigation is expected to be effective Commitment for environmental monitoring to be conducted by a qualified EM; ▪ Adherence to component EMPs and EPPs that will be prepared in accordance with applicable provincial and federal guidelines and BMPs (e.g., monitoring TSS); ▪ Mitigation is widely used and proven effective (e.g., re-vegetation, silt fencing, wet processing to reduce dust etc.); and ▪ Plan to reclaim the fines storage area in a progressive manner.	Compliance monitoring will be conducted through the implementation of the: ▪ Erosion and Sediment Control Plan; ▪ Fisheries Habitat Protection and Mitigation Plan; and ▪ Air Quality and Dust Control Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Fish and Fish Habitat Monitoring Plan; and ▪ Air Quality and Meteorological Monitoring Program Details provided in Volume 3, Part E - Section 17.0.
Reclamation and Closure					
Surface Water Quality	Surface Water Quality	Changes to Water Quality – Suspended Sediments	▪ Proposed Project design elements ▪ Adherence to an Erosion and Sediment Control Plan.	▪ Mitigation is expected to be effective; ▪ Commitment for environmental monitoring to be conducted by a qualified EM; ▪ Adherence to component EMPs and EPPs that will be prepared in accordance with applicable provincial and federal guidelines and BMPs (e.g., monitoring TSS); ▪ Mitigation is widely used and proven effective (e.g., re-vegetation, silt fencing, wet processing to reduce dust etc.); and ▪ Plan to reclaim the fines storage area in a progressive manner.	Compliance monitoring will be conducted through the implementation of the: ▪ Erosion and Sediment Control Plan; ▪ Fisheries Habitat Protection and Mitigation Plan; and ▪ Air Quality and Dust Control Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Fish and Fish Habitat Monitoring Plan; and ▪ Air Quality and Meteorological Monitoring Program Details provided in Volume 3, Part E - Section 17.0.

Table 15-12: Summary of Proposed Measures for Mitigating Potential Effects to Aquatic Health

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
			Construction		
Aquatic Health	Surface water quality Fish populations and fish habitat	Direct Toxicity-Related Effects	▪ Adherence to an Erosion and Sediment Control Plan. ▪ Adherence to a Material Storage, Handling and Waste Management Plan.	▪ The mitigation is expected to be effective in reducing the potential impact of the residual effect. ▪ Mitigation plans will be prepared in accordance with applicable provincial and federal guidelines and BMPs and by and QEP.	Compliance monitoring will be conducted through the implementation of the: ▪ Erosion and Sediment Control Plan; and ▪ Material Storage, Handling and Waste Management Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Surface Water Quality Monitoring Program; and ▪ Aquatic Health Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.
Aquatic Health	Surface water quality Fish populations and fish habitat	Nutrient Enrichment-Related Effects	▪ Adherence to an Erosion and Sediment Control Plan.	▪ The mitigation is expected to be effective in reducing the potential impact of the residual effect. ▪ Mitigation plans will be prepared in accordance with applicable provincial and federal guidelines and BMPs and by and QEP.	Compliance monitoring will be conducted through the implementation of the: ▪ Erosion and Sediment Control Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Surface Water Quality Monitoring Program; and ▪ Aquatic Health Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.
			Operations		
Aquatic Health	Surface water quality Fish populations and fish habitat	Direct Toxicity-Related Effects	▪ Adherence to an Erosion and Sediment Control Plan. ▪ Adherence to a Material Storage, Handling and Waste Management Plan.	▪ The mitigation is expected to be effective in reducing the potential impact of the residual effect. ▪ Mitigation plans will be prepared in accordance with applicable provincial and federal guidelines and BMPs and by and QEP.	Compliance monitoring will be conducted through the implementation of the: ▪ Erosion and Sediment Control Plan; and ▪ Material Storage, Handling and Waste Management Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Surface Water Quality Monitoring Program; and ▪ Aquatic Health Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.
Aquatic Health	Surface water quality Fish populations and fish habitat	Nutrient Enrichment-Related Effects	▪ Adherence to an Erosion and Sediment Control Plan.	▪ The mitigation is expected to be effective in reducing the potential impact of the residual effect. ▪ Mitigation plans will be prepared in accordance with applicable provincial and federal guidelines and BMPs and by and QEP.	Compliance monitoring will be conducted through the implementation of the: ▪ Erosion and Sediment Control Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Surface Water Quality Monitoring Program; and ▪ Aquatic Health Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.
			Reclamation and Closure		
Aquatic Health	Surface water quality Fish populations and fish habitat	Direct Toxicity-Related Effects	▪ Adherence to an Erosion and Sediment Control Plan. ▪ Adherence to a Material Storage, Handling and Waste Management Plan.	▪ The mitigation is expected to be effective in reducing the potential impact of the residual effect. ▪ Mitigation plans will be prepared in accordance with applicable provincial and federal guidelines and BMPs and by and QEP.	Compliance monitoring will be conducted through the implementation of the: ▪ Erosion and Sediment Control Plan; and ▪ Material Storage, Handling and Waste Management Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Surface Water Quality Monitoring Program; and ▪ Aquatic Health Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.
Aquatic Health	Surface water quality Fish populations and fish habitat	Nutrient Enrichment-Related Effects	▪ Adherence to an Erosion and Sediment Control Plan.	▪ The mitigation is expected to be effective in reducing the potential impact of the residual effect. ▪ Mitigation plans will be prepared in accordance with applicable provincial and federal guidelines and BMPs and by and QEP.	Compliance monitoring will be conducted through the implementation of the: ▪ Erosion and Sediment Control Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Surface Water Quality Monitoring Program; and ▪ Aquatic Health Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
		Accident and Malfunction			
Aquatic Health	Surface water quality Fish populations and fish habitat	Changes to Water Quality – Spills	▪ Adherence to a Material Storage, Handling and Waste Management Plan. ▪ Adherence to a Site specific Spill Prevention and Emergency Response Plan.	▪ Mitigation is expected to be effective; ▪ Use of electricity to power many pieces of equipment reduces the need for fuels on-site; and ▪ Adherence to component EMPs and EPPs that will be prepared in accordance with applicable provincial and federal guidelines and BMPs regarding spill preparedness and spill response measures.	Compliance monitoring will be conducted through the implementation of the: ▪ Spill Prevention and Emergency Response Plan (SERP); and ▪ Material Storage, Handling and Waste Management Plan. Details provided in Volume 3, Part E - Section 16.0.

Table 15-13: Summary of Proposed Measures for Mitigating Potential Effects to Groundwater Resources

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Construction					
		No effects anticipated			
Operations					
Groundwater Flow	Hydrogeology	Changes in groundwater flow.	▪ Limit excavation to the southern portion of delta/fan. ▪ Implementation of a progressive Reclamation and Effective Closure Plan.	▪ Reduced water loss from McNab Creek while maintaining groundwater flow to near baseflow. ▪ Considerable hydrogeological data that were incorporated into a numerical model and calibrated to observed conditions to predict changes in groundwater flow.	Compliance monitoring will be conducted through the implementation of the: ▪ Reclamation and Effective Closure Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Groundwater Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.
Reclamation and Closure					
Groundwater Flow	Hydrogeology	Changes in groundwater flow.	▪ Overflow structure at 5.2 m.	▪ Maintains near baseflow groundwater flow rates.	Compliance monitoring will be conducted through the implementation of the: ▪ Reclamation and Effective Closure Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Groundwater Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.
Groundwater Quality	Groundwater Quality	Changes in groundwater quality.	▪ Fines deposited in the Fines Storage Area around the northern and eastern perimeter of the property but each year's deposition will be limited to small surface area. Fines will be mixed with a growing medium and seeded. ▪ Implementation of a progressive Reclamation and Effective Closure Plan.	▪ Will stabilize soils and reduce chemical loading from fines to small annual areas of fresh fine deposition thereby improving groundwater quality. ▪ Conservative approach used to predict water quality. The 95% concentrations or probability distributions of the sources were used to generate predicted minimum, median and maximum monthly concentrations. The maximum concentration in any month of a given year was used as the predicted value for that year. No water quality parameters are predicted to be above the applicable guidelines. ▪ The 95% concentrations or probability distributions of the sources were used to generate predicted minimum, median and maximum monthly concentrations. The maximum concentration in any month of a given year was used as the predicted value for that year. No water quality parameters were predicted to be above the applicable guidelines.	Compliance monitoring will be conducted through the implementation of the: ▪ Reclamation and Effective Closure Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Groundwater Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.

Table 15-14: Summary of Proposed Measures for Mitigating Potential Effects to Air Quality

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Construction					
Air Quality Indicators	Environmental conditions including climate Air quality (dustfall and particulate matter)	Fugitive particulate concentrations from construction activities: Bulldozing, material handling (material drops), fugitive road dust, and wind erosion from un-vegetated dyke and berms.	▪ Develop and implement an Air Quality and Dust Control Management Plan ▪ Establish an Air Quality and Meteorological Monitoring Program ▪ Watering of unpaved roads and restricted speed limits within Proposed Project Area to reduce particulate emissions.	▪ Compared to the Proposed Project operations phase emissions from the construction phase are expected to be short term and intermittent compared to the operation phase. ▪ Mitigation measures undertaken by BURNCO during the construction phase are consistent with industry practices in control.	Compliance monitoring will be conducted through the implementation of the: ▪ Air Quality and Dust Control Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Air Quality and Meteorological Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.
Operations					
Air Quality Indicators	Environmental conditions including climate Air quality (dustfall and particulate matter)	Fugitive particulate concentrations from onsite activities.	▪ Establish an Air Quality and Meteorological Monitoring Program	▪ Allows the Proposed Project to measure and compare operations phase effects to construction and pre-construction conditions. May be used in determining operational schedule (do not undertake some processes during high wind days).	
Air Quality Indicators	Environmental conditions including climate Air quality (dustfall and particulate matter)	Fugitive particulate concentrations processing plant crushing units.	▪ Partial enclosure	▪ 85% taken from Pits and Quarries Guidance Chapter 8, Section 8.5 - Crusher Emission Control Techniques (Environment Canada 2009).	
Air Quality Indicators	Environmental conditions including climate Air quality (dustfall and particulate matter)	Fugitive particulate concentrations from wind erosion off the10 mm Crushed Gravel and 20 mm Crushed Gravel Stockpiles.	▪ Watering	▪ 50% taken from Environment Canada (2009).	Compliance monitoring will be conducted through the implementation of the: ▪ Air Quality and Dust Control Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Air Quality and Meteorological Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.
Air Quality Indicators	Environmental conditions including climate Air quality (dustfall and particulate matter)	Fugitive particulate concentrations from processing plant dry screening units.	▪ Partial enclosure	▪ 50% taken from Environment Canada (2009)	
Air Quality Indicators	Environmental conditions including climate Air quality (dustfall and particulate matter)	Fugitive particulate concentrations from processing plant wet screening.	▪ Wet process	▪ 100% assumed since material will be saturated.	
Air Quality Indicators	Environmental conditions including climate Air quality (dustfall and particulate matter)	Fugitive particulate concentrations from material handling (material drops).	▪ Partial enclosure	▪ 50% taken from Environment Canada (2009).	

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Air Quality Indicators	Environmental conditions including climate Air quality (dustfall and particulate matter)	Fugitive particulate concentrations from material handling (material drops).	▪ Partial enclosure and water (mist) spray	▪ 75% taken from Environment Canada (2009).	
Air Quality Indicators	Environmental conditions including climate Air quality (dustfall and particulate matter)	Fugitive particulate concentrations from fugitive road dust.	▪ Watering	▪ 55% taken from WRAP Fugitive Dust Handbook (Countess Environmental 2004).	
Reclamation and Closure					
Air Quality Indicators	Environmental conditions including climate Air quality (dustfall and particulate matter)	Fugitive particulate concentrations from reclamation and closure activities: Bulldozing, material handling (material drops), fugitive road dust, and wind erosion from un-vegetated dyke and berms	▪ Watering of unpaved roads and restricted speed limits within Proposed Project Area to reduce particulate emissions.	▪ Compared to the facility operations phase emissions from the reclamation and closure phase are expected to be short term and intermittent compared to the operation phase. ▪ Mitigation measures undertaken by BURNCO during the construction phase are consistent with industry practices in control	Compliance monitoring will be conducted through the implementation of the: ▪ Air Quality and Dust Control Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Air Quality and Meteorological Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.

Table 15-15: Summary of Proposed Measures for Mitigating Potential Effects to Climate Change

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
All Project Phases					
Air Quality Indicators	Environmental conditions including climate Air quality (dustfall and particulate matter)	GHG Emissions from On-Site gravel extraction, handling, transport around site, processing operations and barge loading	▪ Using electrically as a power source instead of diesel vehicles and diesel stationary combustion. ▪ Major extraction and processing equipment such as the dredger, screens and crusher will be powered by electricity. ▪ Extracted and processed material will be transferred around the Proposed Project site using a network of conveyors instead of using haul vehicles.	▪ Highly Effective - use of electricity as a power source will replace diesel combustion which has a much higher GHG emission intensity	Compliance monitoring will be conducted through the implementation of the: ▪ Construction Environmental Management Plan (CEMP). Details provided in Volume 3, Part E - Section 16.0.
Air Quality Indicators	Environmental conditions including climate Air quality (dustfall and particulate matter)	GHG Emissions from On-Site Vehicles	▪ Ongoing routine maintenance of vehicles	▪ Moderately Effective – well maintained vehicles will result in increased fuel efficiency and therefore result in less GHG emissions	Compliance monitoring will be conducted through the implementation of the: ▪ Construction Environmental Management Plan (CEMP). Details provided in Volume 3, Part E - Section 16.0.
Air Quality Indicators	Environmental conditions including climate Air quality (dustfall and particulate matter)	GHG Emissions from On-Site Vehicles	▪ Minimize vehicle idling	▪ Highly Effective - avoiding idling will directly avoid diesel/gas combustion	Compliance monitoring will be conducted through the implementation of the: ▪ Construction Environmental Management Plan (CEMP). Details provided in Volume 3, Part E - Section 16.0.
Air Quality Indicators	Environmental conditions including climate Air quality (dustfall and particulate matter)	GHG Emissions from Barge Tugboat	▪ Minimize tug idling	▪ Highly Effective - avoiding idling will directly avoid diesel/gas combustion	Compliance monitoring will be conducted through the implementation of the: ▪ Construction Environmental Management Plan (CEMP); and ▪ Marine Transportation Management Plan. Details provided in Volume 3, Part E - Section 16.0.

Table 15-16: Summary of Proposed Measures for Mitigating Potential Economic Effects

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Construction and Operations					
Labour Market	Local and regional socio-economic conditions	**Labour Market -** employment and income generating opportunities for local residents	▪ Local hiring and procurement policies and practices.	▪ Proposed Project effects are positive and therefore no residual adverse effects are anticipated.	▪ Proposed Project effects are positive and therefore no monitoring or follow-up programs are suggested.
Regional Economic Development	Local and regional socio-economic conditions	**Regional Economic Development –** goods and services business and contracting opportunities for local businesses			
Local Government Revenue	Local and regional socio-economic conditions	**Local Government Revenue –** local and regional governments would receive taxes and fees in association with construction and operation of the Proposed Project	▪ No mitigation required.		
Real Estate	Local and regional socio-economic conditions	**Real Estate –** reduced value of McNab Creek Strata real estate	▪ Implement noise, visual resource and air quality mitigation measures. ▪ Explore electricity distribution infrastructure and apply for a suitable interconnection to the B.C. Hydro 138 kV transmission line in order to potentially offer access to B.C. Hydroelectricity service to McNab Creek Strata real estate owners. If this electricity service is realized for strata owners then reliance on generators would be diminished along with their associated noise and air emissions. ▪ Implementation of an Access Management Plan to provide special access to certain parts of BURNCO's private property pursuant to discussions between BURNCO and strata residents on access arrangements. ▪ Ongoing engagement with McNab Creek Strata residents regarding issues of benefit and concern.	▪ It is not possible at this stage of Proposed Project development to determine if the proposed mitigation measures will fully offset the anticipated negative effects on real estate values of McNab Creek Strata real estate. At a minimum, they are expected to partially offset the identified adverse effect.	Compliance monitoring will be conducted through the implementation of the: ▪ Air Quality and Dust Control Plan; and ▪ Access Management Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Air Quality and Meteorological Monitoring Program; and ▪ Ongoing engagement with McNab Creek Strata. Details provided in Volume 3, Part E - Section 17.0.
Reclamation and Closure					
Labour Market	Local and regional socio-economic conditions	**Labour Market**	▪ No mitigation required.	▪ No adverse residual adverse effects anticipated.	▪ Proposed Project effects are positive and therefore no monitoring or follow-up programs are suggested.
Regional Economic Development	Local and regional socio-economic conditions	**Regional Economic Development**			
Local Government Revenue	Local and regional socio-economic conditions	**Local Government Revenue**			
Real Estate	Local and regional socio-economic conditions	**Real Estate**			

Table 15-17: Summary of Proposed Measures for Mitigating Potential Social Effects

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Construction					
Housing and Accommodation	Local and regional socio-economic conditions	Workers sourced from outside the LSA could lead to increase demand on local housing and/or temporary accommodation, and affect housing availability and affordability	▪ Local hiring of workforce will assist in reducing any in-migration due to employment opportunity an associated effects on housing.	▪ Anticipate small to negligible in-migration due to small construction workforce; Standard mitigation and best practice to reduce in-migration and demand on local housing and/or temporary accommodation. Mitigation will be effective in management of potential effect.	None suggested.
Emergency Services	Local and regional socio-economic conditions	Construction activities requiring direct use of local emergency services. Change in demand for emergency services exceeding service supply/capacity	▪ Develop and implement a Spill Prevention and Emergency Response Plan. ▪ Develop and implement an Emergency Response Plan. ▪ Develop and implement an Access Management Plan. ▪ Aggregate transport by an experienced barge and tug operator that implements an Environmental Management System (EMS) in conformance with ISO 14001:2004.	▪ Standard mitigation measures and best practice for Proposed Project of this size and type. Mitigation will be effective in management of potential effect.	Compliance monitoring will be conducted through the implementation of the: ▪ Spill Prevention and Emergency Response Plan; ▪ Emergency Response Plan; and ▪ Access Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Operations					
Housing and Accommodation	Local and regional socio-economic conditions	Workers sourced from outside the LSA could lead to increase demand on local housing and/or temporary accommodation, and affect housing availability and affordability	▪ Local hiring of workforce will assist in reducing any in-migration due to employment opportunity an associated effects on housing	▪ Anticipate small to negligible in-migration due to small operational workforce; Standard mitigation and best practice to reduce in-migration and demand on local housing and/or temporary accommodation. Mitigation will be effective in management of potential effect.	None suggested.
Emergency Services	Local and regional socio-economic conditions	Operational activities requiring direct use of local emergency services. Change in demand for emergency services exceeding service supply/capacity	▪ Develop and implement a Spill Prevention and Emergency Response Plan. ▪ Develop and implement an Emergency Response Plan. ▪ Develop and implement an Access Management Plan. ▪ Aggregate transport by an experienced barge and tug operator that implements an Environmental Management System (EMS) in conformance with ISO 14001:2004.	▪ Standard mitigation measures and best practice for Proposed Project of this size and type. Mitigation will be effective in management of potential effect.	Compliance monitoring will be conducted through the implementation of the: ▪ Spill Prevention and Emergency Response Plan; ▪ Emergency Response Plan; and ▪ Access Management Plan. Details provided in Volume 3, Part E - Section 16.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Reclamation and Closure					
Housing and Accommodation	Local and regional socio-economic conditions	Change in demand for housing and temporary accommodation affecting housing affordability and availability	▪ Local hiring of workforce will assist in reducing any out-migration due to cessation of employment , and associated effects on housing	▪ Anticipate small to negligible out-migration due to small operational workforce; Standard mitigation and best practice to reduce in-migration (during operations) and associated out-migration during closure and demand on local housing and/or temporary accommodation. Mitigation will be effective in management of potential effect	None suggested.
Emergency Services			▪	▪	

Table 15-18: Summary of Proposed Measures for Mitigating Potential Effects to Marine Transportation

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Construction					
Marine Navigation.	Local and regional socio-economic conditions Human health	Interference with navigation use and navigability due to Project-related infrastructure	Measures to reduce navigational hazard from Project-related infrastructure: ▪ Marine Transport Management Plan. ▪ Proposed Project marine control zone will be marked using buoys subject to TC requirements. ▪ Proposed Project-related infrastructure will incorporate recommendations of the Navigation Protection Program review process. ▪ Dark sky shielded features will be installed in the Proposed Project Area, where technically possible. ▪ Relevant authorities will be notified so that Notices to Mariners and Notices to Shipping can be issued. ▪ CHS navigational charts and other appropriate nautical publications will be updated to show the terminal and other marine features, where appropriate.	▪ Mitigation measures are expected to be effective and will reduce potential effects to a level that is considered negligible.	Compliance monitoring will be conducted through the implementation of the: ▪ Marine Transportation Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Marine Navigation.	Local and regional socio-economic conditions Human health	Interference with navigation use and navigability due to Project-related vessel traffic	Measures to reduce interference to existing vessel traffic, access routes and fisheries: ▪ Commitment for consultation with CCG, PPA, HPP, BC Ferries and Squamish Terminals along with other stakeholders regarding potential interference to identify operating practices or vessel route options that should be adopted. ▪ Commitment to investigate further passage routing options to avoid busy recreational waters and BC Ferries routes particularly during the summer months. ▪ Marine Transport Management Plan (described above) will include a procedure for marine stakeholders to consult with the proponent regarding special events such as, yacht races, regattas and marine based festivals. ▪ Commitment to limit the number of water taxi movements traversing through Thornbrough Channel and to avoid peak recreational boating times, where possible.	▪ Mitigation measures are expected to be effective and will reduce potential effects.	Compliance monitoring will be conducted through the implementation of the: ▪ Marine Transportation Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Operations					
Marine Navigation.	Local and regional socio-economic conditions Human health	Interference with navigation use and navigability due to Project-related infrastructure	Measures to reduce navigational hazard from Project-related infrastructure: ▪ Marine Transport Management Plan. ▪ Proposed Project marine control zone will be marked using buoys subject to TC requirements. ▪ Proposed Project-related infrastructure will incorporate recommendations of the Navigation Protection Program review process. ▪ Dark sky shielded features will be installed in the Proposed Project Area, where technically possible. ▪ Relevant authorities will be notified so that Notices to Mariners and Notices to Shipping can be issued.	▪ Mitigation measures are expected to be effective and will reduce potential effects to a level that is considered negligible.	Compliance monitoring will be conducted through the implementation of the: ▪ Marine Transportation Management Plan. Details provided in Volume 3, Part E - Section 16.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
			▪ CHS navigational charts and other appropriate nautical publications will be updated to show the terminal and other marine features, where appropriate.		
Marine Navigation.	Local and regional socio-economic conditions Human health	Interference with navigation use and navigability due to Project-related vessel traffic	Measures to reduce interference to existing vessel traffic, access routes and fisheries: ▪ Commitment for consultation with CCG, PPA, HPP, BC Ferries and Squamish Terminals along with other stakeholders regarding potential interference to identify operating practices or vessel route options that should be adopted. ▪ Commitment to investigate further passage routing options to avoid busy recreational waters and BC Ferries routes particularly during the summer months and at weekends. ▪ Marine Transport Management Plan (described above) will include a procedure for marine stakeholders to consult with the proponent regarding special events such as, yacht races, regattas and marine based festivals. ▪ Commitment to limit the number of water taxi movements traversing through Thornbrough Channel and to avoid peak recreational boating times, where possible.	▪ Mitigation measures are expected to be effective and will reduce potential effects on both recreational and commercial users.	Compliance monitoring will be conducted through the implementation of the: ▪ Marine Transportation Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Reclamation and Closure					
Marine Navigation.	Local and regional socio-economic conditions Human health	Interference with navigation use and navigability due to Project-related infrastructure	Measures to reduce navigational hazard from Project-related infrastructure: ▪ Marine Transport Management Plan. ▪ Proposed Project marine control zone will be marked using buoys subject to TC requirements. ▪ Proposed Project-related infrastructure will incorporate recommendations of the Navigation Protection Program review process. ▪ Dark sky shielded features will be installed in the Proposed Project Area, where technically possible. ▪ Relevant authorities will be notified so that Notices to Mariners and Notices to Shipping can be issued. ▪ CHS navigational charts and other appropriate nautical publications will be updated to show the terminal and other marine features, where appropriate.	▪ Mitigation measures are expected to be effective and will reduce potential effects to a level that is considered negligible.	Compliance monitoring will be conducted through the implementation of the: ▪ Marine Transportation Management Plan. Details provided in Volume 3, Part E - Section 16.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Marine Navigation.	Local and regional socio-economic conditions Human health	Interference with navigation use and navigability due to Project-related vessel traffic	Measures to reduce interference to existing vessel traffic, access routes and fisheries: ▪ Commitment for consultation with CCG, PPA, HPP, BC Ferries and Squamish Terminals along with other stakeholders regarding potential interference to identify operating practices or vessel route options that should be adopted. ▪ Commitment to investigate further passage routing options to avoid busy recreational waters and BC Ferries routes particularly during the summer months. ▪ Marine Transport Management Plan (described above) will include a procedure for marine stakeholders to consult with the proponent regarding special events such as, yacht races, regattas and marine based festivals. ▪ Commitment to limit the number of water taxi movements traversing through Thornbrough Channel and to avoid peak recreational boating times, where possible.	▪ Mitigation measures are expected to be effective and will reduce potential effects to a level that is considered negligible.	Compliance monitoring will be conducted through the implementation of the: ▪ Marine Transportation Management Plan. Details provided in Volume 3, Part E - Section 16.0.

Table 15-19: Summary of Proposed Measures for Mitigating Potential Effects to Non-Traditional Land and Resource Use

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Construction					
Harvesting Fish and Wildlife Recreation and Tourism	Local and regional socio-economic conditions	Change in Quality of Environmental Setting (Harvesting Fish and Wildlife and Outdoor Recreation and Tourism)	**Measures outlined in Table 15-23 (Noise), Table 15-14 (Air Quality), and** ▪ ▪ Table 15-20 (Visual Resource). ▪ Measures outlined in Table 15-18 (Marine Transport).		
Operations					
Harvesting Fish and Wildlife Recreation and Tourism	Local and regional socio-economic conditions	Change in Quality of Environmental Setting (Harvesting Fish and Wildlife and Outdoor Recreation and Tourism)	▪ Barges will be loaded only on weekdays. **Measures outlined in Table 15-23 (Noise), Table 15-14 (Air Quality), and** ▪ ▪ Table 15-20 (Visual Resource). ▪ Measures outlined in Table 15-18 (Marine Transport).		
Reclamation and Closure					
No residual effects.					

Table 15-20: Summary of Proposed Measures for Mitigating Potential Effects to Visual Resources

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Construction					
Visual Quality	Human health Physical and cultural heritage Archaeological, historical, paleontological or architectural resources including structures and sites of significance	Site preparation, processing area and marine loading facility installation	▪ Minimize removal of vegetation and topsoil to ensure that existing natural vegetation is retained and incorporated into site design. This will be integrated into the Vegetation Management Plan. ▪ Implementation of a Construction Environmental Management Plan (CEMP).	▪ Mitigation measures will reduce potential residual effects by providing screening for construction activity and related effect, as well as ensuring blending with the existing land cover.	Compliance monitoring will be conducted through the implementation of the: ▪ Construction Environmental Management Plan (CEMP). Details provided in Volume 3, Part E - Section 16.0.
Visual Quality	Human health Physical and cultural heritage Archaeological, historical, paleontological or architectural resources including structures and sites of significance	Dust related to construction activities	▪ Dust suppression techniques should be in place at all times during construction. ▪ Implementation of an Air Quality and Dust Control Management Plan. ▪ Implementation of a Construction Environmental Management Plan (CEMP).	▪ Mitigation measures will reduce potential residual effects by reducing visible Project effect.	Compliance monitoring will be conducted through the implementation of the: ▪ Construction Environmental Management Plan (CEMP); and ▪ Air Quality and Dust Control Management Plan. Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Air Quality and Meteorological Monitoring Program. Details provided in Volume 3, Part E - Section 17.0.
Visual Quality	Human health Physical and cultural heritage Archaeological, historical, paleontological or architectural resources including structures and sites of significance	ancillary land-based and marine -based construction works	▪ Keep the scale and size of infrastructure components and layout concentrated. ▪ Any desired planting programs for vegetative screening of land-based structures should be considered as results will not be immediately effective. ▪ Preserve the level of structure contrast of infrastructure components by re-finishing and maintaining external surfaces as required. ▪ Additional screening of land-based structures may be possible around welfare and ancillary work not currently screened by existing vegetation. ▪ Implementation of a Construction Environmental Management Plan (CEMP).	▪ Mitigation measures will reduce potential residual effects to avoid visibility and reduce the level of visual contrast with the existing landscape.	Compliance monitoring will be conducted through the implementation of the: ▪ Construction Environmental Management Plan (CEMP). Details provided in Volume 3, Part E - Section 16.0.
Operations					
Visual Quality	Human health Physical and cultural heritage Archaeological, historical, paleontological or architectural resources including structures and sites of significance	Pit development from clamshell dredging and processing;	▪ Maintain natural screening to decrease the visibility of extraction and processing activity. This will be integrated into the Vegetation Management Plan. ▪ Dust suppression techniques should be in place at all times during operation. ▪ Implementation of an Air Quality and Dust Control Management Plan. ▪ Implementation of an Operational Environmental Management Plan (OEMP).	▪ Mitigation measures will reduce potential residual effects by providing screening for operation activity and related effect, as well as ensuring blending with the existing land cover.	Compliance monitoring will be conducted through the implementation of the: ▪ Vegetation Management Plan including an Invasive Plant Species Management Plan; ▪ Air Quality and Dust Control Management Plan; and ▪ Environmental Management Plan (OEMP). Details provided in Volume 3, Part E - Section 16.0. Follow-up monitoring will be conducted through the implementation of the: ▪ Vegetation Monitoring Plan. Details provided in Volume 3, Part E - Section 17.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Visual Quality	Human health Physical and cultural heritage Archaeological, historical, paleontological or architectural resources including structures and sites of significance	Marine loading	▪ No mitigation measures proposed.	▪ Minor effects identified.	No monitoring or follow-up programs proposed.
Visual Quality	Human health Physical and cultural heritage Archaeological, historical, paleontological or architectural resources including structures and sites of significance	Stockpile storage	▪ Keep the height of stockpiles low to avoid their visibility above existing screening. ▪ Implementation of an Operational Environmental Management Plan (OEMP).	▪ Mitigation measures will reduce potential residual effects to avoid visibility and reduce the level of visual contrast with the existing landscape.	Compliance monitoring will be conducted through the implementation of the: ▪ Environmental Management Plan (OEMP). Details provided in Volume 3, Part E - Section 16.0.
Visual Quality	Human health Physical and cultural heritage Archaeological, historical, paleontological or architectural resources including structures and sites of significance	Security lighting	▪ Negative lighting impacts can be mitigated by installing fixtures that reduce light 'spillage' beyond the direct area of illumination. ▪ Implementation of an Operational Environmental Management Plan (OEMP).	▪ Mitigation measures will reduce potential residual effects to avoid visibility and reduce the level of visual contrast with the existing landscape.	Compliance monitoring will be conducted through the implementation of the: ▪ Environmental Management Plan (OEMP). Details provided in Volume 3, Part E - Section 16.0.
Visual Quality	Human health Physical and cultural heritage Archaeological, historical, paleontological or architectural resources including structures and sites of significance	Progressive reclamation	▪ Implementation of a Reclamation and Effective Closure Plan. ▪ Site planning and progressive reclamation plans throughout all phases of mine development including landform design and temporary planting.	▪ Mitigation measures will reduce potential residual effects to avoid visibility and reduce the level of visual contrast with the existing landscape.	Compliance monitoring will be conducted through the implementation of the: ▪ Reclamation and Effective Closure Plan. Details provided in Volume 3, Part E - Section 16.0.
Reclamation and Closure					
Visual Quality	Human health Physical and cultural heritage Archaeological, historical, paleontological or architectural resources including structures and sites of significance	Removal of land-based and marine infrastructure	▪ Implementation of a Reclamation and Effective Closure Plan. ▪ Eliminate anthropogenic features through the removal of surface facilities and marine infrastructure not required to the operation or maintenance of the site.	▪ Mitigation measures will reduce potential residual effects to avoid visibility and reduce the level of visual contrast with the existing landscape.	Compliance monitoring will be conducted through the implementation of the: ▪ Reclamation and Effective Closure Plan. Details provided in Volume 3, Part E - Section 16.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Visual Quality	Human health Physical and cultural heritage Archaeological, historical, paleontological or architectural resources including structures and sites of significance	Site Reclamation	▪ Implementation of a Reclamation and Effective Closure Plan. ▪ Final reclamation of disturbed areas with landscaping/landform design and re-vegetation with native species	▪ Mitigation measures will reduce potential residual effects to avoid visibility and reduce the level of visual contrast with the existing landscape.	Compliance monitoring will be conducted through the implementation of the: ▪ Reclamation and Effective Closure Plan. Details provided in Volume 3, Part E - Section 16.0.

Table 15-21: Summary of Mitigation Measures for Heritage Resources

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Construction					
Heritage Resources	Physical and cultural heritage Archaeological, historical, paleontological or architectural resources including structures and sites of significance	Changes to heritage resource integrity, if present, through compaction, crushing and chemical alteration.	Implement Heritage Resource Chance Find Management Plan (Volume 3, Part E - Section 16.0) that provides management recommendations for avoidance, systematic data recovery or monitoring, in the event that undetected heritage resources are encountered during project activities.	▪ Mitigation measures will minimize potential residual effects to acceptable levels. ▪ No heritage resources currently identified in LSA, heritage sites avoided in the RSA. ▪ Implementation of Heritage Resource Chance Find Management Plan will facilitate the effective management of resources to meet Heritage Conservation Act objectives for site protection.	Compliance monitoring will be conducted through the implementation of the: ▪ Heritage Resource Chance Find Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Heritage Resources	Physical and cultural heritage Archaeological, historical, paleontological or architectural resources including structures and sites of significance	Changes to heritage resources context, if present, through surface and subsurface disturbance.	Implement Heritage Resource Chance Find Management Plan (Volume 3, Part E - Section 16.0) that provides management recommendations for avoidance, systematic data recovery or monitoring, in the event that undetected heritage resources are encountered during Proposed Project activities.	▪ Mitigation measures will minimize potential residual effects to acceptable levels. ▪ No heritage resources currently identified in LSA, heritage sites avoided in the RSA. ▪ Implementation of Heritage Resource Chance Find Management Plan will facilitate the effective management of resources to meet Heritage Conservation Act objectives for site protection.	Compliance monitoring will be conducted through the implementation of the: ▪ Heritage Resource Chance Find Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Heritage Resources	Physical and cultural heritage Archaeological, historical, paleontological or architectural resources including structures and sites of significance	Changes to heritage resources accessibility, if present (increased or decreased access)	Implement Heritage Resource Chance Find Management Plan (Volume 3, Part E - Section 16.0) that provides management recommendations for avoidance, systematic data recovery or monitoring, in the event that undetected heritage resources are encountered during Proposed Project activities.	▪ Mitigation measures will minimize potential residual effects to acceptable levels. ▪ No heritage resources currently identified in LSA, heritage sites avoided in the RSA. ▪ Implementation of Heritage Resource Chance Find Management Plan will facilitate the effective management of resources to meet Heritage Conservation Act objectives for site protection.	Compliance monitoring will be conducted through the implementation of the: ▪ Heritage Resource Chance Find Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Operations					
Same as for construction					
Reclamation and Closure					
Same as for construction					

Table 15-22: Summary of Proposed Measures for Mitigating Potential Effects to Public Health

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
All Project Phases					
People	Human health	Air Quality Assessment Particulate Matter Multimedia Assessment	▪ Information on the mitigation measures are summarized in Volume 2, Part B - Section 5.7 (air quality) and Part B, Section 5.5 (surface water resources).		▪ Monitoring plans specific to human health will not be developed as part of the EA. If necessary, monitoring plans will be developed in the corresponding EA studies to confirm the predictions associated with predicted changes in levels of chemical constituents in environmental media to which humans may be exposed. Monitoring criteria specific to human health will be developed in co-operation with the originating discipline study team.

Table 15-23: Summary of Proposed Measures for Mitigating Potential Noise Effects

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Construction					
Noise Levels	Environmental conditions including climate Human health	Increase in noise levels	▪ Limit construction activity to daytime hours.	▪ Highly effective – limiting activities to daytime period will completely eliminate Proposed Project-related noise during the nighttime.	Compliance monitoring will be conducted through the implementation of the: ▪ Noise Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Noise Levels	Environmental conditions including climate Human health		▪ Schedule significant noise-causing activities to reduce disruption to nearby residents.	▪ Moderately effective – BURNCO will consult with nearby residents and attempt to schedule particularly noisy activities so as to minimize disruption, but some disruption may be unavoidable.	Compliance monitoring will be conducted through the implementation of the: ▪ Noise Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Noise Levels	Environmental conditions including climate Human health		▪ Position heavy equipment muster points at least 500 m from any receptor.	▪ Moderately effective – ensuring a minimum distance of 500 m between heavy equipment muster points and receptors effectively increases noise propagation distance and reduces noise levels reaching the receptors.	Compliance monitoring will be conducted through the implementation of the: ▪ Noise Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Noise Levels	Environmental conditions including climate Human health		▪ Fit equipment with standard mufflers or silencers and keep in good working order.	▪ Highly effective – mufflers/silencers reduce noise emissions from internal combustion engines dramatically.	Compliance monitoring will be conducted through the implementation of the: ▪ Noise Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Noise Levels	Environmental conditions including climate Human health		▪ Use acoustical screening from existing on-site barriers.	▪ Moderately effective – on-site berms, dyke/barriers will screen noise emissions from Proposed Project equipment and thereby reduce noise levels reaching nearby receptors; berms, dyke/barriers will screen direct propagation paths but noise will still arrive at receptors via indirect propagation paths (i.e., over and around barriers).	Compliance monitoring will be conducted through the implementation of the: ▪ Noise Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Operations					
Noise Levels	Environmental conditions including climate Human health	Increase in noise levels	▪ Construct a McNab Creek Flood Protection Dyke, approximately 830 m long and 5 m high on the north side of the aggregate pit.	▪ Moderately effective – on-site berms, dyke /barriers will screen noise emissions from Proposed Project equipment and thereby reduce noise levels reaching nearby receptors; berms, dyke /barriers will screen direct propagation paths but noise will still arrive at receptors via indirect propagation paths (i.e., over and around barriers).	Compliance monitoring will be conducted through the implementation of the: ▪ Noise Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Noise Levels	Environmental conditions including climate Human health		▪ Construct a Pit Lake Containment Berm, approximately 800 m long and 9 m high on the south side of the aggregate pit.	▪ Moderately effective – on-site berms, dyke /barriers will screen noise emissions from Proposed Project equipment and thereby reduce noise levels reaching nearby receptors; berms, dyke /barriers will screen direct propagation paths but noise will still arrive at receptors via indirect propagation paths (i.e., over and around barriers).	Compliance monitoring will be conducted through the implementation of the: ▪ Noise Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Noise Levels	Environmental conditions including climate Human health		▪ Construct a Processing Area Dirt Berm, approximately 230 m and 9 m high on the east side of the processing plant.	▪ Moderately effective – on-site berms/barriers will screen noise emissions from Proposed Project equipment and thereby reduce noise levels reaching nearby receptors; berms, dyke /barriers will screen direct propagation paths but noise will still arrive at receptors via indirect propagation paths (i.e., over and around barriers).	Compliance monitoring will be conducted through the implementation of the: ▪ Noise Management Plan. Details provided in Volume 3, Part E - Section 16.0.

Relevant VC(s)	Federal Scope of Factors	Potential Effects	Proposed Mitigation Measures	Anticipated Effectiveness of Proposed Mitigation	Linkage to Environmental Monitoring and Follow-up Program
Noise Levels	Environmental conditions including climate Human health		▪ Dry screens and crusher in the processing plant will be housed in fabric enclosures.	▪ Marginally effective – the current design uses a low density foam and vinyl composition; increased fabric density would increase effectiveness.	Compliance monitoring will be conducted through the implementation of the: ▪ Noise Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Noise Levels	Environmental conditions including climate Human health		▪ Limit operation activity to daytime hours.	▪ Highly effective – limiting activities to daytime period will completely eliminate Proposed Project-related noise during the nighttime.	Compliance monitoring will be conducted through the implementation of the: ▪ Noise Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Reclamation and Closure					
Noise Levels	Environmental conditions including climate Human health	Increase in noise levels	▪ Limit reclamation and closure activity to daytime hours.	▪ Highly effective – limiting activities to daytime period will completely eliminate Proposed Project-related noise during the nighttime.	Compliance monitoring will be conducted through the implementation of the: ▪ Noise Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Noise Levels	Environmental conditions including climate Human health		▪ Schedule significant noise-causing activities to reduce disruption to nearby residents.	▪ Moderately effective – BURNCO will consult with nearby residents and attempt to schedule particularly noisy activities so as to minimize disruption, but some disruption may be unavoidable.	Compliance monitoring will be conducted through the implementation of the: ▪ Noise Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Noise Levels	Environmental conditions including climate Human health		▪ Position heavy equipment muster points at least 500 m from any receptor.	▪ Moderately effective – ensuring a minimum distance of 500 m between heavy equipment muster points and receptors effectively increases noise propagation distance and reduces noise levels reaching the receptors.	Compliance monitoring will be conducted through the implementation of the: ▪ Noise Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Noise Levels	Environmental conditions including climate Human health		▪ Fit equipment with standard mufflers or silencers and keep in good working order.	▪ Highly effective – mufflers/silencers reduce noise emissions from internal combustion engines dramatically.	Compliance monitoring will be conducted through the implementation of the: ▪ Noise Management Plan. Details provided in Volume 3, Part E - Section 16.0.
Noise Levels	Environmental conditions including climate Human health		▪ Use acoustical screening from existing on-site barriers.	▪ Moderately effective – on-site berms, dyke /barriers will screen noise emissions from Proposed Project equipment and thereby reduce noise levels reaching nearby receptors; berms, dyke /barriers will screen direct propagation paths but noise will still arrive at receptors via indirect propagation paths (i.e., over and around barriers).	Compliance monitoring will be conducted through the implementation of the: ▪ Noise Management Plan. Details provided in Volume 3, Part E - Section 16.0.

15.1.6 Residual Environmental Effects and Significance

As part of the federal requirements for the EAC Application/EIS in accordance with the former CEA Act, the proponent must provide the following:

- Describe any residual environmental effects following implementation of the mitigation measures in order to describe the consequences of the Proposed Project, the degree to which effects can be mitigated and which effects cannot be mitigated or compensated.
- The scope and methods of the effects assessment with respect to the determination of significance of residual effects.

Part B Section 5.1 through 9.2 provides a detailed discussion regarding the potential residual effects and the determination of significance related to each VC.

As described in Part B, Section 4.0 of the Application, the EA framework guidelines for federal and provincial EA processes; FEARO 1994a and BC EAO 2013; provide slightly different methods for determining and assessing potential project related effects. The federal framework "A Reference Guide for the *Canadian Environmental Assessment Act:* Determining Whether a Project is Likely to Cause Significant Environmental Effects" requires proponents to determine the likelihood of significant adverse environmental effects. Table 15-24 describes the determination of significance for each adverse residual effect identified for the Proposed Project and defines the likelihood of significant adverse environmental effects.

Table 15-24: Summary of Potential Residual Environmental Effects from the Project and their Significance

Section	Issue	VC	Phase	Potential Residual Effect	Residual Effect Assessment Criteria						Significance	Likelihood of Significant Adverse Environmental Effect
					Context	Magnitude	Extent	Duration	Reversibility	Frequency		
5.1	Fisheries and Freshwater Habitat	Anadromous Chum Coho and Cutthroat Trout and their Habitats	Construction	Changes to Surface Water Quality - Suspended Sediments Changes to Surface Water Quality - Cementitious (alkaline) Material Effects of Artificial Lighting	Sensitive	Low	Local	Short-Term to Long-Term	Fully Reversible	Low to High	Negligible	Unlikely
			Operations	Loss of Habitat Changes to Surface Water Quality - Suspended Sediments Effects of Artificial Lighting	Sensitive to Resilient	Low	Local	Short-Term to Long-Term	Fully Reversible	Low to High	Negligible	Unlikely
			Reclamation and Closure	Changes to Surface Water Quality - Suspended Sediments Effects of Artificial Lighting Loss of Habitat	Sensitive to Resilient	Low	Local	Short-Term to Long-Term	Fully Reversible	Low to High	Negligible	Unlikely
			Accidents and Malfunctions	Toxic or hazardous material spills	Sensitive	High	Local to Beyond Regional	Short-Term	Fully Reversible	Low	Negligible	Unlikely
		Resident Cutthroat Trout and their Habitat	Construction	Loss of Habitat Changes to Surface Water Quality - Suspended Sediments Effects of Artificial Lighting	Sensitive to Resilient	Low	Local	Short-Term to Long-Term	Fully Reversible	Low to High	Negligible	Unlikely
			Operations	Changes to Surface Water Quality - Suspended Sediments Effects of Artificial Lighting Loss of Habitat	Sensitive to Resilient	Low	Local	Short-Term to Long-Term	Fully Reversible	Low to High	Negligible	Unlikely
			Reclamation and Closure	Changes to Surface Water Quality - Suspended Sediments Effects of Artificial Lighting Loss of Habitat	Sensitive to Resilient	Low	Local	Short-Term to Long-Term	Fully Reversible	Low to High	Negligible	Unlikely
			Accidents and Malfunctions	Toxic or hazardous material spills	Sensitive	High	Local to Beyond Regional	Short-Term	Fully Reversible	Low	Negligible	Unlikely

Section	Issue	VC	Phase	Potential Residual Effect	Residual Effect Assessment Criteria						Significance	Likelihood of Significant Adverse Environmental Effect
					Context	Magnitude	Extent	Duration	Reversibility	Frequency		
5.2	Marine Resources	Marine Water and Sediment Quality	Construction	Changes in Marine Water and Sediment Quality	Resilient	Low	Local	Medium-Term	Fully Reversible	Low to Medium	Negligible	Unlikely
			Operations	Changes in Marine Water and Sediment Quality	Resilient	Low	Local	Medium-Term	Fully Reversible	Low to Medium	Negligible	Unlikely
			Reclamation and Closure	Changes in Marine Water and Sediment Quality	Resilient	Low	Local	Medium-Term	Fully Reversible	Low to Medium	Negligible	Unlikely
			Accidents and Malfunctions	Toxic or hazardous material spills	Sensitive	High	Regional to Beyond Regional	Medium-Term	Fully Reversible	Low	Not Significant	Unlikely
			Accidents and Malfunctions	Aggregate spills	Resilient	Low	Local	Short-Term	Fully Reversible	Low	Negligible	Unlikely
		Marine Benthic Communities	Construction	Changes in Habitat Quality - Propeller Scour Potential Mortality - Propeller Scour	Resilient	Low to Moderate	Local	Medium-Term	Fully Reversible	Low to Medium	Negligible	Unlikely
			Construction	Loss of Habitat Changes to Habitat Quality - In-Water Works Potential Mortality - In-Water Works	Resilient	Low to Moderate	Local	Medium-Term	Fully Reversible	Low to Medium	Negligible	Unlikely
			Operations	Changes in Habitat Quality - Propeller Scour Potential Mortality - Propeller Scour	Resilient	Low to Moderate	Local	Medium-Term	Fully Reversible	Low to Medium	Negligible	Unlikely
			Reclamation and Closure	Changes in Habitat Quality - Propeller Scour Potential Mortality - Propeller Scour	Resilient	Low to Moderate	Local	Medium-Term	Fully Reversible	Low to Medium	Negligible	Unlikely
			Reclamation and Closure	Changes to Habitat Quality - In-Water Works Potential Mortality - In-Water Works	Resilient	Low	Local	Medium-Term	Fully Reversible	Low to Medium	Negligible	Unlikely
			Accidents and Malfunctions	Toxic or hazardous material spills	Sensitive	High	Regional to Beyond Regional	Medium-Term	Fully Reversible	Low	Not Significant	Unlikely
			Accidents and Malfunctions	Aggregate spills	Sensitive to Resilient	Low to Moderate	Local	Short-Term	Fully Reversible	Low	Negligible	Unlikely
		Marine Fish	Construction	Loss of Habitat Changes to Habitat Quality - In-Water Works Changes in Habitat Quality - Propeller Scour Injury/Mortality - UW Noise (Pile Driving)	Resilient	Low to Moderate	Local	Short Term to Medium Term	Fully Reversible to Permanent	Low	Negligible	Unlikely
			Operations	Changes in Habitat Quality - Propeller Scour	Resilient	Negligible	Local	Medium Term	Fully Reversible	Medium	Negligible	Unlikely
			Reclamation and Closure	Changes in Habitat Quality - Propeller Scour	Resilient	Negligible	Local	Medium Term	Fully Reversible	Medium	Negligible	Unlikely
			Reclamation and Closure	Changes in Habitat Quality - In-Water Works	Resilient	Negligible	Local	Medium Term	Fully Reversible	Low	Negligible	Unlikely
			Accidents and Malfunctions	Toxic or hazardous material spills	Sensitive	High	Regional to Beyond Regional	Medium Term	Fully Reversible	Low	Not Significant	Unlikely
			Accidents and Malfunctions	Aggregate spills	Sensitive to Resilient	Low to Moderate	Local	Short Term	Fully Reversible	Low	Negligible	Unlikely

Section	Issue	VC	Phase	Potential Residual Effect	Residual Effect Assessment Criteria						Significance	Likelihood of Significant Adverse Environmental Effect
					Context	Magnitude	Extent	Duration	Reversibility	Frequency		
		Marine Mammals	Construction	Injury/Mortality - Vessel Strikes	Sensitive to Resilient	High	Local	Medium Term	Fully Reversible to Irreversible	High	Negligible	Unlikely
			Construction	Injury/Mortality - UW Noise (Pile Driving) Behavioural Disturbance - UW Noise	Sensitive to Resilient	Low to Moderate	Local to Regional	Short Term to Medium Term	Fully Reversible to Permanent	Low to Medium	Negligible to Not Significant	Unlikely
			Operations	Injury/Mortality - Vessel Strikes	Sensitive to Resilient	High	Regional	Medium Term	Fully Reversible to Irreversible	High	Negligible	Unlikely
			Operations	Behavioural Disturbance - UW Noise	Resilient	Moderate	Regional	Medium Term	Fully Reversible	Low to Medium	Not Significant	Unlikely
			Reclamation and Closure	Injury/Mortality - Vessel Strikes	Sensitive to Resilient	High	Local	Medium Term	Fully Reversible to Irreversible	High	Negligible	Unlikely
			Reclamation and Closure	Behavioural Disturbance - UW Noise	Resilient	Moderate	Regional	Medium Term	Fully Reversible	Low to Medium	Not Significant	Unlikely
			Accidents and Malfunctions	Toxic or hazardous material spills	Sensitive	High	Regional to Beyond Regional	Medium Term	Fully Reversible	Low	Not Significant	Unlikely
			Accidents and Malfunctions	Aggregate spills	Sensitive to Resilient	Low to Moderate	Local	Short Term	Fully Reversible	Low	Negligible	Unlikely
		Marine Birds	Construction	Behavioural Disturbance - In-air Noise	Resilient	Low	Local	Short Term to Medium Term	Fully Reversible	Low to High	Negligible	Unlikely
			Operations	Behavioural Disturbance - In-air Noise	Resilient	Low	Local	Short Term to Medium Term	Fully Reversible	Low to High	Negligible	Unlikely
			Reclamation and Closure	Behavioural Disturbance - In-air Noise	Resilient	Low	Local	Medium Term	Fully Reversible	High	Negligible	Unlikely
			Accidents and Malfunctions	Toxic or hazardous material spills	Sensitive	High	Regional to Beyond Regional	Medium Term	Fully Reversible	Low	Not Significant	Unlikely
			Accidents and Malfunctions	Aggregate spills.	Sensitive to Resilient	Low to Moderate	Local	Short Term	Fully Reversible	Low	Negligible	Unlikely
			Accidents and Malfunctions	Toxic or hazardous material spills	Sensitive	High	Regional to Beyond Regional	Medium-Term	Fully Reversible	Low	Not Significant	Unlikely
			Accidents and Malfunctions	Aggregate spills	Sensitive to Resilient	Low to Moderate	Local	Short-Term	Fully Reversible	Low	Negligible	Unlikely

Section	Issue	VC	Phase	Potential Residual Effect	Residual Effect Assessment Criteria						Significance	Likelihood of Significant Adverse Environmental Effect
					Context	Magnitude	Extent	Duration	Reversibility	Frequency		
5.3	Terrestrial Wildlife and Vegetation	Amphibian species at risk (i.e., red-legged frog, western toad, Pacific tailed frog)	Construction	Habitat loss	Moderately Resilient	Low	Local	Medium-Term	Partially Reversible	High	Not Significant	Unlikely
			Construction	Barriers to movement	Moderately Resilient	Negligible	Local	Medium-Term	Partially Reversible	High	Not Significant	Unlikely
			Construction	Change in mortality	Moderately Resilient	Low	Local	Medium-Term	Fully Reversible	Medium	Not Significant	Unlikely
			Operations	Habitat loss.	Moderately Resilient	Low	Local	Medium-Term	Partially Reversible	High	Not Significant	Unlikely
			Operations	Barriers to movement.	Moderately Resilient	Negligible	Local	Medium-Term	Partially Reversible	High	Not Significant	Unlikely
			Operations	Change in mortality	Moderately Resilient	Low	Local	Medium-Term	Fully Reversible	Medium	Not Significant	Unlikely
			Reclamation and Closure	Habitat losses during construction and operations are predicted to recover during and post-closure. Reclamation is predicted to return wildlife habitat to at least a capability equivalent to baseline conditions. No post-closure residual adverse effects are anticipated.	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Unlikely
		Western screech owl	Construction	Habitat loss	Sensitive	None. Other criteria reflect net effect on VC.	Local	Long-Term	Fully Reversible	High	Negligible	Unlikely
			Construction	Change in mortality	Sensitive	Negligible	Local	Medium-Term	Fully Reversible	High	Negligible	Unlikely
			Operations	Habitat loss	Sensitive	None. Other criteria reflect net effect on VC.	Local	Long-Term	Fully Reversible	High	Negligible	Unlikely
			Operations	Change in mortality	Sensitive	Negligible	Local	Medium-Term	Fully Reversible	High	Negligible	Unlikely
			Reclamation and Closure	Habitat losses during construction and operations are predicted to recover during and post-closure. Reclamation is predicted to return wildlife habitat to at least a capability equivalent to baseline conditions. No post-closure residual adverse effects are anticipated.	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Unlikely
		Common nighthawk	Construction	Habitat loss	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	High	Negligible	Unlikely
			Construction	Change in mortality	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	High	Negligible	Unlikely
			Operations	Habitat loss	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	High	Negligible	Unlikely
			Operations	Change in mortality	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	High	Negligible	Unlikely

Section	Issue	VC	Phase	Potential Residual Effect	Residual Effect Assessment Criteria						Significance	Likelihood of Significant Adverse Environmental Effect
					Context	Magnitude	Extent	Duration	Reversibility	Frequency		
			Reclamation and Closure	Habitat losses during construction and operations are predicted to recover during and post-closure. Reclamation is predicted to return wildlife habitat to at least a capability equivalent to baseline conditions. No post-closure residual adverse effects are anticipated.	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Unlikely
		Northern goshawk	Construction	Change in mortality	Sensitive	Negligible	Local	Medium-Term	Fully Reversible	High	Negligible	Unlikely
			Operations	Change in mortality	Sensitive	Negligible	Local	Medium-Term	Fully Reversible	High	Negligible	Unlikely
			Reclamation and Closure	Habitat losses during construction and operations are predicted to recover during and post-closure. Reclamation is predicted to return wildlife habitat to at least a capability equivalent to baseline conditions. No post-closure residual adverse effects are anticipated.	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Unlikely
		Band-tailed pigeon	Construction	Habitat loss.	Sensitive	Negligible	Local	Long-Term	Fully Reversible	High	Negligible	Unlikely
			Construction	Change in mortality.	Sensitive	Negligible	Local	Medium-Term	Fully Reversible	High	Negligible	Unlikely
			Operations	Habitat loss.	Sensitive	Negligible	Local	Long-Term	Fully Reversible	High	Negligible	Unlikely
			Operations	Change in mortality.	Sensitive	Negligible	Local	Medium-Term	Fully Reversible	High	Negligible	Unlikely
			Reclamation and Closure	Habitat losses during construction and operations are predicted to recover during and post-closure. Reclamation is predicted to return wildlife habitat to at least a capability equivalent to baseline conditions. No post-closure residual adverse effects are anticipated.	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Unlikely
		Marbled murrelet	Construction	Change in mortality	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	Medium	Negligible	Unlikely
			Operations	Change in mortality	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	Medium	Negligible	Unlikely
			Reclamation and Closure	Habitat losses during construction and operations are predicted to recover during and post-closure. Reclamation is predicted to return wildlife habitat to at least a capability equivalent to baseline conditions. No post-closure residual adverse effects are anticipated.	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Unlikely
		Roosevelt elk	Construction	Habitat loss	Resilient	Low	Local	Long-Term	Fully Reversible	High	Not Significant	Unlikely
			Construction	Barriers to movement	Resilient	Negligible	Local	Medium-Term	Fully Reversible	High	Not Significant	Unlikely

Section	Issue	VC	Phase	Potential Residual Effect	Residual Effect Assessment Criteria						Significance	Likelihood of Significant Adverse Environmental Effect
					Context	Magnitude	Extent	Duration	Reversibility	Frequency		
			Construction	Change in mortality	Resilient	Negligible	Local	Medium-Term	Fully Reversible	High	Not Significant	Unlikely
			Operations	Habitat loss	Resilient	Low	Local	Long-Term	Fully Reversible	High	Not Significant	Unlikely
			Operations	Barriers to movement	Resilient	Negligible	Local	Medium-Term	Fully Reversible	High	Not Significant	Unlikely
			Operations	Change in mortality	Resilient	Negligible	Local	Medium-Term	Fully Reversible	High	Not Significant	Unlikely
			Reclamation and Closure	Habitat losses during construction and operations are predicted to recover during and post-closure. Reclamation is predicted to return wildlife habitat to at least a capability equivalent to baseline conditions. No post-closure residual adverse effects are anticipated.	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Unlikely
		Grizzly bear	Construction	Habitat loss	Sensitive	Low	Local	Long-Term	Fully Reversible	High	Not Significant	Unlikely
			Construction	Change in mortality	Sensitive	Negligible	Local	Medium-Term	Partially Reversible	Low	Not Significant	Unlikely
			Operations	Habitat loss	Sensitive	Low	Local	Long-Term	Fully Reversible	High	Not Significant	Unlikely
			Operations	Change in mortality	Sensitive	Negligible	Local	Medium-Term	Partially Reversible	Low	Not Significant	Unlikely
			Reclamation and Closure	Habitat losses during construction and operations are predicted to recover during and post-closure. Reclamation is predicted to return wildlife habitat to at least a capability equivalent to baseline conditions. No post-closure residual adverse effects are anticipated.	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Unlikely
		Environmentally sensitive ecosystems (wetlands, riparian ecosystems, old growth forest)	Construction	Spread of invasive species	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	High	Negligible	Unlikely
			Construction	Introduction of deleterious substances	Sensitive	Negligible	Beyond Regional	Medium-Term	Partially Reversible	Low	Negligible	Unlikely
			Construction	Introduction of dust	Resilient	Negligible	Local	Short-Term	Fully Reversible	Medium	Negligible	Unlikely
			Construction	Surface runoff	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	Low	Negligible	Unlikely
			Construction	Loss of extent	Moderately Resilient	Low	Local	Long-Term	Fully Reversible	High	Not Significant	Unlikely
			Construction	Soil disturbance	Moderately Resilient	Low	Local	Long-Term	Fully Reversible	High	Negligible	Unlikely
			Construction	Increased Windthrow	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	Low	Negligible	Unlikely
			Operations	Spread of invasive species	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	High	Negligible	Unlikely
			Operations	Increased Windthrow	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	Low	Negligible	Unlikely

Section	Issue	VC	Phase	Potential Residual Effect	Residual Effect Assessment Criteria						Significance	Likelihood of Significant Adverse Environmental Effect
					Context	Magnitude	Extent	Duration	Reversibility	Frequency		
			Operations	Introduction of dust	Resilient	Negligible	Local	Medium-Term	Fully Reversible	Medium	Negligible	Unlikely
			Operations	Surface runoff	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	Low	Negligible	Unlikely
			Operations	Soil disturbance	Moderately Resilient	Low	Local	Long-Term	Fully Reversible	High	Negligible	Unlikely
			Operations	Introduction of deleterious substances	Sensitive	Negligible	Beyond Regional	Medium-Term	Partially Reversible	Low	Negligible	Unlikely
			Reclamation and Closure	Spread of invasive species	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	High	Negligible	Unlikely
			Reclamation and Closure	Introduction of deleterious substances	Sensitive	Negligible	Beyond Regional	Medium-Term	Partially Reversible	Low	Negligible	Unlikely
			Reclamation and Closure	Introduction of dust	Resilient	Negligible	Local	Short-Term	Fully Reversible	Medium	Negligible	Unlikely
			Reclamation and Closure	Soil disturbance	Moderately Resilient	Negligible	Local	Long-Term	Fully Reversible	Low	Negligible	Unlikely
			Construction	Spread of invasive species	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	High	Negligible	Unlikely
			Construction	Introduction of deleterious substances	Sensitive	High	Beyond Regional	Medium-Term	Partially Reversible	Low	Negligible	Unlikely
			Construction	Introduction of dust	Resilient	Negligible	Local	Short-Term	Fully Reversible	Medium	Negligible	Unlikely
			Construction	Surface runoff	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	Low	Negligible	Unlikely
			Construction	Loss of extent	Moderately Resilient	Low	Local	Long-Term	Partially Reversible	High	Not Significant	Unlikely
			Construction	Soil disturbance	Moderately Resilient	Low	Local	Long-Term	Fully Reversible	High	Negligible	Unlikely
			Construction	Increased Windthrow	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	Low	Negligible	Unlikely
		Ecosystems at-risk	Operations	Spread of invasive species	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	High	Negligible	Unlikely
			Operations	Loss of extent	Moderately Resilient	Low	Local	Long-Term	Partially Reversible	High	Not Significant	Unlikely
			Operations	Introduction of dust	Resilient	Negligible	Local	Short-Term	Fully Reversible	Medium	Negligible	Unlikely
			Operations	Surface runoff	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	Low	Negligible	Unlikely
			Operations	Soil disturbance	Moderately Resilient	Low	Local	Long-Term	Fully Reversible	High	Negligible	Unlikely
			Operations	Increased Windthrow	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	Low	Negligible	Unlikely
			Operations	Introduction of deleterious substances	Sensitive	High	Beyond Regional	Medium-Term	Partially Reversible	Low	Negligible	Unlikely
			Reclamation and Closure	Spread of invasive species	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	High	Negligible	Unlikely

Section	Issue	VC	Phase	Potential Residual Effect	Residual Effect Assessment Criteria						Significance	Likelihood of Significant Adverse Environmental Effect
					Context	Magnitude	Extent	Duration	Reversibility	Frequency		
			Reclamation and Closure	Introduction of deleterious substances	Sensitive	Negligible	Beyond Regional	Medium-Term	Partially Reversible	Low	Negligible	Unlikely
			Reclamation and Closure	Introduction of dust	Resilient	Negligible	Local	Short-Term	Fully Reversible	Medium	Negligible	Unlikely
			Reclamation and Closure	Soil disturbance	Moderately Resilient	Low	Local	Long-Term	Fully Reversible	Low	Negligible	Unlikely
			Reclamation and Closure	Increased Windthrow	Moderately Resilient	Negligible	Local	Medium-Term	Fully Reversible	Low	Negligible	Unlikely
		Plant species at-risk	Construction	Introduction of deleterious substances	Sensitive	Negligible	Beyond Regional	Medium-Term	Partially Reversible	Low	Negligible	Unlikely
			Construction	Loss of extent	Sensitive	Low	Local	Medium-Term	Irreversible	Low	Negligible	Unlikely
			Operations	Introduction of deleterious substances	Sensitive	Low	Beyond Regional	Medium-Term	Partially Reversible	Low	Negligible	Unlikely
			Reclamation and Closure	Introduction of deleterious substances	Sensitive	Negligible	Beyond Regional	Medium-Term	Irreversible	Low	Negligible	Unlikely
5.4	Geotechnical and Natural Resources	Terrain stability	Construction	Land-based Mass Movement - Terrain Stability: changes to slope morphology or drainage conditions.	Resilient	Negligible	Regional	Medium-Term	Partially Reversible	Medium	Negligible	Unlikely
			Construction	Land-based Mass Movement - Terrain Stability: changes to debris flow-debris flood transport or run out zones.	Resilient	Negligible	Regional	Medium-Term	Partially Reversible	Medium	Negligible	Unlikely
			Operations	Land-based Mass Movement - Terrain Stability: changes to slope morphology or drainage conditions.	Resilient	Negligible	Regional	Medium-Term	Partially Reversible	Medium	Negligible	Unlikely
			Operations	Land-based Mass Movement - Terrain Stability: changes to debris flow-debris flood transport or run out zones.	Resilient	Negligible	Regional	Medium-Term	Partially Reversible	Medium	Negligible	Unlikely
			Reclamation and Closure	Land-based Mass Movement - Terrain Stability: changes to slope morphology or drainage conditions.	Resilient	Negligible	Regional	Short-Term	Fully Reversible	Medium	Negligible	Unlikely
			Reclamation and Closure	Land-based Mass Movement - Terrain Stability: changes to debris flow-debris flood transport or run out zones.	Resilient	Negligible	Regional	Short-Term	Fully Reversible	Medium	Negligible	Unlikely
		Earthquakes and tsunamis	Construction	Increased ground movement during earthquake event.	Resilient	Low	Local	Short-Term to Medium-Term	Partially Reversible	Low	Negligible	Unlikely
			Construction	Increased shoreline erosion and offshore debris deposition during earthquake or landslide generated tsunami.	Resilient	Negligible	Local	Short-Term to Medium-Term	Partially Reversible	Low	Negligible	Unlikely
			Construction	Initiation of submarine landslides	Resilient	Low	Local	Short-Term to Medium-Term	Partially Reversible	Low	Negligible	Unlikely
			Operations	Increased ground movement during earthquake event.	Resilient	Low	Local	Short-Term to Medium-Term	Partially Reversible	Low	Negligible	Unlikely
			Operations	Increased shoreline erosion and offshore debris deposition during	Resilient	Negligible	Local	Short-Term to Medium-Term	Partially Reversible	Low	Negligible	Unlikely

Section	Issue	VC	Phase	Potential Residual Effect	Residual Effect Assessment Criteria						Significance	Likelihood of Significant Adverse Environmental Effect
					Context	Magnitude	Extent	Duration	Reversibility	Frequency		
				earthquake or landslide generated tsunami.								
			Operations	Initiation of submarine landslides.	Resilient	Low	Local	Short-Term to Medium-Term	Partially Reversible	Low	Negligible	Unlikely
			Reclamation and Closure	Increased ground movement during earthquake event.	Resilient	Low	Local	Short-Term to Medium-Term	Partially Reversible	Low	Negligible	Unlikely
			Reclamation and Closure	Increased shoreline erosion and offshore debris deposition during earthquake or landslide generated tsunami.	Resilient	Negligible	Local	Short-Term to Medium-Term	Partially Reversible	Low	Negligible	Unlikely
			Reclamation and Closure	Initiation of submarine landslides	Resilient	Low	Local	Short-Term to Medium-Term	Partially Reversible	Low	Negligible	Unlikely
5.5	Surface Water Resources	Surface Water Flow	Operations	Changes in baseflow in WC2	See Section 5.1	Medium to High	Local	Medium-Term	Irreversible	High	Negligible	Unlikely
			Reclamation and Closure	Changes in baseflow in WC2	See Section 5.1	Medium	Local	Long-Term	Irreversible	High	Negligible	Unlikely
		Water Quality	Construction	Changes to Water Quality – Suspended Sediments	Resilient	Negligible	Local	Short-Term	Fully Reversible	Low	Negligible	Unlikely
			Construction	Changes to Water Quality – Spills	Sensitive	Negligible	Local	Short-Term to Long-Term	Fully Reversible to Irreversible	Low	Negligible	Unlikely
			Operations	Changes to Water Quality – Suspended Sediments	Resilient	Negligible	Local	Medium-Term	Fully Reversible	Low	Negligible	Unlikely
			Operations	Changes to Water Quality – Spills	Sensitive	Negligible	Local	Short-Term to Long-Term	Fully Reversible to Irreversible	Low	Negligible	Unlikely
			Reclamation and Closure	Changes to Water Quality – Suspended Sediments	Resilient	Negligible	Local	Short-Term	Fully Reversible	Low	Negligible	Unlikely
			Reclamation and Closure	Changes to Water Quality – Spills	Sensitive	Negligible	Local	Short-Term to Long-Term	Fully Reversible to Irreversible	Low	Negligible	Unlikely
		Aquatic Health	Construction	Direct Toxicity-Related Effects	Sensitive	Negligible	Local	Short-Term	Fully Reversible	Low	Negligible	Unlikely
			Construction	Nutrient Enrichment-Related Effects	Sensitive	Negligible	Local	Short-Term	Fully Reversible	Low	Negligible	Unlikely
			Operations	Direct Toxicity-Related Effects	Sensitive	Negligible	Local	Medium-Term to Long-Term	Fully Reversible	Low	Negligible	Unlikely
			Operations	Nutrient Enrichment-Related Effects	Sensitive	Negligible	Local	Medium-Term to Long-Term	Fully Reversible	Low	Negligible	Unlikely
			Reclamation and Closure	Direct Toxicity-Related Effects	Sensitive	Negligible	Local	Long-Term	Fully Reversible	Low	Negligible	Unlikely
			Reclamation and Closure	Nutrient Enrichment-Related Effects	Sensitive	Negligible	Local	Long-Term	Fully Reversible	Low	Negligible	Unlikely

Section	Issue	VC	Phase	Potential Residual Effect	Residual Effect Assessment Criteria						Significance	Likelihood of Significant Adverse Environmental Effect
					Context	Magnitude	Extent	Duration	Reversibility	Frequency		
5.6	Groundwater Resources	Groundwater Flow	Operations	Changes in groundwater flow	Resilient	Low	Local	Medium-Term	Fully Reversible	Low	Negligible	Unlikely
		Groundwater Quality	Operations	Changes in groundwater quality	Resilient	Negligible	Local	Short-Term	Fully Reversible	Low	Negligible	Unlikely
		Groundwater Quality	Reclamation and Closure	Changes in groundwater quality	Resilient	Negligible	Local	Short-Term	Fully Reversible	Low	Negligible	Unlikely
		Groundwater Flow	Accidents and Malfunctions	Changes to groundwater flow - Uncontrolled surface flow during construction of overflow structure at closure	Resilient	High	Local	Short-Term	Fully Reversible	Low	Negligible	Unlikely
		Groundwater Quality	Accidents and Malfunctions	Changes to groundwater quality - Insufficient progressive reclamation of fines leading to chemical dissolution	Resilient	Negligible	Local	Short-Term	Fully Reversible	Low	Negligible	Unlikely
5.7	Air Quality	Air Quality Indicators	Construction	Increase in $PM_{2.5}$ – 24-hour Increase in $PM_{2.5}$ – Annual Increase in PM_{10} – 24-hour Increase in TSP – 24-hour Increase in TSP – Annual Increase in NO_{2-} 1-hour, tug boats Increase in NO_{2-} Annual, tug boats Increase in SO_{2-} 1-hour, tug boats	Somewhat Disturbed	Moderate ($PM_{2.5}$, PM_{10} and TSP 24hr) Low (TSP Annual) Negligible (NO_2, SO_2)	Local (PM, TSP) to Beyond Regional (NO2, SO2)	Medium-Term	Fully Reversible	Medium to High	Negligible (NO2, SO2) to Not Significant (PM, TSP)	Unlikely
			Operations	Increase in $PM_{2.5}$ – 24-hour Increase in $PM_{2.5}$ – Annual Increase in PM_{10} – 24-hour Increase in TSP – 24-hour Increase in TSP – Annual Increase in NO_{2-} 1-hour, tug boats Increase in NO_{2-} Annual, tug boats Increase in SO_{2-} 1-hour, tug boats	Somewhat Disturbed	Moderate ($PM_{2.5}$, PM_{10} and TSP 24hr) Low (TSP Annual) Negligible (NO_2, SO_2)	Local (PM, TSP) to Beyond Regional (NO2, SO2)	Medium-Term	Fully Reversible	Medium to High	Negligible (NO2, SO2) to Not Significant (PM, TSP)	Unlikely
			Reclamation and Closure	Increase in $PM_{2.5}$ – 24-hour Increase in $PM_{2.5}$ – Annual Increase in PM_{10} – 24-hour Increase in TSP – 24-hour Increase in TSP – Annual Increase in NO_{2-} 1-hour, tug boats Increase in NO_{2-} Annual, tug boats Increase in SO_{2-} 1-hour, tug boats	Somewhat Disturbed	Moderate ($PM_{2.5}$, PM_{10} and TSP 24hr) Low (TSP Annual)	Local (PM, TSP) to Beyond Regional (NO2, SO2)	Medium-Term	Fully Reversible	Medium to High	Negligible (NO2, SO2) to Not Significant (PM, TSP)	Unlikely
6.1	Sustainable Economy	Regional Economic Development	Construction	Proposed Project effects are positive and therefore no residual adverse effects are anticipated.	n/a	Positive	n/a	n/a	n/a	n/a	n/a	Unlikely
			Operations	Proposed Project effects are positive and therefore no residual adverse effects are anticipated.	n/a	Positive	n/a	n/a	n/a	n/a	n/a	Unlikely
		Labour Market	Construction	Proposed Project effects are positive and therefore no residual adverse effects are anticipated.	n/a	Positive	n/a	n/a	n/a	n/a	n/a	Unlikely
			Operations	Proposed Project effects are positive and therefore no residual adverse effects are anticipated.	n/a	Positive	n/a	n/a	n/a	n/a	n/a	Unlikely

Section	Issue	VC	Phase	Potential Residual Effect	Residual Effect Assessment Criteria						Significance	Likelihood of Significant Adverse Environmental Effect
					Context	Magnitude	Extent	Duration	Reversibility	Frequency		
		Local Government Revenue	Construction	Proposed Project effects are positive and therefore no residual adverse effects are anticipated.	n/a	Positive	n/a	n/a	n/a	n/a	n/a	Unlikely
			Operations	Proposed Project effects are positive and therefore no residual adverse effects are anticipated.	n/a	Positive	n/a	n/a	n/a	n/a	n/a	Unlikely
		Real Estate	Construction	Change in real estate value	Moderately Resilient	Low	Local	Medium-Term	Fully Reversible	Continuous	Not Significant	Unlikely
			Operations	Change in real estate value	Moderately Resilient	Low	Local	Medium-Term	Fully Reversible	Continuous	Not Significant	Unlikely
7.1	Social Conditions	Housing and Accommodations	Construction	Workers sourced from outside the LSA could lead to increase demand on local housing and/or temporary accommodation, and affect housing availability and affordability	Resilient	Negligible	Local	Short-Term	Fully Reversible	Continuous	Negligible	Unlikely
			Operations	Workers sourced from outside the LSA could lead to increase demand on local housing and/or temporary accommodation, and affect housing availability and affordability	Resilient	Negligible	Local	Medium-Term	Fully Reversible	Continuous	Negligible	Unlikely
		Emergency Services	Construction	Construction activities requiring direct use of local emergency services. Change in demand for emergency services exceeding service supply/capacity	Resilient	Negligible	Local	Short-Term	Fully Reversible	Medium	Negligible	Unlikely
			Operations	Operational activities requiring direct use of local emergency services. Change in demand for emergency services exceeding service supply/capacity	Resilient	Negligible	Local	Medium-Term	Fully Reversible	Medium	Negligible	Unlikely
7.2	Marine Transportation	Marine Navigation	Construction	Interference with navigation use and navigability due to Project-related vessel traffic	Resilient	Negligible	Local	Medium-Term	Fully Reversible	Low to Medium	Not Significant	Unlikely
			Construction	Interference with navigation use and navigability due to Project-related infrastructure	Resilient	Negligible	Local	Medium-Term	Fully Reversible	Low	Negligible	Unlikely
			Operations	Interference with navigation use and navigability due to Project-related vessel traffic	Resilient	Negligible - Low	Local	Medium-Term	Fully Reversible	Low to Medium	Not Significant	Unlikely
			Operations	Interference with navigation use and navigability due to Project-related infrastructure	Resilient	Negligible	Local	Medium-Term	Fully Reversible	Low to Medium	Negligible	Unlikely
			Reclamation and Closure	Interference with navigation use and navigability due to Project-related vessel traffic	Resilient	Negligible	Local	Medium-Term	Fully Reversible	Low to Medium	Not Significant	Unlikely
			Reclamation and Closure	Interference with navigation use and navigability due to Project-related infrastructure	Resilient	Negligible	Local	Medium-Term	Fully Reversible	Low	Negligible	Unlikely
7.3	Non-Traditional Land and Resource Use	Harvesting Fish and Wildlife	Construction	Change in quality of environmental setting	Resilient	Moderate	Local	Medium-Term	Fully Reversible	Continuous	Not significant	Unlikely
			Operations	Change in quality of environmental setting	Resilient	Moderate	Local	Medium-Term	Fully Reversible	Continuous	Not significant	Unlikely

Section	Issue	VC	Phase	Potential Residual Effect	Residual Effect Assessment Criteria						Significance	Likelihood of Significant Adverse Environmental Effect
					Context	Magnitude	Extent	Duration	Reversibility	Frequency		
		Recreation and Tourism	Construction	Change in quality of environmental setting	Resilient	Moderate	Local	Medium-Term	Fully Reversible	Continuous	Not significant	Unlikely
			Operations	Change in quality of environmental setting	Resilient	Moderate	Local	Medium-Term	Fully Reversible	Continuous	Not significant	Unlikely
7.4	Visual Resources	Visual Quality	Construction	The temporary construction of infrastructure and the installation of land-based and marine-based infrastructure will introduce built structures to the existing landscape.	Sensitive	Low	Local	Short-Term	Fully Reversible	High	Not significant	Unlikely
			Operations	The operation of land-based and marine-based infrastructure and night-time security lighting will present built structures and lighting conditions to the existing landscape.	Sensitive	Low	Local	Medium-Term	Fully Reversible	High	Not significant	Unlikely
8.1	Heritage Resources	Heritage Resources	Construction	Changes to heritage resource integrity, context and accessibility, if present.	Sensitive	Low	Local and Regional	Short-Term	Fully Reversible	Low	Not significant	Unlikely
			Operations	Changes to heritage resource integrity, context and accessibility, if present.	Sensitive	Low to Medium	Local and Regional	Medium-Term	Irreversible	High	Not significant	Unlikely
			Reclamation and Closure	Changes to heritage resource integrity, context and accessibility, if present.	Resilient	Negligible	Local and Regional	Short-Term	Irreversible	Low	Not significant	Unlikely
9.1	Public Health	People	Construction	Human Health - Air Quality Human Health - Particulate Matter Human Health - Multimedia	See Section 9.1.7	Negligible to Low	See Section 9.1.7	See Section 9.1.7	See Section 9.1.7	See Section 9.1.7	Negligible to Not Significant	Unlikely
			Operations	Human Health - Air Quality Human Health - Particulate Matter Human Health - Multimedia	See Section 9.1.7	Negligible to Low	See Section 9.1.7	See Section 9.1.7	See Section 9.1.7	See Section 9.1.7	Negligible to Not Significant	Unlikely
			Reclamation and Closure	Human Health - Air Quality Human Health - Particulate Matter Human Health - Multimedia	See Section 9.1.7	Negligible to Low	See Section 9.1.7	See Section 9.1.7	See Section 9.1.7	See Section 9.1.7	Negligible to Not Significant	Unlikely
9.2	Noise	Noise Levels	Construction	Increase in noise levels	Disturbed	Negligible to Low	Predominantly Local	Short-Term	Fully Reversible	High	Negligible	Unlikely
			Operations	Increase in noise levels	Disturbed	Negligible to Low	Predominantly Local	Long-Term	Fully Reversible	High	Negligible	Unlikely
			Reclamation and Closure	Increase in noise levels	Disturbed	Negligible to Low	Predominantly Local	Short-Term	Fully Reversible	High	Negligible	Unlikely

15.1.7 Cumulative Environmental Effects (CEE)

As part of the federal requirements for the EAC Application/EIS in accordance with the former CEA Act, the proponent must provide the following:

- An assessment of CEE for each of the previously identified VCs that are likely to result from the Proposed Project in combination with other projects or activities that have been, are, or will be carried out.

The scope and methods for the Cumulative Effects Assessment is provided in Volume 2, Part B - Section 4.0 and has been developed to satisfy regulatory requirements of the BCEAA and the former CEAA; the following guidelines and standards were used:

- Addressing Cumulative Environmental Effects. A Reference Guide for the *Canadian Environmental Assessment Act*. (FEARO 1994b);
- Operational Policy Statement: Addressing Cumulative Environmental Effects under the Canadian Environmental Assessment Act (CEA Agency 2007)
- Cumulative Effects Practitioners Guide (Hegmann et al. 1999);
- Guideline for the Selection of Valued Components and Assessment of Potential Effects (BCEAO 2013).

Cumulative effects were considered throughout the effects assessment for each VC that was shown to have residual effects that were characterized as not-significant or significant[3] (Volume 2, Part B - Section 5.1 through 9.4). Residual effects on VCs that were considered negligible were not carried forward to the cumulative effects assessment. Those VCs are:

- Anadromous Chum Coho and Cutthroat Trout and their Habitats
- Resident Cutthroat Trout and their Habitat
- Marine Water and Sediment Quality
- Marine Benthic Communities
- Marine Fish
- Marine Birds
- Western screech owl
- Common nighthawk
- Northern goshawk
- Band-tailed pigeon
- Marbled murrelet
- Plant species at-risk
- Terrain stability
- Earthquakes and tsunamis
- Surface Water Flow
- Water Quality
- Aquatic Health
- Groundwater Flow

[3] Excluding accidents and malfunctions as directed by the Hegmann et al. 1999.

- Groundwater Quality
- Groundwater Quality
- Groundwater Flow
- Groundwater Quality
- Regional Economic Development
- Labour Market
- Local Government Revenue
- Housing and Accommodations
- Emergency Services
- Noise Levels

The residual cumulative effects are characterized and evaluated using the same methods for the assessment criteria and significance thresholds established for the Proposed Project-specific effects. Table 15-25 summarizes all cumulative effects considered during the Proposed Project and provides a cross referenced list of where the each is addressed in Part B of the Application.

Table 15-25: Summary of Residual Cumulative Effects Considered During the Assessment and their Significance

Section Addressed	Issue	VC	Federal Scope of Factors	Phase	Potential Cumulative Residual Effect	Add'l Mitigation	Cumulative Residual Effect Assessment Criteria						Significance
							Context	Magnitude	Extent	Duration	Reversibility	Frequency	
5.2.5.7	Marine Resources	Marine Mammals	Mammals and their habitat.	Construction	Behavioural disturbance of marine mammals from Project-generated underwater noise (i.e., pile driving / vessel operations / barge loading)	All Project vessels will follow established shipping lanes / navigational routes typically used in the area.	Resilient	Medium	Regional	Long-Term	Fully Reversible	Medium to High	Not Significant
				Operations	Behavioural disturbance of marine mammals from Project-generated underwater noise (i.e., vessel operations / barge loading)		Resilient	Medium	Regional	Long-Term	Fully Reversible	High	Not Significant
				Reclamation and Closure	Behavioural disturbance of marine mammals from Project-generated underwater noise (i.e., vessel operations)		Resilient	Medium	Regional	Long-Term	Fully Reversible	High	Not Significant
5.3.3	Terrestrial Wildlife and Vegetation	Amphibian species at risk (i.e., red-legged frog, western toad, Pacific tailed frog)	Amphibians; and Species at risk, its critical habitat or residences as defined in the Species at Risk Act.	Construction	Habitat loss	Communication and planning with other proponent within McNab Valley. Access management planning with other proponents within McNab Valley.	Moderately Resilient	Low	Regional	Medium-Term	Fully Reversible	Medium	Not Significant
					Barriers to movement		Moderately Resilient	Low	Regional	Long-Term	Partially Reversible	High	Not Significant
					Change in mortality		Moderately Resilient	Low	Regional	Medium-Term	Fully Reversible	High	Not Significant
				Operations	Habitat loss	Communication and planning with other proponent within McNab Valley. Access management planning with other proponents within McNab Valley.	Moderately Resilient	Low	Regional	Medium-Term	Fully Reversible	Medium	Not Significant
					Barriers to movement		Moderately Resilient	Low	Regional	Long-Term	Partially Reversible	High	Not Significant
					Change in mortality		Moderately Resilient	Low	Regional	Medium-Term	Fully Reversible	High	Not Significant
		Roosevelt elk	Mammals and their habitat.	Construction	Habitat loss	Communication and planning with other proponents within McNab Valley. Access management planning with other proponents within McNab Valley.	Resilient	Medium	Regional	Long-Term	Fully Reversible	High	Not Significant
					Barriers to movement		Resilient	Negligible	Regional	Medium-Term	Fully Reversible	High	Not Significant
					Change in mortality		Resilient	Negligible	Regional	Medium-Term	Fully Reversible	Low	Not Significant
				Operations	Habitat loss	Communication and planning with other proponents within McNab Valley. Access management planning with other proponents within McNab Valley.	Resilient	Medium	Regional	Long-Term	Fully Reversible	High	Not Significant
					Barriers to movement		Resilient	Negligible	Regional	Medium-Term	Fully Reversible	High	Not Significant
					Change in mortality		Resilient	Negligible	Regional	Medium-Term	Fully Reversible	Low	Not Significant
		Grizzly bear	Mammals and their habitat.	Construction	Habitat loss	Communication and planning with other proponents within McNab Valley. Access management planning with other proponents within McNab Valley.	Sensitive	Low	Regional	Medium-Term	Fully Reversible	High	Significant
					Change in mortality		Sensitive	Low	Regional	Medium-Term	Fully Reversible	Low	Significant
				Operations	Habitat loss	Communication and planning with other proponents within McNab Valley.	Sensitive	Low	Regional	Medium-Term	Fully Reversible	High	Significant

Section Addressed	Issue	VC	Federal Scope of Factors	Phase	Potential Cumulative Residual Effect	Add'l Mitigation	Cumulative Residual Effect Assessment Criteria						Significance
							Context	Magnitude	Extent	Duration	Reversibility	Frequency	
					Change in mortality	Access management planning with other proponents within McNab Valley.	Sensitive	Low	Regional	Medium-Term	Fully Reversible	Low	Significant
		Environmentally sensitive ecosystems (wetlands, riparian ecosystems, old growth forest)	Vegetation; and Rare and sensitive ecological communities including wetlands.	Construction	Loss of extent	Communication and planning with other proponents within McNab Valley.	Moderately Resilient	Low	Regional	Long-Term	Fully Reversible	Medium	Not Significant
		Ecosystems at-risk	Vegetation; and Rare and sensitive ecological communities including wetlands.	Construction	Loss of extent	Communication and planning with other proponents within McNab Valley.	Moderately Resilient	Medium	Regional	Long-Term	Fully Reversible	High	Not Significant
				Operations	Loss of extent		Moderately Resilient	Medium	Regional	Long-Term	Fully Reversible	High	Not Significant
5.7.5.7	Air Quality	Air Quality Indicators	Air quality (dustfall and particulate matter).	Construction	Increase in PM2.5 – 24-hour Increase in PM2.5 – Annual Increase in PM10 – 24-hour Increase in TSP – 24-hour Increase in TSP – Annual	None	Somewhat Disturbed	Negligible	Local	Short-Term	Fully Reversible	Medium	Negligible
				Operations	Increase in PM2.5 – 24-hour Increase in PM2.5 – Annual Increase in PM10 – 24-hour Increase in TSP – 24-hour Increase in TSP – Annual		Somewhat Disturbed	Negligible	Local	Short-Term	Fully Reversible	Medium	Negligible
				Reclamation and Closure	Increase in PM2.5 – 24-hour Increase in PM2.5 – Annual Increase in PM10 – 24-hour Increase in TSP – 24-hour Increase in TSP – Annual		Somewhat Disturbed	Negligible	Local	Short-Term	Fully Reversible	Medium	Negligible
6.1.5.7	Sustainable Economy	Real Estate	Local and regional socio-economic conditions.	Construction	Change in real estate value	None	Moderately Resilient	Low	Regional	Medium-Term	Fully Reversible	Continuous	Not Significant
				Operations	Change in real estate value		Moderately Resilient	Low	Regional	Medium-Term	Fully Reversible	Continuous	Not Significant
7.2.5.7	Marine Transportation	Marine Navigation	Human health; and Local and regional socio-economic conditions.	Construction	Interference with navigation use and navigability due to Project-related vessel traffic	None	Resilient	Low	Regional	Medium-Term	Fully Reversible	Low	Not Significant
				Operations	Interference with navigation use and navigability due to Project-related vessel traffic		Resilient	Low	Regional	Medium-Term	Fully Reversible	Low	Not Significant
				Reclamation and Closure	Interference with navigation use and		Resilient	Low	Regional	Medium-Term	Fully Reversible	Low	Not Significant

Section Addressed	Issue	VC	Federal Scope of Factors	Phase	Potential Cumulative Residual Effect	Add'l Mitigation	Cumulative Residual Effect Assessment Criteria						Significance
							Context	Magnitude	Extent	Duration	Reversibility	Frequency	
					navigability due to Project-related vessel traffic								
7.3.5.7	Non-Traditional Land and Resource Use	Harvesting Fish and Wildlife	Human health; and Local and regional socio-economic conditions.	Construction	Change in quality of environmental setting.	None	Resilient	Moderate	Regional	Medium-Term	Fully Reversible	Continuous	Not significant
				Operations	Change in quality of environmental setting.		Resilient	Moderate	Regional	Medium-Term	Fully Reversible	Continuous	Not significant
		Recreation and Tourism	Local and regional socio-economic conditions.	Construction	Change in quality of environmental setting.	None	Resilient	Moderate	Regional	Medium-Term	Fully Reversible	Continuous	Not significant
				Operations	Change in quality of environmental setting.		Resilient	Moderate	Regional	Medium-Term	Fully Reversible	Continuous	Not significant
7.4.5.7	Visual Resources	Visual Quality	Physical and cultural heritage; Human health (for example from changes to air quality, noise and vibration, water quality, light, country foods); and Archaeological, historical, paleontological or architectural resources including structures and sites of significance.	Construction	Change in visual quality	None	Sensitive	Medium	Regional	Medium-Term	Fully Reversible	Medium	Not significant
				Operations	Change in visual quality		Sensitive	Medium	Regional	Medium-Term	Fully Reversible	Medium	Not significant
8.1.5.7	Heritage Resources	Heritage Resources	Physical and cultural heritage; and Archaeological, historical, paleontological or architectural resources including structures and sites of significance.	Construction	Changes to heritage resource integrity, context and accessibility, if present	None	Sensitive	Low	Regional	Long-Term	Irreversible	Low	Negligible
				Operations	Changes to heritage resource integrity, context and accessibility, if present		Sensitive	Low	Regional	Long-Term	Irreversible	High	Not Significant
				Reclamation and Closure	Changes to heritage resource integrity, context and accessibility, if present		Sensitive	Low	Regional	Long-Term	Irreversible	Low	Negligible
9.1.7.2	Public Health	People	Human health (for example from changes to air quality, noise and vibration, water quality, light, country foods).	Construction	Human Health - Air Quality Human Health - Particulate Matter	None	Somewhat Disturbed	Negligible	Local	Short-Term	Fully Reversible	Medium	Negligible
				Operations	Human Health - Air Quality Human Health - Particulate Matter		Somewhat Disturbed	Negligible	Local	Short-Term	Fully Reversible	Medium	Negligible
				Reclamation and Closure	Human Health - Air Quality Human Health - Particulate Matter		Somewhat Disturbed	Negligible	Local	Short-Term	Fully Reversible	Medium	Negligible

15.1.8 Follow-Up Program

A description of all follow-up programs suggested for the Proposed Project is provided in Volume 3, Part E - Section 17.0.

15.1.9 Alternative Means

An evaluation of alternative means that are technically and economically feasible for carrying out the Proposed Project and their associated environmental effects is provided in Volume 1, Part A - Section 2.8.

15.1.10 Capacity of Renewable Resources

Under the former CEAA, the EAC Application/EIS is required to include an analysis of the capacity of renewable resources to meet the needs of the present and those of the future where these resources are likely to be significantly affected by the Proposed Project. There are no guidance documents or standard methods on how to assess the potential effects of projects on the capacity of renewable resources.

Renewable resources are those resources that have the ability to recover or be replenished over time following depletion as a result of removal, usage or consumption. Recovery of the resource may occur through reproduction (e.g., animals and plants etc.) or other natural processes (e.g. natural recharge of groundwater in aquifers). In general, for a resource to continue to be renewable, the rate of depletion must not exceed the rate of recharge or recovery. The methods implemented to assess the potential effects as a result of the Proposed Project involved defining characteristics related to the assessing the current and future sustainability of the VC as a result of potential Proposed Project effects and are:

- **Context** – describes the current and future sensitivity and resilience of the VC to change caused by the Proposed Project;
- **Magnitude** – the expected size or severity of the residual effect;
- **Extent** – the spatial scale over which the residual effect is expected to occur;
- **Duration** – the length of time the residual effect persists. Long-term effects beyond Proposed Project life were defined and assessed;
- **Reversibility** - indicating whether the effect is reversible, partially reversible or permanent; and
- **Frequency** – how often the residual effect occurs.

Renewable resources that have been assessed as part of the EAC Application/EIS are presented in Table 15-26. Potential effects as a result of Proposed Project activities on non-traditional resource use were assessed in Volume 2, Part B - Section 7.3 and included an assessment of Forestry, Harvesting Fish and Wildlife, Recreation and Tourism Minerals and Industrial Development. All residual effects were assessed as either Negligible-Not Significant or Not-Significant. No significant residual effects as a result of Proposed Project activities were found.

Significant cumulative residual effects were found grizzly bear populations in the RSA. However, the Proposed Project will likely not contribute to the grizzly bear mortality in the RSA (Volume 2, Part B - Section 5.3). It is predicted that logging activities in the RSA will potentially increase grizzly bear mortality in the RSA and therefore the main cause for the significance determination.

Table 15-26: Renewable resources that have been assessed as part of the EAC Application/EIS

Section	Discipline Area	Renewable Resource/Value Components
5.1	Fisheries and Freshwater Habitat	▪ Anadromous Chum, Coho, Pink and Cutthroat Trout and their habitats ▪ Resident Cutthroat Trout and their habitats
5.2	Marine Resources	▪ Marine Benthic Communities ▪ Marine Fish ▪ Marine Mammals ▪ Marine Birds
5.3	Terrestrial Wildlife and Vegetation	▪ Amphibian species at risk ▪ Western screech-owl ▪ Common nighthawk ▪ Northern goshawk ▪ Band-tailed pigeon ▪ Marbled murrelet ▪ Roosevelt elk ▪ Grizzly bear ▪ Environmentally sensitive ecosystems ▪ Ecosystems at-risk ▪ Plant species at-risk
5.5	Surface Water Resources	▪ Surface Water Flow ▪ Surface Water Quality ▪ Aquatic Health
5.6	Groundwater Resources	▪ Groundwater flow ▪ Groundwater quality
5.7	Air Quality	▪ Air Quality Indicators

15.1.11 Standalone Bilingual Summary

The Executive Summary represents a standalone summary of the EAC Application/EIS. It has been provided in both official languages (English and French) as a standalone document.