Section 21.0

Requirements for All Federal Environmental Assessment Types

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21.0 REQUIREMENTS FOR ALL FEDERAL ENVIRONMENTAL ASSESSMENT TYPES

This section of Avanti Kitsault Mine Ltd.'s Application for an Environmental Assessment Certificate for the proposed Kitsault Mine Project, made under section 16 of the British Columbia *Environmental Assessment Act* (Application) provides an examination of the federal scope of the proposed Kitsault Mine Project (proposed Project) and its resulting outcomes.

As defined in the *Canadian Environmental Assessment Act* (*CEA Act*) (Government of Canada 1992) section 16 (1):

> every screening or comprehensive study of a project and every mediation or assessment by a review panel shall include a consideration of the following factors:
>
> (a) the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;
>
> (b) the significance of the effects referred to in paragraph (a);
>
> (c) comments from the public that are received in accordance with this Act and the regulations;
>
> (d) measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project; and
>
> (e) any other matter relevant to the screening, comprehensive study, mediation or assessment by a review panel, such as the need for the project and alternatives to the project, that the responsible authority or, expect in the case of a screening, the Minister after consulting with the responsible authority, may require to be considered. (Government of Canada 1992).

This section addresses the required information for all federal environmental assessment types, corresponding to the federal scope, including:

- Potential environmental effects of the proposed Project (Section 21.1);
- Any change that the proposed Project may cause in the environment (Section 21.2);
- Potential effects on navigability of water bodies (Section 21.3);
- Any change that the proposed Project 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 federal *Species At Risk Act* (*SARA*) (Government of Canada 2002) (Section 21.4);
- Potential environmental factors that may affect the proposed Project, such as flooding, terrain instability or extreme climatic events, and the predicted effects of those environmental factors (Section 21.5);

- Potential effects of accidents, malfunctions, and unplanned events, such as traffic accidents, spills or power failures, that could occur in any phase of the proposed Project (Section 21.6);
- Any measures that are technically and economically feasible that would avoid or mitigate the environmental effects (Section 21.7);
- Any residual environmental effects expected to remain following the implementation of specified mitigation measures (Section 21.8);
- Significance of residual environmental effects (Section 21.9);
- Any cumulative environmental effects (CEE) that are likely to result from the project in combination with other projects or activities that have been or will be carried out (Section 21.10);
- A list of Nisga'a Nation and Aboriginal groups which the federal Responsible Authorities (RAs) have identified as requiring consultation, as well as applicable summaries of any groups or consultation activities different from provincial requirements (Section 21.11); and
- Other information as required by a RA such as details about the Nisga'a Final Agreement (NFA) (British Columbia Ministry of Aboriginal Relations and Reconciliation (BC MARR) 2000) (Section 21.12).

The information provided in this section corresponds to the federal scope and direction from RAs and the Canadian Environmental Assessment Agency (Agency). Section 22.0 of this Application provides additional federal requirements for comprehensive studies. For further information on the federal scope of the proposed Project and the requirements for the federal Environmental Assessment (EA) process, refer to Sections 2.4 and 4.2. Section 4.2 of this Application also provides detailed information regarding the federal review process, and lists the agencies, departments, and organisations likely to be involved in the review.

In accordance with the *Application Information Requirements Template* (British Columbia Environmental Assessment Office (BC EAO) 2010), where federal information requirements have been addressed earlier in the Application, a cross-reference is provided to respective sections to minimise unnecessary duplication. A Table of Concordance has also been prepared and is presented with the Application.

21.1 Environmental Effects

As part of federal information requirements for the Application and in accordance with the *CEA Act*, the proponent must provide a thorough examination of the potential environmental effects of the proposed Project including any change the proposed Project may cause in the environment, corresponding to the federal scope.

As defined under the CEA Act, "environment" means 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). (Government of Canada 1992)

Also defined under the *CEA Act*,

environmental effect means, in respect of a 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,

(iv) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, or

(c) any change to the project that may be caused by the environment, whether any such change or effect occurs within or outside Canada. (Government of Canada 1992).

The assessment process, as presented in Part B, C, and D of this Application, identifies potential environmental effects of the proposed Project and determines the nature of these potential effects. The following list cross-references each environmental effect as listed above to the respective section of the Application where the environmental effect is addressed.

- Any change that the project may cause the environment, refer to:
  - Air Quality and Climate (Section 6.2);
  - Noise and Vibration (Section 6.3);
  - Groundwater (Section 6.4);
  - Surface Hydrology (Section 6.5);
  - Surface Water and Sediment Quality (Section 6.6);
  - Freshwater Aquatic Resources (Section 6.7);
  - Marine Aquatic Resources (Section 6.8);
  - Terrain, Surficial Geology and Soil (Section 6.9);
  - Vegetation and Plant Communities (Section 6.10);
  - Wildlife and their Habitat (Section 6.11);

- Any change to a listed wildlife species, its critical habitat or the residences of individuals of that species (refer to Section 21.4 and Section 6.11);
- Any effects on health and socio-economic conditions, refer to:
  - Potential Economic Effects (Section 7.0);
  - Potential Social Effects (Section 8.0);
  - Potential Health Effects (Section 10.0);
  - Nisga'a Effects Assessment (Part C, Section 14.0);
  - Aboriginal Groups Information Requirements (Part D, Section 16 to 19);
  - Road Use Effects Assessment (RUEA; Appendix 8.0-C);
  - Nisga'a Economic, Social and Cultural Impact Assessment (Rescan 2012)
- Any effects on physical and cultural heritage, refer to:
  - Potential Heritage Effects (Section 9.0);
  - Nisga'a Effects Assessment (Part C, Section 14.0);
  - Aboriginal Groups Information Requirements (Part D, Section 16 to 19);
  - Road Use Effects Assessment (RUEA; Appendix 8.0-C);
  - Nisga'a Economic, Social and Cultural Impact Assessment (Rescan 2012)
- Any effects on the current use of lands and resources for traditional use purposes by Aboriginal groups, refer to:
  - Land use effects (Potential Social Effects, Section 8.0);
  - Nisga'a Effects Assessment (Part C, Section 14.0);
  - Aboriginal Groups Information Requirements (Part D, Section 16 to 19);
  - Road Use Effects Assessment (RUEA; Appendix 8.0-C);
  - Nisga'a Economic, Social and Cultural Impact Assessment (Rescan 2012)
- Any effect to any structure, site or thing that is of historical, archaeological, paleontological or architectural significance (refer to Potential Heritage Effects, Section 9.0); and
- Any change to the Project that may be caused by the environment (refer to Section 21.5).

Section 21.2 also provides a detailed table (Table 21.2-1) which outlines the respective Environmental Assessment (EA) discipline sections and Valued Components (VCs) that represent federal scope factors, and cross-references the tables and respective Application sections that present and describe potential environmental effects and interactions.

21.2 Environmental Changes

As part of federal information requirements for the Application and in accordance with the *CEA Act* (Government of Canada 1992), the proponent must describe any change that the proposed Project may cause in the environment corresponding to the federal scope. Sections 6.0 through 10.0 of the Application describe the environmental context, VCs, and

potential effects of the proposed Project. Environmental change is discussed in these sections as it pertains to each specific environmental subject area.

Section 21.2 of the Application Information Requirements (AIR) lists the following factors that may be considered in the federal scope based on the proposed Project proposal:

- Terrestrial environment;
- Freshwater quality;
- Hydrology;
- Hydrogeology;
- Air quality;
- Climate and meteorology;
- Terrain, soils and geology;
- Light and noise emissions;
- Natural hazards;
- Vegetation and plant communities;
- Wetlands;
- Wildlife and wildlife habitat;
- Ecologically sensitive or significant areas and species of conservation concern, including species at risk and their habitats;
- Freshwater aquatic environment (e.g., fish and aquatic life);
- Fish and fish habitat;
- Migratory birds and their habitats;
- Water quality;
- Marine / coastal processes (e.g., erosion and sedimentation);
- Navigable waters;
- Marine aquatic environment (e.g., aquatic life, marine biota);
- Human environment;
- Current use of lands and resources for the Nisga'a Nation purposes;
- Current use of lands and resources for Aboriginal groups' purposes;
- Fisheries, including aquaculture;
- Human health (e.g., noise, drinking water quality, and country foods);
- Physical and cultural heritage; and
- Structure and sites of archaeological significance.

Table 21.2-1 cross-references each of the above factors listed under the federal scope to EA discipline sections, as outlined in the Application. This table also identifies the VCs representing each federal scope factor, and references the tables and respective Application

sections that present potential effects and interactions as the basis for describing and assessing environmental change. The tables referenced in Table 21.2-1 offer an overview of the relationship between the relevant key issues (including environmental change) anticipated for each VC and the potential interaction of these effects (and environmental changes) on other VCs, which in turn face potential effects as a result of proposed Project activities. Textual descriptions of environmental effects are also provided in the corresponding sections of table locations.

Table 21.2-1: Cross-Reference to Environmental Change Corresponding to Federal Scope Factors

EA Discipline	Federal Scope Factors	Valued Components	Environmental Change Cross-Reference	
Atmospheric Environment	Air quality Climate and meteorology Noise emissions	Air Quality Climate Noise and Vibration	**Section 6.2** Table 6.2.1-1 Table 6.2.1-2 Table 6.2.1-3 Table 6.2.1-4 Table 6.2.1-5 Table 6.2.2-7 Table 6.2.2-8 Table 6.2.2-9 Table 6.2.2-10 Table 6.2.3-4	**Section 6.3** Table 6.3.9-1 Table 6.3.9-7 Table 6.3.9-8 Table 6.3.9-9 Table 6.3.9-10
Groundwater	Hydrogeology Water quality	Groundwater Flow Groundwater Quality Groundwater Recharge and Discharge Groundwater and Surface Water Interaction	**Section 6.4** Table 6.4.1-1 Table 6.4.1-2 Table 6.4.1-3 Table 6.4.1-4 Table 6.4.1-5 Table 6.4.1-6 Table 6.4.1-7 Table 6.4.2-3 Table 6.4.2-4 Table 6.4.2-5 Table 6.4.2-6 Table 6.4.2-7 Table 6.4.3-3 Table 6.4.3-4	 Table 6.4.3-5 Table 6.4.3-6 Table 6.4.3-7 Table 6.4.4-3 Table 6.4.4-4 Table 6.4.4-5 Table 6.4.4-6 Table 6.4.4-7 Table 6.4.5-3 Table 6.4.5-4 Table 6.4.5-5 Table 6.4.5-6 Table 6.4.5-7
Hydrology	Hydrology	Lime / Patsy Creek Watershed Clary Creek Watershed	**Section 6.5** Table 6.5.1-1 Table 6.5.1-2 Table 6.5.1-3 Table 6.5.1-4 Table 6.5.1-5	 Table 6.5.2-15 Table 6.5.2-16 Table 6.5.2-17 Table 6.5.2-18 Table 6.5.2-19

EA Discipline	Federal Scope Factors	Valued Components	Environmental Change Cross-Reference	
Surface Water and Sediment Quality	Freshwater quality Water quality	Surface Water Quality Sediment Quality	**Section 6.6** Table 6.6.1-1 Table 6.6.1-2 Table 6.6.1-3 Table 6.6.1-4 Table 6.6.1-5 Table 6.6.2-27 Table 6.6.2-28 Table 6.6.2-29	 Table 6.6.2-30 Table 6.6.2-31 Table 6.6.2-34 Table 6.6.3-12 Table 6.6.3-13 Table 6.6.3-14 Table 6.6.3-15 Table 6.6.3-16
			Appendix Water Quality Model (Appendix 6.6-B)	
Freshwater Aquatic Resources	Freshwater aquatic environment Fish and fish habitat	Dolly Varden Coho Salmon Rainbow Trout Benthic Macro-Invertebrates	**Section 6.7** Table 6.7.1-2 Table 6.7.1-3 Table 6.7.1-4 Table 6.7.1-5 Table 6.7.1-6 Table 6.7.2-15 Table 6.7.2-16 Table 6.7.2-17 Table 6.7.2.18 Table 6.7.2-19 Table 6.7.2-20 Table 6.7.3-5 Table 6.7.3-6 Table 6.7.3-7 Table 6.7.3-8	 Table 6.7.3-9 Table 6.7.3-10 Table 6.7.4-14 Table 6.7.4-15 Table 6.7.4-16 Table 6.7.4-17 Table 6.7.4-18 Table 6.7.4-19 Table 6.7.5-5 Table 6.7.5-6 Table 6.7.5-7 Table 6.7.5-8 Table 6.7.5-9 Table 6.7.5-10
Marine Aquatic Resources	Marine / coastal processes Marine aquatic environment Water Quality	Marine Water Quality Marine Biota	**Section 6.8** Table 6.8.1-1 Table 6.8.1-2 Table 6.8.1-3 Table 6.8.1-4	 Table 6.8.1-5 Table 6.8.2-2 Table 6.8.2-5
Terrestrial Environment – Terrain, Surficial Geology and Soil	Terrestrial environment Terrain, soils and geology	Physiography and topography Surficial geology Soil Cover Soil Quality	**Section 6.9** Table 6.9.1-1 Table 6.9.1-2 Table 6.9.1-3 Table 6.9.1-4 Table 6.9.1-5 Table 6.9.2-2 Table 6.9.2-3 Table 6.9.2-4	 Table 6.9.3-5 Table 6.9.3-6 Table 6.9.4-2 Table 6.9.4-3 Table 6.9.4-4 Table 6.9.4-5 Table 6.9.4-6 Table 6.9.5-2

EA Discipline	Federal Scope Factors	Valued Components	Environmental Change Cross-Reference	
			Table 6.9.2-5 Table 6.9.2-6 Table 6.9.3-2 Table 6.9.3-3 Table 6.9.3-4	Table 6.9.5-3 Table 6.9.5-4 Table 6.9.5-5 Table 6.9.5-6
Terrestrial Environment – Vegetation and Plant Communities	Terrestrial environment Vegetation and plant communities Wetlands Ecologically sensitive or significant areas and species of conservation concern, including species at risk and their habitats	Ecosystem Composition Wetland Ecosystems Old Forests Species at Risk Ecological Communities at Risk Cultural Plants	**Section 6.10** Table 6.10.1-1 Table 6.10.1-2 Table 6.10.1-3 Table 6.10.2-2 Table 6.10.2-6 Table 6.10.2-7 Table 6.10.2-8 Table 6.10.3-1 Table 6.10.3-3 Table 6.10.3-4 Table 6.10.3-5 Table 6.10.3-6 Table 6.10.4-1 Table 6.10.4-3 Table 6.10.4-4 Table 6.10.4-5	 Table 6.10.5-3 Table 6.10.5-5 Table 6.10.5-6 Table 6.10.5-7 Table 6.10.5-8 Table 6.10.6-1 Table 6.10.6-3 Table 6.10.6-4 Table 6.10.6-5 Table 6.10.6-6 Table 6.10.7-3 Table 6.10.7-8 Table 6.10.7-9 Table 6.10.7-10 Table 6.10.7-11
Wildlife and their Habitat	Wildlife and wildlife habitat Migratory birds and their habitats Ecologically sensitive or significant areas and species of conservation concern, including species at risk and their habitats	Western Toad Olive-sided Flycatcher Sooty Grouse Northern Goshawk American Marten Mountain Goat Moose Grizzly Bear	**Section 6.11** Table 6.11.2-1 Table 6.11.2-2 Table 6.11.2-3 Table 6.11.2-4 Table 6.11.2-5 Table 6.11.3-1 Table 6.11.3-2 Table 6.11.3-3 Table 6.11.3-4 Table 6.11.3-5 Table 6.11.4-1 Table 6.11.4-3 Table 6.11.4-4 Table 6.11.4-5 Table 6.11.4-6 Table 6.11.5-1 Table 6.11.5-3 Table 6.11.5-4 Table 6.11.5-5 Table 6.11.5-6	 Table 6.11.6-5 Table 6.11.6-6 Table 6.11.7-1 Table 6.11.7-3 Table 6.11.7-4 Table 6.11.7-5 Table 6.11.7-6 Table 6.11.8-1 Table 6.11.8-2 Table 6.11.8-3 Table 6.11.8-4 Table 6.11.8-5 Table 6.11.9-1 Table 6.11.9-3 Table 6.11.9-4 Table 6.11.9-5 Table 6.11.9-6 Table 6.11.10-2 Table 6.11.10-3 Table 6.11.10-4

EA Discipline	Federal Scope Factors	Valued Components	Environmental Change Cross-Reference	
			Table 6.11.6-1 Table 6.11.6-3 Table 6.11.6-4	Table 6.11.10-5 Table 6.11.10-6
			Appendix Road Use Effects Assessment (Appendix 8.0-C)	
Economic	Human environment	Provincial Economy and Government Revenues Regional Employment and Income Employment Opportunities Contract and Business Opportunities Labour Income Generated Local Unemployment Rates and Trends Employment and Economic Diversification Labour Force Qualification Regional Government Finances	**Section 7.0** Table 7.2.1-1 Table 7.2.1-2 Table 7.2.1-3 Table 7.2.1-4 Table 7.2.1-5 Table 7.2.2-12 Table 7.2.2-13 Table 7.2.2.14 Table 7.2.2-16 Table 7.2.3-7 Table 7.2.3-14 Table 7.2.3-15 Table 7.2.3-16 Table 7.2.4-7 Table 7.2.4-11 Table 7.2.4-12 Table 7.2.4-13 Table 7.2.5-2 Table 7.2.5-4 Table 7.2.5-5 Table 7.2.5-6	 Table 7.2.6-4 Table 7.2.6-5 Table 7.2.6-6 Table 7.2.6-7 Table 7.2.7-2 Table 7.2.7-4 Table 7.2.7-5 Table 7.2.7-6 Table 7.2.8-3 Table 7.2.8-4 Table 7.2.8-5 Table 7.2.8-6 Table 7.2.9-4 Table 7.2.9-5 Table 7.2.9-6 Table 7.2.9-7 Table 7.2.10-2 Table 7.2.10-3 Table 7.2.10-4 Table 7.2.10-5
Social	Human environment Current use of lands and resources for the Nisga'a Nation purposes Current use of lands and resources for Aboriginal groups' purposes Fisheries, including aquaculture	Regional Demographics Housing Regional Services Regional Infrastructure Family and Community Wellbeing Educational Services Transportation Land and Resource Use	**Section 8.0** Table 8.2.1-1 Table 8.2.1-2 Table 8.2.1-3 Table 8.2.1-4 Table 8.2.1-5 Table 8.2.2-5 Table 8.2.2-6 Table 8.2.2-7 Table 8.2.2-8 Table 8.2.3-1 Table 8.2.3-2 Table 8.2.3-3 Table 8.2.3-4 Table 8.2.4-2	 Table 8.2.5-4 Table 8.2.6-7 Table 8.2.6-8 Table 8.2.6-9 Table 8.2.6-10 Table 8.2.7-3 Table 8.2.7-4 Table 8.2.7-5 Table 8.2.7-6 Table 8.2.8-3 Table 8.2.8-4 Table 8.2.8-5 Table 8.2.8-6 Table 8.2.9-1

EA Discipline	Federal Scope Factors	Valued Components	Environmental Change Cross-Reference	
			Table 8.2.4-3 Table 8.2.4-4 Table 8.2.4-5 Table 8.2.5-1 Table 8.2.5-2 Table 8.2.5-3	Table 8.2.9-2 Table 8.2.9-3 Table 8.2.9-5 Table 8.2.9-6 Table 8.2.9-7 Table 8.2.9-8
Heritage	Physical and cultural heritage Structure and sites of archaeological significance Human environment	Archaeological Sites Historic Heritage Sites	**Section 9.0** Table 9.2.1-1 Table 9.2.1-2 Table 9.2.1-3 Table 9.2.1-4 Table 9.2.1-5 Table 9.2.2-3 Table 9.2.2-4 Table 9.2.2-5	 Table 9.2.2-6 Table 9.2.2-7 Table 9.2.3-2 Table 9.2.3-3 Table 9.2.3-4 Table 9.2.3-5 Table 9.2.3-6
Human Health	Human health Human environment	Public Health Visual and Aesthetic Resources Healthy Living Worker Safety and Health	**Section 10.0** Table 10.2.1-1 Table 10.2.2-4 Table 10.2.2-9 Table 10.2.2-10 Table 10.2.3-3 Table 10.2.3-4 Table 10.2.3-5 Table 10.2.3-6	 Table 10.2.3-7 Table 10.2.4-1 Table 10.2.4-2 Table 10.2.4-3 Table 10.2.5-1 Table 10.2.5-2 Table 10.2.5-3 Table 10.2.5-4
Nisga'a Nation Rights and Interests	Human environment Current use of lands and resources for the Nisga'a Nation purposes		**Section 14** Section 14.0 Nisga'a Effects Assessment **Appendix** Nisga'a Economic, Social and Cultural Impact Assessment (Rescan 2012) Road Use Effects Assessment (Appendix 8.0-C)	
Aboriginal Groups Information Requirements	Human environment Current use of lands and resources for Aboriginal groups' purposes		**Part D** Section 16 through 19 (Metlakatla First Nation only) **Appendix** Road Use Effects Assessment (Appendix 8.0-C)	

Note: EA - Environmental Assessment

21.3 Navigation

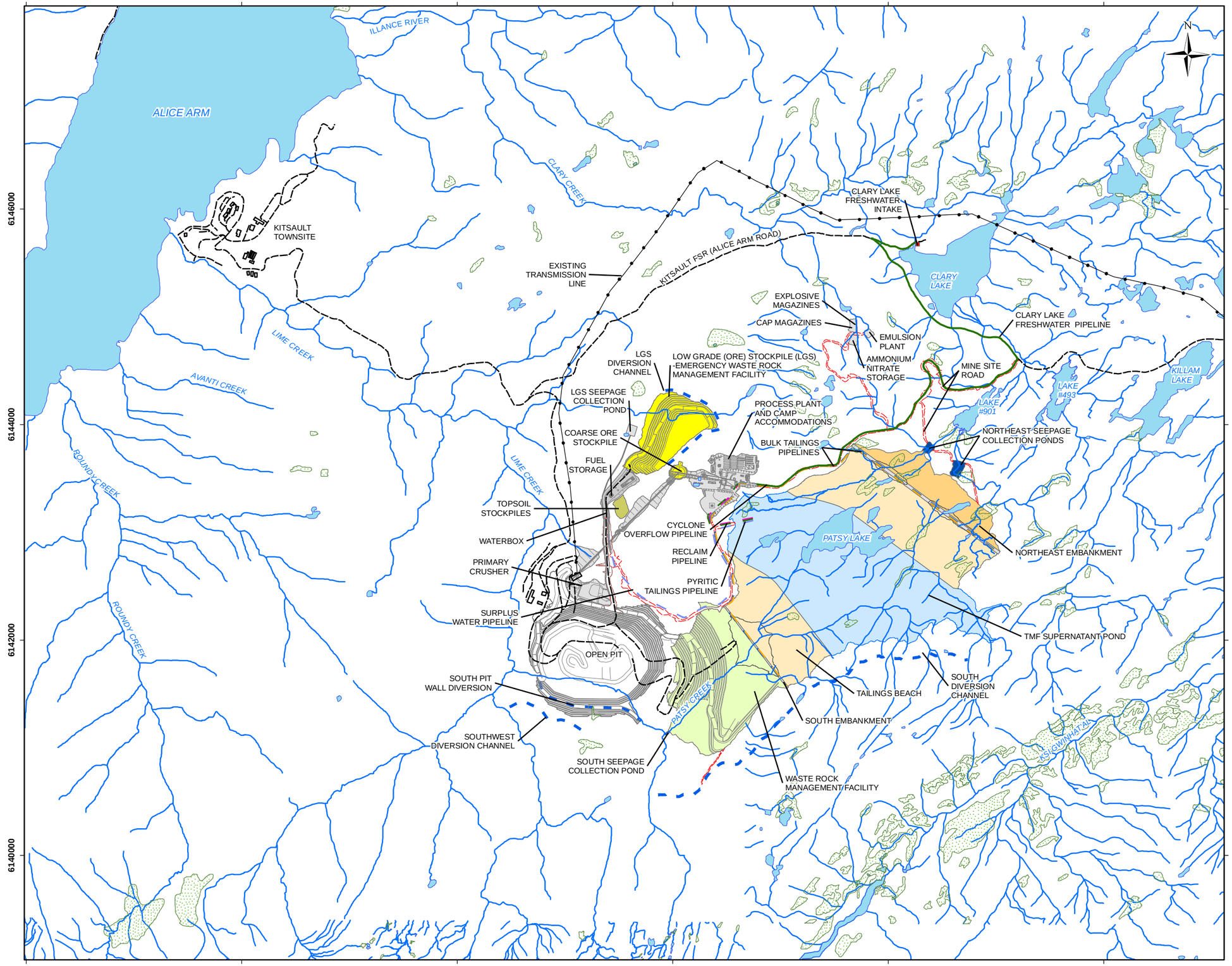
21.3.1 Introduction

The following information was compiled with the intent to inform Transport Canada (TC) of the potential effects to Navigable Waters with respect to the proposed Project. The purpose of this report therefore was to provide information that would aid TC in making a determination, if an authorisation was required under section 5 of the *Navigable Waters Protection Act* (*NWPA*) (Government of Canada 1985) and / or an exemption under section 22 of the *NWPA*. Upon review of the proposed Project through the Agency process, TC determined that no approvals were required to be issued for the proposed Project.

For the purpose of review by TC, the proposed Project has been divided into separate Project components: the site access road and the Tailings Management Facility (TMF). Each was meant to inform TC as to which waterbodies may be affected by the proposed Project during each stage of proposed development. In accordance with the guidelines published by TC, detailed information of streams is only required for systems where the mean bankfull channel width exceeds 3.0 metres (m).

21.3.2 Mine Site Road

The proposed mine site road intersects the Alice Arm Road, which travels northwest from the Nass Forest Service Road (FSR) to the Town of Kitsault (Figure 21.3.2-1). The proposed mine site road crosses many unnamed tributaries, all of which have mean bankfull stream widths less than 3.0 m. These unnamed tributaries flow into tributaries of Clary Creek, such as Lake 901 and Clary Lake (Figure 21.3.2-1, Table 21.3.2-1). The Clary Creek Watershed (33.7 kilometres squared (km^2)) is a sub-basin to the Illiance River Watershed. Clary Creek drains out of Clary Lake and into the Illiance River, then into Alice Arm.



Legend

- Access Road
- Mine Site Road
- Transmission Line
- Stream
- Waterbody
- Wetland
- Diversion Ditch
- Pipeline - Bulk Tailings
- Pipeline - Cyclone Overflow
- Pipeline - Pyritic Tailings
- Pipeline - Reclaim
- Pipeline - Surplus Water
- Pipeline - Freshwater
- Process Plant
- Open Pit
- Ore Stockpile
- Clary Lake Freshwater Intake
- Topsoil Stockpiles
- Waste Rock Management Facility
- Northeast Embankment
- Tailings Beach
- Tailings Management Facility (TMF) Supernatant Pond

KEY MAP

Scale:1:35,000

1 0.5 0 1

Kilometres

Note:

Drawing is preliminary and subject to revision during ongoing design as additional information is obtained.

Reference

1. Base Data
Geobase 1:20,000 (TRIM)
Land and Resource Data Warehouse 1:20,000 (TRIM)
2. Kitsault Mine General Layout
Supplied by AMEC and Knight Piesold on March 2011

CLIENT: Avanti Kitsault Mine Ltd.

PROJECT: Kitsault Mine Project

Kitsault Mine Project General Layout

DATE: November 2011	ANALYST: MY	**Figure** 21.3.2-1
JOB No: VE51988	QA/QC: TT	PDF FILE: Other-50-012_project_layout_v8.pdf
GIS FILE: Other-50-012_v8.mxd		
PROJECTION: UTM Zone 9	DATUM: NAD83	

Y:\GIS\Projects\VE\VE51988_KitsaultMapping\Other\Other-50-012_v8.mxd

Table 21.3.2-1: Local and Regional Watersheds Within the Proposed Project Area

Watershed	Tributary Of	Proposed Project Components Located Within Catchment	Watershed Area (km^2)
Lime	Alice Arm	TMF; Kitsault Pit; WRMF; Processing Plant; haul roads – all within the Patsy sub-basin	40.13
Patsy	Lime Creek	TMF; Kitsault Pit; WRMF; Processing Plant; haul roads	12.21[a]
Clary	Illiance River	Mine site roads; water pipelines	33.70[b]

Note: km^2 - kilometre squared; TMF - Tailings Management Facility; WRMF - Waste Rock Management Facility
a - Area upstream of confluence with Lime Creek
b - Area upstream of confluence with Illiance River

21.3.3 Proposed Tailings Management Facility

The proposed TMF is estimated to support an ore milling rate of 40,000 to 50,000 tonnes per day (t/d) over approximately a 15 to 16-year operations period. It is proposed to be located within the Lime Creek Watershed, west of the historic operating pit location (Figure 21.3.3-1).

473000 474000 475000 476000 477000

6144000 6143000 6142000 6141000

LGS DIVERSION CHANNEL
LOW GRADE (ORE) STOCKPILE (LGS) -EMERGENCY WASTE ROCK MANAGEMENT FACILITY
SITE ACCESS ROAD
LGS SEEPAGE COLLECTION POND
PROCESS PLANT AND CAMP ACCOMMODATIONS
COARSE ORE STOCKPILE
BULK TAILINGS PIPELINES
NORTHEAST SEEPAGE COLLECTION PONDS
FUEL STORAGE
LIME CREEK
TOPSOIL STOCKPILES
WATERBOX
CYCLONE OVERFLOW PIPELINE
PATSY LAKE
RECLAIM PIPELINE
PRIMARY CRUSHER
NORTHEAST EMBANKMENT
SURPLUS WATER PIPELINE
PYRITIC TAILINGS PIPELINE
TMF SUPERNATANT POND
OPEN PIT
SOUTH DIVERSION CHANNEL
TAILINGS BEACH
SOUTH PIT WALL DIVERSION
SOUTH EMBANKMENT
PATSY CREEK
WASTE ROCK MANAGEMENT FACILITY
SOUTHWEST DIVERSION CHANNEL
SOUTH SEEPAGE COLLECTION POND
KSI GWINHAT'AL

N

Legend

- Access Road
- Mine Site Road
- Transmission Line
- Contour (20 m)
- Contour (100 m)
- Diversion Ditch
- Pipeline - Bulk Tailings
- Pipeline - Cyclone Overflow
- Pipeline - Pyritic Tailings
- Pipeline - Reclaim
- Pipeline - Surplus Water
- Freshwater Pipeline
- Stream
- Waterbody
- Wetland
- Process Plant
- Open Pit
- Ore Stockpile
- Topsoil Stockpiles
- Waste Rock Management Facility
- Northeast Embankment
- Tailings Beach
- Tailings Management Facility (TMF) Supernatant Pond

KEY MAP

Scale:1:15,000

0 250 500

Metres

Reference

1. Base Data
Geobase 1:20,000 (TRIM)
Land and Resource Data Warehouse 1:20,000 (TRIM)
2. Kitsault Mine General Layout
Supplied by AMEC and Knight Piesold on March 2011

CLIENT: Avanti Kitsault Mine Ltd.

PROJECT: Kitsault Mine Project

Tailings Management Facility General Arrangement

DATE: November 2011	ANALYST: MY	**Figure** 21.3.3-1
JOB No: VE51988	QA/QC: TT	PDF FILE: Other-50-052_tailings_v6.pdf
GIS FILE: Other-50-052_v6.mxd		
PROJECTION: UTM Zone 9	DATUM: NAD83	

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The Lime Creek Watershed (40.1 km^2) is a direct tributary to Alice Arm. The Patsy Creek Watershed (12.1 km^2) is a lake-headed sub-basin of the Lime Creek Watershed (Figure 21.3.2-1, Table 21.3.2-1). The proposed TMF footprint would be 170 hectares (ha) and is proposed to encompass Patsy Lake in addition to one smaller unnamed lake (Figure 21.3.3-1). Both lakes are surrounded by mature forest interspersed amid swamp ecosystems. To the northwest of Patsy Lake lies a 40-m cliff. Within the Patsy Creek drainage, streams were either: (1) small (<3.0 m), steep (>4%) and often ephemeral or intermittent; or, (2) small (<3.0 m), low-gradient (<4%), and originating in wetlands. In short, streams within the Patsy Creek drainage did not have sustained reaches that met TC Navigability Criteria, as defined under the *NWPA*.

Lower Lime Creek, below the confluence with Patsy Creek, consistently exceeded 3.0 m bankfull channel width. The stream gradient also consistently exceeded 4%, and the stream was either entrenched or confined at all times. Large (D_{95} 1.5 m) in-stream boulders in addition to frequent hillslope coupling further reduce the likelihood of navigability in Lower Lime Creek. There is an 8.0-m waterfall 5.4 kilometres (km) downstream of the confluence with Patsy Creek.

Tables 21.3.3-1 through 21.3.3-4 provide descriptions of three of the water features (Patsy Lake, an unnamed Lake and Patsy Creek)) involved in the proposed Project area and include: location; width; depth; and gradient. Figures 21.3.3-2 and 21.3.3-3 show Patsy Lake and the unnamed Lake, and the lakes are described in Tables 21.3.3-1 and 21.3.3-2. Figures 21.3.3-4 and 21.3.3-5 show the Patsy Creek and the creeks are described in Tables 21.3.3-3 and 21.3.3-4.

Figure 21.3.3-2: Patsy Lake – No. 51

Table 21.3.3-1: Description of Patsy Lake

Feature	Detail
UTM Coordinates	9U 475197 6142748
Watercourse Name	Patsy Lake
Watershed	Lime Creek
Mean Channel Width (m)	n/a
Maximum Lake Depth (m)	29.2
Channel Gradient %	0
Channel Morphology	Lake
Channel Disturbance	n/a
Crossing Rationale	TMF

Note: m - metre; n/a - not applicable; % - percent; TMF - Tailings Management Facility; UTM - Universal Transverse Mercator

Figure 21.3.3-3: Unnamed Lake – No. 115

Table 21.3.3-2: Description of Unnamed Lake

Feature	Detail
UTM Coordinates	9U 475002 6143004
Watercourse Name	Unnamed Lake
Watershed	Lime Creek
Mean Channel Width (m)	n/a
Mean Channel Depth (m)	n/a
Channel Gradient %	0
Channel Morphology	Lake
Channel Disturbance	n/a
Crossing Rationale	TMF

Note: m - metre; n/a - not applicable; % - percent; TMF - Tailings Management Facility; UTM - Universal Transverse Mercator

Figure 21.3.3-4: Patsy Creek – No. 44

Table 21.3.3-3: Description of Patsy Creek (a)

Feature	Detail
UTM Coordinates	9U 474830 6142034
Watercourse Name	Patsy Creek
Watershed	Lime Creek
Mean Channel Width (m)	2.7
Mean Channel Depth (m)	0.4
Channel Gradient %	3
Channel Morphology	CP_b-w
Channel Disturbance	Erosion
Crossing Rationale	TMF

Note: CP_b-w - cascade-pool boulder - presence of large woody debris; m - metre; % - percent; TMF - Tailings Management Facility; UTM - Universal Transverse Mercator

Figure 21.3.3-5: Patsy Creek – No. 39

Table 21.3.3-4: Description of Patsy Creek (b)

Feature	Detail
UTM Coordinates	9U 0473291 6141587
Watercourse Name	Patsy Creek
Watershed	Lime Creek
Mean Channel Width (m)	5.0
Mean Channel Depth (m)	1.0
Channel Gradient %	5
Channel Morphology	CP_b-w
Channel Disturbance	Erosion
Crossing Rationale	TMF

Note: CP_b-w - cascade-pool boulder - presence of large woody debris; m - metre; % - percent; TMF - Tailings Management Facility; UTM - Universal Transverse Mercator

The TMF was designed to provide environmentally secure storage for disposal of 233 million tonnes (Mt) of tailings, and includes provision up of to 300 Mt. Water management components were designed to maximise the diversion of clean water around the proposed Project components, while ensuring the capture of contact water throughout the site. The TMF would include the following:

- South Embankment;
- Northeast Embankment;
- Seepage collection ditches and ponds;
- Bulk tailings distribution system;
- Bulk tailings beaches;
- Bulk tailings feeder lines to on-crest cyclones;
- Cleaner tailings distribution;
- Cleaner tailings cell;
- Reclaim water system;
- Surplus water system; and
- Supernatant water pond.

Water management components have been designed to maximise the diversion of clean water around the Project components, while ensuring the capture of contact water throughout the site.

21.3.4 Closure and Reclamation

Closure of the TMF would involve maintaining a water cover or lake over the tailings in perpetuity. The TMF pond surface elevation would be regulated and is expected to fluctuate throughout the year. Section 3.10 (Decommissioning Activities) and Appendix 3.0-K provide details of the closure and reclamation planned for the TMF.

21.4 Species at Risk

This section describes any change that the proposed Project may cause to listed wildlife species, their critical habitat and / or the residences of individuals of that species, according to the terms defined in subsection 2(1) of the federal *SARA*. Wildlife species, as defined in *SARA*, refer to "a species, subspecies, variety or geographically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature" (Government of Canada 2002). "Listed" means listed on the List of Wildlife Species at Risk as set out in Schedule 1 of *SARA*. Based on the above definitions, there are 14 Schedule 1 species that either occur or potentially occur within or near the proposed Project area, including six marine mammals, six birds, and two amphibians (Appendix 6.11-A; Rescan 2010b). No plant or fish species listed on Schedule 1 of *SARA* occur or potentially occur in the proposed Project area (Vegetation Baseline Report, Appendix 6.10-A; Freshwater Aquatic Resources Baseline Report, Appendix 6.7-A).

21.4.1 Marine Mammals

There is current ocean access via the Portland Inlet and the Observatory Inlet to Alice Arm and the Kitsault Townsite. During baseline marine surveys, two mammal species listed on Schedule 1 were identified, the threatened humpback whale (*Megaptera novaeangliae*) North Pacific population (Committee on the Status of Endangered Wildlife in Canada (COSEWIC) 2003a) and the special concern harbour porpoise (*Phocoena phocoena*) Pacific Ocean population (COSEWIC 2003b). One transient humpback whale was observed in September 2009 in Portland Inlet, approximately 80 km from Alice Arm. Harbour porpoise were observed numerous times during baseline marine surveys throughout Observatory Inlet and Alice Arm, and is considered a resident of the Inlet (Rescan 2010b).

Other marine mammals listed on Schedule 1 under *SARA* that were identified in baseline studies as potentially occurring within Portland Inlet, Observatory Inlet or Alice Arm (Rescan 2010b) include the threatened killer whale (*Orcinus orca*) Northern Resident population (COSEWIC 2008a), threatened killer whale West Coast Transient population (COSEWIC 2008a), special concern grey whale (*Eschrichtius robustus*) Eastern North Pacific population (COSEWIC 2004), and special concern Steller sea lion (*Eumetopias jubatus*) (COSEWIC 2003c).

Based on the Project Description (Section 3.0), there would be no Project associated marine traffic through Alice Arm to Observatory Inlet and Portland Inlet to the ocean and the barge facilities that currently exist within and adjacent to the Kitsault Townsite would not be used during the construction and operations phase. Marine biota (which includes marine mammals) was selected as a marine aquatic resources VC and assessed in Section 6.8. Based on this assessment, no Project-related effects on marine biota are anticipated since there are no direct interactions with proposed Project activities and indirect effects of the proposed Project on marine water quality are anticipated to be negligible. Thus, the proposed Project would not cause any change to these Schedule 1 marine mammal species, their critical habitat or the residences of individuals of that species.

21.4.2 Birds

Three bird species listed on Schedule 1 under *SARA* were identified during baseline surveys (Appendix 6.11-A; Rescan 2010b) including the threatened olive-sided flycatcher (*Contopus cooperi*), the threatened marbled murrelet (*Brachyramphus marmoratus*), and the special concern great blue heron *fannini* subspecies (*Ardea herodias fannini*). An additional three bird species listed on Schedule 1 under *SARA* were identified as potentially occurring during baseline surveys (Rescan 2010b), including the threatened northern goshawk *laingi* subspecies (*Accipiter gentilis laingi*), special concern western screech-owl *kennicottii* subspecies (*Otus kennicottii kennicottii*), and special concern peregrine falcon *pealei* subspecies (*Falco peregrinus pealei*). Each of these species is further discussed below.

Olive-sided flycatcher (*Contopus cooperi*): The olive-sided flycatcher is designated as threatened on Schedule 1 due to widespread and consistent population decline over the last 30 years; the cause of which remains uncertain (COSEWIC 2007a). Five olive-sided flycatcher individuals were identified during 2009 baseline studies within the Local Study Area (LSA), Regional Study Area (RSA), and along the Kitsault / Alice Arm Road, exclusively in the Mountain Hemlock (MH) biogeoclimatic (BGC) variants (Rescan 2010b). None of these observations were in locations of the proposed footprint; however, one observation was just east of the proposed TMF. Olive-sided flycatchers were also detected in 2010 north of Patsy Lake (Appendix 6.11-A). Olive-sided flycatchers are generally found in open coniferous forests and often near wetlands with dead trees (snags), and nests are generally placed in conifers, such as Douglas fir and Engelmann spruce (Campbell et al 1997; COSEWIC 2007a).

The olive-sided flycatcher was selected as a wildlife VC due to their presence in the Project area and conservation status. Details regarding potential Project effects on the olive-sided flycatcher and its habitat are presented in Section 6.11. In summary, the primary concern is habitat loss, noise disturbance, and mortality. Habitat modelling conservatively identified approximately 649 ha (33% of the total LSA) as potential olive-sided flycatcher breeding habitat; of this habitat approximately 228 ha (or 35%) would be directly removed by Project development, particularly from the development of the TMF. Habitat loss would likely affect nesting opportunities for olive-sided flycatcher on a local scale. However, it is anticipated that birds would move on to other territories and the disruption would be temporary in nature. Baseline detections of olive-sided flycatcher were outside of the Project footprint area, suggesting the RSA and surrounding areas provide suitable breeding habitat.

Potential mortality and disturbance would be mitigated by avoiding vegetation clearing during breeding periods and where breeding periods cannot be avoided, conducting pre-clearing surveys for nesting birds during the breeding season. Although mitigation is expected to minimise potential effects, a residual effect to olive-sided flycatcher is anticipated. Considering past mining activity occurring on the site, the current conservation status of the olive-sided flycatcher in BC, and remaining potential breeding habitat throughout the proposed Project's LSA and RSA, the overall potential effect on the local population of olive-sided flycatchers and other songbirds is anticipated to be distinguishable

from the natural range of variation but not at the level of populations, and thus, assessed as not significant (minor) (Section 6.11).

Overall, some individuals and the residences of some individuals may be affected by the development of proposed Project. Considering mitigation measures, a potential change to the local breeding population is not anticipated.

Marbled murrelet (*Brachyramphus marmoratus*): The marbled murrelet is designated as threatened on Schedule 1 due to the high rate of loss of nesting habitat in old growth forests and marine threats such as fisheries bycatch and oil spills (Canadian Marbled Murrelet Recovery Team 2003; Burger 2002). Marbled murrelets spend most of their lives at sea (Canadian Marbled Murrelet Recovery Team 2003) and were detected during marine bird baseline surveys within Alice Arm (Rescan 2010b). Overall, 233 individual marbled murrelets were observed throughout Alice Arm, with the majority of individuals observed during the spring (n=154) and summer (n=62), suggesting that this species likely breeds in the area of Alice Arm (Rescan 2010b).

As previously discussed regarding marine mammals, the proposed Project would have no associated marine traffic or use of the existing barge facilities in Alice Arm; and subsequently no potential Project interaction is anticipated with marbled murrelets during marine foraging within Alice Arm. However, marbled murrelets breed inland, with most nest sites occurring on large limbs (15 to 75 centimetres (cm) diameter), high in the canopy of large, old-growth conifers (generally >140 years old to >200 years old) (Burger 2002). Most nest sites occur within 30 km of the ocean shore (Canadian Marbled Murrelet Recovery Team 2003) and from sea level to approximately 1,500 m in elevation, with optimum nesting conditions in BC considered to be found from 0 to 900 m elevation (Burger 2002), and up to 600 m in more northern areas (Canadian Marbled Murrelet Recovery Team 2003). The North Coast Land and Resource Management Plan (LRMP) (2005) specifically identifies optimum marbled murrelet breeding habitat as forest habitat of age class 9 (>250 years old), height class 4, and at less than 600 m elevation.

The proposed Project is located approximately 4 km away from the Alice Arm shore between 600 m (location of Kitsault Pit) and 920 m (location of Process Plant, TMF, and WRMF) elevation. Based on preferred breeding habitat requirements of marbled murrelet, the majority of the proposed Project is located outside of the general optimum elevation of less than 600 m. However, marbled murrelets have been found to nest higher than 600 m elevation in some areas (Burger 2002).

Old forest (defined as structural stage 7, forests greater than and equal to 250 years old) was identified as a VC for the vegetation assessment (Section 6.10). Approximately 306 ha of old forest presently occur in the LSA, and 811 ha of old forest occur in the RSA. Project development would remove 46 ha of old forest (5.7% of old forest the RSA), specifically from the development of the Waste Rock Management Facility (WRMF) and the northeast section of the TMF (Section 6.10). The majority of this loss (44 ha) occurs above 900 m in the MH (moist maritime leeward variant) BGC unit, with limited loss (2 ha) of old forest occurring

from greater than 600 m elevation in the Coastal Western Hemlock (CWH) (wet submaritime montane variant) BGC unit.

The proposed Project is a brownfield site with the majority of additional development occurring at elevations greater than 900 m. Approximately 2 ha of old forest would be removed from elevations around 600 m. Based on the nesting habitat preferences of marbled murrelet and the elevation of the proposed Project, marbled murrelet breeding is not expected in the Project area. If breeding does occur, any potential interaction and disturbance with nesting birds would be minimised from pre-clearing nest surveys during the breeding period (April 1 to July 31) (Section 11.2.21 Wildlife Management Plan). The proposed Project is not anticipated to cause any change to marbled murrelet, its critical habitat or the residences of individuals of that species.

Great blue heron *fannini* subspecies (*Ardea herodias fannini*): The great blue heron *fannini* subspecies, also referred to as the Pacific great blue heron, is designated as special concern on Schedule 1 under *SARA* due to a relatively small population that is concentrated at a few breeding colonies in southern British Columbia (BC) (COSEWIC 2008b). The Pacific great blue heron is non-migratory and resides year-round on the north and south coasts of BC and associated islands. Most nesting colonies are located in the Strait of Georgia with the largest concentrations occurring around the Fraser River delta where the areas of foraging habitat (i.e., mudflats and eelgrass beds) are extensive (COSEWIC 2008b). Outside the Georgia Basin, Pacific great blue herons are scattered in small groups and as individuals that nest in woodlands near foraging areas, most commonly in red alder (*Alnus rubra*), black cottonwood (*Populus balsamifera*), and Douglas-fir (*Pseudotsuga menziesii*) tree species (Gebauer and Moul 2001).

During baseline studies, 12 Pacific great blue herons were observed along the shores of Alice Arm during winter (n=4), spring (n=1), and fall (n=6) (Rescan 2010b). Based on baseline survey results, Pacific great blue herons are likely not breeding in the area since none were observed during summer surveys and only one was observed during spring surveys. Instead, habitat along the shore of Alice Arm likely provides foraging habitat for Pacific great blue heron as it moves between breeding and overwintering areas (Rescan 2010b).

No interaction is anticipated between the proposed Project and marine foraging habitat for herons as there would be no use of the existing barge facilities and no associated marine traffic. Marine biota (which includes marine birds) was selected as a marine aquatic resources VC and assessed in Section 6.8. Based on this assessment, no Project-related effects on marine biota are anticipated since there are no direct interactions with Project activities and indirect effects of the Project on marine water quality are anticipated to be negligible. Although Pacific great blue heron breeding is not expected in the Project area, if breeding does occur any potential interaction with nesting birds would be minimised. The Wildlife Management Plan (Section 11.2.21) outlines mitigation measures including pre-clearing nest surveys to minimise interaction and disturbance of nest sites during the breeding period (April 1 to July 31). The proposed Project is not anticipated to cause any

change to Pacific great blue herons, its critical habitat or the residences of individuals of that species.

Northern goshawk *laingi* subspecies (*Accipiter gentilis laingi*): The northern goshawk *laingi* subspecies (formerly referred to as the Queen Charlotte Goshawk) is designated as threatened on Schedule 1 under *SARA* due to a relatively small, sedentary population and threats to its habitat from forest harvesting (COSEWIC 2000; BC MOE 2008). In BC, *A. g. laingi* populations are likely restricted to Vancouver Island, the Queen Charlotte Islands, and other large coastal islands (Cooper and Chytyk 2000). The precise range boundaries along the coastal mainland are uncertain (Cooper and Chytyk 2000) and more recent reports suggest this subspecies also occurs along portions of the coastal mainland, west of the Coast Mountains (BC MOE 2008). However, there is likely some overlap between *A. g. laingi* and *A. g. atricapillus* (secure in BC and Canada) where coastal forests transition to interior forests (BC MOE 2008).

The proposed Project area borders the Northern Goshawk North Coast Conservation Region and occurs within the possible range overlap of *A. g. laingi and A. g. atricapillus* (as per Figure 1 of the Recovery Strategy for the Northern Goshawk, *laingi* subspecies; BC MOE 2008). The range of *A. g. laingi* is thought to follow the distribution of the CWH and Coastal Douglas-fir (CDF) biogeoclimatic variants with the drier CWH variants (CWHds1, CWHds2, CWHms1, CWHms2, CWHws1, CWHws2) forming the transitional zone where both *A. g. laingi* and *A. g. atricapillus* overlap (BC MOE 2008). The proposed project study area is mostly represented by the MH moist maritime BGC variants; with drier CWH submaritime variants (CWHws 1 and CWHws2) occurring in 37% of the LSA and 39% of the RSA. Baseline raptor studies, including northern goshawk call playback surveys, were conducted to assess the presence of northern goshawk in the study area (Rescan 2010b). No northern goshawks were observed or detected during field surveys.

Critical habitat has not been defined at this time for *A. g. laingi* (BC MOE 2008). However, nesting habitat and foraging habitat are considered necessary for successful breeding and survival of northern goshawks (BC MOE 2008). Nesting habitat is generally characterised as mature and old forests, closed canopy (>50%), and relatively large diameter trees (Kennedy 2003; Greenwald et al 2005; Anderson et al 2003; as cited in BC MOE 2008). *A. g. laingi* nest at elevations between 0 and 900 m, in stands that are greater than 100 ha in size and greater than 200 m from hard forest edges (McClaren 2003; Doyle 2005; McClaren and Pendergast 2003; as cited in BC MOE 2008). Foraging habitats are similar to nesting habitats and are characterised by closed canopies, relatively large diameter trees, and open understoreys (Drennan and Beier 2003; Boal et al 2005; as cited in BC MOE 2008). Northern goshawks also forage where they do not nest, including forest edges, riparian areas, estuaries, and elevations greater than 900 m (McClaren 2003 as cited in BC MOE 2008).

Northern goshawk was selected as a wildlife VC because they are highlighted as requiring consideration in the region by the North Coast LRMP (2005) and are considered to be an indicator of mature forest ecosystem health; whereby they require the structural complexity

of these forests to breed and forage (BC MOE 2008). Details regarding potential Project effects on northern goshawk (in general) and its habitat are presented and assessed in Section 6.11. Based on Section 6.11, no residual effects are anticipated on northern goshawk.

In summary, there is limited suitable breeding habitat available within the LSA. The proposed Project is a brownfield site with the majority of additional development occurring at elevations greater than 900 m; beyond the elevation limit for *A. g. laingi* nesting habitat. Furthermore, the Project area occurs at the boundary of the CWH drier biogeoclimatic variants, a transitional area where both subspecies potentially overlap. Habitat modelling conservatively identified approximately 120 ha (6% of the total LSA) as potential northern goshawk breeding habitat; of this habitat approximately 72 ha (or 60%) would be directly removed by Project development. However, habitats at lower elevations near Alice Arm and towards the west within the Northern Goshawk North Coast Conservation Region (BC MOE 2008) are likely of higher value for northern goshawk nesting habitat.

Although their presence was not detected during baseline call playback surveys or incidentally in 2009, any potential interaction with nesting *A. g. laingi,* if they occur, would be mitigated through breeding period avoidance or pre-clearing surveys for nest sites as outlined in the Wildlife Management Plan (Section 11.2.21). Other mitigation measures, including reporting, recording and adaptively managing observations or incidents of wildlife, carrion removal along the roads, and water quality monitoring from operations through post-closure would further minimise any potential adverse effects on *A. g. laingi*. The proposed Project is not anticipated to cause any change to *A. g. laingi*, its critical habitat or the residences of individuals of that species.

Western screech-owl *kennicotti* subspecies (*Megascops kennicottii kennicottii*): The western screech-owl *kennicottii* subspecies is designated as special concern on Schedule 1 under *SARA* due to declines in population along the southwestern portion of the mainland (COSEWIC 2002). In BC, this subspecies occurs at lower elevations throughout the coastal mainland west of the coastal ranges and on Vancouver Island (COSEWIC 2002). The status of this coastal subspecies along the upper mainland coast up to the Alaska border is poorly known, although there is a large amount of available habitat (COSEWIC 2002). The western screech-owl is found in varied habitats throughout its ranges including coniferous or mixed forests, frequently near riparian zones or close to open wetlands or fields. It depends largely on tree cavities, particularly those of northern flickers and pileated woodpeckers, for nest sites (British Columbia Ministry of Water, Land and Air Protection (BC MWLAP) 2004).

During baseline surveys, this subspecies was not detected. However, as a nocturnal species, the western screech-owl is not often seen nor is it particularly easily surveyed. Based on the limited distribution information of this subspecies along the northern coast, the presence of *M. k. kennicottii* within the proposed Project area is possible. Elevation range of the coastal western screech-owl has been found from sea level to 900 m (COSEWIC 2002). The majority of the proposed Project is at or above this elevation. Although the proposed Project is a brownfield site, additional tree clearing near riparian areas or wetlands could

remove potential nesting habitat of *M. k. kennicottii*. However, there is a large amount of available habitat along the coast, thus any potential loss associated with the proposed Project would not affect the overall habitat availability for western screech-owl. If breeding does occur with the Project area, interaction with nesting owls would be minimised through pre-clearing nest surveys during the breeding period (April 1 to July 31) (Section 11.2.21). Overall, the proposed Project is not anticipated to cause any change to *M. k. kennicottii,* its critical habitat or the residences of individuals of that species.

Peregrine falcon *pealei* subspecies (*Falco peregrinus pealei*): The peregrine falcon *pealei* subspecies is designated as special concern on Schedule 1 under *SARA* due to historical declines, small population size, and dependence on seabird prey base (COSEWIC 2007b). The *pealei* peregrine falcon is restricted to Pacific coastal areas and in BC breeds on the Queen Charlotte Islands, northern Vancouver Island, and islands and headlands of the central and north mainland coast (Cooper and Beauchesne 2004; COSEWIC 2007b). Peregrine falcon generally nests on cliff faces close to adequate food supply. *F. p. pealei* typically nests on ledges of rocky island cliffs near seabird colonies, particularly ancient murrelets (Cooper and Beauchesne 2004; COSEWIC 2007b).

Marine bird baseline studies suggest there are no sea bird colonies within Alice Arm near the proposed Project area (Rescan 2010b). Furthermore, raptor baseline studies did not identify peregrine falcon or potential peregrine falcon cliff nesting habitat within the proposed Project area (Rescan 2010b). Thus, based on this subspecies nesting habitat preferences (i.e. cliffs near sea bird colonies) the proposed Project location is unlikely to provide suitable nesting habitat for *F. p. pealei.* Overall, the proposed Project is not anticipated to cause any change to *F. p. pealei,* its critical habitat or the residences of individuals of that species.

21.4.3 Amphibians

Two amphibian species listed on Schedule 1 under *SARA* either occur or potentially occur within the proposed Project area including the special concern western toad (*Anaxyrus boreas*) and the special concern coastal tailed frog (*Ascaphus truei*). Both of these species is further discussed below.

Western toad (*Anaxyrus boreas*): The western toad is designated as special concern on Schedule 1 due to population declines and extirpations of populations in the more heavily populated south coast of BC (COSEWIC 2002b). Throughout other areas of BC, western toad are considered widely distributed in the interior and commonly encountered along the mid-coast (Wind and Dupuis 2002). In general, western toad adults are highly adaptable and appear to utilise any habitat that has some accessible water and cover throughout the summer (Davis 2002). Breeding habitat typically include wetlands with an open canopy, shallow sloping edges, and muddy substrate (COSEWIC 2002b).

Baseline surveys, including visual encounter surveys and road transects surveys, were conducted for western toads and other amphibians in 2009 (Rescan 2010b) and 2010 (Appendix 6.11-A). During 2009, 10 western toads were observed along Alice Arm Road near the port, near Clary Lake and between Clary Lake and Killam Lake (Rescan 2010b).

Two additional western toads were observed in 2010, north of the TMF area (Appendix 6.11-A). No western toad breeding activity was identified during baseline studies and the majority of wetlands (classified as bog-mire complex; Rescan 2010d) do not offer optimum western toad breeding habitat because they are usually deep and have a steep dropoff into the water from the surrounding terrestrial vegetation (Rescan 2010b). Such characteristics are not suitable for newly emerging metamorphs to disperse into the surrounding terrestrial environment. Of the surveyed sites, Lake 493 northeast of the TMF has shallow aquatic areas and gently sloping banks and may support breeding western toads (Rescan 2010b).

The western toad was selected as a wildlife VC due to their presence in the Project area and conservation status. Details regarding potential Project effects on the western toad and its habitat are presented in Section 6.11. In summary, the potential residual effects from proposed Project development on western toad are habitat loss, disruption of movement, and mortality. These potential effects would be mitigated through avoiding breeding habitats, conducting pre-clearing surveys for breeding or dispersing western toads, and monitoring and reporting observations of breeding or mass toad migrations and movements (see Section 11.2.21 Wildlife Management Plan). Although mitigation is expected to minimise potential effects, a residual effect to western toads is anticipated. Considering the ability of western toads to utilise a variety of terrestrial habitats and make long-distance movements, the lack of potential breeding habitat affected by the proposed Project and relatively large amount of terrestrial and aquatic habitat available throughout the LSA and RSA; the overall potential Project residual effect on western toad is predicted to be distinguishable from the natural range of variability but not at the level of populations, and thus assessed as not significant (minor) (Section 6.11).

In summary, some individuals and the residences of some individuals may be affected by the development of proposed Project. Critical habitat has not been defined at this time for western toad (COSEWIC 2002b), but aquatic breeding habitat is considered important for this species productivity and survival. Considering mitigation measures and the lack of suitable breeding habitat within the proposed Project footprint, a potential change to the local population is not anticipated.

Coastal tailed frog (*Ascaphus truei*): The coastal tailed frog is designated as special concern on Schedule 1 due to population declines, low reproductive rates, and habitat declines from logging (*SARA* Registry; BC MWLAP 2004). Coastal tailed frog occurs throughout mature and old forest in the coastal mountain ranges in BC. Coastal tailed frogs are habitat specialists and are restricted to cold, permanent mountain streams or creeks within the windward and leeward drainages of the Coast Mountains (BC MWLAP 2004). Suitable streams are characterised by regularly spaced pools and bed of boulders or cobbles, adjacent to old or mature forest with significant understorey (BC MWLAP 2004).

During 2010 baseline surveys, time-constrained searches for coastal tailed frog were completed along streams associated with the proposed Project footprint and LSA, including

Lower Lime Creek, Upper Lime Creek, Patsy Creek, Clary Lake outlet, Lake 901 inlet, and Lake 901 outlet (Appendix 6.11-A). No coastal tailed frogs, tadpoles or eggs were detected.

Coastal tailed frogs have a narrow temperature tolerance; eggs require stream temperatures of 5 to 18.5 degrees Celsius (^{o}C) to survive (*SARA* Registry). Project development could indirectly affect water temperature of Lime Creek. However, based on Section 6.7 (Freshwater Aquatic Resources), it is unlikely that water temperatures in lower Lime Creek would increase outside the range of natural variability during any phase of the Project. Although not detected, it is possible coastal tailed frogs occur within the Project RSA. Mitigation measures, such as conducting pre-clearing surveys for breeding amphibians during breeding periods would minimise potential effects on coastal tailed frog, if they occur. Overall, the proposed Project is not anticipated to cause any change to coastal tailed frog, its critical habitat or the residences of individuals of that species.

21.5 Effects of the Environment on the Proposed Project

This section assesses the environmental factors that may affect the proposed Project and the predicted effects of those environmental factors. Factors can include extreme weather events such as lightning, heavy precipitation, extreme temperatures, flooding, drought, and wind. Provided here is a description and assessment of how the potential for climate change, extremes in current climate, seismic activity, and potential volcanic activity and other extreme events (e.g., fires and floods) could affect the integrity of the proposed development infrastructure, particularly the TMF, water retention dykes, pit wall stability, road operation, and waste rock dumps. This section also describes mitigation measures, including design strategies, planned to avoid or minimise the likelihood and severity of the changes or effects.

Major resource project proponents must factor environmental effects into the design of any project. Facilities must be built to withstand local environmental conditions to ensure uninterrupted project operations, maintenance of project assets, and safety of personnel. This section examines the natural hazards that could produce an effect on the proposed Project. For the purposes of this discussion in respect of proposed Project, these hazards specifically include:

- Forest fires;
- Geo-hazards (snow or mud / rock slides);
- Seismic events (earthquakes, volcanoes); and
- Weather events (exceptional rain or blizzard events).

These hazards have been assessed in terms of their likelihood of occurrence, their anticipated effect on the proposed Project's infrastructure and production, and the proponent's potential response should one or all of these environmental hazards occur.

21.5.1 Forest Fires

No wildfires have been documented in the Kitsault area of BC during the last 10 years (BC Forestry Service 2011). Seven fires have been documented in the surrounding region (west of Highway (Hwy) 37), with six of these seven fires being less than 0.5 ha, and only one that was between 0.5 - 2.0 ha. The cool year-round temperatures, abundant precipitation and water supply, and lack of thunderstorms that characterise this area contribute to the paucity of wildfires in the region (Klock and Mullock 2001).

Increased activity in the area as a result of the proposed Project could potentially result in a slightly higher risk of fire, especially during the construction and decommissioning phases. All site clearing operations that would occur during the decommissioning phase of the proposed Project would comply with the terms of the *Forest Fire Prevention and Suppression Regulation* (Government of BC 1995), which forms part of the *Forest Practices Code Act* (Government of BC 1996a). During the operations phase of the proposed Project's time line, the proponent would reduce the risk of fire by:

- Carefully managing the proposed Project mine site, keeping areas clean and free of clutter and unused equipment, and maintaining well-mowed road edges;
- Complying with fire hazard ratings and carefully managing or postponing activities that could potentially increase the risk of fire, especially during high-risk periods; and
- Remaining continuously attentive to minimising the risk of fire, especially during fire closures and particularly during construction clearing activities.

The proponent would train employees in fire prevention, early detection, and effective firefighting techniques, and would have a fire prevention policy and fire response plan in place to assist in protecting the proposed Project site and surrounding area from fire. This fire response plan would involve designating employees to remain in close contact with the BC Ministry of Forests, Lands and Natural Resource Operations (BC MFLNRO) fire control staff during the fire season to identify any fire threats that may occur at or near the proposed Project site.

21.5.2 Geo-Hazards (Snow and Landslides)

The proposed Project is located in the Prince Rupert Forest Region, where large-magnitude landslides have occurred in the past on an infrequent basis (Schwab n.d.). Closer inspection of past geological activity in the immediate vicinity of the proposed Project reveals a low probability of landslides or avalanches, since no avalanche paths have been located within the proposed Project footprint. In the vicinity of nearby Patsy Creek and Lime Creek, however, the landslide and avalanche risk rises to the moderate to high range (see Appendix 4 of Appendix 6.9-A). Snow avalanches generally occur on terrain with slope angles of at least 25 degrees (°) to 45° (United States Search and Rescue Taskforce (US SARTF) 2011). The predominant slope angles in the vicinity of the proposed Project are gentle to moderate (0 percent (%) to 49%, or 4° to 26° slope angles) (Appendix 4 of Appendix 6.9-A). Additionally, the few moderately steep slopes that are in closer proximity to the proposed Project feature angles of 50% to 70% or 27° to 35° slope angles, and are

not typically long enough for avalanche paths to develop (Appendix 4 of Appendix 6.9-A). The terrain stability mapping conducted by the Proponent has generally indicated a low likelihood of landslide occurrence at the proposed Project site and in the vicinity of the proposed Project infrastructure. Moderately steep, gullied terrain located adjacent to Lime Creek and Patsy Creek is categorised as having a localised moderate to high likelihood of landslide occurrence. No proposed Project infrastructure is proposed to be located in these areas. The Coarse Ore Storage and Conveyor are proposed close to the columnar jointed basalt, which has been assigned as potentially unstable. The design layouts have considered this during the Feasibility Study, and appropriate set-backs have been included in the designs. Additional technical work for the slope stability will be carried out as part of detailed engineering.

The terrain stability mapping also indicated a low likelihood of landslide occurrence along the majority of the road alignments. Along the new mine site road to the Process Plant and explosive storage facilities, several unstable areas, associated with the sites of recent landslides, were identified to the west of Channel (Ch.) 38+500. Potentially unstable terrain was also identified between Ch. 42+500 and Ch. 47+600 of the mine access road alignment. In addition, the terrain stability mapping identified unstable terrain along portions of the road alignments within the mine site, in particular between Ch. 0+500 and 1+500 of the Crusher Access Road (Appendix 4 of Appendix 6.9-A).

Prior to the commencement of any construction activities, the proponent would identify and stabilise all potentially unstable slopes during the upgrade work that would be conducted to improve the road.

The mapping did not highlight any significant snow avalanche paths within the RSA. The area of northwestern BC where the proposed Project would be located receives a large amount of snowfall annually; however, the proponent has concluded from the results of its terrain stability mapping activities that the topography of the proposed Project area is not particularly conducive to avalanche formation. Snow avalanches generally occur on terrain with slope angles of 27° to 40° degrees. The predominant slope angle class within the RSA is gentle (0% to 26% or 4° to 15° slope angles) to moderately inclined slopes (27% to 49% or 16° to 26° slope angles). Additionally, the moderately steep inclined slopes (50% to 70% or 27° to 35° slope angles) in the RSA do not typically have enough length to develop avalanche paths (Appendix 4 of Appendix 6.9-A).

During winter, road use would be monitored so that any potential snow hazard can be identified quickly and removed or stabilised.

21.5.3 Seismic Events

Seismic events are common in certain areas of BC, notably Haida Gwaii, Vancouver Island, and the southwest Lower Mainland region. The area where the proposed Project is located has not experienced an earthquake in over 400 years, although 36 minor seismic events with a magnitude 3 or less have occurred in a 150 kilometres squared (km^2) area surrounding the proposed Project site.

The proponent calculated probabilities for future seismic events for BC and the data for Prince Rupert indicated an 8.5% likelihood of a magnitude 5 earthquake occurring during the next 10 years, rising up to 59% during the next 100 years (Onur and Seeman 2004). The likelihood of a magnitude 7 event was only 0.12% during the next 10 years, and 1.2% during the next 100 years (Onur and Seeman 2004). All buildings and waste management structures (for example, the TMF) would be designed to meet anticipated flood and seismic requirements, as well as withstanding any future potential seismic events.

The TMF has been designed to meet all current Canadian Dam Association (CDA) Dam Safety Guidelines. According to these guidelines, each structure is assigned a “Dam Class” based on the incremental losses that would result from failure of the dam with respect to loss of life, environmental and cultural values, as well as infrastructure and economic losses. The Dam Class determines the required Inflow Design Flood (IDF) and Earthquake Design Ground Motion (EDGM) for the design of the dam structure and water management systems. The TMF embankment has been classified as ”Very High” under the CDA Dam Safety Guidelines, which provides assurance that the TMF embankment is designed for anticipated flood or earthquake events. The proponent has opted for an even more conservative approach to its design of the proposed Project’s major structures. To account for the overall height and location upstream of the Kitsault Townsite, the proponent has selected the design parameters for a Dam Class of Extreme. The corresponding IDF is designed to withstand the Probable Maximum Flood (PMF) and the EDGM is designed to withstand a 10,000-year return period earthquake event (Appendix 4 of Appendix 6.9-A).

There are no volcanoes in the RSA; however, there is a cinder cone volcano, known as the Tseax Cone, which is located approximately 46 km from the location of the proposed Project. This cinder cone volcano is believed to have last erupted in about 1750, and it is believed to be still active (as evidenced by gas emissions). It is likely that there would be some warning before a serious eruption occurred; however, in any event the distance from the Tseax Cone to the proposed Project site makes it unlikely that the proposed Project and personnel would be in danger from any direct effects resulting from a volcanic eruption. Should an event occur, it is possible that the site could be affected by ash dust / cloud, depending on wind direction.

21.5.4 Weather Events and Climate Change

As noted in Section 6.2, Atmospheric Environment, it is important to understand the difference between climate and weather. Climate is a description of the long-term (usually more than 30 years) pattern of weather over a large area, using meteorological parameters which are continuously monitored. In addition to long-term climate change, shorter-term climate variations also occur. This so-called climate variability could be represented by periodic or intermittent changes related to El Niño or La Niña events, volcanic eruptions, or other changes in the Earth’s systems.

Weather, on the other hand, is the day-to-day state of the atmosphere and its short-term (minutes to weeks) variation. Representing the set of meteorological elements in a given atmosphere at a given time, weather usually includes the following elements:

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

At the location of the proposed Project, there may be some winters that produce above-average snow levels and other winters that are mild with less snow and early spring rains. Both of these conditions will require an adaptive response by the proponent. In years of heavy snow, for example, it will take a greater effort to keep the supply and mine haul roads clear and passable, and fuel use and maintenance costs will increase. Likewise, summer conditions may require a different adaptive response from the proponent. Hot, dry conditions may require increased road watering as well as increased vigilance to guard against fires caused by lightning strikes or by machinery, particularly during the construction phase of the proposed Project. Wet summers, conversely, may require the proponent to conduct increased road maintenance such as structure and culvert repair, make changes in tailing pond management activities, or improving water control in the Kitsault Pit.

Climate change predictions can only be addressed in broad terms because no suitable computer programs exist to calculate climate change rates using model input specific to the small scale and short duration of the proposed Project. Warmer average temperatures in the proposed Project area may cause more intense spring melting for a shorter period of time, which would have an effect on the run-off and long-term tailing pond management practices. Warmer summers may also lead to increased fire risk and could require additional reclamation effort during closure.

21.6 Accidents or Malfunctions

21.6.1 Introduction

Management of risks and preparation for the unexpected (contingency planning) are integral to the corporate policies of the proponent. Together with the corporate environmental policy, the aim (and result) is to minimise the risk of accidents and the consequences of accidents that occur to people and the environment. Management systems would mitigate most risks and limit consequences through:

- Prevention of accidents and malfunctions through training, awareness, education and equipment maintenance;
- Assessment of risks of accidents and malfunctions through the design phase of the proposed Project;
- Employment of adaptive management to ensure continual appraisal of risks; and
- Design and implementation of effective emergency response and contingency plans and implementation of a site Environmental Management Plan (EMP).

Figure 21.6.1-1 shows major inputs, internal mine products and outputs for the proposed Project. Red, blue, orange, and black lettering in the figure denotes solid, liquid, airborne and miscellaneous (power and noise) forms respectively.

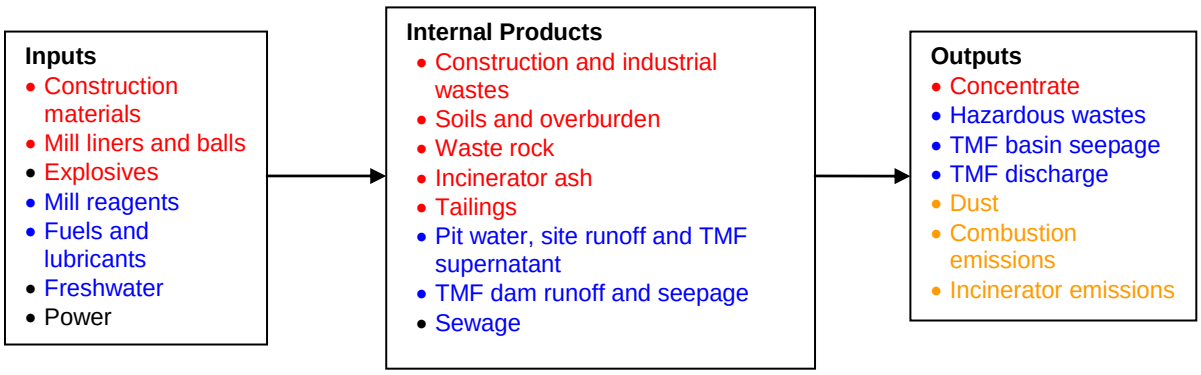

Figure 21.6.1-1: Major Inputs, Internal Products, and Outputs

21.6.2 Risk Assessment

A qualitative risk assessment was carried out for the accidents and malfunctions discussed in this section. Qualitative methodologies, though lacking the ability to account for the dependencies between events, are effective in identifying potential hazards and failures within the system. Potential accidents and malfunctions associated with the proposed Project were evaluated based on methods developed by the Manitoba Industrial Accidents Council (1996). The methodology is straight-forward and transparent and follows a Failure Modes Effects Analysis (FMEA) framework.

21.6.2.1 Risk Assessment Methodology

The risk assessment methodology involved a four step process:

- Step 1 - Identify the Hazards:
  - The risk assessment began by creating a list of all of the hazards that could possibly impact the site of operations. This process included both natural hazards as well as human made hazards;
- Step 2 - Evaluate Risks:
  - The second step was to evaluate the degree of risk represented by each hazard. Risk is a function of the frequency (probability) and consequences (severity) of a hazards occurrence;
- Step 3 - Evaluate Consequences:
  - The consequences (severity) resulting from the hazard were evaluated by selecting the category which best described the effects of a worst credible

mishap on personnel, environment, and facilities, after emergency planning and management controls were in place (e.g., a large spill of diesel fuel at the fuel farm could have severe environmental consequences if there were no containment for the fuel tanks but this scenario was not evaluated because the facility would be built using best practical technology); and

- Step 4 - Evaluate Risk:
  - Risk is the combination of probability and consequences (severity). Based on answers from the probability table and the consequences table, the corresponding risk category was selected. Risk was derived from the average of probability and consequences except where any consequence was high; in this latter case, risk was conservatively taken to be high.

Issues for construction are listed in Table 21.6.2-1, for operations in Table 21.6.2-2, and for closure and post-closure in Table 21.6.2-3. Issues are grouped by category.

Table 21.6.2-1: Accidents and Malfunctions Assessed for Construction

Issue	Facility	Effects	Prevention / Mitigation
Petroleum spills	Equipment	Routine drips and spills, major loss to land or water body	Drip trays, maintenance, training, spill response plan
	Storage	Routine drips and spills, major loss to land or water body	Drip trays, secondary containment, SOP, training, Emergency and Spill Response Plan
Containment pond failure	Sedimentation ponds	Loss of sediment to water bodies, impacts to aquatic organisms	Inspection, monitoring clean-up (e.g., Emergency and Spill Response Plan)
Pipeline leakage	Water supply line	Fresh water loss, erosion, sedimentation	Design, inspection
Off-spec effluent from treatment plants	Sewage treatment plant	Raw or partly treated sewage	Monitoring, maintenance, SOP, training, clean-up
Power outages	All facilities requiring electricity	Shutdown of electric equipment, loss of lighting and heat	Backup generators, maintenance, inspection
Fire	Slash, forest wildfire, buildings, mobile equipment	Damage / destruction of facilities and / or surroundings, injury or loss of life	Design, monitoring, suppression equipment, training, medical response
Accidental explosion	Buildings, propane tanks, vehicles	Injury or loss of life, damage / destruction of facilities and / or surroundings	Design, maintenance, monitoring, SOPs, training, medical response

Issue	Facility	Effects	Prevention / Mitigation
Motor vehicle accidents	Mobile equipment at mine, personnel and materials transport vehicles	Injury or loss of life, spills of hazardous or non-hazardous substances to land or water, fires	Maintenance, training, re-enforcement of safety procedures, clean-up, medical response
Sediment release to water courses	Sedimentation pond or coffer dam malfunction or failure	Sediment export to water bodies, impacts to aquatic organisms	Design, maintenance, monitoring, silt screens
Chronic dust	Disturbed, non vegetated surfaces	Dust generation, inhalable and respirable suspended particulate	Watering roads and other bare surfaces if required
Chronic vehicle emissions	Mobile equipment	Off-spec exhaust gases (PM, NOx, SOx, CO, CO_2)	Maintenance
Chronic incinerator emissions	Incinerator	Off-spec stack gases (PM, NOx, SOx, CO, CO_2)	Maintenance, SOP, training

Note: CO - carbon monoxide; CO_2 - carbon dioxide; NOx - nitrogen oxides; off-spec - off-specification; PM - particulate matter; SOP - standard operating procedure; SOx - sulphur oxides

Table 21.6.2-2: Accidents and Malfunctions Assessed for Operations

Issue	Facility	Effects	Prevention / Mitigation
Petroleum spills	Equipment	Routine drips and spills, major loss to land or water body	Drip trays, maintenance, training, spill response plan
	Storage	Routine drips and spills, major loss to land or water body	Drip trays, secondary containment, SOP, training, Emergency and Spill response plan
Hazardous substance spills	Mill, explosives plant, truckshop, warehouse, cold storage building	Health hazard, injury, contaminated soil, contaminated water, impacts to aquatic organisms	Design, secondary containment, SOPs, training, spill response plan
Containment pond failure	Seepage collection ponds	Loss of potentially contaminated water and sediment to water bodies, impacts to aquatic organisms	Design, inspection, monitoring, clean-up (e.g., Emergency and Spill Response Plan)
Stockpile failure	LGS, WRMF	Small slump: loss of material to a lower bench or surroundings Large failure: injury or loss of life, covering of surrounding area	Design, construction, use of trained equipment operators, monitoring, inspection, clean-up, medical response

Issue	Facility	Effects	Prevention / Mitigation
Embankment failure	TMF Northeast and South embankments	Small: loss of water and / or tailings to open pit (South Embankment) or to seepage control ponds (Northeast Embankment) Large: loss of water and tailings to the open pit (South Embankment) or to Lake 901 tributaries, the lake or downstream	Design, construction, monitoring, independent inspection, clean-up
Pipeline leakage	Water supply line	Fresh water loss, erosion, sedimentation	Design, inspection
	Tailings line	None; tailings will drain to TMF	Design, inspection, monitoring
Off-spec effluent from treatment plants	Sewage treatment plant	Raw or partly treated sewage	Monitoring, maintenance, SOP, training, clean-up
Power outages	All facilities requiring electricity	Shutdown of electric equipment, loss of lighting and heat	Backup generators for essential equipment such as seepage and water pumps, process control equipment, emergency lighting and heating; maintenance; inspection
Fire	Buildings, mobile equipment	Damage / destruction of facilities and / or surroundings, injury or loss of life	Design, monitoring, suppression equipment, training
Accidental Explosion	Explosives storage, buildings, propane tanks, vehicles	Injury or loss of life, damage/destruction of facilities and / or surroundings	Design, maintenance, monitoring, SOPs, training, handling by qualified personnel only, medical response
Fly rock from blasting	Open pit	Injury, rock project beyond the open pit	Safe placement of facilities, equipment and people, signage, training, blast warnings, medical response
Motor vehicle accidents	Mobile equipment at mine, personnel and materials transport vehicles	Injury or loss of life, spills of hazardous or non-hazardous substances to land or water, fires	Maintenance, training, re-enforcement of safety procedures, clean-up, medical response
Accidental release of ML/ARD	Open pit, LGS, WRMF, TMF	Damage to aquatic habitat and organisms	Design, monitoring of runoff and seepage, maintenance of ditches and ponds and the TMF, clean-up

Issue	Facility	Effects	Prevention / Mitigation
Sediment release to water courses	Diversion channels, ditches	Sediment export to water bodies, impacts to aquatic organisms	Design, maintenance, monitoring, silt screens
Chronic dust	Disturbed, non vegetated surfaces	Dust generation, inhalable and respirable suspended particulate	Watering roads and other bare surfaces if required; manage tailings beaches to keep wet if required
Chronic vehicle emissions	Mobile equipment	Off spec exhaust gases (PM, NOx, SOx, CO, CO_2)	Maintenance
Chronic incinerator emissions	Incinerator	Off spec stack gases (PM, NOx, SOx, CO, CO_2)	Maintenance, SOP, training

Note: CO - carbon monoxide; CO_2 - carbon dioxide; LGS - low grade ore stockpile; ML/ARD - metal leaching / acid rock drainage; NO_x - nitrogen oxides; off-spec - off-specification; PM - particulate matter; SOP - standard operating procedure; SO_x - sulphur oxides; TMF - Tailing Management Facility; WRMF - Waste Rock Management Facility

Table 21.6.2-3: Accidents and Malfunctions Assessed for Closure and Post-Closure

Issue	Facility	Effects	Prevention / Mitigation
Petroleum spills	Equipment	Routine drips and spills, major loss to land or water body	Drip trays, maintenance, training, spill response plan
	Storage	Routine drips and spills, major loss to land or water body	Drip trays, secondary containment, SOP, training, Emergency and Spill Response Plan
Stockpile failure	WRMF	Small slump: loss of material to a lower bench or surroundings Large failure: injury or loss of life, covering of surrounding area	Design, construction, use of trained equipment operators, monitoring, inspection, clean-up, medical response
Embankment failure	TMF Northeast and South embankments	Small: loss of water and / or tailings to open pit (South Embankment) or to seepage control ponds (Northeast Embankment) Large: loss of water and tailings to the open pit (South Embankment) or to Lake 901 tributaries, the lake or downstream	Design, construction, monitoring, independent inspection, clean-up
Off-specification treatment plant effluent	Discharge water treatment plant	Small: minor, one time, exceedances of discharge criteria Large: major malfunction of treatment plant leading to general non-compliance with discharge criteria	Treatment plant design; redundancy built in, plant operator training, monitoring of plant operations

Issue	Facility	Effects	Prevention / Mitigation
Power outages	All facilities requiring electricity	Shutdown of electric equipment, loss of lighting and heat	Backup generators, maintenance, inspection
Fire	Slash, forest fire, buildings, mobile equipment	Damage/destruction of facilities and / or surroundings, injury or loss of life	Design, monitoring, suppression equipment, training
Motor vehicle accidents	Mobile equipment at mine, personnel and materials transport vehicles	Injury or loss of life, spills of hazardous or non-hazardous substances to land or water, fires	Maintenance, training, re-enforcement of safety procedures, clean-up, medical response
Sediment release to water courses	Sedimentation pond or coffer dam malfunction or failure	Sediment export to water bodies, impacts to aquatic organisms	Design, maintenance, monitoring, silt screens
Chronic dust	Disturbed, non-vegetated surfaces	Dust generation, inhalable and respirable suspended particulate	Watering roads and other bare surfaces if required
Chronic vehicle emissions	Mobile equipment	Off spec exhaust gases (PM, NOx, SOx, CO, CO_2)	Maintenance
Chronic incinerator emissions	Incinerator	Off spec stack gases (PM, NOx, SOx, CO, CO_2)	Maintenance, SOP, training

Note: CO - carbon monoxide; CO_2 - carbon dioxide; NOx - nitrogen oxides; off-spec - off-specification; PM - particulate matter; SOP - standard operating procedure; SOx - sulphur oxides; TMF - Tailings Management Facility; WRMF - Waste Rock Management Facility

21.6.2.2 Temporal Framework

Temporal framework is from mine construction through post-closure.

21.6.2.3 Spatial Framework

The areas considered for this assessment are:

- The proposed Project site;
- The Kitsault Townsite;
- Alice Arm adjacent to the proposed Project site; and
- The access road from Terrace to the proposed Project site.

The risk criteria are based on frequency (probability) and consequences to people, the environment and facilities. Frequency was defined as follows in Table 21.6.2-4.

Table 21.6.2-4: Probability of Occurrence of Accidents and Malfunctions

Probability	Frequency
Unlikely	The hazard is likely to occur less than once in 100 years.
Possible	The hazard is possible (1% - 10%) within a year; or at least one chance of occurring in the next 100 years.
Likely	The hazard is probable (10% - 100%) within a year; or at least one chance of occurring in the next 10 years.
Highly Likely	The hazard is very probable (100% chance) within a year

Note: % - percent

Consequences are categorised by personnel, environment and facility as previously discussed and into four consequences as follows (Table 21.6.2-5).

Table 21.6.2-5: Consequences Categories

Category Impact Type	High	Moderate	Low	Negligible
Personnel	Permanent disability, severe injury or illness	Injury or illness not resulting in disability, major quality of life loss or perceived illness	Treatable first aid injury	No injury or illness
Environment	A major accident (spill or other) that is uncontained or Regional or total species / subspecies loss	A minor accident (spill or other) that is uncontained or Local or species / subspecies damage	A major accident (spill or other) which is contained or Portion of local organisms negatively impacted	A minor accident (spill or other) which is contained or No measurable impact to the environment
Facility	Complete shutdown of facilities and critical services for more than one month	Complete shutdown of facilities and critical services for more than one week	Complete shutdown of facilities and critical services for more than 24 hours	No shutdown of facilities

Risk increases as frequency and consequences increase as illustrated in Figure 21.6.2-1.

Frequency of Events	Consequences			
	Negligible	Low	Moderate	High
Highly Likely				
Likely				
Possibly				
Unlikely to Occur				

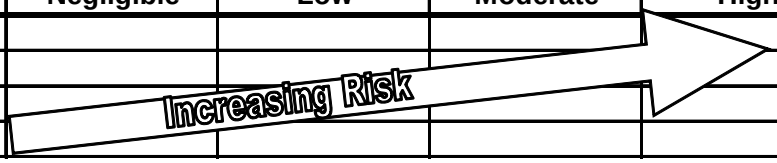

Figure 21.6.2-1: Generic Risk Matrix

The following sections discuss accidents or malfunctions by Project phase and accident type for construction, operations, closure and post-closure. A probabilistic risk assessment summary is provided in Section 21.6.6. Appendix 21.6-A is a report of the Risk Workshop held to assess the potential risks and develop mitigation strategies to ameliorate potential risks. Mitigation strategies include:

- Reducing the probability of occurrence of the event (e.g., using double-walled tanks for fuel storage);
- Reducing the consequences of the event (e.g., moving fuel storage away from sensitive fisheries habitat);
- Developing system redundancies (e.g., shutoff valves for waterlines);
- Employing Adaptive Management strategies as part of an overall Environmental Management System (EMS) (e.g., ongoing predictive modelling of geochemistry and acid rock drainage potential); and
- Developing additional confidence in the predictions (e.g., ongoing meteorological monitoring to better predict site wide hydrology).

The risk associated with the events and appropriate mitigation strategies are discussed in subsequent sections.

21.6.3 Construction

21.6.3.1 Petroleum Spills

Dealing with petroleum spills is discussed in the Emergency and Spill Response Plan, Section 11.2.6. The proponent would develop, maintain and implement emergency response and spill contingency training, equipment, and materials at the site to limit the consequences of spills by prompt containment and clean up action.

21.6.3.1.1 Equipment

Site construction presents risks of spills that may release harmful materials into the environment. A primary risk event is spills of petroleum products resulting from an accident or malfunction during the refuelling or servicing of construction equipment such as bulldozers, excavators, dump trucks or graders where such refuelling and servicing occurs

in the field (as opposed to within a service facility). Drip pans would be used to catch routine drips and spills from vehicle refuelling. Any accidental spills would be cleaned up immediately and logged. Contaminated soil would be stockpiled in a temporary waste transfer area either until it can be removed from site by a licensed hazardous waste contractor or placed in an appropriate location.

During construction, milling reagents and other process chemicals would not be on the site and so there is no risk of spillage.

The proponent would implement the following mitigation actions to prevent such spills from occurring and to minimise impacts when such events occur:

- Site wide procedures would be developed and used to regulate where and how field refuelling and servicing activities are to occur. These procedures would be a term of contract for all site construction contractors. Such procedures would dictate that re-fuelling and servicing cannot take place close to water bodies or in areas where spills can reach watercourses;
- The proponent would maintain a supply of spill response and clean up equipment on site throughout the various construction sites;
- The proponent would employ environmental personal during construction to monitor contractor performance and to ensure that suitable environmental precautions and standards are being followed; and
- Accidental spills would be reviewed to determine whether a modification of procedures is required.

21.6.3.1.2 Storage

Temporary storage of petroleum would employ double-walled “Enviro-tanks” with leak detection. Tanks would be placed where required during construction, clearly marked and protected with bumpers if at risk from vehicle collision. Refilling of storage tanks would be by petroleum supply contractor. A tank refill Standard Operating Procedure (SOP) would be developed prior to construction. Spills during refilling of the tanks are unlikely to occur. If a spill occurs, contaminated soil would be handled as discussed above under equipment spills. See also vehicle refuelling above.

21.6.3.2 Failure of Containment Ponds

The only containment ponds employed during construction would be sedimentation ponds, which are discussed in Section 2.6.3.8. Failure of containment ponds that would be constructed for operation is discussed in Section 21.6.4.3.

21.6.3.3 Pipeline Leakage

During the construction period, the only pipeline that would carry liquids would be the water supply line from Clary Lake, which would be clean water. A minor leak would have no effect other than possible loss of pressure. A complete break could result in erosion of soil at the

site of the break and downslope. If the break were to occur near Clary Lake, eroded sediments might carry into the lake and affect fish habitat.

The water supply line would be equipped with a shutoff valve at the reservoir tank (top) end. The Clary Lake pump would be shut off in the event of a major break. Silt screens would be deployed, if required, in the event of a break to limit eroded sediment entering a water body. Erosion would be a short term event limited to the time to shut down the supply system; the volume of water after the reservoir tank value was closed would be limited to that in the supply pipe from the shutoff value to the break.

The water line would be protected from vehicle collision and be made of high density polyethylene (HDPE) or similar material capable of withstanding the anticipated pressure with a safety margin. Thus the risk of a major break is small. In the event the pipe is covered by snow in the winter, loss of pressure would immediately indicate a break and would be addressed immediately.

21.6.3.4 Discharge of Off-Specification Effluent from Treatment Plants

The only treatment plant during construction would be the sewage treatment plant. For initial construction activities, the existing exploration camp sewage treatment facilities would be employed. A modular sewage treatment plant would be brought to the site and commissioned during early construction. Treated sewage would be discharged to the starter TMF after disinfection. Operation of the sewage treatment plant would be monitored and any off-specification (off-spec) discharge addressed immediately. A SOP would be developed prior to construction and a mine services employee designated and trained to operate the plant. In the event that the sewage treatment plant technician cannot address off-spec discharge, a manufacturer's engineer would be brought to site to solve sewage plant water quality problems.

21.6.3.5 Power Outages

Until the power station and distribution system are completed at the mine, power would be provided by diesel gensets as required. Backup generators would be available in the event of shutdown for routine maintenance or mechanical failure.

21.6.3.6 Fires or Explosions

21.6.3.6.1 Fires

Fires could occur at the mine site during construction as a result of:

- A forest fire in the area that threatened or engulfed the proposed Project area;
- A brush fire from slash burning during mine site clearing;
- A facilities fire from ignition of inflammable materials including petroleum; and
- A vehicle fire as a result of collision.

In the case of a forest fire, the BC MFLNRO would be notified and the mine would provide assistance in firefighting if requested. In severe cases, evacuation might be necessary. Early in the construction, a water reservoir would be constructed to supply fresh and fire fighting water. Prior to completion of the freshwater supply system, pumps could be deployed to pump water from Clary Lake for firefighting purposes if required.

Brush fires caused by an escaped slash burn would be minimised to the extent possible by ensuring slash is burned only in clearings and not at times when the forest fire hazard is high. Burns would be monitored, particularly when they are increasing. Given these precautions, the risk of slash fires escaping and causing adjacent areas to catch fire is small. SOPs would be developed and employees or contractors engaged in slash burning trained in necessary precautions.

Per Fire Marshall and BC Building Code regulations, all buildings would be equipped with fire alarm, fire suppression and firefighting equipment including hose reels and fire extinguishers. The proponent and contractors would have staff trained in fire suppression. Fire drills would be carried out as required. A worst-case scenario would require evacuation by mine and contractor personnel. Buildings would be located away from forested areas as much as possible and any fires would not spread to the surrounding forest.

A vehicle fire as a result of collision could occur at the mine site or on the access road. A vehicle fire at the mine site would be dealt with by mine personnel. Attendance at a vehicle fire on the access road would depend on the location. Close to the mine, the mine first aid staff would attend once notified. A vehicle fire remote from the mine would be attended by others. A vehicle fire could result in injury or death of occupants. Medivac from the mine may be required. In the event of a death, the Royal Canadian Mounted Police (RCMP) and the Chief Mines Inspector would be contacted.

The risk of a major fire at the mine site is low but the consequences with respect to safety of people on the site are high. A site specific emergency response plan built on the existing exploration emergency response plan would be developed prior to mine construction; a conceptual plan is provided in this EA. Further discussion of the potential effects of earthquakes and forest fires are included in the Section 21.5, Effects of the Environment on the proposed Project.

21.6.3.6.2 Accidental Explosions

Initial construction would not require blasting. Other potential sources include inflammable vapours at concentrations between the lower explosives limit and the upper explosives limit. This could include propane, gasoline, and Jet B. Diesel and Jet A (which is essentially diesel), are not as volatile as the previously-named and are unlikely to explode, except under high temperatures (e.g., that caused by a fire surrounding a sealed container of diesel or Jet A). SOPs would be developed for handling inflammable substances prior to construction as part of the mine's overall safety plan. Orientation would be provided to all new employees and only those trained would handle such substances.

In the event of an accidental explosion, a Code 1 alert would be issued throughout the mine and the immediate area evacuated. The emergency coordinator would take charge and decide when it is safe to enter the explosion area and take charge. Any explosion in the mine area would be handled by the trained mine rescue crew required under mine regulations.

Injuries would be handled as a medical first aid or emergency, depending on the situation. Medivac would be initiated if required. Deaths would be reported immediately to the RCMP as required by law.

All accidental explosions at a mine site must be investigated by the Chief Mines Inspector. The mine health and safety committee would investigate from the mine's side and provide a report to the mine manager and the proponent's corporate head office.

21.6.3.7 Motor Vehicle Accidents

See Section 21.6.4.11.

21.6.3.8 Sediment Release to Water Courses

Construction phase activities would require sedimentation ponds and coffer dams at strategic locations to prevent sediment laden water from construction zones entering water courses. Each of these sedimentation ponds will require a BC *Environmental Management Act* (BC *EMA*) (Government of BC 2003) permit for discharge which would provide details. A break in a containment dyke would constitute a spill and would be reported per permit requirements.

Sediment carried into a water course could smother aquatic organisms if of a high enough volume or of long enough duration to build up in a gradation zones. Most water courses where construction activities would occur are non-fish-bearing. As well, much of the site was cleared during previous mining periods. Once the TMF starter embankments are constructed, water upslope from the TMF would drain into it. Two streams down-slope from the Northeast Embankment are fish-bearing and could be negatively impacted by sedimentation.

The principal preventative action would be to inspect all sedimentation ponds to detect any problems early and effect repairs immediately before a break or spill occurs.

Immediately after a spill is noticed, silt screens would be deployed to catch as much of the silt as possible before it enters the water course; silt curtain materials would be stockpiled at sedimentation pond sites together with appropriate spill kits. If possible, upslope water would be diverted to an alternate location. Silt screens would be placed on the upstream side of the dyke to aid in filtering out sediment while the dyke is repaired.

A report would be filed by the contractor and mine environmental coordinator to the Mine Manager and the incident reviewed by mine management to determine what preventative actions are appropriate to prevent a repeat.

21.6.3.9 Dust

Dust could be generated from newly disturbed surfaces during construction. However, the greatest new disturbance would be for the TMF. Most other areas required for mine facilities and infrastructure were disturbed and stabilised during previous mining and subsequent reclamation activities. Dust would only be a problem if chronic and from areas that are not practical to water. Given the climate in the proposed Project area, dust is unlikely to be problematic. However, if required, road surfaces would be watered.

21.6.3.10 Vehicle Emissions

Malfunctioning exhaust systems on petroleum-powered mobile equipment would increase exhaust emissions beyond design specifications. All mine mobile equipment would be placed on a regular service schedule and non-scheduled maintenance would be carried out as required. Contractors would be required to regularly service their equipment as part of contract terms.

21.6.3.11 Incinerator Emissions

Failure of the secondary exhaust chamber on the camp incinerator(s) left unrepaired would lead to incinerator emissions exceeding manufacturer's guidelines. Camp incinerator(s) would be operated by trained personnel who would monitor operating parameters to ensure correct functioning. A SOP would be developed prior to construction for incinerator operation and as a training aid for operators. Faulty incinerators would be repaired promptly either by mine services personnel, or the incinerator manufacturer if self repair is not feasible. Thus, chronic out-of-specification incinerator emissions are not expected and can be prevented.

21.6.4 Operation

During operations, the risk of accidents and malfunctions would extend to the possible release of chemicals, reagents, petroleum products, and concentrates during transport to and from the mine site, during loading and off-loading, during storage, and during use.

21.6.4.1 Petroleum Spills

21.6.4.1.1 Equipment

Refuelling and servicing of mining equipment would take place in the open pit or at designated sites where spills relating to accidents and malfunctions can be contained.

21.6.4.1.2 Storage

The storage facilities for diesel fuel would be constructed in a lined bermed tank farm built according to industry best practice with the berm designed to hold 110% of the capacity of the largest storage tank.

See also Section 21.6.3.1.

21.6.4.2 Spills of Hazardous Substances on Site

Spills of hazardous substances are discussed in the Emergency and Spill Response Plan, Section 11.2.6. All hazardous materials would be stored in lined or silled areas and handled per Material Safety Data Sheet (MSDS) guidelines. Only qualified employees would handle these substances. Spills of hazardous wastes would be cleaned up per the above-referenced plan which would be updated prior to construction with specifics about location of substances and location of hazardous waste storage areas together with on hand quantities of hazardous substances. In the event that the quantities of propane or other toxic or hazardous substances kept on-site exceed specified thresholds in the *Canadian Environmental Protection Act (CEPA) E2 Regulations* (Government of Canada 1999), an Emergency Preparedness Plan will be prepared and Environment Canada (EC) notified.

21.6.4.3 Failure of Containment Ponds

Other than the TMF (discussed in Section 21.6.4.5), there would be three seepage collection ponds employed during operations: the low grade (ore) stockpile (LGS) seepage collection pond; and two seepage collection ponds northeast of the Northeast Embankment.

Failure of the LGS seepage collection pond would result in water reporting to land downslope and to the west of the pond. A large volume of water could possibly reach Lime Creek. With absorption in the forest soil between the pond and Lime Creek and the relatively small volume of the seepage collection pond, the effect on water quality of Lime Creek would be small and possibly not measurable. Water in the seepage collection pond is predicted to have slightly elevated metals levels (discussed in Section 6.1.3). Small leaks from the dykes would be unlikely to reach Lime Creek, which would be approximately 1 kilometre (km) west of the pond. Catastrophic failure of a LGS seepage collection pond dyke would constitute a spill and would be reported to the Chief Mines Inspector and BC MOE. If indicated, EC would also be notified.

Failure of the Northeast seepage collection pond dykes could result in seepage water from the TMF with potentially elevated metals levels, entering the two tributaries flowing into Lake 901, all of which have populations of rainbow trout. Small leaks in one of the dykes would likely have little effect on the tributaries and no effect on Lake 901, whereas a complete failure of one of the dykes could result in impacts to fish in both the tributaries and Lake 901. Depending on the concentration of metals in the seepage, a large volume of seepage in the tributaries could have acutely toxic effects on sensitive life stages of fish and possibly chronic toxic effects on fish in Lake 901.

Any break would be repaired immediately and impacts would be short term. The probability of small leaks is moderate and of a catastrophic failure low. However, given the environmental consequences could be high, dykes would be engineered structures and routinely inspected by mine personnel and annually by an independent geotechnical engineer. A SOP would be developed prior to operation of the TMF and mine employees responsible for inspection of the dykes would be trained. Leaks or breaks in dykes would constitute spills and would be reported to authorities.

21.6.4.4 Accidental Release from Stockpiles of Ore and Waste

By their nature, ore and waste stockpiles are not designed to hold water, thus only runoff (from precipitation and snow melt) and seepage from infiltrated water would occur. This is a more or less continuous process and ditches and seepage collection ponds are constructed to intercept both. Thus, there can be no accidental discharge from stockpiles.

The LGS and WRMF could fail (i.e., ore or rock on a face slump). In either case, the result would be areas beyond those planned would be covered. In the case of the WRMF, until final configuration is reached, any failure would be to an area which would be covered at a future date. The WRMF would be built from the bottom up, buttress the TMF South Embankment on the upslope side, and expand southwestward. Both the LGS and WRMF would be engineered structures with factors of safety which would take failure into consideration. As well, these structures will be inspected annually by an independent geotechnical engineer, as required by the *Mines Act* (Government of BC 1996b). Recommendations from the engineer must be addressed by the mine.

The risk of a minor failure (a small slump) is moderate and easily addressed. The risk of a major failure is low (based on the arguments presented above).

21.6.4.5 TMF Embankment Failure

The TMF would have south and northeast embankments, the south by centreline construction, and the northeast by downstream construction, both with compacted cycloned sand over rockfill, lined starter dams. As the embankments are raised, tailings beaches would be created on the upstream side of each. Each embankment would have an emergency spillway to pass Probable Maximum Precipitation (PMP) to preserve embankment integrity under extreme precipitation events. The South Embankment would be buttressed by the WRMF, which would progressively increase as the mine progresses through to Year 14. The initial volume of water in the tailings pond would be 10 million cubic metres (Mm^3) and would be variable throughout the mine life. The TMF would have a positive water balance requiring annual discharge of effluent from the South Embankment. On closure, a permanent spillway would be constructed adjacent to the north shoulder of the embankment.

21.6.4.5.1 Seismicity

The Kitsault embankments were assigned a very high dam classification based on CDA guidelines because of the potential for loss of life from a catastrophic South Embankment failure into the open pit and the probably significant damage to fish and fish habitat from the same level of failure of the Northeast Embankment.

The region of coastal northwest BC and southwestern Yukon is one of the most seismically active areas of Canada. A conservative design was requested by the proponent, exceeding CDA “Dam Safety Guidelines” (CDA 2007). An Operating Basis Earthquake (OBE) design earthquake of magnitude 7 was chosen. Under the OBE, the TMF would continue to operate in a normal manner. A one in 10,000 year return period earthquake of magnitude

7.5 was chosen for Maximum Design Earthquake (MDE). Under a MDE, limited deformation of the tailings embankments is acceptable under seismic loading from the MDE, provided that the overall stability and integrity of the TMF is maintained and that there is no release of stored tailings or water (International Commission on Large Dams (ICOLD) 1995).

21.6.4.5.2 Inflow Design Flood

The very high dam classification for the South and Northeast Embankments necessitated that the IDF be two-thirds between the one in 1000 year return period flood and the PMF. The proponent required that the embankments be designed for the more conservative PMF. Therefore, the spillway for the TMF would be sized to convey the PMF. This is a very conservative design assumption, and by ignoring the attenuating effect of the large storage volume, allowance is made for the possibility to manage multiple storm events.

21.6.4.5.3 Dam Failure

The frequency and length of occurrence of embankment failures is difficult to predict. The impacts of a large tailings spill would be largely irreversible and would last beyond the life of mine, except in areas where complete cleanup could be affected.

Modes of failure of earth-fill embankments, of which tailings dams are a type, have been found to be the following (Fell et al. 1999):

- Flood: overtopping of the embankment, scour of the spillway chute, or overtopping of the spillway chute walls;
- Slope instability: downstream slope instability or upstream slope instability, both of which can cause breaching;
- Internal erosion and piping: erosion of dam construction materials from water flow either on a front or channelised (i.e., piping); and
- Earthquake: failure caused by liquefaction of the dam foundation, or seepage erosion and piping through earthquake-induced cracking.

Worldwide, slope instability failure to 1986 had the following average annual frequency (Fell et al. 1999):

upstream: 0.3×10^{-5} downstream: 2×10^{-5}

which is a low risk for an individual dam. Risk of failure due to downstream slope instability has been historically higher during the first five years than after that time. Other failure mode statistics were not provided by Fell et al.

A survey of world-wide dam failure rates to 1975 (Geo-Institute of American Society of Civil Engineers (ASCE) 1998) indicated an average rate of 4×10^{-4}. For the United States, a 40-year survey period to 1967 indicated an average rate of 5×10^{-4}, which is again, a negligible risk.

Slope stability failures usually provide advance warning (Fell et al. 1999) and thus remedial action can be taken prior to failure. Likewise, internal erosion / piping can be readily detected through routine inspection by mine site personnel (e.g., through increased seepage rates on the downstream face of dams), and from annual inspections by qualified geotechnical engineers (required as a condition of mine permits for mines in Canada).

Warnings of piping, unusual movement or deformation of embankments, cracks, or other relatively small changes in embankments would be addressed immediately by mine staff, or with the aid of third party geotechnical engineers. In the event, despite preventive measures, of catastrophic failure of either of the embankments occurs, permanent damage to habitat beyond the mine life is likely to occur. Further, a catastrophic failure of the South Embankment could result in the loss of life of people working in the open pit. The risk of catastrophic failure, which is low to begin with, would become progressively less as the WRMF buttress progresses upward and westward from the downstream embankment face. The TMF would be operated so that beaches progressively build up on the upstream sides and water would not be against upstream faces, thus reducing the risk of embankment failure.

Small failures (e.g., due to piping), would be captured by the open pit (South Embankment) or seepage collection ponds (Northeast Embankment).

A catastrophic failure of either embankment could mean the loss of 10 Mm^3 of water at any time during mine life and a variable volume of tailings. The TMF is designed to hold 233 million tonnes (Mt) of tailings. At a specific gravity of 2.7, that equates to 86 Mm^3 of tailings. Much less than this amount could actually be released from a catastrophic failure because the TMF would be located in a basin.

Failure of the South Embankment would result in released water and tailings flowing into and partially filling the open pit. Thus, a South Embankment failure would be contained within the site. Failure of the Northeast Embankment could result in the release of most, or all of the stored water and a significant fraction of the tailings. The sudden release of water could wash fish out of Lake 901 tributary streams downslope from the Northeast Embankment. Scour of the stream beds is also likely. Some of the released tailings would lodge in these relatively low grade tributary streams covering fish habitat. TMF supernatant water would flow into Lake 901 (volume 126,970 cubic metres (m^3)), mixing with and displacing lake water and likely continue downstream toward or into Clary Lake and beyond. If a large enough volume of tailings were released, Lake 901 bottom would be partly or completely covered, potentially affecting or eliminating more fish habitat. Indirect effects on fish and other aquatic organisms could potentially be acute toxicity and some chronic toxicity would be expected. Chronic toxic effects could be expected to last until elevated contaminants had leached out of the tailings. It is not possible to estimate the length of time chronic toxicity might persist because the time would depend on the amount of tailings deposited and the leaching rate. Leaching rate would be more rapid in moving water than in Lake 901.

The risk of a catastrophic embankment failure is very low, but because of the high potential for loss of human life and long term damage to the aquatic environment, SOPs for inspection and training of employees will be instituted by the proponent, together with regular inspections of embankments by trained mine employees and annual independent geotechnical inspections.

21.6.4.6 Pipeline Leakage

Tailings pipes would be sited where possible so that they drain back towards the tailings impoundment so that spills will drain into the tailings impoundment. Spills of process water and tailings would occur within the TMF contained area such that fluids would drain by gravity into the TMF. Spills from the TMF seepage pump back lines would drain back into the collection ditches and ponds. Lines would be repaired and the seepage pumped back to the TMF.

See also Section 21.6.3.

21.6.4.7 Discharge of Off-Specification Effluent from Treatment Plants

The only treatment plant on site during operations would be the sewage treatment plant. See Section 21.6.3.4.

21.6.4.8 Power Outages

Standby generators would be maintained for system critical facilities including but not limited to:

- Communications equipment;
- Electric fire and other water pumps;
- Fire alarm systems;
- Emergency lighting that is non-battery operated;
- Process plant controllers;
- Emergency heating;
- Sewage treatment plant; and
- Potable water treatment plant.

Periodically, on a schedule set by the mine services manager (or designate), all emergency power systems would be checked and tested. Emergency equipment would be placed on the master equipment testing schedule maintained by the mine maintenance department. All emergency tests would be logged and reviewed regularly by the Mine Superintendent (or designate).

21.6.4.9 Fires or Explosions

21.6.4.9.1 Fires

See Section 21.6.3.6.

21.6.4.9.2 Accidental Explosions

Accidental explosions from blasting are extremely rare. Explosives would only be handled by trained employees. Caps and powder magazines and the emulsion plant would be set back the required distance from working areas and accommodations. A protective berm is required at the magazines to protect against an accidental explosion. The explosives storage area would be restricted to authorised employees only and the access road signed per mines regulations.

See safety precautions listed in Section 21.6.4.10 and also see Section 21.6.3.6.2.

21.6.4.10 Fly Rock from Blasting

No mine facilities other than the in-pit crusher and equipment working in the pit would be within the blast zone. Prior to blasting, per standard mine safety procedures, the open pit and areas within the range of fly rock would be cleared, access roads blocked and all mine staff warned a blast would occur. A sweep of all areas within the blast zone would be done by the pit foreman or designate prior to the blast. Regulations also require signage on all roads leading into the blast zone the day blasting would occur, giving the time for the blast. Typical warnings for all staff with radio contact (which would include all vehicles - no exceptions) would include a two hour, half hour, and two minute warning before the blast is set off, again per regulations. With these safety procedures in place and only certified employees charging drill holes and setting off blasts, no accidents are expected. Fly rock blocking roads would be removed immediately after the blast by mine services personnel if required.

21.6.4.11 Motor Vehicle Accidents

The mine access road would be upgraded to accommodate the safe passage of trucks hauling potentially hazardous commodities to and from the mine including petroleum products, reagents, and concentrates. Speed limits would be established and enforced to prevent accidents. The road would be maintained to ensure that trucks travel on a safe road surface throughout the year.

A motor vehicle accident at the mine site would be dealt with by mine staff. Potential impacts include injury or death of vehicle operators, spill of fuel, and vehicle fires as result of impact if severe. All vehicles operated at the mine would likely be fuelled with diesel, which is much less likely to ignite than gasoline. A collision between ore trucks is highly unlikely and loss of fuel even less likely. A collision of ore trucks and mine service vehicles is also unlikely but is more likely to cause severe damage to the service vehicle, depending on its size.

As a safety precaution, all mine vehicles would be radio-equipped. Pickup trucks and other light vehicles would be equipped with buggy whips as required by mine regulations. A safety orientation would be provided to all employees driving vehicles. At mine sites, ore trucks have the Right-of–Way (ROW). Careless driving would be disciplined.

Any fuel spill from an accident would be cleaned up immediately and contaminated soil would be removed to the mine landfarm for bioremediation. An accident upslope and near a water body could result in petroleum entering the water body. It could not occur within the mine site itself due to the distance to water bodies outside the mine control zone, except near the Patsy Creek diversion channel. Away from the pit, TMF, accommodation and truck shop, spilled petroleum could enter water bodies, such as Clary Lake. Traffic volume would be much less in these areas and the risk of vehicle accident greatly reduced. Spills of fuel from a vehicle accident would be relatively small, any impacts to water bodies would be temporary and not likely to result in acute toxicity to aquatic organisms.

Spills of chemicals or concentrate from transport trucks on the access road near water courses could result in impacts to aquatic organisms. Process chemicals required for the proposed Project are of relatively low toxicity when diluted with short term effects. Molybdenum concentrate shipped from the mine would be in tote bags contained within sea containers, which are designed to withstand considerable impact from waves on the open decks of container ships and are unlikely to break open except under extreme impact. Any spills to land would be cleaned up immediately.

The risk of spills from motor vehicle accidents is small but potential for environmental damage or safety hazards exists and a spill response plan would be developed prior to construction, as previously noted.

21.6.4.12 Metal Leaching / Acid Rock Drainage

Acid rock drainage (ARD) management is discussed in Section 11.2.12. Unless acid generation onset is much faster than predicted, ARD would not occur during the mine life. Should metal leaching (ML) / ARD become problematic to the extent that TMF discharge does not meet effluent permit criteria, a treatment plant would be one of the options investigated. Any spill from a treatment plant would be reported per the *Spill Reporting Regulation* (Government of BC 1990) and the operator would initiate steps necessary to stop the spill. The initial steps would be to initiate pumping plant feed water back to the open pit (assuming a treatment plant would be placed downstream from the open pit final discharge point). A worst-case scenario would be loss of water contained within the treatment plant system to Lime Creek, which, depending on the circumstances of the leak, may not be able to be contained. Should a treatment plant be found to be necessary post-closure, an SOP would be developed including emergency procedures and trained operators.

The impacts of a spill of untreated water would depend entirely on the quality of water (i.e., the contaminant load and the volume released). Fish-bearing reaches of Lime Creek are over 5 km downstream from the mine and a large discharge would be required to negatively

affect fish or fish habitat. Aquatic organisms further upstream could be affected by smaller quantities of spills.

21.6.4.13 Sediment Release to Water Courses

During operations, sediment could be released to water courses from piping or failure of dykes around seepage collection ponds. Sediment released due to dyke failure of the LGS pond would flow to ground immediately downslope of the pond. Sediment from a failure of dykes on one or both of the Northeast Embankment seepage collection ponds could enter fish-bearing waters and result in damage to fish habitat. Piping of water from a dyke would not likely entrain enough sediment to cause permanent damage, although temporary reduction in habitat usability could be expected. A catastrophic failure of a dyke would likely lead to greater and more permanent damage.

All pond dykes would be inspected periodically by mine staff and annually by an independent geotechnical engineer, as would be required by the proposed Project's *Mines Act* permit. Any problem areas would be repaired immediately.

21.6.4.14 Dust

Dust could be generated from road surfaces, the in-pit crusher, stockpiles, and tailings beaches. Surfaces subject to dust generation that become problematic would be watered (refer to Section 3.7.8 in the Project Description). The in-pit crusher could be fitted with mist sprays if problematic. Chronic dust generation with proposed control measures and the climate in the proposed Project region is not expected.

21.6.4.15 Vehicle Emissions

See Section 21.6.3.10.

21.6.4.16 Incinerator Emissions

See Section 21.6.3.11.

21.6.5 Closure and Post-Closure

After mining, the risk of accidents and malfunctions would decrease significantly but not totally disappear. Site activity would significantly decrease. Once initial site reclamation has been completed (within two to three years of the final cessation of milling), site activity would then be limited to environmental inspections, monitoring, and periodic maintenance. As discussed in Section 21.6.2, there will be ongoing monitoring of potential ML during the life of mine and the prediction models will be updated based on this data. A water treatment plant has been included as a contingency for this proposed Project in the event that treatment is required at closure and post closure.

The proponent would implement the following actions to mitigate against the potential adverse effects of releases of harmful materials resulting from an accident or malfunction:

- All chemicals, reagents, and petroleum products no longer required will be removed from the site once milling ceases;
- Field servicing of any decommissioning equipment would be conducted within the TMF contained area;
- Any fuel supplies and chemicals required for decommissioning would be stored with the contained TMF area; and
- Emergency response and spill contingency training and supplies would be kept on the site in appropriate quantity to deal with potential spill incidents.

21.6.5.1 Petroleum Spills

See Section 21.6.3.1.

21.6.5.2 Waste Rock Stockpile Failure

As required by the ”Health, Safety and Reclamation Code for Mines British Columbia (BC Ministry of Energy, Mines and Petroleum Resources (BC MEMPR) 2008), annual WRMF inspections will continue as long as mandated by the BC MFLRNO Chief Mines Inspector. A major failure of the WRMF would result in rock entering the open pit which, if full, would displace a volume of water equal to the rock entering the pit. This would result in a surge of water down Lime Creek which, if not moderated sufficiently by the time it reached fish habitat 5 km downstream, could negatively affect fish populations and habitat. Some erosion of the stream bed of upper Lime Creek is also probable. Bed material is coarse at this location and it is unlikely bed material would carry down to fish habitat. Major failure is an unlikely event but with potentially large environmental consequences and thus the need for annual geotechnical inspections until the WRMF is completely reclaimed.

21.6.5.3 Power Outages

Spare gensets would be kept at the camp.

21.6.5.4 TMF Embankment Failure

As required by the ”Health, Safety and Reclamation Code for Mines in British Columbia” (BC MEMPR 2008), annual tailings embankment inspections will continue as long as mandated by the BC MFLRNO Chief Mines Inspector. The South Embankment would be buttressed by the WRMF and therefore there is essentially zero risk of failure of this embankment.

Once the TMF is completely reclaimed to dry land and wetland, the risk of failure of the Northeast Embankment would be small. As well, by closure, large tailings beaches would be formed on the upstream side of both embankments.

21.6.5.5 Fires

When no staff personnel are on the site, fire suppression would likely be coordinated through the Terrace office of BC MFLRNO, although this would have to be confirmed at the time of closure. With a skeleton staff on the site, small fires could be extinguished if safe it

is safe to do so. Otherwise, assistance would be requested, again through the BC MFLRNO.

See also Section 21.6.3.6.

21.6.5.6 Motor Vehicle Accidents

Immediately after closure, petroleum and process chemicals would be removed from the site via the access road. Saleable and recyclable mine infrastructure would also be transported off the site. During this closure period, motor vehicle accidents could result in spills to the environment, including water courses, or injury or death to vehicle operators. Once all materials targeted for removal are transported off the site, the volume of vehicle traffic would reduce to near zero with a concomitant decrease in the risk of accidents. See Section 21.6.4.11 for further discussion.

21.6.5.7 Sediment Release into Water Courses

During the closure period, water courses would be restored as much as practical to their natural courses. These operations could lead to sediment export and temporary coffer dams, sedimentation ponds and silt fences would be employed as required to control sediment export. Any sediment impacts would be short term and not affect fish bearing waters given that precautions stated here are carried out. See also Sections 21.6.3.8 and 21.6.4.13.

21.6.5.8 Chronic Dust

See Section 21.6.3.9. After reclamation and closure activities, dust suppression would no longer be required.

21.6.5.9 Chronic Vehicle Emissions

See Section 21.6.3.10. After reclamation and closure, the number of vehicles servicing the mine would be very limited and there would no longer be facilities at the mine site to service vehicles.

21.6.5.10 Chronic Incinerator Emissions

See Section 21.6.3.11. After reclamation and closure, there would not be an incinerator on the site.

21.6.6 Risk Summary

As previously stated, risk is the combination of probability and consequences (severity). Based on answers from the probability table and the consequences table, the corresponding risk category was selected. Risk was derived from the average of probability and consequences except where any consequence was high; in this latter case risk was conservatively taken to be high. Table 21.6.6-1 is a legend for the tables that follow. Tables 21.6.6-2 through 21.6.6-4 provide a summary list of risks discussed above for construction, operations, closure and post-closure.

Table 21.6.6-1: Legend for Risk Summary Tables

Consequences							
Probability		Personnel		Environment		Facility	
Unlikely	1	Negligible	1	Negligible	1	Negligible	1
Possible	2	Low	2	Low	2	Low	2
Likely	3	Moderate	3	Moderate	3	Moderate	3
Highly likely	4	High	4	High	4	High	4

Table 21.6.6-2: Risk Summary for Construction

Risk	Frequency / Probability	Consequences			Result
		Personnel	Environment	Facility	(Frequency x Consequence)
Petroleum spills: small	4	1	1	1	2
Petroleum spills: large	1	2	3	3	2
Containment pond failure: small	2	1	1	1	1
Containment pond failure: large	1	1	1	1	1
Pipeline leakage: small	3	1	1	1	2
Pipeline leakage: large	1	1	2	1	1
Off-spec effluent - treatment plants	2	1	1	1	1
Power outages	4	2	1	2	1
Fire: brush / forest	2	1	2	1	1
Fire: building	1	4	2	4	4
Fire: vehicle	2	4	2	4	4
Accidental explosion	1	4	2	4	4
Motor vehicle accident	2	4	3	4	4
Sediment release to water	4	1	2	2	1
Chronic dust	2	3	2	1	2
Chronic off-spec vehicle emissions	1	2	2	1	2
Chronic off-spec incinerator emissions	1	2	2	1	2

Note: off-spec – off specification

Table 21.6.6-3: Risk Summary for Operations

Risk	Frequency / Probability	Consequences			Result
		Personnel	Environment	Facility	(Frequency x Consequence)
Petroleum spills: small	4	1	1	1	2
Petroleum / hazardous waste spills: large / any	1	2	3	3	2
Containment pond failure: small	2	1	1	1	1
Containment pond failure: large	1	1	4	3	4
Stockpile failure: small	4	1	1	1	2
Stockpile failure: large	2	3	3	4	4
Embankment failure: small	2	1	2	2	2

Risk	Frequency / Probability	Consequences			Result
		Personnel	Environment	Facility	(Frequency x Consequence)
Embankment failure: large	1	4	4	4	4
Pipeline leakage: small	3	1	1	1	2
Pipeline leakage: large	1	1	2	1	1
Off-spec effluent - treatment plants	2	1	1	1	1
Power outages	4	2	1	2	2
Fire: building / forest	1	4	2	4	4
Fire: vehicle	2	4	2	4	4
Accidental explosion	1	4	2	4	4
Fly rock from blasting	3	1	1	1	2
Motor vehicle accident	2	4	3	4	4
Accidental release of ML/ARD	2	1	4	1	4
Sediment release to water	4	1	2	2	2
Chronic dust	2	3	2	1	2
Chronic off-spec vehicle emissions	1	2	2	1	2
Chronic off-spec incinerator emissions	1	2	2	1	2

Note: ML/ARD – metal leaching / acid rock drainage; off-spec - off specification

Table 21.6.6-4: Risk Summary for Closure and Post-Closure

Risk	Frequency / Probability	Consequences			Result
		Personnel	Environment	Facility	(Frequency x Consequence)
Petroleum spills: small	4	1	1	1	2
Petroleum spills: large	1	2	3	3	2
Stockpile failure: small	4	1	1	1	2
Stockpile failure: large	2	3	3	4	4
Embankment failure: small	1	1	2	2	2
Embankment failure: large	1	4	4	4	4
Off-spec effluent - treatment plants	2	1	1	1	1
Power outages	4	2	1	2	2
Fire: Forest	1	4	2	4	4
Fire: vehicle	1	4	2	4	4
Motor vehicle accident	2	4	3	4	4
Sediment release to water	4	1	2	2	2
Chronic dust	1	3	2	1	2
Chronic off-spec vehicle emissions	1	2	2	1	2
Chronic off-spec incinerator emissions	1	2	2	1	2

Note: off-spec - off specification

All of the risks discussed in this section have been addressed, or would be addressed, at the design stage of the proposed Project and would be monitored during all phases of mining. Risks in the highest category are considered non-routine and would receive additional planning, employee training and management scrutiny as appropriate. Waste and water management facilities, which are considered potentially higher risk are all engineered structures and would be continuously monitored and would have detailed plans developed for them prior to construction. Conceptual plans for water (Section 11.2.20), mine waste (Section 11.2.17), occupational health and safety (Section 11.2.13), and emergency and spill response (Section 11.2.6), amongst others, are discussed in the EMP section (Section 11.2) of this EA.

21.7 Mitigation Measures

As part of federal information requirements for the Application and in accordance with the *CEA Act* (Government of Canada 1992), the proponent must provide a thorough description of any measures that are technically and economically feasible that would avoid or mitigate the environmental effects of the proposed Project. Section 6.0 through 10.0 provides a comprehensive discussion of the potential effects to identified VCs, and describes the proposed mitigation measures for mitigating those effects. An evaluation of the effectiveness of the proposed mitigation measures is also provided in those sections, along with an assessment of the risk of mitigation failure and potential severity of the consequences where relevant. In the event that significant uncertainty is identified or if a residual risk remains, Section 11 (Environmental and Operational Management Plans) and Section 22.3 (Follow-up Program) outline details regarding mitigation measures, management, and monitoring.

Section 21.2 identifies factors that may be considered in the federal scope based on the proposed Project proposal and cross-references these factors to respective EA discipline sections and VCs. Table 21.7-1 below cross-references these federal scope factors to corresponding tables and sections of the Application that describe mitigation measures. The Table of Concordance has also been prepared and is presented with the Application.

Table 21.7-1: Cross-Reference to Mitigation Measures Corresponding to Federal Scope Factors

EA Discipline	Federal Scope Factors	Valued Components	Mitigation Measure Cross-Reference
Atmospheric Environment	Air quality Climate and meteorology Noise emissions	Air Quality Climate Noise and Vibration	**Section 6.2 and 6.3** Table 6.2.2-12 Table 6.2.3-5 Table 6.3.9-11 **Section 11.0** Air Quality Management Plan (section 11.2.1) Dust Management Plan (section 11.2.5) Noise Management Plan (section 11.2.12) **Section 22.3** Atmospheric Monitoring and Follow-up Plan
Groundwater	Hydrogeology Water quality	Groundwater Flow Groundwater Quality Groundwater Recharge and Discharge Groundwater and Surface Water Interaction	**Section 6.4** Table 6.4.2-8 Table 6.4.3-8 Table 6.4.4-8 Table 6.4.5-8 **Section 22.3** Aquatic Effects Monitoring and Follow-up Program **Appendix** Water Management Report (Appendix 6.5-B)
Hydrology	Hydrology	Lime / Patsy Creek Watershed Clary Creek Watershed	**Section 6.5** Section 6.5.2.7.9 **Section 22.3** Aquatic Effects Monitoring and Follow-up Program **Appendix** Water Management Report (Appendix 6.5-B)
Surface Water and Sediment Quality	Freshwater quality Water quality	Surface Water Quality Sediment Quality	**Section 6.6** Table 6.6.2-35 Table 6.6.3-17 **Section 11.0** Erosion and Sediment Control Plan (section 11.2.7) Waste Water Management Plan (section 11.2.19) Tailings and Mine Water

EA Discipline	Federal Scope Factors	Valued Components	Mitigation Measure Cross-Reference
			Management Plan (section 11.2.20) **Section 22.3** Aquatic Effects Monitoring and Follow-up Program **Appendix** Water Management Report (Appendix 6.5-B) Reclamation and Closure Plan (Appendix 3.0-K)
Freshwater Aquatic Resources	Freshwater aquatic environment Fish and fish habitat	Dolly Varden Coho Salmon Rainbow Trout Benthic Macro-Invertebrates	**Section 6.7** Table 6.7.2-21 Table 6.7.2-22 Table 6.7.2-23 Table 6.7.2-24 Table 6.7.2-27 Table 6.7.2-28 Table 6.7.2-29 Table 6.7.2-30 Table 6.7.4-20 Table 6.7.5-11 Table 6.7.5-12 Table 6.7.5-13 Table 6.7.5-14 Table 6.7.5-17 Table 6.7.5-18 Table 6.7.5-19 Table 6.7.5-20 **Section 11.0** Aquatic Resources Management Plan (Section 11.2.2) Erosion and Sediment Control Plan (Section 11.2.7) **Section 22.3** Aquatic Effects Monitoring and Follow-up Program Fish and Fish Habitat Monitoring and Follow-up Program **Appendix** Water Management Report (Appendix 6.5-B) Fish Habitat Mitigation and Compensation Plan (Appendix 11.2-A) Reclamation and Closure Plan

EA Discipline	Federal Scope Factors	Valued Components	Mitigation Measure Cross-Reference
			(Appendix 3.0-K)
Marine Aquatic Resources	Marine / coastal processes Marine aquatic environment Water Quality	Marine Water Quality Marine Biota	**Section 22.3** Marine Monitoring Program
Terrestrial Environment – Terrain, Surficial Geology and Soil	Terrestrial environment Terrain, soils and geology	Physiography and topography Surficial geology Soil Cover Soil Quality	**Section 6.9** Table 6.9.2-7 Table 6.9.3-7 Table 6.9.4-7 Table 6.9.5-7 **Section 11.0** Soil Management Plan (Section 11.2.16) **Section 22.3** Terrain and Geotechnical Monitoring and Follow-up Program Soils Monitoring and Follow-up Program **Appendix** Reclamation and Closure Plan (Appendix 3.0-K)
Terrestrial Environment – Vegetation and Plant Communities	Terrestrial environment Vegetation and plant communities Wetlands Ecologically sensitive or significant areas and species of conservation concern, including species at risk and their habitats	Ecosystem Composition Wetland Ecosystems Old Forests Species at Risk Ecological Communities at Risk Cultural Plants	**Section 6.10** Table 6.10.2-9 Table 6.10.3-7 Table 6.10.4-6 Table 6.10.5-9 Table 6.10.6-7 Table 6.10.7-12 **Section 11.0** Vegetation Management Plan (Section 11.2.8) Soil Management Plan (Section 11.2.16) **Section 22.3** Vegetation Monitoring and Follow-up Program **Appendix** Reclamation and Closure Plan (Appendix 3.0-K)
Wildlife and their Habitat	Wildlife and wildlife habitat Migratory birds and their habitats Ecologically	Western Toad Olive-sided Flycatcher Sooty Grouse	**Section 6.11** Table 6.11.3-6 Table 6.11.4-7 Table 6.11.5-7

EA Discipline	Federal Scope Factors	Valued Components	Mitigation Measure Cross-Reference
	sensitive or significant areas and species of conservation concern, including species at risk and their habitats	Northern Goshawk American Marten Mountain Goat Moose Grizzly Bear	Table 6.11.6-7 Table 6.11.7-7 Table 6.11.8-6 Table 6.11.9-7 Table 6.11.10-7 **Section 11.0** Wildlife Management Plan (Section 11.2.21) Transportation and Access Management Plan (Section 11.2.18) **Section 22.3** Wildlife Monitoring and Follow-up Program **Appendix** Reclamation and Closure Plan (Appendix 3.0-K) Road Use Effects Assessment (Appendix 8.0-C)
Economic	Human environment	Provincial Economy and Government Revenues Regional Employment and Income Employment Opportunities Contract and Business Opportunities Labour Income Generated Local Unemployment Rates and Trends Employment and Economic Diversification Labour Force Qualification Regional Government Finances	**Section 7.0** Table 7.2.2-17 Table 7.2.3-17 Table 7.2.3-18 Table 7.2.4-14 Table 7.2.5-7 Table 7.2.6-8 Table 7.2.7-7 Table 7.2.8-7 Table 7.2.9-8 Table 7.2.10-6
Social	Human environment Current use of lands and	Regional Demographics Housing Regional Services	**Section 8.0** Table 8.2.2-9 Table 8.2.3-5 Table 8.2.4-6

EA Discipline	Federal Scope Factors	Valued Components	Mitigation Measure Cross-Reference
	resources for the Nisga'a Nation purposes Current use of lands and resources for Aboriginal groups' purposes Fisheries, including aquaculture	Regional Infrastructure Family and Community Wellbeing Educational Services Transportation Land and Resource Use	Table 8.2.5-5 Table 8.2.6-11 Table 8.2.7-7 Table 8.2.8-7 Table 8.2.9-9
Heritage	Physical and cultural heritage Structure and sites of archaeological significance Human environment	Archaeological Sites Historic Heritage Sites	**Section 9.0** Table 9.2.2-8 Table 9.2.3-7 **Section 11.0** Archaeology and Cultural Heritage Resources Management Plan (Section 11.2.3)
Human Health	Human health Human environment	Public Health Visual and Aesthetic Resources Healthy Living Worker Safety and Health	**Section 10.0** Table 10.2.2-11 Table 10.2.3-8 Table 10.2.5-5 **Section 11.0** Occupational Health and Safety Plan (Section 11.2.13)
Nisga'a Nation Rights and Interests	Human environment Current use of lands and resources for the Nisga'a Nation purposes		**Section 14.0** **Section 15.0** **Section 11.2** Environmental Management Plans **Appendix** Road Use Effects Assessment (Appendix 8.0-C) Nisga'a Economic, Social and Cultural Impact Assessment (Rescan 2012)
Aboriginal Groups Information Requirements	Human environment Current use of lands and resources for Aboriginal groups' purposes		**Part D** Section 17.0 (Metlakatla only) **Appendix** Road Use Effects Assessment (Appendix 8.0-C)

21.8 Residual Environmental Effects

As part of federal information requirements for the Application and in accordance with the *CEA Act* (Government of Canada 1992), the proponent must provide a thorough description of any residual environmental effects expected to remain following the implementation of mitigation measures. Section 6.0 through 10.0 provides a comprehensive discussion of the potential residual effects for each identified VC. A summary of potential residual effects is also presented in Section 6.13 (summary of potential environmental effects), Section 7.3 (summary of potential economic effects), Section 8.3 (summary of potential social effects), Section 9.3 (summary of potential heritage effects), and Section 10.3 (summary of potential health effects).

Section 21.2 identifies factors that may be considered in the federal scope based on the proposed Project proposal and cross-references these factors to respective EA discipline sections and VCs. Table 21.8-1 below cross-references these federal scope factors to corresponding tables and sections of the Application that describe residual environmental effects.

Table 21.8-1: Cross-Reference to Residual Effects Corresponding to Federal Scope Factors

EA Discipline	Federal Scope Factors	Valued Components	Residual Effects Cross-Reference
Atmospheric Environment	Air quality Climate and meteorology Noise emissions	Air Quality Climate Noise and Vibration	**Section 6.2 and 6.3** Table 6.2.2-13 No residual effects for climate and noise and vibration
Groundwater	Hydrogeology Water quality	Groundwater Flow Groundwater Quality Groundwater Recharge and Discharge Groundwater and Surface Water Interaction	**Section 6.4** Table 6.4.2-9 Table 6.4.3-9 Table 6.4.4-9 Table 6.4.5-9
Hydrology	Hydrology	Lime / Patsy Creek Watershed Clary Creek Watershed	**Section 6.5** Table 6.8.2-20
Surface Water and Sediment Quality	Freshwater quality Water quality	Surface Water Quality Sediment Quality	**Section 6.6** Table 6.6.2-41 Table 6.6.3-19
Freshwater Aquatic Resources	Freshwater aquatic environment Fish and fish habitat	Dolly Varden Coho Salmon Rainbow Trout Benthic Macro-Invertebrates	**Section 6.7** Table 6.7.2-38 Table 6.7.3-13 Table 6.7.4-32 Table 6.7.5-24
Marine Aquatic Resources	Marine / coastal processes	Marine Water Quality Marine Biota	**Section 6.8** No residual effects

EA Discipline	Federal Scope Factors	Valued Components	Residual Effects Cross-Reference
	Marine aquatic environment Water Quality		
Terrestrial Environment – Terrain, Surficial Geology and Soil	Terrestrial environment Terrain, soils and geology	Physiography and topography Surficial geology Soil Cover Soil Quality	**Section 6.9** Table 6.9.2-8 No residual effects for surficial geology, soil cover, soil quality
Terrestrial Environment – Vegetation and Plant Communities	Terrestrial environment Vegetation and plant communities Wetlands Ecologically sensitive or significant areas and species of conservation concern, including species at risk and their habitats	Ecosystem Composition Wetland Ecosystems Old Forests Species at Risk Ecological Communities at Risk Cultural Plants	**Section 6.10** Table 6.10.2-10 Table 6.10.3-8 Table 6.10.4-7 Table 6.10.5-10 Table 6.10.6-8 Table 6.10.7-13
Wildlife and their Habitat	Wildlife and wildlife habitat Migratory birds and their habitats Ecologically sensitive or significant areas and species of conservation concern, including species at risk and their habitats	Western Toad Olive-sided Flycatcher Sooty Grouse Northern Goshawk American Marten Mountain Goat Moose Grizzly Bear	**Section 6.11** Table 6.11.3-7 Table 6.11.4-8 Table 6.11.5-8 Table 6.11.7-8 Table 6.11.9-8 Table 6.11.10-8 No residual effects for northern goshawk and mountain goat
Economic	Human environment	Provincial Economy and Government Revenues Regional Employment and Income Employment Opportunities Contract and Business Opportunities Labour Income Generated Local Unemployment Rates and Trends	**Section 7.0** Table 7.2.2-18 Table 7.2.3-19 Table 7.2.4-15 Table 7.2.5-8 Table 7.2.6-9 Table 7.2.7-8 Table 7.2.8-8 Table 7.2.9-9 Table 7.2.10-7

EA Discipline	Federal Scope Factors	Valued Components	Residual Effects Cross-Reference
		Employment and Economic Diversification Labour Force Qualification Regional Government Finances	
Social	Human environment Current use of lands and resources for the Nisga'a Nation purposes Current use of lands and resources for Aboriginal groups' purposes Fisheries, including aquaculture	Regional Demographics Housing Regional Services Regional Infrastructure Family and Community Wellbeing Educational Services Transportation Land and Resource Use	**Section 8.0** Table 8.2.2-10 Table 8.2.3-6 Table 8.2.4-7 Table 8.2.5-6 Table 8.2.6-12 Table 8.2.7-8 Table 8.2.8-8 Table 8.2.9-10
Heritage	Physical and cultural heritage Structure and sites of archaeological significance Human environment	Archaeological Sites Historic Heritage Sites	**Section 9.0** Table 9.2.2-9 Table 9.2.3-8
Human Health	Human health Human environment	Public Health Visual and Aesthetic Resources Healthy Living Worker Safety and Health	**Section 10.0** Table 10.2.2-12 Table 10.2.3-9 Table 10.2.4-4 Table 10.2.5-6
Nisga'a Nation Rights and Interests	Human environment Current use of lands and resources for the Nisga'a Nation purposes		**Section 14.0** **Section 15.0** **Appendix** Road Use Effects Assessment (Appendix 8.0-C)
Aboriginal Groups Information Requirements	Human environment Current use of lands and resources for		**Appendix** Road Use Effects Assessment (Appendix 8.0-C)

EA Discipline	Federal Scope Factors	Valued Components	Residual Effects Cross-Reference
	Aboriginal groups' purposes		

21.9 Significance Assessment / Analysis

As part of federal information requirements for the Application and in accordance with the *CEA Act* (Government of Canada 1992), the proponent must provide a thorough discussion of the significance of each residual environmental effect identified. The methodology to determine significance is provided in Section 5.0. Section 6.0 through 10.0 provides a comprehensive discussion of the significance of potential residual effects for each identified VC. A summary of the significance of potential residual effects is also presented in Section 6.13 (summary of potential environmental effects), Section 7.3 (summary of potential economic effects), Section 8.3 (summary of potential social effects), Section 9.3 (summary of potential heritage effects), and Section 10.3 (summary of potential health effects).

Section 21.2 identifies factors that may be considered in the federal scope based on the proposed Project proposal and cross-references these factors to respective EA discipline sections and VCs. Table 21.9-1 below cross-references these federal scope factors to corresponding tables and sections of the Application that describe the significance of potential residual environmental effects.

Table 21.9-1: Cross-Reference to Significance Assessment of Residual Effects Corresponding to Federal Scope Factors

EA Discipline	Federal Scope Factors	Valued Components	Significance Assessment of Residual Effects Cross-Reference
Atmospheric Environment	Air quality Climate and meteorology Noise emissions	Air Quality Climate Noise and Vibration	**Section 6.2 and 6.3** Table 6.2.2-14 No residual effects for climate and noise and vibration
Groundwater	Hydrogeology Water quality	Groundwater Flow Groundwater Quality Groundwater Recharge and Discharge Groundwater and Surface Water Interaction	**Section 6.4** Table 6.4.2-10 Table 6.4.3-10 Table 6.4.4-10 Table 6.4.5-10
Hydrology	Hydrology	Lime / Patsy Creek Watershed Clary Creek Watershed	**Section 6.5** Table 6.8.2-21
Surface Water and	Freshwater quality	Surface Water Quality	**Section 6.6**

EA Discipline	Federal Scope Factors	Valued Components	Significance Assessment of Residual Effects Cross-Reference
Sediment Quality	Water quality	Sediment Quality	Table 6.6.2-42 Table 6.6.3-20
Freshwater Aquatic Resources	Freshwater aquatic environment Fish and fish habitat	Dolly Varden Coho Salmon Rainbow Trout Benthic Macro-Invertebrates	**Section 6.7** Table 6.7.2-39 Table 6.7.3-14 Table 6.7.4-33 Table 6.7.4-34 Table 6.7.4-35 Table 6.7.4-36 Table 6.7.4-38 Table 6.7.4-39 Table 6.7.5-25
Marine Aquatic Resources	Marine / coastal processes Marine aquatic environment Water Quality	Marine Water Quality Marine Biota	**Section 6.8** No residual effects
Terrestrial Environment – Terrain, Surficial Geology and Soil	Terrestrial environment Terrain, soils and geology	Physiography and topography Surficial geology Soil Cover Soil Quality	**Section 6.9** Table 6.9.2-9 No residual effects for surficial geology, soil cover, soil quality
Terrestrial Environment – Vegetation and Plant Communities	Terrestrial environment Vegetation and plant communities Wetlands Ecologically sensitive or significant areas and species of conservation concern, including species at risk and their habitats	Ecosystem Composition Wetland Ecosystems Old Forests Species at Risk Ecological Communities at Risk Cultural Plants	**Section 6.10** Table 6.10.2-11 Table 6.10.3-9 Table 6.10.4-8 Table 6.10.5-11 Table 6.10.6-9 Table 6.10.7-14
Wildlife and their Habitat	Wildlife and wildlife habitat Migratory birds and their habitats Ecologically sensitive or significant areas and species of conservation	Western Toad Olive-sided Flycatcher Sooty Grouse Northern Goshawk American Marten Mountain Goat Moose Grizzly Bear	**Section 6.11** Table 6.11.3-8 Table 6.11.4-9 Table 6.11.5-9 Table 6.11.7-9 Table 6.11.9-9 Table 6.11.10-9 No residual effects for northern

EA Discipline	Federal Scope Factors	Valued Components	Significance Assessment of Residual Effects Cross-Reference
	concern, including species at risk and their habitats		goshawk and mountain goat
Economic	Human environment	Provincial Economy and Government Revenues Regional Employment and Income Employment Opportunities Contract and Business Opportunities Labour Income Generated Local Unemployment Rates and Trends Employment and Economic Diversification Labour Force Qualification Regional Government Finances	**Section 7.0** Table 7.2.2-19 Table 7.2.2-20 Table 7.2.2-21 Table 7.2.3-20 Table 7.2.4-16 Table 7.2.4-17 Table 7.2.4-18 Table 7.2.5-9 Table 7.2.5-10 Table 7.2.6-11 Table 7.2.6-12 Table 7.2.6-13 Table 7.2.7-9 Table 7.2.7-10 Table 7.2.7-11 Table 7.2.8-9 Table 7.2.9-10 Table 7.2.10-8
Social	Human environment Current use of lands and resources for the Nisga'a Nation purposes Current use of lands and resources for Aboriginal groups' purposes Fisheries, including aquaculture	Regional Demographics Housing Regional Services Regional Infrastructure Family and Community Wellbeing Educational Services Transportation Land and Resource Use	**Section 8.0** Table 8.2.2-13 Table 8.2.2-14 Table 8.2.3-7 Table 8.2.4-8 Table 8.2.5-7 Table 8.2.6-13 Table 8.2.7-9 Table 8.2.8-9 Table 8.2.9-11
Heritage	Physical and cultural heritage Structure and sites of archaeological significance	Archaeological Sites Historic Heritage Sites	**Section 9.0** Table 9.2.2-11 Table 9.2.3-10

EA Discipline	Federal Scope Factors	Valued Components	Significance Assessment of Residual Effects Cross-Reference
Human Health	Human health Human environment	Public Health Visual and Aesthetic Resources Healthy Living Worker Safety and Health	**Section 10.0** Table 10.2.2-12 Table 10.2.3-9 Table 10.2.4-4 Table 10.2.5-6
Nisga'a Nation Rights and Interests	Human environment Current use of lands and resources for the Nisga'a Nation purposes		**Section 14.0** **Section 15.0** **Appendix** Road Use Effects Assessment (Appendix 8.0-C)
Aboriginal Groups Information Requirements	Human environment Current use of lands and resources for Aboriginal groups' purposes		**Appendix** Road Use Effects Assessment (Appendix 8.0-C)

21.10 Cumulative Environmental Effects

As part of federal information requirements for the Application and in accordance with the *CEA Act* (Government of Canada 1992), the proponent must provide consideration of any CEE that are likely to result from the proposed Project in combination with other projects or activities that have been or will be carried out. Section 5.0 outlines the methodology of the cumulative effects assessment (CEA). Section 6.0 through 10.0 provides an assessment of CEE. This section provides a summary of the CEA conducted in Section 6.0 through 10.0, including a description of other projects or activities that have been or will be carried out, potential interactions with Project residual effects, and potential cumulative effects and their significance.

21.10.1 Approach

The CEA was conducted to identify the potential for cumulative effects to occur and to assess the significance of those effects. The assessment of CEE largely depends on effective scoping, i.e., setting the boundaries of the assessment and focus of the analysis. Scoping includes:

- identifying environmental effects to be considered;
- identifying likely CEE within those limits; and
- setting the spatial and temporal boundaries for the assessment.

The Agency defines cumulative effects as: “changes to the environment that are caused by an action in combination with other past, present and future human actions” (Agency 1999). Under this definition “actions” include human projects and activities. Projects are typically some form of commercial or industrial development that is planned, constructed and operated, e.g., a mine development or resource access road. Activities may either be part of a project or may arise over time because of ongoing human presence in an area. Examples of activities are public traffic, hiking and hunting (Agency 1999).

Although cumulative effects can occur in various ways, four potential effects are identified by the Agency and are described below:

1. Physical-chemical transport: A physical or chemical constituent is transported away from the action under review where it then interacts with another action (e.g., air emissions, waste water effluent, and sediment);
2. Spatial and temporal crowding: Cumulative effects can occur when too many activities within too small an area occurring in too brief a period of time. A threshold may be exceeded and the environment may not be able to recover to pre-disturbance conditions. This can occur quickly or gradually over a long period of time before the effects become apparent. Spatial crowding results in an overlap of effects among actions (e.g., noise from a highway adjacent to an industrial site, confluence of stack emission plumes, and close proximity of timber harvesting, wildlife habitat and recreational use in a park). Temporal crowding may occur if effects from different actions overlap or occur before the VC has had time to recover. (VCs encompass each of the valued environmental, social, economic, heritage, health components of the project setting.);
3. Growth-inducing potential: Each new action can induce further actions to occur. The effects of these “spin-off” actions (e.g., increased vehicle access into a previously relatively inaccessible area) may add to the cumulative effects already occurring near the proposed action, creating a “feedback” effect. Such actions may be considered as “reasonably foreseeable actions”; and
4. Nibbling loss: Described as the gradual disturbance and loss of land and habitat (e.g., clearing of land for a new sub-division and roads into a forested area). Regional plans are required that clearly establish regional thresholds of change against which the specific actions may be compared in order to address effects associated with “nibbling” (Agency 1999).

The CEA focuses on describing the VCs that have been identified in the associated effects assessment as being potentially affected by the proposed Project. VCs with not significant (minor), not significant (moderate) and significant effects identified during the residual effects significance assessment were carried forward into the CEA. Linkages with other VCs were identified and spatial and temporal overlap with other historical, current and future foreseeable human activities and projects described. Where linkages are identified, a clear rationale is provided before conducting the next step in the CEA process. The following steps were conducted for the CEA in Section 5.0 through Section 10.0:

- Describing methods;
- Determining spatial and temporal overlap;
- Describing other projects and human activities that overlap with the cumulative effects assessment;
- Determining incremental effects;
- Providing mitigation and monitoring requirements/options;
- Rating residual effects significance;
- Defining assessment certainty; and
- Describing limitations of the assessment.

The following sections summarise the above steps and provides a stand-alone summary document of the CEAs conducted for each relevant VC earlier in the Application.

21.10.2 Methods

This CEA is limited to those residual effects (post mitigation) on VCs resulting from past, present or reasonably foreseeable human activities or actions which occur within the area where a linkage between the residual effects resulting from the activities related to the proposed Project and the residual effects of other actions occurs. The CEA study area is specific to each VC and includes that area where cumulative effects from multiple activities can occur. The CEA for each VC includes the following steps:

- Determine if a project activity may have an effect on a VC;
- If an effect occurs, determine if the incremental effect acts cumulatively with the effects of other human activities, either past, present or reasonably foreseeable future; and
- Determine if the effect of the project, in combination with other effects, may cause a significant change now or in the future after mitigation.

Section 5.0 provides a detailed description of the methodology for the effects assessment and cumulative effects assessment.

21.10.2.1 Cumulative Effects Assessment Framework

Tasks typically considered within the basic environmental assessment framework include scoping, analysis, mitigation, significance determination and follow-up (Agency 1999). Following the completion of the effects assessment, the following steps are conducted for the CEA:

- Residual effects of not significant (minor), not significant (moderate) or significant are carried forward as VCs in the CEA;
- Temporal and spatial boundaries are defined;

- Potential future human activities and reasonably foreseeable projects considered in the CEA are identified and described;
- Incremental effects associated with other projects/human activities are identified;
- Significance of residual cumulative effects and likelihood after mitigation are discussed; and
- The level of certainty and any limitations in the CEA are described.

21.10.2.2 Valued Component Selection

The VCs identified in the Environmental Effects Assessment, which were selected for evaluation as required under the AIR, are summarised in Table 21.10-1. The residual effects on each VC are described in the corresponding effects assessment sections (Section 6.0 (biophysical environment) and Sections 7.0 to 10.0 (human environment)).

Table 21.10.2-1: Summary of Valued Components Identified in Effects Assessment

Discipline	Valued Components
Atmospheric Environment	Air Quality
	Climate
	Noise and Vibration
Groundwater	Flow
	Quality
	Recharge and Discharge
	Surface Water Interaction
Hydrology	Lime Creek / Patsy Creek Watershed
	Clary Creek Watershed
Surface Water Quality	Lime Creek Watershed
	Clary Creek Watershed
	Sediment Quality
Freshwater Aquatic Resources	Dolly Varden
	Coho Salmon
	Rainbow Trout
	Benthic Macro Invertebrates
Marine Aquatic Resources	Marine Water Quality
	Marine Biota
Terrain, Surficial Geology and Soils	Physiography and Topography
	Surficial Geology
	Soil Cover
	Soil Quality
Vegetation and Plant Communities	Ecosystem Composition
	Wetland Ecosystems
	Old Forests
	Species at Risk
	Ecological Communities at Risk
	Cultural Plants
Wildlife and Their Habitat	Western Toad
	Olive-sided Flycatcher
	Sooty Grouse
	Northern Goshawk
	American Marten
	Mountain Goat
	Moose
	Grizzly Bear
Environmental Health	Humans

Discipline	Valued Components
	Mammals
	Birds
	Amphibians
	Fish
	Soil Invertebrates
	Terrestrial Plants
	Aquatic Invertebrates
	Aquatic Plants
Economic Health*	Provincial Economy and Government Revenue
	Regional Employment and Income
	Employment Opportunities
	Contract and Business Opportunities
	Labour Income Generated
	Local Unemployment Rates and Trends
	Employment and Economic Diversification
	Labour Force Qualifications
	Regional Government Finances
Social Conditions*	Regional Demographics
	Housing
	Regional Services
	Regional Infrastructure
	Family and Community Wellbeing
	Educational Services
	Transportation
	Land and Resource Use**
Heritage Resources	Archaeological Sites
	Historic Heritage Sites
Health Effects	Public Health
	Visual and Aesthetic Resources
	Healthy Living
	Worker Safety and Health

Notes: * the social and economic effects assessments were completed in the manner of a CEA and are described in detail in Sections 7 and 8.
** Land and Resource Use was further assessed in the CEA several potential linkages with other activities/projects were identified.
CEA - cumulative effects assessment

21.10.2.3 Temporal and Spatial Boundaries

21.10.2.3.1 Temporal Boundaries

Temporal boundaries define the timeframe over which the effects originating from the project development are anticipated to occur (BCEAO 2006). Incremental changes between scenarios can be compared to assess the relative contribution of various actions to overall cumulative effects within the selected study area. In practice, temporal boundaries often first reflect the operational life or phases of the action under review (e.g., exploration, construction, operations, abandonment), and then extend to reflect the life of all actions under progressively greater levels of regional development.

Preliminary temporal boundaries of the proposed Project, which are contingent on permitting, include four primary phases:

1. Construction Phase - estimated 25 month period. Includes:
   - Site clearing and preparation, earthworks such as excavating and site grading;
   - Facilities, such as the mine processing facilities, TMF South Embankment, and water management facilities;
   - Camp complex; and
   - May include the Patsy Creek diversion;
2. Operations Phase - estimated at approximately two months of commissioning, and 15 to 16 years of mining (last two years are milling low grade ore). Routine operations were considered to commence Year 3 (25 months after the Notice to Proceed).
3. Decommissioning and Closure Phase - estimated at 15 to 17 years. Includes a closure period during which the buildings and unneeded infrastructure would be removed and the sites reclaimed. A preliminary decommissioning and closure plan for the mine is presented in Section 3.10 and Appendix 3.0-K. The temporal boundary for the future typically ends when areas disturbed by mining operations return to acceptable end land use and capability.
4. Post-closure Phase - estimated at five years or more. This includes post-closure monitoring until on-site water quality has stabilised and indicates no future adverse effects on local receiving waters. Stabilisation of the WRMF and TMF would also be considered in post-closure monitoring.

For the purpose of the CEA, the following temporal criteria are used to identify actions that may act cumulatively with the Project:

- Past: actions that are abandoned but still may cause effects of concern;
- Existing: currently active actions; and
- Future: actions that may yet occur.

Selected actions that have the potential to overlap with the proposed Project temporally are described in more detail in Section 21.10.3 below.

21.10.2.3.2 Spatial Boundaries

There are no mandated requirements on how far-reaching a CEA should be or what projects and activities should be included in the CEA. The selection is based on the available information and considers factors such as spatial distance between the projects and the ability of a project proponent to reasonably gather information.

Spatial boundaries for the Project were identified using the following criteria outlined in the Mine Proponents Guide (BC EAO 2006):

- The physical extent of the proposed project, including any off-site facilities or activities;
- The extent of potential effects arising from the project;
- The extent of the aquatic and terrestrial ecosystems, economic systems, communities and First Nations interests potentially affected by the proposed Project; and
- The size, nature and location of past, present and reasonably foreseeable projects and activities which could interact with the project's own effects.

Environmental Components

A representative LSA and RSA were established for each environmental component to ensure specific issues were adequately captured. The discipline specific RSAs were used to identify linkages in a specific area for each VC. A representative Cumulative Effects Study Area (CESA) was also established for each VC (described in Section 6.0). CESA varied depending on discipline due to the extent of potential effects arising from the Project and the potential overlap with past, present of future projects. For the CEA, incremental effects were identified for each VC in combination with other projects / human activities using the discipline specific RSA.

The following two transportation routes are also considered within the CEA for relevant VCs:

- From the mine site this transportation route follows the Alice Arm Road where it turns south on to the Nass FSR north of Nass Camp. The route continues through the Nass Camp to New Aiyansh, continuing south to Terrace along Hwy 113. The proponent owns Special Use Permit (SUP) 09228 for the private section of this route and has Road Use Permits for the public sections; and
- The alternate route travels from Alice Arm Road continuing north along the Nass FSR to the Cranberry Connector leading to Cranberry Junction and then south on Hwy 37 to Kitwanga.

Several land use management initiatives were reviewed for the CEA, including:

- Former North Coast LRMP area, which was combined with the Central Coast LRMP in the Coast Land Use Decision of 2006;
- Nass South Sustainable Resource Management Plan; and
- Pacific North Coast Integrated Management Area (PNCIMA).

Social and Economic Components

The proposed Project is located in the central section (Area A) of the Regional District (RD) of Kitimat-Stikine. The communities closest to the mine site include the four Nisga'a Villages, located on Nisga'a Lands - Gitwinksihlkw, Gingolx, Laxgalts'ap and New Aiyansh - as well as the communities located at Kitsault Resort and Alice Arm. These villages, communities and the small rural population on Nisga'a Lands are considered to comprise the LSA, in terms of describing social conditions and assessing social effects.

A regional approach was primarily used for the social and economic assessments because there are no communities near the proposed mine site. The social and economic RSAs, which consist of those communities that are most likely to provide the workers, goods and services needed to construct and operate the mine and / or that will be directly or indirectly affected by mine construction or operation. The boundary of the Social RSA, which was selected to reflect the statistical reporting units used by Statistics Canada and the Government of BC, is defined to include four distinct regions and major communities:

- District Municipality (DM) of Stewart (located in Area A of the Kitimat-Stikine Regional District Electoral Area (RDEA));
- Kitimat-Stikine RDEA Area B, including the Village of Hazelton, DM of New Hazelton and numerous reserves: Gitanmaax 1, Gitsegukla 1, Sik-e-dakh 2, Kispiox 1, Hagwilget 1, Gitwangak 1, Gitanyow 1, Moricetown 1, Bulkley River 19 and Coryatsaqua (Moricetown) 2;
- Town of Smithers; and
- Terrace Census Agglomeration (CA), which includes the City of Terrace, the rural populations of Kitimat-Stikine RDEA Area C (Part 1) and RDEA E, and four reserves: Kitsumkaylum 1, Kitselas 1, Kshish 4, and Kulspai 6.

These groupings were selected to reflect Statistics Canada census subdivisions and areas that might be called upon to provide the labour, goods, and services required for mine construction and operations. A detailed description of the spatial boundary selection is provided in Section 7, Potential Economic Effects.

The spatial boundaries for assessing proposed Project effects on the provincial economy and government revenues are the boundaries of the Province of BC.

21.10.2.4 Determination of Incremental Effects

Cumulative effects may result from actions that, when viewed individually, are not considered as a source of significant effects, but which are significant when added to other

actions (Council on Environmental Quality (CEQ) 1997). Cumulative effects can result from multiple pathways and be manifested on both biophysical and socio-economic resources (Canter 1999). Descriptions of future / foreseeable human activities are provided in Section 21.10.3. The project residual effects carried forward following the review of specific project details, including spatial and temporal overlap between disciplines and current land use activities, are then compared with future / foreseeable human activities within the CESA to identify incremental effects. Note that the detailed environmental, social and economics cumulative effects assessments are presented in Sections 6, 7 and 8, respectively.

21.10.2.5 Cumulative Effects Assessment Significance Rating

Determining the significance of residual effects (i.e., effects after mitigation) is usually considered the most important task when conducting an environmental assessment. The determination of significance is often more complex for cumulative effects than it is for individual disciplines because of the broader nature of what is being examined. For cumulative effects, the approach requires determining how much further effects can be sustained by a VC before undergoing changes in condition or state that cannot be reversed with mitigation or management.

The establishment of thresholds, in some form which the results of the CEA can be compared, facilitate assessment. Thresholds can be value-based, ecological, physical, economic, or socio-economic. In Canada, there is often little empirical data available to support the use of thresholds on a broader or regional scale (National Energy Board (NEB) 2011). Anthropogenic and natural contributions are also often difficult to separate. Thresholds or regional objectives are not available for most of the VCs. Where established thresholds are not available, professional judgement is used to provide a qualitative classification based on a weight of evidence approach. For this CEA, significance rating criteria were developed to rate potential incremental cumulative effects. The approach is based on the magnitude, spatial extent, and duration of expected change in the VC as a result of the project. Four categories are established for rating significance of cumulative effects:

1. Not significant (negligible);
2. Not significant (minor);
3. Not significant (moderate); and
4. Significant.

Significance for VCs is based on magnitude, spatial extent and duration, and if effects on VCs are rated as not significant (minor), not significant (moderate) or significant the frequency, reversibility, ecological context, direction and certainty are used to fully assess significance. For human health effects, significance is based on magnitude, duration, and population context.

21.10.3 Other Projects and Human Activities

The selection of other projects and human activities to be considered in the CEA include those which overlap either spatially or temporally with the proposed Project that may cause changes to the biophysical or social economic environment in combination with the proposed Project, including:

- Historical land use and projects/activities;
- Existing / active projects;
- General land use activities; and
- Reasonably foreseeable future projects.

Historical projects / activities and existing projects were identified during a detailed desktop review of available literature. The description of general land use was summarised from the Land and Resource Baseline Report (Appendix 8.0-B). A preliminary list of future and reasonably foreseeable future projects was generated from the December 2010 Major Projects Inventory (BC Ministry of Finance 2011). Table 21.10.3-1 summarises the projects and human activities included in the CEA and the associated rationale. Table 21.10.3-2 below summarises the project and human activities that were not carried forward in the CEA based on the rationale provided.

Table 21.10.3-1: Projects and Human Activities Carried Forward Into the Cumulative Effects Assessment

Land Use RSA	CEA RSA	Land Use Type	Project	Status	Developer	Description	Spatial Overlap with Proposed Project	Temporal Overlap with Proposed Project	Include in CEA
No	No	Mining	KSM Mine Project	Pre-application	Seabridge Gold	The KSM Copper / Gold Mine Project, which is located approximately 200 km north-northeast of the proposed Project, is also in the pre-application stage under the *BCEAA.* If the project proceeds, it is assumed that ground access to the mine site would be via Hwys 16, 37 and 37A and a local access road. However, at present, no information about project construction and operations schedules or transportation plans and traffic volume is publicly available. Following a review of the available information, there is the potential for overlaps temporally and spatially with the Project. The KSM mine project has been included in the CEA, primarily focussing on potential cumulative effects on traffic along the transportation route.	No	Potentially	Yes
No	Yes	Energy	NTL	Approved	BC Transmission Corp.	Consists of a new 335-km, 287-kV transmission line between the Skeena Substation at Terrace and Bob Quinn Lake, predominantly following the Hwy 37 corridor. The NTL Project would also consist of an upgrade to the existing Skeena Substation and a new substation at Bob Quinn Lake. Temporary infrastructure to support constructing the transmission line consists of construction camps and equipment laydown or staging areas, some access roads, trails, and stream crossings.	Yes	Yes	Yes
No	Yes	Mining	Operating mines	Historical / current	Historical: Granby Consolidated Mining, Smelting and Power Co. Current: Tru-Grit Abrasives Inc.	The Anyox Slag Heap is listed as an active producer located at Anyox at the mouth of Granby Bay (more than 20 km west of the proposed Project) working under a quarry permit to mine slag silica. The slag pile at the Anyox Smelter was originally a single massive sloping slab of glass which resulted from the historical (1914 - 1935) smelting of the Hidden Creek (Anyox) copper deposit. The quarrying permit at the Anyox Slag Heap was first issued to Tru-Grit Abrasives in July 1990. Primary production season was over the summer months, but extended well into the spring and fall. The quarry was still active in 1998. The BC Geological Survey gives a conservative estimate of 20 Mt. It is not known the extent of mining activity associated with this mine but the area has been mined in the past and is recognised as a contaminated site.	Potentially	Yes	Yes fisheries section only (Section 6.7)
Yes	Yes	Mining	Operating mines	Historical	Various	**Kitsault Mine** - Operated from 1967 - 1972 and 1981 - 1982 **Illy Mine** - Operated from 1919 - 1923. High grade silver-lead-zinc mine located along the west bank of the Illiance River, approximately 16 km northeast of Alice Arm. **Macy Mine** - Operated from 1916 - 1920. Silica mine located less than 10 km south of Alice Arm. **Esperanza Mine** - Operated from 1911 - 1948. High grade silver ore with associated gold, copper and lead located approximately 1 km north of Alice Arm. **Wolf Mine** - Operated sporadically from 1925 - 1953. High grade gold-silver-copper-lead-zinc located approximately 400 m north-northwest of the centre of Alice Arm **Tidewater Mine** - Operated from 1916 - 1931. Molybdenum, silver, gold, lead, zinc, copper mine located approximately 3 km east of Alice Arm	Yes	No	Yes

Land Use RSA	CEA RSA	Land Use Type	Project	Status	Developer	Description	Spatial Overlap with Proposed Project	Temporal Overlap with Proposed Project	Include in CEA
No	Yes	Mining	Operating mines	Historical	Various	From a cumulative effects perspective, historical mines operating north of Alice Arm, with access provided by the Alice Arm Road were included in the assessment. These included: **La Rose** - Located on the east flank of Tsimstol Mountain west of the Kitsault River, approximately 9.75 km north-northwest of Alice Arm. A few small shipments of high grade ore were made from this deposit between 1918 and 1927. **Dolly Varden** - Located approximately 0.3 km west of the Kitsault River, 22.5 km north of Alice Arm. The mine produced high-grade silver ore periodically between 1919 and 1940. One glory hole, is located 300 m west of the Kitsault River, 22.5 km north of Alice Arm. **North Star** - Adit portal is located on the west bank of the Kitsault River, 23 km north of the town of Alice Arm. Between 1919 and 1921, a small tonnage of silver ore was mined from this deposit. **Torbrit** - The mine was located on the east bank of the Kitsault River, approximately 23.5 km north of the town of Alice Arm. Between 1949 and 1959 Torbrit Silver Mines Ltd. produced 1,249,942 tonnes of ore containing silver, lead, zinc and gold.	Yes	No	Yes
Yes	Yes	Mining	Exploration	Historical / potential prospect	Various	**Keystone** - Explored various times between 1916 - 1968. Located about 8.0 km south of Alice Arm in the valley of Roundy Creek. **Alice** - Explored in 1920s and 1930s. Located north of the Esperanza Mine approximately 1.75 km north northwest of Alice Arm. **Silver Cord** - Explored from 1919 - 1967. Located on the Dak River, approximately 8.5 km northeast of Alice Arm. **San Diego** - Explored from 1965 - 2003. Located approximately 5 km north of Alice Arm. **Roundy Creek** - Located about 6.0 km south of Alice Arm. Exploration ongoing. **Bell Moly** - Located about 10 km east of Alice Arm. Exploration ongoing.	Yes	Potentially	Yes
No	Yes	Mining	Exploration	Historical / potential prospect	Various	From a cumulative effects perspective, historical exploration activities and potential prospects north of Alice Arm, with access provided by the Alice Arm Road were included in the assessment. These include: **Tiger** - The Tiger vein occurs 0.4 km east of the Kitsault River, 24 km due north of the town of Alice Arm. This prospect has been extensively explored since 1916 for silver. **Kitsol** - Located on the west bank of the Kitsault River, 24 km north of Alice Arm. The South Musketeer (103P 019), probably an extension of the Kitsol, lies just across the river on the east bank. The Kitsol prospect was extensively explored by Dolly Varden Mines in the early 1970s. **Wolf** - The Wolf occurrence is located on the east side of the Kitsault River, 25.5 km north of the town of Alice Arm. Extensive diamond drilling and underground development between 1960 and 1980 by various operators has defined moderate sized reserves of low grade silver-lead-zinc ore. **Moose-Climax** - The Moose-Climax occurrence is situated 0.5 km east of the Kitsault River, 26.5 km north of the town of Alice Arm. This vein has been extensively explored since 1916 for its silver-lead-zinc mineralisation. **Victory** - Adit portal, 1.25 km east of Kitsault River, 27.5 km north of the town of Alice Arm. Drilling between 1963 and 1975 has outlined moderate sized reserves of ore for this silver-bearing vein. **Robin** - Located along Blue Bird Creek in the Upper Kitsault Valley, 28.5 km north of the town of Alice Arm. Zones containing argentiferous galena have been extensively explored by trenching and diamond drilling since 1918. **Vangaurd Copper** - Located 500 m southwest of Homestake Creek in the Upper Kitsault Valley, about 29 km north of Alice Arm. A zone of copper mineralisation has been extensively investigated, since 1916, by trenching and tunnelling. **Sault** - Located just south of Kitsault Lake, approximately 30.5 km north of Alice Arm. This zinc showing has been extensively investigated since its discovery in 1966.	Yes	Potentially	Yes

Land Use RSA	CEA RSA	Land Use Type	Project	Status	Developer	Description	Spatial Overlap with Proposed Project	Temporal Overlap with Proposed Project	Include in CEA
No	Yes	Mining	Exploration	Current	Various	Mining exploration activities are ongoing and a number of private claims are surrounded by the proponent's Kitsault mineral tenure area. Several exploration projects were referenced as "major" by the 2008 and / or 2011 Exploration and Mining in British Columbia reports produced by the BC Ministry of Forests, Mines and Lands. **Big Bulk** - Located 22 km northeast of Alice Arm, the occurrence is situated on the southeast shore of Kinskuch Lake. The area has been explored extensively since 1938 for copper and gold. **Clone** - Located approximately 16 km west of Stewart. **Homestake Ridge** - Homestake prospect is located 1.5 km west of Homestake Creek in the Upper Kitsault Valley, 32 km north of Alice Arm. The prospect has been extensively explored since 1916.	Yes	Potentially	Yes
Yes	Yes	Natural resource use	Trapping	Ongoing		Project is located entirely within one trap line. Ten other trap lines fall within the regional study area.	Yes	Yes	Yes
Yes	Yes	Natural resource use	Guide Outfitting	Ongoing		Project is located entirely within one guide outfitter area.	Yes	Yes	Yes
Yes	Yes	Community		Ongoing		**Kitsault Townsite** - Kitsault was built in 1978 to support the molybdenum mining operation of Phelps Dodge, a US-based mining company. People began to inhabit the town in 1980. The mine closed in 1982 and Kitsault became a ghost town. Mr. Krishnan Suthanthiran purchased Kitsault in 2005 and created Kitsault Resorts Ltd. The townsite has been primarily vacant since 1983. Available information indicates that a maintanence crew of less than 10 occupies the townsite during the winter months. In the summer months, when the roads are open, the maintanence staff work 10 on and 4 off. Specific information related to future development plans is limited and schedule is dependent on acquiring required permits. **Alice Arm** - Booming mining town in the 1920s and 1930s until the nearby silver mine shut down. In the late 1960s, workers commuted by boat from Alice Arm to work the neighbouring mines.	Yes	Yes	Yes
No	Yes	Community		Ongoing		Cumulative effects in relation to communities will be limited to transportation associated with construction and routine operations of the proposed Project: **Stewart** - Located approximately 315 km north of Terrace with a population of approximately 500. **Meziadin Junction** - Located 156 km north of Kitwanga (Gitwangak) and 65 km east of Stewart at the junction of Hwy 37A. A small population supports a gas station and a grocery store and restaurant. **Cranberry Junction** - Located approximately 150 km north of Terrace at the junction of Hwy 37 (Stewart-Cassiar Hwy) and Hwy 113 (Nisga'a Hwy). **Nass Camp** - Nass Camp, which used to provide lodging for the various loggers that logged the Nass Valley through the years, is located 125 km north of Terrace along Hwy 113 (Nisga'a Hwy). Nass Camp now has a lodging facility called the Bil-Nor Tillicum Lodge. **New Aiyansh** - The community in which the NLG is headquartered, is located approximately 97 km northwest of Terrace, and on the eastern side of the Nisga'a Memorial Lava Bed Park. Its population is approximately 1,800 people. **Gitwinksihlkw** - Located 100 km northwest of Terrace and has a population of approximately 390. **Laxgalts'ap** - This village is 29 km from the Nass River mouth with a population of approximately 1,700. **Gingolx** - Located at the mouth of the Nass River with a population of approximately 1,900.	Potentially	Yes	Yes
Yes	Yes	Transportation	Site access / local access	Ongoing		Alice Arm Road, an existing gravel road which provides site access from Nass FSR, is the main road located within the land use RSA. A branch off the Alice Arm Road before Clary Lake will be constructed that leads directly to the Kitsault mine site.	Yes	Yes	Yes

Land Use RSA	CEA RSA	Land Use Type	Project	Status	Developer	Description	Spatial Overlap with Proposed Project	Temporal Overlap with Proposed Project	Include in CEA
No	Yes	Transportation	Regional access	Ongoing		The Kitsault mine site is accessed along Hwy 113, Nass FSR north of Nass Camp, and also via Hwy 37 north of Kitwanga to Cranberry Junction and southwest along the Nass FSR. Hwy 113 and Hwy 37 are used by local residents and tourists as well as commercial / industrial traffic associated with activities such as exploration. There are also several FSRs that may be used by traffic and local / industrial or tourism traffic associated with the proposed Project. Hwy 113 (the Nisga'a Hwy) links the Nisga'a Nation lands and the four villages (Gingolx, GitwinksihIkw, Laxgalts'ap and New Aiyansh) to Terrace where it intersects Hwy 16. An alternate road access to and from Nisga'a lands to Terrace or Smithers is via the Nass FSR, an all weather gravel surfaced road that runs east from New Aiyansh to Hwy 37 at Cranberry Junction and then south to Hwy 16 at Kitwanga.	Yes	Yes	Yes
No	No	Mining	Snowfield Gold Project	Exploration Not in formal assessment process	Pretium Resources Inc.	In May 2011, Pretium announced the signing of a Mutual Confidentiality and Cooperation Agreement and a Mutual Access Agreement with Seabridge Gold Inc., whose KSM Project shares a common boundary with Snowfield. The Mutual Confidentiality and Cooperation Agreement provides for, amongst other things, the completion of an engineering study examining the economics of combining Pretium's Snowfield project and Seabridge's KSM Project into one operation. The study is expected to be completed in the fourth quarter of 2011.	No	Unknown	Yes economic section only (Section 7.0)

Note: *BCEAA* - British Columbia *Environmental Assessment Act;* CEA - cumulative effects assessment; FSR - Forest Service Road; Hwy - Highway; km - kilometre; KSM - Kerr-Sulphurets-Mitchell Copper / Gold Mine Project; kV - kilovolt; Mt - million tonnes; NLG - Nisga'a Lisims Government; NTL - Northwest Transmission Line; US - United States; RSA - Regional Study Area

Table 21.10.3-2: Projects and Human Activities not Carried Forward Into the Cumulative Effects Assessment

Land Use RSA	CEA RSA	Land Use Type	Project	Status	Developer	Description	Spatial overlap with Proposed Project	Temporal overlap with Proposed Project	Include in CEA
No	Yes	Energy	Jade Lake Power Project	Proposed	Syntaris Power Corp., formerly Max Pacific Power Inc.	Proposed 120 MW Jade power cluster will have 4 intakes: Kinskuch River, Jade River, ZZ-4 Creek and Tchitin River located above Kinskuch lake 27 km east of Stewart. Available information (http://pierremarchildon.com/wp-content/uploads/2010/12/Syntaris-Power-Point-FT-October-2010.pdf) indicates that a standing offer program application will be submitted in 2014 and a BC Hydro Energy Purchase Agreement award is expected Sept 2014. Potential facility operation is indicated as July 2016. Specific project information is limited and schedule is dependant on electricity purchase agreement being approved by BC Hydro and acquiring required permits in the future.	Yes	Unknown	No
No	Yes	Energy	Kinskuch Hydro Project	Proposed Pre-application stage under *BCEAA*	Enmax Syntaris Bid Corporation	Proposed 80 MW hydroelectric project located on Kinskuch Lake. Project will include a 39 km 138 kV transmission line along Hwy 37. The project was not accepted into the Clean Call for Power in May 2010. Syntaris Power Corp. announced that it will continue to advance development of its Kinskuch Hydro Project (http://syntarispower.com/2010/05/news-release/). The project is in pre-application under the *BCEAA*. BC EAO website last checked March 2011. An Order under section 13 was signed August 31, 2009 amending the section 11 Order (http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_project_doc_index_339.html) Specific project information is limited and schedule is dependant on electricity purchase agreement being approved by BC Hydro and acquiring required permits in the future.	Yes	Unknown	No
No	No	Energy	Long Lake Power Project	Proposed	Long Lake Joint Venture with Premier Power Corporation	Proposed 16 MW Long Lake power project near Stewart was awarded a BC Hydro electricy purchase agreement under the 2010 Clean Power Call in August 2010. Specifics regarding how equipment will be transported to site during construction and routine maintanence was not provided, therefore it is unknown whether or not there will be a spatial overlap with the proposed Project. The Long Lake Power Project will supply an excess of 130 GWh/year to BC Hydro. The Long Lake reservoir will be redeveloped and will feed into a 7.2 km long penstock, which will convey flows to a powerhouse and turbines configured to optimise firm generation throughout the year. The balance of the on-site project facilities will use existing service roads and local infrastructure. It is expected that the development of Long Lake Hydro Project will improve the water quality of the Cascade Creek and Salmon River by providing more flows during the critical winter months to dilute effluents from the past mining operations in the area. Specific project information is limited and schedule is dependant on acquiring required permits in the future.	Potentially	Unknown	No
No	Yes	Mining	Swamp Point Aggregate Project	Permitted - on hold since 2006 due to fall in US housing market	Ascot Resources	Aggregate mine and ship loading facility 50 km south of Stewart and includes land on the east side of the Portland canal. The production capacity is 3.3 Mt per year with a lifespan of a minimum of 18 years. Received BC EAO approval. There is no spatial linkage with the proposed Project as the Swamp Point site is a remote location, with access by boat, helicopter, or float plane. There is no site access by road, and none is planned (Environmental Assessment Certificate Application, Ascot Resources Ltd. 2005). Not included in CEA as the BC EAO approval for this project is over 5 years and there is no indication of when this project may proceed.	No	Potentially	No
No	Yes	Mining	Bear River Aggregate Project	Last activity on BC EAO e-PIC website is an Order under section 11 of the Environmental Assessment Act signed by Kim Cholette (BC EAO) dated February 21, 2006	Glacier Aggregates Inc.	Proposed aggregate mine near Stewart with a capacity of 2 Mt in the first year and 3.8 Mt for 5 years. The project is in pre-application under the *BCEAA* (last posting February 2006). BC EAO website last checked March 2011. Not included in the CEA as there is not enough information to consider this project in the foreseeable future.	No	Unknown	No
No	Yes	Energy	Anyox Creek Hydro	Proposed	Sprott Power Corp.	The Anyox Creek hydro project is designed as a 30 MW hydroelectric plant located just above Granby Bay in BC. The project will require refurbishing of an existing concrete arch dam, reservoir and related infrastructure along with a new pressure tunnel, penstock, powerhouse, transformer station and transmission facilities. The resulting facility is expected to have sufficient storage capacity to provide 18 days of full production with no net inflows. A conditional water license was issued in 2003 with a leave to construct issued on February 6, 2006.	No	Unknown	No
No	Yes	Energy	Anyox Hydro Generation Project - Anyox - Kitsault - Homestake	No longer a project	Confederation Power Inc. - projects are no longer linked	The IPP facility will consist of two 16.7 MVA synchronous units in Anyox, two 7.7 MVA units in Homestake, one 7.7 MVA unit in Kitsault and one 6.1 MVA unit at Trout Creek. (BC Hydro, 2006). The total nameplate capacity is 63 MVA. The IPP's facility collectively referred to as Anyox, will connect to the Transmission System at Kitsault Substation.	No	No	No
No	Yes	Energy	Alice Arm Hydropower	No longer a project	Confederation Power Inc. (now	The proposed 30 MW Alice Arm Project cluster projects (Gwunya Creek [10 MW], Perry Creek [10 MW] and Upper Illiance River [10 MW]) did not receive a BC Hydro Contract in 2010 under the Clean Power Call. Confederation Power	No	No	No

Land Use RSA	CEA RSA	Land Use Type	Project	Status	Developer	Description	Spatial overlap with Proposed Project	Temporal overlap with Proposed Project	Include in CEA
			Projects		Sprott Power Corp.)	(owned by First Asset PowerGen Fund) merged with Sprott Power Corp in January 2011.			
No	Yes	Energy	Upper Kitsault Valley Hydropower Projects	No longer a project	Confederation Power Inc. (now Sprott Power Corp.)	Seven proposed projects with penstock, powerhouse and interconnection lines include: Evindsen Creek, Falls Creek, Klayduc, LaRose, Lyall Creek, Stark Creek and Trout Creek. These projects did not receive a BC Hydro Contract in 2010 under the Clean Power Call. No construction has started but hydrology monitoring is ongoing.	No	No	No
No	Yes	Energy	Kitsault River and Homestake Creek Hydro Project	No longer a project	Kitsault Hydroelectric Corporation, part of Confederation Power Corp.	14.5 MW hydro facility on the Kitsault river and Homestake Creek. Construction of the 30 km access road is complete (Website: www.anyox.com). Unknown whether construction camp was installed but available information indicates that tunneling has not occurred. The power purchase agreement, signed with Powerex in October 2005, has been cancelled.	No	No	No
No	No	Mining	Davidson Molybdenum Mine	Application is under review by BC EAO	Blue Pearl Mining - a subsidiary of Thompson Creek Metals	The project Application was submitted to the BC EAO in September 2008. Comments from various provincial, federal and local regulators as well as stakeholders and the general public have been posted to the BC EAO website up to February 2010. Available information indicates that the project is on hold and the future status of the project is unknown.	No	Unknown	No
No	No	Mining	Mount Klappan Coal Mine	Pre-application stage under *BCEAA*	Fortune Minerals Ltd.	The pre-application stage of the BC environmental assessment process was commenced in October 2004 when Fortune Minerals Ltd. submitted their project description. Fortune Minerals put a hold on the environmental assessment process in June 2008 while they entered into a formal process to attract a suitable partner. Available information indicates that in July 2011 Fortune Minerals entered into a definitive agreement to form a joint venture (the "JV") with POSCO Canada Ltd. ("POSCAN") and its wholly-owned subsidiary, POSCO Klappan Coal Ltd., to advance the project to production. POSCAN's parent company, POSCO is based in South Korea and is one of the world's largest steel producers. The status of this project is unknown.	No	Unknown	No
No	No	Mining	Mount Klappan Coal Slurry Pipeline	Feasibility being evaluated	Fortune Minerals Ltd.	Information from the BC Major Projects Inventory indicates that studies are being conducted to assess the feasibility of a coal slurry pipeline from the Mount Klappan coal mine site to the port of Stewart or Prince Rupert. The status of these studies is not know at this time.	No	Unknown	No

Note: BC - British Columbia; *BCEAA* - British Columbia *Environmental Assessment Act;* BC EAO - British Columbia Environmental Assessment Office; CEA - cumulative effects assessment; e-PIC - Electronic Project Information Centre; GWh/year - gigawatt hours per year; Hwy - Highway; IPP - Independent Power Producers; km - kilometre; MW - megawatt; Mt - million tonnes; MVA - megavolt-ampere; RSA - Regional Study Area; US - United States

21.10.3.1 Historical Land Use and Projects / Activities

21.10.3.1.1 Aboriginal Context

From a historical perspective the Nisga'a people and five other Aboriginal groups occupied the area to varying extents at first contact and continue to live in the CESA.

Until first contact in 1793, the Nisga'a people lived in a thriving society and continue to inhabit and use the area in and around the Nass River as they have for thousands of years. The lives of Nisga'a people are closely tied to the land and its resources in the Nass Valley and beyond. Traditional activities followed the seasons and Nisga'a people fish, trap, and hunt a wide variety of marine and terrestrial species, and use of aquatic and terrestrial plants. Salmon and oolichan also are central to Nisga'a history, economy, and way of life. Trade has played an important role since before Euro-Canadian colonial systems were imposed upon the Nisga'a in the 19th century, which did not recognise Nisga'a rights or Nisga'as matrilineal system.

Since 2000 and the signing of the NFA, a tripartite, constitutionally-binding agreement between the Nisga'a Nation, BC, and Canada, the Nisga'a Nation has been self-governing. Nisga'a governance and administration is provided by Nisga'a Lisims Government (NLG) and the Nisga'a Village governments. NLG has law-making authority and jurisdiction over Nisga'a Lands. A number of Nisga'a laws, objectives, policies, and regulations have been enacted in the areas of forestry, fisheries, wildlife, and lands. NLG also co-manages fishery and wildlife resources in collaboration and coordination with the province and federal governments via the Nass Wildlife Committee and the Joint Fisheries Management Committee (JFMC) Temporal Boundaries. The proposed Project footprint and transportation route falls within the Nass Wildlife Area (NWA).

The proposed Project is approximately 5 km southeast of Category A lands (i.e., *Gits'oohl*, former Gitzault Indian Reserve No. 24). Adjacent to these lands held in fee simple by the Nisga'a Nation, there is Nisga'a commercial recreation tenure with use and activity described in the "Nisga'a Commercial Recreation Tenure Management Plan" (1998). The tenure term is 27 years until 2027.

In addition to the Nisga'a Nation, five Aboriginal groups that have been identified as being potentially affected by the proposed Project's site and / or transportation route, include:

- Metlakatla First Nation;
- Kitsumkalum First Nation;
- Kitselas First Nation;
- Gitxsan Chiefs; and
- Gitanyow Hereditary Chiefs Office (GHCO) (including wilp Luuxhon; wilp Wiitaxhayetwx-Sidok; wilp Gwass Hlaam; wilp Gwinuu; and wilp Gamlaxyeltxw).

The Metlakatla asserted territory overlaps with the proposed Project site, and the most westerly portions of the proposed transportation route option. The transportation route for the proposed Project intersects with approximately 71 km of the northeast portion of the Kitsumkalum's asserted territory. Approximately 56 km of the proposed Project's transportation route passes through the northwest corner of the Kitselas asserted territory. Gitxsan territory overlaps with 64 km of the proposed Project's transportation route. The proposed Project transportation route overlaps with 109 km of Gitanyow territory. Three Gitanyow reserves, including Gitanyow 1, Gitanyow 2, and Gitanyow 3A, are located along the Kitwanga River, which parallels Hwy 37.

Hunting for wildlife species such as moose, deer, grizzly bear, black bear, mountain goat, snowshoe hare, red squirrel, and game birds were / are of great importance for subsistence and cultural practices of the First Nations. Fishing for species such as sockeye, pink, coho, chum, and Chinook salmon, steelhead, rainbow trout, Dolly Varden, and cutthroat trout was / is also important for subsistence, economic, and cultural purposes. Berry picking, medicinal plant gathering, and bark collecting were also common activities. Tourism based activities are also being explored and implemented. The First Nations in the area have participated extensively in a variety of provincial land use planning processes including: participating in resource management planning; management of old growth areas; and recommending management objectives for Traditional Resource Use Areas.

21.10.3.1.2 Post Contact Land Use

The region has a history of mining and mineral exploration activities. The village of Alice Arm was home to miners during the silver boom in the early part of the 20th century. The village of Kitsault was established to serve the Kitsault Mine. Table 21.10.3-3 lists historical mining and exploration activities proximate to the Project.

Table 21.10.3-3: Historical Mining and Exploration Activities in the Kitsault Region

Project	Description
Operating Mines	Kitsault Mine - Operated from 1967 - 1972 and 1981 - 1982 Illy Mine - Operated from 1919 - 1923. High grade silver-lead-zinc mine located along the west bank of the Illiance River, located ~16 km northeast of Alice Arm Macy Mine - Operated from 1916 - 1920. Silica mine located less than 10 km south of Alice Arm Esperanza Mine - Operated from 1911 - 1948. High grade silver ore with associated gold, copper and lead located ~1 km north of Alice Arm Wolf Mine - Operated sporadically from 1925 - 1953. High grade gold-silver-copper-lead-zinc located ~400 m north-northwest of the centre of Alice Arm Tidewater Mine - Operated from 1916 - 1931. Molybdenum, silver, gold, lead, zinc, copper mine located ~3 km east of Alice Arm La Rose - Located on the east flank of Tsimstol Mountain west of the Kitsault River, ~9.75 km north-northwest of Alice Arm. A few small shipments of high grade ore were made from this deposit between 1918 and 1927 Dolly Varden - Located ~0.3 km west of the Kitsault River, 22.5 km north of Alice Arm. The mine produced high-grade silver ore periodically between 1919 and 1940. One glory hole, is located 300 m west of the Kitsault River, 22.5 km north of

Project	Description
	Alice Arm North Star - Adit portal is located on the west bank of the Kitsault River, 23 km north of the town of Alice Arm. Between 1919 and 1921, a small tonnage of silver ore was mined from this deposit Torbrit - The mine was located on the east bank of the Kitsault River, ~23.5 km north of the town of Alice Arm. Between 1949 and 1959, Torbrit Silver Mines Ltd. produced 1,249,942 tonnes of ore containing silver, lead, zinc and gold
Exploration	Keystone - Explored various times between 1916 - 1968. Located ~8.0 km south of Alice Arm in the valley of Roundy Creek. Alice - Explored in 1920s and 1930s. Located north of the Esperanza Mine ~1.75 km north northwest of Alice Arm. Silver Cord - Explored from 1919 - 1967. Located on the Dak River, ~8.5 kilometres northeast of Alice Arm. San Diego - Explored from 1965 - 2003. Located ~5 km north of Alice Arm.

Note: km - kilometres; m - metre

Other than the historical Kitsault Mine, none of the above-listed overlap temporally or spatially with the proposed Project; all mining operations were small scale except the historic Kitsault Mine and none were located in the watersheds that may potentially be affected by the proposed Project, except the Kitsault and Illy mines. Exploration activities occurred in the early- to mid-20th century, except San Diego, and none were in the same watersheds as the Kitsault Mine.

BC Molybdenum Corporation (BC Moly), a subsidiary of Kennco Explorations Ltd. (Kennco) owned the Kitsault Mine from 1963 to 1972. Mine and processing facilities were constructed and open pit mining commenced in January 1968 and continued to April 1972, when low molybdenum prices forced closure. During that period, approximately 9.3 Mt of ore was produced, with approximately 22.9 million pounds of molybdenum recovered. Climax Molybdenum Corporation (Climax) purchased the deposit from Kennco in 1973 and reserve estimates were expanded following additional drilling.

Amax of Canada Ltd. (Amax), an affiliate of Climax, obtained the property title in 1979, constructed the Kitsault Townsite and recommenced production in April 1981. An access road was constructed to access the property and transport goods and personnel to and from the site. A transmission line was also constructed to supply the mine with electricity power. Approximately 4.08 Mt of ore and stockpile material were processed and 8.99 million pounds of saleable molybdenum were recovered. Direct submarine discharge of tailings to Alice Arm occurred (permitted by both the federal and provincial governments and regulated through the Alice Arm Tailings Deposit Regulations under the federal Fisheries Act and BC Pollution Control Permit No. PE-4335). Due to low metal prices, production was suspended in November 1982.

The Kitsault Townsite was maintained after mine closure in 1982 under a joint management agreement and mine reclamation commenced in 1996. Kitsault Resorts Ltd., a third party, purchased the Kitsault Townsite in 2006.

The former Kitsault mine is a permitted brownfield site with considerable past mining activity and basic infrastructure in place. It is not an abandoned mine because a Mines Act Permit is in place, and there are outstanding reclamation obligations. Permit M-10, an "Amended Permit Approving Reclamation Program," supports reclamation activities associated with the former Kitsault mine. The historical Kitsault Mine has been under care and maintenance since 1995. In February 1996, planning and implementation of the reclamation plan for the Kitsault mine site commenced. At the same time, demolition and salvaging of the buildings and equipment at the mine site was initiated and hazardous materials and waste was removed from the site.

A "Kitsault Mine Reclamation Work Plan" in February of 1997, which was then submitted to the BC Ministry of Energy and Mines (BC MEM). The scope of the 1997 work plan focused on re-sloping of the waste rock dumps, placement of growth medium, and the re-vegetation program. The plan also looked at control measures for any significant chemical instability. The key considerations of the 1997 reclamation work plan included the protection from contamination of the fish-bearing reaches of Lime Creek below a natural migration barrier located 2.7 km upstream from the mouth of the creek, and restoring the site to wilderness forest environment but with a balanced requirement of providing future access to the mineral resource. On the basis of the above considerations, the following specific objectives for the work plan were formulated:

- Ensure long-term physical stability of watercourses, rock piles, and pit walls with minimal maintenance;
- Substantially return the site to wilderness forest environment, while retaining access for future exploitation of the mineral resource; and
- Control significant chemical instability, where it is currently evident, and provide contingency measures for chemical instability elsewhere, should it occur.

A vegetation monitoring program is carried out annually as a requirement for amended Permit M-10.

No other historical industrial projects or activities have occurred that overlap with the Project.

21.10.3.2 Existing/Active Projects

There are no large scale industrial projects that overlap with the proposed Project.

The Anyox Slag Heap is listed as an active producer located at the mouth of Granby Bay (more than 20 km west of the Project) working under a quarry permit to mine slag silica. The old slag pile that sits on the beach at Anyox is being recycled by True-Grit Abrasives, which has been in operation since 1990. The slag, which was the waste product of the historical (1914 - 1935) smelting operation of the Hidden Creek (Anyox) copper deposit (Minfile 2011; Sherlock 2008), consists of sheeted layers of silica. Sixty years of weathering devitrified this material into sharply angular coarse to fine glass splinters, making it an excellent abrasive for sand-blasting. This abrasive is used for the regularly scheduled stripping and repainting of the special sonar-absorbing coating applied to the hulls of the U.S nuclear submarine fleet stationed in Puget Sound. Primary production season was over the summer months, but extended well into the spring and fall. The quarry was still active in 1998 and the B.C. Geological Survey gives a conservative estimate of 20 Mt (Minfile 2011). It is not known the extent of mining activity associated with this mine but the area has been mined in the past and is recognised as being historically contaminated area (DFO 2007).

The Social RSA includes all existing projects, businesses and activities that generate economic activity in the region and affect community well-being, but does not consider their individual effects. The Social RSA includes large industrial operations as well as government offices and services (e.g., health care), education facilities, retail trade, and the services industries. The baseline information presented in Sections 7.2.3.3 and 8.2.2.3 reflects changes from 2006 to 2009 in regional economic activity and the related demographic indicators. For future employment, income, and population in the region, conditions would be influenced by other major projects that would be competing for labour, goods, and services. A list of major projects, published by the BC Ministry of Finance (December 2010), and a summary of major projects in the study area that have been proposed, are on hold, and have started is provided in Table 7.2.3-6. The table shows major projects located near Alice Arm, Iskut, Smithers, Stewart, and Terrace. By examining project effects in the context of other regional development that is expected to occur in the near future, the assessment of social and economic effects is inherently a CEA. The economic effects and social assessments are provided in Section 7 and Section 8, respectively.

The Major Projects Inventory used for this CEA, provided by the BC Ministry of Finance, contains summary information on major projects in the Province of BC that are over $15 million (Canadian) capital cost. Information sources used to generate the Major Projects Inventory include print and electronic media, developers, architects, general contractors, and government agencies (provincial, regional, municipal) as well as occasional site visits (BC Ministry of Finance December 2010). Projects that are under consideration or proposed to be funded by the provincial government may be listed where there is public information about such projects. The description may indicate the status of provincial funding applications, if it is known. The social and economic assessments (Section 7 and Section 8) utilise all of the projects located within the relevant study areas referenced in the Major

Project Inventory. The CEA (when required) conducted for the other EA sections including Environmental, Heritage and Human Health used a list of historical, current and future / potentially foreseeable future projects and human activities that were selected based on available information. The initial Project Inclusion List for the CEA was based on the December 2010 Major Project Inventory and then each project was screened for "foreseeableness" as outlined by the Agency (Agency 1999).

21.10.3.3 General Land Use

A detailed description of the historical and current land use activities is provided in the Land and Resource Use Baseline Report provided in Appendix 8.0-B. Table 21.10.3-4 summarises the known land use activities.

Table 21.10.3-4: General Land Use Activities in Cumulative Effects Study Area

Project/Activity	Description
Parks and Protected Areas	Three provincial parks (Nisga'a Memorial Lava Bed Park, Bear Glacier Park and Meziadin Lake Park), and three conservancies (Ksi Xts'at'kw / Stagoo, Larcom Lagoon, and Ksi X'anmas) and one ecological reserve (Gingietl Creek) are located between 18 km and 75 km from the proposed Project. Two BMTAs are located less than 5 km from the proposed Project (Gits'oohl and Ksi Galsgiist / Stagoo). Several parks are located along the proposed transportation route.
Local communities	Kitsault Townsite - Kitsault was built in 1978 to support the historical Kitsault Mine. People began to inhabit the town in 1980. The mine closed in 1982 and Kitsault became a ghost town. Mr. Krishnan Suthanthiran purchased Kitsault in 2005 and created Kitsault Resorts Ltd. The townsite has been primarily vacant since 1983. Available information indicates that a maintenance crew of less than 10 occupies the townsite during the winter months. In the summer months, when the roads are open, the maintenance staff work 10 on and 4 off. Specific information related to future development plans is limited and schedule is dependent on acquiring required permits. Alice Arm - Booming mining town in the 1920s and 1930s until the nearby silver mine shut down. In the late sixties workers commuted by boat from Alice Arm to work the neighbouring mines. Available information indicates one residence is occupied year round with vacationers returning to the area during the summer months. The Alice Arm Lodge provides lodging and support to the exploration companies operating in the area.
Exploration	Exploration activities in the area are ongoing. Two exploration projects are ongoing by the proponent: Roundy Creek - located about 6 km south of Alice Arm; and Bell Moly - located about 10 km east of Alice Arm. Keystone - located about 8.0 kilometres south of Alice Arm in the valley of Roundy Creek has been explored various times between 1916 - 1968 and is considered a potential prospect. Exploration activities associated with a variety of deposits are located north of Alice Arm, the majority along the upper reaches of the Kitsault River. Road access to this area, which is maintained by various companies operating in the area, follows the Kitsault River for approximately 25 km.
Forestry	Historical logging proximate to the proposed mine site has been minimal other than areas cleared for the historical Kitsault mine. All logging conducted by the proponent will be based on their License to Cut for exploration as applied for with the Notice of Work. Trees will only be removed for mining related infrastructure. No other logging activities were identified that had a linkage to the proposed Project. Residual effects associated with the transportation route are not predicted.
Trapping	Project is located entirely within one trapline. Ten other traplines fall within the regional study area. Residual effects associated with the transportation route are not predicted.
Guide outfitting	Project is located entirely within one guide outfitter area. One other guide outfitter area is located east of Hwy 37 and Cranberry Junction. Residual effects associated with the

Project/Activity	Description
	transportation route are not predicted.
Fishing	People from the community of Alice Arm and guests of the Alice Arm Lodge are known to fish in Kitsault River and the Alice Arm Canal. Nisga'a Nation harvests a number of species for food, social and ceremonial purposes. Commercial fisheries activity (shrimp trawling, trapping and crab fishing) is limited to the marine environment. The Nisga'a Nation has been issued an angling guide licence that includes watercourses in the area.
Permits, Licences and Tenures	Lisims Backcountry Adventures Inc. holds a Commercial Recreation Licence for areas at least 5 km away from the Project. One groundwater well is located proximate to the site of the historical open pit mine. The Kitsault Resorts Water System, which is located within the Kitsault Townsite, is a deep water well. Two active water license applications (submitted by Kitsault Resorts Ltd.) for power generation were identified – one on Lime Creek in the Lime / Patsy Creek Watershed and one on Clary Creek. A permit for water licensed work was also located on Lime Creek in the Lime / Patsy Creek Watershed. Several other wind power and water power licenses (status unknown) are located proximate to the Project.
Transportation and Access	Kitsault/Alice Arm Road runs from Hwy 37 to Kitsault Townsite and Alice Arm. Traffic along this road is primarily associated with exploration activities and local access. Tourism/recreation based traffic is considered to be minimal.

Note: BMTA- Biodiversity, Mining and Tourism Area; Hwy - Highway; km - kilometre

Further information is provided in Appendix 8.0-B, Land and Resource Use.

Current employment and socio-economic conditions are described in Sections 7 and 8, respectively.

21.10.3.4 Reasonably Foreseeable Future Projects

Relevant future projects include those which are either certain to proceed or at least reasonably foreseeable (BC EAO, 2009). Research, professional judgement, and consultation are used to identify which future projects should be considered in a cumulative environmental effects assessment. There is no simple rule that can be applied to include or exclude future projects from the environmental assessment of the project in question. In general, if an environmental assessment has been completed and accepted and a lease, permit, or license has been issued, then it is very likely that the future project will proceed. The decision to include a project in the CEA is based on the 'weight of evidence' that a future project will proceed. 'Weight of evidence' decisions usually consider:

- The quality of the evidence: Are the indications that a future project will proceed strong or weak?
- The quantity of the evidence: Is there one indication that a future project will proceed, or several indications?

Future projects that may result from a project's 'growth inducing ability', are not considered as part of the CEA. This section provides the rationalisation for selecting the projects included in the Project Inclusion List for the CEA.

The assessment of CEE that are likely to result from a project in combination with other projects or activities that have been or will be carried out, include the likely environmental effects of future projects and human activities. There is often a degree of uncertainty related to which environmental effects from which future projects and activities should be included in the assessment. The *CEA Act* states that projects and activities that "will be carried out" must be considered. At a minimum, projects and activities that have been approved will be included in the assessment.

The Northwest Transmission Line (NTL) is a reasonably foreseeable large scale project. The NTL was approved by the BC EAO on 23 February 2011. The NTL consists of a new 335-km, 287-kilovolt (kV) transmission line between the Skeena Substation at Terrace and Bob Quinn Lake, predominantly following the Hwy 37 corridor. The NTL Project would also consist of an upgrade to the existing Skeena Substation and a new substation at Bob Quinn Lake. Temporary infrastructure to support constructing the transmission line consists of construction camps and equipment laydown or staging areas, some access roads, trails, and stream crossings. The Project transportation route overlaps the NTL along the Hwy 37 corridor and conflicts associated with traffic, which may occur during construction of the NTL, are included in the CEA.

The Kerr-Sulphurets-Mitchell (KSM) mine project by Seabridge Gold Inc. located north of Stewart, and with a capital cost of $3 billion, is currently in the BC EAO EA review process. If the project proceeds, it is assumed that ground access to the mine site would be via Hwys 16, 37 and 37A and a local access road. However, at present, no information about project construction and operations schedules or transportation plans and traffic volume is publicly available. Following a review of the available information there is the potential for overlaps temporally and spatially with the Project. The KSM mine project has been included in the CEA, primarily focussing on potential cumulative effects on traffic along the transportation route.

The rationale for selecting and not selecting activities and projects to be considered in the CEA are provided above in Tables 10.21.3-1 and 10.21.3-2, respectively.

The social and economic assessments incorporate the potential “foreseeable” major projects that are listed in the Major Projects Inventory (BC Ministry of Finance, 2010) without reviewing and confirming their “foreseeableness” as it applies to a cumulative effects assessment. The list of projects that may compete for regional labour and services is shown in Table 7.2.3-6, Section 7, Potential Economic Effects.

21.10.4 Residual Effects and Spatial and Temporal Overlap with Other Human Activities

Table 21.10.4-1 describes proposed Project related residual effects for each VC and identifies which have a potential spatial or temporal overlap with other projects and activities identified in Section 21.10.3. Those VCs and / or specific residual effects which overlap spatially or temporally with other human activities are carried forward in the cumulative effects assessment below.

Table 21.10.4-1: Project Residual Effects and Spatial / Temporal Overlap with Other Human Activities

Discipline	Valued Components	Residual Effects Assessment Results	Temporal/ Spatial Overlap	Carried Forward
Atmospheric Environment	Air quality	Maximum predicted ambient concentrations of TSP, PM_{10}, $PM_{2.5}$ SO_2 and CO concentrations comply with the appropriate air quality criteria. Only concentrations of NO_2 one-hour average are likely to have any residual air quality effects. The affected area is small and is adjacent to the proposed Project fence line on the west side and NO_2 concentration at longer averaging times are predicted to meet the relevant air quality objectives. Residual effect rated not significant (minor).	No	No
	Climate	Taking into account the vast size of the atmosphere in the climate study area as compared to predicted size of CO_2 emissions from the proposed Project sources, it can be expected that residual effects of climate change would neither be measurable nor demonstrable. No measurable residual effects are anticipated.	No	No
Noise and Vibration	Noise and Vibration	From a noise and vibration perspective, if the level of a potential effect is less than the PSLs, it is not a residual effect. For this proposed Project, residual effects from noise and vibration are unlikely, since the maximum noise and vibration levels comply with the permissible criteria defined by other jurisdictions. No measurable residual effects are anticipated.	No	No
Groundwater	Flow	Provided that the identified mitigative measures are implemented during construction, operations, and decommissioning / closure and post closure, development of the proposed Project after mitigation is unlikely to have a significant residual effect on the Groundwater Flow VC near the Kitsault Pit. Residual effect rated not significant (negligible).	No	No
	Quality	During construction, operations, closure, and post-closure, local groundwater flow quality near the Kitsault Pit, LGS, WRMF, and TMF may be affected by the proposed Project. Such effects however, are anticipated to be local. Residual effect rated not significant (negligible).	No	No
	Recharge and Discharge	During construction and operations, local groundwater recharge rates near the Kitsault Pit and near the TMF may be affected by the proposed Project. Such effects are expected, however, to be local and are unlikely to affect groundwater flow or discharge rates at the scale of the watershed. Development of the Kitsault Pit component of the proposed Project during closure phases after mitigation is not anticipated to have a significant residual effect. Residual effect rated not significant (negligible).	No	No
	Groundwater and Surface Water Interaction	As a result of proposed Project controls and design, it is unlikely that alteration of baseline groundwater and surface water interaction conditions will occur. Residual effect rated not significant (negligible).	No	No
Hydrology	Lime Creek / Patsy Creek Watershed	Changes to hydrology of Lime Creek / Patsy Creek. Residual effect rated not significant (minor).	No	No

Discipline	Valued Components	Residual Effects Assessment Results	Temporal/ Spatial Overlap	Carried Forward
	Clary Creek Watershed	Residual effects include: decrease annual flows; decreased low flows; and decreased lake levels. Residual effect rated not significant (minor).	No	No
Surface Water Quality	Lime Creek Watershed	Based on applicable rating criteria, planned mitigation and monitoring, and considering the current water quality of the brownfield site; the potential residual effect is assessed as not significant (minor).	Yes	Yes
	Clary Creek Watershed	Based on applicable rating criteria, planned mitigation and monitoring, and considering the current water quality of the brownfield site; the potential residual effect is assessed as not significant (minor). Historically elevated concentrations of several water quality parameters may be incrementally increased during post-closure due to continued periodic elevated levels (above proposed site specific guidelines) entering the receiving environment from the decommissioned Project facilities.	Yes	Yes
	Sediment Quality	Predicted to be indistinguishable from the natural range of variability in physical and chemical characteristics. Based on applicable rating criteria, planned mitigation and monitoring, and considering the current sediment quality of the brownfield site; the potential residual effect is assessed as not significant (negligible).	No	No
Freshwater Aquatic Resources	Dolly Varden	Changes in surface water quality could affect the growth, health, and survival of Dolly Varden in lower Lime Creek. Changes in stream flows could affect the spawning success and egg hatching survival of Dolly Varden in lower Lime Creek. Residual effect rated not significant (minor),	Yes	Yes
	Coho Salmon	Changes in surface water quality could affect the growth, health, and survival of coho salmon parr in lower Lime Creek. Changes in the benthic invertebrate community in Lime Creek could affect the growth and survival of coho salmon parr in lower Lime Creek. Residual effect rated not significant (minor).	Yes	Yes
	Rainbow Trout	Potential changes in surface water quality due to the proposed Project could cumulatively affect water quality, and rainbow trout, in Clary Lake also potentially affected by exploration of the Bell Moly deposit. Potential changes in stream flows due to the proposed Project could cumulatively affect lake levels in Clary Lake and stream flows at the Clary Lake outlet also potential affected by changes in streams flows caused by exploration of the Bell Moly deposit	Yes	Yes
	Benthic Macro Invertebrates	Mine tailings potentially affected the BMI population in Lime Creek Watershed.	No	No
Marine Aquatic Resources	Marine Water Quality	No residual or cumulative effects to marine water quality would occur. Changes in marine water quality would have the potential to affect the species composition of benthic infauna and epifauna near the mouth of Lime Creek. However, given the small contribution of Lime Creek discharge to Alice Arm any changes to Lime Creek discharge will not have measurable effects on marine biota.	No	No
	Marine Biota	No effects are expected to occur during mining operations as the assessment of activities related to the proposed Project will have negligible effects on marine water quality.	No	No

Discipline	Valued Components	Residual Effects Assessment Results	Temporal/ Spatial Overlap	Carried Forward
Terrain, Surficial Geology and Soils	Physiography and Topography	The complete restoration of the baseline condition following Project closure is not possible. Instead, the Reclamation and Closure Plan incorporates measures to develop the irreversible alterations in landscape into new features which are physically and functionally integrated in the post-closure landscape. The overall potential cumulative residual effect is rated as not significant (minor) due to the existing brownfield status of the site.	Yes – with historical / current land use	Yes
	Surficial Geology	Mitigation measures would minimise the overall effect that the redistribution of surficial materials would have on the landscape. Therefore, upon completion of mitigation measures, no residual effects are identified.	No	No
	Soil Cover	Soil cover differences would exist between baseline and proposed Project closure; however, the replacement of topsoil and development of growth mediums to support reclamation would serve to initiate reclamation at the site to an equivalent functioning landscape. Therefore, upon completion of mitigation measures, no residual effects are identified.	No	No
	Soil Quality	All Project effects related to soil quality would either be directly addressed at the time of occurrence or would be addressed within the final closure plan of the proposed Project. Mitigation measures would minimise the overall effect that the redistribution of surficial materials would have on the landscape. Therefore, upon completion of mitigation measures, no residual effects are identified.	No	No
Vegetation and Plant Communities	Ecosystem Composition	The landscape would differ from the baseline condition with the addition of the WRMF, the TMF and the Kitsault Pit lake; although it is expected, the adjacent landscape is anticipated to function in a similar manner to pre-proposed project conditions. Growth medium and topsoil would be applied to the downstream faces of the embankments then seeded to native species. For other facilities, the surficial material would be replaced once a facility has been decommissioned. Residual effect rated not significant (minor). Following decommissioning and closure the majority of the site will be re-vegetated and potential residual effects on ecosystem composition are considered reversible.	No	No
	Wetland Ecosystems	A potential residual effect of not significant (minor) was anticipated due to the loss or alteration of approximately 113 ha of baseline wetland ecosystems. The development of a compact Project footprint and the eventual reclamation of the site would reduce the overall effect of the proposed Project on wetland ecosystems VC. The conceptual reclamation plan includes consideration of wetland development and enhancement, particularly around the TMF.	No	No
	Old Forests	A potential residual effect of not significant (minor) was predicted due to the loss of approximately 46 ha of old forests from the WRMF, tailings ponds and Northeast Embankment. Potential residual effects to old forests associated with the proposed Project are considered reversible (although over the very long term).	No	No
	Species at Risk	Although no plant species at risk were identified a potential residual effect of not significant (minor) is anticipated from the approximate loss of 34 ha of area ranked as high or medium potential for species at risk.	No	No

Discipline	Valued Components	Residual Effects Assessment Results	Temporal/ Spatial Overlap	Carried Forward
	Ecological Communities at Risk	The development of the proposed Project would directly remove 1 ha of ecological communities at risk due to the development of mine facilities (open pit, conveyor belt) and mine site access roads. Mitigation would reduce this potential effect to not significant (minor).	No	No
	Cultural Plants	The proposed Project would have a potential residual effect on cultural plants, specifically from the loss of 35 ha of potential large cedar trees, 369 ha of potential high and medium ranked cultural plant habitat, and 274 ha of potential high and medium ranked berry producing habitat. Potential effects to potential pine mushroom habitat is limited and not considered a residual effect. Loss of cultural plants and habitat for cultural plants rated as not significant (minor). Potential residual effects to cultural plants associated with the proposed Project are considered reversible.	No	No
Wildlife and Their Habitat	Western Toad	The proposed Project would have a potential residual effect on western toad, specifically from habitat loss, disruption of movement, and potential mortality. Mitigation measures include avoiding breeding habitats, conducting pre-clearing surveys for breeding or dispersing western toads, and monitoring and reporting observations of breeding or mass toad migrations and movements. The potential residual effect on the local western toad population is rated as not significant (minor).	No	No
	Olive-sided Flycatcher	The proposed Project would have a potential residual effect on olive-sided flycatcher, specifically from habitat loss, noise disturbance, and potential mortality. These potential effects would be mitigated by avoiding vegetation clearing during breeding periods and conducting pre-clearing surveys for nesting birds during the breeding season. The potential residual effect on the local olive-sided flycatcher population is rated as not significant (minor).	No	No
	Sooty Grouse	The proposed Project would have a potential residual effect on sooty grouse, specifically from habitat loss or alteration of potential breeding habitat, noise disturbance, and potential mortality from vehicle interactions. These potential effects would be mitigated by avoiding vegetation clearing during breeding periods and conducting pre-clearing surveys for nesting birds during the breeding season. The potential residual effect on the local sooty grouse population is rated as not significant (minor).	No	No
	Northern Goshawk	Based on the elevation of the site, existing disturbance and mitigation measures, no potential residual effects are anticipated for northern goshawk.	No	No
	American Marten	The proposed Project would have a potential residual effect on American marten, specifically from habitat loss or alteration and potential mortality. These potential effects would be mitigated through traffic management, carrion removal, waste management and reclamation and closure activities. The potential residual effect on the local American marten population is rated as not significant (minor).	No	No
	Mountain Goat	Potential Project effects on mountain goat include potential mortality, attraction to salt use along the access roads, and noise disturbance. These potential effects are considered unlikely since mountain goat habitat is located more than 5 km outside the proposed Project's RSA. With mitigation measures, including reporting, recording and adaptively managing observations or	No	No

Discipline	Valued Components	Residual Effects Assessment Results	Temporal/ Spatial Overlap	Carried Forward
		incidents of mountain goat, a no hunting policy, and providing snow breaks along the FSR, no potential residual effects are anticipated for mountain goat.		
	Moose	The proposed Project would have a potential residual effect on moose, specifically from potential mortality from vehicle interactions and access, and noise and human activity disturbance resulting in displacement. Habitat loss, particularly winter habitat, is not considered a residual effect because the Project area is at higher elevations and of limited value as moose wintering habitat. Mitigation measures such as gating access to site, speed restrictions, and incident / accident reporting and monitoring and adaptive management of moose near misses, mortality or observations along the road would minimise potential effects, particularly near the mine site and along the Kitsault / Alice Arm Road. Snow ploughing along the Nass FSR north to Cranberry Junction could increase vehicle traffic and winter access to moose winter range. Based on the location of moose winter range, expected increase in vehicle traffic along the transportation route, and the current decline in the regional moose population in the Nass Wildlife Area; the overall potential effect on the local population of moose is anticipated to be not significant (moderate).	Yes	Yes
	Grizzly Bear	The proposed Project would have a potential residual effect on grizzly bear, specifically from potential mortality from vehicle interactions and attraction to waste associated with human activity. Habitat loss is not considered a residual effect because the Project area is mostly of moderate value for grizzly bear and likely used by transient grizzly bears moving to higher elevations for berry producing shrubs during the late summer and fall. Mitigation measures such as gating access to site, speed restrictions, bear management plan, and wildlife incident / accident reporting and monitoring and adaptive management would minimise potential residual effects. The potential residual effect on the local grizzly bear population is rated as not significant (minor).	Yes	Yes
Economic Assessment		Residual effects and CEA described together in Section 7, Potential Economic Effects	See Section 7, Assessment of Potential Economic Effects	
Social Assessment	Regional Demographics Housing Regional Services Regional Infrastructure Family and Community Wellbeing Educational	Residual effects and CEA described together in Section 8, Assessment of Potential Social Effects	See Section 8, Assessment of Potential Social Effects	

Discipline	Valued Components	Residual Effects Assessment Results	Temporal/ Spatial Overlap	Carried Forward
	Services Transportation			
	Land Use	Change in local ambience along transportation route due to increased noise, vibration and decreased visual quality associated with traffic volume was rated as not significant (minor).	Yes	Yes
Heritage Resources	Archaeological Sites	No archaeological sites are identified within the proposed Project footprint or for additional areas assessed in the LSA. No documented archaeological sites would be affected by the proposed Project. However, unidentified sites might be encountered during construction. The residual effect for each stage of development is assessed as not significant (minor).	No	No
	Historic Heritage Sites	No known residual effects that could affect historic heritage sites have been identified. However, an overall increase in general activity in the LSA may have adverse effects. The residual effect for each stage of development is assessed as not significant (minor).	No	No
Health Effects	Public Health	Potential effects of the proposed Project on public health are not expected to be adverse and not significant (negligible) for permanent residents and temporary and seasonal land users in the environmental health LSA and RSA.	No	No
	Visual and Aesthetic Resources	Change in visual landscape was identified as the only issue associated with visual and aesthetic resources, which included the following effects: direct alteration of the landscape; visual effects associated with increased road traffic; and light, emissions, and dust from increased traffic and equipment at the mine site. The significance of the residual effects were not significant (ranging from negligible to minor) due to the small footprint of the proposed Project, the limited use of the area, and the mountainous terrain.	Yes	Yes
	Healthy Living	A not significant (negligible) rating has been determined based on the small numbers of potentially affected persons when compared to the size of the host community; effects on local and regional Local Health Area health statistics are likely to be negligible.	No	No
	Worker Safety and Health	A not significant (minor) rating has been determined based on the low frequency and effects likely distinguished within the worker sub-population. Potential effects would likely be indistinguishable in any potentially affected community or Local Health Area.	No	No

Note: BMI - benthic macro-invertebrate; CEA - cumulative effects assessment; CO - carbon monoxide; FSR - Forest Service Road; ha - hectare; LGS - low grade (ore) stockpile; LSA - Local Study Area; µm - micrometre; NO_2 - nitrogen dioxide; $PM_{2.5}$ - particulate matter no greater than 2.5 µm of aerodynamic diameter; PM_{10} - particulate matter no greater than 10 µm of aerodynamic diameter; PSL - permissible sound level; RSA - Regional Study Area; SO_2 - sulphur dioxide; TMF - Tailings Management Facility; TSP - total suspended particulates; VC - Valued Component; WRMF - Waste Rock Management Facility

21.10.5 Determination of Incremental Effects

This section provides a description of the incremental effects of a given action when added to other past, present, and reasonably foreseeable future actions. Table 21.10.5-1 summarises the potential linkages between Project residual effects and other human activities / projects.

Table 21.10.5-1: Assessment of Potential Cumulative Effects with Other Activities / Projects

Potential Residual Project Effect	Historical Land Use			Representative Current and Future Land Use					Reasonably Foreseeable Projects	
	Mining / exploration (includes Kitsault)	Kitsault Resort (presume inhabited by caretakers for foreseeable future)	Alice Arm (presume inhabited by vacationers in the summer for foreseeable future)	Mining exploration	Transportation and access (local /regional)	Trapping / guide outfitting	Nisga'a Nation hunting, trapping, fishing and other uses	Aboriginal hunting, trapping, fishing and other uses	Northwest Transmission Line Project	Kerr-Sulphurets-Mitchell Copper-Gold Mine
Change in topography and physiography	-	NI	NI	NI	NI	NI	NI	NI	NI	NI
Change in water quality	-	NI	NI	NI	NI	NI	NI	NI	NI	NI
Change in Dolly Varden, coho salmon, and rainbow trout	-	-	NI	-	NI	-	-	-	NI	NI
Increased disturbance on moose from vehicle traffic noise	NI	NI	NI	NI	-	NI	NI	NI	o	o
Increased moose mortality risk from vehicle traffic and access	NI	NI	NI	NI	-	NI	o	o	o	o
Increased grizzly bear mortality risk from vehicle traffic	NI	NI	NI	NI	-	NI	NI	NI	o	o
Change in local ambience from increased traffic	NI	o	o	-	-	o	o	o	-	-
Physical change in visual landscape	NI	NI	NI	o	NI	NI	NI	NI	NI	NI
Visual effects associated with increased vehicle traffic	NI	NI	NI	o	o	NI	NI	NI	NI	o

Interaction definition: o - interaction; - - key interaction; + - benefit; NI - no interaction

Cumulative effects associated with physiography and topography and water quality are directly associated with historical mining activities at the Kitsault Mine. Potential cumulative effects associated with moose and grizzly bear are associated with current and future land use and potential transportation overlap with two reasonably foreseeable projects, NTL and KSM. Potential cumulative effects on local ambience (land and resource use) and visual and aesthetic resources (human health) are directly associated with ongoing exploration activities in the Alice Arm area and potential transportation overlap with two large projects, KSM and NTL, identified as potentially foreseeable.

21.10.5.1 Physiography and Topography

The alteration of the baseline landscape is considered a potential direct effect of the proposed Project on physiography and topography. Based on the expected Project components, the alteration of the baseline landscape, previously affected by historical mining activities, is likely to occur. This additional alteration is required to support the proposed Project development and would occur throughout each project phase.

The baseline topographic conditions for the associated mine site facilities and infrastructure would undergo varying degrees of alteration. The spatial extent of changes to baseline physiography and topography was determined by comparing the baseline case to a Project case scenario. The WRMF, the TMF and Kitsault Pit, represent a combined 583 ha (83% of the mine site footprint) and are expected to undergo the most extensive alterations from baseline topographic conditions.

The complete restoration of the baseline condition following Project closure is not possible. Instead, the Reclamation and Closure Plan (Appendix 3.0-K) incorporates measures to develop the irreversible alterations in landscape into new features which are physically and functionally integrated in the post-closure landscape. There are three key new features which would be created in the case of the proposed Project:

- A new water feature, or lake, would be developed through quarrying and reclamation of the Kitsault Pit;
- Patsy Lake would be enlarged by the construction and reclamation of the TMF; and
- The construction of the WRMF would be a positive relief feature on the landscape that would alter the current drainage course of Patsy Creek.

A functioning and variable landscape is proposed in the Reclamation and Closure Plan although the landscape would be different from baseline conditions (which reflect historical mining and reclamation activity). The conceptual plan indicates reclamation and re-vegetation of the TMF to support upland and wetland landscapes. The WRMF would be re-sloped and covered with a suitable reclamation material to promote the establishment of new vegetation.

21.10.5.2 Water Quality

Historical mining activities have affected the water quality conditions within the Project area resulting in elevated baseline conditions for several parameters (see Section 6.6, Surface Water and Sediment Quality for details). Guidelines and standards for comparison with the model output data were determined with respect to the most sensitive receptors in the downstream environment and where regulations were applicable. The guidelines and standards are as follows:

- BC MOE water quality guidelines (approved) for the protection of freshwater aquatic life:
  - The Maximum Acceptable limits (Max); and
  - The 30-Day Average limits (30-Day Average);
- CCME guideline for the protection of aquatic life (freshwater); and
- *MMER* (Government of Canada 2002), enabled under the *Fisheries Act* (Government of Canada 1985). Schedule 4 - Authorised Limits of Deleterious Substances, with maximum authorised concentrations from the following columns:
  - Column 2 – Maximum Authorised Monthly Mean Concentration;
  - Column 3 – Maximum Authorised Concentration in a Composite Sample; and
  - Column 4 – Maximum Authorised Concentration in a Grab Sample.

Based on a critical review of BCMOE and CCME guidelines with respect to site-specific conditions, some modifications of standard guidelines were made to derive proposed site-specific guidelines justified for aquatic life for fluoride, dissolved aluminum, cadmium, copper, lead, and zinc. This approach was considered appropriate due to the existing elevated levels of a variety of parameters that directly affected the water quality modelling results for the Project. A full discussion of the derivation can be found in Appendix 6.7-B.

In order to complete the review of potential incremental effects of the Project on water quality a conservative approach was used which included the following:

- Conservative assumptions incorporated into source term predictions;
- Conservative assumptions incorporated into water quality model; and
- Used concentrations throughout assessment which represent estimated worst case scenarios

The source term predictions were prepared as inputs to a site-wide water quality model developed by Knight Piésold (Appendix 6.6-B). The predictions are provided as dissolved concentrations and loads. Potential effects of leaching of explosives residues were also predicted. Source-term predictions were developed based on the following data inputs and assumptions:

- Anticipated characteristics of each facility, including rock types and grain size distributions;

- Release rates of key parameters from kinetic testing program and association of those release rates with bulk characteristics of various materials;
- Anticipated effects of temperature effects on weathering rates; and
- Expected infiltration and seepage associated with each facility.

A mass balance mixing model for surface water in the vicinity of the proposed Project was prepared in support of the water quality assessment. The model was developed to predict water quality as a result of direct discharge or seepage into the Lime Creek and Clary Creek Watersheds, and at points of direct discharge for the construction, operations, closure, and post-closure phases of mine development. Background surface water and groundwater quality source terms were developed from the database of baseline water quality data that were used for the baseline characterisation for the EA Application. The water quality predictions were modelled from construction through to post-closure, with monthly outputs over a 90 year period. The construction period was modelled over a two year period, operations for 15 years, closure for 15 years, and post-closure extended to 58 years after closure.

Acidification of the waste rock and Open Pit highwalls were conservatively assumed 35 years after mine operations cease. Water treatment is proposed if these assumptions materialise. However, the data for the period after acidic terms assume no water treatment has been applied to the model.

For parameters which were reported as lower than the method detection limit, the value equivalent to half of the method detection limit was used in the water quality model which is considered a conservative approach. Historic effects on water quality represent the baseline condition of the site, and were incorporated in the results of the water quality model which provided the cumulative effects on water quality associated with the proposed project. The assessment of potential Project effects on water quality used the 95th percentile and maximum concentrations which represent worst case scenarios. Background contributions of several parameters contributed to elevated concentrations which exceeded the proposed site specific water quality guidelines in some cases.

ARD is not likely to start during the operating life of the mine, and there is expected to be a lag time of at least 50 years after the end of mining before management of potentially-acid-generating (PAG) rock and ARD may need to be considered. This will negate the need for water treatment during the life of the mine and in the immediate post-closure period. During this post-closure period, the seepage from the TMF and the WRMF will be allowed to discharge directly into the newly formed pit lake. However, modelling of post-closure water quality has indicated that the waste rock dump downstream of the South Embankment of the tailings impoundment could be a primary source of contamination and that if acidic conditions develop, receiving water quality at the mouth of Lime Creek would exceed aquatic life guidelines. While placement of low permeability covers over the dump will improve the water quality, water treatment would still be needed. In light of this, allowances for water treatment have been made (see Appendix 6.6-C).

No residual effects were identified from a marine receiving environment perspective because the minor exceedances identified when compared to the proposed site specific criteria (for the protection of freshwater aquatic life) during post closure were less than the corresponding criteria for the protection of the marine environment (CCME 2011).

21.10.5.3 Freshwater Aquatic Resources

A detailed description of the potential interaction between freshwater aquatic resources and other past, present or future projects / activities is provided in Section 6.7, Freshwater Aquatic Resources.

21.10.5.3.1 Dolly Varden

Past mining activities at the Kitsault Mine during the 1960s and early 1970s and again during the early 1980s may cumulative interact with predicted residual effects of the proposed proposed Project on Dolly Varden in two ways. First, previous disposal of mine tailings in Lime Creek in the early 1970s may have previously extirpated the Dolly Varden run in Lime Creek (i.e., the current Dolly Varden run in Lime Creek was a result of recolonisation during the 40 years since tailings disposal in the creek stopped) or may have reduced the size, growth, and health of the Dolly Varden population in lower Lime Creek from pre-disposal condition. Second, channelisation of the lower reaches of Lime Creek during the construction of the town of Kitsault during the early 1980s may have reduced the spawning, rearing, or overwintering habitat of the lower reaches of Lime Creek for Dolly Varden.

Three other past or current Projects or land uses have the potential to cumulatively interact with potential residual effects of the proposed Project on Dolly Varden. These are the past mining activities at the head of Observatory Inlet (principally the old Anyox Slag heap), the ongoing commercial and recreational fisheries in the Alice Arm / Observatory Inlet area, and the ongoing recreational fishing in the Kitsault and Illiance Rivers guided by Nisga'a guides. The Anyox Slag heap is the tailings of a copper mine which were deposited in the nearshore area of Granby Bay between 1914 and 1936. The ongoing erosion of slag deposits are thought to be cause of elevated levels of copper, zinc, cadmium, and iron in the local marine sediments 42 years after mine abandonment (Johannessen et al., 2007). Thus, past or ongoing contamination from this mine has the potential to cumulatively increase the acute or chronic toxicity of any of these metals that Dolly Varden in Lime Creek may be exposed to during construction, operation, and closure of the proposed Project.

Dolly Varden are not targeted in any commercial fisheries or in any recreational fishery in Alice Arm / Observatory Inlet or their tributary rivers. However, they can be by-catch in commercial and recreational fisheries targeting salmon or steelhead. Therefore, the potential exists for both commercial and recreational fishing to cumulatively reduce the number of Dolly Varden returning to Lime Creek to spawn, thus potentially reducing the sustainability of the Lime Creek population.

All three of these past or ongoing projects or land uses have the potential to interact with Dolly Varden potentially affected by residual effects of the proposed Project because of the migratory behaviour of adult Dolly Varden once they enter the ocean and because of the potential amphidromous behaviour of juvenile Dolly Varden in Lime Creek.

21.10.5.3.2 Coho Salmon

Past mining activities at the Kitsault Mine during the 1960s and early 1970s and again during the early 1980s may cumulative interact with predicted residual effects of the proposed Project in two ways. First, previous disposal of mine tailings in Lime Creek in the early 1970s may have extipirated any coho salmon run that may have previously existed in the creek. Second, the channelisation of the lower reaches of Lime Creek during the early 1980s may have reduced habitat quality of the lower reaches of Lime Creek which may have precluded the re-establishment of a coho salmon run in the creek after the disposal of mine tailings in the creek ceased. A detailed review of the potential interaction between the historical mining activities and current baseline conditions is provided in Section 6.7, Freshwater Aquatic Resources.

Channelisation of the lower reaches of Lime Creek during construction of the town of Kitsault in the 1980s eliminated the natural delta at the mouth of the creek that can be clearly see in old aerial photos. The channels in this delta could have provided spawning and rearing habitat for coho salmon prior to construction of the town and prior to the deposit of mine tailings in the creek in the 1970s.

Ongoing commercial and recreational fisheries in the Alice Arm, Observatory Inlet and Pacific Ocean plus recreational fishing guided by Nisga'a peoples in the Kitsault and Illiance Rivers have the potential to cumulative interact with potential residual effects of the proposed Project on coho salmon. This potential interaction exists because both commercial and recreational fishing and residual effect of the proposed Project have the potential to reduce the number of coho salmon returning to the natal streams to spawn, thus potentially reduce the size and sustainability of the stock(s).

21.10.5.3.3 Rainbow Trout

Projects which could potentially interact with the residual effects to rainbow trout from the proposed Project is the past use of Clary Lake as the freshwater supply sources during previous mining operations at the Kitsault Mine and the ongoing exploration and potential future mining of the Bell Moly deposit in the upper Clary Creek Watershed. A detailed review of the potential interaction between the historical mining activities and other activities / projects and current baseline conditions is provided in Section 6.7, Freshwater Aquatic Resources.

The Nisga'a Nation has angling guide tenures on the Illiance and Kitsault rivers under the NFA. As far as is known, no guiding occurs for rainbow trout in the Clary Creek Watershed. Available information indicates that there is no active fishery for rainbow trout by Aboriginal peoples or any recreational fishermen.

Use of Clary Lake for freshwater supply during previous Kitsault mining operations in the early 1970s has created a potential cumulative effect to rainbow trout because the lake was raised by approximately one metre to so that pumps would not be “cut-off” from the majority of inflows to Clary Lake by the shallow narrows between the north and south basins of the lake during summer and winter low flow conditions. Exploration of the Bell Moly deposit has the potential to alter water quality and stream flows in the northeastern portion of the Clary Creek Watershed. During operations the lake will be used for plant process water which may affect rainbow trout and benthic macro-invertebrate (BMI) habitat.

21.10.5.4 Wildlife and their Habitat

The residual effect to moose (noise and potential mortality) and grizzly bear (mortality) due to Project-related vehicle traffic can interact with existing or reasonably foreseeable vehicle traffic along the transportation route. A road use cumulative effects assessment, including the potential cumulative effects on wildlife from vehicle strikes, is provided in Appendix 8.0-C (Road Use Effects Assessment; RUEA). Based on existing traffic-wildlife collision information along these highways (see Appendix 8.0-C), moose represent the most frequently hit wildlife species along Hwy 37 and Hwy 113 (data from 1988 to 2010 depending on highway segment). Moose accidents are more prevalent in the winter months (January and December) and bear accidents are more prevalent in the summer months (August and September).

proposed Project traffic-related effects (noise and mortality) are not anticipated to interact with past mining / exploration, the Kitsault mine site, the Kitsault Resort, current mining exploration, trapping, Nisga’a Nation treaty activities, and Aboriginal traditional land use because these activities represent a low to negligible level of traffic along the Kitsault transportation route. However, the current transportation use of Hwys 37 and 113 and from reasonably foreseeable projects such as the NTL Project and the KSM Copper-Gold Mine can cumulatively interact with the proposed Project traffic on moose and grizzly bear.

Project-related ploughing of the Nass FSR and the Nass-Kinskuch FSR could increase winter access to high quality moose winter range habitat. Increased access to areas of high quality wildlife habitat when wildlife are concentrated in such areas can lead to a re-distribution of hunting pressure to these areas and overall increase in the total level of hunting pressure via increased non-regulated hunting and poaching. Thus Nisga’a Nation hunting and Aboriginal hunting is considered a potential cumulative interaction on moose mortality.

As recognised in the RUEA, it is difficult to quantify the extent of cumulative traffic and access effects due to the lack of traffic data available for reasonably foreseeable projects and the uncertainty of the timing of the construction and operations phases of each project, dependent on environmental approvals. The use of Hwy 37 and Hwy 113 by the proposed Project and reasonably foreseeable projects (including the NTL and KSM Projects) will vary and shift over time and between highways.

The RUEA assessed the interaction of traffic related to the proposed Project with reasonably forecasted ranges of traffic levels from the NTL and KSM Projects during all phases of the projects. Table 21.10.5-2 provides a summary of the traffic scenarios, in vehicles per day (vpd) during construction and operations phases along Hwy 37 and Hwy 113 for the proposed Project and the two potentially future foreseeable projects that overlap the Kitsault transportation route. The descriptive labels low (1-50 vehicles per day (vpd)), medium (51-150 vpd), and high (150+ vpd) traffic volumes illustrates the ebb and flow of cumulative traffic associated with these projects. These descriptors are rough representations of daily traffic levels (using the information available at the time of report preparation) for purposes of developing the cumulative effects assessment and are subject to change.

Table 21.10.5-2: Summary of Transportation-Related Traffic Level Scenarios

Project	Transportation-Related Traffic Level Scenarios			
	Construction		Operations	
	Hwy 113	Hwy 37	Hwy 113	Hwy 37
Kitsault	Low	Medium	Low	Low
NTL	High	Low	Low	Low
KSM	n/a	High	n/a	Low

Note: KSM - Kerr-Sulpherets-Mitchell; NTL - Northwest Transmission Line; n/a - not applicable

Overall, there is a potential for minimal overlap between these projects based on different levels of anticipated use between Hwy 37 and Hwy 113. Available information indicates that when the proposed Project use of Hwy 113 is low during the construction phase, NTL use is high. The reverse is predicted for Hwy 37, by Cranberry Junction, where medium-level use is anticipated by the proposed Project with a low corresponding use by the NTL Project. The medium-level use of the proposed Project along Hwy 37 may overlap temporally and spatially with the high-level use of the highway by the KSM Project during construction; however, this is largely dependent on if and when these projects are permitted. The worst-case scenario entails the KSM and proposed Project being permitted at the same time resulting in an overlap of construction phases. During the operations phases of these projects, there is low-level of use anticipated for all the projects along both Hwy 37 and Hwy 113, resulting in minimal long-term cumulative traffic effects. The KSM Project is not anticipated to use Hwy 113.

Along Hwy 37, it is unlikely that the NTL and the KSM Projects will reach historic levels of traffic (observed in 1990 at the height of forestry activities in the region) to support construction activities given that KSM's proposed use of the Port of Stewart for concentrate shipment and mine employees and contracts will be flown to site, limiting the use of Hwy 37 to transportation of supplies and materials.

21.10.5.5 Land and Resource Use

There is no interaction with any historical land use activities in the area. Key interactions are predicted between mining exploration, local and regional traffic, and two foreseeable

future projects: NTL and KSM. These activities and projects, along with the proposed Project, have the potential to add to the traffic volume along the transportation route and adversely affect the local ambience. Interactions were identified between the Kitsault Resort and Alice Arm, trapping / guide outfitting and Nisga'a Nation and Aboriginal land use. This interaction is based on the possibility that proposed Project traffic may change the local ambience along the transportation route and land use within the local and regional study areas by these groups may be affected by the improved access.

21.10.5.6 Visual and Aesthetics Resources

There is the potential that current and / or future mining exploration activities may adversely affect the regional landscape, particularly in the area north of the community of Alice Arm. This area, which is mainly visible from Alice Arm, has had a variety of historical and current exploration projects and it has been assumed that mining exploration would continue into the foreseeable future. There is also the potential that traffic associated with mining exploration in the region would affect the visual landscape. There is also the potential that construction traffic associated with the NTL and construction/operation traffic from KSM may overlap with proposed Project traffic along portions of the transportation route.

During construction, operations, and decommissioning, traffic on the access road (i.e., the series of FSRs) is predicted to have a minor effect on visual aesthetics because very few tourists or residents are expected to use the road and the majority of traffic would be related to the proposed Project. Traffic associated with the proposed Project would not be traveling north of the site down the Alice Arm Road to the Kitsault Townsite and Alice Arm. Access along the Nass FSR and onto Alice Arm road would remain unchanged, although traffic would increase. Light, emissions, and dust generated by vehicles and equipment during construction, operations and decommissioning would be visible along the new site access road and Alice Arm Road during construction, operations, and decommissioning and closure. After decommissioning, there would be no additional effects on transportation and access associated with closure other than a reduction in traffic.

21.10.6 Mitigation and Monitoring

Mitigation, monitoring and management strategies are provided to reduce / limit potential cumulative effects and the significance of residual cumulative effects and likelihood after mitigation.

21.10.6.1 Physiography and Topography

Cumulative effects associated with physiography and topography within the proposed Project footprint can be minimised and managed through mitigation. Specific techniques can be used during different Project phases and include:

- Footprint minimisation;
- Erosion control measures and maintenance of slope gradients; and
- Site reclamation following mine closure.

Key mitigation measures which will be incorporated into the proposed Project include:

- Facility location planning: grouping facilities in centralised areas and development of a functional Project footprint, especially for the TMF;
- Use of waste rock as construction material whenever technically feasible;
- Use of existing forestry roads to reduce the site access footprint;
- Sourcing aggregate for construction within areas of anticipated disturbance (where available) during development of additional Project activities or components; and
- Use of existing disturbance areas as a foundation for expansion of new facilities whenever feasible.

The development and implementation of an Erosion and Sediment Control Plan would ensure that surface water and slope gradients within the Project footprint are managed. The primary approach to this mitigation is the incorporation of erosion control approaches into the Project design. For a more detailed description of the Erosion and Sediment Control Plan, refer to the EMS outlined in Section 11.

The development of a conceptual Reclamation and Closure Plan (Appendix 3.0-K) is an important step associated with the closure and decommissioning activities of mining developments. The Reclamation and Closure Plan would clearly outline the intended reclamation activities, account for allocation of materials, and identify targets for reclamation. Adaptive management techniques may be implemented during the lifespan of the proposed Project to respond to reclamation requirements.

21.10.6.2 Water Quality

Permitted requirements under the *MMER* include the commitment for an Environmental Effects Monitoring (EEM) Program. A summary of the following Environmental Management Plans is provided in Section 11, Environmental Management System:

- Aquatic Resource Management Plan;
- Waste Water Management Plan;
- Tailings and Mine Water Management Plan; and
- Reclamation and Closure Plan.

Environmental monitoring plans should include measures to assess possible cumulative effects. The assessment of cumulative effects associated with mine development and operation should begin as early as possible in the mine life cycle, with consideration given to:

- Applicable legislation related to the assessment of cumulative effects;
- Potential activities in the vicinity of the mining facility, including infrastructure, that may contribute to cumulative effects; and

- Existing monitoring activities, including any existing activities related to the assessment of cumulative effects.

Cumulative effects are those effects that are the result of an activity in combination with other past, present or reasonably foreseeable future activities. For example, cumulative effects may result from:

- A number of mining facilities operating in close proximity;
- A mining facility operating near another industrial facility, such as a pulp and paper mill; or
- A mining facility operating in an area of historical industrial activity.

When environmental monitoring activities identify an effect or a change not predicted or not deemed acceptable in the environmental assessment, additional monitoring measures should be implemented to investigate the cause of the effect.

21.10.6.3 Freshwater Aquatic Resources

There are no mitigation measures specifically proposed to eliminate potential cumulative effects of the proposed Project on freshwater aquatic resources with residual effects for other past, present, or reasonably foreseeable future projects or land uses. The likely effectiveness of the implementation of the water management plan, addition of a water treatment plant at closure (if required), and adherence to water quality objectives that would be used to reduce proposed Project effects on freshwater aquatic resources have already been assessed.

Although not strictly a mitigation measure, an environmental effect monitoring program would be developed in consultation with EC, the BC MOE, and NLG prior to construction of the Project. This monitoring program would be designed and implemented with the two-fold purpose of: 1) assessing whether predictions made during the effects assessments are accurate; and 2) determining whether any unanticipated effects are occurring, and if so, to trigger the implementation of additional mitigation, adaptive management, and / or compensation as required.

Modern mine exploration operations require strict government permit requirements including use of Best Management Practices (BMPs) to reduce or eliminate potential effects to fish-bearing habitat downstream during ongoing mine exploration at the Bell Moly deposit. These mitigation measures are likely to be highly effective at reducing any potential cumulative effect on rainbow trout in Clary Lake. The likely success of this mitigation measure is increased because the proponent owns the lease for the Bell Moly deposit and the proponent would ensure that all ongoing and future exploration activities associated with the Bell Moly deposit are conducted to environmental best practices.

21.10.6.4 Wildlife and Their Habitat

While the proponent of the proposed Project is not solely responsible for cumulative effects related to traffic based on interactions between the proposed Project and other reasonably foreseeable projects, there are key measures (in addition to mitigation measures outlined in Section 11.2.21) the proponent can implement to cooperate and proactively anticipate and address issues. These mitigation measures include:

- The proponent would coordinate and communicate with BC Hydro and Seabridge to exchange information on traffic schedules, volume, and composition, where relevant and applicable. Where there is anticipated potential for high volume and corresponding risk, the proponent will coordinate with BC Hydro and / or Seabridge to consider and develop appropriate mitigation measures to address and minimise the risk during peak periods, especially during construction phases along Hwy 37 and Hwy 113;
- The proponent would exchange wildlife and human accident data and information with BC Hydro and Seabridge and coordinate relevant and applicable mitigation measures to reduce risk to wildlife and humans along roads and highways of shared use;
- Given that the proponent intends to apply for the SUP for the Nass FSR, the proponent would communicate with BC Hydro about year round planned maintenance activities to facilitate shared use of the Nass FSR;
- The proponent would cooperate and participate (where invited) in any future regional cumulative effects assessment and planning efforts, especially if related to traffic along Hwy 37 and Hwy 113;
- The proponent agrees to participate in any meetings or workshops related to transportation, access, and traffic held by the Nisga'a Nation and / or Aboriginal groups to address cumulative effects in a collective and collaborative manner; and
- The proponent would consider and possibly incorporate guidance and advice provided by BC Ministry of Transportation and Infrastructure (BC MOTI) and Insurance Corporation of BC (ICBC) related to cumulative traffic effects along Hwy 37 and Hwy 113. The proponent would consider and possibly incorporate guidance and advice provided by BC MFLRNO related to cumulative traffic effects along the network of FSRs leading to the mine site, including the Nass FSR.

21.10.6.5 Land and Resource Use

Mitigation measures for managing potential cumulative effects associated with increased traffic volume and changes to local ambience along the transportation route will be developed in coordination with the other proponents, and, where necessary, Nisga'a Nation, Aboriginal groups, stakeholders, and local, provincial and federal agencies. If warranted, there may be an opportunity for involved parties to develop specific transportation strategies for particular areas along the transportation route.

21.10.6.6 Visual Aesthetics

Although it is important to mitigate potential local effects as much as possible, from a cumulative effects perspective mitigation measures and associated monitoring plans should be long term and regionally based. For visual aesthetics, it is important to encourage feedback from local residents, businesses, and tourists during all phases of the proposed Project in order to ensure adverse cumulative effects are identified as soon as possible and managed collaboratively.

21.10.7 Cumulative Effects Assessment Significance Rating

21.10.7.1 Physiography and Topography

Cumulative effects from the proposed Project are expected to occur within the post-closure phase of the proposed Project. The specific proposed Project contribution to the cumulative effects is presented in Table 21.10.7-1. Overall, the cumulative effect rating of the residual effect associated with physiography and topography is considered to be not significant (minor) with a neutral direction post closure due to ongoing reclamation efforts.

Table 21.10.7-1: Residual Cumulative Effects Assessment on Physiography and Topography Valued Component by Project Development Phase

Parameter	Current / Future Cumulative Physiography and Topography Effect(s) Without Project	Project Contribution Cumulative Physiography and Topography Effect	Project Phase
Alteration of baseline landscape			
Effect attribute			
Magnitude	Low	Low	PC
Geographic extent	Local	Local	PC
Duration	Chronic	Chronic	PC
Frequency	Continuous	Continuous	PC
Reversibility	No	Yes	PC
Direction	Negative	Neutral	PC
Certainty	High	High	PC
Residual effect significance	Not significant (minor)	Not significant (minor)	PC
Level of confidence	Medium	High	PC

Project phase: PC - post-closure

21.10.7.2 Water Quality

The development of the proposed Project would have a residual effect on the Surface Water Quality VC. Surface water quality in the Lime Creek and Clary Creek Watersheds would differ from the baseline condition. The water quality model conducted for the proposed Project predicted surface water quality in the receiving waterbodies of the Lime Creek and Clary Creek Watersheds.

The water quality model (Appendix 6.6-A) indicated that there would be exceedances of chemical parameters in the waterbodies of the Lime Creek and Clary Creek Watersheds. However, many of the exceeded guidelines are already exceeded in the baseline conditions due to historical mining activities. It should be noted that unadjusted (non-site-specific) guidelines were used in comparisons for the water quality model. The discussion for fluoride, aluminum, cadmium, copper, lead, and zinc were based on proposed site-specific guidelines.

To produce a cumulative effect, the residual effects of the proposed Project must act in combination with the residual effects of one or more actions. The residual effects identified for surface water quality were:

- No significant effects from the exceedances of chemical parameters on surface water quality in the waterbodies of the Lime Creek and Clary Creek Watersheds are expected as many of the exceeded guidelines are already exceeded in the baseline conditions. Additionally, proposed site-specific guidelines were introduced that suggest exceedances from the proposed project would not be harmful to aquatic life.

Residual cumulative effects for surface water quality are both negative and positive. Table 21.10.7-2 provides a summary of potential residual cumulative effects on surface water quality by Project development phase. The overall residual effect significance was assessed as not significant (minor) with a medium level of confidence.

Table 21.10.7-2: Residual Cumulative Effects Assessment on Surface Water Quality by Proposed Project Development Phase

Parameter	Current / Future Cumulative Surface Water Quality Effect(s) Without Project	Project Contribution Cumulative Surface Water Quality Effect	Project Phase
Change in surface water quality			
Effect attribute			
Magnitude	Low	Low	C,O,D/C, PC
Geographic extent	Point	Point	C,O,D/C, PC
Duration	Chronic	Chronic	C,O,D/C, PC
Frequency	Ongoing	Ongoing	C,O,D/C, PC
Reversibility	No	No	C,O,D/C, PC
Direction	Negative	Negative / Positive	C,O,D/C, PC
Certainty	High	High	C,O,D/C, PC
Residual effect significance	Not significant (minor)	Not significant (minor)	C,O,D/C, PC
Level of confidence	Medium	Medium	C,O,D/C, PC

Project phase: C - construction; D/C - decommissioning and closure; O - operations; PC - post-closure

21.10.7.3 Freshwater Aquatic Resources

21.10.7.3.1 Dolly Varden

The only potential cumulative effect on Dolly Varden with a reasonable likelihood of occurrence is the potential residual effects from the deposition of mine tailings in Lime Creek during previous mining operations at Kitsault (Table 21.10.7-3). This potential cumulative effect is considered to be not significant (minor) because the presence of a Dolly Varden population in Lime Creek suggests that any previous residual effects of past mining activities and mine tailings deposition in Lime Creek have abated since previous mining concluded over 35 years ago. It is not apparent from metals concentrations in the current Dolly Varden population that any lasting effects of past residual effects from tailings deposition remain.

Table 21.10.7-3: Residual Cumulative Effects Assessment on Dolly Varden by Project Development Phase

Parameter	Current / Future Cumulative Environmental Effect(s) Without Project	Project Contribution Cumulative Environmental Effect	Project Phase
Change in Dolly Varden growth, survival and health from combined changes in water quality in Lime Creek due to past deposition of mine tailings and mine effluent from proposed Project			
Effect Attribute			
Direction	Negative	Negative	C,O,D/C, PC
Magnitude	Low	Low	C,O,D/C, PC
Geographic extent	Local	Local	C,O,D/C, PC
Duration	Chronic	Chronic	C,O,D/C, PC
Frequency	Continuous	Continuous	C,O,D/C, PC
Reversibility	No	No	C,O,D/C, PC
Probability of occurrence	Unknown	Low	C,O,D/C, PC
Certainty	Low	High	C,O,D/C, PC
Residual Effect Significance	Not significant (negligible)	Not significant (minor)	C,O,D/C, PC
Level of Confidence	Low	High	C,O,D/C, PC

Project Phase: C - construction; D/C - decommissioning and closure; O - operations; PC - post-closure

21.10.7.3.2 Coho Salmon

The potential for residual effects on coho salmon parr from the proposed Project to interact cumulatively with potential residual effects of past mining at Kitsault, construction of the Kitsault townsite and ongoing and future commercial and / or recreational fishing, including the fishing the in Kitsault and Illliance rivers guided by Nisga'a peoples is negligible.

21.10.7.3.3 Rainbow Trout

Table 21.10.7-4 summarises potential residual cumulative effects identified for rainbow trout in Clary Lake and the Project phases of their occurrence. The potential cumulative effect on

rainbow trout in Clary Lake due to the combined effects on water quality changes from TMF seepage from the proposed Project and mine exploration drilling were assessed to be not significant (minor).

Table 21.10.7-4: Residual Cumulative Effects Assessment on Rainbow Trout by Project Development Phase

Parameter	Current / Future Cumulative Environmental Effect(s) Without Project	Project Contribution Cumulative Environmental Effect	Project Phase
Change in surface water quality in Clary Lake due to TMF seepage on ongoing or future mine exploration at the Bell Moly deposit			
Effect Attribute			
Magnitude	Low	Medium	C,O,D/C, PC
Geographic extent	Regional	Local	C,O,D/C, PC
Duration	Short-term	Chronic	C,O,D/C, PC
Frequency	Intermittent	Continuous	C,O,D/C, PC
Reversibility	Yes	No	C,O,D/C, PC
Direction	Negative	Negative	C,O,D/C, PC
Certainty	Low	Medium	C,O,D/C, PC
Residual Effect Significance	Not significant (negligible)	Not significant (minor)	C,O,D/C, PC
Level of Confidence	High	Medium	C,O,D/C, PC

Project phase: C - construction; O - operations; D/C - decommissioning and closure; PC - post-closure

21.10.7.4 Wildlife and Their Habitat

21.10.7.4.1 Moose

The potential cumulative effect of disturbance from vehicle traffic on moose is anticipated to be not significant (negligible). The potential cumulative contribution of the proposed Project to noise disturbance along Hwys 37 and 113 is anticipated to remain similar to existing conditions. The potential Project-effect of noise along the Nass FSR and the Nass-Kinskuch FSR is a residual effect of the proposed Project. The potential of this effect to cumulatively interact with other transportation is expected to be minimal, particularly since the KSM Project is not anticipated to use this route and use from the NTL Project (if any) would be infrequent.

It is anticipated that there may be a cumulative effect related to increased vehicular accidents involving moose, especially along Hwy 37 where there is a potential for overlap between the proposed Project, KSM, and NTL if their construction or operations phases coincide (dependent on permitting) (Table 21.10.7-5). In addition to potential moose-vehicle accidents from Project-related traffic and existing or foreseeable traffic volumes, mortality from increased access to winter range habitat could cause a synergistic cumulative effect on the moose population within the CEA study area. This potential cumulative effect is anticipated to extend through the regional area, occur over the long-term, and with an

intermittent frequency for some individuals and potentially at a continuous frequency when considering the broader context and system. Based on the projected vehicle traffic volumes, existing data on vehicle-moose interactions, and regional status of the moose population; it is anticipated that the overall potential cumulative effect from vehicle traffic and access-related mortality on local moose populations is not significant (minor).

Table 21.10.7-5: Residual Cumulative Effects Assessment on Moose by Project Development Phase

Parameter	Current / Future Cumulative Land and Resource Use Effects Without Project	Project Contribution Cumulative Land and Resource Effect	Project Phase
Changes to local ambience due to increased traffic along transportation route			
Effect attribute			
Magnitude	Low	Low	C, O, D/C
Geographic extent	Regional	Regional	C, O, D/C
Duration	Long-term	Long-term	C, O, D/C
Frequency	Continuous	Continuous	C, O, D/C
Reversibility	Yes	Yes	C, O, D/C
Direction	Negative	Negative	C, O, D/C
Certainty	Low	Medium	C, O, D/C
Residual effect significance	Not significant (negligible)	Not significant (negligible)	C, O, D/C
Level of confidence	Low	Low	C, O, D/C
Mortality from increased vehicle traffic accidents with moose and increased access to winter range habitats			
Effect attribute			
Magnitude	Medium	Medium	C, O, D/C
Geographic extent	Regional	Regional	C, O, D/C
Duration	Long-term	Long-term	C, O, D/C
Frequency	Continuous	Continuous	C, O, D/C
Reversibility	Yes	Yes	C, O, D/C
Direction	Negative	Negative	C, O, D/C
Certainty	Low	Low	C, O, D/C
Residual effect significance	Not significant (minor)	Not significant (minor)	C, O, D/C
Level of confidence	Low	Low	C, O, D/C

Project phase: C - construction; D/C - decommissioning and closure; O - operations

21.10.7.4.2 Grizzly Bear

It is anticipated that there may be a cumulative effect related to increased vehicular accidents involving grizzly bears, especially along Hwy 37 where there is a potential for substantial overlap between the proposed Project, KSM, and NTL if their construction or operations phases coincide (dependent on permitting) (Table 21.10.7-6). This potential cumulative effect is anticipated to extend through the regional area, occur over the long-

term, and with an intermittent frequency for some individuals. With limited regional data on grizzly bear mortality sources, distribution and demographics, it is difficult to predict how the cumulative effect of potential mortality from vehicle traffic along Hwys 37 and 113 affects the local population. Mitigation is anticipated to minimise the potential Project contribution to this cumulative effect. Based on current data on vehicle-bear collisions, low reproductive rate of grizzly bears, and the predicted increase in vehicle traffic; the overall potential cumulative effect from vehicle traffic on local grizzly bear populations is anticipated to be not significant (minor).

Table 21.10.7-6: Residual Cumulative Effects Assessment on Grizzly Bear by Project Development Phase

Parameter	Current / Future Cumulative Land and Resource Use Effects Without Project	Project Contribution Cumulative Land and Resource Effect	Project Phase
Mortality from increased vehicle traffic accidents with grizzly bear			
Effect attribute			
Magnitude	Low	Low	C, O, D/C
Geographic extent	Regional	Regional	C, O, D/C
Duration	Long-term	Long-term	C, O, D/C
Frequency	Intermittent	Intermittent	C, O, D/C
Reversibility	Yes	Yes	C, O, D/C
Direction	Negative	Negative	C, O, D/C
Certainty	Low	Low	C, O, D/C
Residual effect significance	Not significant (minor)	Not significant (minor)	C, O, D/C
Level of confidence	Low	Low	C, O, D/C

Project phase: C - construction; D/C - decommissioning and closure; O - operations

21.10.7.5 Land and Resource Use

The residual cumulative effects remaining following implementation of proposed mitigation strategies are associated with increased traffic volume and changes to local ambience along the transportation route. The proponent will develop further mitigation strategies and measures in coordination with other potential projects, and upon further consultation with the Nisga'a Nation, Aboriginal groups, stakeholders, and local, provincial and federal agencies. The final outcome may include development of specific transportation strategies for particular areas along the transportation route to ensure that land use interests and potential effects are sufficiently addressed. Thus, the potential cumulative effect of changes to local ambience due increased vehicle traffic along the transportation route is anticipated to be not significant (negligible).

Table 21.10.7-7: Residual Cumulative Effects Assessment on Land and Resource Use by Project Development Phase

Parameter	Current / Future Cumulative Land and Resource Use Effects Without Project	Project Contribution Cumulative Land and Resource Effect	Project Phase
Changes to local ambience due to increased traffic along transportation route			
Effect attribute			
Magnitude	Low	Low	C,O,D/C
Geographic extent	Regional	Regional	C,O,D/C
Duration	Long-term	Long-term	C,O,D/C
Frequency	Continuous	Continuous	C,O,D/C
Reversibility	Yes	Yes	C,O,D/C
Direction	Negative	Negative	C,O,D/C
Certainty	Low	Medium	C,O,D/C
Residual effect significance	Not significant (negligible)	Not significant (negligible)	C,O,D/C
Level of confidence	Medium	High	C,O,D/C

Project phase: C - construction; O - operations; D/C - decommissioning and closure; PC - post-closure

21.10.7.6 Visual Aesthetics

It is likely that there would be negative effects to the visual landscape associated with increased traffic in the area. It is unlikely that there would be any adverse effects on the visual landscape associated with current and future mining exploration as long as best practices are implemented. However, as a conservative example, the physical change in visual landscape due to mining exploration was carried forward into the residual CEA.

Current / future cumulative visual effects without the proposed Project associated with a physical change in the visual landscape would be limited to mining exploration activities that are not necessarily following acceptable BMPs. This potential effect was rated as having a low magnitude, local / sub-regional geographic extent, and continuous frequency (Table 21.10.7-8). The residual effect significance, which was rated as not significant (negligible), had a low certainty due to the limited amount of information available, and was rated as reversible. The proposed Project cumulative effect on physical change in the visual landscape was rated as a low magnitude, long-term duration, and medium certainty. The residual effect significance was rated as not significant (negligible) and reversible since the proposed Project is located on an existing brown field site and reclamation is expected to reverse negative effects on the visual landscape (or improve them over the long term).

Visual effects associated with increased road traffic would be directly dependant on the receptors (e.g., residents and tourists either driving along the road or stopped within the immediate vicinity of the road). Cumulatively there is the potential for current and potential future traffic to temporally and / or spatially overlap with traffic from the proposed Project; however, the magnitude is rated as low and effects are reversible (Table 21.10.7-8). The

significance of the cumulative residual effect is rated as not significant (minor) with a certainty of low for current / future cumulative visual effects without the proposed Project and a certainty of medium for the proposed Project contribution to cumulative visual effects.

Table 21.10.7-8: Residual Cumulative Effects Assessment on Visual Landscape by Project Development Phase

Parameter	Current / Future Cumulative Visual Effects Without Project	Project Contribution Cumulative Visual Effect	Project Phase
Physical change in visual landscape			
Effect attribute			
Magnitude	Low	Low	C,O,D/C
Geographic extent	Local/sub-regional	Local/sub-regional	C,O,D/C
Duration	Chronic	Long-term	C,O,D/C
Frequency	Continuous	Continuous	C,O,D/C
Reversibility	Yes	Yes	C,O,D/C
Direction	Negative	Negative	C,O,D/C
Certainty	Low	Medium	C,O,D/C
Residual effect significance	Not significant (negligible)	Not significant (negligible)	C,O,D/C
Level of confidence	Medium	High	C,O,D/C
Visual effects associated with increased road traffic			
Effect attribute			
Magnitude	Low	Low	C,O,D/C
Geographic extent	Local/sub-regional	Local/sub-regional	C,O,D/C
Duration	Chronic	Long-term	C,O,D/C
Frequency	Continuous	Continuous	C,O,D/C
Reversibility	Yes	Yes	C,O,D/C
Direction	Negative	Negative	C,O,D/C
Certainty	Low	Medium	C,O,D/C
Residual effect significance	Not significant (minor)	Not significant (minor)	C,O,D/C
Level of confidence	Medium	High	C,O,D/C

Project phase: C - construction; D/C - decommissioning and closure; O - operations

21.10.8 Level of Certainty

The history of the area is well documented and ongoing reclamation efforts have provided a solid baseline. There is a level of uncertainty when considering cumulative effects because the assessment process requires predictions regarding whether future developments or human activities will take place and the effects of those developments. Human activities are currently being conducted in the area and would be expected to continue into the future to some degree. The future foreseeable projects incorporated into the CEA have several unavoidable inherent uncertainties which may include (depending on the project):

- approval date and / or specific temporal and spatial boundaries are unknown (e.g. various run or the river hydro projects); and
- economic drivers change (e.g. commodity prices).

The level of certainty associated with the water quality assessment is directly based on the assumptions used in the water balance and water quality models. These uncertainties are inherent in any modelling exercise and were not noted to be extraordinary. The level of certainty for the other VCs is related to the professional judgement used to interpret available information.

Assessing environmental risks from environmental chemicals is always associated with uncertainty. Where there is uncertainty, conservative assumptions have been used to ensure that risks have not been underestimated (and in fact almost certainly overestimated). In the exposure assessment, uncertainty relate to the assumptions regarding the presence of VCs. Conservative assumptions were made to ensure any ecological receptors that might be present in the vicinity of the proposed Project site are provided sufficient protection.

The level of certainty associated with the moose and grizzly bear assessment is low. The extent of cumulative effects on the local wildlife populations within the cumulative effects assessment study area depends on a number of factors, including the numbers, sex, and age-class of individuals affected, and the influence of these variables on the demographics of the local populations. These factors are unknown and difficult to predict without quantitative data regarding the present and predicted regional cumulative influences. The probability that the combined effects of Projects and human activities would adversely affect some individual moose and grizzly bear is high. However, the level of confidence of the cumulative effects assessment is considered low.

21.10.9 Limitations

The CEA was prepared following a detailed review of the information publicly available at the time of report preparation. Some of the information included this report was based, in part, on the public information provided by others. Changes to the Project Description following the completion of this assessment may affect the results of the assessment.

The assessment of potential project-specific and cumulative effects was in some cases directly dependent on results of quantitative modelling conducted to determine the potential changes in surface water quality, stream flows, lake levels and air-borne contaminants and dust deposition within the representative Project study areas. Models are simplified abstractions of reality. They are useful because they provide a means of predicting future conditions that would otherwise not be possible without actually imposing the effect on the environment and monitoring changes in the receptors. As such, the accuracy of any model's predictions are dependent on the quality of the input data, the accuracy of calibrated model to predict existing conditions, and the number and validity of the assumptions included in the model.

Critical to the assessment of potential effects of the proposed Project and subsequent interpretation of possible cumulative effects, was the uncertainty regarding the effect of the predicted exceedances of existing provincial and federal water quality guidelines for the protection of freshwater aquatic biota for a number of potential chemicals of concern. Clarified in the appropriate some of these guidelines may be overly protective and site-specific water quality guidelines (WQGs) may be more appropriate. Methods to arrive at some these alternative site-specific WQGs have been provided in this assessment. The BC MOE and the CCME acknowledge that site-specific WQGs for certain chemicals of concern may be more appropriate than existing provincial and federal guidelines depending on site-specific conditions. Both agencies provide guidance on how these guidelines could be derived (McDonald et al 1997; CCME 2007).

21.10.10 Conclusions

Potential residual effects where addressed in the CEA for physiography and topography, water quality, freshwater aquatic resources, wildlife and their habitat, land and resource use, and visual aesthetics. Results from the environmental health assessment (Section 6.12) provided clarification and additional confidence in the CEA. Cumulative effects associated with physiography and topography, water quality and freshwater aquatic resources were primarily related to historical mining activities at the mine site. Cumulative effects associated with moose, grizzly bear, land and resource use, and visual aesthetics were primarily related to increase vehicle traffic along the transportation route. Potential residual cumulative effects associated with the proposed Project were rated as not significant (minor) with the implementation of applicable mitigation measures.

21.11 Nisga'a Nation Engagement and Consultation

This section of the Application addresses federal engagement and consultation requirements concerning the Nisga'a Nation, and summarises the proponent's engagement and consultation activities with the Nisga'a Nation. Section 4.3 and Part C of this Application provide more detailed information regarding all engagement and consultation activities conducted with the Nisga'a Nation to date. Measures and commitments for addressing issues are further presented in Section 24.0 (Summary of Commitments).

A "Canada-BC Agreement on Environmental Assessment Cooperation" (Government of Canada 2004) outlines a harmonised process that satisfies the requirements of both the *BCEAA* (Government of BC 2002) and the *CEA Act*. This process is managed by the BC EAO, and coincides with consultation process specified by the NFA (BC MARR 2000).

21.11.1 Nisga'a Nation Background Information

While the proposed Project site falls outside of Nisga'a Lands owned by the Nisga'a Nation under the terms of the NFA, it is situated in the Nass Area, over which NLG holds primary interest and authority.

The NFA includes a specific set of jurisdictional authorities that are, in practice, distinct from responsibilities associated with addressing issues with Aboriginal Groups' interests in adjacent traditional territories and overlapping claim areas.

The Nisga'a Nation is distinct from non-treaty First Nations in BC, since its citizens are self-governing under the NFA. The requirements for engagement, information distribution, and assessment of the effects related to the proposed Project are stipulated in Chapter 10 of the NFA. The proponent acknowledges the requirement to work with the federal and provincial governments in meeting obligations under the terms of the NFA, and has directed its consultation efforts in an effort to meet the terms specified in the NFA. The EA of the proposed Project is being carried out in a manner that complies with the NFA, particularly the applicable provisions of the NFA, including paragraphs 6, 8 and 10 of Chapter 10. Additional background information on the Nisga'a Nation is provided in Section 13.0 of Part C of this Application.

21.11.2 Nisga'a Nation Consultation Summary

The Crown has a constitutional obligation under the NFA to consult with the Nisga'a Nation if the proposed Project may reasonably be expected to have adverse environmental effects on Nisga'a Lands, residents of Nisga'a Lands or Nisga'a Nation interests, as set out in the NFA. The proponent has taken a "multiple path" approach toward consultation, in that provincial and federal authorities have provided ongoing direction (and legislated authority) related to the Nisga'a Nation, Aboriginal groups, and public consultation requirements (with Nisga'a Nation observation of this process).

The proponent's initial contact with the Nisga'a Nation was made in February 2008, when the proponent prior to purchase of the Kitsault property, recognising the importance of establishing and developing a strong working relationship with the Nisga'a Nation early in the process. Since 2008, the proponent's management team has been engaging and consulting with the Nisga'a Nation, initiating communications and sharing information in advance of regulatory consultation and engagement requirements. In 2010, the proponent held a series of open houses to introduce the proposed Project to the Nisga'a Nation people residing in the four main Nisga'a Villages (described in Section 4.3). Additional open houses were also held for Nisga'a Nation citizens residing in urban regions of BC, including Prince Rupert, Terrace, and Vancouver. Consultation activities also took place with the Nisga'a Nation in the form of the BC EAO Working Group, which assembled during the development of the proposed Project's AIR document. All feedback received from the Nisga'a Nation to date in response to the proposed Project has been documented, and is presented in Section 4.3 of this Application. Measures and commitments for addressing issues are further presented in Section 24.0, Summary of Commitments.

Consultation and engagement activities during the pre-Application period were conducted by the proponent in accordance with government direction. Throughout the pre-Application period, the proponent's approach has been to apply relevant terms and conditions of the NFA. The proponent acknowledges the requirement to work with the federal and provincial governments in meeting obligations under the terms of the NFA. The AIR identifies BC EAO

reference paragraphs 6, 8(5), (6), and (9), and paragraph 10 of Chapter 10 of the NFA as providing primary direction for the proponent in relation to fulfilling the treaty.

The proponent's management team has continued to foster its relationship with the Nisga'a Nation in advance of any regulatory consultation and engagement requirements, recognising the value of directly engaging with NLG in all aspects of proposed Project planning from the earliest stages of development.

21.11.3 Nisga'a Nation Future Engagement

Throughout 2011, the proponent plans to continue conducting consultation with the Nisga'a Nation. The proponent will continue to directly engage with the Nisga'a Nation and will draw on the knowledge and insight gained from this engagement in the implementation of the public consultation process. The proponent will also continue to follow-up on and address issues raised by the Nisga'a Nation during the Application review stage and beyond, in accordance with regulatory direction.

In particular, road use issues are being addressed through the efforts of a Technical Working Group that has been established by the provincial government (BC EAO) specifically to review and consider the effects associated with the proposed Project's transportation route associated with the transport of concentrate, materials, equipment, and personnel to and from the mine site. A RUEA (required as part of the section 13 Order) summarises the cross-disciplinary effects related to transportation, and is provided in Appendix 8.0-C.

Nisga'a Nation economic, social, and cultural effects are considered within the context of the Economic, Social, and Cultural Impact Assessment (ESCIA; Rescan 2012).

The proponent plans to incorporate results from further consultation sessions, and will continue to develop measures to address identified Nisga'a Nation rights and interests.

It will be essential to continually update the record of mitigation measures proposed as part of the proposed Project that are finalised for inclusion based on further negotiation and engagement with NLG, and considerations raised within the context of the RUEA.

21.12 Aboriginal Groups Engagement and Consultation

Included in this section is a description of the federal government's policy for Aboriginal consultation based on the "Aboriginal Consultation and Accommodation – Updated Guidelines for Federal Officials to Fulfill the Duty to Consult" (Indian and Northern Affairs Canada (INAC) 2011). Included in this section is a list of the Aboriginal Groups that have been identified by the federal government for consultation and that could be potentially affected by the proposed Project.

Unlike Canada, the Province of BC does not recognise the asserted rights and title of Métis groups in Canada. References to Aboriginal rights, titles, and interests include only First Nations for the Province of BC, whereas for Canada this reference includes the asserted

rights of both First Nations and Métis. As such, this section provides detailed information about the Métis Nation of BC.

Set against this federal / provincial regulatory framework, the "Canada-BC Agreement on Environmental Assessment Cooperation" (Government of Canada 2004) outlines a harmonised process that satisfies the requirements of both the *BCEAA* and the *CEA Act*. The process is managed by the BC EAO.

Recently revised direction from the BC EAO's section 13 Order provided the proponent with clarity related to the Aboriginal Groups with whom the proponent was originally directed to engage. The section 13 Order modified the list of Aboriginal Groups requiring consultation on the proposed Project.

Taking from the recently released section 13 Order, the proponent understands that it is directed to consult with a number of Aboriginal Groups whose traditional territories overlap with the Kitsault transportation route (along Hwy 37 and Hwy 113) and / or overlap with the Project mine site, including:

- Kitselas First Nation - close to Hwy 113;
- Metlakatla First Nation - overlaps with mine site and Hwy 113;
- Kitsumkalum Nation - overlaps with Hwy 113;
- Gitxsan Chiefs' Office - overlaps with Hwy 37; and
- GHCO (including *wilp* Gwass Hlaam; *wilp* Gwinuu; *wilp* Wiitaxhayetwx-Sidok; and *wilp* Gamlaxyeltxw) – overlaps with Nass FSR and Hwy 37; and
- Gitanyow *wilp* Luuxhon – overlaps with Nass FSR.

21.12.1 Aboriginal Groups Background Information

21.12.1.1 Overview

The proponent has conducted desk-based research in an effort to learn more about the Aboriginal Groups whose traditional territories overlap with the proposed Project transportation route and (in the case of Metlakatla) overlap with the mine site footprint.

This section focuses on a discussion of the Metlakatla First Nation and BC Métis Nation, and the Road Use Effects Assessment (RUEA) (Appendix 8-C) includes information about the remaining Aboriginal groups. The rationale for this is that the RUEA is intended to be a stand-alone document summarizing baseline and effects assessment related exclusively to the Kitsault transportation route. Kitselas, Kitsumkalum, Gitanyow and Gitxsan traditional territories overlap with the transportation route, and not the mine site, whereas the Metlakatla traditional territories overlap with both.

21.12.1.2 Metlakatla First Nation

Table 21.12.1-1 below provides a summary of the information gathered to date regarding the Metlakatla First Nation in relation to the proposed Project. More detailed information on

baseline and assessment of effects related to Metlakatla issues, interests, values, and rights is provided in Part D of the Application.

Table 21.12.1-1: Information About Local Aboriginal Groups

Category	Details
Governance	Chief Harold Leighton with six councilors under the Metlakatla Governing Council.
	Traditional governance through four clans and *walp* (house) system.
Territory and Reserves	1,062,200 ha territory with 6 km overlap of Kitsault transportation route.
	16 reserves near Prince Rupert, none of which proximate to Kitsault transportation route.
History	Pre-contact semi-nomadic hunting and gathering society with a seasonal round that covered both coastal and inland areas.
	Hudson Bay fort and Christian presence at contact changed Metlakatla way of life.
Demographics	830 registered members (2011) with many living off-reserve in Prince Rupert.
Language	Few Metlakatla speak *Sm'algyax*; however, there are efforts to revive the language.
Land use setting	Continued traditional activities, including hunting, trapping, fishing, cedar harvest, and seaweed gathering.
Land use planning	Involvement in the North Coast LRMP process, including a special forest management zone overlapping the proposed Project.
	Signatory to the Metlakatla Indian Band Forestry Agreement.
	Developed Strategic Land Use Planning Agreement with designated zones.
Economy	Majority of Metlakatla employment is in the public sector (58%).
	Development of tourism opportunities, especially around the cruise ship industry.
	Economic participation in forestry and fisheries.
Land use interests	Developing sustainable ecotourism and recreation.
	Economic development related to forestry, small-scale hydroelectric developments, and mineral extraction.
	Continued ability to practice traditional activities.
Heritage interests	Protecting villages and historical sites, pictographs, middens, petroglyphs, and CMTs.
Economic interests	Developing tourism, fisheries, construction, and education opportunities to improve economic participation.
Health and social interests	Metlakatla developing health planning process to address community health needs and priorities.
	Health and social services provided by both Metlakatla and Prince Rupert.

Note: CMT - culturally modified tree; FSR - Forest Service Road; ha - hectares; Hwy -Highway; KFN - Kitselas First Nation; km - kilometres; km^2 - kilometres squared; LRMP - Land and Resource Management Plan; SRMP - Sustainable Resource Management Plan; *waap* - house (Kitsumkalum); *walp* - house (Metlakatla); *wilp* - house (Gitanyow); *huwilp* - house (Gitanyow); % - percent

21.12.1.3 Métis Nation of BC

According to guidance and direction from the Agency, the proponent is also required to engage and consult with the Métis Nation of BC (MNBC). As such, Section 21.12.2 provides a broad overview of Métis interests and values to satisfy the proponent's federal requirement to address Métis rights, titles, and interests.

21.12.2 Governance

Métis Nation is an Aboriginal group that evolved from a mix of Aboriginal and European ancestry. The fur trade in the 18th century was accompanied by a growing number of Europeans that married Aboriginal women and produced offspring. As this mixed-race population grew, they often formed separate communities that differed from other Aboriginal groups and Europeans. The collective Métis groups refer to themselves as the Métis Nation.

Three factors are used to distinguish legal membership into the MNBC:

- Self-identification as Métis;
- Ancestry that connects an individual to a historic Métis community; and
- Acceptance by the Métis community.

The MNBC was officially formed in 1996 to represent the Métis people of BC. It was incorporated into the Métis Provincial Council of BC (MPCBC), which was formed prior to the MNBC in 1983 (MNBC 2011; Métis Nation Gateway 2011). There are three levels to governance of Métis in Canada, including federal, provincial, and local.

21.12.2.1 Federal

At the federal level, the Métis National Council is composed of five provincial Métis organisations, each of which represents their province and has a certain number of votes (representational number by province) on issues affecting them. The Métis organisations include:

- MNBC;
- Métis Nation of Alberta;
- Métis Nation of Saskatchewan;
- Manitoba Métis Federation; and
- Métis Nation of Ontario.

A Federal Interlocutor position for Métis and non-status Indians was created as a liaison between the federal government, Métis, and non-status Aboriginal people in 1985 for the Canadian Cabinet.

21.12.2.2 Provincial and Regional

MNBC is the BC organisation of Métis, which was established in 1996. The MNBC is composed of 37 Métis community associations throughout BC that fall within seven regional governance councils, and the MNBC Board of Directors. Based on the 2006 Census, there are a recorded 59,445 Metis people in BC. The development of the provincial governance model allows the MNBC to deliver geographically-focussed programs and services, ranging from employment and training, education, health, youth and women's advocacy, veteran's services, and several others, to Métis throughout BC. Métis people participate in regular ballot-box elections to determine regional and provincial leadership. Métis citizens and communities participate in governance by electing local leaders or Community Councils, and by attending provincial assemblies of the Métis Nation held once a year (MNBC 2011).

The MNBC is divided into four main governing arms:

- The Legislative Arm;
- The Judicial Arm;
- The Governance Arm; and
- The Business Arm.

21.12.2.3 Relevant Métis Associations and Regional Métis Nation BC Government Council

There are no Métis associations proximate to the proposed Project. The closest communities with Métis associations are:

- Northwest BC Métis Association - Terrace (164 Métis citizens);
- Tri River Métis Association - Smithers (150 Métis citizens); and
- Northwest Métis Association - Prince Rupert (108 Métis citizens).

The relevant MNBC regional government council for the proposed Project area is the Region 6 MNBC. Information about the Region 6 MNBC and relevant contact information is provided in Table 21.12.2-1.

Table 21.12.2-1: Description of the Region 6 MNBC and Contact Information

Description and Services	
Description	Métis Nation British Columbia develops and enhances opportunities for Métis communities by implementing culturally relevant social and economic programs and services.
Areas Served	Port Hardy; Prince Rupert ; Terrace.
Languages	English.
Contact Information	
Address	President: Elizabeth Pearce New Address Effective Feb.1, 2011 102 4647 Lakelse Ave. PO Box 29006 Terrace BC V8G 1R0.
Accessibility	Unknown.
Office Phone	250 - 638-1199.
Fax	250 - 638-1299.
E-Mail	nwbcma@yahoo.ca.

21.12.3 Territory and Title

The Métis Nation has conducted an “Assertion of Métis Rights and Traditional Land Uses” study in 2009, which is a compilation of 14,000 historical documents, indicating “a significant Métis presence throughout BC. Métis Traditional Land Use interviews support Métis use since 1920 and verify Métis continue to exist and use land as our ancestors did” (MNBC 2010a). MNBC clarified in a recent submission to the BC Utilities Commission (BCUC) it does not assert specific areas of BC; instead, “MNBC on behalf of our Métis Citizens, assert Rights and Traditional uses over the entire province” (MNBC 2010a) with documented traditional land use in 95 percent (%) of the provincial watersheds.

21.12.4 History

Métis Nation is an Aboriginal group that evolved from a mix of Aboriginal and European ancestry. The fur trade in the 18th century was accompanied by a growing number or Europeans that married Aboriginal women and produced offspring. As this mixed-race population grew, they often formed separate communities that differed from other Aboriginal groups and Europeans. Three factors are used to distinguish legal membership into the MNBC:

- Self-identification as Métis;
- Ancestry that connects an individual to a historic Métis community; and
- Acceptance by the Métis community.

The MNBC was officially formed in 1996 to represent the Métis people of BC. It was incorporated into the MPCBC, which was formed prior to the MNBC in 1983 (MNBC 2011; Métis Nation Gateway 2011).

21.12.5 Culture and Language

There are many unique traditions found within the Métis culture that are still practiced or are being revived. Some of these traditions include:

- Fiddle playing;
- Folk songs and tales;
- Crafts, such as beading; and
- Métis dances.

The Métis Sash is also important to this Aboriginal group. Traditionally it was important for practical reasons and now it is largely symbolic. The sash originally served as an emergency bridle or saddle blanket. The sash is still an integral part of Métis celebrations, and the colours have symbolic meanings. The ceremony referred to as the “order of the sash” is a short ceremony where a sash is presented as an award to recognise exceptional work that aids in supporting Métis citizens.

The language spoken by Métis is typically English – the traditional Métis language is Michif. However, a variety of Aboriginal languages may be spoken, depending on the Aboriginal heritage and transmission. Little information is available for the numbers of BC Métis that speak an Aboriginal language in BC. Culture camps have been organised in various locations by provincial groups for youth to attend and learn about Métis culture (MNBC 2011).

21.12.6 Economy

Economic development is also indicated as an interest for Métis on the Métis Nation Gateway, where contributors to economic development are discussed in five main strategies: partnership development; community development; Métis human resource development; education; and business support (loan equity).

21.12.7 Métis Rights

MNBC (2011) identifies and describes several Aboriginal rights asserted by Métis with a focus on the Aboriginal right to harvest. As per the MNBC Constitution (2008), MNBC also asserts rights to self-government and title. Many Métis hunt, fish, and trap, and have an ongoing interest in harvesting traditions. The *Natural Resources Act* of the Métis Nation allows harvesting of fish and wildlife for food, social, ceremonial, and traditional (but not commercial) purposes. To harvest for these purposes, Métis Nation of BC (MNBC) harvesting cards can be applied for by Métis citizens. MNBC harvesting cards apply only to species, areas, and times of year, as described by regulations developed by the BC MARR. Currently, harvesting cards only replace the Canadian Migratory Bird license; they do not,

on their own, authorise freshwater fishing, saltwater fishing, hunting (other than migratory birds), cutting timber, or trapping.

Furthermore, *R v Powley* (2003) is an important court ruling confirming and further clarifying the nature of Métis rights since the inclusion of Métis in the Constitution Act of 1982. The ruling indicates that site-specific harvesting rights are tied to historic distinct community-based Métis societies that continue into the present. "A Métis community is a group of Métis with a distinctive collective identity, living together in the same geographical area and sharing a common way of life" (*R v Powley* 2003). Given the unique nature of Metis, arising from union of Aboriginal and non-Aboriginal peoples at contact, previous tests of Aboriginal rights related to distinct pre-contact practices and activities were not applicable to Métis. As such, the Supreme Court of Canada introduced the concept of pre-control, which recognizes Metis communities that arose at contact with their own distinct practices and governance, but were not subject to control of Euro-Canadian laws and customs.

21.12.8 Social and Health Interests

The Métis Nation Relationship Accord (2006) identifies the following subjects as important to the Nation:

- Collaborative renewal of the Métis tripartite process;
- Identification of Métis and data (e.g. genealogy) collection;
- Health (community, family, and individual);
- Housing; and
- Education opportunities.

21.12.9 Potential Effects

There is no known information from publicly available research about the use by and value of the areas in and around the proposed Project mine site and the transportation route to the MNBC. As such, it is not possible to determine the effects of the proposed Project on Métis rights. Future consultation with MNBC may provide additional information in order to ascertain and assess the effects and develop meaningful mitigation measures to address these effects.

21.12.10 Future Planned Consultation

The proponent has and will continue to proactively engage with Aboriginal Groups potentially impacted by the proposed Project on local, regional, and traditional territory levels. In addition, the proponent will continue to encourage Aboriginal Groups' involvement in, and benefit from, the proposed Project in accordance with its policy on Corporate Social Responsibility (Avanti 2011).

21.12.11 Aboriginal Groups Consultation Summary

This section of the Application includes a summary describing past and planned consultation activities with Aboriginal Groups; key issues identified through consultation and responses to these issues; and measures and commitments for addressing these issues.

During discussions and meetings with Aboriginal Groups, the proponent provided information on the proposed Project's progress, its stage in development, and the regulatory process. Team members solicited feedback from Aboriginal group leaders regarding priorities for their asserted territories, and learned about interests and concerns related to proposed Project activities (with a particular focus on transportation-related effects), and ways to mitigate or address these in relation to the proposed Project.

Printed materials and information were provided to Aboriginal Groups on the proposed Project, and follow-up letters were written to Chiefs to thank them for their time and summarise issues. A full account of engagement with Aboriginal Groups is contained in the consultation records discussed in Section 4.4.

Key issues that have been raised through engagements to date are focussed primarily on economic opportunities presented by the proposed Project, along with more detailed discussions related to the transportation route, including:

- Heritage sites along the transportation corridor and their protection from unwanted third-party access and vandalism;
- Increased risk of vehicular-wildlife collisions and increased pressure on wildlife resources with options for managing and monitoring;
- Employment opportunities in relation to the proposed Project;
- Business development and economic interests in service and supply opportunities; and
- Traffic rates and transportation impacts such as noise, visual impacts, and safety considerations along the transportation route.

A detailed summary of the issues identified through consultation and engagement with Aboriginal Groups is provided in Appendix 4.4-A.

21.12.12 Further Engagement with Aboriginal Groups

Throughout 2012, the proponent plans to continue conducting consultation with Aboriginal Groups. These meetings will help to further address amendment to BC EAO's section 11 Order in the section 13 Order, and also provide a means to follow-up with ongoing discussions that have taken place to date. The proponent will continue follow-up on and address issues raised by Aboriginal Groups during the Application review stage and beyond, in accordance with regulatory direction.

In particular, road use issues are being addressed through the efforts of a Technical Working Group that has been established by the provincial government (BC EAO)

specifically to review and consider the effects associated with the proposed Project's transportation route associated with the transport of concentrate, materials, equipment, and personnel to and from the mine site. A RUEA (required as part of the section 13 Order) summarises the cross-disciplinary effects related to transportation, and is provided in Appendix 8.0-C.

The proponent plans to incorporate results from further consultation sessions, and will continue to develop measures to address identified Aboriginal Groups' rights and interests.

It will be essential to continually update the record of mitigative measures proposed as part of the proposed Project that are finalised for inclusion based on ongoing engagement with Aboriginal Groups and considerations raised within the context of the RUEA (Appendix 8.0-C) and the Nisga'a ESCIA (Rescan 2012).

21.13 Need for Other Information as Required by a Responsible Authority Pursuant to the *Canadian Environmental Assessment Act*

Pursuant to the *CEA Act* section 16(1) (e), this section of the proponent's Application provides other information as required by a RA. For the proposed Project, other information as required by a RA include:

- Considerations for the Nisga'a Nation and the assurance that provisions in NFA is suitably recognised; and
- The presentation of necessary habitat compensation plans and discussion of the TMF location as it may pertain to a potential Schedule II allocation for the approval of the TMF location, and an expanded multiple accounts analysis to substantiate the proposed location of the TMF.

Each of the above is discussed in the following as a summary of more detailed information presented elsewhere in this Application.

21.13.1 Obligation for Projects Occurring Within Lands Governed by the Nisga'a Nation

During the draft AIR process, the Agency determined that the proposed Project occurs within an area governed by the NFA and that the proposed Project is also subject to the EA provisions stated in Chapter 10 of the NFA. To partially fulfill the Government of Canada's obligations to the NFA, the Agency indicated that the scope of the EA was to include the NFA Chapter 10, paragraphs 8 (e) and 8 (f) as quoted below:

> "8(e) assess whether the project can reasonably be expected to have adverse environmental effects on residents of Nisga'a Lands, or Nisga'a interests set out in this Agreement and, where appropriate, make recommendations to prevent or mitigate those effects;

> 8(f) assess the effects of the project on the existing and future economic, social and cultural well-being of Nisga'a citizens who may be affected by the project."
> (BC MARR 2000)

The NFA was implemented in 2000 and defines the Nisga'a Nation's rights and title as a treaty nation. NLG is the governing body over Nisga'a Lands. Depending on the type of project involved, the NFA can assess concurrently as part of the *CEA Act* and can assess multi-disciplinary environmental and social effects. The NFA requires that issues specific to the proposed Project affecting Nisga'a Nation citizens and lands be identified and, if possible, determine how the potential effects will be mitigated.

Part C (Sections 13.0, 14.0, and 15.0) of this Application contains a detailed assessment describing how the proposed Project may potentially affect the Nisga'a Nation and Nisga'a Nation interests, and how these potential effects would be mitigated. In addition, the assessment of potential proposed Project effects presented in Sections 6.0 to 10.0 provides a discussion where information was available of the key aspects of the Nisga'a Nation cultural, ecological or community knowledge pertaining to the specific discipline.

21.13.2 Project Alternatives Considerations

The footprint of the proposed Project TMF lies primarily within the non-fish-bearing Patsy Creek Watershed. However, the TMF encroaches into the headwaters of the adjacent fish-bearing Clary Creek Watershed. Specifically, the Northeast Embankment, tailings beach, and northeast water management plans and collection ditches are located on fish-bearing headwater tributaries of Lake 901, a fish-bearing headwater lake that drains into Clary Lake.

Construction and operation of the proposed Project would result in the harmful alteration, disruption, or destruction (HADD) of fish habitat in the Clary Creek Watershed. Mitigation measures have been incorporated into the proposed Project to minimise these losses; however, residual impacts to fish habitat in the headwater tributaries of Lake 901 are unavoidable. Schedule 35(1) of the federal *Fisheries Act* (Government of Canada 1985f) prohibits the HADD of fish habitat in Canada. However, schedule 35(2) of the *Fisheries Act* allows Fisheries and Oceans Canada (DFO) to authorise the HADD of fish habitat if DFO is satisfied that all HADDs can be compensated such that there is "no-net-loss of productive capacity" of fish habitat. This Fish Habitat Mitigation and Compensation Plan (Appendix 11.2-A) is included in the EA Application for the proposed Project to provide federal and provincial regulators and representatives of NLG with the information needed to determine whether the proposed Project will or will not result in significant residual adverse effects to fish and fish habitat.

Section 3.13.8 provides an evaluation of alternatives completed for the selection and siting the TMF for the proposed Project. As the proposed Project assessment proceeded, the proponent recognised that the preferred location for the TMF could result in a HADD as defined under DFO schedule 35(2). In addition, the location would also be potentially subject to requirements of *MMER* (Government of Canada 2002a) that imposes limits on releases of arsenic, copper, cyanide, lead, nickel, zinc, radium-226 and total suspended

solids (TSS), and prohibit the discharge of effluent that is acutely lethal to fish. The *MMER* includes provisions to designate natural, fish-frequented water bodies as Tailings Impoundment Areas (TIAs) because at some sites the disposal of mine wastes (e.g., TMF or WRMF) in such water bodies may be the preferred disposal option for pollution prevention and reduction of long-term environmental risk. Approval for the use of a water body as a TIA requires an EA and an assessment of alternatives for mine waste disposal.

The further assessment of this TIA will include a Multiple Accounts Analysis (MAA) that presents the tailings disposal alternatives assessment taking into account environmental, social, economic, engineering, and proposed Project economic aspects if a Schedule II Amendment is required. Section 3.13.18 includes an alternative assessment that follows a typical assessment methodology. If required, a MAA will be completed that follows a similar but unique three step process as follows:

- Step 1 entails documenting environmental, social, economic, engineering, and proposed Project economic criteria that are of importance in evaluating each of the site-specific tailings disposal alternatives;
- Step 2 entails a pre-screening assessment. This assessment uses a selected series of evaluation criteria, which allows for the rejection of tailings alternatives that are identified as being “fatally flawed” to be rejected; and
- Step 3 is the final analysis the tailings disposal alternatives that remain after the pre-screening assessment.

The results of this analysis are presented in Appendix 3.0-L of the Application.