Section 3.0

Proposed Project Description and Scope of Proposed Project

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

3.0 PROPOSED PROJECT DESCRIPTION AND SCOPE OF PROPOSED PROJECT

Avanti Kitsault Mine Ltd. (proponent), a wholly owned subsidiary of Avanti Mining Inc., is proposing to redevelop the Kitsault mine. The proposed Kitsault Mine Project (proposed Project) is on the northwest coast of British Columbia (BC).

Section 3 of the Application for an Environmental Assessment Certificate for the proposed Project, made under section 16 of the BC *Environmental Assessment Act* (Application) provides context (rationale, location, geology and geochemistry), describes the Mine Plan, and describes all facilities (on-site and off-site) and activities (construction phase, operations phase, and closure / decommissioning phase) associated with the proposed Project. Also provided are a proposed schedule, the human resources requirements, and alternatives to the proposed Project. Sufficient detail is provided to predict potential adverse effects and address concerns of interested parties. The Environmental Management System (EMS) is described in Section 11 of the Application, which also includes management plans for various aspects of the proposed Project.

The engineering design presented in Section 3 is generally a summary of supporting documents from previous studies. The supporting documents are voluminous and as such are (in most cases) included as an appendix to the Application or cited as a referenced document. When referring to supporting documents that cover multiple aspects of the proposed Project, care was taken to direct the reader to a specific section of the document to assist the reader in finding the material of interest but also to focus the reader away from other sections of the document that may describe out-of-date Project information. For example, the proponent completed a National Instrument 43-101 (NI 43-101) Technical Report on Feasibility Study for the proposed Project (Appendix 3.0-A). Subsequent to this report being published, a stand-alone Water Management Report (Appendix 6.5-B) has been released, which includes additional details relating to water management as well as minor changes to the Water Management Plan. As per Canadian security and exchange regulations, the NI 43-101 Technical Report cannot be modified. However, it is important that the NI 43-101 Technical Report is available to the reader, as it contains proposed Project details that are not presented elsewhere.

3.1 Background and Rationale

This section describes the background of and rationale for the proposed Project. Subsequent sections describe: the history of exploration and mine production activities on and around the Kitsault property since its initial discovery (Section 3.1.1); the history of reclamation at this previously active mine site (Section 3.1.2); the rationale for the proposed Project, including how the molybdenum supply from the proposed Project will help satisfy global demands for the metal, and other potential benefits (Section 3.1.3); the proponent's objectives in, and guiding principles behind, developing the proposed Project, including economic study results, and sustainability principles (Section 3.1.4).

3.1.1 History of Exploration and Mine Production

Mineralisation was first staked at the head of Alice Arm in 1911. At that time, the major focus was a polymetallic vein with silver values found southeast of the Kitsault molybdenum deposit. The first recognition of molybdenite-bearing exposures was in 1916 along Lime Creek. A small quantity of molybdenite was produced from the Alice Arm area during World War I; however, these excavations occurred outside the proposed Project area. Limited work was done on the project in the 1920s and early 1930s.

Kennco Explorations Ltd. (Kennco) evaluated the Lime Creek molybdenum deposit (now the Kitsault molybdenum deposit) in 1956, and optioned the property in 1957. Drilling commenced in 1959.

BC Molybdenum Corporation (BC Moly), a subsidiary of Kennco, owned the mine from 1963 to 1972. A first-time mineral resource estimate was prepared in 1964, with the announced presence of an ore body containing 36 million tonnes (Mt), averaging 0.138% molybdenum. Construction of a mine and processing facilities subsequently began. 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. Additional drilling was completed, and mineral resources were updated. An expanded reserve was estimated at 142 Mt with an average grade of 0.109% molybdenum.

Amax of Canada Ltd. (Amax), an affiliate of Climax, obtained the property title in 1979. Amax conducted engineering studies, and constructed the Kitsault Townsite. Production recommenced in April 1981. During this second production period, approximately 4.08 Mt of ore and stockpile material were processed and 8.99 million pounds of saleable molybdenum were recovered. During this period, 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 property was then transferred to the Alumax Aluminum division of Amax to harvest tax losses associated with mine development.

Phelps Dodge Corporation (the successor of Amax) and Climax managed maintenance of the Kitsault Townsite after mine closure in 1982 under a joint management agreement.

Cyprus Minerals Company merged with Amax in late 1993. As part of the merger, the Alumax division of Amax was spun off to the Amax shareholders. The Kitsault molybdenum deposits were included in the Alumax divestment. Mine reclamation commenced in 1996.

Alcoa Inc. purchased Alumax in 1998, and transferred the Kitsault molybdenum deposits to its wholly owned subsidiary, Aluminerie Lauralco, Inc. (Aluminerie). Kitsault Resorts Ltd., a third party, purchased the Kitsault Townsite in 2006.

The proponent completed the purchase of an undivided, 100 percent (%) direct interest in the Kitsault molybdenum mine and surrounding mineral tenures from Aluminerie in October 2008. Since that date, work has comprised drilling, including confirmation and condemnation drill holes, evaluation and interpretation of legacy data, engineering and metallurgical studies, mineral resource and reserve estimates, and environmental baseline studies. A preliminary economic assessment was completed in 2008 (SRK 2008), the results of which indicated that more detailed studies were supported. In 2009, a Pre-Feasibility Study presented a conventional open pit mining operation and process route producing molybdenum concentrates (Wardrop 2009). In 2010, AMEC Earth and Environmental (AMEC) completed a NI 43-101 report entitled: "Kitsault Molybdenum Project, British Columbia, Canada, NI 43-101 Technical Report on Feasibility Study" (Appendix 3.0-A).

Under its previous operators, the Kitsault mine produced approximately 6,000 tonnes per day (t/d) (BC Moly) and approximately 12,000 t/d (Climax). Both operators ran the mine as a conventional drill, blast, shovel, and truck open pit operation, and the concentrator consisted of a three-stage crushing circuit, two-stage grinding circuit (rod-ball mills), and rougher-scavenger cleaner flotation for the production of a final molybdenum concentrate. 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.

The mine operated intermittently from 1968 to 1982 when low molybdenum prices and market conditions forced its shutdown. The mine operation was under a care and maintenance program until 1995.

3.1.2 History of Reclamation

3.1.2.1 Introduction

This section presents a history of the reclamation of the Kitsault Mine; an open-pit molybdenum mine currently owned by the proponent.

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 mine is approximately 5 kilometres (km) inland by road and 600 metre (m) higher in elevation than the Kitsault Townsite, which is located at sea level near the head of Alice Arm and is approximately 100 km northeast of Prince Rupert, BC. The area is situated in rugged mountainous terrain, and is accessible only by logging road.

In February 1996, Climax commissioned SRK Consulting (Canada) Inc. (SRK) and CE Jones and Associates (CEJA) (currently Stantec) to initiate planning and implementation of the reclamation of the Kitsault mine site. At the same time, Climax commissioned the Tradewest Group (TTG) and AMIX Salvage and Sales Ltd (ASSL) to initiate demolition and salvaging of the buildings and equipment at the mine site. SRK also contracted Laidlaw Environmental Services Limited (LESL) to remove hazardous materials and waste from the site.

SRK and CEJA completed 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 following sections present a summary of the implementation of the 1997 reclamation work plan.

3.1.2.2 Reclamation Objectives

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.

3.1.2.3 Site Preparation

3.1.2.3.1 Waste Rock Dumps

There are two main waste rock dumps at the mine site; the Patsy Dump located east of the pit and the Clary Dump located to the north. Other smaller dumps consisted of two low grade (ore) stockpiles (LGS) and three overburden stockpiles. Figure 3.1-1 provides an overview of the site.

Figure 3.1-1: Overview of Kitsault Site Conditions in 1998

Source: SRK (Appendix 3.0-C)

Clary Dump was constructed in one lift and is estimated to consist of approximately 2 Mt of rock. Clary Dump was re-sloped and re-vegetated in 1997. The Patsy Dump is larger, containing an estimated 29 Mt of rock and was constructed by free dumping and single lift methods. It was partly re-graded and re-vegetated in 1997. Both dumps contained a mixture of hornfels and intrusives.

Low grade ore was stockpiled near the old Pit Shop as well as near Patsy Dump. The stockpiles contained approximately 1 Mt and 1.2 Mt, respectively. Both stockpiles were re-vegetated and re-graded in 1999. The low grade ore was comprised of both hornfels and intrusives.

The slopes of both the Patsy and Clary dumps were re-sloped where possible to a shallower angle (2:1 ratio of the horizontal distance of the excavation's slope to its vertical rise (H:V)) in order to redistribute the fines over the slope surface and provide a growth medium for the re-vegetation. No additional growth medium was placed over the dumps. Level areas and roads were scarified. Similar re-sloping was carried out on the LGS.

During the development of the mine in the early 1980s, the three overburden stockpiles were established for use in the final reclamation of the site. In the reclamation carried out in the late 1990s, the material contained in the stockpiles was used in those areas of the mine site where growth medium was required for re-vegetation, such as the pit floor.

During the operation of the mine, waste rock was dumped around the southwest corner of the mine site above the confluence of the Patsy and Lime Creeks. However, as re-sloping of this waste would have a negative impact on the existing streams, remedial action was limited to pulling the crest back to provide additional stability.

Seep surveys have been conducted on site since 1996 and results to date have concluded that none of the waste rock or low grade ore is currently discharging net acidic drainage. Water quality sampling locations are shown on Figures 3.1-2 and 3.1-3. Seeps emerging from below the Pit Shop area have higher molybdenum and sulphate concentrations than seeps from other areas but this has been attributed primarily to the greater mineralisation present in the LGS.

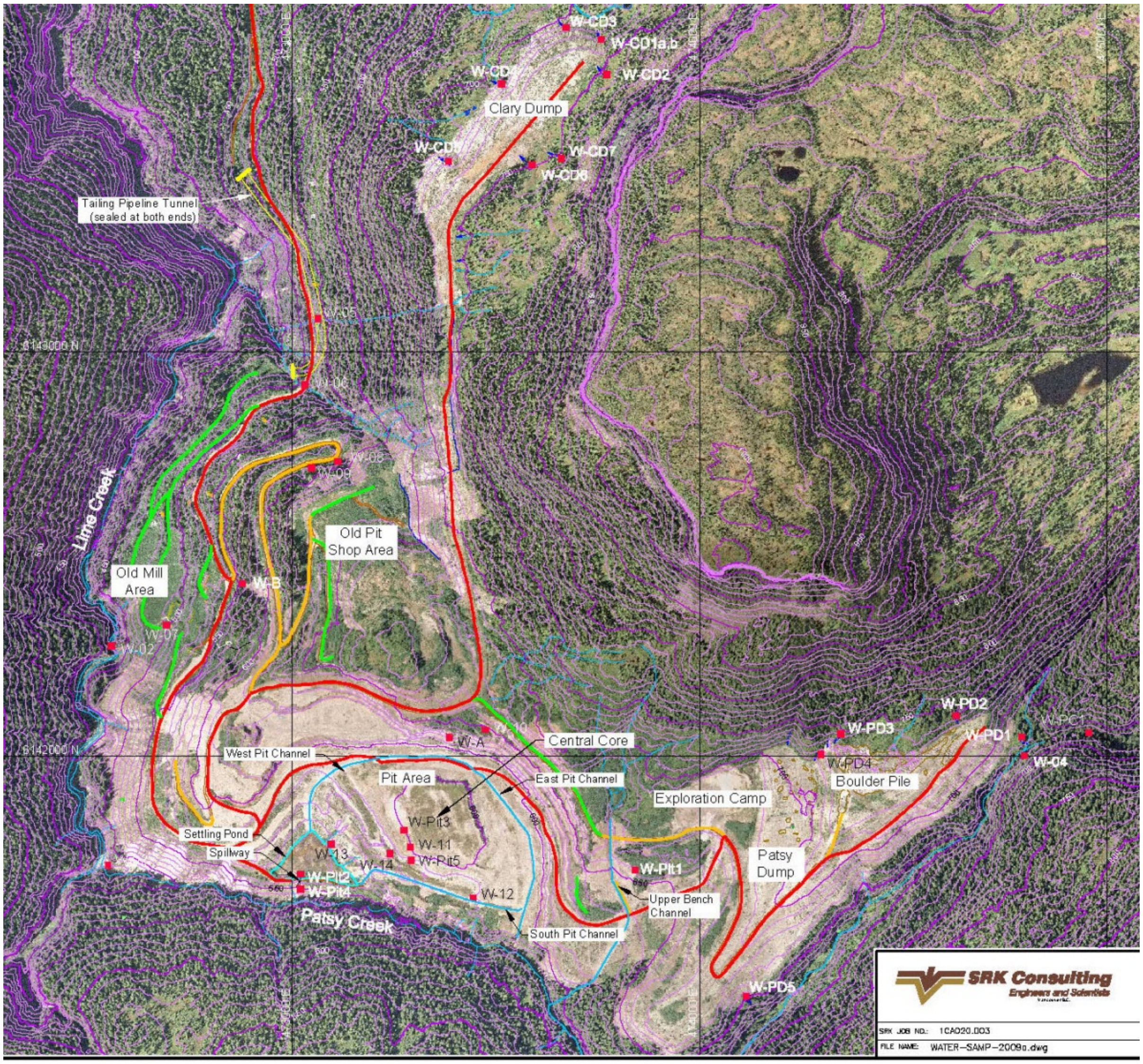


Figure 3.1-2: Water Quality Sampling Locations Prior to 2006

Source: SRK (Appendix 3.0-B)

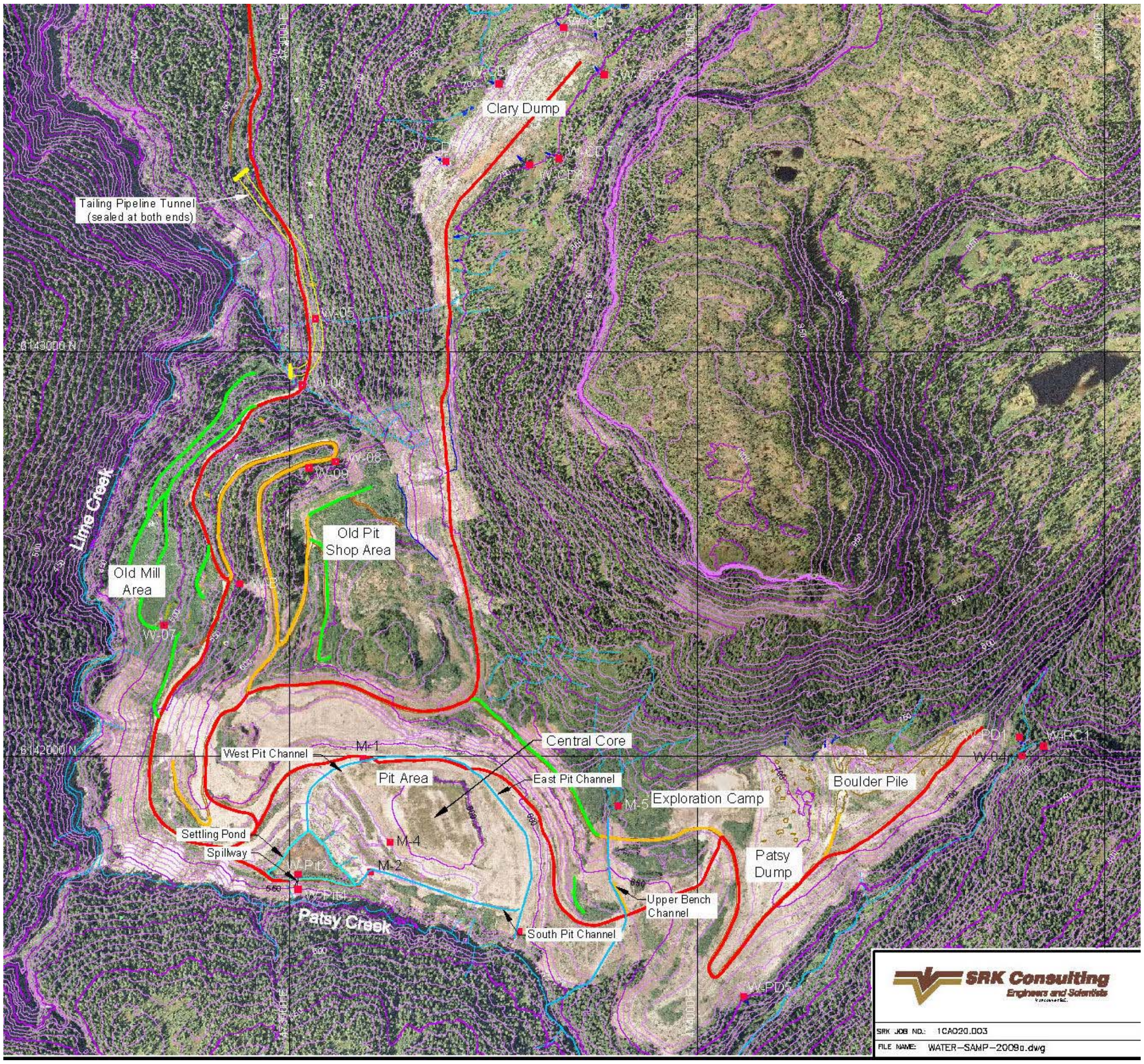


Figure 3.1-3: Water Quality Sampling Locations After 2006

Source: SRK (Appendix 3.0-B)

3.1.2.3.2 Mill Site

The reclamation of the mill site involved the demolition and removal of all the structures, including the dismantling and removal of three rod and ball mills, the breakup and burial of the concrete tailings line drop boxes, and the removal of hazardous materials and oil sludges. Figures 3.1-4 and 3.1-5 show the mill site prior to, and under demolition in 1997. Once this work was completed, the foundations were capped with the stockpiled overburden material and re-vegetated. There has been no indication of any acidic drainage from this area of the mine site.

Figure 3.1-4: Mill Site Prior to Demolition

Source: SRK

Figure 3.1-5: Mill Area During Demolition (1997)

Source: SRK

3.1.2.3.3 Pit Shop Area

Reclamation of the pit shop area involved removal of all items within the shop and demolition of the building (Figures 3.1-4 and 3.1-5). An attempt was made to dismantle the building and ship to a buyer in Alberta, but an agreement was never completed. Following removal of the building, the LGS was recontoured to slopes varying from 2:1 to 4:1 (H:V) and material was pushed out over the concrete slab to depth of 1 to 2 m in preparation for the re-vegetation process.

3.1.2.3.4 Open Pit

The existing open pit is a side hill excavation approximately 40 hectares (ha) in area and ranging from 550 to 700 m in elevation, with a northern high wall and a 12 m high central barren core that rises above the central part of the pit (Figure 3.1-6). Both intrusives and hornfels lithologies are exposed within the pit area. There was one area in the pit floor (Orange Pond) that was seasonally producing acidic drainage.

Reclamation of the pit area was completed in 2006 and consisted of placing covers over the wide pit benches, including an impermeable cover over the barren core, substantial regrading and ditching to improve water management, placement of a growth medium on the wide pit floor benches and establishment of vegetative cover. Remediation to stabilise the acidic drainage from the Orange Pond was also carried out in 2006.

After reclamation of the pit area in 2006, seepage from the area previously referred to as the Orange Pond improved significantly compared to conditions observed prior to reclamation. Since this reclamation, seepage is consistently near-neutral year-round and is generally slightly alkaline.

Based upon the previous four years of data at the new pit area stations, metal concentrations are observed to be generally stabilising.

Figure 3.1-6: Central Core in the Open Pit (2010)

Source: SRK (Appendix 3.0-K)

3.1.2.3.5 Tailings Tunnel Portals

On completion of reclamation of the mill and pit shop areas, the portals at the north and south ends of the tailings tunnel were sealed off. The timber support structures at both portals were left in place and fill was pushed into the portals to seal the openings. The mine site roads to the portals were scarified. There is no drainage from either portals.

3.1.2.3.6 Clary Lake

At Clary Lake, the concrete slab and gravel base that was used to support the transformers were covered with overburden fill in preparation for re-vegetation.

3.1.2.3.7 Roads

Mine site roads to and from the mill and pit shop areas were scarified using short shank rippers attached to a grader. A narrow unscarified trail was left down the middle of the roads to allow future access for small vehicles.

3.1.2.4 Vegetation

The re-vegetation program at the historic Kitsault Mine was conducted during four separate years within a 10 year time frame. The ongoing vegetation monitoring is based on the re-vegetation work conducted between 1997 and 2006. Planting of native shrubs and trees was conducted in 1997, 1998, and 1999 at the Mill Area, Pit Shop Area, Clary Dump and Patsy Dump. Planting was also carried out following completion of the 2006 pit remediation work. Figure 3.1-7 shows the LGS in a re-vegetated state.

In addition to planting of native trees and shrubs, the sites were seeded with site specific grass / legume mixes during the same periods for either erosion control or ground cover.

Figure 3.1-7: Low Grade Ore Stockpile (2010)

Source: SRK

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

The monitoring focus includes metal uptake in reclamation vegetation and establishment to demonstrate that the land has been re-vegetated to a self-sustaining state and to ensure that reclamation objectives are being achieved.

The guideline being used for plant densities to achieve wildlife habitat is the BC Ministry of Forests and Range (BC MOFR) silviculture stocking guidelines for alder and poplar. This guideline has growth rates ranging from 700 to 1540 stems/ha for alder and poplar in managed forest stands. Plant densities measured at the Kitsault sites are much greater. It is expected that over time plant densities will undergo a self-thinning process and be similar to the surrounding forested areas.

The planted trees / shrubs are continuing to increase in size and are growing well at all of the reclamation sites. A considerable amount of natural establishment is occurring at the sites and this provides an indication that the sites are becoming productive and are sustaining tree / shrub growth.

Sampling results for foliar metal concentrations indicate that the majority of elements are within the "normal / adequate" range of dietary tolerances for beef cattle. Some exceedances were observed in the following elements: barium, cadmium, calcium and molybdenum. The 2010 Kitsault Annual Reclamation Report presents the details of the vegetation monitoring and analysis (Appendix 3.0-B).

3.1.3 Project Justification

The proponent completed a Feasibility Study for the proposed Project (Appendix 3.0-A). Based on a molybdenum price of $13.58 (Canadian) per pound the proposed Project has a pre-tax net present value at an 8% discount of $1,325 million (Canadian) and an internal rate of return of 31.8%. The proposed Project has an after-tax net present value at an 8% discount of $863 million and an internal rate of return of 26.8%, which equates to a payback on capital expenditures of 2.6 years.

3.1.3.1 Global Molybdenum Demand

Molybdenum is a naturally occurring metal element that has a variety of useful industrial applications, most notably in the steel industry. Molybdenum-alloy steels are strong (e.g., increased tensile, fatigue, impact strength, wear resistance), respond uniformly to heat treatment, and are corrosion resistant. This makes making them useful in a variety of specialty steels (e.g., stainless, full alloy, tool, high-strength low-alloy, carbon) for application in inhospitable environments (e.g., extreme temperatures, deep water, and other locations exposed to corrosive elements), including oil and gas pipelines, offshore infrastructure, industrial plants, and automotive, ship and aircraft components. Roughly 70% of worldwide molybdenum use is in steel alloying. Other applications for molybdenum include catalysts (e.g., for petroleum refining), superalloys (metallurgical products with greater concentrations of alloys such as molybdenum, nickel, and / or cobalt, in addition to other metals), molybdenum metals and alloys, cast irons, lubricants, pigments, and other specialty uses (e.g., as a smoke suppressant in polyvinyl chloride).

Possible substitutes for molybdenum in the steel industry include chromium, manganese, nickel, vanadium, niobium, boron, and tungsten. Molybdenum has also been subject to replacement by other materials in other chemical uses, such as catalysts, lubricants, and pigments. Substitution remains a threat to demand for some molybdenum-bearing products, but a significant changeover to other metals is unlikely, as these are not perfect substitutes for most existing molybdenum applications. There is a forecasted growth in demand for molybdenum.

3.1.3.2 Global Molybdenum Supply

The world's molybdenum supply is primarily produced as a by-product of copper production. Secondary supplies are obtained by recycling steel and spent catalysts, but using molybdenum scrap versus "new" molybdenum is not always cost advantageous.

Global suppliers of molybdenum include China (40%), the United States (24%), Chile (16%), Peru (5%), Canada (4%), Mexico (3%), and other countries (8%). Roughly 64 % of the world's molybdenum reserves are in China and the United States, according to United States Geological Survey estimates.

Global roasting capacity is in China (approximately 33%), South America (25%), North America (25%), the European Union (8%), and other Asian (excluding China) countries (<4%).

More supply of molybdenum is needed to meet the forecasted growth in demand.

3.1.3.3 Molybdenum Supply from the Proposed Project

The proposed Project contains approximately 232.5 Mt of economically mineable molybdenum ore at the site of the former mine (Appendix 3.0-A).

The proponent has entered into a Molybdenum Concentrate Tolling Agreement (MCTA) with Molibdenos y Metales S.A. (Molymet) of Chile for the life-of-mine molybdenum concentrate production at the proposed Project. Within this agreement, the proponent has the option to reduce the molybdenum concentrate delivered to Molymet for processing to 80% of the total production in the event one of the company's strategic partners wants to take its 20% share in the form of molybdenum concentrate. The MCTA allows for the conversion of Kitsault molybdenum concentrates to technical-grade molybdenum oxide, which will meet the specifications of the London Metals Exchange and ferro-molybdenum. Molymet is a publicly owned Chilean corporation listed on the Santiago Stock Exchange, and has been processing molybdenum concentrates since 1975. Molymet has production facilities in Chile, Mexico, Belgium, Germany and China, and processes approximately 180 million pounds per annum of molybdenum in concentrates at its various facilities. This represents approximately 35% of world molybdenum consumption.

The proponent has determined that the best strategy for selling the processed molybdenum concentrate produced from the proposed Project is to enter into off-take agreements with several selected end-users of the product. Terms of these off-take agreements would vary depending on proposed Project financing conditions. For instance, during the period of proposed Project debt repayment, a portion of the off-take may require a price protection mechanism (floor price) to ensure debt repayment. It is expected that, in return for committing to this floor price, the purchaser would receive a discount to the spot price. Although the proponent has entered an off-take commitment Letter of Intent with one potential purchaser, consisting of 10% of production for the first four years with an option to increase to 20%, the terms have not yet been finalised. After the proposed Project financing has been discharged, off-take agreements would be indexed to a spot price. Discussions with several other parties are in progress at the time of preparation of this report.

3.1.3.4 Other Benefits of the Proposed Project

Mining the deposit will provide jobs and business opportunities to local First Nations as well as other British Columbians and Canadians, and provide tax revenue to the provincial and federal governments. The deposit can be mined in an environmentally responsible manner and, with proper closure (which is planned), will leave a positive environmental legacy. The proposed Project will contribute to the economic sustainability of the region by facilitating acquisition of job skills that can be used outside of mining, or at other mining projects in the future.

Additional benefits of the proposed Project are presented in Section 2.7 (Project Benefits) and Section 7 (Economics).

3.1.4 Objectives and Guiding Principles

The proponent has the necessary understanding, resources, technical capability, and intent to develop the mine in a safe and environmentally sound manner. The proponent's objective was to develop a robust Mine Plan based on the philosophy of "design for closure" together with accepted best engineering and environmental practices. The proposed Project will be developed, operated, and closed with the objective of leaving the property in a condition that will mitigate potential environmental effects and restore the land to an agreed-upon land use and capability. The Mine Plan considered the results of environmental studies to minimise potential proposed Project effects. The proposed Project footprint will be located and sized to minimise effects. The Mine Plan was developed in accordance with the "Health, Safety and Reclamation Code for Mines in British Columbia" (BC Ministry of Energy, Mines and Petroleum Resources (BC MEMPR) 2008).

3.2 Proposed Project Location and Mapping

This section describes the location of the proposed Project, with mapping at appropriate scales. It describes the specific location of the proposed Project and how to access it by road, rail, sea, and air from nearby communities (Section 3.2.1), the terrain (Section 3.2.2), the climate (Section 3.2.3), and natural hazards and environmental concerns (Section 3.2.4). Tenure, ownership and management details for all above ground lands within the proposed Project footprint are also provided (Section 3.2.5).

3.2.1 Location and Access

The proposed Project is located within National Topographic System (NTS) maps 103P 044 and 043, at approximately latitude 55º 25' 19" N and longitude 129º 25' 10" W. It is on the east shore of Alice Arm, which is one of two (the other being Hastings Arm) terminal branches of Observatory Inlet off the northwestern coast of BC, just south of the Alaskan Border (Figure 3.2-1 and 3.2-2). It is in the Skeena Mining Division of BC, and is approximately 140 km northeast of Prince Rupert, BC. The proposed Project lies within the

Nass Area and the Nass Wildlife Area (NWA), as defined by the Nisga'a Final Agreement (NFA), but outside of Nisga'a Lands owned by the Nisga'a Nation under the terms of the NFA, which came into effect on 11 May 2000 (Figure 3.2-2).

The nearest main highway, Highway (Hwy) 16, connects Prince Rupert and Prince George. The nearest town to the mine site is Terrace. Figure 3.2-3 shows the access route to the site. The site is currently accessed from Terrace by travelling:

- 100 km north to Nass Camp via Hwy 113 (the Nisga'a Hwy) where pavement ends;
- 19 km along the Nass Forest Service Road (FSR) (Cranberry Connector), which is a gravel road that connects Nass Camp and Hwy 37 via the Cranberry Connector and Cranberry Junction;
- 16 km along the Nass Kinskuch FSR (known locally as the Squish Road) traveling north-northeast from the Nass FSR and past the Nass Bridge to the junction of the Nass Kinskuch and Nass Kwinatahl FSRs;
- 11 km along the Nass Kwinatahl FSR past the Kwinatahl logging camp;
- 28 km along the Kitsault FSR to the west end of the proponent's Special Use Permit (SUP) (S09228); and
- 10 km on the Alice Arm Road to a decommissioned transformer station next to the existing mine site road.

The total distance by road from Terrace is 194 km. Within the proponent's mineral claims the Kitsault FSR is known as the Alice Arm Road. The Alice Arm Road continues 4.7 km past the mine to the Kitsault Townsite and foreshore. The proposed Project can also be accessed by turning west off Hwy 37 onto the Nass FSR and traveling 32 km to the junction of the Nass Kinskuch FSR. Once on the Nass Kinskuch FSR, the site is accessed as per the description above.

The nearest rail line that links with the North American rail network is operated by Canadian National Rail (CN Rail), and passes through Terrace. Ocean access is via the Portland Canal-Observatory Inlet to Alice Arm and the Kitsault Townsite. Prince Rupert has extensive barging facilities. The nearest major airports are at Prince Rupert and Terrace. Both are served by local airlines out of Vancouver.

Figures 3.2-1, 3.2-2, and 3.2-3 show the location of the proposed Project in BC, the regional Project location, and its access routes.

Legend

- Populated Place
- Road
- International / Provincial Border
- Stream
- Waterbody

Reference

Atlas of Canada scale 1:7,500,000

Scale: 1:9,000,000

100 50 0 100 200

Kilometres

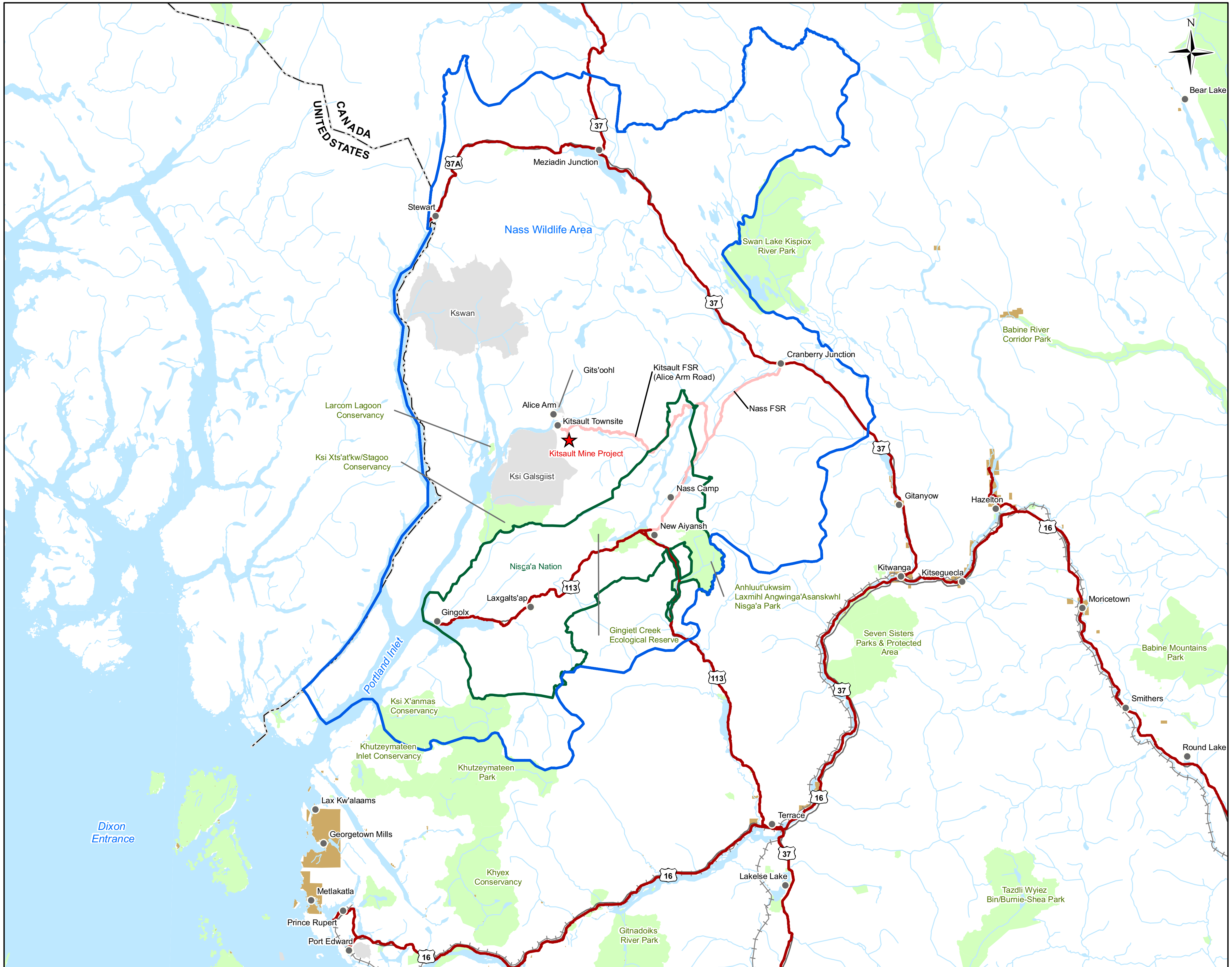
CLIENT: Avanti Kitsault Mine Ltd.

PROJECT: Kitsault Mine Project

Project Location in BC

DATE: November 2011	ANALYST: MY	**Figure** 3.2-1
JOB No: VE51988	QA/QC: TT	PDF FILE: VE52005_key_plan.pdf
GIS FILE: VE52005_key_plan.mxd		amec
PROJECTION: UTM Zone 10	DATUM: NAD83	

Y:\GIS\Admin\Key_Plan\Mapping\MXD\VE51988_key_plan.mxd



Legend

- ★ Kitsault Mine Project
- Populated Place
- Road
- Highway
- Railway
- International / Provincial Border
- Stream
- Waterbody
- Indian Reserve
- Parks & Protected Area
- Biodiversity, Mining And Tourism Area
- Nisga'a Nation
- Nass Wildlife Area

KEY MAP

Scale:1:1,000,000

10 5 0 10 20

Kilometres

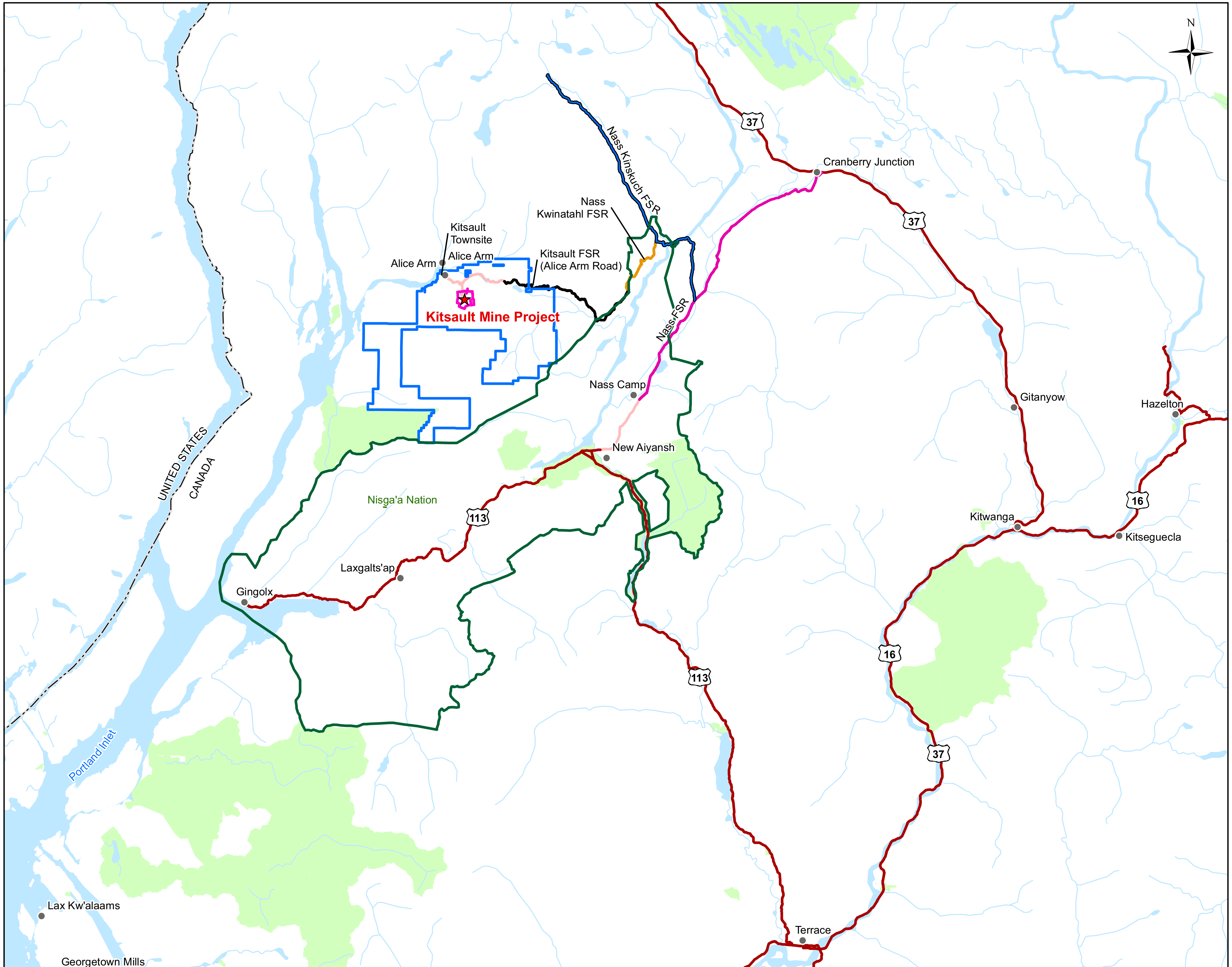
Reference

Base Data
Geobase 1:20,000 (TRIM)
Land and Resource Data Warehouse 1:20,000 (TRIM)
Atlas of Canada scale 1:1,000,000.

CLIENT:	AVANTI — Avanti Kitsault Mine Ltd.
PROJECT:	Kitsault Mine Project
	Kitsault Mine Project Location

DATE: November 2011	ANALYST: MY	**Figure** 3.2-2
JOB No: VE51988	QA/QC: TT	PDF FILE: Other-50-047_project_location_v3.pdf
GIS FILE: Other-50-047_v3.mxd		amec
PROJECTION: UTM Zone 9	DATUM: NAD83	

Y:\GIS\Projects\VE\VE51988_Kitsault\Mapping\Other\Other-50-047_v3.mxd



Legend

- Kitsault Mine Project
- Populated Place
- Road
- Highway
- International / Provincial Border
- Stream
- Waterbody
- Parks & Protected Area
- Nisga'a Nation
- Nass Forest Service Road (FSR)
- Nass Kinskuch Forest Service Road (FSR)
- Nass Kwinatahl Forest Service Road (FSR)
- Kitsault Forest Service Road (FSR)
- Avanti Kitsault Mine Ltd. Mineral Tenures
- Avanti Kitsault Mine Ltd. Mining Leases

KEY MAP

Scale:1:600,000

0 5 10 20

Kilometres

Reference
Base Data
Atlas of Canada scale 1:1,000,000.

CLIENT: Avanti Kitsault Mine Ltd.

PROJECT: Kitsault Mine Project

Access Route for Kitsault Mine Project

DATE: November 2011	ANALYST: MY	**Figure** 3.2-3
JOB No: VE51988	QA/QC: TT	PDF FILE: Other-50-081_access_route.pdf
GIS FILE: Other-50-081.mxd		
PROJECTION: UTM Zone 9	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE51988_Kitsault\Mapping\Other\Other-50-081.mxd

3.2.2 Terrain

The Kitsault property is located on an upland hilly plateau characterised by thick stands of timber interspersed with small lakes, meadows, and swamps. Bedrock is generally blanketed by a few metres of glacial till and commonly overlain by a layer of peat bog up to 1 m thick. The dominant topographic features are a series of eroded basaltic lava flows that commonly form cliffs up to 100 m high. Topography rises quickly from tidewater at Alice Arm to an elevation of 600 m above mean sea level (amsl) in the vicinity of the existing historic open pit mine, and then up to approximately 920 m amsl on a lava flow that forms a plateau known as Widdzech Mountain, where the new Process Plant is proposed to be located. The mine site is drained by Patsy and Lime Creeks. Patsy Creek flows into Lime Creek in the vicinity of the former mill site, then runs steeply toward the Kitsault Townsite, entering the ocean just to the southwest.

For more background information about terrain, see Sections 6.1.7, and 6.9.

3.2.3 Climate

The climate in the area is temperate coastal, verging on rainforest, and is controlled by four major factors: westerly winds (which cause atmospheric disturbances that cross the area from west to east); proximity to the Pacific Ocean (which results in moderate temperatures and an abundant moisture supply); the North Pacific semi-permanent high-pressure cell (which controls the seasonal distribution of precipitation by forcing the major storm tracts to migrate over the area, moving south during October and north during March); and the rugged topography (which creates distinct solar radiation balances and wind circulations). Average annual precipitation at Alice Arm is about 2 m; at the proposed Project site, annual precipitation is approximately 2.45 m (approximately 30% as rain, approximately 70% as snow).

For more background information about climate, see Sections 6.1.1.1, and 6.2.

3.2.4 Natural Hazards and Environmental Concerns

The region of coastal northwest BC and the southwest Yukon Territory is one of the most seismically active areas in Canada. The seismic hazard in the region is also influenced by the seismically active region of southeast Alaska, including the panhandle. The coastal region has experienced many large earthquakes, including events with magnitudes in the range of 7.0 to 8.0+. These earthquakes are typically associated with the Queen Charlotte fault, Fairweather fault (the northern extension of the Queen Charlotte fault) and the eastern Denali fault system.

For more information about the effects of the environment on the proposed Project, see Section 21.5.

3.2.5 Legal Status and Ownership

The Kitsault, Bell Moly, and Roundy Creek molybdenum deposits are located on the Kitsault land package, along with the existing access roads, power lines, and waste areas. Bell Moly and Roundy Creek deposits are not part of the proposed Project.

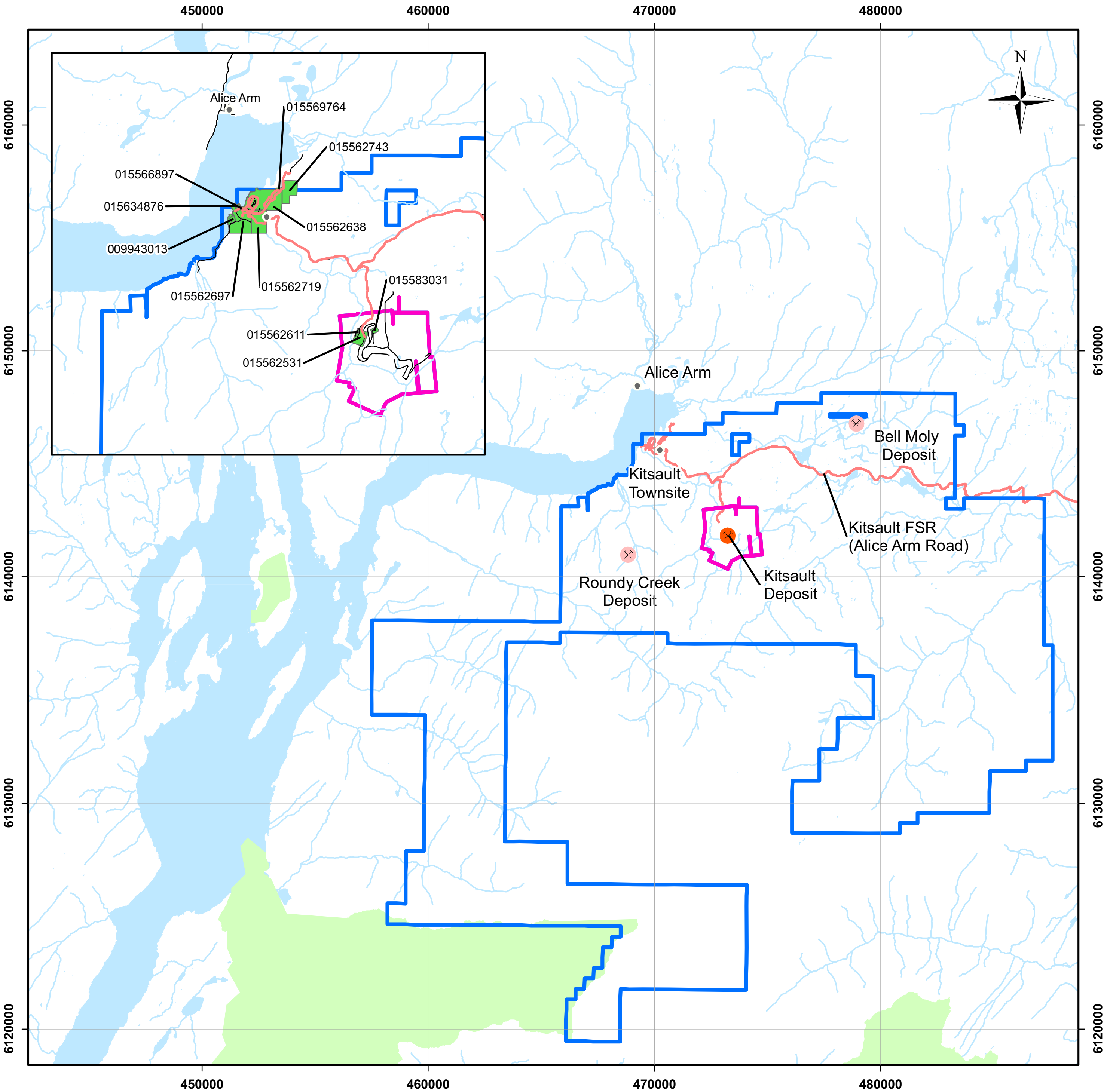
The former Kitsault mine is a permitted brownfield site with considerable past mining activity and basic infrastructure in place. It is not an abandoned mine because a *Mines Act* Permit is in place, and there are outstanding reclamation obligations. Permit M-10, an "Amended Permit Approving Reclamation Program," supports reclamation activities associated with the former Kitsault mine.

The proponent has title to a total of 35 mining leases and 310 mineral tenure claims (Table 3.2-1) within the boundaries shown in (Figure 3.2-4).

Table 3.2-1: Avanti Kitsault Mine Ltd. Mineral Claims and Mining Leases

Mineral Claim							Mining Lease
250340	254733	255059	255122	255372	568519	617323	254543
250341	254734	255060	255123	255373	568520	617344	254544
250342	254735	255061	255124	255374	568521	617345	254545
250343	254736	255062	255125	255375	568522	617346	254546
250344	254737	255063	255126	509804	568523	617363	254547
250345	254738	255064	255127	510205	568524	620565	254548
250346	254739	255066	255128	510225	568525	620583	254549
250347	254740	255067	255129	510226	568526	649604	254550
250390	254741	255068	255130	517362	568527	649605	254551
250391	254742	255069	255131	517364	568530	683484	254552
250458	254743	255070	255132	517367	568534	683503	254553
250508	254744	255071	255133	517371	568537	683523	254554
250512	254745	255072	255134	527089	568538	683543	254555
250513	254746	255073	255135	530006	568539	707024	254556
250514	254747	255074	255136	530007	598581	719548	254557
250515	254748	255083	255137	530008	602567	839492	254558
250516	254749	255084	255138	530009	602570	844688	254559
250517	254750	255085	255139	530826	602571		254560
250578	254752	255086	255158	530827	602572		254561
250579	254753	255087	255159	530884	602574		254562
250612	254754	255088	255160	530885	602576		254563
250613	254755	255089	255161	530886	602577		254564
250685	254764	255090	255162	530887	602580		254565
250991	254765	255091	255163	530888	602583		254566
250992	254766	255092	255164	530889	602584		254567
251157	254767	255099	255165	530890	602586		254568
254670	254768	255100	255166	530891	602587		254569
254671	254769	255101	255167	530892	602593		254570
254672	254770	255102	255169	530893	603005		254571
254673	254771	255103	255170	530912	603006		254572
254715	254772	255104	255354	530913	603007		254573
254716	254777	255105	255355	530914	603009		254574
254717	254778	255106	255356	555363	603011		254575
254718	254779	255107	255357	555366	603012		254576
254719	254955	255108	255358	564915	603533		254577
254720	254956	255109	255359	564916	603534		
254721	254957	255110	255360	564917	603535		

Mineral Claim							Mining Lease
254722	254958	255111	255361	566438	603536		
254723	254959	255112	255362	566439	603537		
254724	254960	255113	255363	566480	603538		
254725	254961	255114	255364	566483	606521		
254726	254962	255115	255365	566486	606522		
254727	254963	255116	255366	568513	606523		
254728	255024	255117	255367	568514	606524		
254729	255025	255118	255368	568515	606963		
254730	255026	255119	255369	568516	606964		
254731	255027	255120	255370	568517	617304		
254732	255058	255121	255371	568518	617306		



Legend

- Access Road
- Stream
- Waterbody
- Parcel
- Parks & Protected Area
- Kitsault Deposit
- Bell Moly Deposit
- Roundy Creek Deposit
- Avanti Kitsault Mine Ltd. Mineral Tenures
- Avanti Kitsault Mine Ltd. Mining Leases

Reference

Base Data: 1:50,000.
Tenure Data: Date March 22, 2011

Scale: 1:250,000
0 2.5 5 10
Kilometres

CLIENT:	Avanti Kitsault Mine Ltd.
PROJECT:	Kitsault Mine Project

Avanti Kisault Mine Ltd.
Mineral Tenures and Mining Leases

DATE: November 2011	ANALYST: MY	**Figure** 3.2-4
JOB No: VE51988	QA/QC: TT	PDF FILE: Other-50-004_mineral_lease_v6.pdf
GIS FILE: Other-50-004_v6.mxd		
PROJECTION: UTM Zone 09	DATUM: NAD83	

Y:\GIS\Projects\VE\VE51988_Kitsault\Mapping\Other\Other-50-004_v6.mxd

Most of the mining leases and mineral claims are located under provincial Crown lands, and four are located under privately owned lands at the Kitsault Townsite along Alice Arm. Surface rights are granted under the mining leases from the Crown. Mineral claims surface rights are obtained through the process of converting mineral claims to mining leases.

The proposed Project also consists of the following surface lands that overlap a number of the leases and claims (see inset on Figure 3.2-4). The three parcels of land are as follows:

- Parcel Identifier 015-583-031, District Lot 2656 Cassiar District (2.34 ha);
- Parcel Identifier 015-562-531, Block A District Lot 35 Cassiar District (12.1 ha); and
- Parcel Identifier 015-562-611, Block B District Lot 35 Cassiar District (0.057 ha).

One Statutory Right-of-Way (SROW) SROW No. BX201679 allows for access through the following Kitsault Townsite privately owned lands:

- Parcel Identifier 015-634-876, District Lot 2757 Cassiar District;
- Parcel Identifier 015-566-897, Block B (Plan 9849) District Lot 63 Cassiar District;
- Parcel Identifier 015-562-638, Block A District Lot 63 Cassiar District;
- Parcel Identifier 015-569-764, Block B District Lot 63 Cassiar District;
- Parcel Identifier 015-562-697, Block A District Lot 64 Cassiar District Except Plan 6531;
- Parcel Identifier 015-562-719, District Lot 6930 Cassiar District;
- Parcel Identifier 015-562-743, District Lot 6931 Cassiar District; and
- Parcel Identifier 009-943-013, Lot 1 District Lot 64 Cassiar District Plan 6531.

A royalty is payable by Climax to Bell Molybdenum Mines Ltd. (Bell) on each tonne of ore mined and removed from claims 250340, 250341, 250342, 250343, 250344, 250345, 250346, 250347, 250390, and 250391 (covering the Bell Moly deposit only). The entire property is subject to a 9.22% net cash flow interest that is owned by Amax. This net cash flow interest is only payable after the recovery of all operating and capital costs associated with construction or sustaining capital.

Aluminerie has a 1% net smelter royalty on future production subject to the right, within 90 days from the presentation of a Feasibility Study, to elect to surrender the net smelter royalty in exchange for either an additional US$10 million payment (payable at commercial production or in shares of Avanti Kitsault Mining Inc. within 30 days after the date of election).

3.3 Geology and Molybdenum Resources

This section describes the geology and molybdenum resources of the proposed Project area. Subsequent sections describe: regional geology (Section 3.3.1); local Kitsault geology (Section 3.3.2); and the Kitsault deposit mineral resources (Section 3.3.3).

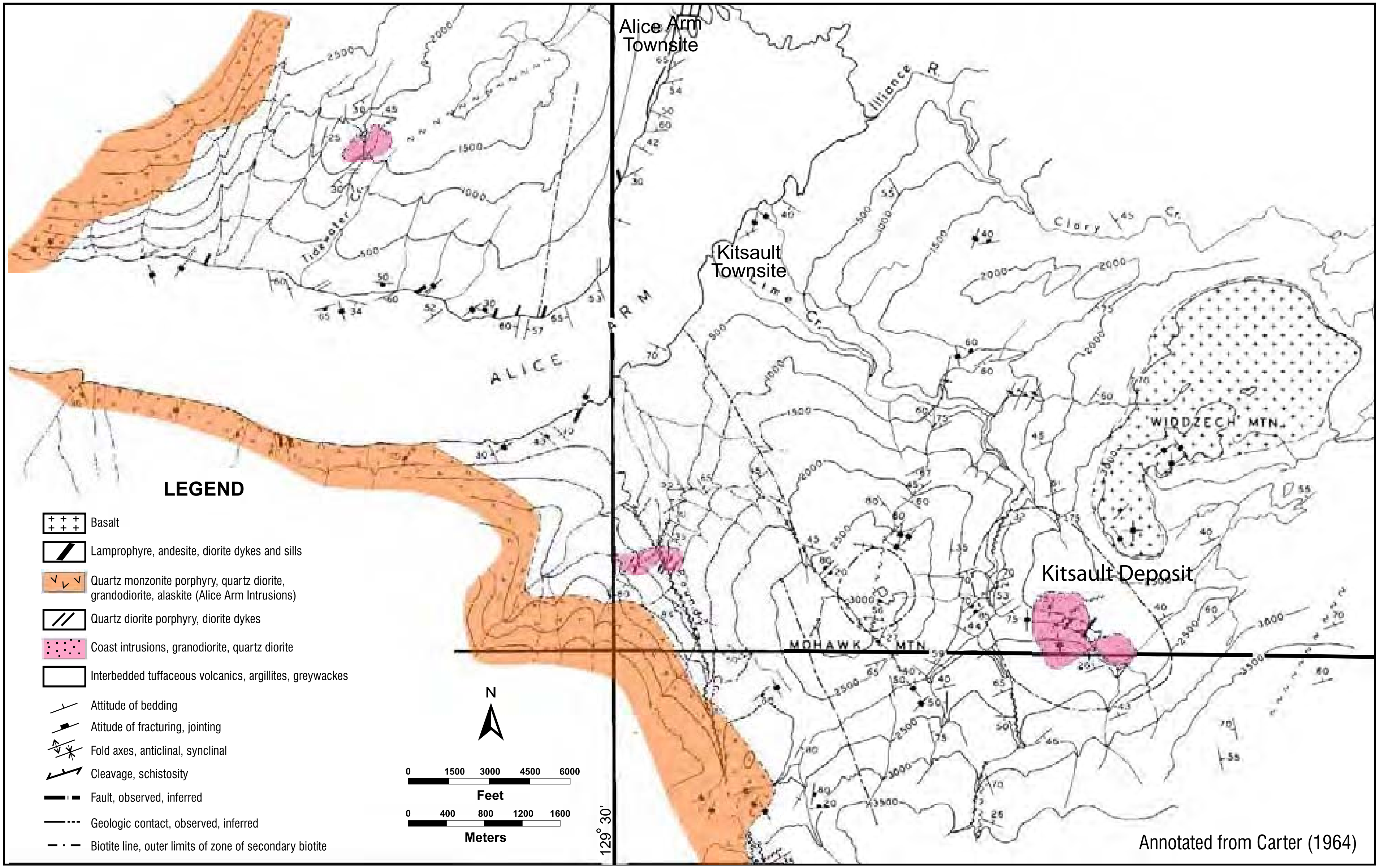
3.3.1 Regional Geology

This description of the regional geology is based on Carter (1964, 1981). The deposits are hosted within the Intermontaine Tectonic Belt of the Canadian Cordillera along its contact with the Coast Range Crystalline Complex. The Intermontaine Tectonic Belt is an assemblage of accreted sedimentary and island arc terranes that docked against the North American craton in the Early to Middle Jurassic. The Coast Range Crystalline Complex intrusive rocks range in composition from granodiorite to quartz monzonite and have an age span from the Late Jurassic to the early Tertiary period. Overlying both the Intermontaine Tectonic Belt and the Coast Range Crystalline Complex are the eroded remnants of more recent plateau-type lava flows.

In the general proposed Project area, the primary sedimentary lithologies within the Intermontaine Tectonic Belt are the Lower to Middle Jurassic Hazelton Formation and Upper Jurassic to Lower Cretaceous Bowser Lake Group. The Hazelton Formation consists of volcanic breccias, tuff, conglomerate, volcaniclastic sedimentary rocks, and andesite flows, all metamorphosed to greenschist facies. The Bowser Lake Group consists of interbedded greywacke and argillite with minor conglomerate and limestone metamorphosed to greenschist facies. The Coast Range Crystalline Complex is represented by 50 to 55 mega-annum granodiorite to quartz monzonite stocks in the proposed Project area; this suite is informally referred to as the “Alice Arm intrusives”. Many of the Alice Arm intrusive bodies are loci for molybdenum mineralisation, including at Kitsault.

Following the emplacement of the Alice Arm intrusive suite and related molybdenum mineralisation, a swarm of approximately 34 to 36 mega-annum, northeast-striking, lamprophyre dykes was intruded into the Bowser Lake Group. The youngest igneous event comprises approximately 0.62 to 1.6 mega-annum basaltic plateau-type flows and related vesicular basaltic dykes. The entire area was exposed to glaciation, the majority of which occurred after the last igneous event.

The regional geological setting is shown in Figure 3.3-1.



CLIENT: Avanti Kitsault Mine Ltd.	ANALYST: MY QA: MY	PROJECT: Kitsault Mine Project	REV. NO.: A DATE: November 2011
AMEC ENVIRONMENT & INFRASTRUCTURE 4445 Lougheed Highway, Burnaby, B.C., V5C 0E4 Tel. 604-294-3811 Fax 604-294-4664	DATUM: Undefined PROJECTION: Undefined SCALE: Not to Scale	TITLE: Regional Geology of the Proposed Project Area	PROJECT NO: VE51899 FIGURE No. 3.3-1

Y:\GIS\Projects\VE\VE51988_Kitsault\Mapping\Other\AI\Other-50-011.ai

3.3.2 Local Kitsault Geology

The Bowser Lake Group in the proposed Project area consists of regionally and thermally metamorphosed interbedded argillite and greywacke. These lithologies were intruded by the Early Tertiary Lime Creek Intrusive Complex, the Clary Creek stock, and the Roundy Creek intrusive complex.

Intrusive rocks associated with molybdenum mineralisation at Kitsault are multi-phase diorite, quartz monzonite, and younger felsic units. Surrounding the intrusive rocks are hornfels aureoles. Cross-cutting relationships within the intrusive suites indicate that molybdenum mineralisation is the result of multiple mineralising events.

Away from the Kitsault Pit, surface rock exposures are limited, as the area is covered by soil, swamp, glacial till, and in places basalt flows. The primary source of geological data is drill core.

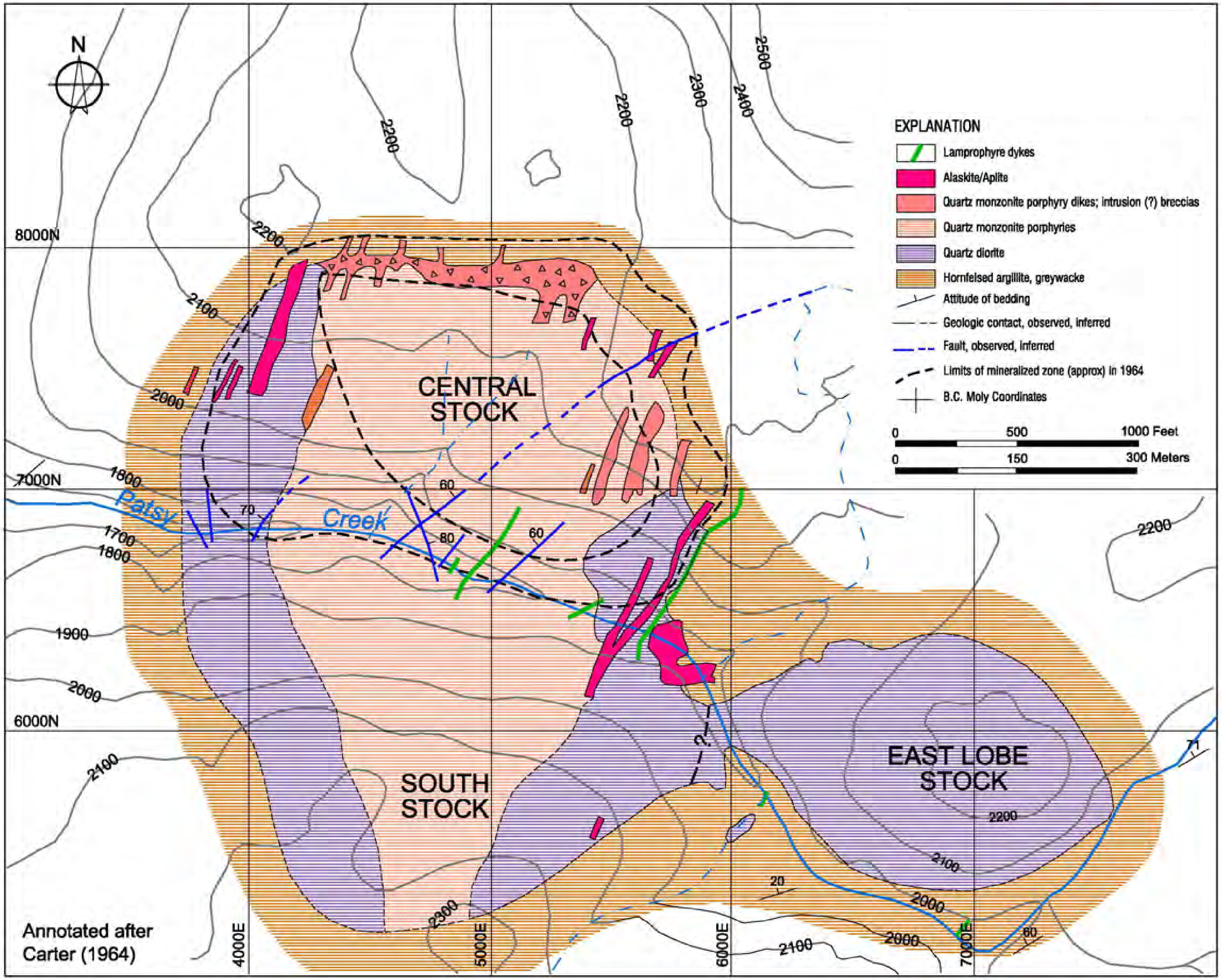
The following description is based on the NI 43-101 report completed by AMEC (Appendix 3.0-A). Originally, the stocks in the Kitsault mine area, from oldest to youngest intrusive phase, had been defined as:

- East Lobe: the oldest intrusive phase, poorly exposed; now covered by historic mine dumps;
- Border Stock: medium-grained and equigranular quartz diorite or diorite; locally displays a distinct foliation defined by the alignment of abundant biotite;
- Southern Stock: quartz monzonite; the probable contact of the Central and Southern Stocks, at the surface of Patsy Creek, is marked by extensive development of secondary K-feldspar alteration;
- Central Stock: A variably porphyritic quartz monzonite porphyry that hosts the bulk of the molybdenum mineralisation;
- Northeast Porphyry: quartz monzonite porphyry; and
- Intramineral porphyry dykes: possibly related to the Northeast Porphyry intrusion.

The molybdenum mineralisation was interpreted to form a hollow, steeply dipping, annular, cylindrical shape that is well-developed on three sides of the margins of the central Lime Creek Intrusive Complex (See Figure 3.3-2.)

The exterior of the annulus was localised within, along, and slightly exterior to, the contact with the hornfelsed Bowser Lake Group sediments. Interior to the annular and cylindrical molybdenite mineralisation, a barren core was interpreted. The south side of the intrusive complex was in contact with another, largely unmapped intrusive body, and in this area, the exterior boundary of the annular and hollow cylinder was less well constrained by drilling and may have extended across the intrusive contact.

The interpretations subsequently have been refined, based on the additional drilling completed by the proponent.



CLIENT: AVANTI MINING INC — Avanti Kitsault Mine Ltd.	ANALYST: MY	PROJECT: Kitsault Mine Project	REV. NO.: A
	QA: MY		DATE: November 2011
AMEC ENVIRONMENT & INFRASTRUCTURE 4445 Lougheed Highway, Burnaby, B.C., V5C 0E4 Tel. 604-294-3811 Fax 604-294-4664 — amec	DATUM: Undefined	TITLE: Geology of the Kitsault Deposit	PROJECT NO: VE51988
	PROJECTION: Undefined		FIGURE No. 3.3-2
	SCALE: Not to Scale		

The following description is based on the Feasibility Study for the proposed Project (Appendix 3.0-A).

The host units to the intrusions are argillites and greywackes of the Bowser Lake Group. In the pit area, the sediments have a general N25 degree (°) -45°E strike and northwesternly dip angles of 20°-60°. These trends indicate that the Lime Creek Intrusive Complex is largely discordant to bedding in the sediments.

The Bowser Lake Group sediments have been thermally altered for distances of as much as 750 m from the intrusive contacts, producing hornfels aureoles. The hornfels zones typically display an outer, weakly-developed albite-epidote facies, a central, pale-brown biotite zone, and an inner, brown biotite zone. The biotite hornfels zones locally contain small veinlets of epidote and clots of andradite garnet.

The largest intrusive stock, and the main mineralisation host, is the Central Stock, located north of Patsy Creek. It is a variably porphyritic and seriate quartz monzonite, primarily composed of feldspar, quartz, and biotite. It has been divided into three major phases, which are, from oldest to youngest, quartz diorite, QMP-I, and QMP-II. The phases are described below.

- Quartz diorite is the oldest intrusive unit of the Lime Creek Intrusive Complex, and forms the western intrusive-hornfels contact. Contacts between the QMP-I and quartz diorite are typically obscured by alteration and mineralisation, but at core scale, inclusions of quartz diorite were observed by the proponent within QMP-I. It is unclear from the core whether the quartz dirorite is an early phase of the QMP-I or a distinctly separate intrusive phase; however, geological interpretations used for estimation purposes have treated the unit as an earlier intrusive event. In this interpretation, the quartz diorite has been cut by the central QMP-I intrusive, leaving screens or major inclusions within, and a ring of quartz diorite around, the main stock of QMP-I;
- The QMP-I intrusion is pre- or syn-mineralisation in age. The stock is approximately 500 m wide at surface and on the 450 m level plan, and displays a plug-like morphology. The stock has steeply outward-dipping contacts with the enclosing hornfelsed Bowser Lake Group sediments at near-surface elevations. The flanking quartz diorite rim to the QMP-I skirts the hornfels contact along the west and north sides of the QMP-I stock; the proponent notes that it is more abundant in the subsurface along the eastern and southeastern contact than its surface distribution would suggest. The vertical extent of the QMP-I body is unknown. Historic drilling has generally tested this plug down to the 200 m elevation, and two drill holes have intersected mineralisation within QMP-I to the 0 m elevation; and
- The QMP-II intrusion post-dates all economic molybdenum mineralisation and in part includes the historic Northeast Porphyry body. Where it carries >75 parts per million (ppm) molybdenum values, the mineralisation is either due to the presence of late quartz-carbonate veins, or to very rare, isolated quartz-molybdenite veinlets. The QMP-II unit has a more obvious porphyritic appearance than QMP-I. QMP-II

reaches the surface as a narrow, circular plug within the barren core, and broadens with depth towards the north and northeast.

The contact between QMP-I and QMP-II is almost always obscured by strong silicification in core specimens. The proponent's staff have noted that differentiation between the QMP-I and QMP-II contacts in drill holes within the central area is more difficult to determine than in the holes drilled in the northeastern and northern parts of the complex.

Three dyke phases are recognised by the proponent in addition to the porphyry phases:

- Aplite dykes: typically display 15-75 m, northerly trending strike lengths, and moderate widths of 3-15 millimetres (mm), forming sheeted zones of dykes, sometimes with cumulative widths of 10 m or more. Aplite dykes commonly show gradations from a typical sucrosic texture to micro-pegmatitic textures and are generally spatially associated with the margins of the QMP-I stock. They cross-cut all rock types except for QMP-II and have little spatial continuity. Aplite dykes can contain abundant disseminated molybdenite and pockets of high-grade clots of molybdenite as well as irregular quartz-molybdenite veinlets, which visually appear to originate from within the aplite bodies;
- Intramineral porphyry dykes: cut QMP-I. Radial dykes mapped by Kennco on the open pit benches in 1970 may be the wider, high-level equivalents of the narrow intramineral porphyry dykes observed at depth in 2008 drill core; and
- Lamprophyre porphyry dykes: typically 1 m to 10 m wide, generally have a northerly or easterly strike direction and are steeply dipping. Lamprophyre porphyry dykes are non-mineralised, considered volumetrically insignificant, and tend to display poor continuity along strike and down dip.

Widespread structural breaks, generally marked by gouge-bearing fault zones from centimetres to less than a metre in width, are commonly observed in many of the 2008 drill holes. However, these fault zones are difficult to correlate between sections. Mapping in 2008 of the exposed pit walls indicated no major fault zones within the pit area.

3.3.3 Mineral Resources

3.3.3.1 Estimation Method

Details on the estimated resources can be found in the "National Instrument 43-101 Technical Report on Feasibility Study" (Appendix 3.0-A). Mineral resources were estimated using a mining block model. Block size was 10 x 10 x 10 m. Mineral resources were interpolated using ordinary kriging, and confined within Lerchs-Grossmann pit shells that were developed using appropriate mining, processing, and recovery parameters for the deposit type.

Mineral resources were classified (effective date of 8 November 2010) using Canadian Institute of Mining, Metallurgy and Petroleum (CIM) "CIM Standards for Mineral Resources and Mineral Reserves, Definitions and Guidelines" (CIM 2005), "Estimation of Mineral

Resources and Mineral Reserves Best Practices Guidelines" (CIM 2003), and Canadian Securities Administrators "National Instrument 43-101, Standards of Disclosure for Mineral Projects" (Canadian Securities Administrators 2005). The following criteria were used to pre-classify blocks into resource categories:

- Measured (proven) resources: required composites from a minimum of three drill holes within a 45 m average distance from a block centroid;
- Indicated (probable) resources: required samples from a minimum of three drill holes within a 90 m distance of the block centroid, or composites from two drill holes at an average distance of 45 m from the block centroid; and
- Inferred material: blocks that were not classified as Measured or Indicated categories, but had a composite within 150 m from the block centroid.

Measured and Indicated resources (before adjustments for dilution) were used in the Kitsault Pit optimisation and subsequent mine design. Inferred material was treated as waste.

3.3.3.2 Estimated Quantities of Materials

The mineral resources for the proposed Project are shown in Table 3.3-1 based on a cut-off grade of 0.021% molybdenum (Appendix 3.0-A).

Table 3.3-1: Kitsault Mineral Resources, Effective Date 8 November 2010

Category	Tonnage (Mt)	Molybdenum (%)
Measured	73.0	0.093
Indicated	225.8	0.065
Measured + Indicated	298.8	0.072
Inferred	157.1	0.050

Source: Appendix 3.0-A
Note: Based on a cut-off of 0.021% Molybdenum

The amount of material to be mined during the life of the proposed Project differs from the total resource presented in Table 3.3-1 as the resource estimate does not include various engineering and mining considerations of extracting the ore. The total amount of material to be mined from the Kitsault Pit is estimated at 410 Mt. This includes waste rock and molybdenum ore.

The total amount of waste rock is approximately 178 Mt at a cutoff grade of 0.021% molybdenum. This results in a stripping ratio of approximately 0.77:1. Within the 178 Mt of waste rock is 35 Mt of Inferred material. This Inferred material, although treated as waste in the Mine Plan, has a molybdenum grade of 0.046% and represents upside potential as it could possibly be upgraded to a Measured and Indicated resource by further resource definition drilling to be carried out in 2011.

The total amount of molybdenum ore (i.e., mill feed used in the Mine Plan) is approximately 232.5 Mt, at a molybdenum grade of 0.081%. This includes Measured resources (~69.7 Mt at a grade of 0.097%) and Indicated resources (approximately 162.8 Mt at a grade of 0.075%).

For the purpose of the Environmental Assessment (EA) Application, the 35 Mt of Inferred material is included in both the Waste Rock Management Facility (WRMF) and the Tailings Management Facility (TMF) to present the maximum footprint of both the WRMF and the TMF. If this material is classified as ore based on 2011 drilling, it will be milled through the Process Plant and deposited in the TMF. However, if the 2011 drilling does not classify the material as ore it will be deposited in the WRMF.

Molybdenum ore will be processed at a rate of between 40,000 and 50,000 t/d, for 15 to 16 years. The final milling rate and life of production will depend on the results of subsequent drilling within the area of the Inferred material. Processing of the molybdenum ore will produce a final concentrate that is expected (based on data from previous operating periods as well as recent sample testing) to contain approximately 52% molybdenum and few impurities (e.g., <0.04% lead). This concentrate is high-grade and meets smelter specifications (i.e., saleable). Based on both mining recovery and processing recovery, the estimated overall life-of-mine molybdenum recovery is 89.9%.

3.4 Geochemical Characterisation

The following is a summary of the metal leaching (ML) and acid rock drainage (ARD) characterisation program completed for the proposed Project. The full ML/ARD characterisation report is presented in Appendix 3.0-C.

3.4.1 Scope of Assessment

The scope of the geochemical evaluations was to predict concentrations and loadings from the exposure of waste rock, pit walls, stockpiled low grade ore, tailings, and construction materials to surface and / or groundwater. Information sources used to predict these loadings include details of the mine plan, hydrological information, and an understanding of the bulk characteristics and weathering release rates of the various rock types. Characterisation of the existing waste rock piles was an important part of the assessment because they have been exposed to weathering for approximately three decades. These piles show localised development of acidity, with no effect on the receiving waters in Lime Creek being observed.

Rocks types are largely of three main types: hornfels, diorite, and monzonite. The hornfels host rocks are thermally metamorphosed, interbedded argillite and greywacke of the Upper Jurassic to Lower Cretaceous Bowser Lake Group (Hodgson 1995). Thermal metamorphism of these rock types near the intrusive contacts has produced a biotite hornfels aureole adjacent to the intrusive, and an outer, weak, albite-epidote hornfels zone extending up to 750 m away from the intrusive contact. These greywackes typically consist of angular fragments of grey chert and rock fragments in a fine-grained matrix consisting of quartz and chert, plagioclase, chlorite, sericite and epidote. The less abundant argillite is dark grey to black and mineralogically similar to the greywacke matrix.

The intrusives are of the Lime Creek Intrusive Complex, Clary Creek Stock, and Roundy Creek Intrusive Complex. Intrusives associated specifically with molybdenum mineralisation are multiphase diorite, quartz monzonite / granodiorite, and younger felsic units. Post-mineralisation dykes comprised of aplite, lamprophyre, and a quartz monzonite porphyry unit are also present but form inconsequential proportions of the waste.

Mineralogy of these intrusives is dominated by quartz, feldspars (K-spar and plagioclase), aluminosilicates (muscovite, biotite and chlorite), carbonates (calcite, dolomite, ankerite, and siderite), sulphides (pyrite, pyrrhotite, sphalerite, and molybdenite), and gypsum in certain areas of the diorite unit. The sulphides and carbonates are associated with the mineralising events. Molybdenum-bearing mineralisation consists of a stockwork of quartz veins containing appreciable molybdenite and pyrite with minor scheelite, galena, sphalerite, chalcopyrite, Pb-Bi sulphosalts, tetrahedrite, and carbonate minerals; specifically calcite and dolomite with lesser ankerite and siderite. Northeast-trending polymetallic quartz veining, subsequent to molybdenum-bearing mineralisation events, may contain chalcopyrite, tetrahedrite, pyrite, sphalerite, galena, Pb-Bi sulphosalts, molybdenite, fluorite, and carbonate.

Alteration includes high-temperature hydrothermal alteration in the form of an inner silicified zone and surrounding potassic zone (with plagioclase and biotite) and peripheral phyllic alteration (with quartz-pyrite-scheelite veins). Lower-temperature hydrothermal alteration includes propylitic (with sericite and carbonate in the intrusive; and chlorite, calcite, epidote, and sericite in the sedimentary rocks) and argillic alteration (with sericite and kaolin minerals and occasionally montmorillonite associated with faulting) throughout and peripheral to the ore body, and into the sedimentary rocks, overprinting the hornfels facies.

3.4.2 Methods

Methods used in the geochemical evaluation are described fully in Appendix 3.0-C and are summarised here.

Mineralogical characterisation included petrography, X-Ray Diffraction (XRD) and Electron Probe Micro Analyses (EPMA). Petrography included evaluation of polished thin sections and off cuts with emphasis on sulphide minerals and any carbonate minerals present. Quantitative XRD (QXRD) was conducted over a range 3-80°2 with CoK radiation on a standard Siemens (Bruker) D5000 Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a Vantec-1 strip detector. The long fine-focus Co X-ray tube was operated at 35 kilovolt (kV) and 40 milliampere (mA), using a take-off angle of 6. EPMA was conducted on a Cameca electron microprobe and Philips XL-30 scanning electron microscope / Bruker Quanta 200 energy-dispersion X-ray microanalysis system with specific objectives of evaluating the carbonate composition by electron microprobe.

Static geochemical characterisation included acid base accounting (ABA) by the Method EPA 600 in earlier work and the Modified Sobek Method (MEND 1991) in recent work. Also conducted were carbonate analyses and metals analysis by ICP-OES following *aqua regia* digestion and atomic absorption (for molybdenum).

Selected sample sets were also tested using net acid generation tests with analyses of the net acid generation liquor using ICP-MS. Shake flask extraction testwork was performed using a 3:1 de-ionised water-to-solids ratio on the unmodified fines fraction of weathered samples (Price 1997). In addition to shake flask tests, a sequential meteoric water mobility procedure (SMWMP) was conducted on weathered samples, whereby sequential leaches (using the samples leachate for subsequent cycles) were conducted on the same sample at a preserved water-to-solid ratio of 1:1.

Kinetic testing used the humidity cell procedures following the MEND (1991) protocol using a 1 kilogram (kg) sample. Analyses conducted were pH, conductivity, redox, acidity, alkalinity and sulphate (weekly), and metals by ICP-OES (metals) (every 4 weeks).

Site water samples have typically been analysed for pH, conductivity, hardness, total suspended solids (by gravimetric methods), alkalinity (colourimetric method), sulphate (by turbidity), and total metals (by ICP-OES). In addition, dissolved metals (by ICP-OES) were measured at certain stations. Method details and certificates of analyses are provided in the 2010 Annual Reclamation Report (Appendix 3.0-B).

Drillhole K09-15GT in Patsy Dump was instrumented with thermistor cables for monitoring the dump temperature over time. The thermistor type was a 10 kiloOhm (kOhm) RST TH2016 thermistor cable with 15 nodal points at varying depths through approximately 13 m of waste rock and into the underlying greywacke bedrock.

The overall ML/ARD program is summarised in Table 3.4-1.

Table 3.4-1: Metal Leaching and Acid Rock Drainage Test Work Summary

	Mineralogy	ABA	Metals	NAG	SFE	Sequential Mine Waste Management Plan	Reductive Dissolution	Humidity Cell	Sub-Aqueous Column
Weathered pit wall rock		31		7					
Weathered low grade ore		18							
In situ low grade ore (drill core)	3		3					3	
In situ ore (drill core)		4	4					1	

	Mineralogy	ABA	Metals	NAG	SFE	Sequential Mine Waste Management Plan	Reductive Dissolution	Humidity Cell	Sub-Aqueous Column
Weathered Waste Rock	9	140	85	9	21	9	6		2
In situ Waste Rock (drill core)	20	45	45					20	
Metallurgical tailings	5	12	12	3				4 (+dup)	1 (+dup)
Construction rock		18	18					2	

Note: ABA - acid base accounting; +dup - duplicate; NAG - non-acid generating; SFE - shake flask extraction

3.4.2.1 Geochemical Sampling Locations

Geochemical sampling locations from within the proposed pit follow the drilling program and include drill core retrieved from 2011, 2010 and historical core (Figure 3.4-1). Table 3.4-2 provides specifics of the drilling within the south of Patsy Creek.

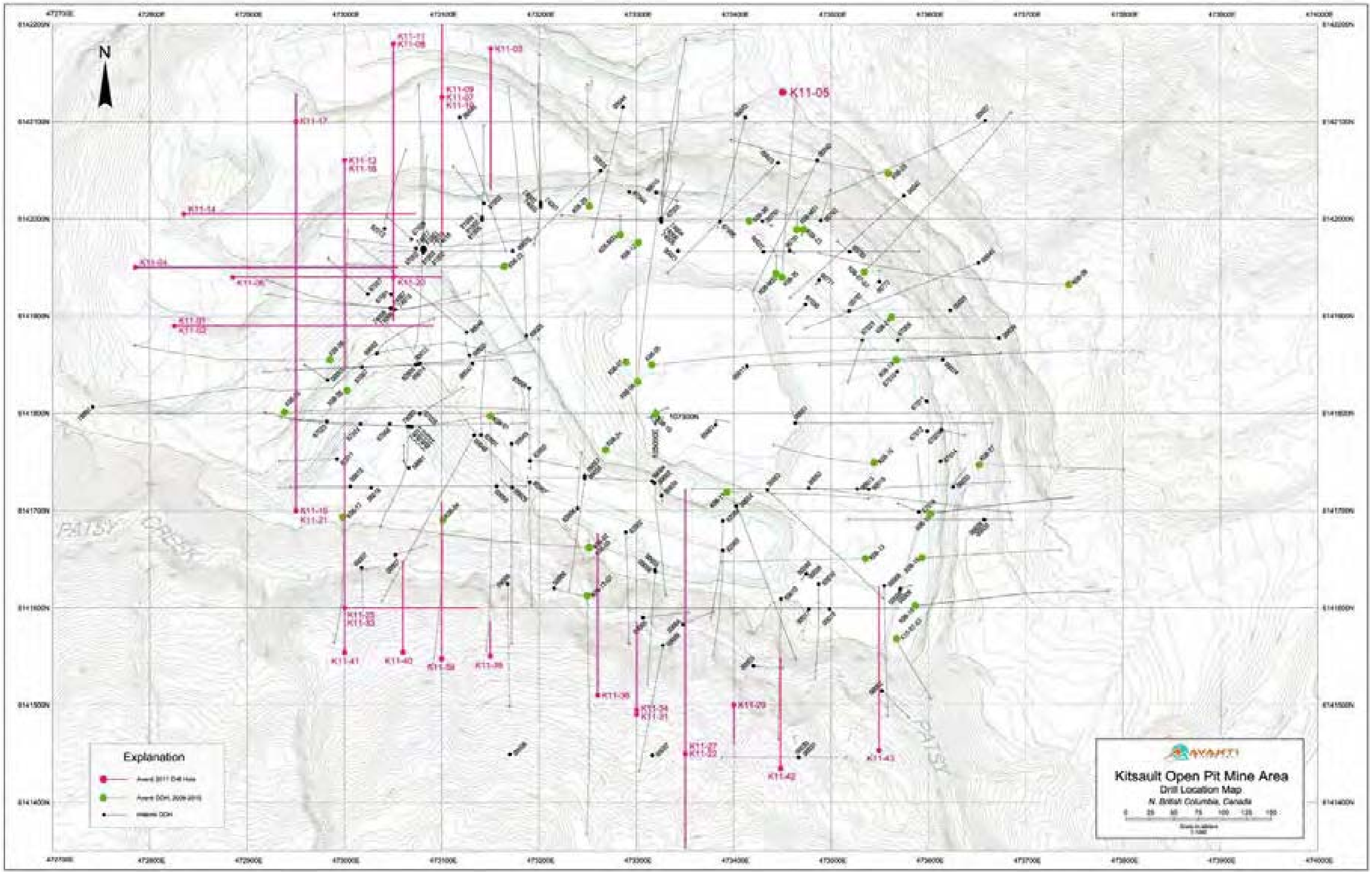


Figure 3.4-1: Drill and Geochemical Sampling Locations

Table 3.4-2: Drillholes Located within the Area South of Patsy Creek

	UTM NAD 83 Zone 9 coordinates					
Hole ID	**Easting (m)**	**Northing (m)**	**Elevation (m)**	**Azimuth**	**Dip ( )**	**Depth (m)**
K11-22	473349.75	6141447.28	619.42	000	-60	542.54
K11-25	473008.46	6141585.22	570.25	090	-45	194.46
K11-27	473350.25	6141447.42	619.44	180	-50	152.4
K11-29	473394.95	6141493.52	599.30	180	-75	155.45
K11-31	473297.76	6141495.15	606.62	000	-65	225.55
K11-34	473297.76	6141495.20	606.42		-90	179.83
K11-36	473260.27	6141513.29	603.96	000	-65	524.26
K11-38	473149.57	6141550.50	593.20	000	-70	103.63
K11-39	473099.52	6141547.56	589.72	000	-55	280.42
K11-40	473059.88	6141554.38	586.17	000	-60	185.93
K11-42	473447.83	6141434.53	619.68	000	-55	198.42
K11-43	473549.06	6141453.06	589.39	000	-50	262.13

Figure 3.4-2 shows molybdenum grade shell (0.05% Mo) and reserve pit showing NP/AP ratios in drill holes and blocks in contact with final Pit faces.

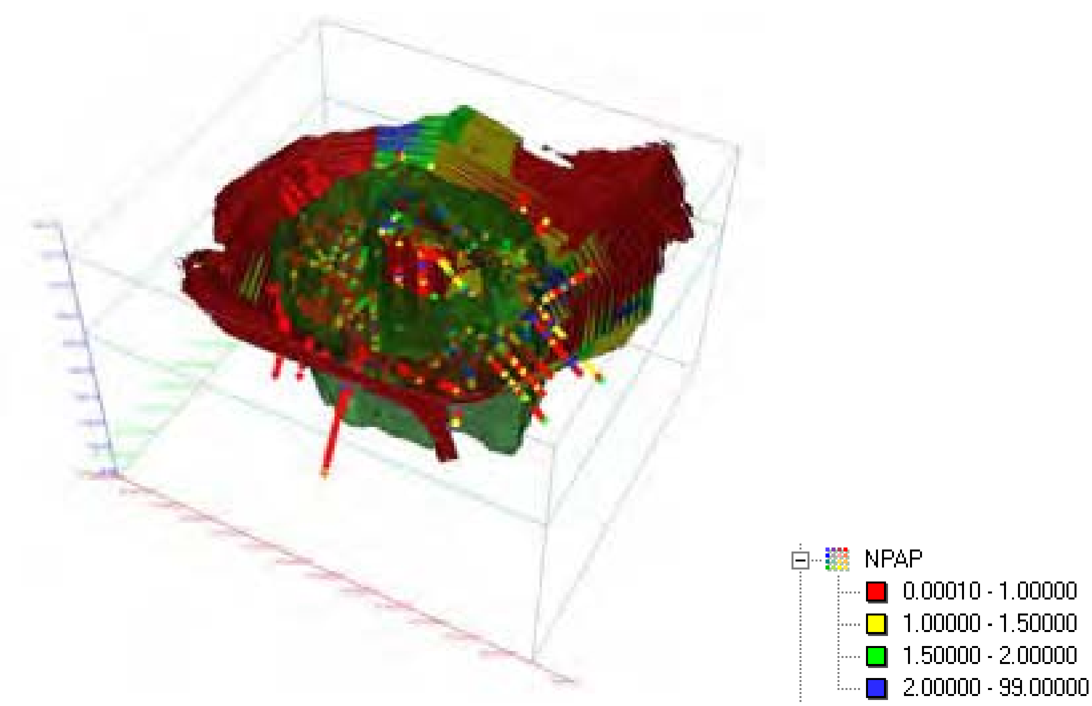


Figure 3.4-2: Molybdenum Grade Shell (0.05%), NP/AP Ratios in Drill Holes and Reserve Pit

Figure 3.4-3 shows the 0.05% molybdenum grade shell and reserve pit and locations of kinetic samples.

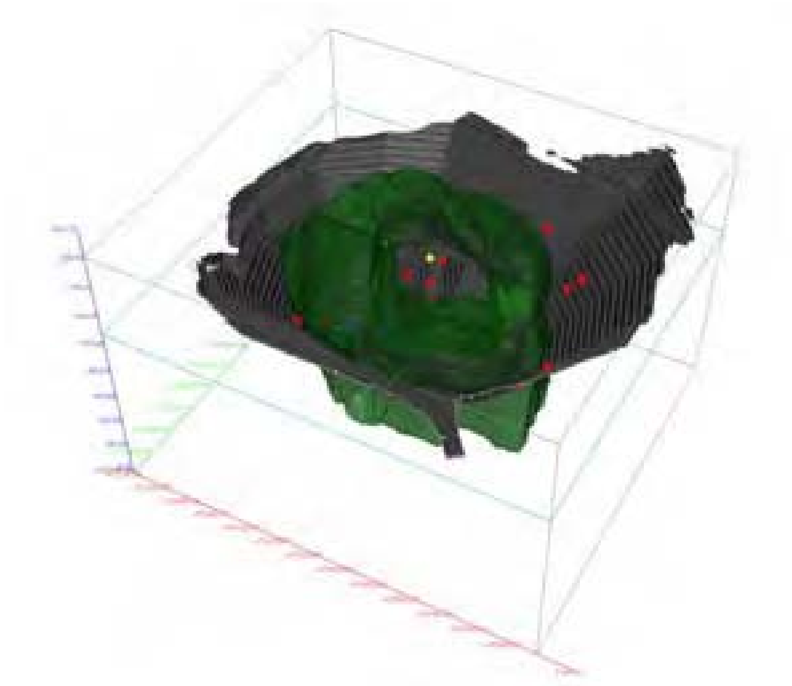


Figure 3.4-3: 0.05% Mo Grade Shell and Reserve Pit and Locations of Kinetic Samples

3.4.3 Geochemical Loading Predictions

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.

Initial leached mass for each parameter were estimated as follows:

Madj = R x krm x kgs x kf x kT

Where:

- Madj = the adjusted element leach mass (in milligrams per week (mg/wk));
- R = element leach rate as observed by humidity cell testing (in milligrams per kilogram per week (mg/kg/wk));
- krm = rock mass and material mixtures (in (kilogram (kg));
- kgs = adjustment factor to correct for grain size effects (unitless);
- kf = adjustment factor to correct for flow path development, or degree of flushing (unitless); and
- kT = adjustment factor to correct for temperature effects (unitless).

Adjusted leached masses for each parameter were converted to concentrations as follows:

Cadj = Madj/Q

Where:

- Cadj = the adjusted unequilibrated field concentration (in milligrams per litre(mg/L));
- Madj = the adjusted metal leach rate (in mg/wk); and
- Q = flows in contact with leachable rock (in litres per week (L/wk)).

The results represent the initial pore water concentrations, which were then refined to consider theoretical thermodynamically controlled concentrations of particular parameters as supported by site-specific observations and data sources as summarised in Appendix 3.0-D.

Source terms were predicted for the existing Patsy Dump to assess site-specific empirical scaling factors and provide a test of reasonableness for the prediction approach. Results are described in Appendix 3.0-C. Source terms were also developed for the future facilities including the LGS, WRMF, Kitsault Pit walls ,and TMF for various time steps and scenarios as summarised below.

3.4.3.1 Waste Rock Management Facility

Waste rock associated with the proposed Project will be dominated by the hornfels unit, with lesser significant amounts of granodiorite / monzonite and diorite. Sulphur content, as represented in histograms produced from drill core assay data, show generally normal distributions for all rock types and a similar range in sulphur content, though the diorite population tends to show a slightly wider range. The median sulphur content for diorite, granodiorite / monzonite, and hornfels sample populations was 1.9%, 1.5% and 1.2%, respectively. The drill core data indicate that the bulk of the samples have sulphur content similar to that currently seen in the pit walls and weathered waste rock dumps with sulphur contents typically between 0.5% and 2.0%.

Sulphate is only seen in significant amounts in diorite, which is anticipated to comprise a small proportion of the waste rock (about 4%). Observations of gypsum occurrence are noted as being local and clustered along fault / argillized zones. Conservatively, total sulphur has been used as a surrogate for sulphide sulphur and maximum acidity potential for all rock types, including diorite, in this study, where sulphate sulphur data is not available.

Total carbon in the drill core database was used as a surrogate for neutralisation potential (NP). Based on the mineralogical work, it is expected that nearly all the carbonate (on the order of 90%) will be in the form of calcium (Ca) and magnesium (Mg)-bearing carbonates. A correction to carbonate content was made in this evaluation whereby 90% of the calculated NP (based on total carbon) has been assumed to represent effective NP. This is also considered a conservative approach when evaluating ARD potential. Applying this correction only 7% of the samples had a shift in the NP to acid potential (AP) (NP/AP) ratio from above 1 to below 1 (i.e. the correction therefore was not a significant factor in the ARD classification of the bulk of the drill core material).

Using corrected NP and AP values in the block model showed that approximately 62 Mt (46%) of the rock will have NP/AP values below 1, with the remaining 72 Mt (53%) of material with NP/AP ratios above 1. Less than 10 Mt of waste, or 7%, will have an NP/AP ratio above 2. Results indicate that there is no clear sulphur cut-off below which the ARD classification would clearly be non-potentially acid-generating (PAG) and there is also no particular rock type that is consistently non-PAG, other than perhaps the lamprophyre, which represents a negligible proportion of the waste rock.

Solids chemistry, when compared to crustal abundances, indicated elevated silver, bismuth, cadmium, molybdenum, and sulphur, and less consistently antimony, arsenic, lead, selenium, tungsten, and zinc. This suite, with the addition of fluoride, is typical of molybdenum porphyry deposits. Sulphide oxidation rates and metal release rates were quantified in a humidity cell kinetic test program composed of samples representing the median and 95th percentile sulphur values for each of the lithologies present in the Kitsault pit. Leachate from all materials was consistently buffered throughout the test program. Calculated lag times for the depletion of NP due to sulphide oxidation and associated carbonate dissolution ranged from approximately one to 11 decades, with an average of 46 years represented by the samples tested.

Results produced a relatively wide range of sulphate release rates, ranging from approximately 2 to 200 mg/kg/wk. Sulphate was attributed to two dominant processes:

1. Oxidation of sulphides and subsequent release of sulphate; and
2. Dissolution of gypsum.

The highest sulphate release rates in the samples tested were from those with the highest gypsum content. Release rates in the 100 to 200 mg/kg/wk were seen in samples with sulphate sulphur contents over 0.5%. These samples were predominantly diorite. Samples with low sulphate sulphur content (less than 0.1%) showed lower sulphate release rates, generally <25 mg/kg/wk with a weak correlation to total sulphur content. Samples representing hornfels had rates between 5 and 20 mg/kg/wk, whereas those representing the granodiorite / monzonite lithology were generally <5 mg/kg/wk, which may reflect slight differences in sulphide mineralogy (e.g., pyrrhotite in the hornfels). Arsenic, antimony, cadmium, lead, molybdenum, selenium, and zinc showed correlation of release rates with bulk element content. There is a general tendency for increased release rates with increased solids metal content. Ranges over approximately two orders of magnitude were apparent in the release rates for these key parameters.

Source term concentrations for the WRMF were based on the average release rates for the period of record, as provided in Appendix 3.0-C. These source term concentrations were used for input values to the site wide water and load balance (Knight Piésold 2011). Long-term predictions related to the development of acidic conditions were estimated using results of calculated release rates from sequential meteoric water mobility procedure results conducted on currently acidic samples. Resulting source terms are provided in Table 3.4-3.

3.4.3.2 Low Grade Ore

Low grade ore will consist of a mixture of the three primary rock types – diorite, hornfels and granodiorite / monzonite – with the dominant rock type being diorite. It is anticipated that at its largest extent, the LGS may consist of approximately 27 Mt of ore.

As with the evaluation of waste rock, the majority of low grade ore will be PAG. Because of the long lag time inherent in the Kitsault rocks and the short period of activity of the low grade stockpile no acidity is anticipated to leach from this facility (i.e., it will be milled before the buffering capacity of the material is expected be depleted).

Metal contents in the solids and release rates from the low grade ore while buffered at near neutral pH may be marginally higher than within the WRMF for those parameters that correlate with sulphur content. Significant differences, however, were not seen in the humidity cell leachate results for samples with molybdenum values above and below the cut-off grade. The exception to this likely pertains to sulphate; if a significant portion of gypsum-bearing diorite is placed within the LGS, sulphate release rates associated with the dissolution of gypsum could be higher than would be expected from the same volume of waste rock.

In general, source term concentrations for the LGS calculated from the humidity cell results did not vary substantially from those provided for waste rock seepage during the operational phase of the proposed Project, particularly for those parameters that are anticipated to be controlled by secondary mineral phases. Results are summarised in Table 3.4-3.

3.4.3.3 Kitsault Pit Walls

The Kitsault Pit walls will consist predominantly of hornfels with lesser areal exposure of diorite and granodiorite / monzonite. At its full extent the Kitsault Pit will consist of approximately 106 ha of hornfels, 33 ha of diorite and 42 ha of granodiorite / monzonite.

ARD characteristics and metal release rates associated with the exposed pit walls are anticipated to be very similar to that estimated for the waste rock. The majority of the Kitsault Pit walls are therefore anticipated to be PAG, but are accompanied by significant lag periods and generally low metal release rates while buffered.

Humidity cell release rates attained from samples representing the three main lithologies were used to calculate predicted pit wall run-off chemistry at the full extent of mining.

After mining, the Kitsault Pit will flood to a level of approximately 515 metres above sea level (masl) prior to overflowing. The time to re-flooding has been predicted by Knight Piésold to be approximately 15 years, a period of time substantially shorter than the predicted delay to the onset of acid generation. The exposed high walls after flooding will nearly completely comprise hornfels.

Source-term predictions based on humidity cell release rates were provided for the exposed full extent of pit walls at the end of mining, as well as for the exposed high wall after re-flooding. Predictions for the long term, related to the development of acidic conditions, were estimated using results of calculated release rates from sequential meteoric water mobility procedure results conducted on currently acidic samples. Predictions are summarised in Table 3.4-3.

3.4.3.4 Tailings

Ore at Kitsault is largely dominated by diorite, although granodiorite / monzonite and hornfels will comprise part of the feed as well. Tailings will be produced by conventional flotation followed by de-pyritisation. There will be two main waste streams from the mill. The first will consist of a de-pyritised rougher tailings, which for a portion of the year will be cycloned, and the remaining time will be discharged to beaches as a de-pyritised whole rougher tailings. When cycloned, the underflow will be used in construction of the northern dam and the overflow will be disposed of on the beach. The second waste stream from the Process Plant will be the combined cleaner scavenger tailings and the pyrite concentrate from the de-pyritisation float. This stream will be disposed of sub-aqueously within the TMF.

The de-pyritised rougher tailings are strongly non-PAG with total sulphur contents anticipated to be less than 0.10% (0.06 and 0.08% in testwork) and NP values of approximately 40 kg calcium carbonate per tonne ($CaCO_3$/t) with resulting NP/AP ratios above 15. The cleaner scavenger tailings and the sulphide concentrates that will be stored below water are anticipated to have sulphide concentrations above 30% and be clearly PAG.

Elements occurring at relative elevated concentrations in the tailings include antimony, arsenic, bismuth, cadmium, fluoride, lead, molybdenum, sulphur, selenium, and tungsten. Many of these parameters are associated with the sulphides and will partition into the de-pyritisation concentrate and cleaner scavenger tails. Humidity cell results indicate the potential for leaching of many of these elements, most notably fluoride, arsenic, antimony, cadmium, and molybdenum.

Results of the test work were used to predict source-term concentrations from the tailings beach and the cyclone sand embankment as inputs to the site-wide water and load balance. These predictions are provided in Table 3.4-3.

Table 3.4-3: Kitsault Mine Project Source Term Predictions

Parameter	Unit	WRMF Seepage	WRMF Seepage	WRMF Seepage - 95% Acidic	LGS Seepage	Pit Walls - Full Extent	Flooded Kitsault Pit - Highwall	Flooded Kitsault Pit - Highwall 95% Acidic	Tailings Beach	Cyclone Sand Embankment	Supernatant Bulk Tailings	Supernatant Sulphide / Cleaner Tailings
		Construction	Operation	Closure	Operation	Operation	Closure	Closure	Closure	Operation & Closure	Operation	Operation
pH		7.2	8.9	4.5	8.9	8.2	8.1	5.2	8.3	8.7	7.9	7.9
Calcium	mg/L	187	740	321	611	212	23	74	25	103	76	87
Magnesium	mg/L	72	199	129	89	10	7	12	9.3	13	8.8	8.1
Potassium	mg/L	4	39	65	39	6	3	6	52	39	19	15
Sodium	mg/L	3.1	35	20	14	2	1	2	20	54	14	10
Carbonate	mg/L	52	66	1	66	66	52	2	66	66	49	75
Chloride h	mg/L	n.a.	4.1	5.3	4.1	2.8	1.7	3.2	4.9	4.1	5.1	5.0
Fluoride a	mg/L	n.a.	1.9	10	1.8	2.0	1.5	3.3	2.3	2.3	1.7	1.8
Sulphate	mg/L	789	1762	5562	1701	512	42	599	55	2258	108	102
Nitrate (as N) b	mg/L	n.a.	13		6.1	3.5	1.4	1.4	0.50			
Ammonia (as N) b	mg/L	n.a.	5.3		2.4	1.4	0.57	0.57	0.20			
Phosphorus h	mg/L	0.30	0.040	0.35	0.040	0.010	0.0048	0.072	0.075	0.040		
Aluminum c	mg/L	0.023	3.9	61	1.6	0.21	0.092	3.7	0.038	0.023	0.041	0.028
Antimony	mg/L	0.0008	0.038	0.063	0.017	0.0086	0.0024	0.0057	0.046	0.039	0.014	0.032
Arsenic	mg/L	0.0002	0.010	0.014	0.013	0.00059	0.00059	0.0013	0.0043	0.030	0.00071	0.00091
Barium	mg/L	0.021	0.0046	0.0021	0.0040	0.012	0.030	0.004	0.025	0.0037	0.099	0.11
Beryllium h	mg/L	<DL	0.00020	0.024	0.00020	0.000046	0.000024	0.0022	0.000078	0.00020	0.00001	0.00001
Bismuth h	mg/L	<DL	0.00010	0.00075	0.00010	0.00010	0.00018	0.000068	0.000040	0.00072	0.00001	0.00002
Boron h	mg/L	<DL	1.00	4.0	1.00	0.23	0.12	0.36	0.39	1.0	0.050	0.050
Cadmium	mg/L	0.001	0.0043	1.0	0.0039	0.0031	0.00044	0.092	0.00036	0.0071	0.00013	0.00023
Chromium h	mg/L	<DL	0.0020	0.0078	0.0020	0.00086	0.00038	0.00070	0.0017	0.0020	0.00010	0.00010
Cobalt	mg/L	<DL	0.00013	1.4	0.00013	0.00013	0.00015	0.13	0.00089	0.00013	0.00014	0.00035
Copper	mg/L	0.0010	0.044	2.6	0.0030	0.0025	0.0012	0.24	0.0018	0.028	0.0027	0.0017
Iron d	mg/L	0.13	0.20	0.066	0.20	0.20	0.20	0.01	0.20	0.20	0.0030	0.0030
Lead	mg/L	<DL	0.0036	1.83	0.0036	0.0036	0.0025	0.33	0.00031	0.0170	0.0001	0.0008
Lithium h	mg/L	0.02	0.013	0.37	0.013	0.009	0.0045	0.033	0.061	0.013	0.014	0.015
Manganese	mg/L	0.1	0.033	150	0.038	0.17	0.10	14	0.12	0.054	0.15	0.24
Mercury h	mg/L	n.a.	0.00043	0.00020	0.00043	0.00005	0.00002	0.000067	0.000080	0.00043	0.000010	0.000010
Molybdenum e	mg/L	2.4	0.82	4.0	0.58	0.042	0.021	2.2	0.069	4.0	0.23	0.31
Nickel	mg/L	0.0040	0.018	8.8	0.0093	0.0010	0.00051	0.79	0.0038	0.069	0.0013	0.0025
Selenium	mg/L	<DL	0.012	0.020	0.0031	0.0019	0.0014	0.0022	0.0013	0.039	0.0003	0.0005
Silicon	mg/L	3	35	32	29	2.5	1.5	7.8	5.1	33	3.2	4.8
Silver h	mg/L	<DL	0.00010	0.00010	0.00010	0.000042	0.000027	0.000056	0.000041	0.00010	0.00001	0.00001
Strontium	mg/L	4.9	0.35	9.3	0.79	2.9	0.70	0.84	4.6	2	4.8	4.9
Thallium	mg/L	<DL	0.000080	0.0031	0.000080	0.000038	0.000020	0.00028	0.00025	0.000080	0.00004	0.00009
Tin h	mg/L	<DL	0.0033	0.11	0.0027	0.00020	0.00008	0.01041	0.044	0.028	0.00004	0.00018
Titanium h	mg/L	<DL	0.015	0.051	0.015	0.0024	0.0012	0.0046	0.0039	0.015	0.0005	0.0005
Uranium	mg/L	0.01	0.24	0.01	0.27	0.010	0.0097	0.01	0.017	0.010	0.0084	0.0088
Vanadium h	mg/L	<DL	0.004	0.015	0.004	0.0012	0.0007	0.0014	0.0069	0.004	0.0005	0.0003
Zinc	mg/L	0.13	0.14	29	0.13	0.009	0.004	2.6	0.0048	0.160	0.0012	0.0014

Note: Fluoride may be limited by theoretical upper bound solubility limit for fluorite; Calculated based on Ferguson and Leask; Aluminum upper bounds based on theoretical solubility limit of $Al(OH)_3$; Iron upper bounds based on theoretical solubility limit of ferrihydrite and / or siderite; Predicted molybdenum concentrations are lower than the upper range recorded from existing monitoring recors; this reflects the lower cut-off for proposed Project than occurred in previous mining

DL - detection limit; LGS - Low grade (ore) stockpile; WRMF - Waste Rock Management Facility; % - percent

3.4.4 Monitoring and Management Plan

This section provides an overview of the ML/ARD Monitoring and Management Plan for the proposed Project. The plan provides basic concepts and scope of monitoring and management measures proposed to minimise, avoid, or mitigate potential effects.

A site-specific ML/ARD Monitoring and Management Plan would be developed before the commencement of construction in consultation with relevant permitting agencies, the Nisg̲a'a Nation, and Aboriginal groups. This plan would include details regarding monitoring to confirm geochemical predictions outlining specific roles and responsibilities, procedures and training, and records and reporting as required and guided in permit requirements. The ML/ARD Monitoring and Management Plan would be based on the principles of adaptive management and continual improvement, as outlined in the EMS Section 11.1.

The following sections outline the general objective of the ML/ARD Monitoring and Management Plan, relevant regulatory requirements and guidelines, and general management and mitigation practices.

3.4.4.1 Summary of ML/ARD Characteristics

3.4.4.1.1 Mined Rock

The mined rock (waste rock, low grade ore, and pit walls) associated with the Kitsault deposit contains both sulphides and carbonates in a few percent each. The majority of the rock anticipated from the proposed plan will have a NP/AP ratio less than 2, and half of that will have NP/AP ratios less than 1. There is no clear sulphur cut-off below which the ARD classification would clearly be non-PAG and there is also no particular rock type that is consistently non-PAG. Therefore, waste segregation for the management of PAG rock has not been proposed and all waste will be placed in a facility for which water management is considered relatively simple and secure.

At these values and relative proportions of NP and AP, the processes of sulphide oxidation (acid generation) and subsequent dissolution of associated carbonates (acid neutralisation) can, and have, balanced one another for a number of decades. The period of time during which these processes are in balance is referred to as the lag period and it is clearly demonstrated in the seepage monitoring for the site. Calculated lag times for NP depletion due to sulphide oxidation and associated carbonate dissolution ranged from approximately one to 11 decades, with an average of 46 years represented by the samples tested.

Metals of interest with respect to potential geochemical impacts associated with the deposit include antimony, arsenic, bismuth, cadmium, fluoride, lead, molybdenum, selenium, silver, sulphur, tungsten, and zinc. This suite is generally typical of that associated with molybdenum porphyry deposits. The metal leaching potential or mobility of metals associated with the proposed Project was evaluated in a humidity cell program. Leachate from all materials tested was consistently buffered throughout the test program. Results produced a relatively wide range of sulphate release rates, attributed to two dominant processes:

1. oxidation of sulphides and subsequent release of sulphate; and
2. dissolution of gypsum.

The latter of these processes is anticipated to be a much lesser contributor to the overall sulphate loading from the system as the gypsum distribution in the deposit is spatially limited. Other parameters that show a correlation of release rates with bulk composition include arsenic, antimony, cadmium, lead, molybdenum, selenium, and zinc. There was a general tendency for increased release rates with increased solids metal content.

3.4.4.1.2 Tailings

Ore at Kitsault is largely dominated by diorite, although granodiorite / monzonite and hornfels will comprise part of the feed as well. Tailings will be produced by conventional flotation followed by de-pyritisation. There will be two main waste streams from the mill. The first will consist of de-pyritised rougher tailings that for a portion of the year will be cycloned, and the remaining time will be discharged to form beaches as a de-pyritised whole rougher tailings. When cycloned, the underflow will be used in construction of the northern dam and the overflow will be disposed of on the beach. The second waste stream from the mill will be the combined cleaner scavenger tailings and the pyrite concentrate from the de-pyritisation float. This stream will be disposed of sub-aqueously within the TMF.

The de-pyritised rougher tailings are strongly non-PAG with total sulphur contents anticipated being less than 0.10% and carbonate contents approximately five times that, with resulting NP/AP ratios above 15. The cleaner scavenger tailings and the sulphide concentrates that will be stored below water are anticipated to have sulphide concentrations above 30% and be clearly PAG.

Metals of note associated with the tailings solids include antimony, arsenic, bismuth, cadmium, lead, molybdenum, sulphur, selenium, and tungsten, as well as fluoride. Many of these parameters are associated with the sulphides and will partition more strongly with the de-pyritisation concentrate and cleaner scavenger tails. Humidity cell results indicate the potential for leaching of many of these metals, most notably fluoride, arsenic, antimony, cadmium, and molybdenum.

3.4.4.1.3 ML/ARD Monitoring and Management Plan Objective

The objective of the ML/ARD Monitoring and Management Plan is to confirm and / or update geochemical characterisation and source-term predictions for the proposed Project. The ML/ARD Monitoring and Management Plan recognises that the ML/ARD assessments completed during the certification and permitting phases need to be continued for mine construction and operations. This would involve the confirmation of preliminary findings based on short-term testing, calibration of testwork results to site conditions, and ongoing monitoring to direct waste management activities. The plan also recognises that it is not practical to completely evaluate all waste components, and that monitoring and management plans need to be in place to address potential for impacts due to ML/ARD. As a result of the specific activities proposed for the mine, the ML/ARD Monitoring and Management Plan will need to contain the following components:

- Data collection and ongoing characterisation of waste rock, low grade ore, tailings, and construction material;
- Ongoing inventorying of waste and low grade ore production and placement for future assessments of facility performance;
- Monitoring of water chemistry (seeps, pit wall run-off, supernatant); and
- Updates of the water and load balance to verify and / or refine water quality predictions for the proposed Project.

3.4.4.2 Review of Regulatory Requirements

The ML/ARD Monitoring and Management Plan will be a requirement of the *Mines Act* Permit for the proposed Project.

3.4.4.3 ML/ARD Research

It is acknowledged that there remain uncertainties related to the long lag time illustrated by the current waste on-site and predicted for the rock associated with the proposed Project, and that these uncertainties relate specifically to the long-term management of the site. The uncertainties that may require some research include:

- The possible role of molybdenum on bacterial communities and the influence that may have on the onset of ARD; and
- The challenge in predicting and understanding long lag times.

3.4.4.4 Management Practices

Management of the waste rock will be such that all rock is stored in one facility, the WRMF, thereby minimising the footprint. In addition, the WRMF would be located upstream of the Kitsault Pit to provide flexibility in water management in the long term. No segregation of waste types for ML/ARD purposes is proposed.

The LGS will be placed in one facility and milled prior to closure and well before the lag time has been exhausted.

The mill will include a de-sulphidation circuit. The rougher tailings from that circuit will be non-PAG and used for construction of the northern embankment and beach development. The cleaner scavenger tailings and the sulphide concentrate from the de-sulphidation circuit will be disposed of sub-aqueously in the TMF.

3.4.4.4.1 ML/ARD Management Concepts

Based on the proposed mine plan described in brief above, the ML/ARD Monitoring and Management Plan would consist of sampling and analysis to confirm the characteristics of wastes and re-evaluation of management measures and predicted Project effects based on the data obtained.

3.4.4.4.2 Analytical Methods

The analytical methods would include routine procedures at an off-site laboratory and would generally follow guidelines and procedures provided by Price (2009) and MEND (1991).

On-site procedures may be conducted which would include rinse pH and rinse conductivity of borrow / quarry materials and existing waste used in construction to assess current geochemical state.

Off-site analyses would be conducted as a routine testing program and on an as-needed basis for more detailed or specific analytical needs. Off-site analyses would include methods such as total sulphur by Leco furnace, total carbon by Leco furnace, sulphur as sulphate by HCl extraction, and water analyses (standard methods to determine pH, acidity, alkalinity, major anions and cations, and regulated parameters on filtered and unfiltered samples). Less-routinely, methods such as metal scans on solids, Rietveld XRD analysis for determination of carbonate forms, microprobe analyses of carbonate mineral grains, optical mineralogy on thin sections, and leach extractions may also be warranted.

3.4.4.4.3 Construction Phase

Construction of the proposed Project is anticipated to take 25 months. During the construction phase, the potential for ML/ARD-related effects is from two primary sources:

- Quarry rock for the northern embankment starter dam for the TMF; and
- Existing waste rock from the Patsy Dump for construction of the southern embankment of the TMF.

Activities within the ML/ARD Monitoring and Management Plan will therefore relate to these facilities and may include, but are not limited to:

- Rinse pH and conductivity on a routine basis;
- Confirmatory sampling and ABA / metals characterisation; and
- Contact water collection and sampling.

3.4.4.4.4 Operations Phase

The operations phase of the proposed Project is anticipated to last for 15 to 16 years. During this phase of the project, most of the routine testing would occur at an off-site analytical laboratory.

Within the proposed Project footprint, specific areas expected to require ongoing geochemical characterisation include the WRMF, LGSs, TMF embankment structures and tailings solids, and supernatant.

During the operations phase, ongoing ML/ARD monitoring and management would be required. Measures may include, but are not limited to:

- Sampling and analysis of blast hole samples to confirm characteristics of each rock type at a frequency to be defined;
- Sampling and analysis of blast rock to evaluate the distribution of ML/ARD potential in size fractions;
- Routine sampling and analysis of tailings, including the cyclone underflow and overflow, combined rougher tailings stream, and combined sulphide concentrate and tailings from the de-sulphidation cells;
- Kinetic testwork modified as necessary to further define release rates and lag times, which may include field-based testwork (test barrels);
- Sampling and analyses of tailings supernatant or pond water at a frequency to be defined;
- Seep monitoring at the LGS and WRMF; and
- Maintenance of an overall up-to-date site water and load balance to compare predictions of metal loadings with actual conditions.

3.4.4.4.5 Closure and Decommissioning Phase

During decommissioning and closure of the proposed Project, the ML/ARD Monitoring and Management Plan will consist of continued sampling of seeps. Monitoring will be relatively infrequent and may take a similar form to that currently conducted on-site as part of the reclamation program for the previous mining activities. Given the anticipated long lag time associated with the rock, frequency of monitoring may be in response to trends for indicator parameters.

3.5 Mine Plan

This section describes the detailed Mine Plan for the proposed Project, including: the design of the Kitsault Pit (Section 3.5.1); pre-production mining details (Section 3.5.2); production mining details (Section 3.5.3); and the methods used to maintain the mine (Section 3.5.4).

3.5.1 Kitsault Pit Design

The preliminary design of the Kitsault Pit was determined to be approximately 1.2 km in diameter and 300 m deep, with a volume of 134.9 million cubic metres (Mm^3). The Kitsault Pit design was broken into phases for scheduling purposes, with 30-m-wide ramps at a maximum in-pit grade of 10% included within each phase.

The ultimate Kitsault Pit has been divided into six phases based on nested Lerchs-Grossman shell guidance, molybdenum grade, the presence of Patsy Creek, strip ratio, the ability to access the Kitsault Pit, and operational constraints. From the existing height of land (800 amsl) to the pit bottom (220 amsl) the depth is approximately 580 m.

Phase 1 of Kitsault Pit development is a continuation of the historical existing pit to depth. This phase is accessed by extending the existing ramp system down to the Kitsault Pit bottom at the 510-m elevation.

Phase 2 is a 110-m pushback to the northeast of Phase 1. Its upper benches are all waste and would be mined in the pre-production period as a source of bulk fill material for construction. It is constrained to the east by the access to the Patsy Creek crossing and to the south by Patsy Creek. Access is by a ramp oriented clockwise around the Kitsault Pit to the 560-m elevation, where it splits to access an eastern and western Kitsault Pit bottom at the 490-m and 470-m elevations, respectively.

Phase 3 (approximately Year 1 or 2 of operations) mines the southern portion of the ultimate Kitsault Pit to the 580-m elevation to establish the Patsy Creek diversion around the ultimate Kitsault Pit. Access for Phase 3 is by road from the Patsy Creek crossing, ramping up at 10% on original topography, and which is mined out as Phase 3 advances.

Phase 4 is a 120-m pushback to the southeast of Phase 2. Access is by a ramp in the east wall from the 620-m to the 580-m elevation, where it ties into the Phase 2 ramp system and provides a second exit from the Kitsault Pit. The Kitsault Pit continues to have two pit bottoms, the eastern one at the 430-m elevation and a western one at the 440-m elevation.

Phase 5 is a 100-m pushback to the southwest of the Phase 4 Kitsault Pit. Access is developed in the western wall from the 600-m elevation to the 500-m elevation, where it ties into the Phase 4 ramp system and provides an alternate route out of the Kitsault Pit. This ramp also provides access to the external fill ramp that runs from the 570-m to the 650-m elevation and is used for access in the ultimate Kitsault Pit design. The phase terminates in a single pit bottom at the 350-m elevation.

Phase 6 is the final phase and mines the Kitsault Pit to its ultimate depth at the 220-m elevation. Access is provided by the fill ramp built while mining Phase 5 to the 570-m elevation, from which a ramp runs counter-clockwise to the 510-m elevation, where it switches back and continues in a clockwise direction to the pit bottom.

A geotechnical program was completed for the design of the Kitsault Pit. Appendix 3.0-D (Pre-Feasibility Geotechnical Pit Slope Design Kitsault Project, June 2009 SRK Consulting) and Appendix 3.0-E (Feasibility Geotechnical Pit Slope Evaluation Kitsault Project, November 2010 SRK Consulting) include standalone geotechnical reports by SRK Consulting.

3.5.2 Pre-Production Mining

Pre-production mining will supply materials for construction projects (e.g., TMF embankments, etc.). Pre-production mining will also focus on developing mine access roads suitable for large mining equipment and "facing-up" the initial Kitsault Pit phases into productive set-ups for the start of production.

Much of the required initial access and pre-stripping has already been completed, as the proposed Project is a brownfield site. The initial stripped materials will be stockpiled for construction and reclamation purposes. Wherever possible, stripped material will be placed immediately at its final destination.

A total of 8.5 Mt of rock will be mined during the pre-production stage. Ore mined during the pre-production period will be stockpiled and rehandled to the Process Plant during operations.

3.5.3 Production Mining

Mine modelling software incorporated data from exploration and production drilling to develop a bench plan to delineate the ore and waste mining zones. Production drilling will be performed on 10-m benches. All production drills will be equipped with a Global Positioning System (GPS) unit so that pattern design can be uploaded directly from the engineering office to the drills (i.e., so the operators do not need to find stakes that could be obscured by snow. Two different drills will be used: a Sandvik 1190E rotary drill for production drilling of 10-m benches; and a Sandvik QXR 920 hammer drill for wall control, pioneering, and secondary blasting. Benches will be drilled on an 8-m by 8-m drill pattern. Benches are 10 m in height and the blast hole drilling will be to a depth of 11.6 m, including sub-drill. Assay analyses will provide grade control for ore. The Kitsault Pit will utilise two different types of drilling: blast pattern drilling to fragment the rock for mining; and horizontal drain-hole drilling to prevent water pressure from building up behind the Kitsault Pit walls.

The main explosive to be used during the construction and operations phases at the site is a mixture of ammonium nitrate (AN) and fuel oil (FO). ANFO is approximately 94.3% AN and 5.7% FO by weight. ANFO is categorised as a high explosive (i.e., it detonates (explodes faster than the speed of sound) rather than deflagrates (slower than the speed of sound)). It is insensitive to shock, which categorises it as a tertiary explosive; this means that it requires a booster of primary and / or secondary explosives to ensure reliable detonation. It requires confinement (placement in boreholes) for efficient detonation and brisance. Water interferes with the explosive function of ANFO. Straight ANFO will be used for blasting in areas of the Kitsault Pit that have no groundwater issues. A water-resistant 30% ANFO / 70% emulsion blend will be used for blasting in other areas of the Kitsault Pit, depending on groundwater conditions.

An explosives supplier will be contracted to provide a "down-the-hole" blasting service. The explosives supplier will provide AN, emulsifier, explosives magazines, mixing equipment, and delivery trucks; the mine operator will provide FO. The explosives supplier will mix the materials (AN, FO, and emulsifiers) at the on-site explosives plant, which is located up a side road from the mine site road, about 500 m to the northeast of the TMF. The explosives facility would have a storage capacity of up to 300 tonnes of AN and emulsifiers. Mine employees will charge the holes, place the detonators and boosters, and tie-in the patterns. Blasting will typically be done once per day.

Loading trucks with ore and waste will be accomplished with three loading units (selected based on requirements for the 10-m bench height and productivity). The primary loading unit is a P&H 2300 cable shovel (26.5 cubic metre (m^3) bucket). The secondary unit is an electrified Komatsu PC5500 hydraulic shovel (28 m^3 bucket). The supporting loader is a Komatsu WA1200 high-lift, front-end loader (18 m^3 bucket).

Hauling of ore and waste will be accomplished with 218-m^3 haul trucks (selected as it is a reasonable match to the loading equipment and is a suitable size to move the annual mining volumes).

Support and ancillary equipment will also be required for miscellaneous tasks (e.g., road and bench maintenance) during production mining. A Cat D10T Track Dozer will be used for stockpile maintenance and cleaning waste from the ore contacts; it can also be used for drop-cut development, highwall cleaning, road maintenance, and as support for shovel floor maintenance. A Cat 854G Wheel Dozer will be used to support waste rock maintenance, for drill pattern cleanup, and for assisting with ore stockpile maintenance. A Cat 16M Grader will be used for road maintenance, snow removal, pioneering road construction, and other projects as needed. A Cat 385CL Hydraulic Excavator will be used for ore cleaning plus general drainage maintenance tasks, such as cleaning out ditches and sumps. A Cat 777F Water Truck will be used for dust control on the Kitsault Pit ramps, floor haul roads, and dumping.

Maximum vertical advance per phase per year is eight 10-m benches.

The mine life is estimated to be 15 to 16 years at a nominal processing rate of between 40,000 and 50,000 t/d. High grade ore will be sent to the Process Plant. Low grade ore will be stockpiled (to be processed during the last two years of operation).

The Mine Plan allows for 240 hours of lost production per year due to adverse driving conditions and poor visibility resulting from snow or fog. This allowance covers both complete mine production shutdowns and truck slowdowns.

3.5.4 Mine Maintenance

Mine maintenance includes plans for a wall control program, snow management, and water management. The wall control program will be used along all final walls, but not normally for intermediate Kitsault Pit phases, except when the walls are planned to be exposed and left standing for more than one full year. This wall-control pattern will include a three-row trim blast and a pre-shear line. Horizontal de-watering holes will be required in selected areas to drain the water from behind the wall rock. On every bench, 50-m-long holes will be spaced every 50 m, and along ramps, 100-m-long holes will be spaced every 50 m. These holes will also be drilled by the smaller supporting drill rig.

Snow management is required because the proposed Project site receives approximately 10 m of snow annually, some of which will accumulate in active areas. Snow will be trucked away from the Kitsault Pit to a dedicated area sized to hold 300,000 m^3 of placed snow (assumed to melt each summer so the same area can be used the following winter).

Water management of the Kitsault Pit will be in accordance with the overall Tailings and Mine Water Management Plan (Section 11.2.20 and Appendix 6.5-B).

3.6 Construction Phase Activities

This section describes the construction phase activities for all components of the proposed Project. General considerations are described in Section 3.6.1. Construction of the following components are described: the Kitsault Pit (Section 3.6.2); the mine processing facilities (Section 3.6.3); the TMF (Section 3.6.4); and water management facilities (Section 3.6.5). The construction schedule is described in Section 3.6.6. Infrastructure and ancillary facilities are described in Section 3.6.7 and construction road use is described in Section 3.6.8.

3.6.1 General Considerations

3.6.1.1 Notice to Proceed and Engineering

The proponent is expected to issue a "A Notice to Proceed" into construction in 2012 following completion of the EA process and receipt of initial construction permits. Basic engineering and long-lead procurement will occur prior to EA approval. Detailed engineering is currently underway.

The proposed Project execution schedule has been broken into three separate components: EA and permitting review and approvals (9 months); construction (25 months); and initial mill start up to full production (3 months). See Table 3.11-1 in Section 3.11.

Proposed Project systems and equipment will be designed to North American standards and will include a maximum of pre-assembly and modularisation of components, consistent with cost optimisation.

3.6.1.2 Challenges

Challenges mainly entail the weather, especially during winter when high levels of snowfall are common. Since construction work is planned to continue through the winter months, a suitable snow management plan will be essential to maintain open access, and to permit earthworks at the Process Plant and South Embankment to progress unhindered.

3.6.1.3 Construction Materials

Construction materials will be obtained from a variety of sources. Aggregates required for civil works will be sourced from the site as much as possible. Initially, a mobile crushing and screening plant will be established in the existing Kitsault Pit area. The barren rock core within the Kitsault Pit will be blasted and processed.

An appropriate source for concrete aggregates on-site is still to be confirmed by further investigation and testing. At present, it is assumed that concrete aggregates will be sourced off-site and shipped in from the nearby Terrace area. Concrete will be produced on-site by a mobile batching plant.

Explosives required prior to establishing the permanent explosive manufacturing and storage facilities will be brought in on an as-needed basis by a certified supplier for a scheduled blasting event. Explosives would not be stored over the long term until the proposed Project's permanent facilities are in place. Materials required for blasting will be as used for operations; see Section 3.5.3.

Steel requirements for the proposed Project are based on local BC supply. In the future, there may be an opportunity to procure off-shore steel supply if potential savings can be identified. Fuels and gas will be sourced locally from Terrace and trucked to the site.

The existing access roads to the proposed Project site will be used. Vehicles with a gross vehicle weight (GVW) of more than 64,000 kg but less than 85,000 kg do not require a detailed route and bridge survey to accompany the application for a transport permit, provided the route has been approved by the BC Ministry of Transportation and Infrastructure (BC MOTI) for such loads. For loads weighing more than 85,000 kg, a bridge survey is mandatory as part of an application for a transport permit. Permits for these loads, along with those with dimensions that exceed the limits of 3.2 m wide, 4.87 m high, or 40 m long, must be approved by BC MOTI. Additionally, the bridge survey must be approved by the BC MOTI Bridge Department.

Existing access roads used to access the site are presented in Section 3.2.1 (Location and Access; also see Figure 3.2-3). Bridges along the road routes are reported to be in good to fair condition and have sufficient capacity to support highway legal traffic (Appendix 3.0-F). Most of the bridges require some form of minor maintenance to their approaches, such as realigning approach barriers and replacing timber curbs. Culverts are generally in fair condition, although the majority require some form of maintenance and / or repair, including removal of debris from inlets and within the culvert.

Equipment suppliers will transport their products directly to the mine site. A contract will be awarded for transport of overweight and oversized loads. The heavy-haul contractor will survey the main highways and forestry access roads to establish the limiting dimensions and weight that may be transported along these routes. Determination of the critical load profile to serve as the basis of access road upgrade design and haulage equipment selection is subject to a final road survey and haulage equipment specifications.

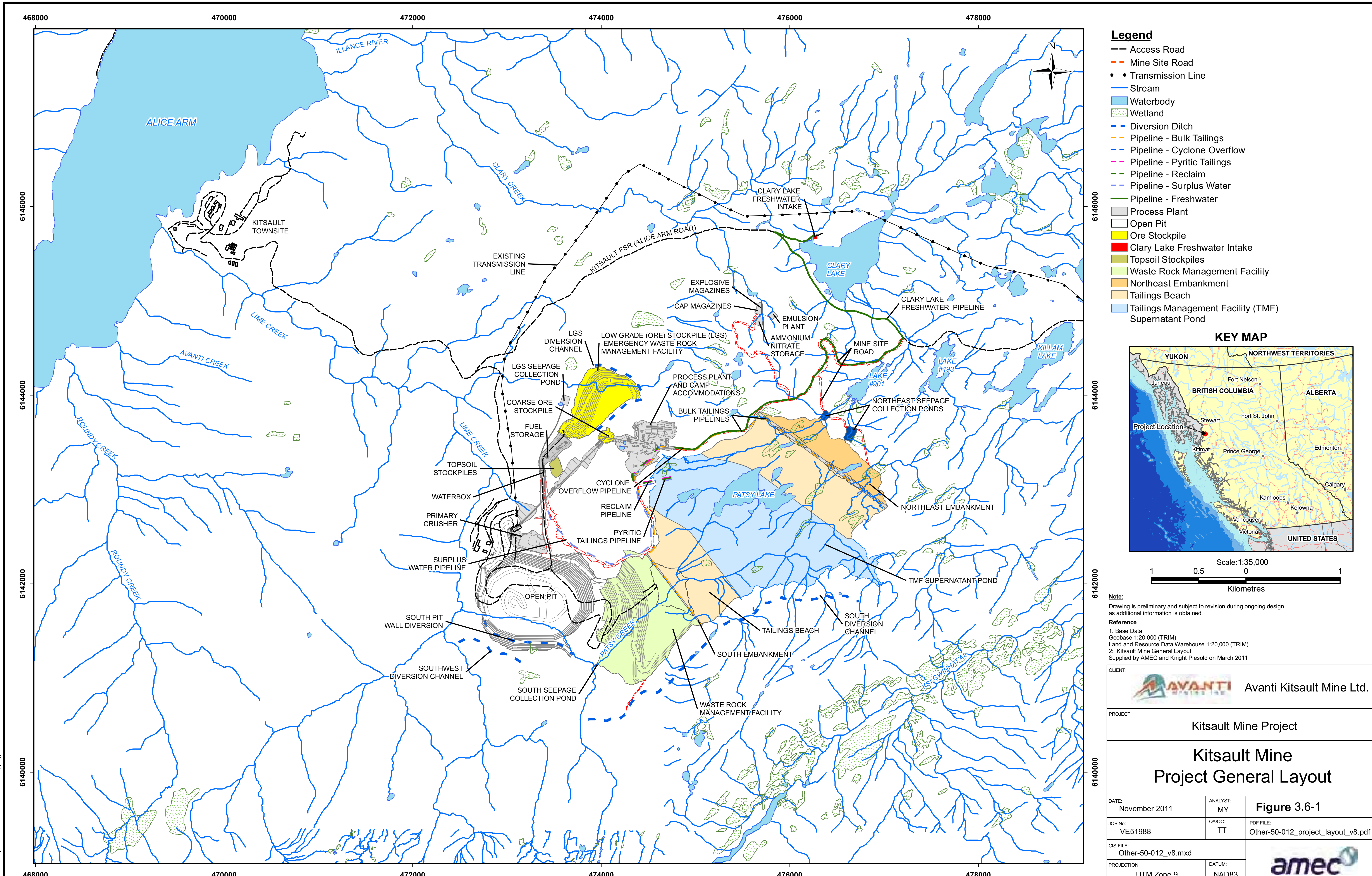
The CN Rail line through Terrace, which provides access to the North American rail network, could also be used to transport oversized and overweight loads. CN Rail has a fleet of equipment capable of transporting loads with weights and dimensions that do not exceed appropriate limits.

The nearest major airports are at Prince Rupert and Terrace. Both are served by local airlines out of Vancouver. Either location could be used to receive rush cargo shipments.

3.6.2 Kitsault Pit

Kitsault Pit pre-production activities will commence 10 months before plant start-up. Minimal clearing of soils and waste rock will be required because the Kitsault Pit is essentially open from the previous mining developments, and a large flat area is already exposed. A core of barren rock left in the middle of the Kitsault Pit will be removed and crushed for use in construction early in the schedule. The existing waste dump area adjacent to the Kitsault Pit will be suitable for assembly of the mine fleet, which would commence three months ahead of pre-production (Figure 3.6-1). To help minimise additional cut-to-fill volumes, waste rock from pre-stripping will be used as fill in two adjacent earthworks sites during construction: the foundation for the lower sections of the overland conveyor from the primary crusher; and the starter South Embankment, where most of the rock will be required. Completion and commissioning of the electrical power systems is a necessary predecessor for operation of the electric shovel and drill fleet by this time.

A geotechnical program was completed for the design of the Kitsault Pit. Appendix 3.0-D (Pre-Feasibility Geotechnical Pit Slope Design Kitsault Project, June 2009 SRK Consulting) and Appendix 3.0-E (Feasibility Geotechnical Pit Slope Evaluation Kitsault Project, November 2010 SRK Consulting) include stand-alone geotechnical reports by SRK Consulting.



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
YUKON
NORTHWEST TERRITORIES
BRITISH COLUMBIA
ALBERTA
Fort Nelson
Juneau
Stewart
Fort St. John
Project Location
Kitimat
Prince George
Edmonton
Calgary
Kamloops
Kelowna
Vancouver
Victoria
UNITED STATES
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 3.6-1
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
468000
470000
472000
474000
476000
478000
6146000
6144000
6142000
6140000
N
ALICE ARM
ILLANCE RIVER
CLARY CREEK
KITSAULT TOWNSITE
EXISTING TRANSMISSION LINE
KITSAULT FSR (ALICE ARM ROAD)
LIME CREEK
AVANTI CREEK
ROUNDY CREEK
CLARY LAKE FRESHWATER INTAKE
CLARY LAKE
EXPLOSIVE MAGAZINES
CAP MAGAZINES
EMULSION PLANT
AMMONIUM NITRATE STORAGE
CLARY LAKE FRESHWATER PIPELINE
MINE SITE ROAD
KILLAM LAKE
LAKE #493
LAKE #901
LGS DIVERSION CHANNEL
LOW GRADE (ORE) STOCKPILE (LGS) -EMERGENCY WASTE ROCK MANAGEMENT FACILITY
LGS SEEPAGE COLLECTION POND
PROCESS PLANT AND CAMP ACCOMMODATIONS
COARSE ORE STOCKPILE
BULK TAILINGS PIPELINES
NORTHEAST SEEPAGE COLLECTION PONDS
FUEL STORAGE
TOPSOIL STOCKPILES
WATERBOX
CYCLONE OVERFLOW PIPELINE
RECLAIM PIPELINE
PATSY LAKE
NORTHEAST EMBANKMENT
PRIMARY CRUSHER
PYRITIC TAILINGS PIPELINE
SURPLUS WATER PIPELINE
TMF SUPERNATANT POND
OPEN PIT
SOUTH PIT WALL DIVERSION
SOUTH DIVERSION CHANNEL
TAILINGS BEACH
PATSY CREEK
SOUTH EMBANKMENT
SOUTHWEST DIVERSION CHANNEL
SOUTH SEEPAGE COLLECTION POND
WASTE ROCK MANAGEMENT FACILITY
KSI GWINHA'AL
Y:\GIS\Projects\VE\VE51988_Kitsault\Mapping\Other\Other-50-012_v8.mxd

3.6.3 Processing Facilities

Construction of processing facilities will be the early focus of construction activities. Logging and clearing activities will begin first; earthworks related to the mill-building platform will follow. Earthworks related to the semi-mobile crusher, the overland conveyor, the mill conveyor, and the pebble circuit will follow mine site road construction and land clearing. Concurrently, work will begin with the building of perimeter foundations for the grinding section, followed by the mill mat foundations and mill piers. Also in the first year of construction, earthworks for the coarse ore stockpile (COS) area and work on perimeter foundations at the flotation end of the building to enable steel erection to proceed in sequence as footings are completed, thereby enclosing the building as expeditiously as possible. Mechanical completion, electrical work, and piping will begin as soon as major equipment installations are completed; likely in the second year of construction. Concrete work for the overland conveyor will start in the first half of year two construction. Cladding and roofing of the process building will be complete in the second half of year two construction. All of the work culminates in a subsequent overall system commissioning within 25 months from initial construction.

In the upper conveyor corridor area, the estimated cut-to-fill volume is 525,000 m^3. It has been assumed that 50% of the cut will be drill-and-blast rock and 50% will be rippable rock. Some 335,000 m^3 of this material will be hauled 300 m to the adjacent downhill fill and the balance will be wasted by pushing it over the ridge to the west. A fill of 554,000 m^3 at the lower end of the conveyor will be borrowed from waste rock generated from the open Kitsault Pit pre-stripping, providing cost efficiencies for the proposed Project.

The Process Plant and ore stockpile areas are covered by topsoil and organics up to 1 m deep overlying competent bedrock. The foundation design includes stripping of the topsoil to place the foundations on rock. The water table is at 22 m into the bedrock. The immediate mill area is a balanced cut-to-fill equal to approximately 754,000 m^3. The mill has been orientated to ensure that the building footprint as well as the mills are founded on rock.

The truckshop was originally located in an area covered by 11 m of waste rock overlying topsoil, organics, soft, fine-grained soil deposits, and competent bedrock. The truckshop building site was therefore shifted southward onto natural (original) ground, permitting the topsoil and organics to be excavated and the foundation to be placed on bedrock. The estimated cut-to-fill volumes of soil for the areas of the crusher, haul road, and section of the service road on the north side of the conveyor to the ore stockpile are 308,000 m^3. The estimated cut-to-waste of rippable rock is 308,000 m^3, and the estimated cut-to-waste of soil is 190,000 m^3.

Site preparation for the explosives plant will consist of approximately 75,000 m^3 of cut-to-fill and 11,000 m^3 of cut-to-waste.

3.6.4 Tailings Management Facilities

Two embankments will be constructed before start-up (Figure 3.6-1). The South Embankment is critical to the proposed Project schedule. Clearing and foundation work for this embankment must commence as an initial step of construction to maintain the proposed Project's 25-month construction schedule. The design of the embankments is discussed in Section 3.7.6.3 (South Embankment) and 3.7.6.4 (Northeast Embankment). Details of the TMF construction phases are presented in Section 3.6.6 (Construction Schedule).

Quarry material from the Bowser Lake Group Sediments described as grey, very fine grained uniform greywacke in the vicinity of the TMF has been proposed for use in construction of the northeast embankment. Characterization to date has indicated that these rocks are typically relatively low in both sulphur content and neutralization potential with the result that the ARD classifications are varied as noted by the reviewer. The amount of material required for the northeast embankment is 384,583 m^3. Avanti will commit to a program of sulphur and carbon analyses on site as surrogates to AP and NP for operational sorting of material during construction. Material with NP/AP ratios less than 2 would not be used in construction of the northeast embankment.

Water management during the construction of the TMF is detailed in Appendix 6.5-B. A geotechnical program was also completed for the TMF and is presented in Appendix 3.0-G. Details of the design of the TMF are presented in Appendix 3.0-L.

3.6.5 Water Management Facilities

Water management facilities will be constructed before earthworks proceed. Cut-off drains will divert runoff from adjoining catchments around the site to reduce the amount of contact water that would require treatment. The period of greatest runoff is during the freshet in May / June of each year. Water management during the construction of the TMF is detailed in Appendix 6.5-B.

3.6.6 Construction Schedule

The following outlines the construction schedule for the proposed Project. Additional details are provided in Appendix 6.5-B.

3.6.6.1 Phase 1

Pre-construction activities include: water management structures required to de-water the South Embankment footprint, mine site roads required for construction and logging, clearing and stripping for TMF, Kitsault Pit, and Process Plant footprint preparation. Construction of the South Embankment is scheduled to begin during the first six months of construction, followed by the Northeast Embankment, which is scheduled to begin in the 18th month of construction.

De-watering of the TMF footprint will require establishing water management and sediment control structures including: cofferdams, pumping systems, and a control structure. Three cofferdams and three pumping systems will be required to de-water the embankment footprint during construction. A cofferdam will be constructed to prevent runoff from the Patsy Creek catchment from disrupting construction activities, and two cofferdams will be constructed to store and divert water from the catchment downstream of Patsy Lake.

Mine site roads required to access the various Project components will be constructed as forestry roads and will be designed in accordance with guidelines from the “Forest Road Engineering Guidebook” (BC Ministry of Forests (BC MOF) 2002).

3.6.6.2 Phase 2

Phase 2 involves initial construction of the South Embankment and South diversion channel. Phase 2 will include: clearing, grubbing, stripping and foundation preparation of the South Embankment footprint and basin; development of a borrow source; preparing the topsoil stockpile areas and placement of the topsoil removed during Phase 1 construction activities. Water management during Phase 2 construction of the South Embankment (Stage 1A) will consist of the following:

- Establishing water management and sediment control structures, including diversion ditches, runoff collection ditches, sediment control ponds, and pumping systems;
- Constructing the south diversion channel along the southern part of the Patsy Creek catchment to divert clean water from the upslope catchment areas around the TMF and Kitsault Pit construction areas;
- Locating a sediment control pond downstream of the South Embankment to collect sediment-laden water from construction activities;
- Using a pumping system as needed to de-water the embankment construction in the case of a large storm event; and
- Decommissioning the Phase 1 cofferdams and pumping systems upon completion of the South Embankment.

3.6.6.3 Phase 3

Phase 3 activities will include Kitsault Pit stripping and waste rock production for embankment construction, and construction of the South and Northeast Embankments. Phase 3 will end at Mill start-up. Water management during Phase 3 construction will consist of the following:

- Establishing water management and sediment control structures;
- Constructing an in-stream pond, the South Seepage Collection Pond (SSCP), to collect runoff from the South Embankment construction. This in-stream pond will be located within the ultimate toe of the WRMF. Water will either be pumped back to the TMF or conveyed to a discharge point on Patsy Creek at the western edge of the Kitsault Pit area (if the water quality is acceptable for discharge);

- Pumping surplus water above the pond capacity of 10 million m^3 at the TMF to the Water Box and then releasing it into Lime Creek;
- Locating a sediment collection pond within the Kitsault Pit footprint, down-gradient of the pre-stripping area during Phase 3 to collect runoff from the Kitsault Pit stripping and the Water Box (if the water quality is not acceptable to be released directly into Lime Creek). The runoff from this pond will then be released to Lime Creek during the construction period;
- Continuing to divert the South diversion channel to the upper catchment areas of the Patsy Creek Watershed around the TMF construction and Kitsault Pit areas; and
- Constructing two in-stream ponds, the northeast water management ponds, downstream of the ultimate toe of the Northeast Embankment. These ponds will collect seepage and sediment-laden runoff from the TMF embankment and water will then be pumped back to the TMF pond.

The northeast water management ponds will be constructed in the headwaters of the two main inlets to Lake 901, which are natural fish-spawning channels.

3.6.7 Infrastructure and Ancillary Facilities

An exploration camp already exists on-site adjacent to the Kitsault Pit, which is currently being used during the summer months for drilling and environmental works. The existing camp was upgraded to 45 beds in 2011 for exploration purposes. The first construction crews arriving on-site will use the existing exploration camp for their accommodations. The first units for the pioneer camp will be set up near the exploration camp, to provide 150 beds. There is suitable cleared, flat space in this area that will allow quick setup to accommodate earthworks and other early activities while the construction and permanent camp area is being cleared and levelled. The site also provides easy access for the crews working on the South Embankment.

The construction camp and the permanent camp will both be placed in the same location, adjacent to the Process Plant to provide easy access for the majority of the workforce both during construction and operations. The units from the pioneer camp will be brought up to the main construction camp site, and other units will be brought in as required to meet demand. The expected peak is 700 beds, including operations personnel. The core of the camp, which includes the kitchen, dining, and recreation facilities, will remain in place for the permanent camp. Permanent camp units used during construction will also remain in place once construction is complete. The remaining rental units will be demobilised and shipped off-site.

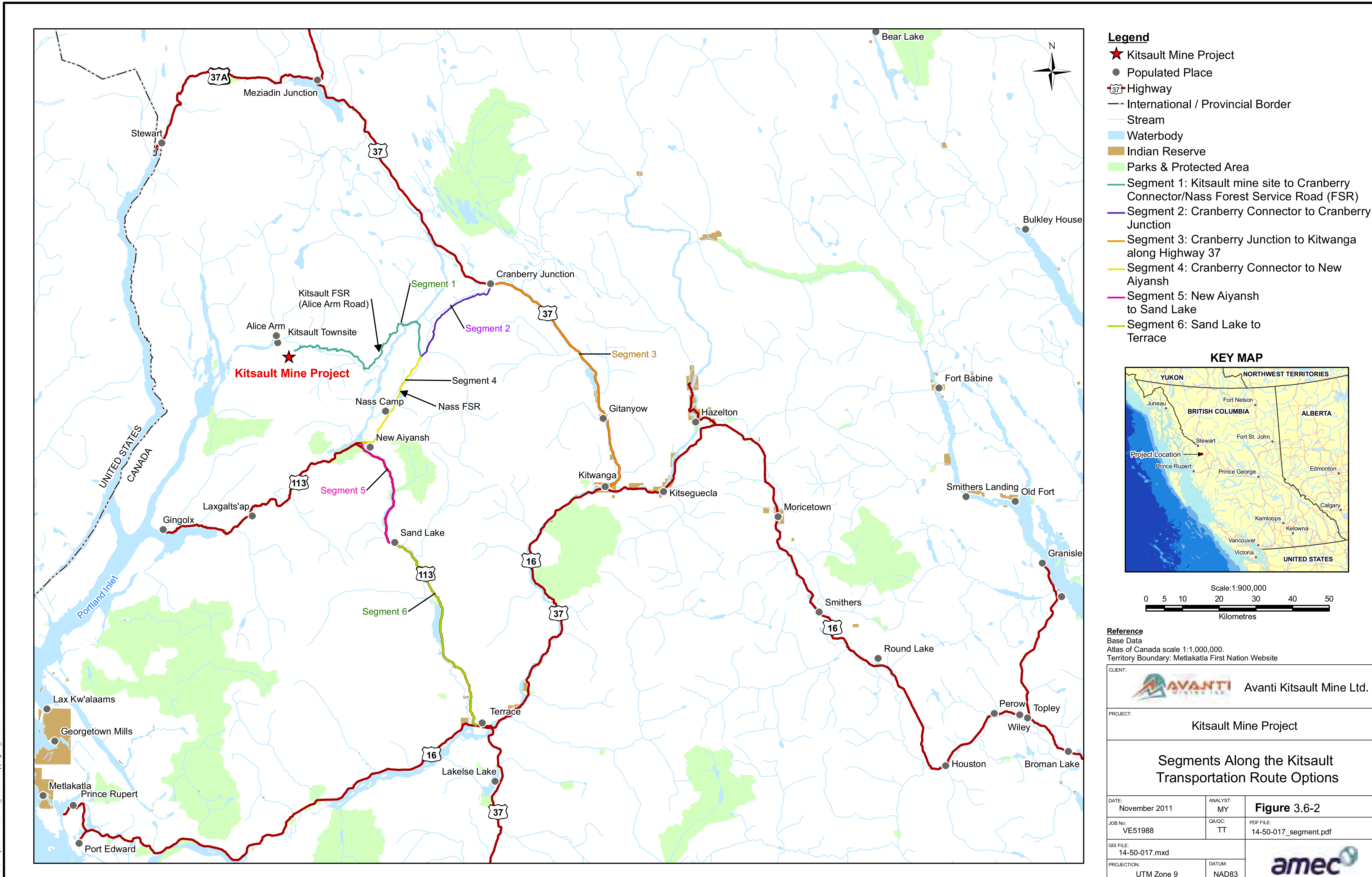
The existing communication system on-site is not suitable for the construction phase. A temporary system will be set up as part of the site establishment and will be further enhanced to suit operations prior to start-up.

3.6.8 Construction Road Use

The transportation of mine personnel, supplies, equipment, and materials for the Kitsault Project during construction is expected to occur along the following secondary road and highway segments:

- **Segment 1**: Kitsault mine site to Nass FSR (aka Cranberry Connector) along the Kinskuch FSR (47 km);
- **Segment 2**: Cranberry Connector to Cranberry Junction along the Nass FSR (30 km);
- **Segment 3**: Cranberry Junction to Kitwanga along Hwy 37 (76 km);
- **Segment 4**: Cranberry Connector to New Aiyansh along the Nass FSR (30 km);
- **Segment 5**: New Aiyansh to Sand Lake along Nisga'a Hwy (25 km); and
- **Segment 6**: Sand Lake to Terrace along Nisga'a Hwy (60 km).

Figure 3.6-2 depicts the Kitsault transportation route along the Nisga'a Hwy and Hwy 37, including relevant segments.



Legend
Kitsault Mine Project
Populated Place
Highway
International / Provincial Border
Stream
Waterbody
Indian Reserve
Parks & Protected Area
Segment 1: Kitsault mine site to Cranberry Connector/Nass Forest Service Road (FSR)
Segment 2: Cranberry Connector to Cranberry Junction
Segment 3: Cranberry Junction to Kitwanga along Highway 37
Segment 4: Cranberry Connector to New Aiyansh
Segment 5: New Aiyansh to Sand Lake
Segment 6: Sand Lake to Terrace
KEY MAP
YUKON
NORTHWEST TERRITORIES
BRITISH COLUMBIA
ALBERTA
UNITED STATES
Project Location
Scale:1:900,000
0 5 10 20 30 40 50
Kilometres
Reference
Base Data
Atlas of Canada scale 1:1,000,000.
Territory Boundary: Metlakatla First Nation Website
CLIENT:
Avanti Kitsault Mine Ltd.
PROJECT:
Kitsault Mine Project
Segments Along the Kitsault Transportation Route Options
DATE: November 2011
ANALYST: MY
Figure 3.6-2
JOB No: VE51988
QA/QC: TT
PDF FILE: 14-50-017_segment.pdf
GIS FILE: 14-50-017.mxd
PROJECTION: UTM Zone 9
DATUM: NAD83
amec
Kitsault Mine Project
Kitsault FSR (Alice Arm Road)
Alice Arm
Kitsault Townsite
Segment 1
Segment 2
Segment 3
Segment 4
Segment 5
Segment 6
Nass Camp
Nass FSR
New Aiyansh
Cranberry Junction
Gitanyow
Kitwanga
Kitseguecla
Hazelton
Moricetown
Smithers
Meziadin Junction
Stewart
Bear Lake
Bulkley House
Fort Babine
Smithers Landing
Old Fort
Granisle
Round Lake
Perow
Topley
Wiley
Houston
Broman Lake
Sand Lake
Terrace
Lakelse Lake
Laxgalts'ap
Gingolx
Lax Kw'alaams
Georgetown Mills
Metlakatla
Prince Rupert
Port Edward
Portland Inlet
UNITED STATES
CANADA
37A
37
16
113
Y:\GIS\Projects\VE\VE51988_Kitsault\Mapping\14_socio-economics\Baseline\14-50-017.mxd

3.6.8.1 Description of Transportation Route

The Kitsault mine site is accessed along Hwy 113 (aka Nisg̱a'a Hwy), Nass FSR past Nass Camp, west along Kinskuch FSR, and also via Hwy 37 north of Kitwanga to Cranberry Junction and west along the Nass FSR. This section provides a brief description of each of these roads and highways.

3.6.8.1.1 Kinskuch and Alice Arm Forest Service Roads

At the Nass FSR turnoff, the Kinskuch FSR initially heads north and then to the west towards Alice Arm, crossing the Nass Bridge to the Kinskuch-Alice Arm FSR junction. The existing Nass River Bridge at the Nass River may require some structural rehabilitation during operations but is currently suitable for construction and operating activities (Appendix 3.0-F). From the junction, the FSR heads southwest parallel to the Nass River for approximately 10 km until it reaches the abandoned Kwinatahl logging camp. From the Kwinatahl camp, the road trends northwest approximately 33 km to the mine access road with another 4 km to the Kitsault Townsite. The traffic along the Kinskuch and Alice Arm FSRs supports industrial traffic, including forestry and mining. The proponent holds a SUP and a Forest Use Permit (FUP) from the Kinskuch-Alice Arm junction to the Kitsault mine site. The road will be maintained regularly for use as the main access road to site.

3.6.8.1.2 Nass Forest Service Road

The Nass FSR (aka the Cranberry Connector) is a gravel road classified by BC MOFR as a "Wilderness Road", requiring industrial radio assistance with a posted speed of 50 kilometres an hour (km/h). The road begins at Nass Camp and ends at Cranberry Junction, covering a distance of approximately 51 km. The road has a range of conditions, including poor conditions "characterised by poor drainage, poor surface conditions, poor alignment, poor sight lines, and/or narrow width" (Robinson Consulting 2009). The road also functions as an emergency and alternate route during closures greater than 24 hours along Hwy 16 between Terrace and Kitwanga due to natural disasters, such a landslides and flooding.

3.6.8.1.3 Nisg̱a'a Highway (Highway 113)

Nisg̱a'a Hwy (Hwy 113) is a north-southbound, then east-westbound two-lane paved highway. The highway connects Terrace to the northerly Nisg̱a'a Villages of New Aiyansh, Laxgalts'ap, Gingolx, and Gitwinksihlkw and the non-Aboriginal communities of Nass Camp and Irene Meadows. The traffic along the highway is a mix of private and tourist vehicles (including motorhomes) and industrial traffic for mining and forestry. There are several attractions, services, and accommodations along the highway, including the Lava Beds Memorial Provincial Park, the Nisg̱a'a auto tour, Nass River, and the Nisg̱a'a capital of New Aiyansh with campgrounds, bed and breakfasts, motels, and lodges to accommodate the tourism influx during the summer.

3.6.8.1.4 Highway 37

Hwy 37 is a north-south-traversing, two-lane highway starting in Kitwanga and terminating at the Yukon-BC border. It is a remote highway covering a distance of 725 km with few amenities along rugged mountainous terrain with many abrupt turns and elevation gains. The Kitsault transportation route overlaps with the first 76 km of the highway from Cranberry Junction to Kitwanga (junction with Hwy 16). Hwy 37 is passable by most types of vehicles, including private passenger cars, trucks, and industrial traffic. The conditions along Hwy 37 are at times challenging, and can change drastically. Hwy 37 connects the community of Gitanyow and the Tahltan communities of Dease Lake and Iskut, as well as Telegraph Creek, to service centres in Smithers and Terrace. The highway also supports industrial traffic related to mining and forestry to port and rail infrastructure. Finally, the highway is a popular tourist scenic route with one of two access points from BC to the Alaska Hwy. Many out-of-province and foreign tourists travel along Hwy 37 in motorhomes during the summer months.

3.6.8.2 Construction Road and Segment Use

The Construction phase of the proposed Project entails short-term, intensive use of FSRs and highway infrastructure. During the Construction phase of the proposed Project, the main goods and services that will require transportation along the secondary roads and highways include construction materials, large-scale mining and construction equipment, and construction and service personnel. Accommodation for 600 to 700 construction personnel will be provided at the Kitsault mine site. The work shift will consist of a three-week (210-hour) rotation with transportation provided to and from the mine site and regional airports. Delivery of mine materials and equipment will occur from Terrace or Smithers via the Nisga'a Hwy and Hwy 37, respectively. Large-scale mining and construction equipment may require wide-load or specialty transports with qualified drivers.

The total number of estimated truckloads to and from the mine site is 6,206, including 557 for the process building, 852 for construction equipment, 562 for construction crew bussing, and 810 contingency trips. This activity is expected to occur over a period of 24 months. This estimate does not include small-vehicle traffic (e.g., pick-up trucks, passenger cars, and vans), which may vary considerably, and is contingent on the proposed Project's policies regarding travel to and from the mine site.

The daily average round trips are anticipated to be 24 at the height of construction activities, inclusive of small-vehicle traffic. Peak daily round trips may occur for a day or two at a time and reach a level of 54 round trips per day (i.e., 108 vehicle movements in and out of the mine site). Table 3.6-1 provides an overview of the distribution of truckloads, daily average roundtrips, and peak daily roundtrips over the 24-month construction phase.

Table 3.6-1: Summary of Truckload and Daily Round Trip Distribution During Construction Phase

	Year 1 (months 0 to 6)	Year 1 (months 7 to 12)	Year 2 (months 0 to 6)	Year 2 (months 7 to 12)
Truckloads	1,053	1,996	2,006	1,151
Daily Average Round Trips	11	24	24	12
Peak Daily Round Trips	22	54	54	24

Note: This estimate includes a 13% contingency.

Section 3.2.1 (Location and Access) provides additional information on road use. In addition, Appendix 8.0-C (Road Use Effects Assessment) presents a complete effects assessment relating only to road use.

3.7 On-site Facilities

This section describes the on-site facilities of the proposed Project, including the Kitsault Pit (Section 3.7.1), roads (Section 3.7.2), WRMF (Section 3.7.3), ore stockpiles (Section 3.7.4), processing facilities (Section 3.7.5), TMF (Section 3.7.6), water management facilities (Section 3.7.7), and infrastructure and ancillary facilities (Section 3.7.8). On-site facilities are shown on Figure 3.6-1.

3.7.1 Kitsault Pit

The Kitsault Pit is the open pit from which molybdenum ore will be mined. As discussed, the Kitsault Pit has been mined in the past, and the proposed Project will develop it further. The Kitsault Pit is discussed in detail in Section 3.5 (Mine Plan). Water in and around the Kitsault Pit will be managed in accordance with Appendix 6.5-B (Water Management), Appendix 3.0-D (Pre-Feasibility Geotechnical Pit Slope Design Kitsault Project, June 2009 SRK Consulting), and Appendix 3.0-E (Feasibility Geotechnical Pit Slope Evaluation Kitsault Project, November 2010 SRK Consulting); also see Section 11.2.20 (Tailings and Mine Water Management Plan).

3.7.2 Mine Site Roads

The mine site will need a network of general vehicle roads around facilities, service roads to remote structures, and haul roads. All roads will have mandatory and advisory traffic and speed limit signs, and all vehicles will be equipped with radio communication systems. All roads will be constructed of suitable rockfill material and crushed surfacing material. A road crew will maintain the roads to a suitable standard year-round (e.g., snow removal will be critical to maintain the main access road and others during winter). Dust will be controlled by regular watering during dry periods as needed.

Mine site roads will be two-way. The main Process Plant road will be 10 m wide, as will all mine site roads to the South Embankment, the Northeast Embankment, and the water reclaim facility. The road between the Process Plant and the truckshop will be 8 m wide, the road to the explosives storage facility will be 6 m wide. A road from the existing forestry road (Kitsault FSR / Alice Arm Road) to the Process Plant will be constructed to handle the material and equipment required during construction.

Haul roads from the Kitsault Pit will be two-way and 23 m wide with an 8-m berm. The roads have generally been laid out with a cut-and-fill balance. Selected waste rock will be used for road bases and capping material. Roads within the ultimate WRMF are all fill construction. Pit haul roads are designed at 10% maximum grade. The running width will be approximately 33 m for permanent roads and 40 m for temporary roads. Haul roads will include rock safety berms where required.

Water on and around the roads will be managed in accordance with the Tailings and Mine Water Management Plan; see Section 11.2.20 and Appendix 6.5-B. A terrain assessment was also completed for the proposed mine site road from the Alice Arm FSR to the explosives facility and the Process Plant (Appendix 3.0-H).

3.7.3 Waste Rock Management Facility

The WRMF is located east of the Kitsault Pit and is the area where waste rock mined from the Kitsault Pit will be deposited. The WRMF has been placed at this part of the site as it is a suitable site close to the pit and it will act as a buttress against the South Embankment of the TMF. Snow (up to 300,000 m^3) will be deposited at the western edge of the WRMF each winter, which is adjacent rather than on top of the waste rock and is downgradient to most of the waste. Runoff from the snow dump will be contained by the pit perimeter ditches and will report to the contact water sump, from where it will be pumped to the TSF for containment.

A total of up to 178 Mt of waste rock is expected to be generated over the life of the mine. Approximately 136 Mt will be placed in the WRMF. Approximately 40 Mt will be used to build the South Embankment. Approximately 2 Mt will be stored in two small waste rock facilities within the Kitsault Pit.

Waste rock has been characterised as either non-acid-generating (NAG) or PAG. The WRMF will be constructed in a bottom-up fashion; no blending or segregation is planned for the NAG and PAG rock placement.

Water runoff from the WRMF (including the snow dump area) will be managed in accordance with the Tailings and Mine Water Management Plan (Section 11.2.20) and Appendix 6.5-B. A geotechnical program was completed for the WRMF and is presented in Appendix 3.0-I.

3.7.4 Ore Stockpiles

Ore stockpiles will be utilised to ensure that mining and processing rates and schedules are maximised. A short-term stockpile will be used to store small quantities of ore (up to 340 thousand tonnes) immediately before it is sent for processing. This stockpile serves to buffer production fluctuations from the Kitsault Pit. A long-term stockpile will store low grade ore (up to 28 Mt) mined early in the life of the proposed Project, so that it may be processed at the end of the mine's life.

A COS will store crushed ore during processing, which will have a live load of 50,000 tonnes, equivalent to over 24 hours supply of ore to the mill. The total live plus dead capacity will be approximately 240,400 tonnes.

Water runoff from the various ore stockpiles will be managed in accordance with the Tailings and Mine Water Management Plan (Section 11.2.20) and Appendix 6.5-B.

3.7.5 Processing Facilities

Processing facilities will process ore mined from the Kitsault Pit into a concentrate. Selected components are described further below. The complete process description, including all components and equipment, is summarised in Section 3.9 (Operations Phase Activities).

The primary crusher will be installed as close as possible to the rim of the Kitsault Pit. The crushed ore will be conveyed at an angle of 14° over a horizontal length of approximately 1,380 m to the COS west of the Process Plant. A semi-mobile crusher was chosen to permit relocation within the Kitsault Pit as mining progresses. Due account was taken of the predominant wind directions (east-northeast and west-southwest). In addition to elevation and topography, the facility layout considers a 500-m flyrock clearance limit beyond the ultimate Kitsault Pit limit. With the exception of the primary crusher, the Process Plant, including the truckshop and fuel storage compound, falls outside this limit.

The Process Plant will be located on a plateau to benefit from the larger area of flat terrain and to centralise the bulk of the facilities. The Process Plant will be a large central structure housing the mills, flotation cells, several related ancillary structures, and process systems. The mill itself has been sited on the eastern flank of an existing knoll with a peak elevation of 935 m and average high elevation of 930 m.

The concentrator will be a steel-framed building with insulated steel cladding founded on spread footings. The Process Plant will be supported on concrete raft-type foundations complete with piers under the mills. Pads and foundations will be provided for the other equipment. Structural steel platforms and associated steelwork will support the elevated equipment and provide access where required. The panels will be steel-faced and insulated with a foam insulation core.

Flotation cells will be circular tanks supported on structural steel platforms founded on strip wall foundations. Curbs and a slab-on-grade, complete with sumps, will be provided to contain overflows in the different areas of the plant. Foundation pads and pump plinths will be provided to support all the other equipment.

The elevated steel thickener will be procured and supplied complete with steel support columns, and will be founded on conventional spread footings. This entire area will be paved with concrete, contained within perimeter curbs or walls, and sloped to the spill pond at the northwest corner of the site. Compressed air would be supplied at a rate of 900 cubic feet (ft^3) per minute in the mill and 250 ft^3 per minute in the maintenance shop.

Water used by and in the vicinity of the processing facilities will be managed in accordance with the Tailings and Mine Water Management Plan (Section 11.2.20 and Appendix 6.5-B). A geotechnical program was also completed for the Process Plant footprint and is presented in Appendix 3.0-G.

3.7.6 Tailings Management Facility

The TMF will manage all tailings (i.e., the waterborne unthickened slurry of materials left over after the process of separating the valuable fraction of molybdenum concentrate from the uneconomic gangue fraction of the ore produced at the processing facilities. Tailings include bulk, or scavenger, tailings (assumed to represent 90% of the total) and cleaner, or pyritic tailings (assumed to represent 10% of the total).

The slurry water content is assumed to be 36.4% by weight, with a solids density of 2.7 tonnes per m^3. The total tailings production is 14.6 Mt per year. The TMF has been designed for secure and permanent storage of 266.5 Mt of tailings, while ensuring protection of the regional groundwater and surface waters, both during operations and in the long term (after closure), and to achieve effective reclamation at mine closure. The TMF includes provision, if the proposed Project were expanded, to store as much as 300 Mt of tailings.

The tailings impoundment and supernatant pond will be created by two embankments constructed with a combination of local borrow materials, the cyclone sand fraction of the tailings, and waste rock from the mining operation. The TMF includes a South (rockfill) Embankment, a Northeast (cyclone sand) Embankment, cyclone sand towers, bulk and cleaner tailings delivery and distribution pipeworks, freshwater channel diversions, a seepage collection system, a reclaim system to recycle water to the Process Plant, and a surplus water system to release water to Lime Creek.

The TMF has been designed to meet all current Canadian Dam Association Dam Safety Guidelines. These guidelines assign each structure to a Dam Class based on the incremental losses resulting from failure of the dam with respect to loss of life, environmental and cultural values, and infrastructure and economic losses.

Waterborne tailings directed to, and seepage from, the TMF will be managed in accordance with the Tailings and Mine Water Management Plan (Section 11.2.20) and Appendix 6.5-B. A geotechnical program was also completed for the TMF and is presented in Appendix 3.0-G. Details of the design of the TMF are presented in Appendix 3.0-L.

Selected components of the TMF are described further below.

3.7.6.1 Tailings Distribution System

The tailings distribution system refers to the pipelines that will deliver and distribute tailings from the processing facilities to the tailings impoundment and supernatant pond. The tailings are collected in collection boxes at the foot of the flotation banks. Both the final cleaner tailings and the final bulk tailings leave the plant by pipelines for transport to the TMF. Tailings will be discharged from the Process Plant by gravity flow (i.e., pumps will not be required).

Bulk tailings will be directed through a distribution box in the Process Plant to split bulk tailings either to the cyclones or to the TMF embankments. Bulk tailings directed to the embankments will be transported in two (one to each embankment) 28-in (”) high-density polyethylene (HDPE) pipelines. Bulk tailings directed to the cyclones will be transported in three (two to the Northeast Embankment and one to the South Embankment) 16” HDPE pipelines. Bulk tailings will be discharged as far as practicable from the embankment faces to provide additional seepage control and keep the surface pond remote from the embankments. The coarse fraction from the cyclones will be used for embankment construction while the fine fraction will be placed within the TMF.

Cleaner, or pyritic, tailings will be transported in a 12” HDPE pipeline along the reclaim line road. This tailings stream will be deposited to a separate, permanently submerged area within the TMF, away from the tailings beaches and embankments, so as to prevent oxidation that may lead to ML/ARD.

3.7.6.2 Tailings Impoundment and Supernatant Pond

The tailings impoundment and supernatant pond contained between the embankments is where the waterborne tailings from the processing facilities will be deposited, and where sedimentation of solid tailings materials from water will occur. As the waterborne tailings are produced over the life of the proposed Project, the elevation of the supernatant pond will increase steadily, with seasonal variations due to snowmelt, runoff, precipitation, evaporation, and consumption of water in the tailings voids. Tailings beaches will isolate the supernatant pond from the embankments.

3.7.6.3 South Embankment

The South Embankment is strategically located to optimise the natural topography along the southern part of the TMF. Foundation conditions are characterised by thin colluvium cover on the side slopes in a deeply incised V-shaped valley bedrock surface. The end of the historic Patsy waste dump is located on the right abutment of the embankment in the valley bottom. Rock mass is strong to very strong and rock mass permeability is low. The embankment will be developed in stages throughout the life of the proposed Project using the centreline construction technique.

The South Embankment will be constructed as a starter embankment made up of a rockfill dam with a water-retaining asphalt core, and raised as a zoned compacted cyclone sand rockfill dam. The South Embankment will be buttressed by the WRMF for additional stability.

The South Embankment has been assigned a very high consequence category based on “loss of life” criteria for personnel working in the adjacent Kitsault Pit. The economic consequences (including clean-up, repair, and remedial works) and social and economic impact to the mine would also be very high.

3.7.6.4 Northeast Embankment

The Northeast Embankment will be constructed at an elevation of approximately 760 m along the northeast. The embankment will be approximately 1,560 m long x 100 m high. Local quarry rock will be used to construct the starter embankment with staged raises constructed with cyclone sand. The site is characterised by thin topsoil and organic peat deposits overlying an undulating bedrock surface. Rock mass is strong to very strong and rock mass permeability is low.

The Northeast Embankment will be constructed across the top of the Patsy Creek Watershed as a geomembrane-faced rockfill dam and raised as a compacted cyclone sand embankment. The embankment will be developed in stages throughout the life of the proposed Project using the downstream technique.

The Northeast Embankment was assigned a very high consequence category based on significant loss or deterioration of critical fish or wildlife habitat and very high economic losses affecting important infrastructure or services. The potential for loss of life after failure is likely minor but if it resulted in the release of tailings and / or process water, it then would have a significant environmental impact on downstream watercourses, particularly in the Clary Creek Watershed. The economic consequences (including clean-up, repair, and remedial works) and social and economic impact to the mine would also be very high.

3.7.7 Water Management Facilities

Overall water management is the key to the success of all mining waste management systems. Water management components have been designed to maximise the diversion of clean water around the components of the proposed Project, while ensuring the capture of contact water throughout the site. The TMF and the Kitsault Pit are located in the middle and lower reaches of the Patsy Lake catchment and hence have the ability to collect all runoff from areas affected by the mining operation, which can then be recycled for reuse or discharged to Lime Creek. A mine de-watering system consisting of horizontal drains, ditches, sumps, submersible pumps, booster pumps, and pipelines will be employed throughout the mine life.

Contact water (i.e., water, seepage, or runoff that has been in contact with mine facilities such as the Kitsault Pit, the WRMF, ore stockpiles, TMF embankments) will be collected and handled by the site water management system, and either conveyed to the TMF or released to Lime Creek. This process will be maintained until closure, when the diverted flows will be allowed to flow directly into the Kitsault Pit until it fills, at which time it will discharge to Lime Creek.

The following is a summary of the water management facilities and a general description of the Water Management Plan. Appendix 6.5-B presents the detailed water management facilities and plan for the proposed Project.

3.7.7.1 Freshwater Runoff Diversion System

Freshwater runoff from upstream areas not affected by the mining operation will be diverted to reduce the amount of water that needs to be handled by the site water management system. Diversion of runoff to the maximum practicable extent possible has been achieved by diverting Patsy Creek around the Kitsault Pit (on a bench along the south wall of the Kitsault Pit) toward Lime Creek; see “South Pit Wall Diversion” on Figure 3.6-1.

3.7.7.2 Kitsault Pit Water Collection System

Water in contact with the Kitsault Pit includes precipitation, seepage from walls, and horizontal drains that introduce water into the Kitsault Pit. Some of this water will be absorbed by the broken rock and will be hauled out with the rock or removed as snow. As the mine deepens, a collection system of ditches, pipes, sumps, pumps, and booster pumps will be required to contain the water: ditches will route water that collects in the Kitsault Pit bottom to small, temporary sumps created as part of the normal mining operation; sumps will allow some solids to settle out before the water is pumped by low-head submersible pumps to skid-mounted booster pumps; booster pumps will be independent, self-contained units that can be added, removed, or relocated as required to meet changing conditions. The Kitsault Pit water will be pumped to the TMF or, if of suitable quality, be discharged to Lime Creek to be mixed with the diverted flows from Patsy and Lime Creeks. The Kitsault Pit de-watering system will be designed to handle a two-year return period rain storm; during the rare rain events that exceed this and flood the lower areas of the Kitsault Pit, mining will be focused on the upper mining phases until the water is pumped out of the Kitsault Pit bottom. Managing Kitsault Pit water is essential not only for water quality but also for wall stability and safe working conditions.

3.7.7.3 Ore Stockpile Water Collection System

Water in contact with ore stockpiles includes seepage and surface runoff. A vertical sump located downstream of the LGS will collect all water that comes into contact with it. The water will be pumped to the water box via a single 8” HDPE pipeline, and ultimately released to Lime Creek. The pipeline will be permanent and follow the LGS access road. The pipeline will be approximately 1.1 km long with a design peak flow rate of 190 m^3 per hour.

3.7.7.4 WRMF Water Collection System

Water in contact with the WRMF includes seepage and surface runoff. A vertical sump or wet well located downstream of the WRMF (i.e., the collection system for the Embankment of the TMF) will collect all water that comes into contact with it and the surrounding area, as well as leakage from the drainage ditches located to the south of the WRMF.

3.7.7.5 TMF South Embankment Water Collection System

Water in contact with the South Embankment of the TMF includes seepage and surface runoff; seepage will result from infiltration of ponded water directly through the embankment fill and the natural ground, and from expulsion of pore water as the tailings mass consolidates. Multiple levels for seepage control have been included in the design of the embankment to minimise seepage losses. Seepage will largely be controlled by the low permeability core zone of the starter South Embankment (constructed prior to development of the tailings beach), the tailings deposit, and the low permeability foundation materials. The extensive South Embankment tailings beach will minimise seepage losses as it isolates the supernatant pond from the embankment.

Seepage at the South Embankment will follow the natural topography via seepage collection trenches and report to the SSCP (a vertical sump or wet well located downstream of the South Embankment, within the ultimate toe of the WRMF), developed at a topographic low point. Seepage will be pumped back from the wet well to the TMF, via a single 24” HDPE pipeline. As the embankment is raised, the pipeline will be extended to accommodate for the change. The total final length of the pipeline will be approximately 2.0 km with a design peak flow rate of 1,500 m^3 per hour.

The South Embankment Seepage Collection System has been sized to manage 120% of the peak June flows, which equates to 1500 m3/hr. This will manage surface flows from the Waste Rock Management Facility (WRMF), as well as the seepage from the South Embankment. It is clear that the seepage volumes are only a fraction of the flows that must be management by this system, as it is primarily the surface runoff during freshet that creates the majority of the flows in June.

The open pit is downstream of the South Embankment and the WRMF. As a result, sub-surface flows that will not be captured by the Seepage Collection System will report to the pit. No groundwater wells are considered as a contingency for this part of the project. A contingency mitigation measure of groundwater pumpback wells located downstream of the Northeast Embankment Seepage Collection Ponds has been identified, should seepage capture by all measures not be suitable. There do presently exist groundwater monitoring wells downstream of these two seepage collection ponds, which are part of the baseline groundwater monitoring network, and will become part of the long-term groundwater monitoring network, once the Kitsault Project is built. Groundwater pumpback is an established method to collect additional seepage water, should it be necessary. The number, depth and monitoring parameters for groundwater pump-back wells have not been identified at this stage of the project design.

South Embankment seepage rates are estimated at:

- Start-up – 14 l/s (within first 6 months, fracture zones expected to be blinded off by tailings)
- Years 2 to 14 – 7 l/s and then rising to 19 l/s
- Steady-State in Post-Closure – 19 l/s

The South Embankment also contains toe drains to reduce seepage gradients, and contingency measures for groundwater recovery and recycling.

3.7.7.6 TMF Northeast Embankment Water Collection System

Water in contact with the Northeast Embankment of the TMF includes seepage and surface runoff. Seepage will result from infiltration of ponded water directly through the embankment fill and the natural ground and from expulsion of pore water as the tailings mass consolidates. Multiple levels for seepage control have been included in the design of the embankment to minimise seepage losses. Seepage will largely be controlled by the low permeability geomembrane face of the starter Northeast Embankment (constructed prior to development of the tailings beach), the tailings deposit, and the low permeability foundation materials. The extensive Northeast Embankment tailings beach will minimise seepage losses as it isolates the supernatant pond from the embankment.

Seepage at the Northeast Embankment will follow the natural topography via seepage collection trenches and report to the two Northeast Seepage Collection Ponds (NESCP), developed at topographic low points. Seepage will be pumped back from the ponds to the TMF, via 16” HDPE pipelines. As the embankment is raised, the pipelines will be extended to accommodate for the change. The total final length of each pipeline will be approximately 0.9 km with a design flow rate of 360 m^3 per hour.

The Northeast Embankment Seepage Collection System has been sized to manage 120% of the design discharge from the cyclone sand system, which will be used to construct the downstream zone of the Northeast Embankment. There are two seepage collection ponds, each capable of pumping 360 m3/hr. Again, the size of these systems is driven by peak events rather than the volume of seepage water that has been estimated.

Northeast Embankment seepage rates are estimated at:

- Start-up – 3 l/s
- Years 2 to 14 – 1 l/s rising to 14 l/s
- Steady-State in Post-Closure – 14 l/s

The Northeast Embankment also contains toe drains to reduce seepage gradients, and contingency measures for groundwater recovery and recycling.

3.7.7.7 Process / Reclaim Water System

Process water is required for the ore processing facilities. Mill commissioning and early operations will utilise some of the approximately 10 Mm^3 of water that will be impounded prior to start-up (i.e., the water that will be collected from the runoff from the watershed and from the disturbed catchment areas used for mine construction activities). Ongoing operations will reclaim water from the TMF (with supplementation from mine disturbance areas, if required), pumping it from the TMF supernatant pond to a process water-holding tank at the mill.

A reclaim water pump will be mounted on a floating barge located on the northwest side of the TMF pond, approximately half way between the South Embankment and the Northeast Embankment. The rising elevation of the supernatant pond will significantly reduce the pumping head requirements over the life of the proposed Project and allow modifications to the pumps, or their mode of operation, to minimise power consumption. The reclaim system is designed to deliver 120% of the peak process water requirements for a nominal throughput of 50,000 t/d.

A single reclaim water pipeline (30” diameter, 0.375” wall thickness steel pipe) will follow a purpose built road from the barge westward to the intersection with the mill road (i.e., it will run in parallel with the surplus water pipeline). From this intersection, the reclaim pipeline will head north and share the pipeline corridor with the South Embankment tailings pipelines up to the mill. The total start-up length of the reclaim water pipeline will be 2.77 km with a design flow of 3,330 m^3 per hour. The length of this pipeline will reduce to 1,960 m in the final year due to barge relocation. This pipeline will be permanent during operations for most of its length. Modifications and shortening of the pipeline will be required at its connection with the reclaim barge, which will be dictated by raises of the TMF supernatant pond.

3.7.7.8 Surplus Water System

Surplus water will be present at the site each year of operations, due to the location (i.e., average precipitation conditions, extreme condition scenarios) of the proposed Project. Active discharge of this water to the receiving environment will be required throughout the mine life to maintain a water balance in the TMF. Surplus water will be stored on-site within the TMF, and then when necessary, pumped from the supernatant pond to a water box north of the Kitsault Pit and ultimately to Lime Creek downstream of the Kitsault Pit.

A surplus water pump will be mounted on a floating barge located on the northwest side of the TMF pond, approximately half way between the South Embankment and the Northeast Embankment. The rising elevation of the supernatant pond will significantly reduce the pumping head requirements over the life of the proposed Project and allow modifications to the pumps, or their mode of operation, to minimise power consumption.

A single surplus water pipeline (24” diameter, 0.375” wall thickness steel pipe) will follow a purpose-built road from the barge westward to the intersection with the mill service road (i.e., it will run in parallel with the reclaim water pipeline). From this intersection the surplus pipeline will follow the service road towards the South Embankment, and from the top of the ridge it will follow the crusher access road down to the water box. The total start-up length will be approximately 3.35 km with a design flow of 1,660 m^3 per hour. The length of this pipeline will reduce to 2.54 km in the final year due to barge relocation. This pipeline will be permanent for the life of the proposed Project for most of its length. Modifications and shortening of the pipeline will be required at its connection with the reclaim barge, which will be dictated by raises of the TMF supernatant pond.

3.7.7.9 Fresh Water Supply System

Fresh water is required for use by personnel (e.g., potable water, showers, sinks, toilets), equipment (e.g., washing at the truckshop), firefighting (e.g., mill, camp), and various other uses (e.g., reagent mixing at the processing facilities). Water for these uses will be obtained from Clary Lake.

A single pipeline (8" diameter, 0.322" wall thickness steel pipe) will connect Clary Lake to a fresh water holding tank (total capacity 1,475 m^3, of which 800 m^3 is dedicated firewater storage in the lower insulated and heated section of the tank) at the mill. The pipeline will be laid along the existing access road and along the new proposed mine site road to the Process Plant. The total pipeline length will be 5.9 km with a design flow rate of 120 m^3 per hour. The entire pipeline will be permanent for the life of the proposed Project.

The holding tank will provide storage for times when the system is not operating during pump maintenance or other interruptions, as well as additional water for firefighting. The freshwater system is designed to provide 120% of the clean water demand.

Fire pumps will draw water from the tank when required. Two pumps will be provided: an electric primary and a diesel backup. The pumps will be installed in a pre-fabricated modular building, which will be supplied complete with all internal piping and controls. Fire water will be distributed to the various plant buildings via fire mains running through the process buildings, mill building, and utilidors. Exterior wall hydrants will be provided on plant site buildings. A gravity-driven fire main will run from the mill platform to the truckshop and fuel storage platform via HDPE / steel heat-traced and insulated pipe to a fire loop around the structures.

The tank farm will be protected with a looped, above-ground, insulated and heat-traced carbon steel piping system with monitor nozzles and hydrants located such that exposed tanks can be wetted on all sides in case of fire. A circulation pump and associated piping will assist with freeze prevention. In addition, foam fire-fighting systems are included in this area.

A potable water treatment system will be provided, but the water will only be distributed to the main plant site facilities (bottled water will be made available for the truckshop, fuel storage, and mining facilities because fewer people are expected to be working in these areas). Water to be treated will be withdrawn from the upper section of the fresh / fire water tank at the Process Plant and pumped to a modular potable water treatment plant designed for both construction and operational needs. Based on sample testing, the fresh water will have elevated levels of total organic carbon and colour prior to treatment. The proposed design includes coagulation followed by ultrafiltration, ultraviolet light treatment, and sodium hypochlorite injection.

3.7.8 Infrastructure and Ancillary Facilities

Infrastructure facilities will include all buildings, shops, utilities, and services necessary to support the mining and ore processing activities. Major structures will be prefabricated, modular, or steel frame buildings founded on spread footings. Considering the rugged topography in the area, buildings and facilities will be constructed on pads at different elevations utilising the limited available flat sections of land.

3.7.8.1 Truckshop

A truckshop is required for equipment and vehicle maintenance. It is located at an elevation of 742 m and is approximately 1.3 km north of the Kitsault Pit. It will be a two-storey pre-engineered structure. The ground floor will house four heavy vehicle repair bays, a tire bay, a light vehicle repair bay with lube oil storage, a welding shop, a wash bay, and dedicated parking areas for the mine rescue truck, fire truck, ambulance, and first aid facility. The north end of the building will have a second-floor office area. Site selection considered topography, suitability of ground conditions, and convenience for the mining trucks to pull in for service or refuelling. It also keeps most of the noise below and away from the camps and mill site.

The wash bay will be at one end of the workshop, next to the heavy vehicle tire repair bay, and will be separated from adjacent areas by walls up to the roof. Floor drains and sumps with pumps will be installed for the transfer of wash water to the wash water treatment pond. Floor- and catwalk-mounted monitors will provide high-pressure water streams to thoroughly wash the haulage trucks and loaders. Wash water will be collected in a large sump outside the building, where solids will settle out before the water is recirculated to the wash system. Any oil in the recycled water will be skimmed off in an oil / water separator prior to re-use.

3.7.8.2 Fuel Storage and Distribution

Diesel fuel will be stored at the truckshop area in two tanks, each having a capacity of 322,000 litres (L) for a total diesel fuel storage capacity of 644,000 L. Fuel will also be stored at the mill site, in one tank with a capacity of 126,000 L (periodically refilled by tanker from the truckshop diesel tanks). Storage tanks will be within an HDPE-lined and bundled tank farm. Used FO will be collected at the truckshop and temporarily stored on-site. Some of it will be used as a constituent of the FO in the ANFO mix; the surplus oil will be sent off-site for recycling.

Liquid propane (e.g., for campsite cooking appliances) will be stored in mobile tanks. A fixed pump / vapouriser assembly will be provided to ensure sufficient vapour flow regardless of outside temperature.

3.7.8.3 Accommodations

Accommodations are required for all on-site personnel during construction and operations because Kitsault is a relatively remote site.

The construction-stage camp will include 15 stand-alone, single-storey dormitories designed to house the anticipated proposed Project personnel requirements, and a stand-alone, single-storey core services facility. All units will be pre-fabricated complete with all services, furnishings, and appliances.

The permanent accommodation complex will be built within the construction camp and will include six upgraded, stand-alone, single-storey dormitories and the same pre-built core services facility from the construction camp.

Campsite selection considered potential effects from dust (e.g., from the ore stockpile) and noise (e.g., from the Kitsault Pit, the processing facilities, the truckshop, etc.).

3.7.8.4 Administration and Changeroom Facility

An administration and changeroom facility is required for human resources requirements. This two-storey facility (47.5 m long x 18.3 m wide) will consist of 13 modules with an additional single-storey section with a mudroom and clean / dirty lockers for both men and women. Space will be allocated for a dispatch / assembly area, training room, and offices. The second floor will contain offices for administrative and senior technical personnel, a reception area, a conference room, washrooms, a kitchenette, and storage space.

3.7.8.5 Heated and Cold Storage Building

A heated and cold storage building is required for storage of various on-site materials. The cold part of the building (15 m x 29 m) will provide a clear-span, open, unheated space for storage. The heated part of the building (15 m x 36 m) will include an open area for racks and shelving, two warehouse personnel offices, and a washroom. The building will be a pre-engineered structure with primary and secondary steel framing founded on spread footings.

3.7.8.6 Heating, Ventilation, and Dust Control

Heating of all buildings and facilities at the mine site will be accomplished with electric heaters.

Ventilation of all personnel-occupied and selected unoccupied spaces will be accomplished with make-up air units for continuous supply of tempered air, general exhaust fans for contaminant removal from the space, and localised (tank) exhaust fans to remove contaminants directly from the source where appropriate.

Dust control systems (e.g., hoods, ductwork, dust collectors, wet scrubbers, enclosures) will minimise the amount of airborne particulate matter introduced to the surrounding environment by capturing fugitive dust or fume emissions at their sources.

3.7.8.7 Communications

Communications systems will be required on-site and will consist of: fibre-optic communications system backbone; voice, data, fax, Internet, and video capabilities; computer system equipment, including all routers, switches, controllers, security firewall, and modems; uninterruptible power supply backup supply for a minimum 30-minute supply with system fully loaded; modular design suitable for expansion, maintenance, and trouble-shooting; cabinets, cabinet wiring, and equipment mounting; and all software.

3.7.8.8 Waste Treatment

Human waste from the campsite will be treated with a modular sewage treatment plant. Effluent from the camps will likely be treated with a membrane bioreactor system (compact and produces less waste sludge compared to other treatment technologies), however the final treatment technology has yet to be determined.

Hazardous materials and wastes will be managed in accordance with the Hazardous Material Management Plan and the Hazardous Waste Management Plan, respectively. See Section 11.2.9 and 11.2.10 for details. For example, hazardous wastes (e.g., oil, antifreeze, solvents, grease, batteries, tires) will be segregated at the point of generation, placed into appropriate storage containers, and then shipped off-site to an appropriate recycling or disposal facility. A lined storage facility will be constructed within or near the site fuel storage facilities to store the hazardous waste held in segregation pending periodic off-site shipment. Hydrocarbon-contaminated soil will be handled and managed as appropriate.

Non-hazardous waste will be managed in accordance with the Solid Waste (Domestic Refuse) Management Plan (Section 11.2.17). Selected components of the Solid Waste (Domestic Refuse) Management Plan include waste segregated into two streams (putrescible and non-putrescible). In addition, putrescible kitchen wastes will be burned in on-site incinerators to limit wildlife attraction associated with disposal of food wastes. Non-putrescible waste will be collected and disposed of within an on-site landfill to be located in a suitable area given conditions at the mine site. Non-hazardous garbage placed within this landfill will be periodically buried under a layer of soil or NAG waste rock to prevent loss of garbage through wind action and to control drainage.

3.7.8.9 Explosives Manufacturing Facility and Explosives Magazines

An explosive manufacturing facility and related explosives magazines will be required for blasting purposes at the Kitsault Pit. The explosives plant will be located up a side road from the mine access road (approximately 500 m to the northeast of the TMF). Section 3.5.3 (Production Mining) details the type of explosives to be used during construction and operations.

The explosives manufacturing plant will be a fenced facility that will include a manufacturing plant, storage tanks, and magazines for storage of explosives. The plant building will meet the bulk guidelines published by the Explosives Regulatory Division of Natural Resources Canada as well as local, provincial, and federal regulations. A sump in the building would collect water for eventual emulsion / oil / water separation and disposal. The proposed Project will require approximately 18,000 kg of explosives per day.

3.7.8.10 Assay Laboratory

A laboratory facility will be constructed at the mine site for metallurgical and analytical services. The facility will be housed in its own building, isolated from the mill. Samples will be analysed for:

- Mine grade control;
- Concentrator OSA calibration;
- Metallurgical testwork;
- Metallurgical accounting; and
- Plant discharge control samples.

The lab will be able to process up to 100 samples per day and perform the following procedures:

- Sample preparation;
- Instrument analysis (AA, Leco, X-ray);
- Wet chemistry (titrations); and
- Environmental analysis.

Design is based on two 12-hour shifts per day for preparation and analysis. The main analytical parameters will be molybdenum, iron, lead, bismuth, and sulphur. The metallurgical testwork will focus on process optimisation within the plant.

3.8 Off-Site Facilities

This section describes the off-site facilities in the vicinity of the proposed Project, including power supply and distribution (Section 3.8.1), access roads (Section 3.8.2), Kitsault Townsite (Section 3.8.3), barge facilities (Section 3.8.4), marshalling yards and warehouses (Section 3.8.5), and ports (Section 3.8.6).

3.8.1 Power Supply and Distribution

Power will be provided by diesel generators for the first six months of construction until power from the grid becomes available on-site; the existing power lines adjacent to the site are not able to meet the requirements of the proposed Project. The generators will then be used as back-up or emergency power both during construction and operations. Maintenance of the existing transmission line will be done in conjunction with BC Hydro. The new BC Hydro substation will be erected on its previous location adjacent to the Kitsault Pit. Construction power will be in place within six months of the construction start date, and final site power will be provided before operations to enable the Kitsault Pit shovel to join the pre-stripping operations and facilitate commissioning.

Power for operations will come from an existing BC Hydro 138-kV (currently energised at 25 kV) transmission line from the New Aiyansh substation, approximately 70 km away. The incoming transmission line will terminate at a new main substation at the proposed Project site. The substation will be adjacent to the mill, where the largest loads are located, to minimise cabling costs and losses. The substation will have an incoming circuit breaker, disconnect switches, power transformers, switchgear, and protective equipment for the transformation of power from the transmission voltage level of 138 kV to the site distribution / utilisation level of 13.8 kV.

Emergency standby power will come from a nominal 2.0 megawatt (MW) modular standby power plant, rated for the maximum power required in the event of a utility power failure. The plant will consist of a minimum of two gensets.

Emergency battery power packs will be available for backup power to the fire alarm system and emergency egress lighting fixtures.

3.8.2 Access Roads

A series of FSRs connect the proposed Project to Nass Camp, north of New Aiyansh, Rosswood, and Terrace. These FSRs – Kitsault, Nass-Kwinatahl, Nass-Kinskuch, and the Nass – roughly parallel the power line from the BC Hydro New Aiyansh substation. The proponent owns SUP S09228 and RUP 08-7876-03. Due to neglected maintenance of the existing FSR, the road is in need of overdue maintenance. Highway-standard roads are available up to Nass Camp. An existing gravel road provides access to the Kitsault Townsite, and a branch off this road extends to the Kitsault mine site.

Section 3.2.1 (Location and Access) and Section 3.6.8 (Construction Road Use) provide additional information on road use. In addition, Appendix 8.0-C (Road Use Effects Assessment) presents a complete effects assessment relating specifically to road use.

3.8.3 Kitsault Townsite

The Kitsault Townsite, constructed during the previous mine operations, is owned by others and does not form part of the scope of the proposed Project, except as may be required through the proponent's SROW. Before this study began, the owner of the Kitsault Townsite had contested the purpose of the proponent's SROW. The proponent has since received confirmation of its SROW through the Kitsault Townsite by the BC Supreme Court, giving the mine the opportunity to use either road or water transport.

3.8.4 Barge Facilities

Barge facilities that currently exist within and adjacent to the Kitsault Townsite do not need to be used during the construction or operations phase of the proposed Project.

3.8.5 Marshalling Yards and Warehouses

All project material and equipment procured off-shore that cannot be moved directly to the site will be staged in a marshalling yard operated by a third party at an off-site location to be determined. Such cargoes include, for example, freight awaiting customs clearance that will be stored in a clearly identified and fenced, bonded-goods area, or those for which limited storage area is available on-site. Special loads and equipment that require escort will be staged in the marshalling yard to await transport to the site. Less-than-full truck loads will be staged to await consolidation with other loads. Goods arriving at a port in containers subject to demurrage will be unloaded and reloaded into containers that will then be used to store these materials at the proposed Project site.

3.8.6 Ports

The primary port of discharge will be in Vancouver. The Vancouver port is a well-equipped, modern port that receives scheduled calls by container and break-bulk shipping lines, and offers a wide range of transport and logistics services.

3.9 Operations Phase Activities

This section describes the operations phase activities for all components of the proposed Project. Kitsault Pit mining activity is briefly summarised in Section 3.9.1. Waste rock management is briefly summarised in Section 3.9.2. Ore management is briefly summarised in Section 3.9.3. Molybdenum ore processing is described in detail in Section 3.9.4. Molybdenum concentrate packaging and transportation is described in Section 3.9.5. Tailings management is briefly summarised in Section 3.9.6. Water management is briefly summarised in Section 3.9.7. Operations road use is briefly summarised in Section 3.9.8.

3.9.1 Kitsault Pit Mining

Molybdenum ore will be mined from the six-phase open pit by conventional drilling and blasting methods (described in detail in Section 3.5, Mine Plan). Appendix 3.0-D (Pre-Feasibility Geotechnical Pit Slope Design Kitsault Project, June 2009 SRK Consulting) and Appendix 3.0-E (Feasibility Geotechnical Pit Slope Evaluation Kitsault Project, November 2010 SRK Consulting) include standalone geotechnical reports by SRK Consulting.

3.9.2 Waste Rock Management

Waste rock (i.e., rock with uneconomical deposits of molybdenum) obtained during operations phase mining activities will be managed by hauling it to the WRMF (described in detail in Section 3.7.3).

3.9.3 Ore Management

Run-of-mine (ROM) ore obtained during operations phase mining activities will be managed by hauling it to the ore stockpiles (described in detail in Section 3.7.4).

3.9.4 Molybdenum Ore Processing

Ore from the Kitsault Pit will be crushed and conveyed to a concentrator, where the ore will be ground to liberate the mineral values from the host rock, and then separated by flotation into a purified molybdenum concentrate. Figure 3.9-1 is a diagram showing all of the major processing steps. The processing methods, facilities, and equipment are based on conventional and proven technology. Major processing steps are discussed further below.

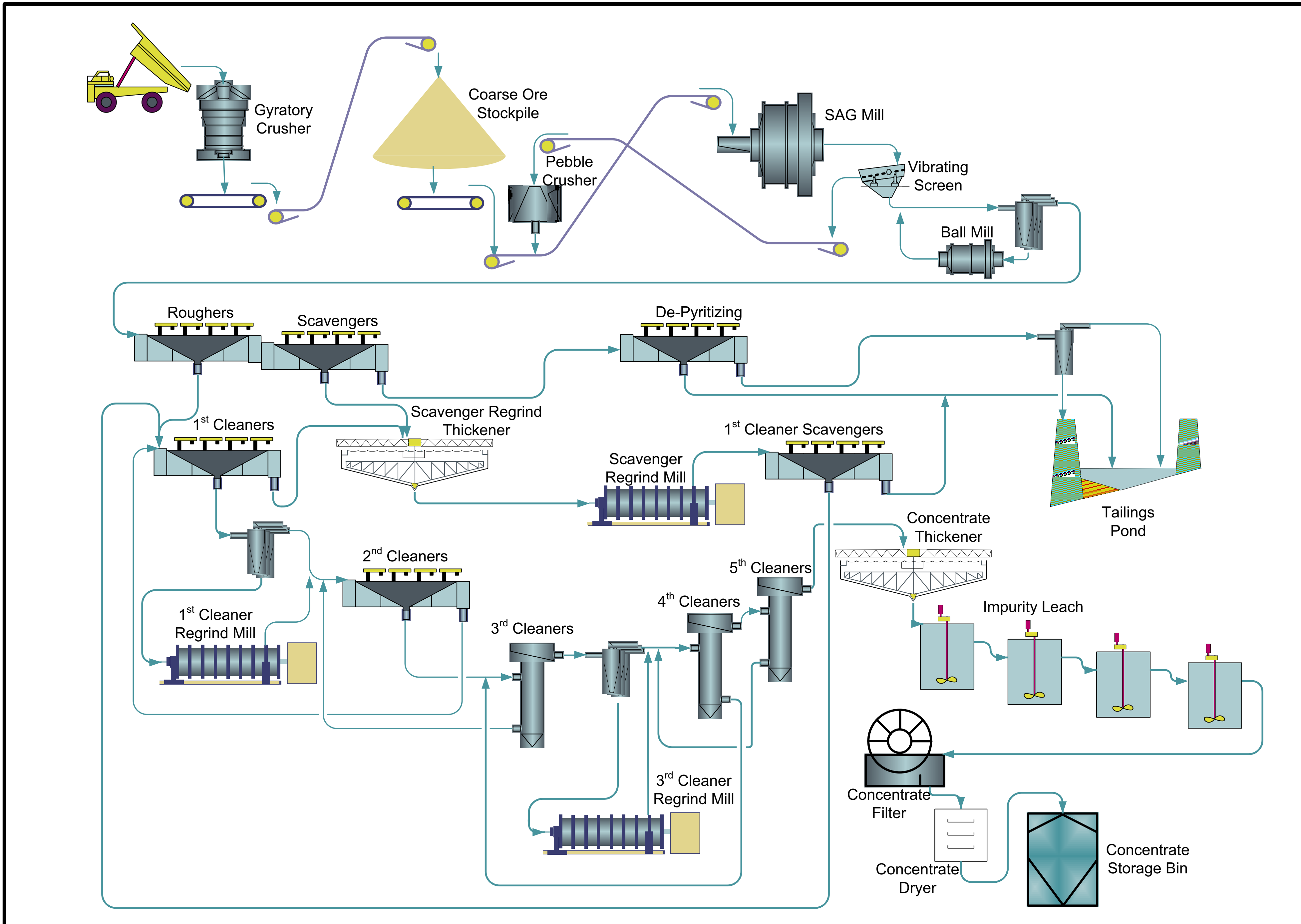
3.9.4.1 Crushing

The first major step in the processing of molybdenum is to crush the ROM ore. Haul trucks will deposit ore mined from the Kitsault Pit directly into a feed-hopper, which will discharge the ore to a crusher station (a semi-mobile gyratory crusher, 63” x 75” founded on a concrete matt, and equipped with a jib-type maintenance crane and a rock breaker) at the rim of the Kitsault Pit. Crushed ore will fall into a surge bin below the crusher, and then be conveyed (via an apron feeder, a crusher discharge conveyor, and a stockpile feed conveyor) to the COS at the Process Plant. The conveyor system will be outfitted with a tramp metal collection system (i.e., a metal detector and self-cleaning magnet) and a dust collection system.

Coarse ore will be reclaimed from the stockpile by four apron feeders, which will discharge to a mill feed conveyor. Coarse ore will be reclaimed from the stockpile at rates determined by the mill demand. Each apron feeder will be able to supply one-third of the design tonnage (i.e., so the operation can be sustained if one of the feeders is down for maintenance, if there is one empty draw point, or if there is a plugged hopper) without starving the mill. A track dozer will be used to push ore into the feeders when upstream maintenance activities require ore to be reclaimed from a dead section of the COS.

3.9.4.2 Semi-Autogenous Grinding Mill

The second major step in the processing of molybdenum is to grind the coarse ore in a Semi-Autogenous Grinding (SAG) mill. The SAG mill grinds the ore to a finer size. Discharge from the SAG mill will pass over a vibrating screen to separate it into two fractions: oversize and undersize.



CLIENT: AVANTI MINING INC — Avanti Kitsault Mine Ltd.	ANALYST: MY QA:	PROJECT: Kitsault Mine Project	REV. NO.: A DATE: November 2011
AMEC Earth & Environmental 4445 Lougheed Highway, Burnaby, B.C., V5C 0E4 Tel. 604-294-3811 Fax 604-294-4664 — amec	DATUM: Undefined PROJECTION: Undefined SCALE: Not to Scale	TITLE: Process Overview	PROJECT NO: VE51899 FIGURE No. 3.9-1

The oversize (>15 mm) fraction will be sent to a pebble crusher. The pebble crusher reduces the size of the pebbles for subsequent re-introduction to the SAG mill. The pebble crusher will be housed in a separate building between the mill building and the COS.

The undersize (<15 mm) fraction will be sent to a mill discharge pumpbox and a cluster of 10 cyclones. Cyclone overflow will feed the rougher-scavenger bulk flotation circuit; cyclone underflow will report to the ball milling circuit. Diesel fuel, Nokes' reagent, and frother will be added to the mill discharge pumpbox to prepare the material for subsequent flotation.

The SAG mill will share a bay with the ball mill, and will be served by an overhead bridge crane. Spills from the SAG and ball mill will be collected in a common sump. Large sump pumps at the low point will handle spilled water and fine solids.

3.9.4.3 Ball Milling

The third major step in the processing of molybdenum is to mill the homogenised ground ore in a ball mill. The ball mill prepares the rougher flotation feed to allow for the most efficient liberation point for the molybdenum. Ball mill discharge will join the SAG mill discharge in the mill discharge pumpbox, which feeds the cluster of 10 cyclones. Cyclone overflow will feed the rougher-scavenger bulk flotation circuit; cyclone underflow will be recycled in the ball milling circuit. Diesel fuel, Nokes' reagent, and frother will be added to the mill discharge pumpbox to prepare the material for subsequent flotation.

The ball mill will share a bay with the SAG mill, and will be served by an overhead bridge crane. Spills from the SAG and ball mill will be collected in a common sump. Large sump pumps at the low point will handle spilled water and fine solids.

3.9.4.4 Flotation and Concentration

The fourth major step in the processing of molybdenum is flotation. Flotation recovers the molybdenum in the form of a concentrate that can be sold commercially.

Flotation and concentration requires a number of reagent chemicals (all of which will be managed in accordance with the Hazardous Materials Management Plan), including the following:

- **Collectors:** Collectors are organic reagents used to form a hydrophobic layer on mineral surfaces in the flotation pulp; the hydrophobic particles then attach to air bubbles and the mineral can be recovered from the froth product. The collectors used for flotation in the proposed Project are diesel fuel (or FO), potassium amyl xanthate (PAX, or xanthate), and A3477;
- **Frothers:** Frothers are heteropolar surface-active compounds that lower the surface tension of water, and also have the ability to adsorb on the air bubble–water interface; their presence in the liquid phase affects the size and film strength of the air bubbles, thus providing better attachment of hydrophobic particles to the bubbles.

The frothers used for flotation in the proposed Project are methyl isobutyl carbonyl (MIBC) and AF65;

- **Regulators:** Regulators modify the action of the collector and thereby make the flotation process more selective. Depressants reduce the ability of the collector to make certain minerals hydrophobic. Nokes' reagent is used as a depressant in flotation (to suppress the flotation of lead into the final molybdenum concentrate). A pH regulator regulates the ionic composition of the pulp by changing the concentration of the hydrogen ion in the pulp; this results in improvement in collector interaction with the selected mineral and reduces collector interaction with undesirable minerals. Lime is used as a pH regulator;
- **Flocculants:** Flocculants are reagents that promote flocculation, by causing colloids and other suspended particles in liquids to aggregate (forming a "floc"); and
- **Leaching chemicals:** Leaching reagents dissolve out impurities such as lead from the concentrated product. Hydrochloric acid is used as a leaching chemical.

The selective recovery of molybdenite (the valuable mineral fraction of the ore) and rejection of gangue (uneconomic material of the ore that constitute tailings) is accomplished by: (i) adding different combinations of reagents to process streams, (ii) regrinding certain process streams to achieve a higher level of liberation, and (iii) recycling process streams through unit operations to allow multiple attempts at recovery of the high value minerals.

Flotation has multiple circuits, including the following:

- **A rougher flotation circuit:** The rougher flotation circuit consists of six rougher cells, which produce a concentrate that is sent directly to the first cleaners (and subsequent parts of the cleaning circuit) for further upgrading. Diesel FO is primarily added in the grinding circuit to ensure adequate dispersal within the ore pulp, while Nokes' Reagent can be added either in grinding or in the conditioning tank. The frother is added primarily in the conditioning tank but can be added throughout the circuit as required. Lime is not used in the roughing circuit because pH is not modified in this part of the plant;
- **A scavenger flotation circuit:** The scavenger flotation circuit consists of six scavenger cells, a scavenger regrind thickener, a scavenger regrind mill, and first cleaner scavengers. The scavenger cells process the tailings from the rougher flotation circuit. Concentrate from the scavenger cells is sent to the scavenger regrind thickener. The high-solids fraction from here is directed to the cleaner scavenger regrind mill to reduce particle size to 50 micrometres (μm). Material is then directed to the first cleaner scavengers. The first cleaner scavengers produce a concentrate that is sent directly to the first cleaners (and subsequent parts of the cleaning circuit) for further upgrading;
- **A de-pyritisation circuit:** The de-pyritisation circuit consists of four de-pyritisation flotation cells. The de-pyritisation cells process the tailings from the scavenger flotation circuit to recover pyrite. The de-pyritisation cell concentrate (i.e., pyritic tailings) joins the other cleaner tailings in a collection box, for eventual deposit in a

separate, permanently submerged area within the TMF, away from the TMF embankments and tailings beaches. The de-pyritisation cell tailings (i.e., the bulk, or scavenger tailings) are directed to a tailings collection box, which feeds four tailings lines (two of which feed separate cyclone systems and two of which deposit material directly into the TMF). The reagent used in this circuit is PAX. Frother is added throughout the circuit as required;

- **A cleaning circuit:** The cleaning circuit consists of five cleaners and two re-grinders. The first cleaners and first cleaner regrind mill clean the concentrate from the rougher cells and reduce particle size to 50 μm. The second cleaners further upgrade the material. The third cleaners and third cleaner regrind mill clean the material and reduce particle size to 25 μm. The fourth cleaners further upgrade the material. The fifth cleaner column produces the final flotation product. All the cleaner columns employ specialised sparger technology, which requires a circulating pump passing material through a cavitation air mixer or similar equipment. This type of technology has been selected to ensure effective cleaning performance. Diesel FO, Nokes' reagent, and frother are added throughout the cleaning circuit as required. Lime is used as the primary pH modifier throughout and is added at the regrind mills as required to depress the pyrite; and
- **A thickening leaching circuit:** The thickening and leaching circuit consists of a concentrate thickener and four agitated leach tanks. The final concentrate from the fifth cleaners is sent to the molybdenum concentrate thickener, where flocculant is added to assist in settling the material and increasing its density to a level suitable for leaching and filtration. The molybdenum concentrate enters the first of four agitated leach tanks, where it is combined with hydrochloric acid to dissolve out impurities (e.g., lead). The last of the four leach tanks is primarily used as concentrate surge storage. After leaching, the concentrate is filtered, washed, re-filtered and then dried before being packaged for shipment. All gases vented from the tank will be recovered to a gas scrubber.

3.9.5 Molybdenum Concentrate Packaging and Transportation

Molybdenum concentrate obtained after operations-phase processing activities will be stored in bags, packaged, and ultimately transported away from the site to international markets, and eventually to industrial consumers of molybdenum.

The storage system for the final concentrate consists of three bins. The storage and bagging system will be fully contained within an enclosed building; thus there will be no dust issues. At any one time, one bin will be in use to feed the bagging system, another bin will be receiving material currently being produced by the dryer, and the third bin will be dedicated to receiving off-specification concentrate. Off-specification concentrate can be re-pulped and returned to either the cleaning circuit or the impurity leaching circuit.

Bags of high-value molybdenum concentrate will be loaded onto trucks and transported to the port facility in Vancouver, where it will be loaded onto seagoing vessels for delivery for roasting by Molymet in either Chile or Belgium.

The proponent is considering two molybdenum concentrate transportation options from the mine site to Hwy 16 at Kitwanga, BC. These two options are presented in Figure 3.9-2. Section 3.9.8 (Operations Road Use) and Appendix 8.0-C provide details of the transportation route for concentrate as well as the potential effects of the use of the existing roads.

3.9.6 Tailings Management

Tailings (i.e., the materials leftover after the process of separating the valuable fraction of molybdenum concentrate from the uneconomic gangue fraction of the ore) obtained during operations phase processing activities will be managed by directing tailings to the TMF (described in detail in Section 3.7.6).

3.9.7 Water Management

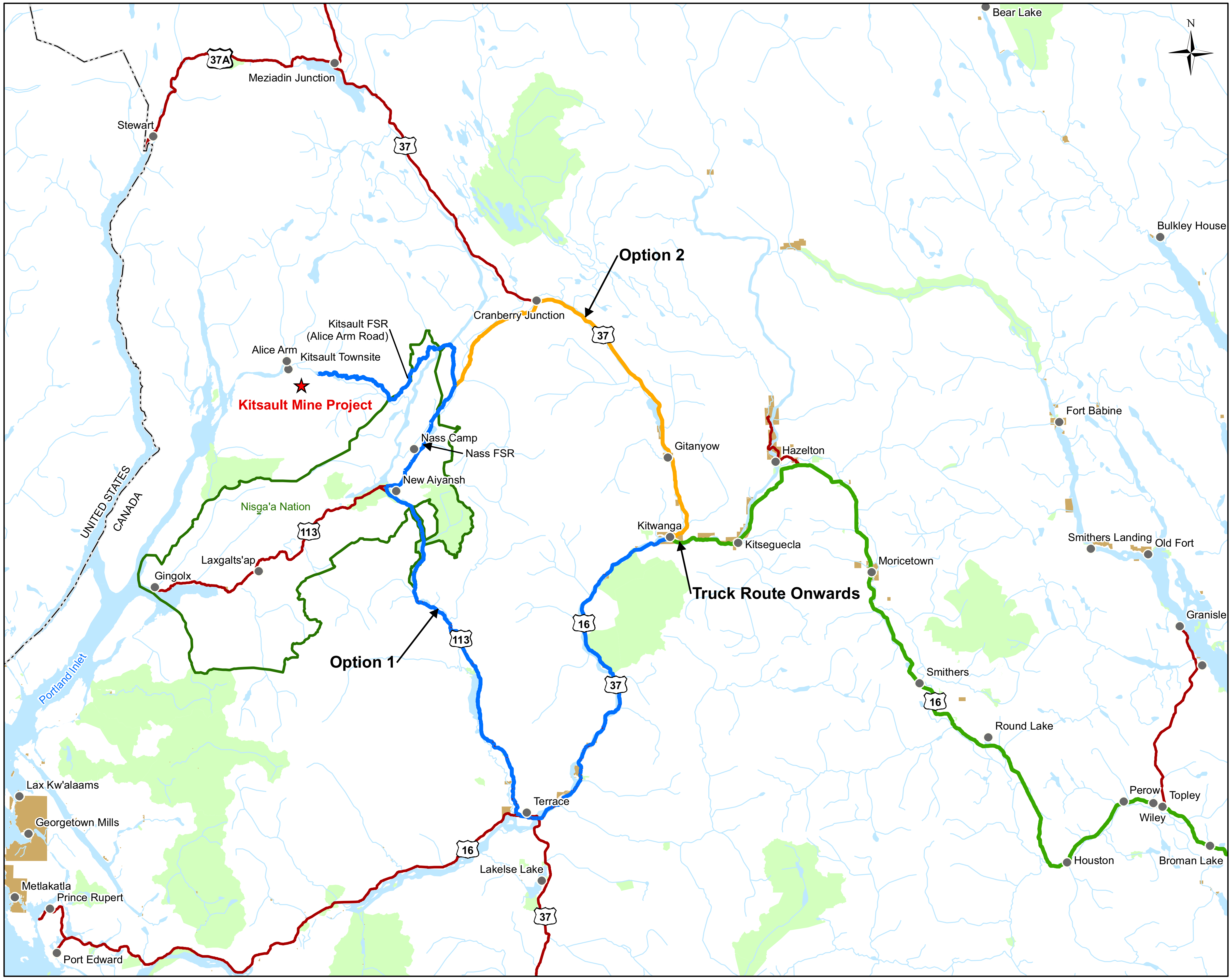
Water used, produced, or recovered during operations-phase activities will be managed by a system of diversions, pipework, collection ponds, and monitoring systems (described in detail in Section 3.7.7).

3.9.8 Operations Road Use

The operations phase of the project entails continuous flow of mine-related traffic between the mine site and regional hubs (including Smithers, Terrace, and Prince George) along road and highway infrastructure. Roads used during operations would be the same as discussed in Section 3.6.8 (Construction Road Use; see Figure 3.6-2). However, during operations the proposed Project will also transport molybdenum concentrate. Trucking of concentrate would be via Hwy 113 (Nisg̱a'a Hwy) or Hwy 37.

According to a "Traffic Impact Analysis" (Appendix 3.0-J), a maximum of 27 daily trips with a total of 6,724 annual trips will occur to and from the mine site. Based on frequency of delivery, McElhanney Consulting Services Ltd. (McElhanney) predicts that there will be eight daily trips with loads of concentrate, people, vendors, suppliers, and expeditors. Every week, 10 deliveries of food, personnel, and maintenance and warehouse supplies are expected to occur at the Kitsault mine site. Each month there will be 152 trips with lime, explosives, reagents, and fuel intended to support operations of the proposed Kitsault Project (Appendix 3.0-J). Table 3.9-1 provides a summary of the truck types, their anticipated loads, delivery frequency, and total annual trips and maximum daily trips.

Section 3.2.1 (Location and Access) and Section 3.6.8 (Construction Road Use) provide additional information on road use. In addition, Appendix 8.0-C (Road Use Effects Assessment) presents a complete effects assessment relating only to road use.



KEY MAP

Scale:1:900,000

0 5 10 20 30 40 50

Kilometres

Reference
Base Data
Atlas of Canada scale 1:1,000,000.

CLIENT: Avanti Kitsault Mine Ltd.

PROJECT: Kitsault Mine Project

Concentrate Transportation Routes for Kitsault Mine Project to Highway 16 at Kitwanga, BC

DATE: November 2011	ANALYST: MY	**Figure** 3.9-2
JOB No: VE51988	QA/QC: TT	PDF FILE: Other-50-071_route_option.pdf
GIS FILE: Other-50-071.mxd		
PROJECTION: UTM Zone 9	DATUM: NAD83	

amec

Y:\GIS\Projects\VE\VE51988_Kitsault\Mapping\Other\Other-50-071.mxd

Table 3.9-1: Summary of Project-Related Traffic

Truck Type	Load	Delivery Frequency	Total Annual Trips	Maximum Daily Trips
40 tonne Tandem	A3477, Pax, MIBC, Nokes	7/month	84	1
	Lime	1/month	12	1
	Grinding Balls and Liners	38/month	456	2
	Explosives	24/month	288	2
	Concentrate	2/day	730	2
40-foot Trailer	Food	2/week	104	2
20,000L Tanker	Diesel	82/month	984	3
50-person Bus	Personnel	2/week	104	2
Passenger Vehicles	People, vendors, suppliers, expeditors	10/day	3,650	10
20 tonne Tractor Trailer	Maintenance and Warehouse Supplies	6/week	312	2
Total			**6,724**	**27**

Source: Appendix 3.0-J
Note: One trip includes inbound and outbound traffic

The arrival and departure of mine-related traffic is expected to occur within the eight-hour working day with peaks in the morning and evening. The 2011 Traffic Impact Analysis (Appendix 3.0-J) predicts that there may be a platooning effect, whereby mine-related personnel and material vehicles leave Terrace (or Smithers) in the morning and depart from the mine site during the same interval in the evening, combining with existing peak traffic at 16:00.

3.10 Reclamation and Closure

This section presents the reclamation and closure activities for all the components of the proposed Project. A complete Closure and Reclamation Plan is presented in Appendix 3.0-K. Mine decommissioning and reclamation activities will be carried out following the completion of production and in accordance with the *BC Mines Act*, the BC "Health, Safety and Reclamation Code for Mines in British Columbia" (BC MEMPR 2003), and the "Environmental Code of Practice for Metal Mines" (Environment Canada (EC) 2009).

The end land use objectives are described in Section 3.10.1, soil management objectives in Section 3.10.2 and a summary of the proposed reclamation activities for each component in Section 3.10.3. Progressive reclamation is discussed in Section 3.10.4. Section 3.10.5 and 3.10.6 present the plan for shutdowns and premature closure, and for post-closure maintenance and monitoring. Section 3.10.7 contains information about water treatment.

Sections 3.10.8 and 3.10.9 includes a discussion on financial assurance and estimated decommissioning, closure, and post-closure costs.

3.10.1 End Land Use Objectives

The objective of the decommissioning activities would be to leave the property in a condition that will mitigate potential environmental impacts and restore the land to an agreed-upon land use and capability. Due to the naturally rugged and steep terrain, as well as the disturbances from previous mining activities, limited sources of good-quality soil reclamation material is available; therefore, the degree of new disturbance for the proposed Project has been minimised as much as possible. Closure and reclamation activities will be carried out concurrently with mine operations wherever possible, and final closure and reclamation measures will be implemented at the time of mine closure.

The end land use and capability objectives are based on available pre-development site conditions. The reclamation approach for the proposed Project includes techniques to facilitate the establishment of self-sustaining vegetation communities to foster the return to functional ecosystems. One of the primary objectives of the reclamation program is to re-establish a productive land use that is of value to wildlife, and mitigates the potential effects of the Project on wildlife, wildlife habitat, and the habitat of species at risk.

3.10.2 Soils Management

The final reclamation plan will be based on the pre-mining land capability, baseline soil metal levels, and end-land use objectives, and will include strategies such as soil salvage, stockpiling, and replacement, progressive reclamation, and interim and final erosion control.

Baseline conditions for the soil, terrain, and surficial geology at the site was compiled from field sampling programs conducted by Rescan Environmental Services Ltd. (Rescan) (Rescan 2010) and AMEC (Appendix 6.9-A) in 2009 and 2010. Based on the terrain and surficial geology information collected and mapped within the 2009 Local Study Area (LSA), a soil map was developed by assigning soil attributes to each parent material. This combination of multiple soil attributes within a single terrain polygon is termed a soil map unit (SMU). The map units were developed based on the type and interpreted thickness of the parent material. Each SMU identified within the LSA was assigned average soil depths and rated for their potential to contain suitable volumes of material that could be used as reclamation material.

The suitability of soils for reclamation purposes was derived by application of the criteria recommended in 1996 by the former BC Ministry of Mines. The reclamation suitability criteria requires consideration of several soil chemical properties (pH, electrical conductivity, and sodicity and saturation percentage) and physical properties (texture, moist consistency, and volumetric stone content). SMUs were rated as Good, Fair, Poor, Unsuitable, or Organic for the upper-lift components of their profiles. For each mineral SMU, a dominant and subdominant rating was applied based on the distribution of great groups within the unit. In all cases, a range of reclamation suitability was noted with the dominant reclamation suitability rating presented first. For organic SMUs, reclamation suitability ratings were not determined and an Organic rating was used to designate these soils.

Based on the historical reclamation completed on the site to date and the soil survey by AMEC, the upper lifts of the mineral soils are expected to be well suited for reclamation material. The organic soils are considered to be suitable for use as an amendment in topsoil replacement during reclamation when mixed with mineral materials. Therefore, during the construction phase of the proposed Project, all of the material stripped from below the TMF embankments would be stored for use during the closure and decommissioning phase. Furthermore, the existing mineral soils used to cap the pit floor in 2006 and an unused borrow source of mineral soil identified by CESA in 2006 would also be excavated and stockpiled for use during reclamation.

In addition, the soil stripped during construction of a number of linear features such as access roads and diversion ditches would be placed in windrows on the site. For diversion ditches the soil excavated for the ditch typically becomes the down-side berm or flattened for an access road. Road construction should have the soil stripped and windrowed along the roadsides. The rationale for not having any of the material removed from site is because at mine closure the original material is replaced and the site is returned as close as possible to the original topography and the pre-mine conditions.

Facilities such as the Kitsault Process Plant, camp, primary crusher, water management ponds, fuel storage, and explosive storage sites would also be developed by windrowing the excavated material. This could result in significant areas which would not have to go through post-closure ecosystem adjustment.

Within the proposed Project footprint, it is estimated that approximately 930,000 m^3 of salvageable reclamation material would be available as shown on Table 3.10-1. It is estimated that based on the average replacement depth, there would be a surplus of suitable reclamation material of approximately 35,000 m^3.

The anticipated volume of salvageable material that would be stockpiled for reclamation purposes is in the order of 540,000 m^3. Most of this material would be placed on the re-sloped waste rock dump, the tailings beaches and the downstream slope Northeast Embankment. Consequently, given the proximity of these facilities, it is likely that more than one stockpile would be developed.

A number of potential stockpile sites for reclamation material have been identified. Stockpiles would be constructed at a maximum side slope gradient of 2:1 (H:V) and seeded with a BC Ministry of Forests, Lands and Natural Resource Operations (BC MFLNRO) approved mix to reduce erosion during the operations phase of the proposed Project. The proposed stockpile locations have been located outside of operational areas to ensure no operational disturbance and will have clear signage to prevent accidental disturbance throughout the proposed Project's life span.

Hydrocarbon-contaminated soils will be excavated and treated on-site in a land farm; once successfully treated, these soils will be used as a growth medium for reclamation. Following the removal of on-site and off-site facilities and any associated contamination, the disturbed areas will be re-graded, capped with topsoil where needed, and fertilised and seeded with native species. The site landfill will be closed using Best Management Practices (BMPs). Table 3.10-1 presents the conceptual reclamation mass balance for the proposed Project.

3.10.3 Description of the Reclamation Activities for Each Mine Component

3.10.3.1 Kitsault Pit

At the end of mine life, the Kitsault Pit would be allowed to fill with water from the SSCP, groundwater inflows, and natural precipitation in the pit area. The south TMF diversion channel, the south diversion ditch (above the pit), and the in-pit diversion channel would be maintained until the pit has filled with water to the low point of the pit rim, estimated to be at 515 masl. During the pit filling period, excess water from the TMF will be directed through a spillway located in the north abutment of the South Embankment towards the Water Box, ultimately circumventing the Kitsualt Pit and into Lime Creek. Once the pit is full and begins to spill to Lime Creek, the south TMF diversion channel upstream of the TMF will be decommissioned, allowing the diverted catchment to once again flow into the TMF. The portion of the south TMF diversion channel that is immediately upstream of the WRMF will be maintained to continue to divert flows around this waste rock and into the Kitsault Pit. Furthermore, the south diversion ditch (above the pit), as well as the in-pit diversion channel, will be decommissioned, allowing flows to enter the Kitsault Pit. The Kitsault Pit is expected to fill to the spill point in the order of 15 years upon the commencement of pit filling.

No reclamation material would be placed within the open pit closure landform. Those slopes above the final water level would remain as exposed bedrock. Any narrow benches (along the pit walls) would be allowed to re-vegetate naturally with no additional reclamation activities. Although the pit walls and area around the pond has minimal wildlife habitat value, over time weathering of pit walls and natural re-vegetation could produce features such as nesting spots for cliff nesting raptors.

3.10.3.2 Access and Haul Roads

Some on-site roads will be maintained for ongoing site maintenance and monitoring. Non-essential mine site roads will be reclaimed. All surfaces will be re-graded and scarified to encourage vegetation growth. Existing FSRs will not be decommissioned.

Table 3.10-1: Conceptual Reclamation Mass Balance for the Proposed Project

Facility	Facility Area (m^2)	Amount of Salvageable Mineral Soil ** (m^3)	Amount of Salvageable Organic Soil (m^3)	Total Amount of Salvageable Reclamation Material (m^3)	Average Replacement Depth (cm)	Reclamation Material Volume Required (m^3)	Surplus / Shortfall (m^3)
Open Pit (New Development)	1,178,899	127,064	5,257	132,321	0	0	132,321
Open Pit (2006 Pit Remediation)	0	92,000	0	92,000	0	0	92,000
TMF North Embankment	374,668	7,323	235,254	242,577	20	74,934	167,643
TMF North Beach	855,620	0	0	0	20	171,124	-171,124
TMF South Beach	536,555	0	0	0	20	107,311	-107,311
WRMF and South TMF Crest	930,911	58,361	12,675	71,036	20	186,182	-115,146
Low Grade Ore Stockpile	340,721	20,285	86,894	107,179	windrowed*	107,179	0
Processing Plant / Camp	221,280	1,222	99,356	100,578	windrowed*	100,578	0
Truck Shop, Warehouse, Fuel	15,000	40,000	0	40,000	20	3,000	37,000
Primary Crusher	66,912	292	0	292	windrowed*	292	0
Main Access	106,096	1,849	43,142	44,991	windrowed*	44,991	0
Site Access	123,125	1,682	10,054	11,736	windrowed*	11,736	0
Diversion Channels	51,989	1,731	14,900	16,631	windrowed*	16,631	0
Water Management Ponds	31,642	0	22,189	22,189	windrowed*	22,189	0
Associated Mine Facilities	217,005	10,111	37,845	47,956	windrowed*	47,956	0
Total	**5,050,423**	**361,920**	**567,566**	**929,486**		**894,103**	**35,383**

Note: * windrowed on site during construction
** incl material on existing pit floor and borrow area identified by CE Jones in 2006
m^2 - metres squared; m^3 - cubic metre; TMF - Tailings Management Facility

3.10.3.3 WRMF and Low Grade Ore Stockpile

An estimated 175 Mt of waste rock would be generated over the life of the mine. Of this, 40 Mt would be used to build the South Embankment. The remaining 135 Mt would be placed in the WRMF, located adjacent to and abutting the South Embankment. On decommissioning of the mine, the downstream slope of the WRMF would be re-sloped to approximately 2:1 (H:V). Based on the reclamation activities previously undertaken at the site, it is anticipated that the process of re-sloping the WRMF would provide satisfactory growth medium for site reclamation. However, to provide an improved growth medium for re-vegetation, a 20-centimetre (cm)-thick cap of reclamation material would be placed over the re-sloped waste rock.

Although the LGS would be a new landform throughout the operations phase of the proposed Project, once active mining from the pit has ceased, the material stored in this location would be processed with the resulting tailings placed in the TMF. Reclamation of this area would consist of the replacement of the soil material that was salvaged and windrowed prior to construction of the stockpile.

Following the re-sloping and the cap placement in the WRMF, the cover would be hydroseeded and fertilised, including the addition of mulch and tackifier. In addition, the native deciduous tree and shrub cover plus seedlings of lodgepole pine (Pl) would be planted in the upper and middle section of the slope and mountain hemlock (MH) and yellow cedar in the lower slope section.

3.10.3.4 Tailings Management Facility

Closure of the TMF would involve maintaining an open water body or lake over a portion of the tailing sand beaches in perpetuity. The TMF water elevation would be regulated and is expected to fluctuate naturally throughout the year. Areas of the south and north beaches not covered by water would be reclaimed to a stable upland. At closure, reclamation material would be placed over the non-inundated tailings beaches (north and south) and the downstream slope of the Northeast Embankment. The reclamation material would be 20 cm thick.

The north and south beaches would be fertilised in accordance with soil requirements and seeded with the annual ground cover. The preferred seeding technique would be either drill or broadcast seeding. The next step involves planting the native deciduous tree and shrub seedlings and Pl either from cuttings or nursery grown species. Leaf litter and coarse woody debris (including stumps and root systems) would also be applied. These areas would be re-vegetated in accordance with the specifications to meet end land use objectives, erosion prevention, and invasive plant control.

Tailings pipelines will be removed and disposed of in the Kitsault Pit and the pipeline routes will be re-vegetated.

3.10.3.5 Processing Facilities

Processing facilities will be demolished at closure. Salvageable items and materials will be removed from the site and sold. Most of the non-hazardous, inert building materials with no salvage value will be disposed of in an on-site landfill or placed in the bottom of the Kitsault Pit (e.g., concrete footings will be broken up and disposed of in the Kitsault Pit). Hazardous wastes will be removed from the site and delivered to an approved facility.

3.10.3.6 Water Management

During operations, rip-rap-lined spillways would be constructed at the north abutment of the south TMF embankment and at the north abutment of the Northeast Embankment (emergency). At closure, the northeast spillway in the Northeast Embankment would be removed. The spillway in the South Embankment would be retained and the invert elevation of the spillway in the South Embankment would be established to minimise the water that would be retained post-closure.

During the life of the mine, surface water diversions would control runoff into the TMF and the Kitsault Pit. Excess flow from the TMF would be pumped over the south spillway and through the in-pit channel to Lime Creek. Once the mine ceases operation, all surface diversions would be breached and the TMF and the pit would be allowed to flood

The areas around the surface diversion would be re-graded to restore positive drainage. Typically for diversion ditches, the soil excavated for the ditch becomes the down-side berm or flattened for an access road. This material would be used to reclaim the ditches at closure. In many locations along the drainage channels, natural recovery is expected through vegetation encroachment. These sites would be seeded with an annual grass seed mix to provide a temporary vegetation cover for erosion and invasive plant control until a tree / shrub cover becomes established.

3.10.3.7 Infrastructure and Ancillary Facilities

Infrastructure and ancillary facilities will be dismantled and removed, or demolished. The area will then be re-graded, covered with reclamation material, and re-vegetated. Salvageable items and materials will be removed from the site and sold. Most of the non-hazardous, inert building materials with no salvage value will be disposed of in an on-site landfill or placed in the bottom of the Kitsault Pit (e.g., concrete footings will be broken up and disposed of in the Kitsault Pit). Hazardous wastes will be removed from site and delivered to an approved facility.

Once the mine facilities have been removed, the ground scarified and decompacted, covered with reclamation material, then it would be fertilised in accordance with soil requirements and seeded with the ground cover crop. The preferred seeding technique will be either drill seeding or broadcast seeding. The next step involves planting the native shrub and tree seedlings either from cuttings or nursery grown.

3.10.3.8 Pipelines

All above-grade tailings and reclaim water pipelines would be removed from the site and disposed of within the Kitsault Pit. The below-grade 75-mm-diameter freshwater supply line would not be removed from the site. The pipeline right-of-ways (ROWs) would be re-graded to blend into the surrounding topography. The surface of the ROW would be scarified and de-compacted prior to reclamation material placement. Reclamation material salvaged prior to site development and placed in windrows would be replaced directly on the re-contoured surface. The locations would be re-vegetated.

Once the tailings and reclaim water pipelines have been removed, the ground scarified and decompacted, and covered with reclamation material, then it would be fertilised in accordance with soil requirements and seeded with the ground cover crop.

3.10.3.9 Conveyor System

The conveyor system would be constructed through a cut-and-fill process utilising both soil fill and rock cut. At closure, the conveyor system would be dismantled, salvaged, and removed from the site. The entire length of the conveyor system area would be re-contoured to blend in with the surrounding topography. The surface would be scarified and de-compacted prior to reclamation material placement. Reclamation material, salvaged prior to site development, would be replaced directly on the re-contoured surface.

The area will be fertilised in accordance with soil requirements and seeded with the ground cover.

3.10.3.10 Borrow Areas

Borrow sites would be reclaimed at closure or through a progressive reclamation approach. Borrow reclamation would involve re-contouring the site to establish drainage patterns and topography consistent with the surrounding landscape. Reclamation material, salvaged prior to site development and windrowed, would be replaced directly on re-contoured area.

Once the borrow areas have been covered with reclamation material, fertiliser would be applied in accordance with soil requirements and seeded with the ground cover crop. The preferred seeding technique would be either drill seeding or broadcast seeding. The next step would involve planting the native shrub and tree seedlings either from cuttings or nursery grown.

3.10.4 Progressive Reclamation

Reclamation material excavated during the construction and operations phases would be stockpiled or placed in windrows for use in reclamation during the closure period. Although there would be limited opportunities for early progressive reclamation such as re-sloping of the waste rock dump or the placement of soil caps or covers, the TMF and the WRMF have been designed to ensure long-term geotechnical stability. The more reactive tailings would be fully submerged with the impoundment and the WRMF would be built with an overall slope of 2:1 so as to facilitate re-sloping at closure without the need to extend the toe or expanding the footprint.

As discussed in the ML/ARD Monitoring and Management Plan (Section 3.4.4), tailings geochemistry would be evaluated during mining operations to ensure that any potentially reactive material is segregated and stored underwater.

The majority of the waste rock from the proposed mine would have NP:AP ratios less than 2, and half of that will have a ratio of less than 1. There is no clear sulphur cut-off below which the ARD classification would clearly be non-PAG and there is also no particular rock type that is consistently non-PAG. Therefore, waste segregation for the management of PAG rock is not proposed and all waste would be placed within the one facility from which water management is considered relatively simple and secure

3.10.5 Shutdown and Premature Closure

For shutdowns of less than one year, facilities would be secured and maintained in a condition such that they could be restarted. For shutdowns of greater than one year, facilities will be secured and maintained such that they could be restarted after a short preparation period.

Premature closure involves permanent closure of the mine before completion of the mining outlined in this Application. The closure plan outlined above would be implemented with the exception that the LGS would be hauled to the pit and submerged.

3.10.6 Post-Closure Maintenance and Monitoring

3.10.6.1 Post-Closure Period

Production would be considered complete when the mine has ceased to use and / or is unlikely to use the plant, and the proponent has decided that mine decommissioning should start. Based on the current life-of-mine plan, the date for completion of production is 31 December 2029. The post-closure period will begin thereafter and will continue over the long-term. The major post-closure activities will be:

- Inspection and maintenance of geotechnical structures;
- Reclamation monitoring;
- Water quality and aquatic environmental effects monitoring;
- Water treatment, if needed at some point in the future; and
- Final closure of access and power corridors, when site access is no longer necessary.

3.10.6.2 Inspection and Maintenance of Geotechnical Structures

Annual inspections of the mine site would be completed for a number of years post-closure of the tailings dams, spillways, and waste rock dumps. The inspections would be completed by a two-person team of a technician and a geotechnical engineer or other qualified dam safety engineer. During the inspection, geotechnical structures will be inspected to identify conditions that could potentially adversely affect the long-term performance of structures during the post-closure period. Annual inspection reports will be prepared and submitted to BC MEMPR as required by the *Mines Act*.

Comprehensive dam safety reviews of the tailings impoundments will be completed every five years in accordance with the Canadian Dam Association Dam Safety Guidelines for dams deemed to have very high-consequence impacts associated with potential failure. The first of these reviews will be completed in Year 5 post-closure. Upon conclusion of the review, a Dam Safety Report that will be stamped by a duly qualified engineer licensed in BC will be prepared and submitted to BC MEMPR.

3.10.6.3 Post-Closure Re-Vegetation Monitoring Program

The main reason for re-vegetation monitoring is to ensure the re-vegetated areas are developing into self-sustaining communities that are compatible with the end land-use objectives of restoring wildlife habitat and providing associated recreational opportunities. The monitoring program will consist of an annual inspection of all re-vegetated areas.

The program will be conducted annually for the first 10 years after closure, then at five-year intervals until such as time as all re-vegetated areas can be deemed as having met the end land-use objective.

3.10.7 Water Treatment

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 PAG rock and ARD may need to be considered. This would 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 would be allowed to discharge directly into the newly formed Kitsault Pit lake. However modelling of post-closure water quality has indicated that the WRMF downstream of the Southeast Embankment could be a primary source of contamination and 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.

3.10.8 Financial Assurance and Closure Cost Estimate

3.10.8.1 Security

Financial security is required as a condition of all BC *Mines Act* permits. Security requirements are addressed at each stage of mining operations. The level of security will increase or decrease as outstanding liability and reclamation obligations change during mine operation. The security will be set at a level that will finance the following:

- Construction, inspection, monitoring, maintenance, and repair of drainage collection and ML/ARD mitigation structures;
- Operation of a drainage treatment plant and disposal of secondary wastes if required;
- Costs associated with conventional reclamation, including replacement of soil, recontouring, seeding, planting, and fertilizing;
- Regular evaluation of the receiving environment; and
- Site drainage and material monitoring, and ongoing research needs.

The level of detail required and the accuracy of closure cost estimates vary with the stage of mining and significance of closure issues. Potential impacts, general liabilities, and conceptual costs will be outlined in the EA Application, and more detailed costs will be provided with the *Mines Act* Permit Application. During the early phases of mining activities, some aspects of the reclamation plan will remain conceptual. As mining progresses, closure needs will become more accurately defined, plans will be refined and more accurate cost estimates would be prepared. Reclamation plans will be re-evaluated every five years or whenever significant changes occur to the mine plan. Detailed closure plans, including a thorough technical evaluation of potential environmental effects, would be prepared approximately two to three years prior to closure so that the necessary work can be carried out during the last years of mining. Liability estimates and closure schedules would be refined and updated prior to undertaking any new programs.

3.10.9 Closure Cost Estimate

“Completion of Production” is the time when the mine has ceased to use and / or is unlikely to use the plant, and the proponent has decided that mine decommissioning should start. Based on the current life-of-mine plan, the date for completion of production is 31 December 2029.

“Decommissioning and Reclamation” refers to the three-year period from 1 January 2030 to 31 December 2032, during which all demolition, breaching of surface diversions, long-term spillway construction, cover construction, and contaminated soil remediation would be completed.

“Post-Closure” refers to the period after 1 January 2033. Activities during this period will include inspection and maintenance of dams, surface water and groundwater monitoring, and water management.

The estimate of decommissioning and reclamation costs is provided in Table 3.10-2 and shows direct and indirect costs for each of the following components:

- Demolition and miscellaneous;
- Diversions and spillways;
- TMF and WRMF;
- Contaminated areas and borrow areas;
- Environmental Monitoring and Reporting; and
- Project management and environmental management.

Table 3.10-2: Decommissioning and Post-Closure Cost Estimate

	Direct Cost	Indirect Cost	Contingency	Total	NPV 2014	2030	2031	2032	2033	2034	2035	2036	2037 - 2040	2040	2041	2042 - 2044	2045	2046 - 2059	2079	2080
Decommissioning and Reclamation																				
Decommissioning and Miscellaneous	$6,170,405	$1,237,764	$1,234,081	$8,642,250	$5,245,760	$3,456,900	$2,592,675	$2,592,675												
TMF and WRMF Areas	$11,142,154	$2,235,081	$2,228,431	$15,605,666	$9,472,484	$6,242,266	$4,681,700	$4,681,700												
Diversions and Spillways	$158,226	$31,740	$31,645	$221,610	$134,515	$88,644	$66,483	$66,483												
Contaminated Areas	$822,775	$165,046	$164,555	$1,152,376	$699,481	$460,950	$345,713	$345,713												
Project Management	$374,400	$0	$0	$374,400	$227,257	$149,760	$112,320	$112,320												
Subtotal	***$18,667,959***	***$3,669,631***	***$3,658,712***	***$25,996,302***	***$15,779,498***	***$10,398,521***	***$7,798,890***	***$7,798,890***												
Environmental Monitoring and Reporting																				
Meteorology (operation and maintenance)					$13,294	$6,500	$6,500	$6,500												
Air Quality (analysis only)					$6,693	$9,600														
Surface Water Quality (analysis only)					$305,097	$72,000	$72,000	$72,000	$12,000	$12,000	$12,000	$12,000	$12,000	$12,000	$12,000	$12,000	$12,000	$12,000	$0	$12,000
Groundwater Quality (analysis only)					$33,891	$12,000	$12,000	$12,000	$3,000	$3,000	$3,000	$3,000	$3,000							
Vegetation and Metal Uptake (analysis only)					$78,103	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$0	$0	$10,000	$0		
Annual Inspections, Maintenance and Reporting (labour only)					$624,821	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$0	$0	$80,000	$0		
Water Treatment System Construction					$1,612,232	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$7,000,000	$0
Water Treatment System Operation					$6,218,608	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$895,000
Environmental Management (labour only)					$2,013,035	$213,200	$213,200	$213,200	$44,200	$44,200	$44,200	$44,200	$44,200	$44,200	$44,200	$44,200	$44,200	$44,200	$88,400	$88,400
Subtotal					***$10,905,774***	***$403,300***	***$393,700***	***$393,700***	***$149,200***	***$149,200***	***$149,200***	***$149,200***	***$149,200***	***$146,200***	***$56,200***	***$56,200***	***$146,200***	***$56,200***	***$7,088,400***	***$995,400***
Total					**$26,685,272**	**$10,801,821**	**$8,192,590**	**$8,192,590**	**$149,200**	**$149,200**	**$149,200**	**$149,200**	**$149,200**	**$146,200**	**$56,200**	**$56,200**	**$146,200**	**$56,200**	**$7,088,400**	**$995,400**

3.11 Schedule

This section describes the schedule for all phases of the proposed Project. The proposed Project schedule is an essential planning tool for success. The schedule will alert management to the need for timely corrective actions to ensure the proposed Project finishes on time.

The Proponent's management group is expected to issue a Notice to Proceed into the Construction phase once Project financing for procurement and construction has been finalised. The Notice to Proceed would occur prior to completion of the EA and permitting review process as financing is completed. The proponent completed a positive Feasibility Study in 2010 (Appendix 3.0-A) and will initiate basic engineering, detailed engineering, and long-lead procurement as financing is available.

Appendix 6.5-B provides details of the various phases of construction and the general timelines to complete each phase. A summary of the construction phases is also presented in Section 3.6.5 (Water Management Facilities).

The proposed Project execution schedule has been broken into three separate components:

- EA and permitting review and approvals (9 months);
- Construction (25 months); and
- Initial mill start-up to full production (3 months) (Table 3.11-1).

The nine-month EA and permitting review includes efficiencies of synchronous permitting and the Canadian Environmental Assessment Agency's (Agency) commitment to streamlining the review process. Authorisations under the federal *Fisheries Act* are not required until the later stages of phase three of construction. The 25-month construction period is divided into three phases that are outlined in Section 3.6.6 (Construction Schedule). The proponent has assumed a three-month period from initial mill operations to full operational capacity. Table 3.11-1 presents the proposed Project execution schedule for the EA and permitting review and construction periods.

Once in operation, the mine will operate 24 hours per day, seven days per week, 365 days per year. The majority of employees will work 12-hour shifts on a three-weeks-in / three-weeks-out schedule. This schedule has been developed to meet the needs of operations, as well as the needs of the employees' personal life and will result in each employee having six months off every year. The schedule could vary based on the needs of the local hires, but all schedules will follow the same ratio of time worked versus time off. This will require four crews, with two crews in camp at any time.

The mine life is estimated to be between 15 and 16 years. Decommissioning and closure activities, which include filling of the Kitsault Pit with water, will last 15 to 17 years depending on climatic conditions.

Table 3.11-1: Proposed Project Execution Schedule: Environmental Assessment and Permitting Review and Construction

	Execution Schedule by Month																																					
	Year 1												Year 2												Year 3												Year 4	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
EA Application (DRAFT)	■																																					
EA Application (Final)		★																																				
EA Review (BC)		■	■	■	■	■	■																															
EA Review (Canada)		■	■	■	■	■	■																															
Public Comment Period		■	■				■																															
BC Minister's Decision								★																														
Federal Minister Decision								★																														
Permit Applications		■	■	■	■	■	■	■	★																													
Initial Construction Permits																																						
Fisheries Authorization Applications		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																						
Phase 1 Construction									■	■	■	■	■	■																								
Phase 2 Construction															■	■	■	■	■	■																		
Phase 3 Construction																					■	■	■	■	■	■												
Phase 4 Construction																											■	■	■	■	■	■	■					
Start Up																																		■	■	■		
Full Production																																					★	

Note: BC - British Columbia; EA - Environmental Assessment

★ - completion milestone

■ - anticipated work program timeline

3.12 Human Resources Procedures and Procurement Policy

3.12.1 General

3.12.1.1 Labour Source and Training

The province of BC will be the source of both skilled and unskilled labour to the extent possible. However, given the shortage of skilled labour in the mining industry, the development of the proposed Project may require some labour from outside the region.

The best philosophy for a stable workforce is to make the hiring of local employees a priority for the long term. Given the desire for local hiring, training will be a key aspect of the proposed Project. The operations group will develop both on-site and off-site training programs to mitigate potential problems with an untrained workforce during start-up.

3.12.1.2 Health and Safety

The health and safety of people and the protection of the environment are imperative and integral to all aspects of the proposed Project execution. All safety policies and procedures will be rigorously observed. A site-specific Occupational Health and Safety (OH&S) Plan will be developed for the proposed Project. The plan will set the minimum requirements for the proposed Project, including the level and frequency of statistical reporting. The program will form part of the standard tender documents. All contractors will be requested to prepare their own site-specific programs, based on their corporate standards, which must meet or exceed the proposed Project OH&S Plan.

Construction safety will be managed and monitored by the construction management (CM) contractor’s qualified safety personnel throughout the construction program. Safety management and responsibility will transition to the owner’s safety team before the commissioning phase of the proposed Project.

3.12.1.3 Accommodations and Transport

Given the remote location of the proposed Project and the lack of nearby communities, the mine will construct a camp to house the employees while they are at work. The camp will be complete with living accommodations, cafeteria, exercise facilities, TV rooms, and lounge area.

Personnel on rotation will be transported to Terrace by a bus fleet, with provision made for intermediate pickups for those who live locally along the Terrace-to-Kitimat route. Private vehicle access to the mine site will be limited to personnel with issued visitor passes. Personnel based elsewhere (e.g., project managers in Vancouver) who need to attend meetings on-site will use the standard passenger flight service to Terrace, and from there they will be transported to site in a bus chartered by the proponent.

3.12.2 Management

The management team, which will likely include a General Manager, Controller, Mine Superintendent, Maintenance Superintendent, Mill Superintendent, Human Resources and Safety Superintendent, and Environmental Superintendent (or similar), will be in place early in the construction phase. The General Manager will have ultimate responsibility for all departments listed above.

The Mine Operations department, under the direction of the Mine Superintendent, will be responsible for operator training and Kitsault Pit operation. Activities include drilling, blasting, loading, and hauling of ore and waste, construction / maintenance of roads, pioneering work, and mine de-watering. The number of operators is based on the annual equipment requirements and the crew's schedule, ensuring that sufficient operators are available on each crew to operate the equipment.

The Engineering department, under the direction of the Chief Engineer, will provide daily, weekly, and monthly plans for operations personnel working on full rotation.

The Geology department, under the direction of the Chief Geologist, will be responsible for updating the resource model, calculating ore reserves, and overseeing grade control.

3.12.3 Workforce

3.12.3.1 Construction Personnel

A peak workforce ranging between 600 to 700 people is anticipated during the construction phase. Positions will include heavy equipment operators, mechanics, millwrights, electricians, control technicians, supervisory personnel, administrative personnel, service and maintenance specialists, labourers, and environmental compliance and health services specialists.

Key operations personnel will be recruited early in the Construction phase of the proposed Project. Early recruitment will be required to hire qualified workers for mining and operations and to establish various training programs. Some of these programs will be designed to attract the residents of local communities to enable them to develop the skills needed to participate in mine development and subsequent operations.

Staffing levels will progressively increase during the construction phase of the proposed Project. The department heads, along with the department trainers, will develop training programs and systems prior to filling the operating positions. Human resources personnel will institute recruitment and safety training programs early in the construction phase to ensure implementation as the employees are hired. Supervisory and technical positions will be filled as required, and operators will be hired and trained to fill production positions as the construction phase of the proposed Project transitions into the operations phase leading up to the Commissioning phase.

3.12.3.2 Operations Personnel

A peak workforce of approximately 350 people is anticipated during the operations phase. Positions will include plant operators, line superintendents, mine truck drivers, mine shovel operators, engineers and technical specialists, administration personnel, service and maintenance specialists, and environmental compliance and health services specialists.

The work schedule assumes that the mine will operate 24 hours per day, seven days per week, 365 days per year. Operations and mining personnel will work on two 12-hour shifts. All personnel assigned to the mine will work a three-weeks-in / three-weeks-out rotation. The rotation schedule will provide employees with approximately six months off each year. The schedule could vary based on the needs of the local hires, but all schedules will follow the same ratio of time worked versus time off. Technical support staff will work the day-shift only. All hourly labour and supervisory personnel will rotate between day and night shifts.

3.12.3.3 Maintenance Personnel

Maintenance crews will work the same shift schedule as mine operations crews. Each maintenance crew will be led by a maintenance shift foreman, who will report to a plant-wide Maintenance Superintendent. The number of maintenance personnel is based on the amount of equipment, according to an equipment-dependent ratio that specifies a range from 0.24 to 1.00 maintenance personnel hours per equipment operator hour.

3.12.3.4 First Aid Personnel

Medical personnel will be qualified to a minimum of Emergency Medical Technician Level 3, with communications links established to off-site medical expertise. Procedures and arrangements for emergency medical evacuations will be established prior to the start of construction. Each phase of the work will require individual procedures as the nature, location, and scope of the construction work changes. On-site emergency medical facilities will be provided during the construction phase, consisting of first-aid facilities equipped to comply with the “Health, Safety and Reclamation Code for Mines in British Columbia” (BC MEMPR 2008), and with WorkSafe BC standards, with specific provisions made for work at a remote site. The emergency medical staff and facilities will be capable of handling industrial construction incidents and will be equipped with an ambulance for medical evacuations and transport. The medical team will be supported by pre-arranged access to emergency air medi-vacs to the nearest suitable hospital if needed.

3.12.3.5 Mine Rescue Personnel

Mine rescue teams will be assembled and trained as appropriate, in accordance with requirements for mines in BC.

3.12.3.6 Security Personnel

Few security issues in terms of unauthorised access or removal of property are anticipated, considering the location of the site and access being limited to the Alice Arm access road or by water through the Kitsault Townsite. Contracted security staff will be present on-site during construction to monitor the camp and construction areas, as well as the proposed Project access points.

Security policies and procedures will be developed before the start of construction and will be included in all tender and purchase order packages, with a requirement that all personnel and contractors on-site comply with the site orientation program (environment, cultural awareness, security, etc.). Responsibility and operation of the security program will transition to the proponent's team before commissioning. The proponent's operational security programs will be in force during commissioning and will be incorporated into the commissioning procedures and planning.

3.12.3.7 Environmental Monitoring Personnel

Environmental monitoring will be performed by appropriately trained personnel. Environmental monitoring staff will be finalised as permitting requirements are developed.

3.12.3.8 Contractors

Project execution will be managed by a composite team, primarily consisting of contractor personnel reporting to the proposed Project management team, supplemented by selected operations personnel. The contracting strategy is based on the assumption that Project delivery will be under the direction and coordination of a CM contractor. During detailed design, a survey of contractor availability and willingness to contract under the assumed terms will be undertaken.

3.12.4 Procurement

Procurement for the proposed Project will consist of planning, purchasing, contracts execution, and materials management, which together form the overall procurement work for the Engineering Procurement and Construction Management (EPCM) phase of the proposed Project. A preliminary list of major and minor equipment, materials, and services, as well as contracting packages, has been developed to form the basis for the Feasibility Study (Appendix 3.0-A) and the EA Application. The detailed strategy and procurement plans will be finalised during basic engineering and permitting.

Procurement will be prioritised so that long-lead major equipment is selected and locked-in during basic engineering: vendor data are to be received in time to support basic and detailed engineering; and equipment and components are delivered in accordance with the requirements of the transportation plan and construction schedule, with the objective of minimising costs incurred for storage or deferred manufacturing.

3.13 Alternative Means of Carrying out the Project

3.13.1 Introduction

The following section describes the methods used to assess the alternative means of carrying out the proposed Project. It describes the methods used, performance objectives, and selection criteria, and provides an overview of the alternatives considered.

3.13.2 Methods

The alternatives presented in this section are based on the development of a series of performance objectives and evaluation criteria. Performance objectives are meaningful attributes that are essential for project success, and they provide a basis for distinguishing between alternatives. Each Project alternative is assessed by each performance objective according to three criteria:

- Preferred;
- Acceptable; and
- Unacceptable.

Using this approach, an alternative is rejected if it attains an Unacceptable rating for any single performance objective. Alternatives were presented to the Nisg̲a'a Nation, the general public, and members of the working group in meetings and open houses.

The alternative that receives the greatest number of Preferred ratings is not necessarily the best, or most preferred, overall alternative. The relative importance of the individual performance objectives needs to be considered as well. It may be that one or two performance objectives are more important and override all other objectives, so long as a minimum rating of acceptable is attained for the less important objectives. The final evaluation of alternatives is therefore a reasoned process, in which the basis for the final selection of alternatives is easily understood at all levels.

Alternatives were considered that satisfied the proponent's requirements for employee and community health and safety. All mining operations pose some unavoidable on-site safety risks, as do most industrial operations; however, the mining industry is the safest heavy industry in the province. The proponent is very conscious of this fact, and has placed a great emphasis on worker health and safety and training programs.

Health and safety risks are governed by engineering design, management systems, employee training, and by the availability of on-site and off-site emergency response and medical facilities. In addition, for alternatives to be acceptable, they must satisfy all of the proponent's corporate policies, which cover, in addition to health and safety, environment and community.

3.13.3 Project Performance Objectives and Selection Criteria

Performance objectives considered for the proposed Project, and the associated criteria for determining Preferred, Acceptable, and Unacceptable performance levels, are described below.

3.13.3.1 Adverse Effects on the Natural Environment

- Preferred – minimises adverse effects on the natural environment without mitigation;
- Acceptable – minimises adverse effects on the natural environment with mitigation; and
- Unacceptable – likely to cause significant or irreversible adverse effects on the natural environment that cannot reasonably be mitigated.

This performance objective follows BC Environmental Assessment Office (BC EAO) guidelines (BC EAO 2010).

3.13.3.2 Adverse Effects on the Social and Economic Environment

- Preferred – minimises negative effects on the social and economic environment without mitigation and provides positive benefits;
- Acceptable – minimises negative effects on the social and economic environment with mitigation; and
- Unacceptable – likely to cause significant negative social and economic effects that cannot be reasonably mitigated.

While undertakings such as the proposed Project will have clear economic benefits to the region, the potential for negative social and economic effects, such as infringement on land use of Nisga'a Nation or Aboriginal groups, is evaluated for the alternatives for the various aspects of the proposed Project.

3.13.3.3 Amenability to Reclamation

- Preferred – causes disturbance to the natural environment that requires limited reclamation;
- Acceptable – causes disturbance to the natural environment that requires moderate to extensive reclamation; and
- Unacceptable – mitigation of disturbance to the natural environment is not practical or feasible.

This performance objective relates to the decommissioning or reclamation of various aspects at eventual Project closure. The options were evaluated against reclamation regulations for BC and the end land-use objectives. The environmental planning for the proposed Project included ensuring that reclamation and closure planning was integral in the mine design. It is relevant to those aspects of the proposed Project that alter the landscape (e.g., roads and stockpiles) and / or require dismantling and either removal from the site or disposal on-site (e.g., buildings).

3.13.3.4 Cost-Effectiveness

- Preferred – facilitates a competitive return on investment;
- Acceptable – facilitates an acceptable return on investment; and
- Unacceptable – cannot be financially supported by the proposed Project.

Cost-effectiveness relates to overall Project costs, including capital, operating, maintenance, and closure / reclamation costs. Each aspect of the proposed Project has cost implications and thus cost-effectiveness is a performance objective common to all aspects.

3.13.3.5 Technical Applicability and / or System Integrity and Reliability

- Preferred – predictably effective with contingencies if the alternative does not perform as expected;
- Acceptable – appears effective based on modelling / theoretical results; contingencies are available if the alternative fails to perform as expected; and
- Unacceptable – effectiveness appears dubious or relies on unproven technologies.

Technical applicability and system integrity and reliability are used interchangeably, as appropriate to the issue, to describe the suitability or expected performance of a given alternative.

3.13.3.6 Ability to Service the Site Effectively

- Preferred – provides a guaranteed access / supply to the site with a very low risk of interruption;
- Acceptable – provides the required access / supply to the site with contingency method(s) of delivery available; and
- Unacceptable – cannot reliably provide sufficient access / supply, or involves an unacceptable level of risk without contingencies.

This performance objective is relevant for those aspects of the proposed Project dealing with the provision of consumables or access to the proposed Project site. The reliable (guaranteed) supply of many consumables, such as fuel, is critical to the uninterrupted operation of the mine. In the same way, the ability of a site access alternative to service the site effectively is very important.

3.13.4 Alternatives Considered

The following sections discuss the alternatives considered. At a higher level, they provide an overall examination of whether to proceed with the proposed Project, delay it, or abandon it. At a lower level, the alternatives examined include looking at various alternatives associated with ensuring that specific components of the proposed Project are developed in the most environmentally sound manner, the most economical, the one that will be most amenable to reclamation, and where applicable, the one that has the least effect on the social and economic environment and its technical applicability and / or system integrity and reliability. The alternative components of the proposed Project that were considered are:

- On-site infrastructure – processing plant, accommodations complex, explosives storage, and manufacture;
- WRMF;
- TMF;
- Water management;
- Transportation of construction materials;
- Transportation of concentrate; and
- Decommissioning, closure, and reclamation.

3.13.5 Alternatives to the Kitsault Molybdenum Project

Unlike other types of projects for which a number of project alternatives might be available, such as the development of transportation systems, mines are unique because ore bodies have a fixed location, and the only way to proceed with a mining venture is to mine the ore body in place. Consequently, the only project alternatives for the proposed Project are to:

- Proceed with the proposed Project in the near term, as planned;
- Delay the proposed Project until circumstances are more favourable; and
- Abandon the proposed Project.

With some mining operations, consideration may also be given to mining the ore body on-site and transporting the ore to another location for processing. This is not a viable alternative for the proposed Project because of the relatively low grade of the deposit, weight and bulk of ROM ore, and the distance to the nearest milling operation that could conceivably handle molybdenum ore (Endako). As a result, this alternative was not considered.

This section focuses on the consideration of proceeding with the proposed Project. Later sections deal with specific parts of the proposed Project.

3.13.6 Performance Objectives and Evaluation

Of the six performance objectives and evaluation criteria outlined in Section 3.13.3, four are applicable to the assessment of the three project alternatives as follows:

- Cost-effectiveness;
- Minimises effects on the natural environment;

- Minimises effects on the social and economic environment; and
- Amenability to reclamation.

3.13.6.1 Performance Objective: Cost-Effectiveness

The proposed Project will employ up to 700 people during peak Construction and will create up to 300 permanent positions during operations. Economic parameters for the proposed Project were presented in Section 2.7. In terms of cost effectiveness, proceeding with the proposed Project in the near-term as planned would provide a competitive return on investment and is the preferred alternative. Delaying the proposed Project until circumstances become more favourable would be an acceptable alternative.

Future conditions are difficult to predict. Mining is a capital intensive industry and short-term metal prices are critical to recover capital investments during the “pay-back” period. Once built, mines can operate very efficiently through normal business cycles.

Metal prices are currently relatively high, and inflation is low. The mine operated for short periods twice in the past and was shut down due to low metal prices. There can be no assurance that future economic conditions would equally, or more strongly support, a decision to proceed with mine development than currently exists.

Similarly, the size of the proposed Project (i.e., ore reserve and mill throughput) has been optimised for economic return. As with other relatively low grade deposits, project economics are sensitive to the size of the proposed Project. Reducing the size affects economic return and would render the proposed Project more vulnerable to metal price downturns. Moreover, the basic elements of design for environmental protection and worker and community health and safety do not change significantly for the proposed Project with changes in the mine size. Therefore, variations in mine size were not evaluated as an alternative to the proposed Project.

3.13.6.2 Performance Objective: Minimise Effects on the Natural Environment

The potential for adverse effects from Project-related activities can be controlled through design and operation technologies and through application of BMPs and Adaptive Management Practices (AMPs). BMPs include: spring erosion and drainage control; dust suppression and air emission controls; environmental monitoring programs, including long-term surface water and groundwater monitoring, and progressive reclamation; and regular inspections and audits. AMP involve changing management as indicated from monitoring to address any performance issues.

The proposed Project may cause adverse environmental effects that can be mitigated during construction, operation, closure and post-closure. Abandoning the proposed Project will limit adverse environmental effects to those that have occurred to date as a result of past mining and present exploration.

3.13.6.3 Performance Objective – Minimise Effects on the Social and Economic Environment

Local worker availability is much better today than in the 1980s when the mine last operated. While the forestry industry has benefited from some resurgence, it is still well below peak employment rates. The proponent received extensive enquiries regarding employment opportunities during the pre-Application consultation period for the proposed Project. The proponent expects that sufficiently large numbers of workers can be found locally and regionally for the proposed Project.

The positive social and economic effects from developing the proposed Project as planned are anticipated to outweigh adverse social and economic effects that may occur, and that will be mitigated through various means including training, counselling, and capacity building. The proposed Project could represent a critical employment opportunity for local community residents who have lost their jobs in the forestry industry because of the effects of the mountain pine beetle and low lumber prices. The option of proceeding as planned is therefore preferred. The alternative of delaying the proposed Project until circumstances are more favourable would be acceptable; however, the positive effects may not be as large as those anticipated under the planned project schedule.

3.13.6.4 Performance Objective: Amenability to Reclamation

The largest potential single impact of proposed Project development will be the permanent loss of Patsy Lake, the upper reaches of Patsy Creek, and the upper reaches of the inlet to Lake 901. On closure, a pond and wetland will be created from the TMF, which will be located on Patsy Lake, thus restoring much of the functionality of the current lake. On closure, the Patsy Creek drainage will be restored to the extent practical. The fish habitat lost in the inlet to Lake 901 will be compensated through a habitat compensation plan negotiated with Fisheries and Oceans Canada (DFO) with input from the BC Ministry of Environment (BC MOE) and the Nisga̱'a Nation. Through habitat compensation, more fish habitat will be created than is lost.

Land disturbance that will result from the development of the proposed Project cannot be completely avoided, but is acceptable, keeping in mind the mine will be located at the former mine site, which was extensively disturbed in the 1960s and 1980s. While the current ecosystem function of some land units will change, ecosystem function will be completely lost for only a small proportion of the mine site, given the design for closure and proposed reclamation. Disturbance will be minimised to the extent practical by the proactive project design proposed, including designing a compact site arrangement and conducting progressive reclamation activities and processes.

The alternative of abandoning the proposed Project would limit the amount of reclamation required to that associated with former mining and covered under the existing *Mines Act* permit (and is preferred).

3.13.6.5 Summary Evaluation

Table 3.13-1 summarises evaluations for the four performance objectives.

Table 3.13-1: Performance Evaluation – Project Alternatives

Performance Objective	Alternatives		
	Proceed with the Proposed Project in the Near Term as Planned	**Delay the Proposed Project Until Circumstances are More Favourable**	**Abandon the Proposed Project**
Cost-effectiveness	Provides a competitive return on investment.	Provides an acceptable return on investment.	Does not meet proposed Project goal of achieving a competitive return on investment.
	Rating: Preferred	**Rating: Acceptable**	**Rating: Unacceptable**
Minimise effects on the natural environment	Effects on the natural environment are minimised through mitigation.	Effects on the natural environment are minimised through mitigation.	Minimises effects on the natural environment without mitigation at closure (except current commitments).
	Rating: Acceptable	**Rating: Acceptable**	**Rating: Preferred**
Minimise effects on the social and economic environment	Minimal adverse effects on the social and economic environment with mitigation; provides significant positive opportunities.	Minimal adverse effects on the social and economic environment without mitigation; provides delayed positive opportunities.	Minimal adverse effects on the social and economic environment without mitigation; but positive opportunities are restricted to those received to date.
	Rating: Preferred	**Rating: Acceptable**	**Rating: Acceptable**
Amenability to reclamation	Will result in land and water disturbance requiring mitigation during operation and at closure.	Will result in land and water disturbance requiring mitigation during operation and at closure.	Will result in limited land and water disturbance requiring mitigation.
	Rating: Acceptable	**Rating: Acceptable**	**Rating: Preferred**
Summary evaluation	**Rating: Preferred**	**Rating: Acceptable**	**Rating: Unacceptable**

Abandoning the proposed Project would not fulfill the Project purpose and provide a competitive return on investment; employment wages, tax, and royalty revenues would be foregone, and business opportunities for communities and BC in general would not occur. Project abandonment is considered an unacceptable alternative. The proponent recognises that for the proposed Project to proceed, all applicable permits, approvals, and authorisations would have to be obtained from the relevant regulatory authorities, in consultation with the Nisga'a Nation and affected Aboriginal groups and communities.

Delaying the proposed Project cannot be ruled out, depending on circumstances related to future project economics, further project investigations, and permitting processes.

Proceeding with the proposed Project in the near term as planned is the preferred alternative, being rated as preferred in two categories and acceptable in the remaining two categories. Delaying the proposed Project is acceptable in all categories but poses a risk because there cannot be any certainty that the proposed Project will proceed in the medium-term future; abandoning the proposed Project does not meet the goal of the proposed Project and is rejected because it attained an unacceptable rating. An unacceptable rating for any performance objective requires rejection of the alternative.

Taking the above perspectives into consideration, the objective of the proponent is to proceed with the permitting and development of the proposed Project in a timely manner, as described in this Project Description.

3.13.7 Site Facilities Alternatives

3.13.7.1 Plant Site

The location of the plant site was dependent on the preferred choices for the TMF (see Section 3.13.8). Two plant site alternatives were assessed (Figure 3.13-1).

The plant site selection was dictated partly by the vertical and horizontal alignment of the overland conveyor from the primary crusher to the COS, but also by the ground conditions and the topography. In addition, plant Site B was large enough to accommodate most of the site facilities, including the construction and permanent camps, change-rooms and administration building, warehouse, laydown area, utilities, and services. This ability to centralise the facilities will reduce the need for ongoing operational coordination and costs.

The average plant site elevation is 920 m. The mill itself has been sited on the eastern flank of an existing knoll with a peak elevation of 935 m and average high elevation of 930 m. Platform grading of the process circuit layout will allow for gravity flow through the process plant and then to the TMF to the southeast.

3.13.7.1.1 Cost Effectiveness

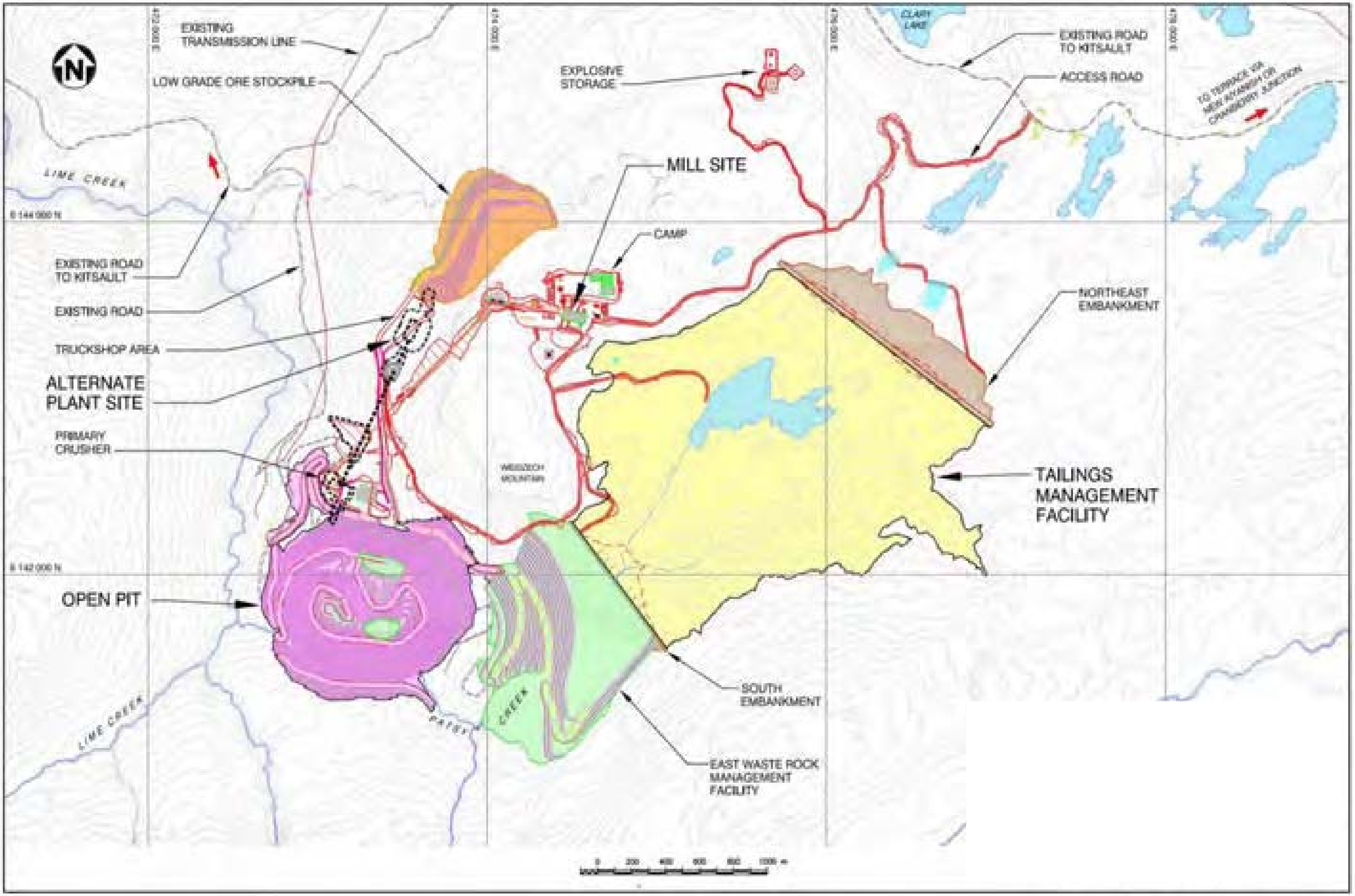
Site B is more cost effective due to consolidation of most of the required mine infrastructure in one location, and is preferred.

3.13.7.1.2 Adverse Effects on the Natural Environment

Site B will result in less overall disturbance. As well, Site B will drain to the TMF, simplifying contact water management.

3.13.7.1.3 Social and Economic Effects

There would be no difference in social and economic effects from selection of either plant site. There are no differential health issues with respect to either site; consolidation at Site B may possibly reduce vehicle use but the reduction in total emissions from the mine site is unlikely to be significant. Employment numbers will not differ with either site selection.



CLIENT: AVANTI MINING INC — Avanti Kitsault Mine Ltd.	ANALYST: MY	PROJECT: Kitsault Mine Project		REV. NO.: A
	QA: TT			DATE: November 2011
AMEC Earth & Environmental 4445 Lougheed Highway, Burnaby, B.C., V5C 0E4 Tel. 604-294-3811 Fax 604-294-4664	DATUM: Undefined	TITLE: Alternative Kitsault Plant Sites		PROJECT NO: VE51899
	PROJECTION: Undefined			FIGURE No. 3.13-1
	SCALE: Not to Scale			

Y:\GIS\Projects\VE\VE51988_Kitsault\Mapping\Other\AI\Other-50-022.ai

3.13.7.1.4 Amenability to Reclamation

Site B is more compact than Site A, but since both are on formerly disturbed sites, there is no difference between the two with respect to amenability to reclamation as the entire site will need to be reclaimed on closure. Neither site would be located where significant progressive reclamation is possible. Table 3.13-2 summarises the alternatives evaluation.

Table 3.13-2: Performance Evaluation – Plant Site Location

Performance Objective	Alternatives	
	Site A	**Site B**
Cost-effectiveness	Operations cost greater due to separation from other facilities.	Operations cost less due to consolidation of infrastructure.
	Rating: Acceptable	**Rating: Preferred**
Minimise effects on the natural environment	Effects on the natural environment are minimised through mitigation.	Effects on the natural environment are minimised through mitigation. Environmental control simplified.
	Rating: Acceptable	**Rating: Preferred**
Minimise effects on the social and economic environment	No significant social and economic effects.	No significant social and economic effects.
	Rating: Acceptable	**Rating: Acceptable**
Amenability to reclamation	Construction on pre-disturbed area requiring mitigation during operation and at closure.	Construction on pre-disturbed area requiring mitigation during operation and at closure.
	Rating: Acceptable	**Rating: Acceptable**
Summary evaluation	**Rating: Acceptable**	**Rating: Preferred**

3.13.7.2 Other Facility Layout Considerations

Other facility layout considerations are as follows:

- Site selection for the truckshop / warehouse and fuel storage compound considered topography, suitability of ground conditions, and convenience for the mining trucks to pull in for service or refuelling. It also keeps most of the noise below and away from the camps and mill site. The truck shop was originally located in an area covered by 11 m of waste rock overlying topsoil, organics, soft, fine-grained soil deposits, and competent bedrock. The truckshop building site was therefore shifted southward onto natural (original) ground, permitting the topsoil and organics to be excavated and the foundation to be placed on bedrock;
- The explosives plant will be located up a side road from the mine access road, approximately 500 m to the northeast of the TMF. In addition to elevation and topography, the facility layout considers a 500 m flyrock clearance limit beyond the ultimate pit limit, in accordance with BC MEMPR recommendations. With the

exception of the primary crusher, the plant site, including the truckshop and fuel storage compound, falls outside this limit; and

- The primary crusher will be installed as close as possible to the rim of the Kitsault Pit. The crushed ore will be conveyed at an angle of 14° over a horizontal length of approximately 1,380 m to the COS west of the plant site. A semi-mobile crusher was chosen to permit relocation within the pit as mining progresses. Due account was taken of the predominant wind directions (east-northeast and west-southwest). Table 3.13.-3 summarises the alternatives evaluation. All ratings are acceptable.

Table 3.13-3: Performance Evaluation – Other Facilities' Layouts

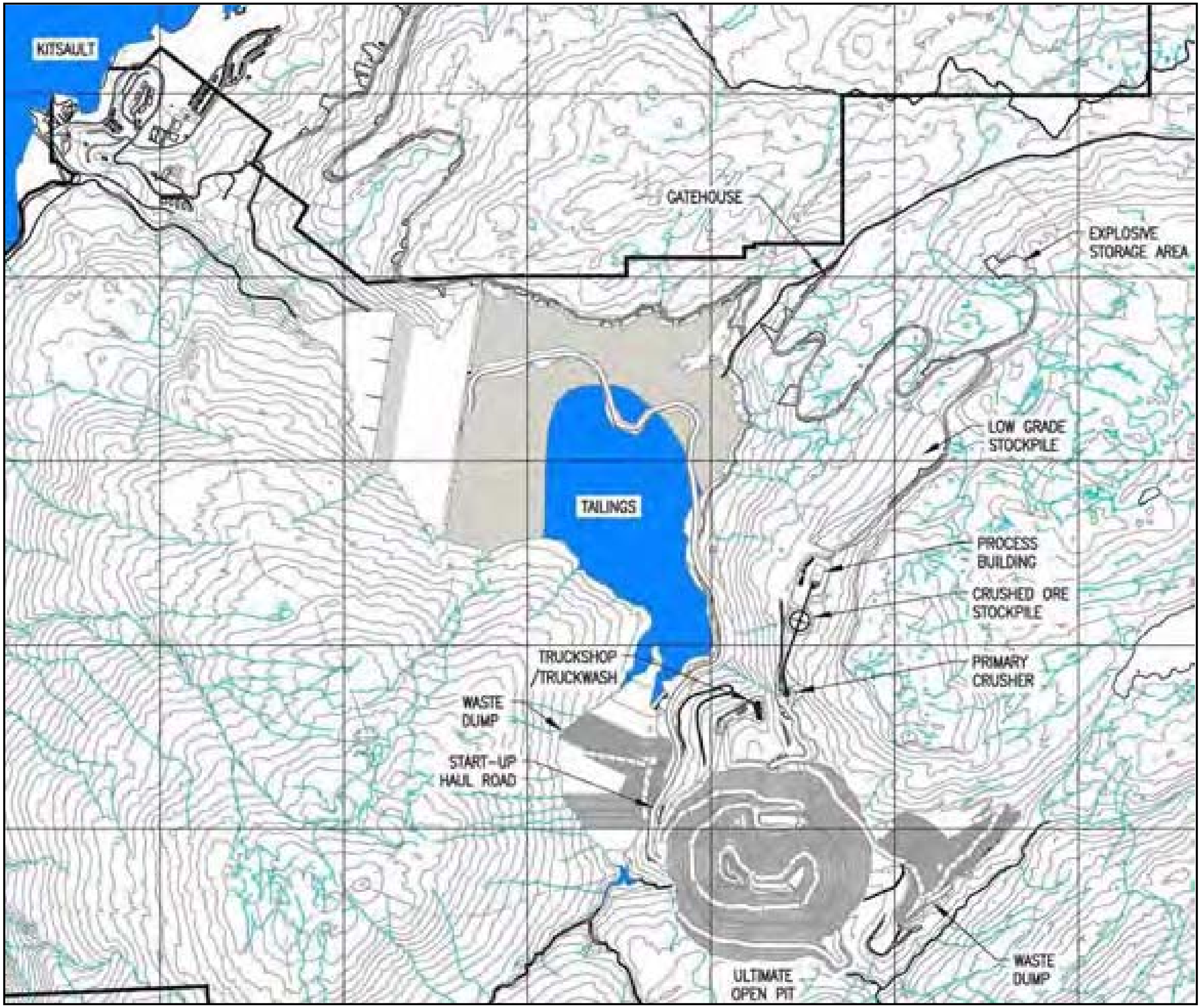
Performance Objective - Chosen Alternatives	Truck Shop / Warehouse and Fuel Storage	Explosives Plant	Primary Crusher
Cost-effectiveness	Less distance to travel for mine trucks; less fuel and time loss than other sites considered.	Location not driven by cost effectiveness.	Configuration chosen is the most cost effective due to proximity to pit and crusher configuration.
Minimise effects on the natural environment	Truckshop site will allow salvage of topsoil for reclamation.	Location is away from water bodies that could be affected by leachate.	Orientation will minimise dust from prevailing winds.
Minimise effects on the social and economic environment	Convenience of location may aid in stress reduction for affected employees.	Main issues are safety and compliance with regulations.	Reduction in dust will mitigate health effects to workers.
Amenability to reclamation	Site chosen is located in a previously disturbed area.	Site chosen will result in new disturbance but is required for legal and safety reasons.	Not applicable; crusher will be in the Kitsault Pit.
Summary evaluation	**Rating: Acceptable**	**Rating: Acceptable**	**Rating: Acceptable**

3.13.8 Alternatives for Waste Rock Management

Three alternatives were considered from the pre-feasibility stage through final feasibility. The Pre-Feasibility Study configuration was based on a WRMF west of the Kitsault Pit and a different TMF location (Site 6; see Section 3.13.9). In preliminary engineering design for the feasibility, two WRMFs were considered: a North and an East WRMF. For the final Feasibility Study design, all waste rock was placed in a larger East WRMF and this is the preferred option using Site 5 for the TMF (see Section 3.13.9).

3.13.8.1 Pre-Feasibility Study WRMF Configuration

The Pre-Feasibility Study WRMF configuration was predicated on having Patsy and Lime Creeks diverted around the WRMF and TMF. With selection of a different TMF site out of Lime Creek, this configuration would pose environmental risks from leaching into Lime Creek and a very low safety risk of dump failure into Lime Creek. This option was not preferred, given the new location for the TMF (see Figure 3.13-2).



REFERENCE
Figure reference from Wardrop Pre-Feasibility Study July 11, 2009

CLIENT: Avanti Kitsault Mine Ltd.	ANALYST: MY QA: TT	PROJECT: Kitsault Mine Project	REV. NO.: A DATE: November 2011
AMEC Earth & Environmental 4445 Lougheed Highway, Burnaby, B.C., V5C 0E4 Tel. 604-294-3811 Fax 604-294-4664	DATUM: Undefined PROJECTION: Undefined SCALE: Not to Scale	TITLE: Pre-feasibility Waste Rock Management Facility	PROJECT NO: VE51899 FIGURE No. 3.13-2

Y:\GIS\Projects\VE\VE51988_Kitsault\Mapping\Other\AI\Other-50-023.ai

3.13.8.2 North and East WRMF Configuration

For the Feasibility Study, TMF Site 5 was selected as the best option considering all factors (see Section 3.13.9), and a new location for mine waste rock was required. The initial consideration was for North and East WRMFs. The North WRMF would be located on the Clary Dump of the former mine. In this way the old dump would be encapsulated. Initial waste rock placement would be on the East WRMF constructed from the bottom up. At such time as the East WRMF reached the same elevation as the base of the North WRMF, waste rock would be placed on the North WRMF. In this way, haulage costs would be minimised. The LGS would be placed in the southeast part of the North WRMF. Downslope drainage to the west would be collected and released to Lime Creek if quality met effluent permit limits, or pumped to the TMF if not. Downslope drainage to the east would be collected and pumped to the TMF.

The East WRMF would be located southwest of the TMF and form part of the South Embankment. Runoff (very little expected based on performance of former mine dumps over a 20-year monitoring period) and seepage would be collected in a wet well and pumped back to the TMF (Figure 3.13-3).

The design was changed based on concerns about control of seepage from the North WRMF which could report to Lime Creek and potentially negatively affect water quality. The resultant design selected as the preferred option was a larger East WRMF.

3.13.8.3 East WRMF

The WRMF is described in Section 3.7.3 (see Figure 3.13-4). Once the single WRMF location was selected, the name for the facility was truncated from East WRMF to WRMF, as described in Section 3.7.3. The site was chosen based on the following considerations:

- Waste rock will serve to buttress the west embankment of the TMF;
- The former mine Patsy Dump will be covered by the WRMF;
- Seepage from the East WRMF can be captured and pumped back to the TMF if required, or released to the diversion channel on the south side of the Kitsault Pit;
- On closure, seepage and runoff (little is expected) would flow by gravity to the Kitsault Pit where it will be monitored while the pit fills; and
- Rock from potential failure of the waste dump, although a very low risk, would be contained either at the foot of the facility or in the Kitsault Pit; Lime Creek would not be affected.

Haul costs would be greater than for the Pre-feasibility option because mine trucks will have to transport rock uphill from the pit lip rather than dumping directly on the lip. Once the East WRMF reaches about 800 m elevation, haul costs would be greater than switching to the North WRMF. However, from environmental and safety perspectives the Feasibility Study option is less of a risk. Figures 3.13-3 and 3.13-4 present the proposed location of the North and East WRMF and the final proposed location of the East WRMF respectively.

3.13.8.4 Evaluation Summary

3.13.8.4.1 Cost Effectiveness

The most cost effective location for waste rock is at the lip of the Kitsault Pit because haul costs are the lowest. The next lowest haul cost option is two WRMFs. Highest haul costs would occur with one WRMF due to the higher elevation difference from the pit to the dump top.

3.13.8.4.2 Minimising Effects on the Natural Environment

Without a TMF to intercept seepage, environmental control with a WRMF west of the Kitsault Pit could be problematic. Seepage from the North WRMF could also be problematic, particularly on closure if seepage was not of adequate quality when it reached Lime Creek. Seepage from the East WRMF during operations offers the greatest amount of control of the three options. On closure, any seepage would enter the Kitsault Pit lake and mix before exiting to Lime Creek.

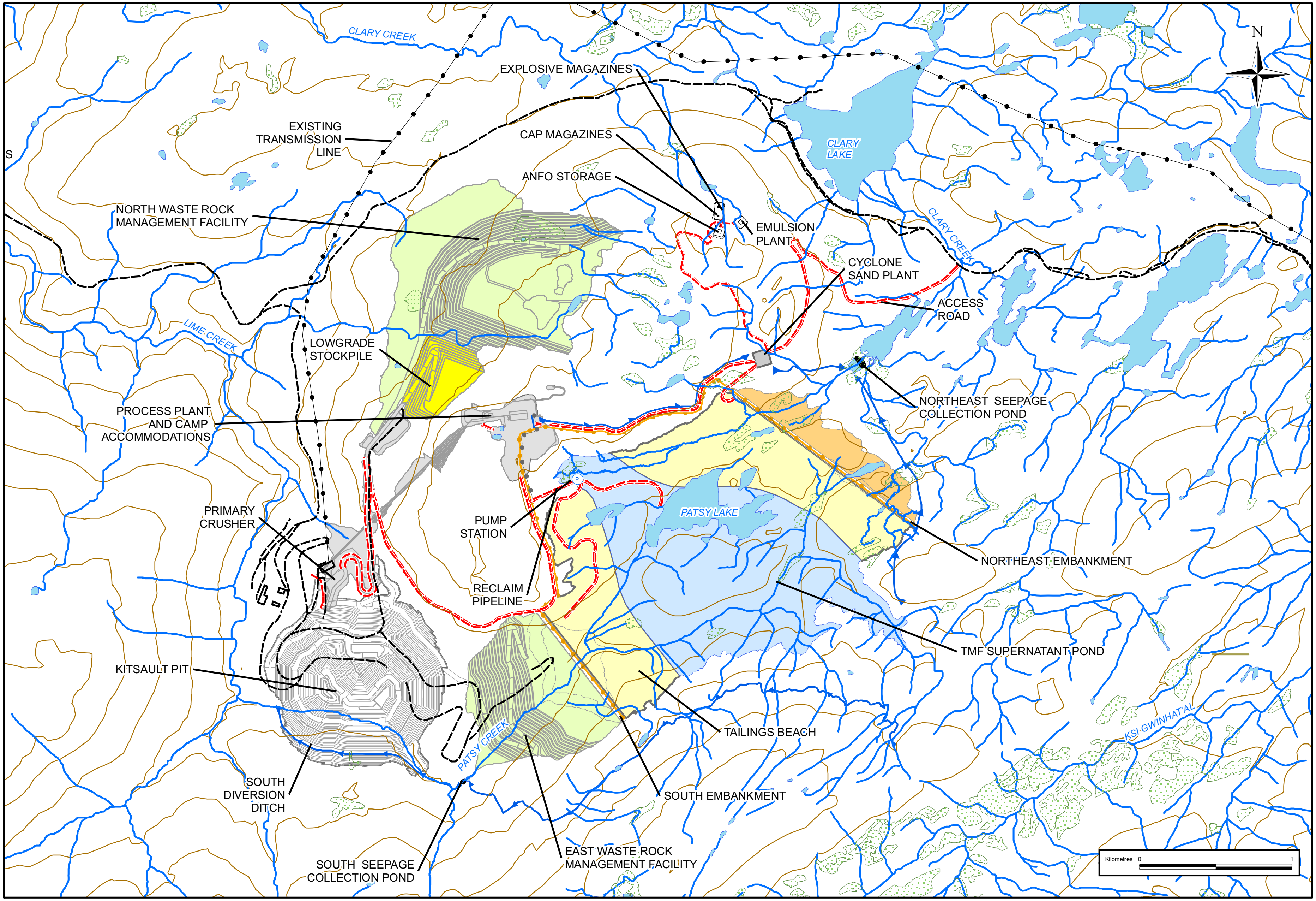
3.13.8.4.3 Minimising Effects on the Social and Economic Environment

Social and economic effects from any of the alternatives are not separable from effects of the proposed Project as a whole. There is some possibility that failure of the Pre-feasibility WRMF could release untreated water into Lime Creek could affect water quality to the extent that fish populations near the mouth of Lime Creek could be negatively affected, which, in turn, could affect subsistence or recreational fishing opportunities. High contaminant loads from the closed North WRMF could also negatively affect fish populations in lower Lime Creek with a similar potential effect on fish and fish habitat.

3.13.8.4.4 Amenability to Reclamation

The East WRMF is the least likely location for the requirement of long-term treatment of seepage on closure, should ML prove to be greater than predicted, because seepage would be mixed in the much larger volume of the pit lake.

Table 3.13.-4 summarises the alternatives evaluation.

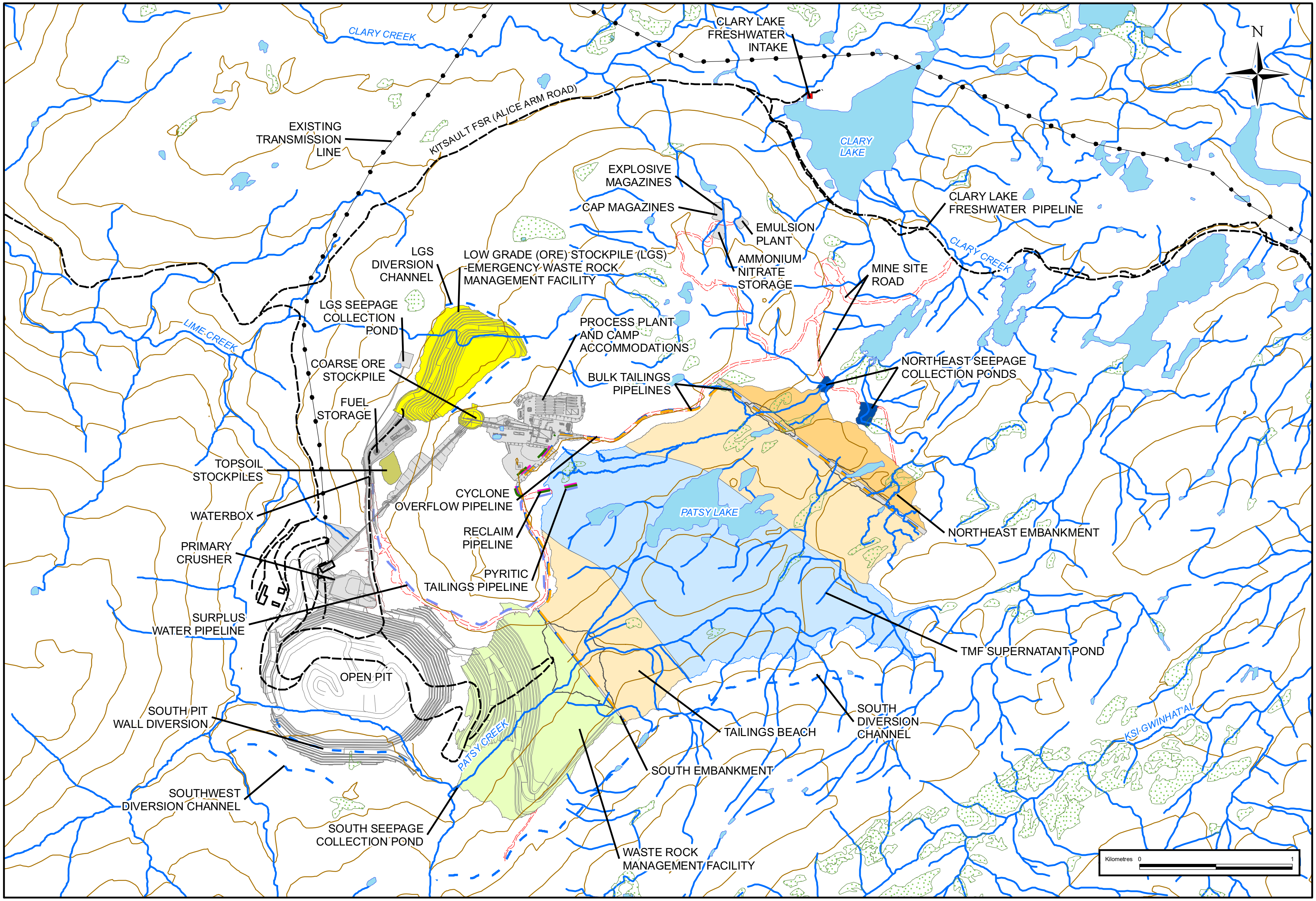


Reference

Base Data
1. Geobase 1:20,000 (TRIM)
2. Land and Resource Data Warehouse 1:20,000 (TRIM)
3. Site Facilities Date July 2010

CLIENT: Avanti Kitsault Mine Ltd.	ANALYST: MY	PROJECT: Kitsault Mine Project		REV. NO.: A
	QA: TT			DATE: November 2011
AMEC Earth & Environmental 4445 Lougheed Highway, Burnaby, B.C., V5C 0E4 Tel. 604-294-3811 Fax 604-294-4664	DATUM: NAD83	TITLE: North and East Waste Rock Management Facilities		PROJECT NO: VE51988
	PROJECTION: UTM 09			FIGURE No. 3.13-3
	SCALE: 1:35,000			

Y:\GIS\Projects\VE\VE51988_Kitsault\Mapping\Other\Other-50-078.mxd



Y:\GIS\Projects\VE\VE51988_Kitsault\Mapping\Other\Other-50-079.mxd

Reference

Base Data
1. Geobase 1:20,000 (TRIM)
2. Land and Resource Data Warehouse 1:20,000 (TRIM)
3. Site Facilities Date February 2011

CLIENT: Avanti Kitsault Mine Ltd.	ANALYST: MY	PROJECT: Kitsault Mine Project	REV. NO.: A
	QA: TT		DATE: November 2011
AMEC Earth & Environmental 4445 Lougheed Highway, Burnaby, B.C., V5C 0E4 Tel. 604-294-3811 Fax 604-294-4664	DATUM: NAD83	TITLE: Final Waste Rock Management Facility	PROJECT NO: VE51988
	PROJECTION: UTM 09		FIGURE No. 3.13-4
	SCALE: 1:35,000		

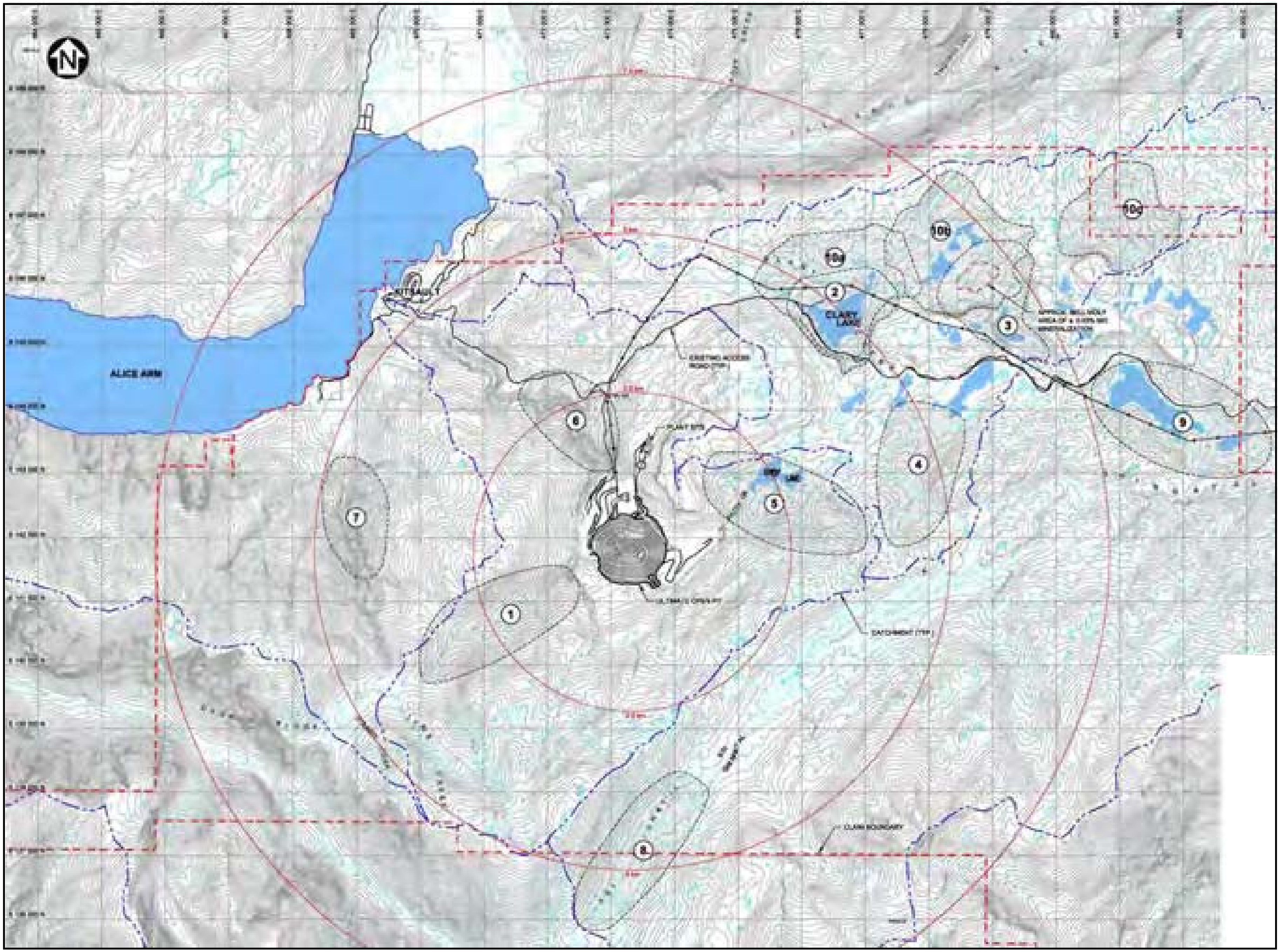
Table 3.13-4: Performance Evaluation – Waste Rock Management Facilities

Performance Objective	Alternatives		
	Pre-feasibility WRMF	**North and East WRMF**	**Feasibility East WRMF**
Cost-effectiveness	Least haul costs.	Higher haul costs.	Highest haul costs but does not make operations uneconomic.
	Rating: Preferred	**Rating: Acceptable**	**Rating: Acceptable**
Minimise effects on the natural environment	Seepage difficult to completely prevent entering Lime Creek; failure would affect Lime Creek and could affect Alice Arm.	Risk of seepage from the North WRMF entering Lime Creek.	Seepage will be captured; failure of seepage control would result in capture in the Kitsault Pit not the receiving environment.
	Rating: Unacceptable	**Rating: Unacceptable**	**Rating: Acceptable**
Minimise effects on the social and economic environment	No social and economic effects separable from the proposed Project as a whole.	No social and economic effects separable from the proposed Project as a whole.	No social and economic effects separable from the proposed Project as a whole.
	Rating: Acceptable	**Rating: Acceptable**	**Rating: Acceptable**
Amenability to reclamation	Seepage collection and treatment on closure might be required.	Seepage collection and treatment on closure might be required.	Seepage would report to and mix with water in the pit lake.
	Rating: Acceptable	**Rating: Acceptable**	**Rating: Acceptable**
Summary evaluation	**Rating: Unacceptable**	**Rating: Unacceptable**	**Rating: Acceptable**

Note: WRMF – Waste Rock Management Facility

3.13.9 Alternatives for Tailings Management

Twelve TMF sites have been evaluated since 2008 (Figure 3.13-5). Sites 1 to 4 were considered for slurry tailings disposal. A refined tailings disposal options study identified Sites 5 to 9 in 2009. A full comparative evaluation was carried through for Sites 1, 5, and 6. Site 6 was selected for evaluation in the Pre-Feasibility Study. A third alternatives study was conducted in January 2010 and examined six options: Sites 1, 5, 6, 10a, 10b, and 10c. Site 5 was identified as the preferred alternative. The information in this section is taken from the three TMF site studies (Knight Piésold 2008, 2009, 2010). Sites 1 to 4 were identified in the 2008 study, Sites 5 to 9 in the 2009 study, and Sites 10a-c in the 2010 study. Progressive narrowing of sites occurred during each of the more detailed alternative assessments. Site 5 was selected for the Feasibility Study as the best option (Appendix 3.0-A). Figure 3.13-5 presents the proposed locations of the TMF alternatives.



REFERENCE
Figure reference from Knight Piesold March 3rd, 2010

CLIENT: AVANTI MINING INC — Avanti Kitsault Mine Ltd.	ANALYST: MY QA: TT	PROJECT: Kitsault Mine Project	REV. NO.: A DATE: November 2011
AMEC Earth & Environmental 4445 Lougheed Highway, Burnaby, B.C., V5C 0E4 Tel. 604-294-3811 Fax 604-294-4664 — amec	DATUM: Undefined PROJECTION: Undefined SCALE: Not to Scale	TITLE: Tailings Management Facility Alternatives Locations	PROJECT NO: VE51899 FIGURE No. 3.13-5

Y:\GIS\Projects\VE\VE51988_Kitsault\Mapping\Other\AI\Other-50-024.ai

3.13.9.1 Screening Criteria

Initial TMF site selection was based on ability of the site to hold the estimated 190 Mt of tailings over the life of mine with reasonable embankment size. TMF site evaluation was then based on the following (Knight Piésold 2008):

- Fisheries issues;
- TMF distance from the Kitsault pit;
- Initial and final embankment crest elevations;
- Initial and final embankment heights;
- Initial and final embankment fill quantities;
- Storage efficiency ratio / TMF stored volume / embankment fill volume;
- TMF catchment area;
- Initial and final water balance annual surplus / deficit;
- Pipeline lengths (mill to head tank; head tank to end-of-line);
- Annual pumping costs;
- Cost / tonne (tailings and reactive waste rock); and
- Interaction with other known ore bodies.

The second alternatives assessment evaluated costs in greater detail. The third alternatives assessment evaluated safety, environment, and costs in greater detail. The screenings eliminated sites from further consideration, first for environmental reasons (principally loss of fish habitat) and second for costs. Sites that would sterilise resources (e.g., Sites 3, 9 and 10b) were deemed to be fatally flawed.

3.13.9.2 Site 1 – Upper Lime Creek

Site 1 was selected as an alternative for the preliminary engineering assessment and carried through to the third screening, but not as the preferred option, since capital and operating costs would be relatively high. Other site challenges included tailings pumping and large embankment heights, however, the site location was well above any fish habitat. Catastrophic failure of the embankment, while a remote possibility, could result in damage to fish habitat on lower Lime Creek and possibly extend to the marine environment.

3.13.9.3 Site 2 – Clary Lake

Site 2, in Clary Lake, although presenting a relatively low cost, was rejected at the first screening because Clary Lake was known to be fish-bearing, since rainbow trout, stocked in Killam Lake upstream, migrate into Clary Lake.

3.13.9.4 Site 3 – Bell Moly

Option 3 would cover the Bell Moly deposit and was removed from further consideration at the first screening because the Bell Moly deposit will not be developed as part of the current proposed Project.

3.13.9.5 Site 4 – Patsy Lake East

Site 4 would require large embankments relative to either Sites 1 or 2; while water diversion issues and costs would be less at Site 4, the site is further from the proposed mine site and therefore tailings pipeline costs would be greater. In addition, the north embankment would slightly overlay or be very close to Killam Lake, which was stocked with rainbow trout.

3.13.9.6 Site 5 – Patsy Lake

Site 5 was selected as an alternative for further engineering at the second alternatives assessment for dry stack tailings. The selection of dry stack deposition was based on the limited area for deposition with relatively low embankments. However, dry stack tailings deposition at the site presents a number of challenges outlined by Knight Piésold (2009):

> The cold climate at site would present challenges during winter operations to prevent snow or ice accumulations in the pile and wind blown dusting can worsen in winter months as freeze-drying and other frost processes can loosen the tailings. The wet climate may cause problems during the spring, summer and autumn months as moisture addition can result in rapid degradation of trafficability and would hamper placement, spreading and compaction of the filtered tailings. It is noted that the Kitsault site is adjacent to an area of very high seismicity along the coast of Vancouver Island. The filtered tailings stack could be susceptible to instability due to ice lenses or localised liquefaction if the pile became saturated due to rainfall, snow entrainment or percolation from runoff. (Knight Piésold 2009)

For the third alternatives assessment, Site 5 was evaluated for slurry tailings because of the aforementioned disadvantages of dry stack. A second Northeast Embankment was added to the design to increase capacity. Initial capital cost as a slurry facility would be over one-third less than Site 6, but operating costs are forecast to be 60% higher. The two embankment configurations at Site 5 would result in embankment heights that would be one half those of Site 6, but with two embankments instead of the one at Site 6. Two drainage basins would be affected (Lime Creek and Clary Creek) versus one for Site 6. Seepage or dam failure of the Site 5 TMF would result in water / tailings flowing into the Kitsault Pit where the loss would be contained and could be pumped back to the TMF, effecting greater environmental control. A catastrophic dam failure would not affect either the Alice Arm estuary nor Kitsault Townsite.

Patsy Lake is non-fish bearing, but two small streams flowing into Lake 901 (northeast of Patsy Lake) would have flow reductions, which could affect fish habitat and require compensation under DFO's No-Net-Loss Policy.

3.13.9.7 Site 6 – Lower Lime Creek

Site 6 was selected as a slurry tailings storage alternative at the second TMF alternatives assessment. It has the advantage over Site 1 of gravity feed of tailings from the Process Plant. Operating costs would be less than Site 5 as a dry stack TMF. Water management is a greater issue at Site 6 because it is lower in the Lime Creek Watershed and would require a larger diversion channel. However, this cost would be offset by lower construction rock hauling costs: rock would be hauled downhill instead of uphill. Site 6 would affect only one drainage (Lime Creek), water from the Kitsault Pit and an adjacent waste rock storage area would be captured by the TMF and the site is above the fish passage level.

The embankment is high (365 m crest to lowest point). A catastrophic dam failure, although a remote possibility, would almost certainly result in tailings flowing to the ocean and could possibly endanger Kitsault Townsite.

3.13.9.8 Site 7 – Roundy Creek

The site was rejected at the second screening as being too far from the most suitable Process Plant site northeast of the Kitsault Pit.

3.13.9.9 Site 8 – Ksi Gwinhat'al

Site 8 would be available for an expanded Kitsault deposit but is over 5 km from the mine and higher in elevation, which would require significant pumping costs, and thus was not identified as a preferred site at the second screening.

3.13.9.10 Site 9 – East Bell Moly

The site was rejected at the second screening because the Bell Moly deposit will not be developed as part of the current proposed Project.

3.13.9.11 Site 10a – Clary Lake North

Site 10a was included in the third assessment because it is attractive from cost considerations but would overlay Clary Lake and was ruled out for the same reason as Site 2.

3.13.9.12 Site 10b – Bell Moly

Site 10b overlays the Bell Moly deposit. A detailed evaluation of the Bell Moly deposit is outside the present engineering scope and therefore Site 10b was rejected for the same reason as Site 3, earlier.

3.13.9.13 Site 10c

Site 10c would have a capacity of 100 Mt and could work in combination with another TMF site of similar capacity. It is also located 9 km from the mine. Its main advantage is that it would not encroach on any fish-bearing ponds or lakes. However, its limited capacity and relatively long distance from the mine would make it impractical as a stand-alone TMF.

3.13.9.14 Evaluation Summary

3.13.9.14.1 Cost Effectiveness

Site 2, Clary Lake, is the lowest cost-per-tonne option. It has the advantage of the most area for expansion of the options examined. Site 10a is also a low-cost option, but would partially overlay Clary Lake. Sites 3, 9, and 10b could cover the Bell Moly and Bell Moly East deposits, and were rejected for economic reasons. Sites 7 and 8 were rejected due to relative long haul distances and associated costs. Site 10c lacks the required capacity. A second site, together with additional construction and operating costs, would be required. Site 1 capital and operating costs would be higher than the chosen site. Site 6 is attractive from an operating cost perspective but could result in higher long term treatment costs. Sites 4 and 5 would have approximately equivalent construction and operating costs.

3.13.9.14.2 Minimising Effects on the Natural Environment

Sites 2, 9, and 10a would have the highest environmental impact due to overlaying or partially overlaying fish-bearing lakes. The area of disturbance would be lowest at Site 7, but the site is in a different watershed from the mine. Site 10c has the next lowest area of disturbance but would be too small to contain all the tailings. Catastrophic failure of the Site 1 and 6 embankments, although a very low risk, would have a large negative environmental effect. The embankment of Site 4 would impinge or be contiguous with fish-bearing lakes. Control of environmental effects would be approximately equivalent for the remaining sites (3 and 5).

3.13.9.14.3 Minimising Social and Economic Effects

Sites 2, 9, and 10a could preclude use of fish-bearing lakes for subsistence or recreational fishing. Site 4 embankment seepage could also negatively affect fish-bearing lakes. Covering the Bell Moly and Bell Moly East deposits would eliminate any potential economic benefits to the province and the region from potential future mining of these deposits. Failure of the Site 6 embankment could have negative safety and social cost effects to Kitsault Townsite and Alice Arm. Longer haul distances for 8, 10b, and 10c would increase the use of fuel and exhaust emissions, which could have both additional environmental and social costs associated with these options. Social and economic costs would be approximately equivalent for the remaining sites (1, 3, and 5).

3.13.9.14.4 Amenability to Reclamation

Post-closure water treatment of seepage could be required at all sites except Site 5, since it would drain to the Kitsault Pit which would become a lake on closure. Seepage treatment would also not likely be required at Site 10c since it is removed from immediate contact with any significant drainage. Long-term stability would likely be highest at Site 5, since the East WRMF will buttress the South Embankment and the Northeast Embankment is low. Sites 2, 9, and 10a could replace lost fish habitat with Post-Closure lakes and marginal wetlands.

Table 3.13.-5 summarises the alternatives evaluation.

Overall, given the currently proposed mine configuration, Site 5, although higher cost than some of the other options, presents the best combined rating.

3.13.10 Process Alternatives

There is no practical alternative to the grind-flotation process, which is the core process of molybdenum concentration. The high floatability of molybdenite has traditionally made its recovery economic at the low grades found in nature. Molybdenite is fairly inert to leaching and a hydrometallurgical approach would have more serious environmental implications and not be economic. Pyrometallurgy (e.g., roasting or smelting) would have even more serious environmental implications. Heat is required with this method, which would result in emission of exhaust gases; any sulphur in the ore is driven off by roasting and emissions would need to scrubbed, typically with some residual sulphur dioxide escaping.

With respect to concentrate leaching to reduce lead impurity, there is not a practical economic alternative to leaching at the proposed Project site. The process chosen will reduce lead reporting to the final concentrate as much as practical. Some minor adjustments may be made by the Process Plant operators based on experience and would, as a normal course of events, occur, but it will be necessary to leach the ore. Neither roasting nor pressure oxidation are options in treating the concentrate, as the environmental impact would be more severe and the economics would be poor. Additional test work to reduce the severity of leaching is being undertaken. A more economical leaching process (including the examination of reagent recycle) is the goal of the proposed test work.

3.13.11 Alternatives for Water Management

Water management options are tied closely to facilities locations configurations, and are limited once these have been chosen. Key to the approach to be used is to divert clean water around the mine site to the extent practical and collect all contact water for treatment, principally in the TMF. Contact water that meets the proposed Project's effluent permit limits will be discharged. The goal for the proposed Project is to recycle as much water as possible and have one discharge point. A water treatment plant is not expected to be required during construction or operations, but will be constructed if monitoring indicates a significant upward trend in concentration of parameters that can reasonably be ascribed to the mine. On closure, pre-mining stream courses will be re-established to the extent practical.

Table 3.13-5: Performance Evaluation – Tailings Management Facility Options and Alternatives

Performance Objective	Alternatives											
	Site 1	**Site 2**	**Site 3**	**Site 4**	**Site 5**	**Site 6**	**Site 7**	**Site 8**	**Site 9**	**Site 10a**	**Site 10b**	**Site 10c**
Cost effectiveness	Capital and operating costs relatively high.	Least construction and operations cost.	Overlay Bell Moly deposit.	Construction and operating costs relatively high, although not the highest.	Higher cost than some of the other alternatives.	Haul distance for embankment and piping distance low; no pumping of tailings, gravity feed.	Haul distance for embankment and piping distance relatively large.	Haul distance for embankment and piping distance relatively large.	Overlay Bell Moly East deposit	Low construction cost, somewhat higher haul costs.	Overlay Bell Moly deposit.	Insufficient capacity for mine life tailings; haul costs high.
	Rating: Acceptable	**Rating: Preferred**	**Rating: Unacceptable**	**Rating: Acceptable**	**Rating: Acceptable**	**Rating: Preferred**	**Rating: Acceptable**	**Rating: Acceptable**	**Rating: Unacceptable**	**Rating: Acceptable**	**Rating: Unacceptable**	**Rating: Unacceptable**
Minimisation of environmental effects	Catastrophic failure of embankment could destroy fish habitat.	Overlay fish bearing lake.	Environmental control at the site relatively straight forward; fish-bearing waters not directly affected.	Environmental control would mean capturing seepage from the embankment to prevent loss to Killam Lake.	Covers a non-fish-bearing lake but potential on closure to form wetland.	Catastrophic failure of embankment could destroy fish habitat.	In separate watershed from deposit; higher environmental impact potential.	Longer haul distances would increase exhaust emissions slightly.	Overlay fish-bearing lake.	Overlay fish-bearing lake.	Fish habitat unknown; could overlay fish-bearing lakes which could require compensation.	Loss of terrestrial habitat which could be replaced on closure with wetland habitat.
	Rating: Unacceptable	**Rating: Unacceptable**	**Rating: Preferred**	**Rating: Acceptable**	**Rating: Acceptable**	**Rating: Unacceptable**	**Rating: Unacceptable**	**Rating: Acceptable**	**Rating: Unacceptable**	**Rating: Unacceptable**	**Rating: Acceptable**	**Rating: Acceptable**
Minimisation of social and economic effects	Embankment failure could affect use of the fish resource and could possibly affect property.	Potentially relatively high social and economic effects due to loss of fish resource.	Loss of the Bell Moly deposit and potential revenues and employment to BC and the region.	Seepage into Killam Lake, if not prevented or adequately controlled, could affect fish.	Safety risks less than Sites 1, 6, 7. Loss of fish use relatively low.	Embankment failure could affect use of the fish resource and could possibly affect property.	Catastrophic failure of the embankment would affect Roundy Creek and could affect Alice Arm.	Social and economic effects not readily separable from overall effects from the proposed Project.	Loss of the Bell Moly East deposit and potential revenues and employment to BC and the region.	Potential loss of subsistence and recreational fishing opportunities which could be compensated.	Social and economic effects not readily separable from overall effects from the proposed Project.	Social and economic effects not readily separable from overall effects from the proposed Project.
	Rating: Unacceptable	**Rating: Unacceptable**	**Rating: Acceptable**	**Rating: Acceptable**	**Rating: Preferred**	**Rating: Unacceptable**	**Rating: Unacceptable**	**Rating: Acceptable**	**Rating: Acceptable**	**Rating: Acceptable**	**Rating: Acceptable**	**Rating: Acceptable**
Amenability to reclamation	Post-closure treatment possibly required.	Post-closure lake and wetland on closure could replace lost fish habitat.	Seepage control and treatment could be required post closure to prevent contaminant migration into adjacent small lakes.	Seepage control and treatment could be required post closure.	Seepage treatment not required on closure because small-volume seepage would drain to large-volume pit lake.	Post-closure treatment possibly required.	Seepage treatment could be required post closure.	Seepage treatment could be required post closure.	Post-closure lake and wetland on closure could replace lost fish habitat.	Post-closure lake and wetland on closure could replace lost fish habitat.	Seepage treatment could be required post closure.	Closure relatively straight forward compared to other sites.
	Rating: Acceptable	**Rating: Acceptable**	**Rating: Acceptable**	**Rating: Acceptable**	**Rating: Preferred**	**Rating: Acceptable**	**Rating: Acceptable**	**Rating: Acceptable**	**Rating: Acceptable**	**Rating: Acceptable**	**Rating: Acceptable**	**Rating: Preferred**
Summary evaluation	**Rating: Unacceptable**	**Rating: Unacceptable**	**Rating: Unacceptable**	**Rating: Acceptable**	**Rating: Preferred**	**Rating: Unacceptable**	**Rating: Unacceptable**	**Rating: Acceptable**	**Rating: Unacceptable**	**Rating: Unacceptable**	**Rating: Unacceptable**	**Rating: Unacceptable**

3.13.12 Alternatives for Transport of Construction Materials

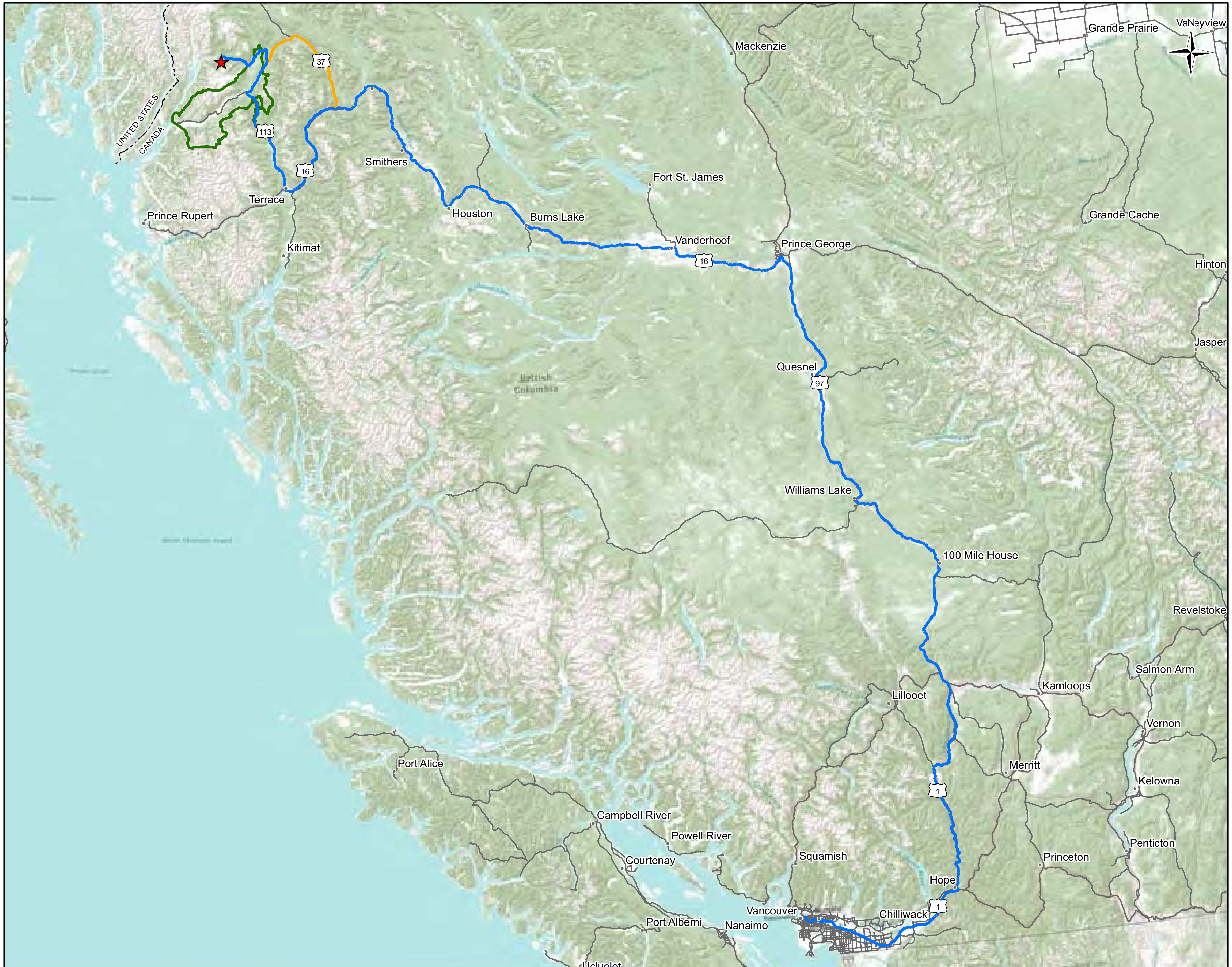
Construction materials will be transported by road. There are no alternatives being considered for transport of construction materials except for the two route options between the mine site and Kitwanga, as discussed in Section 3.2.1. Hwy 16 and 97 would be used beyond that point.

3.13.13 Alternatives for Transport of Molybdenum Concentrate

Concentrate will be trucked from the mine to Vancouver (see Figure 3.13-6). There are no alternatives being considered for molybdenum concentrate transport except for the two route options between the mine site and Kitwanga, as discussed in (Section 3.2.1). Molybdenum concentrate will be bagged at the Process Plant and trucked to a port facility in Vancouver. Both options from the mine site to Hwy 16 are included as part of the proposed Project. Two to three concentrate trucks per day will be required for transport to Vancouver.

3.13.14 Alternatives for Decommissioning, Closure, and Reclamation

Decommissioning, closure, and reclamation requirements for mines in BC are governed by the "Health, Safety and Reclamation Code for Mines in British Columbia" (BC MEMPR 2008), which specifies reclamation and closure requirements. Decommissioning, closure, and reclamation are entirely governed by the as-built mine and the social and environmental setting of the mine. Thus, there are no real alternatives once these factors are set, except end land-use objectives. In the absence of a third-party arrangement for use of the mining area, all facilities will be removed or buried. The power line could be left in place if responsibility for maintenance was assumed by a third party. The access FSR will remain open since it provides access to Kitsault Townsite and Alice Arm. Section 3.10 outlines decommissioning and Section 11.2.15 provides a Reclamation and Closure Plan.



Legend

- ★ Kitsault Mine Project
- • Populated Place
- Road
- Highway
- Alternative Route
- Truck Route
- International / Provincial Border
- Nisga'a Nation

KEY MAP

Scale:1:3,000,000

0 50 100 200

Kilometres

Reference

Base Data
Geobase 1:20,000 (TRIM)
Land and Resource Data Warehouse 1:20,000 (TRIM)
Atlas of Canada scale 1:1,000,000.

CLIENT: Avanti Kitsault Mine Ltd.

PROJECT: Kitsault Mine Project

Concentrate Transportation Routes from Kitsault Mine Project to Highway 16 and Vancouver, BC

DATE: November 2011	ANALYST: MY	**Figure** 3.13-6
JOB No: VE51988	QA/QC: TT	PDF FILE: Other-50-058_Route_VA_v4.pdf
GIS FILE: Other-50-058_v4.mxd		
PROJECTION: UTM Zone 9	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE51988_Kitsault\Mapping\Other\Other-50-058_v4.mxd

3.14 Project Phases, Components and Activities

The following summarises the proposed Project into phases, major components, and the general activities to occur within each. The Project phases, components and activities, together with the valued components (as described in Section 6.1), set the framework to complete the EA. Moreover, mitigation and management plans are informed by the activities and potential for environmental effects.

3.14.1 Project Phases

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 WRMF;
   - 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 would be spent milling low grade ore); this includes progressive reclamation;
3. Decommissioning and Closure Phase - estimated at 15 to 17 years; includes a closure period during which the buildings and un-needed infrastructure would be removed and the sites reclaimed; and
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.

3.14.2 Project Components and Activities

The proposed Project consists of several major components: existing access roads, Kitsault Pit, WRMF, TMF, and associated mine infrastructure (Process Plant, accommodations, etc.). Activities vary with each major Project component and with each Project phase. As such, the interactions with the identified VCs will vary, which could lead to potential effects. Table 3.14-1 presents the major Project components by Project phase, together with the main activities to occur if the proposed Project is approved.

Table 3.14-1: Major Project Components and Activities by Project Phase

Project Component	Project Activity Description
Construction Phase	
Existing access road	Overdue road maintenance including cutting back vegetation along road corridor, culvert replacement where needed, resurfacing of the road where needed, grading road surface for water management Use of the existing access roads from the mine site to Hwy 16, including transportation of hazardous materials
Kitsault Pit	Land clearing, excavating and grading, soil salvage, water management (surface diversions, sediment control ponds)
Borrow sources	Land clearing, excavating and grading, water management (surface diversions, sediment control ponds)
WRMF development	Land clearing, excavating and grading, soil salvage, water management (surface diversions, sediment control ponds)
TMF development	Land clearing, excavating and grading, soil salvage, pipelines and pumping systems construction and installation, water management (surface diversions, sediment control ponds), asphalt plant for South Embankment core, South Embankment development with existing waste rock and Kitsault Pit waste rock, Northeast Embankment development with quarried rock
Expansion of exploration camp to create construction and permanent camps	Land clearing, excavating and grading, soil salvage, water management (surface diversions, sediment control ponds, sewage and gray water treatment), solid waste management, water usage
Mine infrastructure	Land clearing, excavating and grading, soil salvage, water management (surface diversions, sediment control ponds), civil works, pipeline and pumping system from Clary Lake.
Operations Phase	
Existing access road	Road maintenance for mining activity Use of the existing access roads from the mine site to Hwy 16, including transportation of hazardous materials
Kitsault Pit	Water management (surface diversions, sediment control ponds, pumping pit water to central control point), haul truck traffic, blasting. Additional Pit extension through operations: land clearing, excavating and grading, soil salvage
WRMF operation	WRMF access road use, deposition of waste rock, surface and groundwater management including collection of surface runoff in collection pond
TMF operation	TMF access road use, deposition of tailings, regulated supernatant release, sub-aqueous deposition of pyritic tailings, cycloning for construction of the Northeast and South Embankments, deposition of Kitsault Pit waste rock for construction of the South Embankment, reclaim water pumping to mill site, seepage collection and pumpback to TMF
Mine infrastructure	Sewage and gray water treatment, solid waste management, maintenance of surface water management structures and roads, operation of Clary Lake freshwater pumping system

Project Component	Project Activity Description
Decommissioning and Closure Phase	
Access Road	Decommissioning and reclamation as or required: if removal of culverts, scarify surface, access will be impeded
Kitsault Pit	Decommissioning and reclamation of roads not needed for post-closure monitoring, pit filling, growth medium and seeding of disturbed surfaces, construction of single outflow channel
WRMF	WRMF reclamation, reclaim site roads, water management (drainage into the Kitsault Pit), placement of growth medium and seeding
TMF	TMF reclamation, reclaim site roads, water management (spillway to the Kitsault pit), placement of growth medium and seeding where needed, remove pumpback systems from northeast seepage collection systems.
Mine infrastructure	Removal of mining infrastructure, salvage of materials where practical, non-salvagable material buried on site, placement of growth medium and seeding
Post-Closure Phase	
Kitsault Pit	Monitoring and reporting on water quality, water quantity, re-vegetation growth
TMF	Monitoring and reporting on water quality, water quantity, re-vegetation growth, fish habitat compensation works
WRMF	Monitoring and reporting on water quality, re-vegetation growth
Mine infrastructure	Monitoring and reporting on water quality, re-vegetation growth