

5. PROJECT DESCRIPTION

5.1 INTRODUCTION

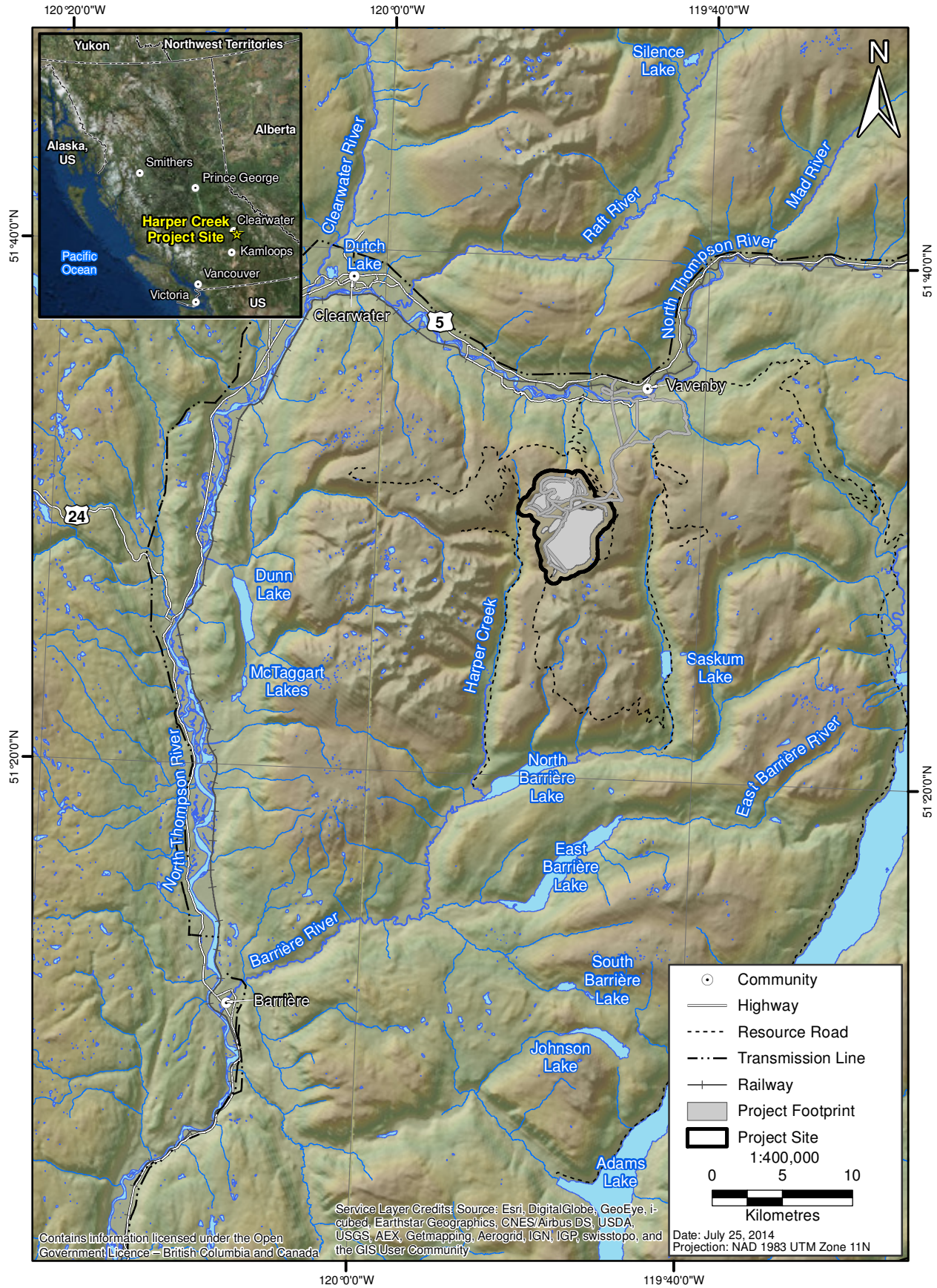
The proposed Harper Creek Project (the Project) will be located in a region of gently sloping plateaus in southeastern British Columbia (BC; Figure 5.1-1). The Project is a proposed open pit copper mine located in the Thompson-Nicola area of BC approximately 150 kilometres (km) north of Kamloops along the Southern Yellowhead Highway (Highway 5) near the town of Vavenby. The proponent of the Project is Harper Creek Mining Corporation (HCMC). HCMC is a wholly owned subsidiary of Yellowhead Mining Inc. (YMI). Access to the Project as planned is south from Highway 5 near the town of Vavenby via the Vavenby Mountain Forest Service Road (FSR), the Saskum Plateau FSR, and the Vavenby-Saskum FSR.

The Harper Creek Deposit is interpreted to be a polymetallic volcanogenic sulphide deposit, comprising lenses of disseminated, fracture-filling, and banded Fe and Cu sulphides with accessory magnetite. The mineable reserves are estimated to be 716.2 million tonnes (Mt), with an average grade of 0.26% Cu, 0.029 grams (g)/t Au, and 1.2 g/t Ag reported at a 0.14% Cu cut-off grade ([Appendix 5-A, Technical Report and Feasibility Study](#)). The total in-pit waste rock is 543.7 Mt. The overall mine life is 28 years after start-up of the concentrator. Construction is expected to take approximately two years.

Ore will be extracted using conventional shovel and truck open pit operations. The overall mining rate will be 60 Mt/annum (a) for most of the mine life. Cut-off grades will be varied to allow higher-grade material to be processed in advance of low grade. The mine has been designed for operations with hydraulic shovels in the 42 m³ range and trucks in the 227-t class with typical support equipment associated with this type of primary mining equipment. Run-of-mine (ROM) ore will be hauled to the primary crusher. Crushed ore will be conveyed to the coarse ore stockpile and subsequently to the crushing, grinding, and flotation sections of the process plant. The concentrate will be trucked from the Project Site approximately 24 km to the rail load-out facility at Vavenby and temporarily stored until loaded onto rail for transport by Canadian National Railway (CNR) to existing concentrate storage, handling, and loading facilities at Port Metro Vancouver for shipment to overseas smelters for further processing.

Waste rock will be segregated. Potentially acid-generating (PAG) waste rock will be placed in the tailings management facility (TMF) and buried under tailings material. The non-potentially acid generating (non-PAG) material will be used in construction activities or stored in a waste rock stockpile. The TMF was designed to provide storage of more than 585 Mt of tailings and more than 237 Mt of PAG waste rock. The capacity of the TMF can be increased by approximately 30% should future expansion be required. The TMF is located in a non-fish-bearing area and is isolated from migratory fish by a natural fish barrier downstream of the TMF embankment. The catchment is hydraulically contained by bedrock on three sides and will be confined by constructing an earthen dam using a combination of suitable non-reactive overburden and waste rock from the open pit and/or local borrow sources.

Figure 5.1-1
Project Location



Power for the Project will be supplied from the provincial electricity grid. This emerged as the preferred option from an evaluation of power supply alternatives for the Project (Chapter 4, Project Design and Alternatives Assessment). A new 14-km power line will be constructed, connecting the Project to the BC Hydro transmission line corridor in Vavenby.

Workers will be transported daily by bus from the rail load-out facility to and from the Project Site.

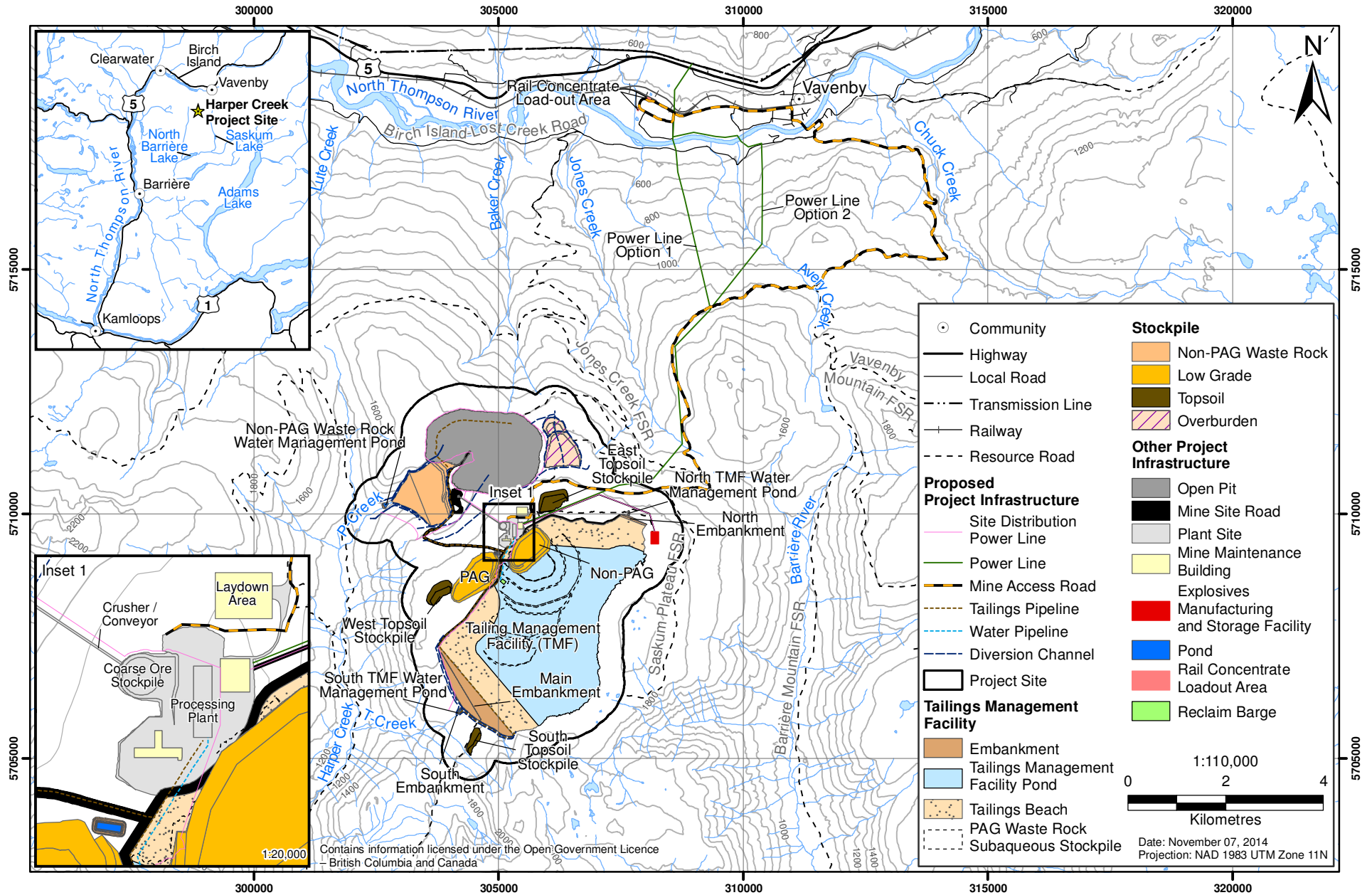
The Project consists of the following key components (as illustrated in Figure 5.1-2 at the peak of operational activity in Year 23, in Operations 1):

- an open pit mine at the Project Site;
- a processing facility located at the Project Site capable of processing 70,000 t/day (d) of ore, producing a copper concentrate (containing copper, gold, and silver);
- a TMF for the long-term storage of tailings solids and PAG waste rock, and recycling of process water including site runoff, diversion, and sediment control, as well as water management structures;
- non-PAG waste rock stockpiles for long-term storage of mined materials;
- low-grade ore (LGO), overburden, and topsoil storage for temporary storage of materials;
- a temporary construction camp to support construction activity;
- ancillary facilities to support mining activity, such as a mine maintenance facility, warehousing, and engineering offices;
- ancillary infrastructure including mine haul roads, plant site roads, yard areas and parking, potable water storage, fuel storage, explosives storage, security and first-aid facilities, sewage and waste management, communication, backup power, and fire protection equipment;
- an access road approximately 24 km in length connecting the Project Site with the rail load-out facility in Vavenby;
- a power line (the “HCMC power line”) approximately 14 km in length, connecting the Project Site to the BC Hydro transmission line corridor in Vavenby, and site distribution; and
- a rail load-out facility located on private land in Vavenby.

5.1.1 British Columbia *Environmental Assessment Act*

The Project triggers an environmental assessment (EA) under the BC *Environmental Assessment Act* (BC EAA; 2002). Since the production capacity of the Project will exceed 75,000 t/a of mineral ore, the Project meets the requirements for reviewability as detailed in Part 3 (Mine Projects) of the Reviewable Projects Regulation (BC Reg. 370/2002) of the BC EAA (2002). A successful project review under the BC EAA will result in the issuance of an Environmental Assessment Certificate by the British Columbia Environmental Assessment Office (BC EAO).

Figure 5.1-2
Operations 1 Infrastructure (Year 23)



5.1.2 *Canadian Environmental Assessment Act*

The EA process for the Project was initiated in 2011, under the *Canadian Environmental Assessment Act* (1992), as a comprehensive study due to the Project being likely to require action under a regulatory provision listed on the Law List Regulations (SOR/94-636). The Canadian Environmental Assessment Agency (CEA Agency) has advised HCMC that the responsible authorities for the Project include Fisheries and Oceans Canada and Natural Resources Canada. The Project is subject to a comprehensive study-type EA because the proposed production capacity of the Project will exceed the stipulations of Section 16(c) of the Comprehensive Study List Regulations (SOR/94-638) for the proposed construction, decommissioning, or abandonment of a metal mine other than a gold mine, with an ore production capacity of 3,000 t/d or more.

On July 6, 2012, the *Canadian Environmental Assessment Act* (1992) was repealed and replaced by the *Canadian Environmental Assessment Act, 2012* (2012). HCMC has been advised of the transition provisions for environmental assessments that were already underway when the new legislation came into force. The CEA Agency has informed HCMC that since the Project's comprehensive study commenced after July 2010, it will continue to follow the requirements of the former legislation, in accordance with the Establishing Timelines for Comprehensive Studies Regulations (SOR/2011-139) of 2011.

5.2 SITE CONTEXT

5.2.1 Project Overview

The Project is located approximately 150 km north of Kamloops along Highway 5 near the town of Vavenby (Figure 5.1-1). The Harper Creek Property Area (the Property) is located on NTS map sheets 82M/12 and 82M/5 and is geographically centred at 51°30'N and 119°48'W. It covers a total of 42,636.48 hectares (ha) and comprises 97 cell claims (41,786.48 ha) and 34 legacy claims (850 ha).

5.2.2 Mineral Tenure

The mineral claims that comprise the Project consist of the 97 cell claims (41,786.48 ha) and 34 legacy claims (850 ha) mentioned above, and cover a total area of 42,636.48 ha. Figure 5.2-1 presents the mineral claims comprising the Project and Table 5.2-1 sets out the area, ownership, expiry, and tenure of the mineral claims. HCMC owns 100% of all mineral claims and all claims are valid to November 3, 2024, at which time they will require renewal.

YMI acquired the claims through a series of claim staking, purchase, and option agreements in 2005.

None of the 97 cell claims are subject to any royalties. Three unconverted legacy claims (mineral tenures 220877, 220878, 220879), and three converted legacy claims (mineral tenures 513235, 513237, 513239), are subject to a 2.5% Net Smelter Royalty (NSR) to XStrata. The remaining 31 legacy claims were acquired from Cygnus Mines Ltd. (subsidiary of US Steel Corp.) pursuant to an Option Agreement exercised in July 2010 and are subject to a 3% NSR, capped at \$2.5 million, subject to inflation adjustment.

Figure 5.2-1
Project Mineral Claims

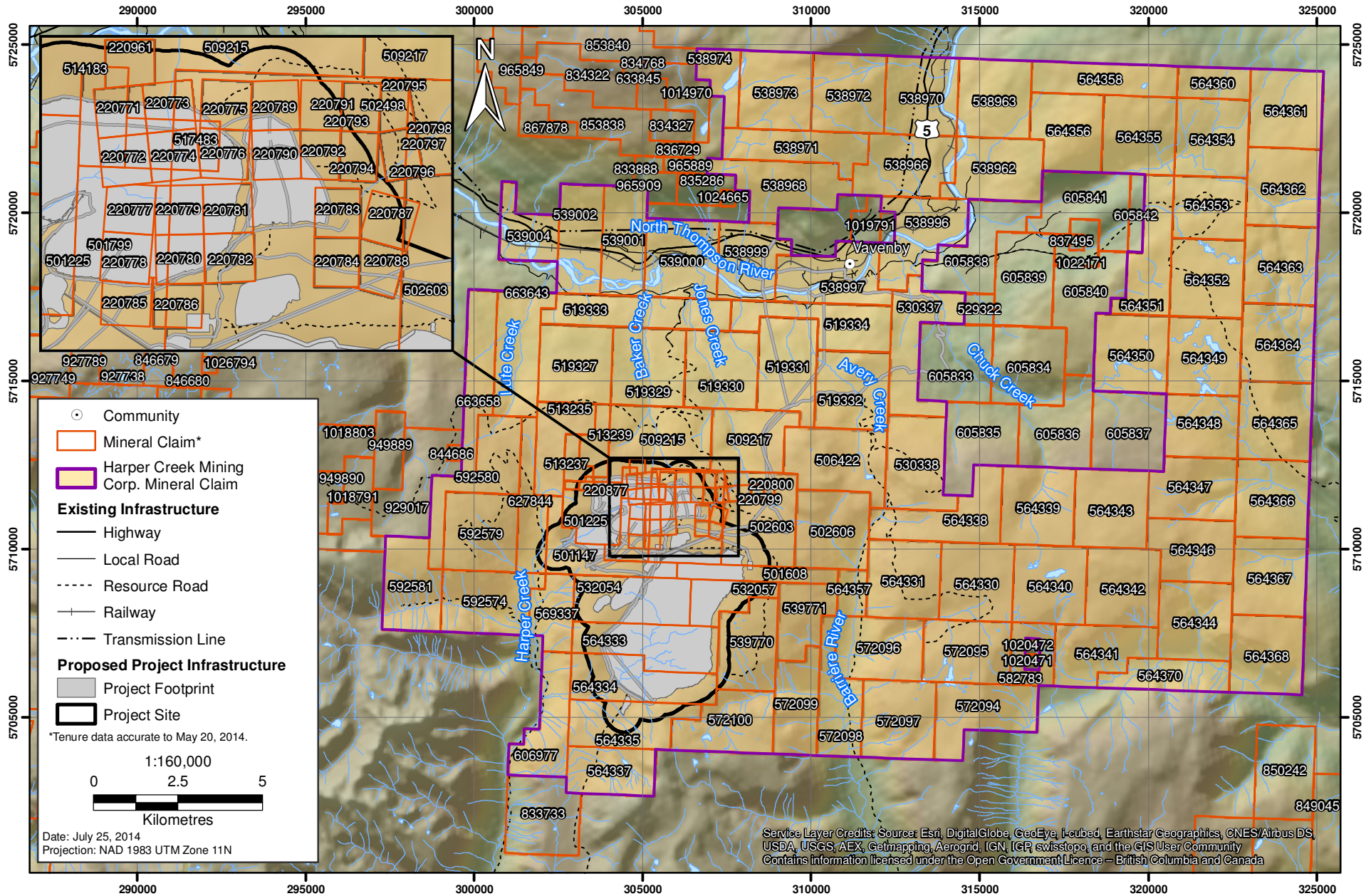


Table 5.2-1. Harper Creek Project Mineral Claims

Tenure No.	Area (ha)	Ownership 100%	Good to Date	Tenure Type
220771	25	Yellowhead	2024/Nov/03	Legacy
220772	25	Yellowhead	2024/Nov/03	Legacy
220773	25	Yellowhead	2024/Nov/03	Legacy
220774	25	Yellowhead	2024/Nov/03	Legacy
220775	25	Yellowhead	2024/Nov/03	Legacy
220776	25	Yellowhead	2024/Nov/03	Legacy
220777	25	Yellowhead	2024/Nov/03	Legacy
220778	25	Yellowhead	2024/Nov/03	Legacy
220779	25	Yellowhead	2024/Nov/03	Legacy
220780	25	Yellowhead	2024/Nov/03	Legacy
220781	25	Yellowhead	2024/Nov/03	Legacy
220782	25	Yellowhead	2024/Nov/03	Legacy
220783	25	Yellowhead	2024/Nov/03	Legacy
220784	25	Yellowhead	2024/Nov/03	Legacy
220785	25	Yellowhead	2024/Nov/03	Legacy
220786	25	Yellowhead	2024/Nov/03	Legacy
220787	25	Yellowhead	2024/Nov/03	Legacy
220788	25	Yellowhead	2024/Nov/03	Legacy
220789	25	Yellowhead	2024/Nov/03	Legacy
220790	25	Yellowhead	2024/Nov/03	Legacy
220791	25	Yellowhead	2024/Nov/03	Legacy
220792	25	Yellowhead	2024/Nov/03	Legacy
220793	25	Yellowhead	2024/Nov/03	Legacy
220794	25	Yellowhead	2024/Nov/03	Legacy
220795	25	Yellowhead	2024/Nov/03	Legacy
220796	25	Yellowhead	2024/Nov/03	Legacy
220797	25	Yellowhead	2024/Nov/03	Legacy
220798	25	Yellowhead	2024/Nov/03	Legacy
220799	25	Yellowhead	2024/Nov/03	Legacy
220800	25	Yellowhead	2024/Nov/03	Legacy
220877	25	Yellowhead	2024/Nov/03	Legacy
220878	25	Yellowhead	2024/Nov/03	Legacy
220879	25	Yellowhead	2024/Nov/03	Legacy

(continued)

Table 5.2-1. Harper Creek Project Mineral Claims (continued)

Tenure No.	Area (ha)	Ownership 100%	Good to Date	Tenure Type
220961	25	Yellowhead	2024/Nov/03	Legacy
501147	342.02	Yellowhead	2024/Nov/03	MTO Cell
501225	301.71	Yellowhead	2024/Nov/03	MTO Cell
501608	221.33	Yellowhead	2024/Nov/03	MTO Cell
501799	181.05	Yellowhead	2024/Nov/03	MTO Cell
502498	583.32	Yellowhead	2024/Nov/03	MTO Cell
502603	603.43	Yellowhead	2024/Nov/03	MTO Cell
502606	502.87	Yellowhead	2024/Nov/03	MTO Cell
506422	562.99	Yellowhead	2024/Nov/03	MTO Cell
509215	603.17	Yellowhead	2024/Nov/03	MTO Cell
509217	422.21	Yellowhead	2024/Nov/03	MTO Cell
513235	321.7	Yellowhead	2024/Nov/03	MTO Cell
513237	80.43	Yellowhead	2024/Nov/03	MTO Cell
513239	140.75	Yellowhead	2024/Nov/03	MTO Cell
514183	40.22	Yellowhead	2024/Nov/03	MTO Cell
517483	20.11	Yellowhead	2024/Nov/03	MTO Cell
519327	502.43	Yellowhead	2024/Nov/03	MTO Cell
519329	502.43	Yellowhead	2024/Nov/03	MTO Cell
519330	502.43	Yellowhead	2024/Nov/03	MTO Cell
519331	502.41	Yellowhead	2024/Nov/03	MTO Cell
519332	502.47	Yellowhead	2024/Nov/03	MTO Cell
519333	502.27	Yellowhead	2024/Nov/03	MTO Cell
519334	462.09	Yellowhead	2024/Nov/03	MTO Cell
530337	502.33	Yellowhead	2024/Nov/03	MTO Cell
530338	502.67	Yellowhead	2024/Nov/03	MTO Cell
532054	482.98	Yellowhead	2024/Nov/03	MTO Cell
532057	241.48	Yellowhead	2024/Nov/03	MTO Cell
538962	501.81	Yellowhead	2024/Nov/03	MTO Cell
538963	501.61	Yellowhead	2024/Nov/03	MTO Cell
538966	501.81	Yellowhead	2024/Nov/03	MTO Cell
538968	501.88	Yellowhead	2024/Nov/03	MTO Cell
538970	501.61	Yellowhead	2024/Nov/03	MTO Cell
538971	421.49	Yellowhead	2024/Nov/03	MTO Cell
538972	501.61	Yellowhead	2024/Nov/03	MTO Cell

(continued)

Table 5.2-1. Harper Creek Project Mineral Claims (continued)

Tenure No.	Area (ha)	Ownership 100%	Good to Date	Tenure Type
538973	501.61	Yellowhead	2024/Nov/03	MTO Cell
538974	200.63	Yellowhead	2024/Nov/03	MTO Cell
538996	502.01	Yellowhead	2024/Nov/03	MTO Cell
538997	502.14	Yellowhead	2024/Nov/03	MTO Cell
538999	421.77	Yellowhead	2024/Nov/03	MTO Cell
539000	502.11	Yellowhead	2024/Nov/03	MTO Cell
539001	421.73	Yellowhead	2024/Nov/03	MTO Cell
539002	421.73	Yellowhead	2024/Nov/03	MTO Cell
539004	281.14	Yellowhead	2024/Nov/03	MTO Cell
539770	442.84	Yellowhead	2024/Nov/03	MTO Cell
539771	322	Yellowhead	2024/Nov/03	MTO Cell
564330	503.01	Yellowhead	2024/Nov/03	MTO Cell
564331	503.01	Yellowhead	2024/Nov/03	MTO Cell
564333	503.23	Yellowhead	2024/Nov/03	MTO Cell
564334	503.34	Yellowhead	2024/Nov/03	MTO Cell
564335	463.1833	Yellowhead	2024/Nov/03	Mineral Claim
564337	362.5917	Yellowhead	2024/Nov/03	Mineral Claim
564338	502.8196	Yellowhead	2024/Nov/03	Mineral Claim
564339	502.7818	Yellowhead	2024/Nov/03	Mineral Claim
564340	503.0087	Yellowhead	2024/Nov/03	Mineral Claim
564341	442.8144	Yellowhead	2024/Nov/03	Mineral Claim
564342	503.0083	Yellowhead	2024/Nov/03	Mineral Claim
564343	502.7818	Yellowhead	2024/Nov/03	Mineral Claim
564344	503.1017	Yellowhead	2024/Nov/03	Mineral Claim
564346	442.5459	Yellowhead	2024/Nov/03	Mineral Claim
564347	462.5005	Yellowhead	2024/Nov/03	Mineral Claim
564348	402.0263	Yellowhead	2024/Nov/03	Mineral Claim
564349	502.3277	Yellowhead	2024/Nov/03	Mineral Claim
564350	502.3298	Yellowhead	2024/Nov/03	Mineral Claim
564351	461.8769	Yellowhead	2024/Nov/03	Mineral Claim
564352	502.0996	Yellowhead	2024/Nov/03	Mineral Claim
564353	401.5149	Yellowhead	2024/Nov/03	Mineral Claim
564354	501.6872	Yellowhead	2024/Nov/03	Mineral Claim
564355	501.6924	Yellowhead	2024/Nov/03	Mineral Claim
564356	461.5516	Yellowhead	2024/Nov/03	Mineral Claim
564357	120.7333	Yellowhead	2024/Nov/03	Mineral Claim

(continued)

Table 5.2-1. Harper Creek Project Mineral Claims (completed)

Tenure No.	Area (ha)	Ownership 100%	Good to Date	Tenure Type
564358	401.2258	Yellowhead	2024/Nov/03	Mineral Claim
564360	200.6108	Yellowhead	2024/Nov/03	Mineral Claim
564361	501.5948	Yellowhead	2024/Nov/03	Mineral Claim
564362	501.824	Yellowhead	2024/Nov/03	Mineral Claim
564363	502.0528	Yellowhead	2024/Nov/03	Mineral Claim
564364	502.2816	Yellowhead	2024/Nov/03	Mineral Claim
564365	502.5096	Yellowhead	2024/Nov/03	Mineral Claim
564366	502.7379	Yellowhead	2024/Nov/03	Mineral Claim
564367	502.9658	Yellowhead	2024/Nov/03	Mineral Claim
564368	503.1923	Yellowhead	2024/Nov/03	Mineral Claim
564370	322.0876	Yellowhead	2024/Nov/03	Mineral Claim
569337	261.6354	Yellowhead	2024/Nov/03	Mineral Claim
572094	503.3905	Yellowhead	2024/Nov/03	Mineral Claim
572095	483.0856	Yellowhead	2024/Nov/03	Mineral Claim
572096	483.0853	Yellowhead	2024/Nov/03	Mineral Claim
572097	503.417	Yellowhead	2024/Nov/03	Mineral Claim
572098	382.5648	Yellowhead	2024/Nov/03	Mineral Claim
572099	382.5738	Yellowhead	2024/Nov/03	Mineral Claim
572100	463.1775	Yellowhead	2024/Nov/03	Mineral Claim
582783	201.2855	Yellowhead	2024/Nov/03	Mineral Claim
592574	503.1198	Yellowhead	2024/Nov/03	Mineral Claim
592579	502.92	Yellowhead	2024/Nov/03	MTO Cell
592580	462.54	Yellowhead	2024/Nov/03	MTO Cell
592581	442.72	Yellowhead	2024/Nov/03	MTO Cell
606977	415.44	Yellowhead	2024/Nov/03	MTO Cell
627844	301.71	Yellowhead	2024/Nov/03	MTO Cell
663643	502.4	Yellowhead	2024/Nov/03	MTO Cell
663658	401.97	Yellowhead	2024/Nov/03	MTO Cell
TOTAL	42,636.48			

5.2.3 Current Access

Current road access to the mine site area from Kamloops is via Highway 5 to Birch Island, then across the North Thompson River and eastward along the Birch Island-Lost Creek Road (BILCR) for approximately 11 km to the Jones Creek FSR intersection. The Jones Creek FSR provides excellent access to the mine site area. The BILCR continues eastward from the Jones Creek FSR intersection for 5.5 km to the town of Vavenby, located on the north side of the North Thompson River with access to Highway 5.

5.3 PROJECT HISTORY

5.3.1 Prior Ownership

In April 1966, Noranda discovered copper mineralization at the headwaters of Baker Creek through a program of prospecting and stream sediment sampling. In June 1966, Quebec Cartier (100% wholly owned subsidiary of US Steel) discovered copper mineralization at the headwaters of a tributary of Harper Creek through a similar program of prospecting and stream sediment sampling. Staking by the two companies in 1966 resulted in ground west of Harper Creek tributary belonging to Noranda (Harper Creek Claims) and east of Harper Creek belonging to Quebec Cartier (Hail Claims). The two companies worked independently on their respective properties from 1967 until mid-1970. In late 1970 the two companies began the joint venture exploration of their contiguous copper deposits until 1974.

The next recorded work program on either property was in 1986, when Aurun Mines Ltd. (Aurun) signed an option agreement with Quebec Cartier (April 22, 1986). On July 16, 1991, Quebec Cartier officially terminated the option agreement with Aurun (at this time insolvent and in receivership).

In 1996, American Comstock purchased the Noranda claims and acquired an option on the Quebec Cartier claims (now held by Cygnus Mines Limited, but still a wholly owned subsidiary of US Steel). Eventually American Comstock dropped the Cygnus option, but maintained ownership of the Noranda group of claims.

YMI obtained control of the Harper Creek claims through a series of claim staking, purchase and option agreements by 2005. In the same year YMI located the historical core from the Noranda drilling campaigns from which selected holes were logged and sampled with the goal of verifying the historical analytical copper results (Naas, 2006). In 2006, YMI undertook the first phase of field exploration on the Harper Creek claims.

In November 2010, all assets were transferred to HCMC, a wholly owned subsidiary of YMI.

5.3.2 Early Exploration

Additional details relevant to this section can be found in [Appendix 5-A](#), Technical Report and Feasibility Study, for the Project.

Early exploration drilling commenced with Quebec Cartier in 1967 with six NQ-sized diamond drill holes totaling 546.19 m drilled within the current pit area. One hundred and seventy four (174) samples were collected for copper analysis. In 1969, Quebec Cartier completed a further 27 BQ-sized drill holes totaling 4,737.21 m. Three of these drill holes targeted the “M” anomaly, located approximately 3 km to the east of the current pit area. In total, 1,529 samples were collected and analysed for copper. Following completion of these holes, no further drilling was conducted on the Quebec Cartier ground until the joint venture exploration program commenced in late 1970.

In 1968, Noranda commenced drilling and between 1968 and 1970 drilled 87 holes totalling 12,150.32 m, focused primarily on the western side of the current pit area. In total 3,746 samples were collected and analysed for copper.

From late 1970 onward, drilling on the Noranda and Quebec Cartier properties was undertaken through a joint venture program, managed by Noranda. In 1970, 12 holes totaling 2,328.69 m were completed and a further 27 holes totaling 5,593.67 m were completed in 1971. Diamond drilling continued in 1972 and the program completed four drill holes totaling 456.74 m. In 1973, a limited exploration program of Very Low Frequency electromagnetics (22.53 km) and five diamond drill holes totaling 625.45 m was undertaken. In 1974, only geological mapping of newly cut logging roads and relogging of historical drill core was undertaken.

In April 1986, Aurun investigated the potential for high grade Cu-Mo deposits, checked the possible presence of precious metal content of the massive sulphide layers of the deposit, determined significance of titanium-bearing minerals, and investigated leaching possibilities of the low grade copper mineralization. Information was gathered by sampling historical trenches and sampling of selected historical drill core. Fourteen (14) surface samples and 39 drill core samples were collected from historical trenches and drill holes and analyzed for gold and silver and titanium dioxide.

In 1996, American Comstock purchased the Noranda claims and acquired an option on the Quebec Cartier claims (now held by Cygnus Mines Limited, but still a wholly owned subsidiary of US Steel). American Comstock drilled 2,847 m in eight holes and 686 samples were analysed for copper, molybdenum and silver. Eventually American Comstock dropped the Cygnus option, but maintained ownership of the Noranda group of claims.

In addition to exploration drilling, additional exploration activities undertaken on the property between 1966 and 1973 included soil sampling and a number of geophysical surveys.

5.3.3 HCMC Exploration

Additional details relevant to this section can be found in the technical report and feasibility study for the Project ([Appendix 5-A](#), Technical Report and Feasibility Study).

YMI/HCMC has undertaken diamond drilling on the Property from 2006 to 2013, with a total of 217 drill holes totalling 64,989.54 m completed. Drilling has been undertaken in four main programs: resource; condemnation; metallurgical; and geomechanical/geotechnical.

Resource diamond drilling was undertaken at the deposit, both within the main body of mineralization to increase the confidence of the resource, as well as along strike and down dip to expand the resource. The drilling was undertaken in seven phases from 2006 to 2013, summarized as follows:

• 2006	7 holes	4,101.40 m
• 2007	5 holes	15,879.94 m
• 2008	26 holes	7,602.92 m
• 2010	37 holes	3,486.92 m
• 2011	12 holes	15,571.31 m
• 2012	12 holes	3,803.29 m
• 2013	23 holes	8,166.16 m
• TOTAL	165 holes	58,611.94 m

A total of 46,275 drill core samples were collected and submitted for geochemical analysis. Geological and geochemical information obtained from this drilling was also used to develop and improve the geological understanding of the deposit model.

In 2011, a condemnation diamond drilling program was undertaken to test for potential mineralization below the proposed mine site infrastructure locations. A total of 1,790.98 m of NQ-sized diamond drill core was drilled in eight drill holes and a total of 571 drill core samples were collected and submitted for geochemical analysis. In general, the drill holes exhibited no significant copper mineralization.

As part of earlier feasibility investigations in 2011, a diamond drilling program was undertaken to collect drill core for metallurgical and crushing/grinding test-work as well as geomechanical/geotechnical analysis. In total, 36 holes were drilled for a total of 4,144.12 m, summarized as follows:

- | | | |
|-----------------|----------|------------|
| • Metallurgical | 4 holes | 441.04 m |
| • Geomechanical | 8 holes | 2,433.13 m |
| • Geotechnical | 24 holes | 1,269.95 m |

A total of 1,216 drill core samples were collected and submitted for geochemical analysis from 19 of the 32 holes drilled for geomechanical/geotechnical analysis.

In 2012, a further eight HQ-sized drill holes totaling 442.50 m were drilled for geotechnical analyses but no samples were submitted for geochemical analysis.

In addition to the exploration drilling carried out on the property, YMI has also carried out airborne geophysics (magnetic and electromagnetic), soil sampling, ground geophysics (magnetic, electromagnetic and induced polarization), rock sampling and geological mapping on the property since 2006. Additional studies have included petrographic and whole rock analyses of drill core and surface rock samples.

5.3.4 HCMC Development

In 2011, HCMC published the results of a preliminary economic assessment (PEA 2011)) of the Project, and in 2012 (Merit 2012) the company completed a feasibility study of the Project that included:

- infill and step out drilling for resource confirmation;
- geomechanical, geotechnical and hydrological drill holes for pit and tailings dam design and foundation testing for proposed infrastructure sites;
- large diameter holes for metallurgical samples for detailed metallurgical test work; and
- condemnation drilling.

The study established the design criteria for a 70,000 tonnes per day processing plant to produce a copper concentrate.

In 2014, HCMC published the results of an updated feasibility study for the Project ([Appendix 5-A, Technical Report and Feasibility Study](#)), which incorporated a number of design changes with respect to the Project footprint and general arrangement, and included updated mineral resource and reserve estimates, updated capital and operating cost estimates, as well as an updated economic analysis of the Project.

5.3.5 Application for Environmental Assessment Certificate

In April 2013, HCMC submitted an Application for an Environmental Assessment Certificate/Environmental Impact Statement (Application/EIS) for the proposed Project. Screening comments were received from the BC EAO, the CEA Agency, and a range of other agencies involved in the screening review, which highlighted additional information requirements in the Application/EIS as compared against the Project Application Information Requirements. HCMC has invested substantial effort to address the screening review comments, including the collection of additional baseline data, alterations to the Project design layout, and updates to modelling and effects assessments for this revised Application/EIS.

5.4 TERRAIN AND LANDFORMS

5.4.1 Terrain and Landforms

The surficial geology and landforms within the Reconnaissance Terrain Study Area (Knight Piésold 2012) are predominantly the result of previous glaciations. The rounded nature of the mountain slopes and the presence of glacial till indicate that most of the study area was glaciated under thick ice. Glacial lakes developed locally as the ice retreated, resulting in deposits of clay and fine sand. Fine sediments, comprising silts and fine sands, accumulated in the lakes. Coarser beach deposits, comprising gravelly sands, accumulated along the shorelines. With the continuing retreat of the ice sheet, the ice dams breached and the lakes dissipated, giving way to swamps. Organic soils accumulated in the swamps as a result of the decomposition of vegetation.

Extensive kames, comprising hummocky terrain and terraces, accumulated at the toe of the North Thompson River Valley. Glacial deposits were eroded by the North Thompson River, resulting in the formation of glaciofluvial terraces. Colluvium has developed locally on the steeper side slopes of the valley as a result of soil creep and landslides. The North Thompson River is actively depositing coarse alluvium within its channel and finer sediments on its floodplain.

5.4.2 Soils and Surficial Materials

Terrain mapping indicates that a blanket of glacial till overlies much of the bedrock in the Project Site. A surface veneer of colluvium is generally present in the steeper areas of terrain and weathered bedrock is locally present. Colluvium is expected to be more prevalent, particularly on the moderately steep slopes.

Surficial soils at the Project Site locally comprise organic soils and silt-rich glacial lake deposits. These soils are particularly prone to erosion after stripping the vegetation. The area of the proposed TMF comprises a broad valley with gentle side slopes in the headwaters of the Harper Creek

catchment. On the valley side slopes, the weathered bedrock is generally mantled by glacial till. The surficial geology on the valley floor was mapped as glacial lake deposits with local organic swamps.

The north portion of the proposed power line alignment crosses glaciofluvial outwash deposits and alluvial deposits on the floor of the North Thompson River Valley and a kame deposit at the toe of the valley slopes. The site of the proposed rail load-out facility is located on a fluvial terrace.

The glacial till encountered generally comprises fine to coarse gravel with trace to some sand and silt and trace cobbles. Where organic soils occur, they range from brown-black spongy fibrous peat to organic silt with some fine sand and many plant remains. The alluvium is anticipated to predominantly comprise coarse soils. The glacial lake deposits vary from a silt with some fine sand to a fine to coarse sand with much fine to coarse gravel.

[Appendix 5-B](#), Terrain and Soils Baseline Report, provides a detailed description of the Project's terrain, landforms, soils, and surficial materials.

5.4.3 Geohazard Assessment

Geohazards mapped within the study area include debris slides, debris flows, debris slumps, rockfall, slumping in bedrock, and snow avalanche.

Steep-sided gully walls of all the larger creeks on the south side of the North Thompson River, including Baker, Jones, Avery, Chuck, P, and T Creeks, are the most common terrain types where debris slides, debris flows, and debris slumps occur. These landslides initiate in till, glaciofluvial sediments, and weak rock types (fissile sedimentary bedrock and foliated metamorphic bedrock). Debris slides and slumps are present on the steep river banks of the North Thompson River, especially where these slopes are undercut by the river.

Rockfall occurs from isolated bedrock cliffs scattered throughout the study area. A large bedrock slump is located north of T Creek and further detailed assessment of the identified bedrock slump is recommended. The avalanche risk is low as most of the Project Site is located on a gently sloping plateau and mostly confined to isolated patches on the south-facing slopes at the site of the proposed non-PAG waste rock stockpile. Additional hazards may occur after mature vegetation is stripped during mine development.

In general, it is unlikely that any potential geohazards initiating from the upslope areas to the north, northeast, and east of the Mine Site will reach existing and proposed mine infrastructure. Proposed mine infrastructure is located on and above potentially unstable terrain in P Creek and geohazards initiating here could potentially have downstream effects. The Main Embankment and South TMF Water Management Pond are located upslope away from potentially unstable terrain in T Creek and adjacent the bedrock slump. A detailed description of the proximity of geohazards and potentially unstable terrain with respect to existing and proposed Project infrastructure is provided in [Appendix 5-C](#), Terrain Mapping and Geohazards.

The findings of a seismicity assessment carried out for the Project are reported in Section 5.5.4 below.

5.5 PROJECT GEOLOGY

The geological setting and mineralization of the Harper Creek deposit presented in this section is based on Naas (2012b). Additional detail, including further description and geological sections are provided in [Appendix 5-A](#) and [5-H](#).

5.5.1 Regional Geology

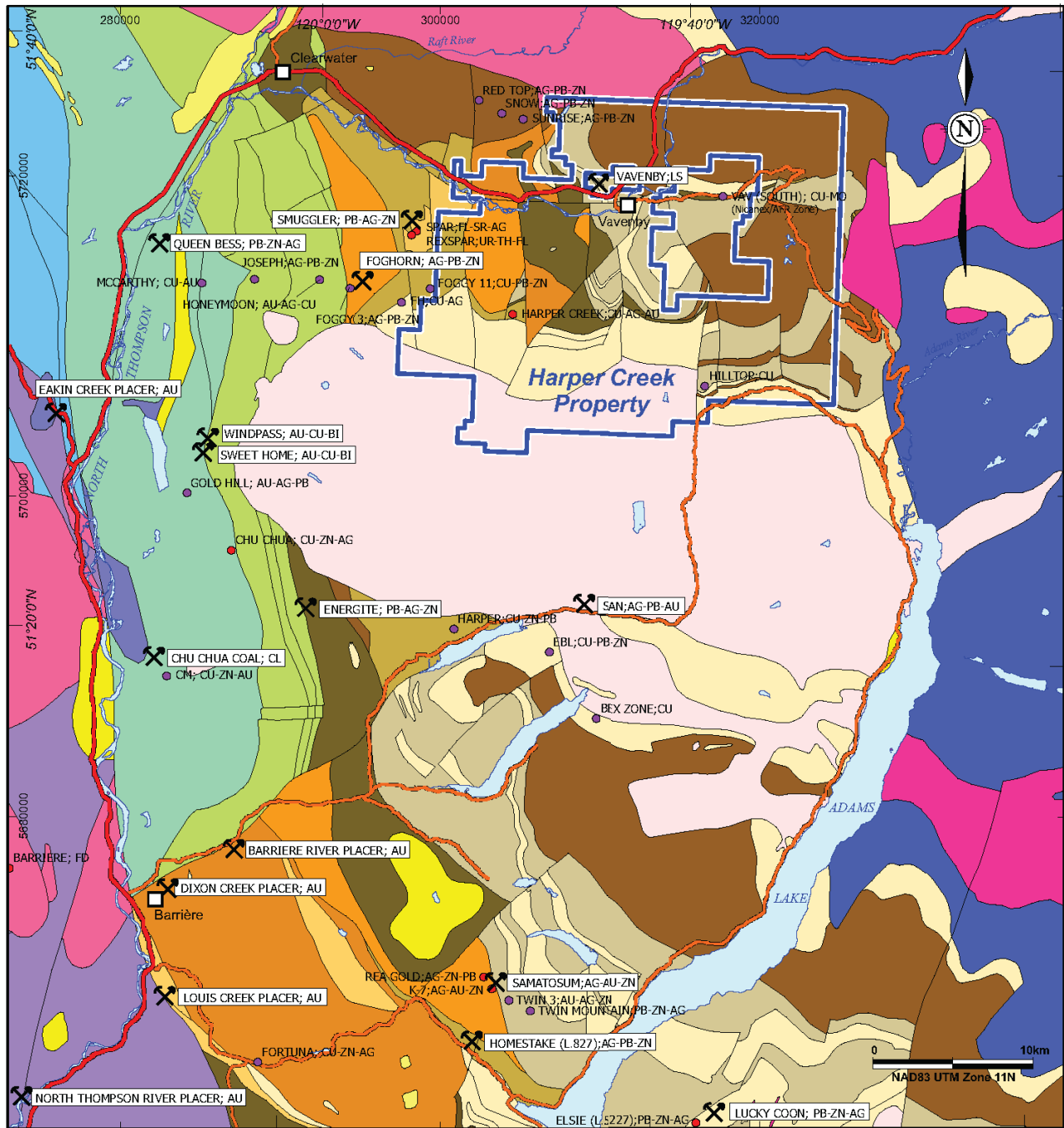
The Project is located within structurally complex, low-grade metamorphic rocks of the Eagle Bay Assemblage, part of the Kootenay Terrane on the western margin of the Omineca Belt in southcentral BC (Figure 5.5-1). This assemblage is flanked by high-grade metamorphic rocks of the Shuswap Complex immediately to the east, also part of the Kootenay Terrane, and by rocks of the Fennell Assemblage immediately to the west. Other factors contributing to the complexity of the area are its situation immediately east of the Quesnel Terrane representing a Late Triassic to Early Jurassic magmatic arc that formed along or near the western North American continental margin. Additionally, the Project Site also lies within the Cretaceous Bayonne plutonic belt (Logan 2002) represented by two large batholiths, the Baldy batholith to the south and the Raft batholith to the north of the deposit.

The Eagle Bay Assemblage incorporates Lower Cambrian to Mississippian sedimentary and volcanic rocks deformed and metamorphosed during the Jurassic-Cretaceous orogeny (Scharizza and Preto 1987). The assemblage is divided into four northeast-dipping thrust sheets that collectively contain a succession of Lower Cambrian rocks overlain by a succession of Devonian-Mississippian rocks. The Lower Cambrian (and possibly Late Proterozoic) rocks include quartzites, grits, and quartz mica schists (Units EBH and EBQ), mafic metavolcanic rocks, and limestone (Unit EBG), and overlying schistose sandstones and grits (Unit EBS) with minor calcareous and mafic volcanic units. These older units are overlain by a "...Devonian-Mississippian succession of mafic to intermediate metavolcanic rocks (Units EBA and EBF) intercalated with and overlain by dark grey phyllite, sandstone and grit (Unit EBP)" (Scharizza and Preto 1987).

The Harper Creek deposit is hosted by Unit EBA of the Devonian-Mississippian succession (Scharizza 1986b, 1986a; Scharizza and Preto 1987). South of the Harper Creek deposit, Unit EBA is overthrust by the Lower Cambrian greenstones, chloritic phyllites, quartzitic units and orthogneiss of Unit EBG, and north of the deposit, by dominantly metasedimentary rocks of Unit EBP (Scharizza 1986a; Scharizza and Preto 1987). According to Bailey et al. (2001), the Devonian volcanic rocks of the Eagle Bay Assemblage belong to bimodal basalt-rhyolite association with alkalic affinity corresponding to a rifted continental marginal setting. The Eagle Bay assemblage in southcentral BC contains numerous although small polymetallic massive sulphide deposits, mainly within Devonian felsic volcanic rocks, formed in an arc volcanic environment in response to eastward subduction of a paleo-Pacific ocean (Hoy and Goutier 1986; Hoy 1996; Bailey, Paradis, and Johnston 2001).

The Fennell Formation outcrops regionally to the northeast of Harper Creek and comprises Devonian to Permian oceanic rocks of the Slide Mountain Terrane. These units have been tectonically emplaced over the Mississippian rocks of the Eagle Bay Assemblage early in the Mesozoic. The Fennell Formation comprises two major divisions. The lower structural division is a heterogeneous assemblage of bedded chert, gabbro, diabase, pillowed basalt, sandstone, quartz-feldspar-porphyrty rhyolite, and intraformational conglomerate. The upper division consists almost entirely of pillowed and massive basalt, with minor bedded cherts and gabbros.

Figure 5.5-1
Regional Geology
and Economic Setting



- LEGEND**
- Quaternary**
 - Basaltic volcanics
 - Tertiary**
 - Kamloops Group: undifferentiated volcanics
 - Tertiary-Mesozoic**
 - Granite, quartz porphyry
 - Mesozoic**
 - Baldy Batholith: quartz monzonite
 - Granodiiorite
 - Nicola Group: sediments
 - Mesozoic-Paleozoic**
 - Harper Ranch and(?) Nicola Groups: seds
 - Paleozoic**
 - Fennell Assemblage: Upper/Lower Structural Division
basaltic volcanic/marine sediments, volcanics
 - Mount Ida Assemblage: metamorphics (calcsilicates)
 - Proterozoic-Paleozoic**
 - Shuswap Assemblage
 - Eagle Bay Assemblage: undifferentiated
 - Dixon Ridge Unit
 - Foghorn Mountain Unit
 - Forest Lake Unit
 - Graffunder Lakes Unit
 - Johnson Lake Unit
 - Rexspar Unit
 - Skwaam Bay Unit
 - Slate Creek Unit
 - Mineral Occurrences (BC Minfile)**
 - ✂ Past Producer
 - Developed Prospect
 - Prospect

Geology after BCGS Open File 2005-1
Mineral occurrences modified from BC Minfile

YELLOWHEAD MINING INC.

**REGIONAL GEOLOGY
AND ECONOMIC SETTING**

Harper Creek Project
Kamloops M.D., British Columbia, Canada

Project No: C111	By: TV
Scale: 1:350,000	Drawn: TV
Figure: 7-1	Date: March 2014

The Fennell Formation is thought to be the deep oceanic basin, distal equivalent to the Eagle Bay Assemblage through striking similarities in sandstone units found in both formations with the sandstone of the Fennell Formation hypothesized as being derived from the sandstones of the Eagle Bay Assemblage. The Devonian quartz-feldspar-porphyry rhyolites found in the Fennell Formation and the Devonian felsic volcanic rocks found in the Eagle Bay Assemblage bear resemblance to each other and are hypothesized as being an expression of the same igneous activity. As such, the Fennell succession is inferred to comprise an imbricated marginal basin suite that was originally not far removed from the Eagle Bay Terrane (Schiarizza and Preto 1987).

The Quesnel Trough, or Quesnel Terrane, is characterized by a Late Triassic to Early Jurassic magmatic arc that formed along or near the western North American continental margin. This arc is represented by Middle to Upper Triassic volcanic and sedimentary rocks that belong mostly to high-potassium to shoshonitic rock series, locally with low-potassium calc-alkaline volcanics. Late Triassic to Early Jurassic (~212 million years ago (Ma) to 173 Ma) subalkaline to alkaline intrusions are abundant, in total forming a belt extending for over 500 km north-northwest (e.g. Mortimer 1987; Panteleyev et al. 1996; Schiarizza and Boulton 2006). The Quesnel Terrane is well known for its porphyry deposits containing copper, gold, and molybdenum. The world-class Highland Valley Cu-Mo porphyry deposits are related to calc-alkaline plutonic rocks of the Late Triassic Guichon Creek batholith (Casselmann, McMillan, and Newman 1995). The Gibraltar Cu-Mo deposit is associated with Late Triassic (2 15±0.8 Ma) sodic calc-alkaline Granite Mountain batholith (Bysouth et al. 1995; Ash and Riveros 2001).

As emphasized by Schiarizza and Boulton (2006), somewhat younger, latest Triassic alkaline plutons define a wide belt to the east of these calc-alkaline deposits, and host important Cu-Au alkalic porphyry deposits, including the Afton mine and associated occurrences within the Iron Mask batholith near Kamloops, and the Mount Polley mine (Fraser et al. 1995; Mortensen, Ghosh, and Ferri 1995; Ross, Godwin, and Dawson 1995; Logan and Mihalynuk 2005). A possible superposition of the Quesnel (Late Paleozoic-Jurassic) and more easterly Devonian-Mississippian arc assemblages is recognized as a common phenomenon in Canadian Cordillera (e.g., Nelson and Friedman 2004).

The Mid-Cretaceous Bayonne Plutonic Suite forms a belt that extends roughly north-south and consists of mostly peraluminous, subalkalic hornblende-biotite granodiorite and highly fractionated two-mica granites, aplites and pegmatites (Logan 2002). In the Harper Creek deposit area, this plutonic suite is represented by the Baldy and Raft batholiths to the south and north of the Harper Creek deposit, respectively. The Baldy batholith is a west-trending multiphase pluton, which covers ~650 km² (Schiarizza and Preto 1987; Calderwood and van der Heyden 1990; Logan 2000, 2001). It intrudes into Proterozoic to mid-Paleozoic Kootenay Terrane metasedimentary and metavolcanic rocks and postdates most of the penetrative deformation in the area. The pluton incorporates potassium-feldspar megacrystic hornblende-biotite quartz monzonite, biotite monzogranite to granite, and biotite-muscovite granite.

As summarized by Logan (2000), the main part of the Baldy batholith is interpreted to have the mid-to Late-Cretaceous age of crystallization of some 129±4 to 99.7±4 Ma. However, quartz monzodiorite of the Honeymoon stock located on the southern margin of the batholith has yielded a Middle Jurassic U-Pb date of 161±7.8 Ma (Logan 2001). A variety of mineral occurrences is related to the pluton (Schiarizza and Preto 1987; Cathro and Lefebure 2000; Logan 2000, 2001). According to

Logan (2000, 2001), copper, copper-molybdenum porphyry, and base metal polymetallic vein showings are associated with the hornblende-biotite granite phase of the pluton. The muscovite-biotite granite is associated with pegmatites, aplites, and porphyry molybdenum mineralization. Areas encompassing the known intrusive-related deposits extend from the mainly steep-dipping contacts of the Baldy batholith at least as far as 7.5 km (Logan 2001).

The Raft batholith is an elongate granitic pluton that extends for about 70 km in a west-northwest direction, and cuts across the boundaries between the Kootenay, Slide Mountain, and Quesnel terranes (Schiarizza, Hefferman, and Zuber 2002). It is composed mostly of hornblende-biotite granodiorite to monzogranite intruded by dykes of pegmatite, aplite, and quartz-feldspar porphyry. The southern Raft batholith margin dips southward in exposures of deeper structural levels (Okulitch 1979). The main part of the Raft batholith is interpreted to have the late Early Cretaceous age of crystallization of some 105.5±0.5 Ma (Schiarizza and Boulton 2006). However, a much older date (168±14/-12 Ma) was obtained from a granodiorite sample (Calderwood and van der Heyden 1990). Therefore, similarly to the Baldy batholith, it is possible that the predominantly mid-Cretaceous Raft batholith encompasses some older, Middle Jurassic phases (Schiarizza and Boulton 2006).

5.5.2 Property Geology

The Project deposit is located within rocks of the Eagle Bay Assemblage of the Kootenay Terrane. The lithological succession found on the Property is interpreted as belonging to the Dgn, EBq, EBa, Ebf, and EBg units of the Eagle Bay assemblage (Schiarizza and Preto 1987). This succession consists of a series of orthogneiss, metasediments, metavolcanics, and metavolcanic clastics respectively, structurally overlain by the Tshinakin limestone unit belonging to unit Ebg. The nature of the structure in the region is a complex sequence of polyphase deformation consisting of a sequence of thrust faulting, intrusion-related folding and faulting, strike-slip, and normal faulting all of which impose a complex alteration and metamorphic fabric on the rocks.

The Project is an extensive volcanogenic hosted sulphide system within a mineralized envelope, as defined by drilling to date, greater than 2.5 km along strike, over 2.0 km down-dip, and 1 km thickness of volcano-sedimentary stratigraphy. Copper mineralization is tabular, striking east-west and dipping about 25° to 45° to the north including a number of high copper grade cores that persist with depth within a multi-phased stringer zone. The deposit is open along strike to the east, down dip to the north and at depth down section. A broad lower-grade zone of copper and gold/silver is linked to multi-phased stringer or feeder zones. Higher-grade copper-bearing massive sulphides are adjacent to porphyritic rhyolite domes. Regionally, vertical zonation of mineralization ranges from upper lead/zinc/silver/barite/pyrite to deeper copper (trace zinc)/silver/gold/pyrite/pyrrhotite. The Project deposit is located within the lower sequence.

5.5.3 Lithology, Faults, and Fractures

The geological legend has been updated and the 2014 Technical Report and Feasibility Study ([Appendix 5-A](#)) contains four primary lithologies encapsulated in nine packages.

The Harper Creek fault trends northeast and appears to dip approximately 70 to 75° to the southeast ([Appendix 5-A](#)). The fault commonly contains several wide zones of pale grey to green gougy faults

and localized quartz and iron carbonate-healed fault breccias. The structure is composed of several fault zones and varies in thickness from 20 to 50 m. The structure also contains several mafic andesitic dikes that are interpreted as late Tertiary dikes with no regional deformation.

5.5.4 Seismicity

A probabilistic seismicity assessment for the Project was carried out by Knight Piésold in 2012, as a required informant into the design parameters for the TMF and other Project geotechnical structures (Appendix 5-F, Seismicity Assessment). The findings indicated that shallow crustal earthquakes in the southeastern region of BC would be the predominant seismic hazard for the Project. Return periods of 5,000 and 10,000 years for earthquakes of 7.0 and 7.3 magnitude respectively were selected as conservative design parameters (KPL 2012).

The seismicity assessment points towards the Project being at low risk of a damaging seismic event. For example, for the entire period of the life of the mine and including a five decade post-closure phase, there is a 8% chance of a 1 in 1,000 year event occurring, with a Peak Ground Acceleration of 0.11, which would cause “light” structural damage at the surface (USGS 2014).

5.5.5 Ore Body Mineralization

The Project deposit is interpreted to be a polymetallic volcanogenic sulphide deposit, comprising lenses of disseminated, fracture-filling, and banded Fe and Cu sulphides with accessory magnetite. Mineralization is generally conformable with the host-rock stratigraphy, as it is consistent with the volcanogenic model. Sulphide lenses are observed to measure many tens of metres in thickness with kilometre-scale strike and dip extents. The current theory is that the Project deposit is a remobilized volcanogenic massive sulfide deposit.

The principal area of mineralization on the Property is located within the Harper Creek deposit. It occurs primarily as two styles that are separated by the northeast trending Harper Creek Fault. In the western and northern areas of the deposit (the West Domain), chalcopyrite mineralization is primarily observed in three copper-bearing horizons. The upper horizon ranges from 60 m to 170 m in width and is continuous along an east-west strike for some 1,320 m, dipping approximately 30° north. Mineralization within this horizon is hosted within felsic and mafic volcanics and volcanoclastic packages of rocks.

The middle horizon is not as well developed and is often fragmented. It is hosted mainly within a graphitic and variably silicified package of rocks that range from 30 to 40 m in width at the western extent, increasing up to 90 m locally eastward, and then gradually appearing to blend into the upper horizon. Of the three horizons, this horizon contains strong to intense silicification and localized fracture-fill tension fractures of mineralization. The lowest or third horizon is even less defined mainly due to a lack of drill intersections. It is commonly hosted within mafic to intermediate volcanoclastics and fragmental rocks and can range from 30 to 90 m in width; though more typical intersections are at the 30 m range. These horizons typically contain foliation-parallel wisps and bands as the dominant style of sulphide mineralization and are hosted within felsic and mafic metavolcanics and metavolcanoclastics.

In the eastern and southern areas (the East Domain) of the deposit. High angle, often discontinuous, tension fractures of pyrrhotite and chalcopyrite +/- bornite, frequently associated with quartz+carbonate as gangue, dominate these areas. This style is commonly observed within, but not limited to, the metasedimentary rocks and areas of increased pervasive silicification. Mineralization is not selective to individual units and is frequently observed to transgress lithological contacts throughout the area. Due to recently identified multiple east-west trending and northward dipping interpreted thrust faults (or possible reverse faults), isolating packages in this area has proven difficult.

At the near surface areas in the south and down dip to the north, mineralization widths typically range from 120 to 160 m. In the central area of the East Domain where thrust/reverse fault stacking has been interpreted, mineralization thicknesses typically range from 220 to 260 m with local intersections of up to 290 m. Generally the mafic metavolcanics and coarse-grained quartz-rich metasedimentary rocks contain higher grade copper mineralization. Little is known of the mineralization located outside of the Harper Creek deposit, as the primary focus of exploration has been on the deposit proper. Known showings include M Anomaly, Avery, and Northwest, as reflected in Figure 5.5-2. Like the Harper Creek Deposit, the principal mineralization of these areas is copper; however, barite is noted at the Northwest Showing

5.5.6 Waste Rock and Tailings Geochemistry

A metal leaching/acid rock drainage (ML/ARD) assessment of waste rock and tailings was undertaken by SRK as part of waste and water management planning for the Project (SRK 2012b). A more detailed description of ML/ARD management is provided in Section 5.9.4.

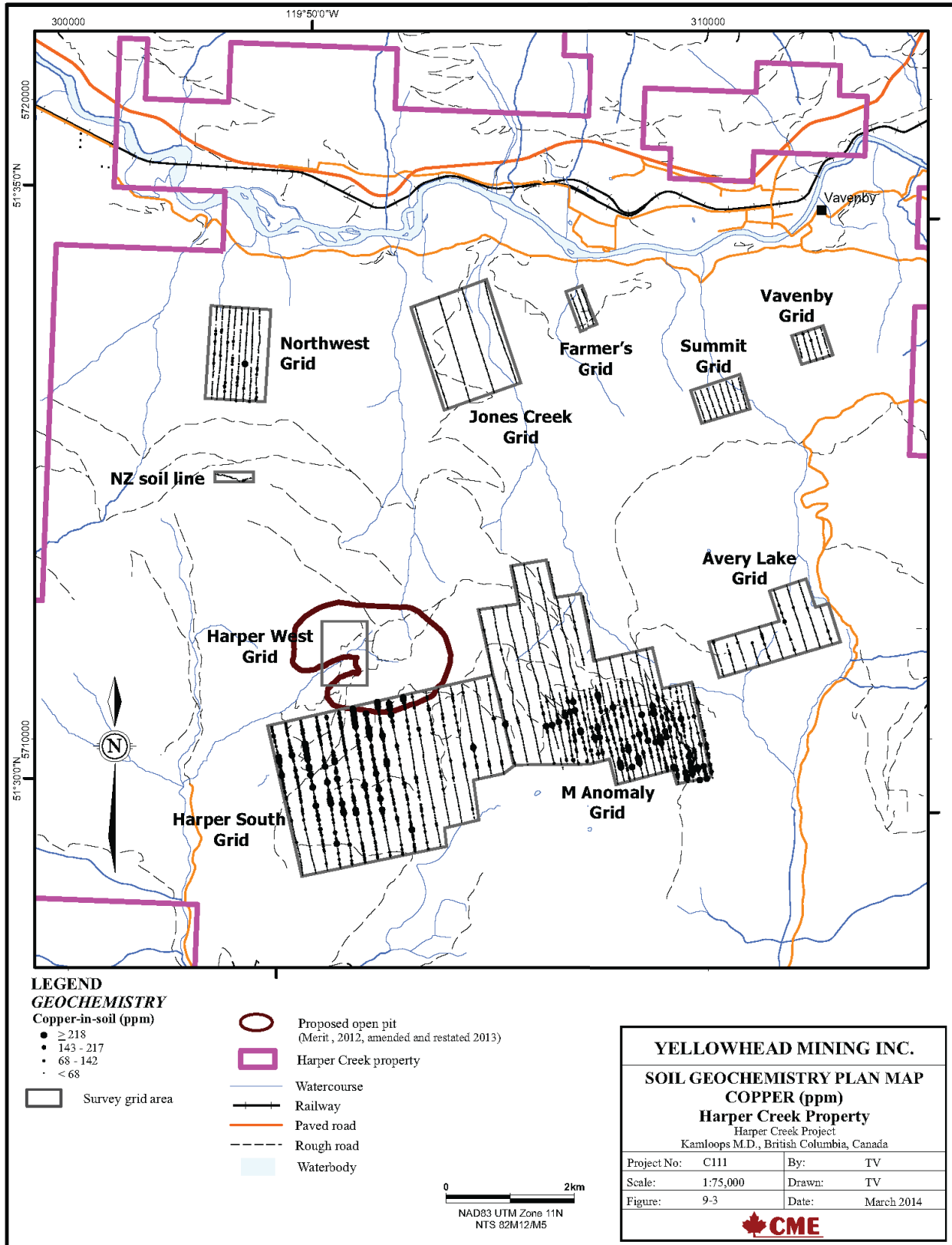
Waste rock characterization has advanced to the stage of block modelling of ARD potential to allow for evaluation of segregation of PAG waste rock from non-PAG waste rock as well as PAG/non-PAG LGO. Tailings testwork focused on the separate management of PAG and non-PAG tailings streams. Summary results from these investigations are provided below.

5.5.6.1 Waste Rock

The ML/ARD potential of waste rock was characterized by 140 samples specifically analyzed for ARD potential using the acid-base accounting (ABA) method (modified neutralization potential [NP] method described in MEND [1991]) and over 33,000 samples analyzed for trace elements as part of exploration activities.

Samples for ABA were selected initially from two holes available for sampling early in 2011 (Phase 1). A second set of samples (Phase 2) was selected by Geosim Services Inc. and SRK from a further 20 holes located throughout the pit area in order to provide a spatially and lithologically representative sample set.

Figure 5.5-2
Soil Geochemistry
Plan Map Copper (ppm)



The initial sample set showed that the concentrations of sulphur and calcium determined by inductively coupled plasma following a 4-acid digestion showed strong correlation with sulphur concentrations and NP determined as part of ABA, respectively. Due to the lack of primary sulphate minerals in the deposit, sulphur determined by inductively coupled plasma is a reliable indicator of sulphide mineral content (mainly pyrite and pyrrhotite) and can be used to calculate acid potential (AP):

$$\text{Sulphide (\%)} = 101.1 \log(S(4\text{-acid}), \%) - 0.04$$

$$\text{Acid Potential (kg CaCO}_3\text{/t)} = 31.25 \times \text{Sulphide (\%)}$$

Mineralogical characterization of waste rock samples showed that several different carbonate minerals (calcite, dolomite, ankerite, and siderite) are present. Interpretation of mineralogy and NP data has shown that bulk neutralization potential represents acid neutralizing carbonate content at NPs less than 100 kg CaCO₃/t and slightly over-estimates acid neutralizing carbonate content at NPs above 100 kg CaCO₃/t. Based on relationships between calcium content and NP, site-specific neutralization potential (NP*) can be estimated from:

$$\text{For NP} < 100 \text{ kg CaCO}_3\text{/t: NP}^* \text{ (kg CaCO}_3\text{/t)} = \text{NP}$$

$$\text{For NP} > 100 \text{ kg CaCO}_3\text{/t: NP}^* \text{ (kg CaCO}_3\text{/t)} = \text{NP} - 18$$

Where:

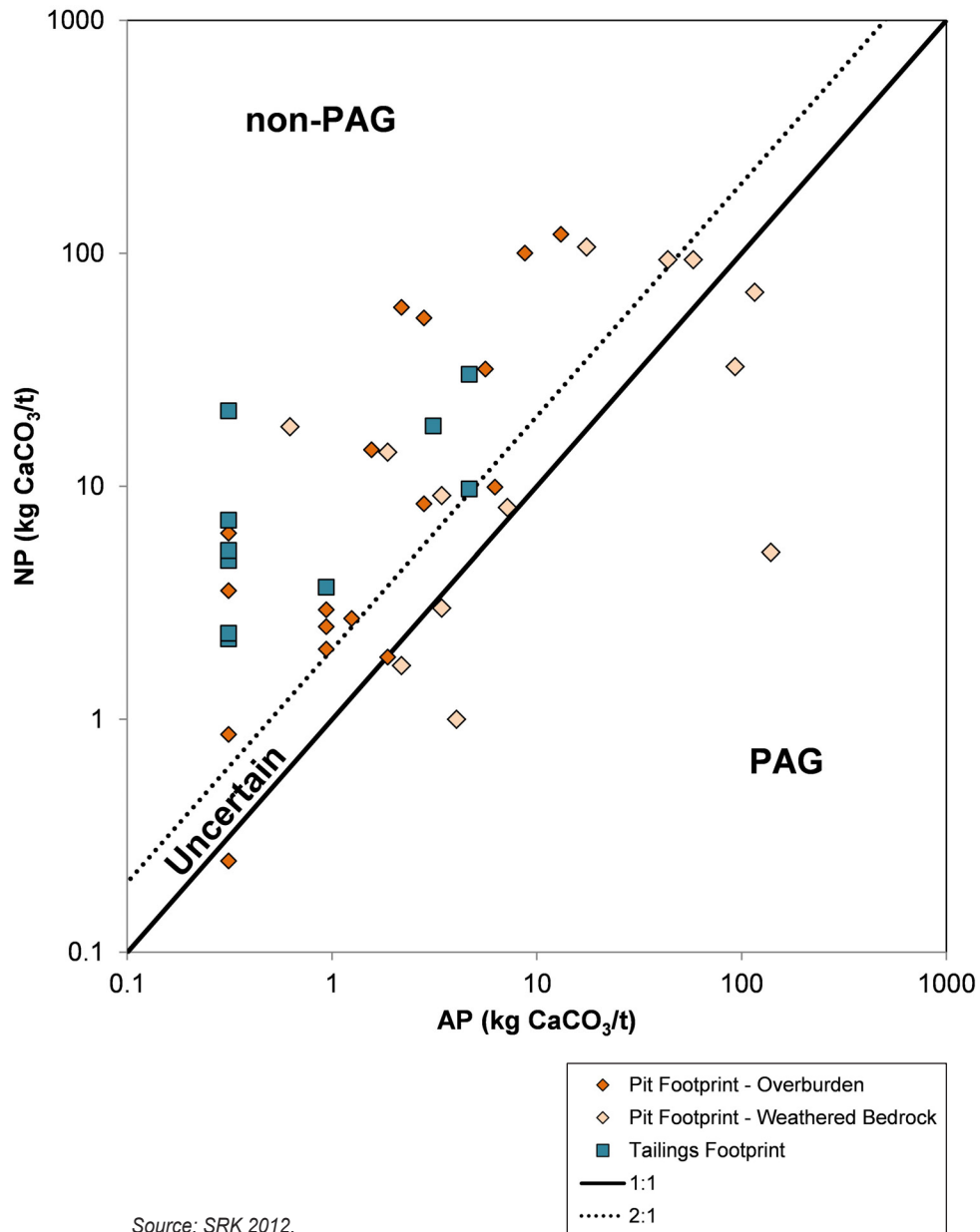
$$\text{NP, kg CaCO}_3\text{/t} = 100.8 \log(\text{Ca (\%)} \times (1,000/40)) + 0.49$$

Figure 5.5-3 (SRK 2012a) illustrates the resulting distribution of AP and NP*, and potential for ARD in waste rock samples. Waste rock with NP*/AP less than 1 is classified as PAG whereas non-PAG is defined as NP*/AP > 2. Between these two classifications, ARD potential is defined as uncertain. A PAG criterion of NP*/AP < 2 was selected at this stage for the purpose of classification because NP* represents carbonate with equivalent reactivity to calcite. For mine planning, a neutralization potential ratio of greater than 2.00 was classified as non-PAG, and PAG and uncertain waste rock were all treated as PAG.

This data set indicates that correlations of ARD potential with rock types are weak. Rock described as “altered” is generally classified as PAG, whereas dikes intruded after mineralization are non-PAG. Phyllite tends to be classified as PAG or uncertain. Schists show a range of classifications from non-PAG to PAG. Schists with quartz eyes tend to have higher acid potential (sulphide content) than schists lacking quartz eyes. Likewise, the presence of quartz eyes also correlates with higher carbonate content.

Metal leaching potential of waste rock has been assessed by comparison of element concentrations with global average values. Elements occurring at elevated (greater than 10 times) global average values include arsenic, cadmium, cobalt, copper, molybdenum, nickel, lead, selenium, and zinc. Most of these elements can be expected to leach under non-acidic conditions from non-PAG rock and PAG rock before the onset of acidic conditions. Several of these elements can also be expected to leach under acidic conditions.

Figure 5.5-3
 Distribution of AP and NP*
 for ARD in Waste Rock Samples



Preliminary results from assessment of ML/ARD potential for waste rock indicates that a range of ARD potentials can be expected based on a site-specific measure of NP/AP. Block modelling has been conducted to estimate volumes of PAG and non-PAG waste rock.

Based on elevated concentrations of several elements, leaching under non-acidic conditions may also be a consideration for waste rock management. The significance of these leaching effects is being evaluated by other test work, and is discussed further in Section 5.10.4.

5.5.6.2 Tailings

The Project milling operation will produce two tailings streams using conventional milling methods. The process includes a primary crusher, primary grinding circuit, flotation circuit, and regrinding and secondary flotation circuits. Mill throughput is anticipated to be nominally 70,000 t/d. Tailings will be separated into two process streams designated as rougher scavenger (bulk) tailings and cleaner scavenger (cleaner) tailings. The bulk tailings stream consists of approximately 93% of the total tailings stream with cleaner tailings representing the remaining balance of 7%. The bulk tailings slurry concentration was estimated to be 34.5% by dry weight, with a solids density of 2.66 t/m³. The cleaner tailings slurry concentration was estimated to be 32.7% by dry weight, with a solids density of 3.11 t/m³. Lock cycle metallurgical test work produced one sample each of cleaner and bulk tailings. The geochemical characteristics of both tailings types were evaluated by SRK Consulting Inc. (SRK) as part of the feasibility design studies. Lock cycle metallurgical testwork produced one sample each of rougher and cleaner tailings. Results showed that the sample of rougher tails was non-PAG whereas cleaner tails were PAG (Table 5.5-1).

Table 5.5-1. Results of Tailings Analysis

Sample ID	Material Type	Paste pH	Total S %	Sulphate %	Sulphide %	NP kg CaCO ₃ /t	CO ₂ %	AP kg CaCO ₃ /t	NP/AP
KM 2916 MCI	Head sample	8.9	1.8	-0.01	1.8	72	4.7	55	1.3
KM 2916-14 Cu Rotl	Rougher tail	8.7	0.87	-0.01	0.87	73	4.7	27	2.7
KM 2916-14 Cu 1CT	Cleaner tail	6.8	9.3	0.37	8.9	80	5.9	280	0.29

5.5.7 Condemnation Drilling

For the purpose of defining the mineralization under proposed mining infrastructure, a total of 1,791 m of NQ-size diamond drill core were drilled in eight drill holes from eight drill setups (Table 5.5-2; HC11-C01 through HC11-C08; Naas 2012a).

In summary, drill holes HC11-C01 through HC11-C05 and HC11-C07 were all drilled through orthogneiss and/or the contact zone or border phase of the orthogneiss. Sulphide mineralization in these holes was primarily pyrite with minor pyrrhotite and rare, sporadic chalcopyrite. Pyrite rarely exceeded 1%. No significant copper mineralization results were returned from these drill holes.

Table 5.5-2. Condemnation Drilling Summary

Hole-ID	Length (m)	Proposed Facility Area
HC11-C01	203.30	Mill building
HC11-C02	200.25	Truck shop
HC11-C03	200.25	Coarse ore stockpile
HC11-C04	200.25	Low-grade stockpile
HC11-C05	200.25	PAG waste rock storage area
HC11-C06	340.46	West overburden stockpile
HC11-C07	200.25	PAG waste rock storage area
HC11-C08	245.97	Primary crusher

Drill holes HC11-C06 and HC11-C08 were cored in rocks other than the orthogneiss. HC11-C06 was drilled through intermediate to felsic volcanoclastics and terminated in a graphitic horizon. Sulphide minerals encountered in this hole were mainly disseminated and foliation-parallel pyrite, locally up to 15% – with up to 5% patchy, sporadic sphalerite – and trace to 3% pyrrhotite. No significant copper mineralization was encountered in the hole; however, increased zinc concentrations were noticeable.

HC11-C08 was collared in a structural deformation zone within a graphitic horizon and passed through a sedimentary package and intermediate volcanoclastics before ending in a graphitic horizon. Sulphide mineralization encountered in this drill hole ranged from disseminated, to fracture fill, to foliation-parallel disseminations, and to a massive sulphide zone from 187.78 to 189.86 m. Copper mineralization results from HC11-C08 include:

- 0.38% copper over 1 m from 9.00 to 11.00 m;
- 0.25% copper over 4 m from 55.00 to 59.00 m;
- 0.72% copper over 5 m from 60.00 to 65.00 m; and
- 0.37% copper over 4 m from 100.67 to 104.67 m.

5.6 MINERAL RESOURCES, RESERVES AND PRODUCTION SCHEDULE

A mineral resource estimate for the Project was prepared by Ron Simpson of Geosim Services Inc. and reported by Merit Consultants International Inc. in the updated Technical Report and Feasibility Study ([Appendix 5-A](#)).

A resource-grade model with copper, gold, and silver grades was estimated (Table 5.6-1). The selected base cut-off grade was 0.15% copper and the resource was reported within an optimal Lerchs-Grossman pit with an average copper recovery of 89% and a base metal price of US\$3.50/lb copper.

The mineral reserve estimate for the Project was prepared by John Nilsson of Nilsson Mine Services Ltd. and reported by Merit Consultants International Inc. in the updated feasibility study (Merit 2014).

Table 5.6-1. Mineral Resource Estimate

Measured and Indicated Mineral Resources					Contained Metal		
	tonnes (000's)	% Cu	g/t Au	g/t Ag	Cu lbs (M's)	Au ounces (000's)	Ag ounces (000's)
Measured (M)	564,361	0.27	0.029	1.2	3,359	526	21,769
Indicated (I)	735,877	0.24	0.027	1.2	3,894	639	28,385
Total M + I	1,300,238	0.25	0.028	1.2	7,253	1,165	50,154
Inferred Mineral Resources							
	tonnes (000's)	% Cu	g/t Au	g/t Ag			
Inferred	119,743	0.25	0.025	1.2	660	96	4,619

Source: [Appendix 5-A, Technical Report and Feasibility Study](#).

The mineral reserves for the Harper Creek Deposit were estimated using a copper price of US\$2.25/lb, a gold price of US\$1250.00/ounce and a silver price of US\$20.00/ounce. An exchange rate of C\$1.00: US\$0.90: was assumed. The mineral reserves are reported using a 0.14% copper cut-off grade. The proven and probable reserves at Harper Creek are 716.175 Mt with an average grade of 0.26% Cu, 0.029 g/t Au and 1.2 g/t Ag (Table 5.6-2).

Table 5.6-2. Mineral Reserves

Proven and Probable Mineral Reserves					Contained Metal		
	tonnes (000's)	% Cu	g/t Au	g/t Ag	Cu lbs (M's)	Au ounces (000's)	Ag ounces (000's)
Proven	457,227	0.27	0.030	1.2	2,706	439	17,465
Probable	258,948	0.24	0.026	1.2	1,371	220	9,636
Proven + Probable	716,175	0.26	0.029	1.2	4,077	659	27,101

Source: [Appendix 5-A, Technical Report and Feasibility Study](#).

The open pit mine development plan consists of five pit development phases expanding to a single large open pit. These five phases will be mined sequentially with overlap of up to three phases with a total of 30.8Mt mined in preproduction. Of this total, 9.5Mt of ore will be mined and stockpiled for later processing and 21.3Mt of waste will be mined and placed on dumps or used for construction. During the first 15 years of operations the total mining rate will be 60,000kt/a. During Years 16 through 25 the mining rates decline from 55,000kt/a to 30,000kt/a as final benches are mined to completion. During Years 24 through 28 the low grade stockpiles are recovered and processed. The mill will process 716.2Mt of ore with an average grade of 0.26% Cu 0.03g/t Au and 1.2g/t Ag. The total effective waste mined will be 541.7Mt with an additional 2.0Mt of low grade remaining unrecovered in the stockpile base. The effective overall strip ratio will be 0.76:1.00 waste to ore.

Table 5.6-3 details the annual production schedule for the project. Further details are provided in [Appendix 5-A](#)

5.7 PROJECT PHASES

5.7.1 Construction

5.7.1.1 Construction Execution Strategy

The Construction phase is expected to last approximately 18 to 24 months. The first six months will be focused on establishing basic site infrastructure including upgrading the site access road and establishing the construction camp. The general arrangement plan of the Project after the second year of Construction is shown on Figures 5.7-1.

Pre-stripping of the open pit utilizing the permanent mine production equipment will begin after approximately six months to assist construction of the large earthwork structures including the TMF embankment, crusher ROM ore pad and ex-pit haul roads. Overburden and non-PAG waste rock from the pre-stripping operations will be used for construction while PAG material will be hauled and stockpiled within the TMF. Pit development and mining is described in Sections 5.9.

In order to commence early pre-stripping operations, at least one of the shovels and one drill will operate under temporary power (portable generators), since connection to the proposed BC Hydro transmission line upgrade that will provide operational power requirements will not be available until the end of the Construction phase.

The schedule anticipates that the assembly of the mine fleet to be used for construction and the associated construction of the haul roads will take about eight months. This is a conservative estimate, but does take some account of potential adverse weather conditions that may be experienced. Using large equipment on heavy earthwork projects has a productive advantage in terms of large volume movements, as well as keeping the material from freezing during winter operations before it is graded and compacted, specifically due to the large volumes that are moved.

The starter TMF embankment will be completed to the 1,723 m elevation by the time of start-up of processing. At this time, the TMF will have captured one full freshet and have a filled pond capacity capable of sustaining the water requirements of the operating process plant.

The key milestones during the construction phase are presented in Table 5.12-1 in Section 5.12, Project Schedule.

The majority of capital equipment will be shipped via Edmonton or Vancouver to a laydown area at the Project Site. Heavy loads include the mine equipment components, substation transformers, crusher components, and mill and motor components. Preliminary analysis of the the Birch Island bridge indicates that it is capable of allowing these loads to pass over them safely given suitable axle configuration and clearances.

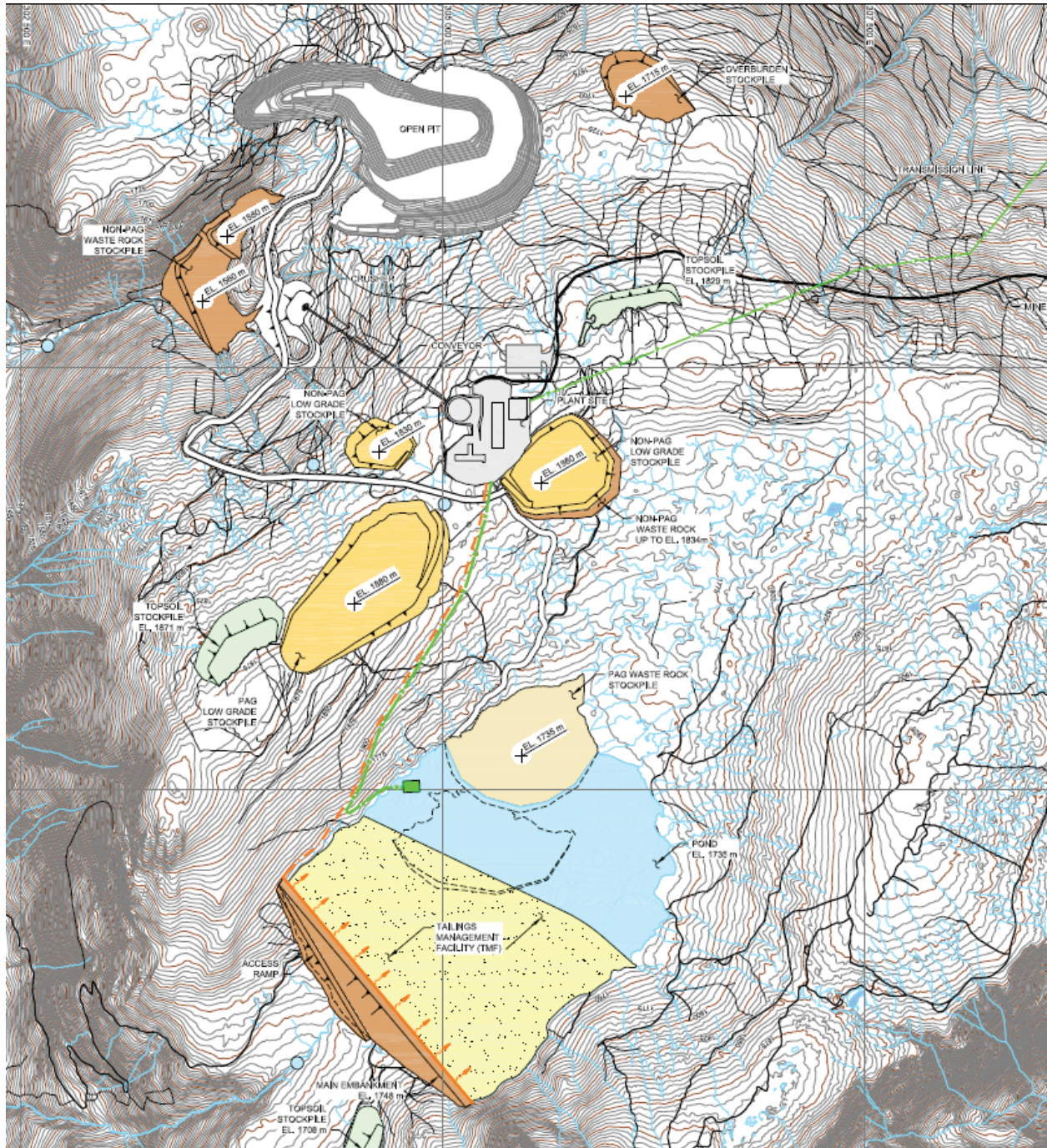
Construction manpower is based on a 70-hour construction contractor work week with crew rotations established by the contractors, but which will generally be three weeks on site and one week off. Manpower loading indicates a peak requirement for 600 construction workers on site.

Table 5.6-3. Annual Production Schedule

		Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	
PHASE I OPEN PIT																			
Potential Mill Feed	kt	9,538	37,203	39,312	22,720	13,144	-	-	-	-	-	-	-	-	-	-	-	-	
Waste	kt	21,312	22,447	4,740	1,870	1,547	-	-	-	-	-	-	-	-	-	-	-	-	
Total	kt	30,850	59,650	44,052	24,590	14,691	-	-	-	-	-	-	-	-	-	-	-	-	
PHASE II OPEN PIT																			
Potential Mill Feed	kt	-	-	1,238	11,458	21,104	18,782	20,947	17,729	3,701	-	-	-	-	-	-	-	-	
Waste	kt	-	-	14,210	23,952	11,522	3,114	1,161	1,950	1,275	-	-	-	-	-	-	-	-	
Total	kt	-	-	15,448	35,410	32,626	21,896	22,108	19,679	4,976	-	-	-	-	-	-	-	-	
PHASE III OPEN PIT																			
Potential Mill Feed	kt	-	-	-	-	852	7,567	9,655	14,276	24,743	23,109	16,390	22,568	18,484	18,705	9,464	3,749	3,502	
Waste	kt	-	-	-	-	11,831	30,537	28,237	26,045	19,985	11,043	5,784	7,655	4,476	3,017	1,063	659	615	
Total	kt	-	-	-	-	12,683	38,104	37,892	40,321	44,728	34,152	22,174	30,223	22,960	21,722	10,527	4,408	4,117	
PHASE IV OPEN PIT																			
Potential Mill Feed	kt	-	-	-	-	-	-	-	-	163	5,544	17,262	6,868	12,981	11,157	15,838	33,475	17,661	
Waste	kt	-	-	-	-	-	-	-	-	10,133	20,304	20,564	5,225	9,269	8,691	11,244	11,398	3,868	
Total	kt	-	-	-	-	-	-	-	-	10,296	25,848	37,826	12,093	22,250	19,848	27,082	44,873	21,529	
PHASE V OPEN PIT																			
Potential Mill Feed	kt	-	-	-	-	-	-	-	-	-	-	-	115	339	1,118	2,752	1,780	5,361	
Waste	kt	-	-	-	-	-	-	-	-	-	-	-	17,569	14,451	17,312	19,639	8,939	23,993	
Total	kt	-	-	-	-	-	-	-	-	-	-	-	17,684	14,790	18,430	22,391	10,719	29,354	
TOTAL OPEN PIT																			
Potential Mill Feed	kt	9,538	37,203	40,550	34,178	35,100	26,349	30,602	32,005	28,607	28,653	33,652	29,551	31,804	30,980	28,054	39,004	26,524	
Waste	kt	21,312	22,447	18,950	25,822	24,900	33,651	29,398	27,995	31,393	31,347	26,348	30,449	28,196	29,020	31,946	20,996	28,476	
Total	kt	30,850	59,650	59,500	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	55,000	
TOTAL STOCKPILE RECOVERY		tonnes	-	-	-	5,663	-	5,765	-	-	1,329	-	-	218	-	-	807	-	
OPEN PIT MILL FEED - Including stockpile recovery			90%																
PHASE 1		kt	-	22,995	25,346	21,033	11,200	3,744	-	-	-	-	-	-	-	-	-	-	
Cu	%	-	0.341	0.349	0.336	0.274	0.224	-	-	-	-	-	-	-	-	-	-	-	
Au	g/t	-	0.040	0.042	0.039	0.029	0.025	-	-	-	-	-	-	-	-	-	-	-	
Ag	g/t	-	1.157	1.317	1.390	1.267	1.079	-	-	-	-	-	-	-	-	-	-	-	
PHASE 2		kt	-	-	204	4,517	13,781	16,914	18,621	14,732	4,508	-	-	-	-	-	807	-	
Cu	%	-	-	-	0.274	0.266	0.258	0.294	0.309	0.245	-	-	-	-	-	-	0.184	-	
Au	g/t	-	-	-	0.023	0.028	0.033	0.032	0.030	0.024	-	-	-	-	-	-	0.022	-	
Ag	g/t	-	-	-	1.492	1.279	1.149	1.042	1.122	1.203	1.052	-	-	-	-	-	0.917	-	
PHASE 3		kt	-	-	-	-	569	4,893	6,929	10,818	20,887	20,553	12,281	19,166	15,393	16,334	8,961	2,968	
Cu	%	-	-	-	-	-	0.303	0.354	0.331	0.297	0.263	0.260	0.268	0.267	0.298	0.320	0.301	0.312	
Au	g/t	-	-	-	-	-	0.036	0.039	0.043	0.041	0.033	0.032	0.032	0.030	0.032	0.032	0.031	0.031	
Ag	g/t	-	-	-	-	-	0.813	1.163	1.631	1.510	1.332	1.298	1.306	1.283	1.387	1.508	1.430	1.463	
PHASE 4		kt	-	-	-	-	-	-	-	-	155	4,997	13,269	6,299	9,877	8,342	13,645	21,657	
Cu	%	-	-	-	-	-	-	-	-	-	0.185	0.246	0.260	0.236	0.245	0.247	0.234	0.251	
Au	g/t	-	-	-	-	-	-	-	-	-	0.015	0.021	0.023	0.022	0.023	0.023	0.023	0.024	
Ag	g/t	-	-	-	-	-	-	-	-	-	1.010	0.988	1.141	1.133	1.159	1.180	1.184	1.290	
PHASE 5		kt	-	-	-	-	-	-	-	-	-	-	-	86	281	874	2,137	925	
Cu	%	-	-	-	-	-	-	-	-	-	-	-	-	0.284	0.266	0.307	0.281	0.324	
Au	g/t	-	-	-	-	-	-	-	-	-	-	-	-	0.027	0.029	0.034	0.033	0.041	
Ag	g/t	-	-	-	-	-	-	-	-	-	-	-	-	0.439	0.378	0.423	0.621	0.790	
TOTAL FEED		kt	-	22,995	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550	
Cu	%	-	0.341	0.348	0.324	0.271	0.271	0.304	0.304	0.259	0.257	0.264	0.260	0.277	0.296	0.260	0.261	0.237	
Au	g/t	-	0.040	0.042	0.037	0.031	0.032	0.035	0.035	0.031	0.029	0.027	0.028	0.028	0.029	0.027	0.026	0.024	
Ag	g/t	-	1.157	1.318	1.371	1.193	1.071	1.260	1.333	1.281	1.237	1.220	1.243	1.288	1.364	1.215	1.292	1.178	
Copper Recovery		%	0.0%	90.4%	90.7%	89.9%	88.5%	88.5%	89.4%	89.4%	88.2%	88.1%	88.3%	88.2%	88.7%	89.2%	88.2%	88.2%	
Gold Recovery		%	0.0%	66.6%	67.0%	65.6%	62.9%	63.4%	64.9%	64.7%	62.9%	62.1%	60.6%	61.1%	61.4%	62.0%	60.2%	59.4%	
Silver Recovery		%	0.0%	40.4%	44.7%	45.8%	41.5%	37.6%	43.3%	45.0%	43.8%	42.7%	42.8%	43.9%	45.7%	42.1%	44.0%	41.0%	
Recoverable Copper	lbs x 1000	-	156,166.0	177,881.1	164,019.3	135,336.8	135,335.4	153,088.7	152,982.8	128,776.7	127,682.0	131,373.7	128,920.3	138,465.6	148,695.6	128,922.5	129,611.1	116,684.2	
Recoverable Gold	ounces	-	19,880	22,870	20,129	16,074	16,749	18,849	18,603	16,022	15,037	13,538	14,032	14,293	15,008	13,135	12,458	11,631	
Recoverable Silver	ounces	-	345,820	483,688	515,817	406,552	331,164	447,757	492,787	460,424	433,782	423,221	437,398	465,056	511,845	419,925	467,212	397,117	
Cumulative Waste	kt	21,312	43,759	62,709	88,531	113,431	147,082	176,480	204,475	235,868	267,215	293,563	324,012	352,208	381,228	413,174	434,170	462,646	
Stockpile Addition	kt	9,538	14,208	15,000	8,628	9,550	799	5,052	6,455	3,057	3,103	8,102	4,001	6,254	5,430	2,504	13,454	974	
Stockpile Balance	kt	9,538	23,746	38,746	47,374	56,924	57,723	62,775	69,230	72,287	75,390	83,492	87,493	93,747	99,177	101,681	115,135	116,109	
Overburden	kt	5,567	5,306	3,743	726	3,076	1,872	2,024	2,707	3,145	1,505	969	2,575	1,260	1,197	1,352	856	952	
Unknown	kt	(1)	0	5	0	(2)	1	2	(0)	1	1	2	0	0	1	0	1	0	
PAG Waste	kt	6,401	7,712	4,885	10,013	8,386	15,777	19,098	18,041	15,612	11,088	9,803	11,510	10,879	10,600	11,686	9,964	12,644	
NAG Waste	kt	9,346	9,428	10,316	15,083	13,441	16,000	8,273	7,248	12,634	18,753	15,573	16,364	16,056	17,222	18,908	10,175	14,881	

(continued)

Figure 5.7-1
Year 3 Development



5.7.1.2 *Types of Construction Activities*

The following activities will be undertaken during the Construction phase:

- main access road improvements;
- erection of temporary construction camp and ancillary facilities;
- clearing, grubbing, and stockpiling of topsoil;
- bulk earthworks;
- pre-stripping of the open pit, stockpiling of topsoil, and generation of construction aggregate, mainly for tailings embankment construction;
- construction of the main substation at the plant site and a 14-km high-voltage power line (the “HCMC power line”) connecting to the BC Hydro transmission line corridor;
- operation of a 150 m³/hour to 200 m³/hour concrete batch plant near the concentrator and primary crusher locations where the majority of concrete will be required;
- forming and placement of concrete foundations;
- supply and installation of pre-engineered buildings;
- supply and installation of primary crushing, grinding, flotation, regrind and concentrate dewatering circuits;
- fuel tank installation;
- earthworks for the cofferdam and Stage 1 main embankment for the TMF;
- installation of conveying and piping systems;
- construction of a concentrate load-out building and cold storage;
- repairs to the rail siding at the rail load-out facility in Vavenby; and
- removal of temporary construction camp and ancillary facilities.

A borrow pit will be established to the south of the proposed concentrator location as a source for aggregate for the development of foundation pads, site access roads, and the starter TMF embankment. Additional details on specific construction activities are provided in subsequent sections.

5.7.1.3 *Site Access Road Upgrade*

Upgrades to existing forest service roads will be required for access to the Project Site. The envisaged route via the Vavenby Mountain FSR, Saskum Plateau FSR and the Vavenby-Saskum FSR will be widened and its alignment improved to accommodate concentrate haulage and Project Site traffic. An approximately 2.5-km section of road will be constructed from the intersection of the Saskum Plateau FSR and the Vavenby-Saskum FSR to the Project Site. See Figure 5.8-4.

5.7.1.4 *Project Site Development*

Project Site development will consist of the establishment of haul roads, laydown areas, and gravel pads for establishment of the construction camp, and development of foundations for the process plant. Construction of the process plant is the critical path item for reaching production, and will require the largest portion of the Construction phase labour force.

5.7.1.5 *Initial Tailings Management Facility Construction*

TMF construction will begin with construction of a cofferdam and Stage 1 main embankment. These construction activities are described in the TMF design and construction description in Section 5.8.2.

5.7.1.6 *HCMC Power Line*

A temporary 25-kV power line will be constructed from a junction point on the existing BC Hydro 138 kV transmission line near Vavenby up to the plant site to power the camp and other Construction phase activities. The temporary power line will follow the route of the proposed 138 kV power line planned for the Operations phase of the Project. The proposed transmission line upgrade by BC Hydro, required to provide the load needed during Operations, will not be available until in the end of Construction.

Notwithstanding later availability, the 14-km-long, 138-kV HCMC power line will be constructed from the Project Site to the existing BC Hydro 230-kV transmission line near Vavenby early in the Construction phase. The proposed routing of the HCMC power line is shown on Figure 5.8-4. A qualified power line contractor will be contracted to clear a 30-m right-of-way and install either single or H-frame wood poles spaced approximately every 100 m. Standard construction and environmental protection practices will be employed by the contractor. A Licence to Cut permit will be obtained to clear the right-of-way. As the proposed HCMC power line route traverses several categories of land status (Crown, tree lots, private, etc.), the salvageable trees will be directed to the appropriate location based on the land status from where they originated.

5.7.1.7 *Rail Load-out Facility Development*

HCMC intends to deliver its copper concentrate product to overseas markets. To accomplish this, HCMC will transport its product by rail to Port Metro Vancouver. The CNR passes through the area via Vavenby and Clearwater, the communities closest to the Project Site.

In November 2011, HCMC acquired the 79.3-ha abandoned sawmill property formerly owned by Weyerhaeuser Company Limited, located 2.5 km west of Vavenby and approximately 24 km by road from the Project Site. The acquisition included a rail siding, buildings, offices, and statutory rights of way. HCMC intends to refurbish the existing load-out infrastructure to establish a rail load-out facility to support the Project. The rail load-out facility will consist of the following:

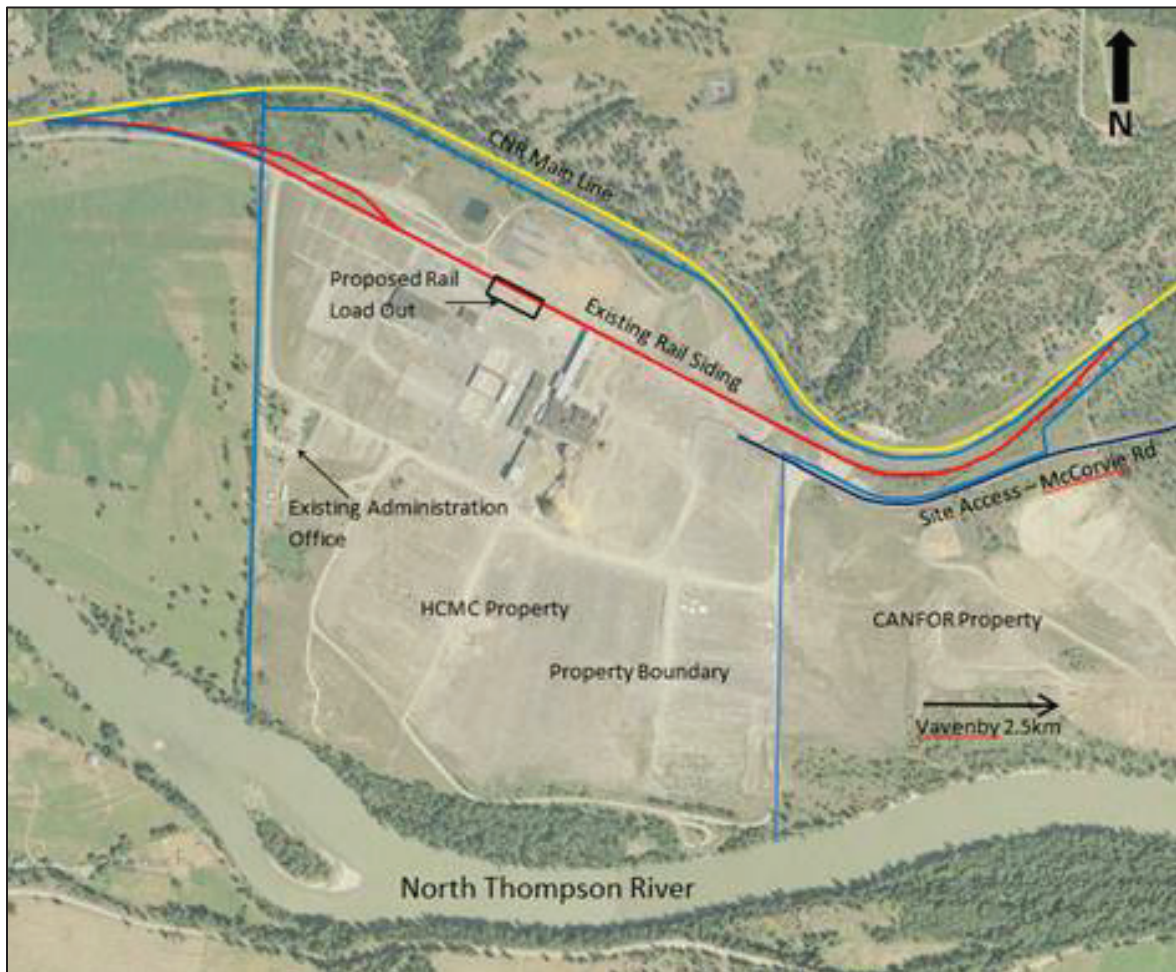
- concentrate storage and railcar loading;
- refurbished railway siding; and
- refurbished offices and associated out-buildings.

The selected property purchased by HCMC can be refurbished with modest investment to meet the Project requirements. The proposed layout of the rail load-out facility is shown on Figure 5.7-2.

Currently it is proposed to utilize the existing 100-lb/yard rail. Additional upgrades include:

- The existing roadbed requires extensive brush cutting to remove overgrown vegetation from the existing track and from the areas where the track has been removed;
- Two 132-lb/yard switches for tie-in to the existing main line;

Figure 5.7-2
Location Rail
Load Out Facility



- Re-grading the siding at the west and east ends to make a suitable roadbed for the reintroduced siding tie-ins as well as the addition of suitable ballast; and
- Upgrading of switches on the existing siding.

Prior to finalizing the design, the facility will be reviewed with a CNR representative to ensure conformance to policy, procedure, and CNR's maintenance-of-way guidelines.

5.7.1.8 *Construction Equipment Fleet*

The array of construction equipment, excluding mining equipment, is anticipated to consist of the following, but note that this is not an exhaustive list:

- 6 x compactors
- 2 x compressors
- 8 x cranes
- 2 x excavators
- 5 x forklifts
- 1 x grader
- 3 x jacks
- 7 x aerial work platforms
- 11 x lifts (scissor, manlift and swing stage)
- 2 x loaders
- 2 x rock drills
- 1 x tractor/caterpillar
- 11 x trucks
- 1 each x mechanic, fuel, lube, water and concrete pump trucks
- 1 x fire truck
- 1 x ambulance
- 1 x bus

Equipment that can be utilized for operations will likely be purchased while the remainder will be rented for the duration of construction. As the mine moves into the Operations phase, the Construction fleet will be expanded to meet the mining requirements.

All mechanical equipment used during construction and operations will be regularly maintained in accordance with manufacturers' recommendations.

5.7.1.9 *Fuel Supply, Storage, and Distribution*

The diesel fuel storage facility dispensing diesel and gasoline that will supply mining equipment during the Operations phase will be installed early in the Construction phase to provide fuel for construction activities. Daily fuel deliveries by highway tanker truck from a fuel terminal will be necessary to replenish supply at the Project Site. Construction fuel tanks will be installed in suitable lined containments at site and a site fuel bowser will fuel remote day tanks.

Sections 5.7.2.5 and 5.9.6 below provide additional information about fuel supply, storage, and distribution.

5.7.1.10 *Construction Aggregate and Concrete Production*

Site geotechnical investigations have determined there are sufficient construction material types available for aggregate materials for general and structural backfill, sand for pipe and electrical cable bedding, filters for the tailings dam, and concrete aggregates. Crushed rock will come from the granodiorite to the south of the concentrator and at the TMF dam site. An aggregate crushing and screening plant will be established at the respective sites when in operation to stockpile the various sizes and types of material needed for Construction.

A 150 m³/hour to 200 m³/hour concrete batching plant will be positioned close to the new concentrator and primary crusher locations where the majority of concrete will be required. The aggregate stockpiles may be heated during cold weather to facilitate year-round civil works. It is expected that several large pours of 16- to 24-hour duration will be required, specifically for the mill foundations and piers and crusher foundation. Approximately seven to eight concrete trucks of 8 m³ capacity will be required during those periods when large pours are scheduled, to convey the concrete from the batching plant to the pour site. Most of the concrete will be placed in the first full year of Construction so that buildings can be erected and closed in before winter when internal installations will commence.

5.7.1.11 *Explosives Manufacture, Storage, Transportation, and Use*

A qualified explosives contractor will be contracted to establish manufacture, store, and deliver bulk ammonium nitrate fuel oil (ANFO) during both the Construction and Operation phases. The location of the proposed explosives manufacture and storage facility is shown on Figure 5.1-2. A description of the facilities, storage, transportation, and use is provided in the following paragraphs.

A bulk ammonium nitrate emulsion plant will be constructed at the Project to provide the necessary explosives for the construction and operation of the mine. 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 will collect any water for eventual emulsion/oil/water separation and disposal.

Ammonium nitrate prill will be unloaded pneumatically into the storage silo adjacent to the main building. From there it will be transferred into stainless-steel heating tanks in the manufacturing plant to produce ammonium nitrate solution (ANS). Off-loaded ANS will be unloaded into a storage tank.

Diesel fuel will be used in the manufacture of the emulsion-based explosive. It will be stored in a diesel fuel storage tank, located at least 25 m away from the manufacturing plant and will likely be re-supplied by tanker truck from the central fuel farm of the mine.

A surfactant is required in the process. The material will be trucked to site in B-train tankers and pneumatically unloaded into a 35,000-litre (L) storage tank located inside the manufacturing plant. Sodium nitrate and ethylene glycol are required for the emulsion production process and will be stored in a separate building in the compound.

The manufacturing process will also require clean water, to be sourced from the site water distribution system. The truck storage/wash bay facility in the compound will have a sump and evaporation system for collecting wash water and wastes. The resulting residue will either be recycled into the manufacturing process or disposed of on site.

Emulsion explosive will be delivered to the open pit for loading in the pre-drilled blast holes using a vehicle specially designed for this purpose. Blasting will typically be done once per day. The explosives delivery vehicles will typically be able to load 20 to 25 holes per trip. An average pattern size of 75 to 100 holes will be completed and shot (blasted) the same day. In the winter months, the amount of snow at the Project Site may dictate loading and shooting the same day. An annual summary of explosive usage is provided in Table 5.7-1.

Table 5.7-1. Annual Explosive Usage

Explosive Type	Year	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Fortan Advantage 35	tonnes	1,104	2,402	2,441	2,602	2,490	2,557	2,552
Fortan Advantage 70	tonnes	4,418	9,608	9,765	10,406	9,961	10,229	10,209
Total	tonnes	5,522	12,010	12,206	13,008	12,452	12,786	12,762
Explosive Type	Year	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Fortan Advantage 35	tonnes	2,527	2,525	2,593	2,622	2,519	2,591	2,587
Fortan Advantage 70	tonnes	10,106	10,099	10,372	10,488	10,075	10,366	10,348
Total	tonnes	12,633	12,624	12,965	13,110	12,594	12,957	12,935
Explosive Type	Year	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Fortan Advantage 35	tonnes	2,588	2,629	2,395	1,775	1,772	1,777	1,603
Fortan Advantage 70	tonnes	10,350	10,518	9,580	7,099	7,089	7,108	6,411
Total	tonnes	12,938	13,147	11,975	8,873	8,861	8,885	8,013
Explosive Type	Year	Year 21	Year 22	Year 23	Year 24	Total		
Fortan Advantage 35	tonnes	1,546	1,526	1,282	830	53,836		
Fortan Advantage 70	tonnes	6,185	6,105	5,126	3,320	215,342		
Total	tonnes	7,732	7,631	6,408	4,150	215,342		

All hazardous materials and dangerous goods will be stored in clearly labelled containers or vessels and handled in accordance with local regulations and appropriate to their hazard characteristics. In addition, all the raw material storage containers within the facility will be placed on environmental containment pads to contain any spills should they occur.

Boosters and detonators will be stored in two separate magazines, located away from the Explosives Plant in accordance with Natural Resources Canada and provincial *Mines Act* (1996) requirements.

5.7.1.12 *Temporary Construction Camp and Supporting Facilities*

A temporary modular construction camp will be positioned at the Project Site to house the Construction phase workforce, peaking at 600 Construction personnel, and will be removed at the end of the Construction phase. The on-site workforce accommodated in the construction camp does not include the pre-production Operations persons who will be housed in the local communities, or the crews that will upgrade the main access road and/or build the HCMC power line. It is expected that local contractors will complete these activities with a predominantly local workforce, and the contractors will be responsible for temporary housing of their respective personnel off site as required.

The construction camp will be located adjacent to the mill area on the access road. This camp will include construction offices, a mine dry, a kitchen, a dining room, and recreational facilities. The camp will gradually be expanded from approximately 100 person capacity at the start of Construction to accommodate the peak force of 600 persons sometime in the second year of Construction. Workers will be transported by bus from the Rail Load-out Facility to and from the construction camp between furloughs.

Potable water will be supplied from local wells. Sewage will be gravity fed to holding tanks that will be periodically emptied by local community services. The putrescible waste from the offices and camps will be incinerated and the ash along with solid, non-flammable/non-hazardous materials will be disposed of in a site landfill. The site landfill will be located in an area of suitable substrate to accommodate such a facility and will be subjected to the required permit approvals.

5.7.1.13 *Construction Power Supply*

Electrical construction starts with the electrification of the construction camp. There is approximately 2.5 MW of power available on the existing BC Hydro transmission line near Vavenby. A temporary 25-kV power line will be constructed from a junction point on the existing BC Hydro 138 kV transmission line near Vavenby up to the plant site to power the camp and other Construction phase activities. The temporary power line will follow the route of the proposed 138 kV power line planned for the Operations phase of the Project. BC Hydro's planned transmission line upgrade, required to provide the load needed during Operations, will not be available until later in Construction.

Mine equipment will be used for pre-stripping operations during Construction, and since the requisite power for Operations will not be available until later in Construction, temporary diesel generators will be installed at the new process plant substation site. Four 2,000-kW generator sets are envisaged and at least two will remain for Operations and act as the emergency generators for the plant. An overhead line will be constructed to the open pit boundary from where a closed loop power line will be constructed around that part of the open pit to be initially developed.

As influenced by increasing demand later in Construction, the BC Hydro transmission line upgrade will be undertaken. The 138-kV HCMC power line will then replace the 25-kV line using the same pole structures, and a substation will be constructed next to the plant site that will step down the voltage from 138 kV to 25 kV.

5.7.1.14 Security

For construction, a security service contractor will be retained and a temporary gatehouse will be installed at the entrance to the construction site. The gatehouse will ensure the physical integrity of the facilities, and control and record the access of people to construction zones and restricted areas. A permanent security facility will be established during Construction and will remain in place for the life of the Project. Vehicles and people will be inspected on the way in (for fitness to work and authority to enter) and on the way out to check for unauthorized removal of materials from the site.

5.7.1.15 Waste Disposal

Waste management during Construction, other than waste material from earthworks, will be one of the subjects of a Waste Management Plan (Section 22.19) that will have the primary purposes of protecting workers and the public from any potentially adverse effects associated with waste from the Project. Such protection will include the minimization of potentially adverse effects to the biophysical as well as human environment, and will be in compliance with regulatory requirements. The focus of the Waste Management Plan during Construction will be on the reduction, reuse, recycling, and recovery of waste; all of these methods will be exhausted before disposing of waste materials.

5.7.1.16 Surface and Subsurface Water Management

Discrete areas of development have been identified within the Project boundary that will require a sediment and erosion control plan to be prepared during detailed design and applied during the Construction phase. Specific surface water control elements and measures will be implemented in these areas to minimize erosion and prevent sediment discharge into surrounding areas.

Surface water sediment mobilization and erosion will be managed *inter alia* throughout the Project Site by standard practices such as installing sediment controls, limiting disturbance, reducing water velocity, rehabilitation, etc. Subsurface water will be controlled by the use of sump pits, wells, or removable pump stations to draw down the natural water table and provide dry, stable construction areas. An adaptive management approach will be implemented that allows sediment and erosion control works to be field-fit to suit conditions encountered during Construction. Regular monitoring and maintenance of implemented practices will ensure success of the plan.

Note that a water management pond has been designed for each major area of disturbance, to accommodate a live storage equal to the 1-in-10-year, 24-hour storm event with 0.5 m of freeboard and to settle out sediment particles sized 0.01 millimetres (mm) and larger, while providing a retention time of at least 20 hours. Each pond and pond outlet spillway was designed to withstand a 1-in-200-year, 24-hour storm event, per the guidelines above. The collection and diversion ditches will be designed for the 1-in-10-year, 24-hour storm event.

5.7.1.17 *Emergency Procedures*

An emergency is a situation that threatens the wellbeing of the environment, affected persons or the mine property, to the extent that a controlled and coordinated response is required. Emergencies during Construction will be managed as far as possible by applying an emergency response procedure as part of the Emergency Response Plan (Section 24.4). Such a plan will ensure that unplanned or episodic events related to the Project that may have consequences that are harmful to the environment, are responded to in a timely and efficient manner, thereby containing and mitigating such consequences. Note that the management of accidental spills will be incorporated in emergency planning as part of the Spill Prevention and Response Plan (Section 24.15).

5.7.2 **Operations**

The Operations phase will comprise two stages over the 28 year life of the mine. A first stage of 23 years (Operations 1) as illustrated in Figure 5.1-2 which shows the Project at the peak of activity, and a second stage of five years (Operations 2) as illustrated in Figure 5.9-1 during which tailings will be deposited in the open pit. These stages are defined by the fact that the mining operations will cease in the open pit in the latter half of Year 24 and the mine will begin processing LGO from the site stockpiles for five years thereafter.

5.7.2.1 *Types of Operations Activities*

The following activities will be undertaken during the Operations phase:

- development of the open pit and extraction of ore;
- operation of the non-PAG waste rock storage facility;
- operation of the non-PAG overburden storage facility;
- crushing and processing of ore;
- storage/stockpiling of LGO;
- transportation of concentrate to the rail load-out facility;
- construction and operation of the TMF, including PAG waste rock storage;
- transportation of workers and goods in and out of the Project Site; and
- fuel resupply.

5.7.2.2 *Open Pit Development*

The mine plan provides mill feed at a rate of 70,000 t/d. The overall mine production has been scheduled by bench and development phase on an annual basis and the expected operating life is 28 years (Appendix 5-A, Technical Report and Feasibility Study). Run of mine ore will be determined based on a variable cut-off strategy to allow higher grade ore to be processed early in the mine life. Cut-off grades will range between 0.22% Cu and 0.16% Cu. Material above this cut-off will be directed to the primary crusher while material below the cut-off but greater than 0.14% Cu will be stockpiled south of the plant

site for processing at the end of the mine life. The majority of the material stockpiled (116.9 Mt) will be processed at the end of the mine life, from Year 24 to Year 28.

5.7.2.3 Mining Equipment

The equipment fleet during Operations will include large-scale units which have been proven in existing operations and are widely used throughout the world. The mine will operate one diesel rotary drill, two electric rotary drills, three electric hydraulic shovels, and a large wheel loader.

Including the mining equipment, it is anticipated that the Operations fleet will consist of the following, but note that this is not an exhaustive list:

Mine Equipment

- 3 x Rotary Blasthole Drill
- 1 x Hydraulic Drill
- 3 x Hydraulic Shovel
- 1 x Wheel Loader
- 28 x Haul Truck
- 6 x Track Dozer
- 2 x Wheel Dozer
- 4 x Grader
- 2 x Water Truck
- 2 x Sand Truck

Support Equipment

- 4 x Wheel Loader
- 4 x Haul Truck
- 3 x Excavator
- 1 x Fuel and Lube Truck
- 1 x Tractor and Low Bed
- 3 x Hiab Truck
- 3 x Maintenance Truck
- 1 x Rough Terrain Crane
- 4 x Forklift
- 32 x Pickups

5.7.2.4 *Waste Rock Storage and Stockpile*

Total waste to be mined from the open pit is estimated to be 543.7 Mt, including 39 Mt of overburden. Some overburden will be used for road and dam construction and the balance will be placed in stockpiles located to the east of the open pit for reclamation operations. A total of approximately 265 Mt of non-PAG waste rock will be mined. Approximately 21 Mt will be used for dam and road construction and for creating bases below the low-grade stockpiles. An additional 110 Mt will be hauled to the TMF for dam raising throughout the mine life. The balance of non-PAG waste rock will be stockpiled north of the plant site and west of the open pit.

Unclassified and PAG waste rock will be placed within the TMF as part of the long-term reclamation requirements for the site.

5.7.2.5 *Fuel Supply, Storage, and Distribution*

The diesel fuel storage facility dispensing diesel and gasoline will supply mining equipment during the Operations phase. Daily fuel deliveries by highway tanker truck from a fuel terminal will be necessary to replenish supply at the Project Site. It is envisaged that two return trips per day by a tri-drive fuel tanker of 48,000 L capacity will be undertaken between the Vavenby Bridge road and the mine, to maintain adequate supply.

During Operations, four 75,000-L diesel storage tanks, single gasoline storage tank and associated loading and dispensing equipment will be located in a purpose-designed facility near the truck shop. A dedicated fuel truck (bowser) will transport diesel to the mining equipment operating in the pit and fuel replacement will be a daily occurrence from an off-site terminal. In the description of ore processing in Section 5.9 below, a plan view of the mine plant site that shows the mill building, truck shop, warehouse and associated infrastructure such as the fuel storage facility is provided in Figure 5.9-4.

5.7.2.6 *Explosives Manufacture, Storage, Transportation, and Use*

Explosives will be handled as outlined in the Construction phase in Section 5.7.1.11 above.

5.7.2.7 *Security*

A gate will be installed at the entrance to the mine site and monitored and controlled remotely by security located at the warehouse. The gate will ensure the physical integrity of the facilities, and control and record the access of people to operation and restricted areas. Security facilities will be established at the beginning of Construction and will remain in place for the life of the Project. Prior to leaving the site vehicles and people will be inspected on the way in (for fitness to work and authority to enter) and on the way out to check for unauthorized removal of materials from the site.

5.7.2.8 *Sewage and Domestic Waste*

For the Operations phase it is planned to install a portable sewage treatment plant (rotating biological contactors or other similar unit) to handle both black and grey water waste. The resultant wastewater, treated to an acceptable quality standard, will be released into the environment via a tile field. Sludge will be removed as required for efficient operation of the plant, and disposed of off-site.

Domestic waste generated during the Operations phase will be a fraction of that generated during the Construction phase. This is due to the reduced number of personnel required for operations and the removal of the accommodation and catering from site. Personnel for operations will reside in the local community and will be transported per shift by bus from the rail load-out facility. The incinerator in use during the Construction phase will be decommissioned and removed. However, the landfill established during the Construction phase will be maintained during the Operations phase, at a reduced level of service.

5.7.2.9 *Environmental Management System and Management Plans*

A summary of the proposed environmental management system (EMS) for the Project is outlined and described herein, Chapter 24 provides more detail. The EMS is a set of procedures and processes that will allow HCMC to improve the company's environmental performance in accordance with regulatory requirements. The EMS will provide a systematic way for organizations such as HCMC to manage their environmental affairs and will include written plans describing how environmental management actions will be applied that are important to the Project meeting necessary environmental performance standards.

A component of the EMS is an array of purpose-designed Environmental Management Plans (EMPs), which will reflect the environmental practices that will be formulated and applied during the Construction, Operations, and Closure phases of the proposed Project. The EMPs will provide a baseline for the development of environmental management method statements and work instructions. The subject areas that will be addressed comprise the following:

- Environmental Management System;
- Air Quality Management Plan;
- Archaeology and Heritage Management Plan;
- Emergency Response Plan;
- Explosives Handling Plan;
- Fish and Aquatic Effects Monitoring and Management Plan;
- Fuel and Hazardous Materials Management Plan;
- Groundwater Management Plan;
- Mine Waste and ML/ARD Management Plan;
- Noise Management Plan;
- Sediment and Erosion Control Plan;
- Selenium Management Plan;
- Site Water Management Plan;
- Soil Salvage and Storage Plan;
- Spill Prevention and Response Plan;

- Traffic and Access Management Plan;
- Vegetation Management Plan;
- Waste Management Plan; and
- Wildlife Management Plan.

An underpinning to the application of EMPs is the principle of adaptive management. By continual and purpose-designed monitoring of environmental performance against defined standards, divergence from such performance standards can be responded to. Adaptive management through a structured and iterative process of review thus allows decisions to be made about modifying the environmental management actions and reduce uncertainty over time. HCMC will undertake adaptive management in the application of the EMPs over the life of the mine and into the Closure phase as required.

5.7.3 Closure and Post-Closure

Closing the mine and reclaiming the various affected sites will accord with regulatory requirements and defined objectives. The necessary supervision and monitoring will be undertaken.

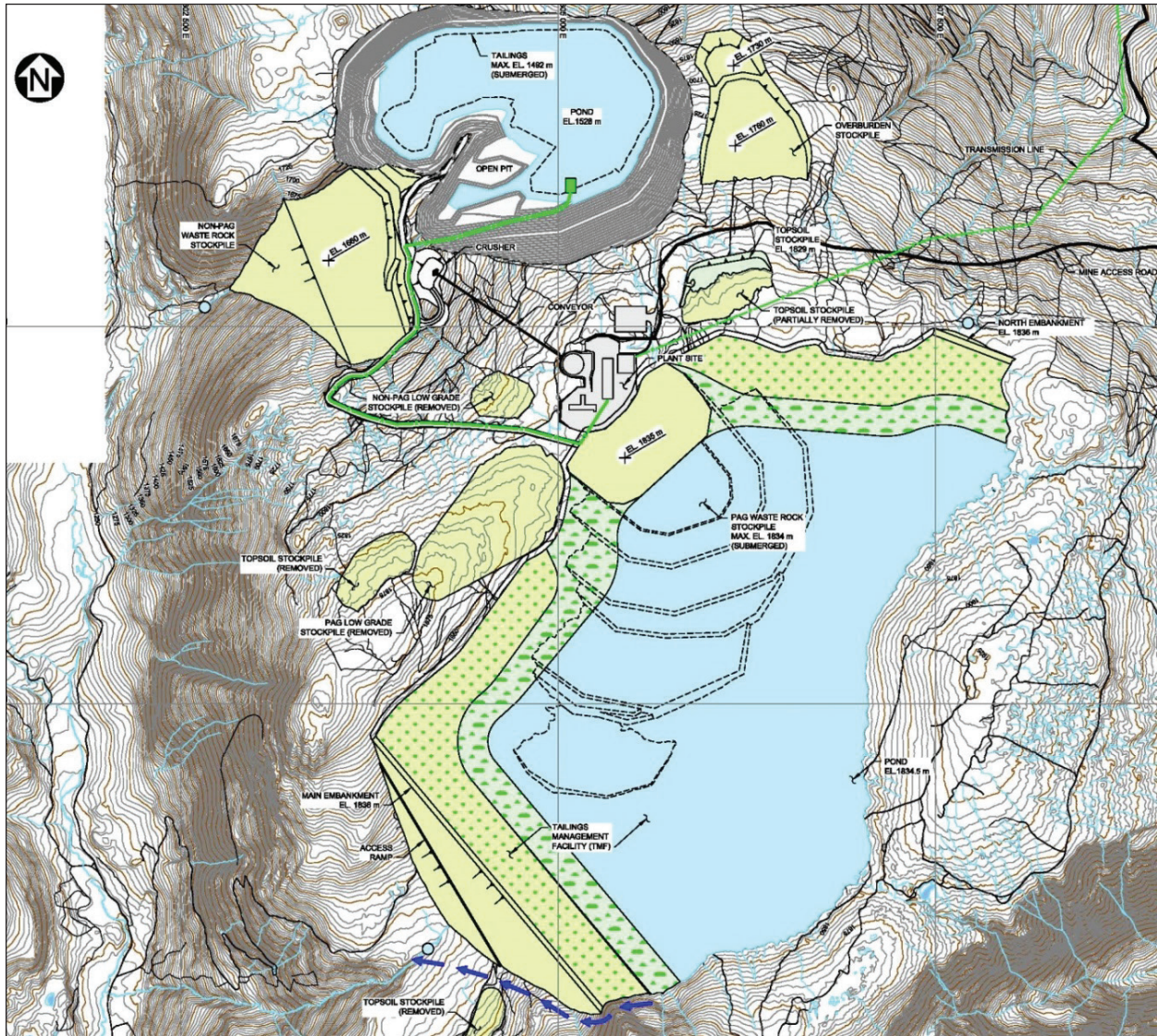
The Project design allows for substantial reclamation activities to occur during the final five years of Operations, such as the reclamation of embankment and stockpiles, leaving only the LGO footprints and infrastructure to be reclaimed in the years following Closure. The situation at the initiation of Closure is illustrated in Figure 5.7-3.

Closure and reclamation activities will commence about five years into mining operations. The activities have been split into concurrent reclamation (Years 5 to 28) and final reclamation (Years 29 to 35). The final reclamation activities extend into the Post-Closure phase of the Project and a nominal monitoring period of 50 years is envisaged. A general description of reclamation activities that will occur in each phase are as follows:

5.7.3.1 Concurrent Reclamation Activities

- Non-PAG LGO stockpile (small stockpile) – apply soil cover and re-vegetation.
- Overburden stockpile footprints – apply soil cover and re-vegetation.
- Non-PAG waste rock stockpile – apply overburden cap, soil cover, and re-vegetation.
- TMF embankments – apply overburden cap, soil cover, and re-vegetation.
- Tailings beaches – apply soil cover and re-vegetation.
- Tailings beaches – construct wetlands at TMF pond margins.
- TMF – construct spillway on eastern abutment of main embankment.

Figure 5.7-3
Project General
Arrangement in Year 28 (at Closure)



Source: Knight Piesold 2014

5.7.3.2 *Final Reclamation Activities*

- Topsoil stockpiles – remove and use to apply soil cover to Project facilities.
- PAG LGO stockpile footprint – apply soil cover and re-vegetation.
- Non-PAG LGO stockpile footprint – apply soil cover and re-vegetation.
- LGO water management ponds – decommissioning, removal, and re-vegetation.
- Crusher, conveyor, and Plant Site – remove structures, apply soil cover, and re-vegetation.
- Crusher pad – apply overburden cap, soil cover, and re-vegetation.
- Pipelines and pump stations – remove mechanical equipment, apply soil cover, and re-vegetation.
- Open pit – construct spillway on northern edge (lowest point of pit rim).
- TMF water management ponds – decommission, remove, and re-vegetation.
- Roads – decommission major haul roads and maintain sufficient road for light vehicle access.

Note that the final reclamation activities extend into the Post-closure phase of the Project and a nominal monitoring period of 50 years is envisaged.

The waste rock stockpiles and embankments will have a cap applied using material from the overburden stockpiles, to facilitate water storage and release, and limit infiltration through the underlying materials. Some areas will be re-forested with the same species that existed prior to mine development. The plant site, crusher, and conveyor will have a soil cover applied and then be re-vegetated, once all structures have been dismantled and removed from site. Access roads will be reclaimed, unless they are required for long-term access to the site.

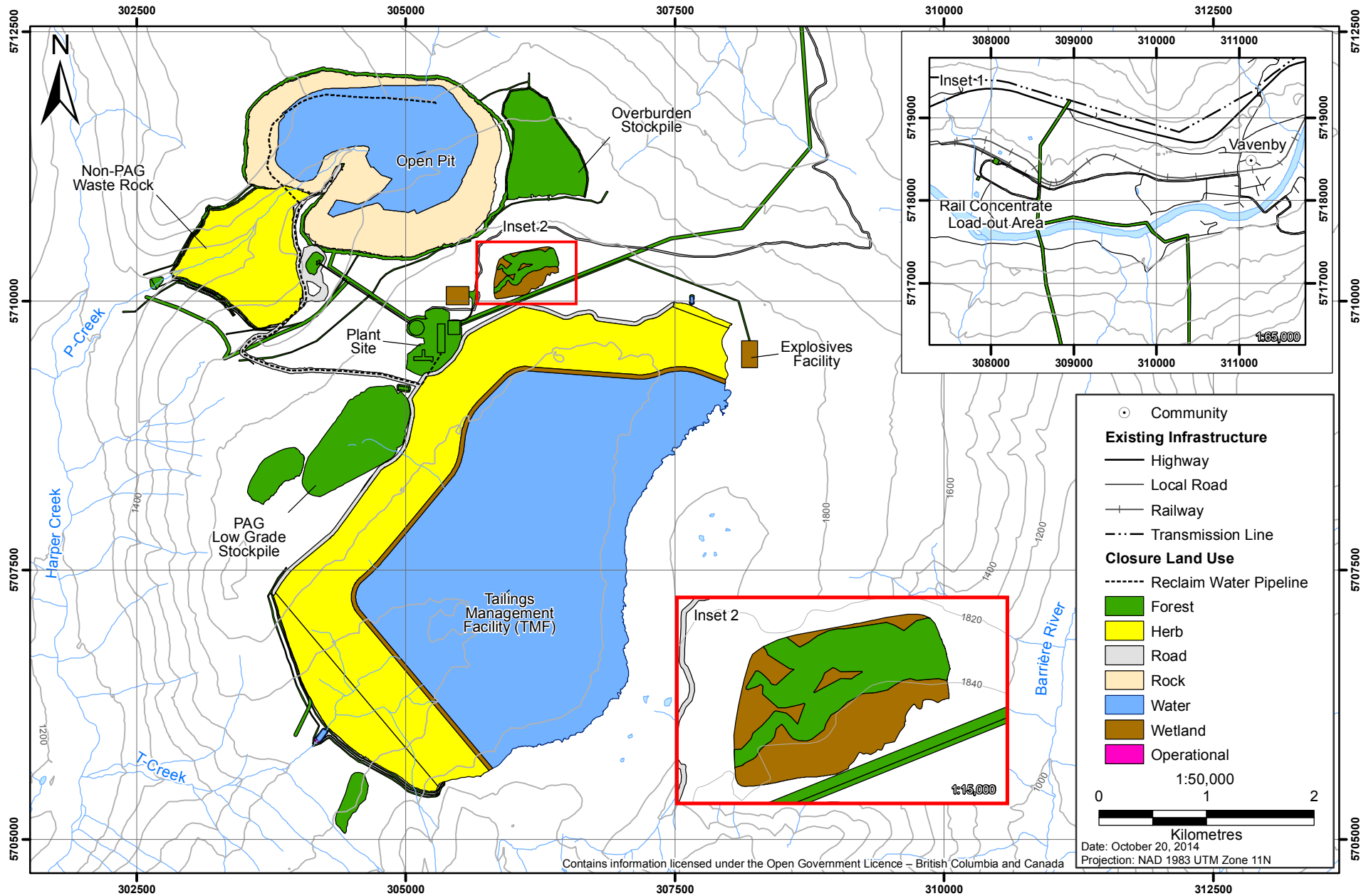
Excess water from the TMF will be released through the spillway on the east abutment once all tailings deposition is complete (after Year 28) and the TMF pond has reached the spillway invert (Year 31). At this time, water from the TMF water management pond will also be released if water quality is suitable for release to the downstream receiving environment.

Figure 5.7-4 provides an illustration of the Post-Closure situation envisaged for the Project.

5.8 PROJECT COMPONENTS AND ACTIVITIES

Highway 5, the CNR transcontinental main line, and a main BC Hydro 138-kV transmission line all pass approximately 10 km due north of the Project Site. The location and proximity to existing infrastructure were thus key drivers in design of the Project. Other than the existing network of FSRs, there are no services or utilities currently running to the immediate Project Site. The area's established infrastructure preclude the need for any major off-site infrastructure developments to service the Project, other than construction of the 14-km HCMC power line connecting the plant site substation to the BC Hydro transmission line and the building of a new 2.5-km road section near the Project Site.

Figure 5.7-4
Harper Creek Post-Closure



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The Sustainability in BC Mining Criteria (BC MEM 2013) has been used to guide project planning for the Project. The eight criteria used are as follows:

- Health and Safety;
- Effective Engagement;
- Respect for Indigenous Peoples;
- Environment;
- Full Mine Life Cycle;
- Resource-use Efficiency;
- Continuous Learning and Adaptations; and
- Benefits.

The components and activities that will comprise the proposed Project and the phases during which they are envisaged to occur are synthesized in Table 5.8-1 below. The following sections describe the components in more detail, according to the major infrastructure areas.

Table 5.8-1. Project Components and Activities per Phase

Project Phase	Project Components and Activities
Construction	Concrete batch plant installation, operation and decommissioning Hazardous materials storage, transport, and off-site disposal Spills and emergency management Construction of fish habitat offsetting sites On-site equipment and vehicle use: heavy machinery and trucks Explosives manufacture, storage and use Fuel supply, storage and distribution Open pit development - drilling, blasting, hauling and dumping Process and potable water supply, distribution and storage Auxiliary electricity - diesel generators Power line and site distribution line construction: vegetation clearing, access, poles, conductors, tie-in Plant construction: mill building, mill feed conveyor, truck shop, warehouse, substation and pipelines Primary crusher and overland feed conveyor installation Employment and labour Procurement of goods and services Aggregate sources/ borrow sites: drilling, blasting, extraction, hauling, crushing Clearing vegetation, stripping and stockpiling topsoil and overburden, soil salvage handling and storage

(continued)

Table 5.8-1. Project Components and Activities per Phase (continued)

Project Phase	Project Components and Activities
Construction (<i>cont'd</i>)	<p>Earth moving: excavation, drilling, grading, trenching, backfilling</p> <p>Rail load-out facility upgrade and site preparation</p> <p>New TMF access road construction: widening, clearing, earth moving, culvert installation using non-PAG material</p> <p>Road upgrades, maintenance and use: haul and access roads</p> <p>Coarse ore stockpile construction</p> <p>Non-PAG Waste Rock Stockpile construction</p> <p>PAG and Non-PAG Low-grade ore stockpiles foundation construction</p> <p>PAG Waste Rock stockpiles foundation construction</p> <p>Coffer dam and South TMF embankment construction</p> <p>Tailings distribution system construction</p> <p>Construction camp construction, operation, and decommissioning</p> <p>Traffic delivering equipment, materials and personnel to site</p> <p>Waste management: garbage, incinerator and sewage waste facilities</p> <p>Ditches, sumps, pipelines, pump systems, reclaim system and snow clearing/stockpiling</p> <p>Water management pond, sediment pond, diversion channels and collection channels construction</p>
Operations 1	<p>Concentrate transport by road from mine to rail loadout</p> <p>Explosives manufacture, storage and use</p> <p>Hazardous materials storage, transport, and off-site disposal</p> <p>Spills and emergency management</p> <p>Fish habitat offsetting site monitoring and maintenance</p> <p>Mine site mobile equipment (excluding mining fleet) and vehicle use</p> <p>Fuel storage and distribution</p> <p>Mine pit operations: blast, shovel and haul</p> <p>Ore crushing, milling, conveyance and processing</p> <p>Process and potable water supply, distribution and storage</p> <p>Backup diesel generators</p> <p>Electrical power distribution</p> <p>Plant operation: mill building, truck shop, warehouse and pipelines</p> <p>Employment and labour</p> <p>Procurement of goods and services</p> <p>Rail-load out activity (loading of concentrate; movement of rail cars on siding)</p> <p>Progressive mine reclamation</p> <p>Construction of Non-PAG tailings beaches</p> <p>Construction of PAG and Non-PAG Low Grade Ore Stockpile</p>

(continued)

Table 5.8-1. Project Components and Activities per Phase (continued)

Project Phase	Project Components and Activities
Operations 1 <i>(cont'd)</i>	Non-PAG Waste Rock Stockpiling Overburden stockpiling Reclaim barge and pumping from TMF to Plant Site South TMF embankment construction Sub-aqueous deposition of PAG waste rock into TMF Tailings transport and storage in TMF Treatment and recycling of supernatant TMF water Traffic delivering equipment, materials and personnel to site Waste management: garbage and sewage waste facilities Monitoring and maintenance of mine drainage and seepage Surface water management and diversions systems including snow stockpiling/clearing
Operations 2 Includes the Operations 1 non-mining Project Components and Activities, with the addition of these activities	Low grade ore crushing, milling and processing Partial reclamation of Non-PAG waste rock stockpile Partial reclamation of TMF tailings beaches and embankments Construction of North TMF embankment and beach Deposit of low grade ore tailings into open pit Surface water management
Closure	Environmental monitoring including surface and groundwater monitoring Monitoring and maintenance of mine drainage, seepage, and discharge Reclamation monitoring and maintenance Filling of open pit with water and storage of water as a pit lake Employment and labour Procurement of goods and services Decommissioning of rail concentrate loadout area Decommissioning and reclamation of mine site roads Decommissioning and removal of plant site, processing plant and mill, substation, conveyor, primary crusher, and ancillary infrastructure (e.g., explosives facility, truck shop) Decommissioning of diversion channels and distribution pipelines Decommissioning of reclaim barge Reclamation of Non-PAG LGO stockpile, overburden stockpile and Non-PAG waste rock stockpile Reclamation of TMF embankments and beaches Removal of contaminated soil Use of topsoil for reclamation Storage of waste rock in the non-PAG waste rock stockpile

(continued)

Table 5.8-1. Project Components and Activities per Phase (completed)

Project Phase	Project Components and Activities
Closure (<i>cont'd</i>)	Construction and activation of TMF closure spillway Maintenance and monitoring of TMF Storage of water in the TMF and groundwater seepage Sub-aqueous tailing and waste rock storage in TMF TMF discharge to T-Creek Solid waste management
Post-Closure	Environmental monitoring including surface and groundwater monitoring Monitoring and maintenance of mine drainage, seepage, and discharge Reclamation monitoring and maintenance Construction of emergency spillway on open pit Storage of water as a pit lake Procurement of goods and services Storage of waste rock in the non-PAG waste rock stockpile Storage of water in the TMF and groundwater seepage Sub-aqueous tailing and waste rock storage TMF discharge

Note that the Operations phase will comprise a first stage of 23 years (Operations 1) and a second stage of five years (Operations 2). These stages are defined by the fact that the mining operations will cease in the open pit in the first half of Year 24 and the mine will begin processing LGO from the site stockpiles thereafter. The tailings deposition from processing of the LGO will continue in the open pit, rather than at the TMF, for the five year Operations 2 stage.

5.8.1 Project Site

The following key mining components will be located within the Project Site:

- an open pit;
- a mine haul road, primary crusher, and ore conveyor;
- a plant site with ore processing facilities and incoming/outgoing pipelines;
- a TMF;
- overburden, topsoil, non-PAG waste rock, and PAG waste rock stockpiles; and
- non-PAG and PAG LGO stockpiles (for processing in latter part of Year 23).

To support development of the mine, the following services and ancillary facilities will be required for the Project:

- a mine access road about 24 km in total length resulting from improvements to existing road infrastructure, and which also includes construction of a new 2.5-km road section near the Project Site;

- a new 138-kV power line (the HCMC power line) approximately 14 km in length, connecting the plant site substation to the BC Hydro transmission line corridor;
- site distribution power lines (25 kV);
- permanent building structures;
- fresh water supply, fire/fresh water storage and distribution, and recycled water collection/storage/distribution;
- fuel storage and dispensing, sewage collection and treatment, drainage, and runoff settling ponds;
- temporary housing facilities for construction personnel;
- secondary roads, yard areas, and parking; and
- security, safety, and first aid facilities.

The Project Site with the open pit at its maximum extent of operations in Year 24 (Operations 2) is shown on Figure 5.1-2.

5.8.2 Tailings Management Facility

5.8.2.1 Tailings Material Testing Program

Geotechnical test work on samples of the bulk tailings stream was completed in support of the 2014 Technical Report and Feasibility Study ([Appendix 5-A](#)). The following points summarize the findings of the tailings tests:

- The tailings sample was described as a non-plastic, fine-grained sandy-silt with some clay.
- The measured specific gravity of the tailings was 2.79.
- The settled dry density of the tailings was approximately 1.2 t/m³ for undrained and drained settling conditions, with a measured supernatant water release of approximately 75%. The tailings slurry took up to four days to complete undrained settling and less than two days to complete drained settling.
- Coefficients of consolidation determined for the tailings generally increased with increasing effective confining stress. The coefficients of consolidation were determined to be between 20 to 1,600 m²/year for confining stresses up to 900 kilopascals.
- The dry density of the tailings increased with increasing effective stress (due to consolidation), with a value of approximately 1.6 t/m³ achieved at an effective stress of approximately 900 kilopascals.
- Measured vertical permeability results during the slurry consolidometer test decreased from approximately 1 x 10⁻⁴ centimetres per second (cm/s) at very low effective stresses to 3 x 10⁻⁵ cm/s at high stresses. The results were similar to the permeability measurements under very low stress that were completed during the drained settling test.
- A tailings dry density of approximately 1.5 t/m³ was achieved under air drying conditions.

The estimated particle size distribution, consolidation characteristics, and geochemical characteristics of the bulk tailings indicate that the tailings will be of suitable quality to be used as an upstream low permeability zone during progressive dam raises. This zone is incorporated into the design to control seepage through the dam during Operations.

5.8.2.2 *Tailings Management Facility Embankment Design and Construction*

The TMF has been designed to provide for secure and permanent storage for 585 Mt of tailings and 237 Mt of PAG waste rock from the proposed mining operation. The TMF is located in a bowl-shaped basin in the upper reaches of a tributary to Harper Creek. The tributary is classified as non-fish habitat and is isolated from migratory fish by a natural fish gradient barrier. The catchment is hydraulically contained by topography on three sides and will be confined by constructing an earthen dam on the fourth side to create the TMF. The TMF has been sited in the preferred location after an examination of potential alternatives. Limited options exist for siting a TMF at this Project location; this is discussed further in Chapter 4, Alternatives Assessment.

The tailings dam will be constructed in several stages to provide the necessary storage capacity over the life of the Project. The dam will consist of a cofferdam and an initial starter embankment (Stage 1) constructed during the Construction phase, an embankment raise during the first year of Operations, and annual staged expansions thereafter over the life of the Project using the centreline method of construction. The ongoing annual raises of the embankment crest to support the staged expansion will be carried out during the summer months of Operations. The design of the tailings dam stages are described in detail in the following sections.

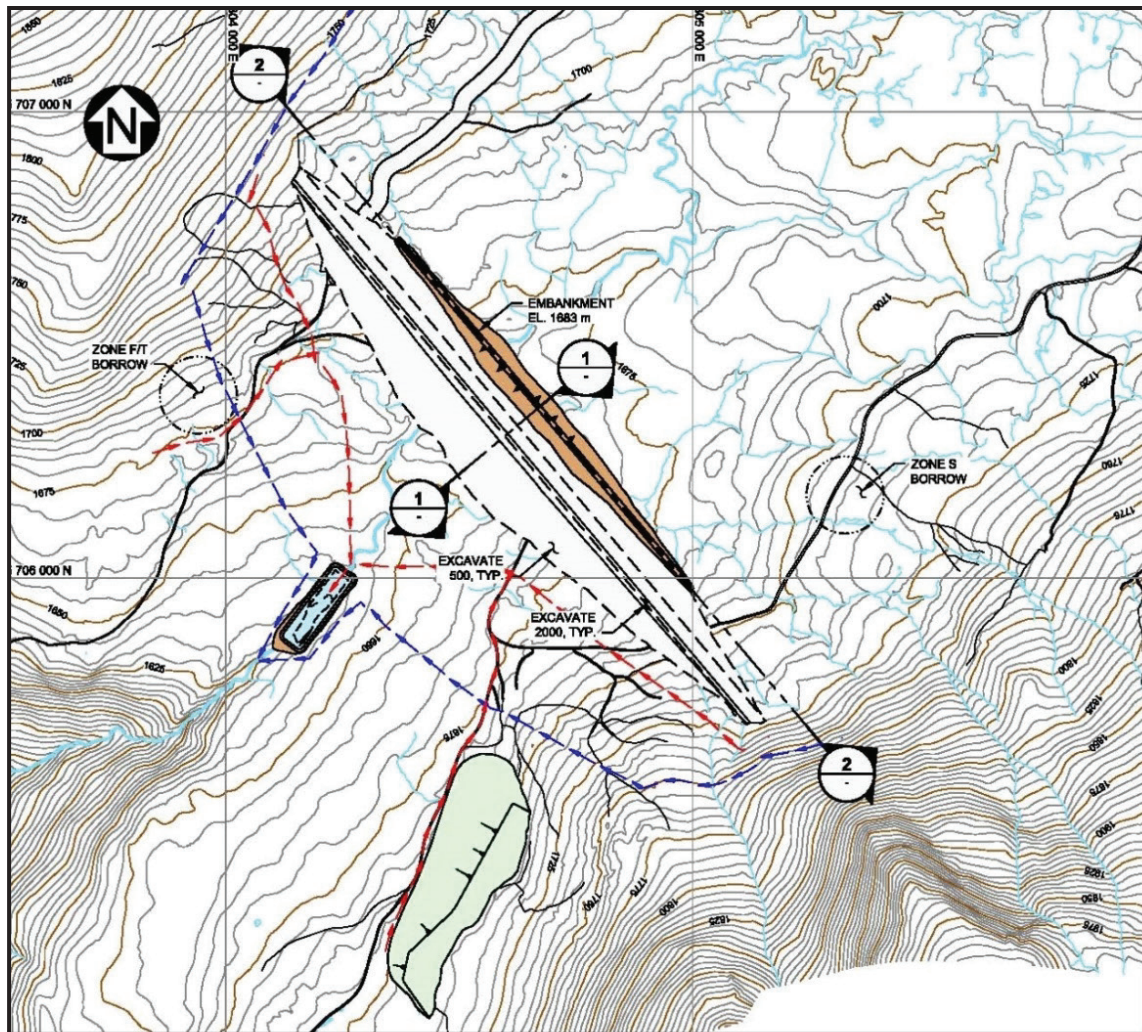
Cofferdam

The initial stage of the tailings dam is the cofferdam, which will eventually become the upstream toe of the full Stage 1 main embankment. It was designed to an elevation of 1,685 m with an embankment crest 10 m wide and 1.5H:1V slopes, upstream and downstream. The general arrangement (plan and section) of the cofferdam is provided as Figure 5.8-1.

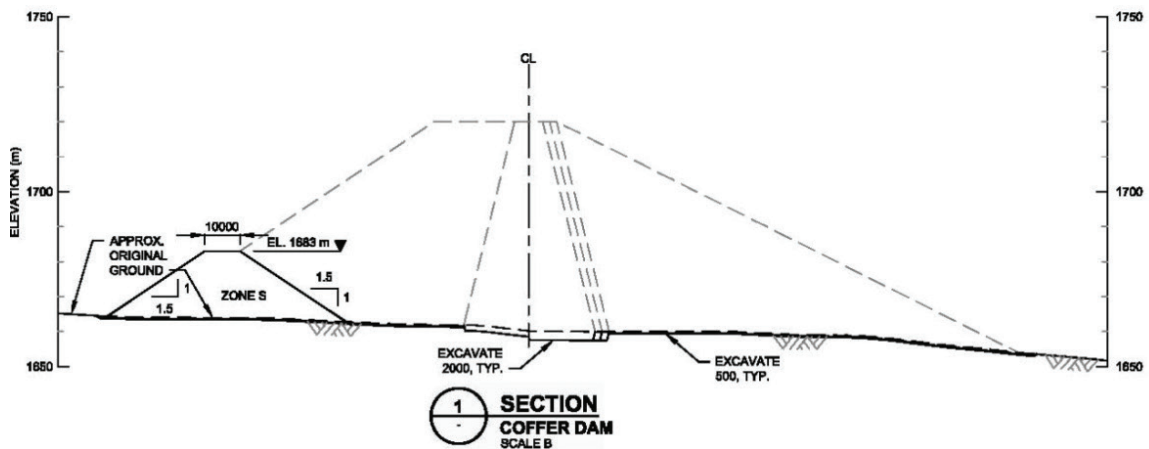
The cofferdam will be constructed entirely of locally borrowed glacial till material from the southeast side of the TMF impoundment area, located within 2 km of the dam. The total volume of the cofferdam has been estimated to be 400,000 m³. During construction of the cofferdam, all contact runoff water will be collected in temporary ponds and stored until closure of the impoundment to prevent sediment-laden water from entering the downstream watercourse. Following closure of the cofferdam, the ponded water will be released or pumped to the TMF impoundment created by the cofferdam. The cofferdam will be constructed entirely of glacial till material from a single borrow area in Zone S (Figure 5.8-2) to limit the need for sediment and erosion control in multiple areas for this initial phase of construction. Non-contact water will be diverted to the maximum extent practical.

Closure of the cofferdam and initial impoundment of the TMF is assumed to occur after August following the annual freshet, which generally provides the vast majority of the run-off at the Project Site. The cofferdam will provide storage capacity for four months (September through December) of statistically wet conditions for the Project Site, in addition to a 10-year return period design flood.

Figure 5.8-1
Cofferdam Plan
and Section

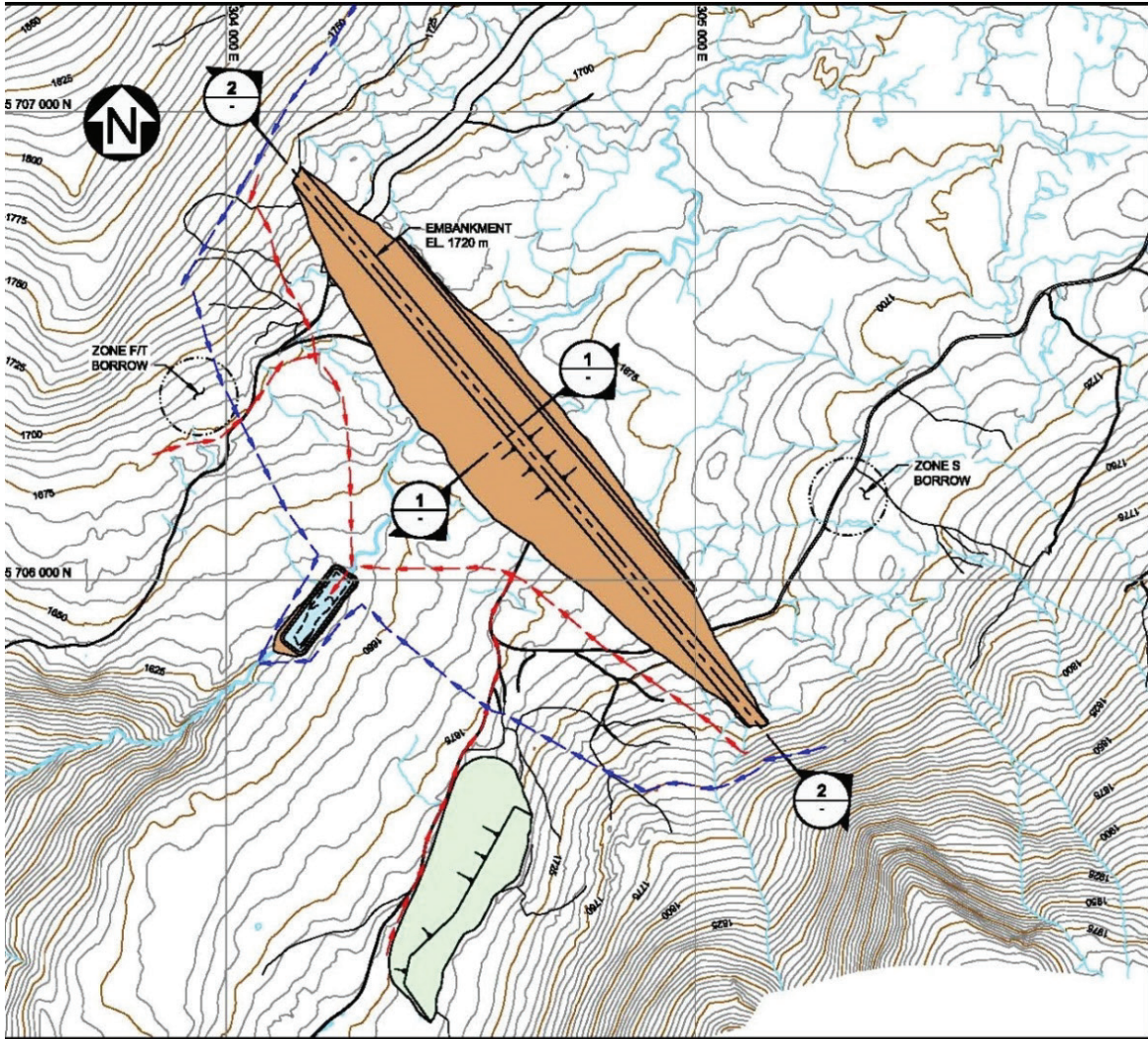


PLAN
STAGE 1 COFFER DAM EL. 1683 m
SCALE A

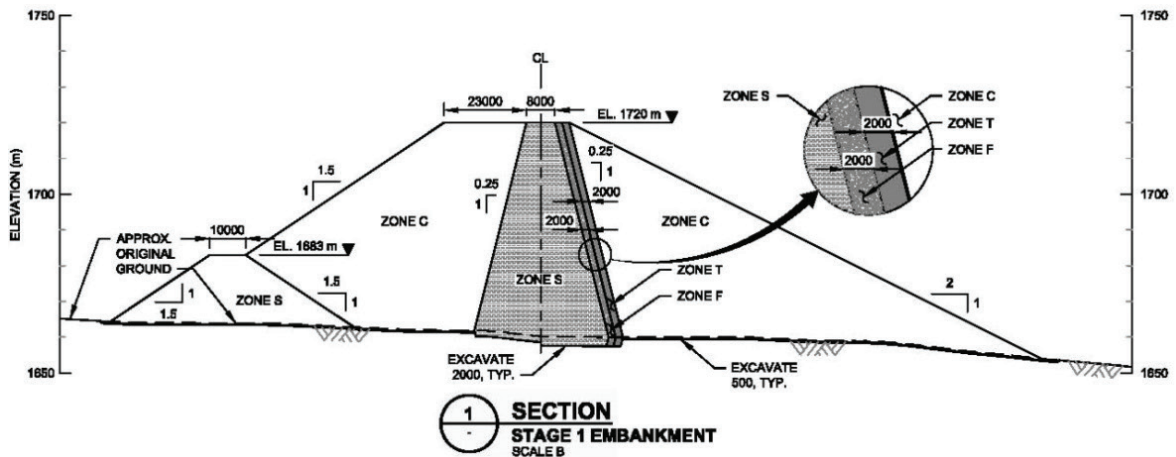


SECTION
COFFER DAM
SCALE B

Figure 5.8-2
 Stage 1
 Main Embankment



PLAN
 STAGE 1 EMBANKMENT EL. 1720 m
 SCALE A



SECTION
 STAGE 1 EMBANKMENT
 SCALE B

The cofferdam will provide a four-month working window for the construction of the Stage 1 main embankment. It is intended to provide secure isolation to construct the downstream seepage collection pond, foundation seepage collection drains, the foundation key-in for the core zone, and to allow the construction of the Stage 1 main embankment to advance above the cofferdam elevation.

Stage 1 - Main Embankment

Construction of the Stage 1 main embankment will commence immediately following completion of the cofferdam to an elevation of 1,700m, which will provide storage capacity for a maximum pond volume of 12 Mm³ in time to collect and store the annual freshet. Stage 1 main embankment construction will continue to reach an elevation of 1,720 m (approximately 70 m in height at the maximum dam section) prior to the start of operation of the process plant. The Stage 1 main embankment will provide an impoundment capable of securely storing process start-up water, one year of process tailings and PAG waste rock, site contact water, and the Inflow Design Flood (IDF) with at least 1 m of freeboard for wave run-up.

The Stage 1 main embankment design incorporates upstream and downstream shell zones comprised of general fill (Zone C), together with the embankment having a core zone of low-permeability (Zone S) material and two downstream filter/transition layers (Zones F and T), which will maintain the integrity of the core zone and control seepage flow that passes through the core. The seepage will be collected in a longitudinal drain running the length of the embankment and directed to an outlet drain near the center of the embankment. Seepage flow will be directed in the outlet drain to a downstream water management pond for collection and recycle of contact water to the TMF.

Construction of the Stage 1 main embankment will require approximately 7.35 Mm³ of material, which will be provided from pit stripping (5.55 Mm³) and external borrow sources (1.8 Mm³). The general arrangement (site plan) of the Stage 1 main embankment is provided as Figure 5.8-2.

Staged Embankment Expansions

Construction of subsequent stages of the main embankment will commence following the start of process plant operation and will be completed using the centreline method of construction. The expansion of the embankment will consist of two major work areas – downstream step-outs and crest raises.

Downstream step-outs of the main embankment shell zone (Zone C) will be constructed in sections at least 30 m-wide using non-PAG waste rock from the open pit. An access ramp will be built into each step-out to allow on-going access to the embankment toe for downstream construction. Each step-out will support one or more vertical embankment crest raises.

Crest raises, constructed on an annual basis, provide storage for the upcoming year of tailings, PAG waste rock, and site contact water. The height of the annual raise varies from 11 m to 3 m depending on storage characteristics of the TMF and the volume of waste to be managed in the upcoming year.

The total fill requirement for the main embankment is 58.4 Mm³ of construction material, which will be provided from pit stripping (55.7 Mm³) and external borrow sources (2.7 Mm³).

The final stage of the main embankment is designed to reach an elevation of 1,836m, which is approximately 185m in height at the maximum dam section. It will be capable of securely storing over 585 Mt of process tailings, 237 Mt of PAG waste rock, site contact water, and the IDF with at least 1 m of freeboard for wave run-up. The general arrangement (site plan) of the ultimate embankment is shown on Figure 5.8-3.

Mining operations will cease in the open pit in the latter half of Year 24 and the mine will begin processing LGO from the site stockpiles thereafter. The tailings deposition from processing of the LGO will continue in the open pit, rather than at the TMF. Reclaim water will continue to be sourced from the TMF supernatant pond for approximately one year, after which process water will be reclaimed from the open pit supernatant pond.

Expansion Potential

The overall site capacity of the TMF is capable of expansion to 920 Mm³, an increase of approximately 30% with additional engineering and capital investment should future expansion be required.

5.8.2.3 *Tailings Distribution Pipeline*

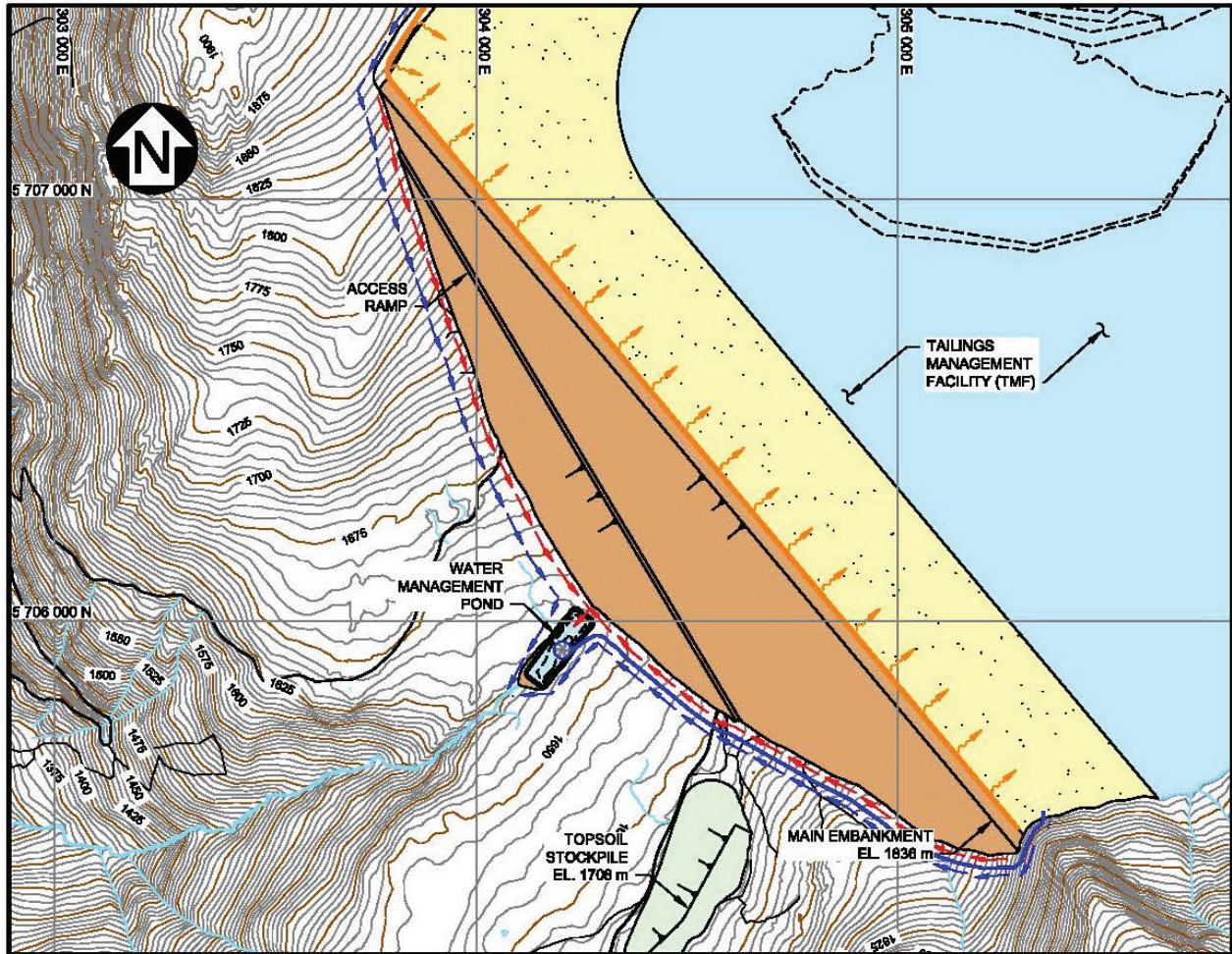
Two tailings streams will be generated in the process plant and transported to the TMF, these being rougher scavenger (bulk) tails and cleaner scavenger (cleaner) tails. The bulk tailings stream consists of approximately 93% of the total tailings generated with cleaner tailings representing the remaining balance of 7%. The bulk tailings slurry concentration was estimated to be 34.5% dry by weight, with a solids density of 2.66 t/m³. The cleaner tailings slurry concentration was estimated to be 32.7% dry by weight, with a solids density of 3.11 t/m³.

The two tailings streams will be transported in separate pipelines to the TMF. These pipelines have been identified as the bulk tailings pipeline and the cleaner tailings pipeline. Both pipelines will follow a pipeline road from the plant site towards the TMF at an approximate grade of 2% for most of the distance. This arrangement allows for approximately 10 years of gravity-fed tailings deposition before relocation of the road and pipeline. The road will generally follow the construction access road developed for construction of the TMF embankment.

The bulk tailings pipeline will consist of 32 to 36-inch-diameter piping. Bulk tailings will be transported to the TMF embankment and discharged from the embankment crest using spigots to build tailings beaches. In addition, the bulk tailings will be used to develop the upstream zone of the staged embankment raises during the first 22 years of Operations.

The cleaner tailings pipeline will consist of a 14-inch-diameter pipe. The cleaner tailings will be transported to a location within the TMF near the reclaim barge. The cleaner tailings will be deposited in an area that maintains the tailings solids in a subaqueous state perpetually. The purpose of disposing of the cleaner tailings in a subaqueous manner relates directly to the geochemical characterization of this material. It is assumed to be PAG, and therefore managed using this technique.

Figure 5.8-3
Main Embankment
- Final Stage



PLAN
EMBANKMENT YEAR 24
SCALE A

During the processing of the low-grade stockpile, tailings will be directed to the open pit via two separate pipelines, in the same fashion as for deposition of tailings in the TMF. The bulk tailings will be deposited to the north, west, and eastern sides of the pit, while the cleaner tailings will be deposited to the south side of the pit, where the pit supernatant pond is expected to be the deepest, again ensuring perpetual subaqueous storage of the PAG cleaner tailings.

5.8.3 Site Access Road

Current road access to the mine site area is described in Section 5.2.3 above.

A safe and reliable means of delivering materials and equipment to the Project Site, and hauling concentrate from the mine to the rail load-out facility, will be required to support the Construction and Operation phases of the Project, respectively. The current access to the site does not meet the Project's requirements, so the feasibility study reviewed potential site access options. The preferred option is shown on Figure 5.8-4.

In general, the proposed operational access to site from Highway 5 is via the Vavenby Bridge Road through Vavenby and across the North Thompson River to the BILCR. From there, access is via an existing 18.5 km network of FSRs that climb up to the plant site from its junction at BILCR south of Vavenby. The FSRs that comprise the access road will be the:

- Vavenby Mountain FSR;
- Saskum Plateau FSR; and
- Vavenby-Saskum FSR.

In order to improve access for both construction and mining, the FSRs will be upgraded as required, as first described in Section 5.7.1.3. The upgrades will include:

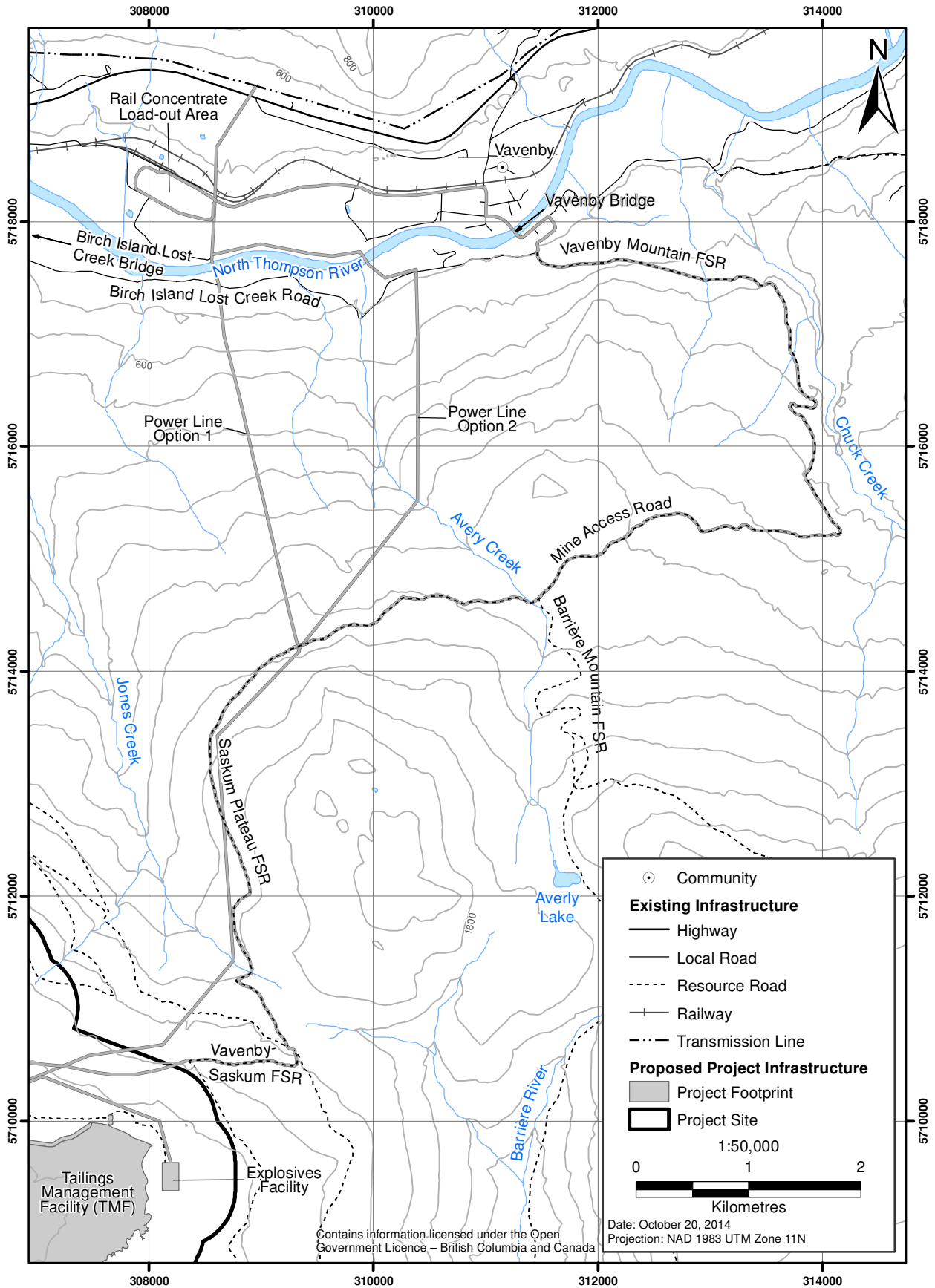
- widening and resurfacing where necessary;
- improvements to alignment where practical;
- improvements to the BILCR/Vavenby Mountain FSR junction; and
- signage improvement.

During the course of construction, oversized loads (overweight and/or over length/width), will require an alternative access across the North Thompson River as the Vavenby Bridge has not been designed to cater for such loads safely. The proposed temporary construction route access for oversize loads will be:

- Highway 5 (from both north and south bound);
- BILCR;
- Vavenby Mountain FSR;
- Saskum Plateau FSR; and
- Vavenby-Saskum FSR.

Figure 5.8-4

Project Access Route



This proposed route crosses the North Thompson River at the BILCR Bridge which has been design for heavier loads. The BILCR is indicated on Figure 5.8-4.

[Appendix 5-E](#), Traffic Impact Assessment, provides a detailed description of the evaluation of transportation and access matters used in the planning of the Project.

5.8.4 Power Line

The average power demand of the Project is approximately 82 MW, which will be accessed from the BC Hydro grid. HCMC will construct a 14 km, 138 kV overhead power line (HCMC power line) from the BC Hydro transmission line, crossing the North Thompson River to the Project's main substation located adjacent to the processing plant, where it will be stepped down to 25 kV for distribution to Project infrastructure. The HCMC power line will be constructed using a combination of single wooden poles and H-frame structures as required. The proposed alignment of the HCMC power line is shown on Figure 5.8-4.

5.9 MINING METHOD

5.9.1 Open Pit

The Project consists of a nominal 70,000 t/d conventional copper concentrator and a combined electric and diesel-powered open pit mining operation. The mineable reserves are estimated to be 716 Mt with an average grade of 0.26% copper, 0.029 g/t gold, and 1.18 g/t silver reported at a 0.14% copper cut-off grade. The reserves will be mined by open pit methods in five phases of pit development and expansion. The overall strip ratio is 0.76:1 and the total in-pit waste is 543.7 Mt (including 1.9Mt of wasted LGO). The overall mine life is 28 years after start-up of the concentrator.

Mill feed and waste will be drilled by diesel and electric powered rotary drills and blasted using heavy ANFO. Mill feed and waste will be loaded into 227-t mine trucks by 42-m³ electric hydraulic shovels and an 18-m³ wheel loader. Potential PAG waste rock will be placed in the TMF. Non-PAG waste rock will be placed in the valley to the west of the pit. Non-PAG and PAG low grade waste rock will be stockpiled separately to the southwest of the plant site adjacent to the TMF to allow runoff from the PAG low grade stockpile to be directed into the TMF. Run-of-mine ore will be hauled to the primary crusher located southwest of the pit. Crushed ore will be conveyed to the coarse ore stockpile located adjacent to the concentrator building and subsequently to the crushing, grinding, and flotation sections of the process plant.

The concentrator design is conventional with primary crushing followed by semi-autogenous (SAG) mill and ball milling grinding and flotation producing a copper concentrate that will be dewatered and transported by truck, rail, and ship to smelter facilities overseas. Ore will be mined from the open pit and hauled directly to the crusher for 24 years. The implementation of an elevated cut-off grade strategy requires the stockpiling of 116.9 Mt LGO. This material will be reclaimed and processed at the end of the open pit life for another four years.

Tailings will be impounded behind a constructed dam, the main embankment of which will be approximately 4.5 km to the south of the open pit. Overburden and non-PAG waste rock from the mine will be used to construct the dam. Figure 5.9-1 shows the general arrangement of the Project in Year 28.

5.9.1.1 *Open Pit Design*

Pit geotechnical and hydrogeological investigations were carried out to define key mining parameters such as pit slope angles and to predict the volume of groundwater that can be expected to flow into the pit during Operations.

The open pit design is based upon the following key considerations:

- minimum mining width defined by double side loading of trucks with allowance for an access ramp;
- bench height achievable and within the safe operating reach of the primary loading units;
- minimum haulage road operating width and maximum effective grade within the operating limitations of the primary haulage units;
- logical and efficient scheduling of material movement from multiple phases of pit;
- expansion to the crusher, the stockpiles and to final waste material placement sites; and
- minimum footprint for disturbance of the surrounding area.

Pit geotechnical investigations carried out by Knight Piésold in 2012 ([Appendix 5-G](#), Open Pit Geotechnical Design) defined six main zones within the open pit, as follows (Figure 5.9-2):

- Northeast Sector:
 - the north hanging wall dips at an azimuth of 180°;
 - consists of West Volcaniclastics geotechnical domain;
 - pit walls approximately 270 m high;
 - characterized by drillholes HC11-GM03 to GM05;
- East Sector:
 - dips towards the west at a nominal pit wall dip direction of 270°;
 - consists of East Volcaniclastic geotechnical domain;
 - pit walls approximately 375 m high;
 - characterized by drill hole HC11-GM06;
- South Sector:
 - this sector contains the northward dipping south foot wall of the pit. The slope angle of the foot wall is influenced by the orientation of the foliation;
 - consists of East Volcaniclastic geotechnical domain;
 - pit walls in this sector are approximately 445 m high;
 - characterized by drillholes HC11-GM01 and HC11-GM07;

Figure 5.9-1
Project Area at Maximum
Extent of Operations

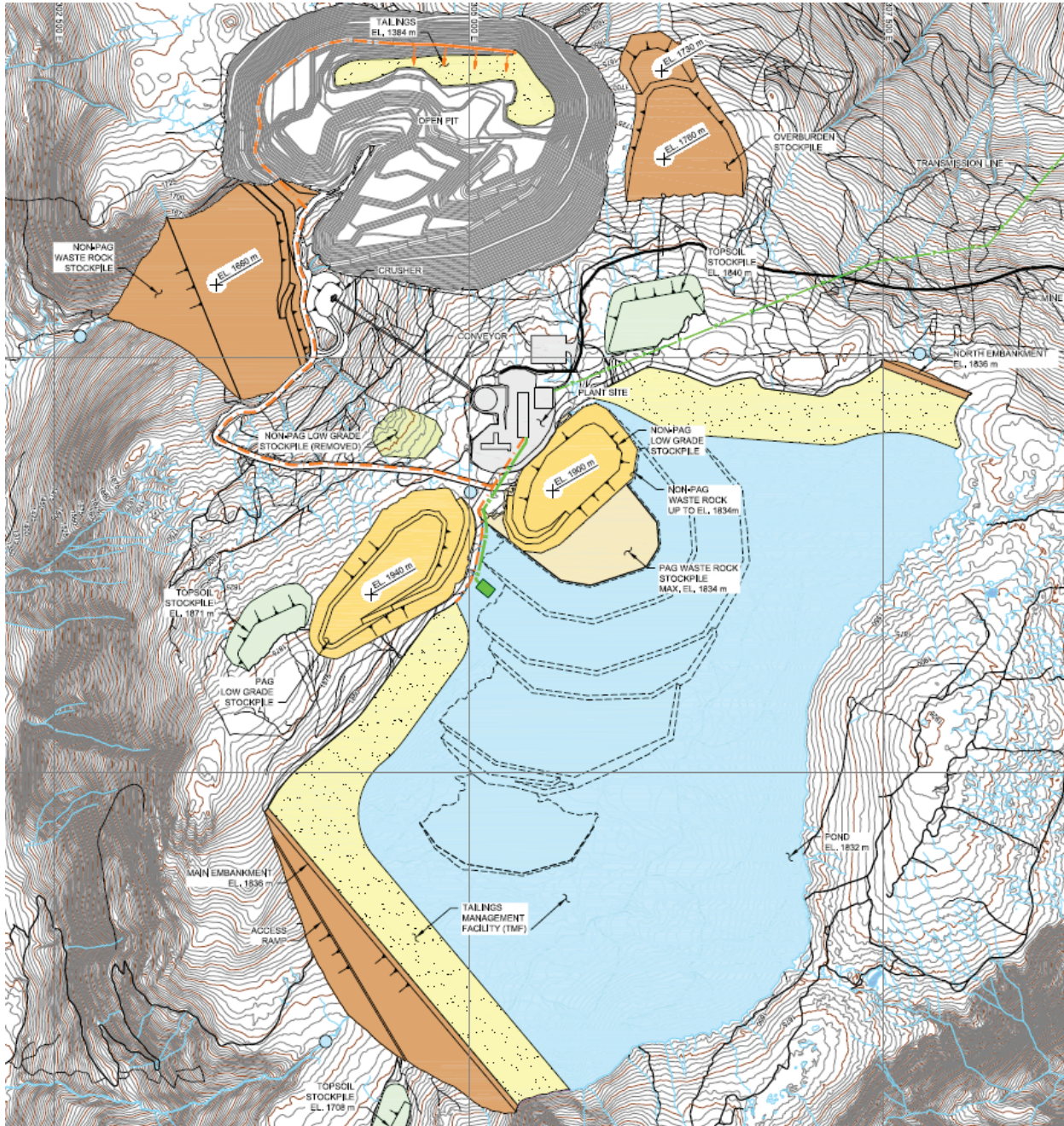
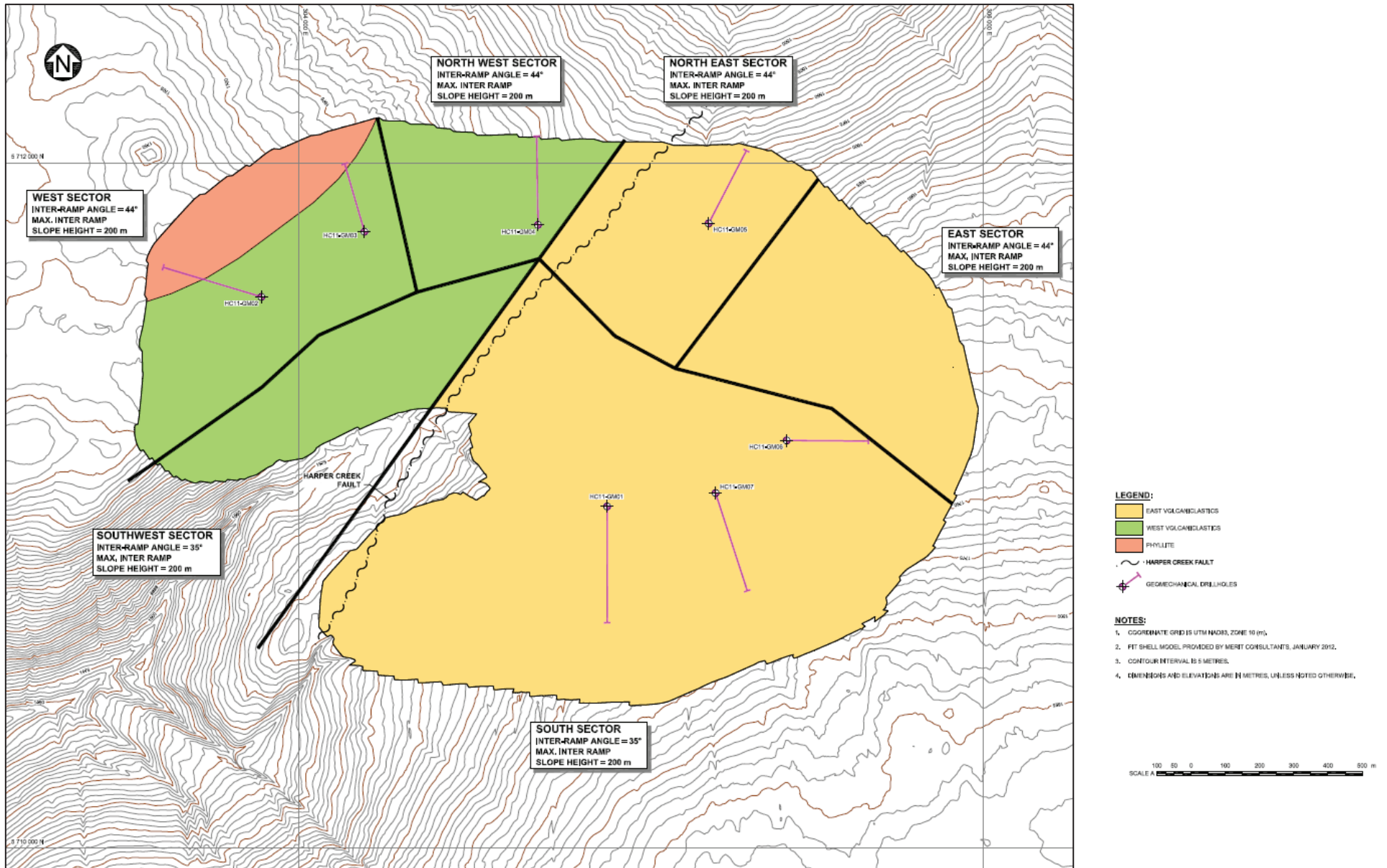


Figure 5.9-2
Pit Shell Model
with Pit Design Sectors



Source: Knight Piésold Consulting.

- Southwest Sector:
 - this sector contains the northward dipping south foot walls of the western arm of the pit. The slope angle of this foot wall is influenced by the orientation of the foliation;
 - consists of West Volcaniclastics geotechnical domain;
 - pit walls are approximately 210 m high;
 - characterized by drill hole HC11-GM02;
- West Sector:
 - consists of southeast and northeast dipping walls of the western area of the pit;
 - both Phyllite and West Volcaniclastic geotechnical domains are present in this sector;
 - pit walls approximately 210 m high;
 - characterized by drill hole HC11-GM02;
- Northwest Sector:
 - continuation of the north hanging wall which dips at an azimuth of 180°, rotates towards a 220° dip direction at the eastern end of the sector;
 - consists of East Volcaniclastic geotechnical domain;
 - pit walls approximately 270 to 300 m high; and
 - characterized by drillholes HC11-GM03 to GM05.

The primary components for open pit slope design include bench geometry, inter-ramp slope angle, and overall slope angles. Pit slope configurations are discussed below.

5.9.1.2 *Bench Geometry*

The height of benches is typically determined by the size of the shovel selected for mining operation.

Given the planned use of electric hydraulic face shovels, a 12-m bench height was selected. It is recommended that single-bench configurations be utilized for open pit development due to the low strength of the rock mass. Berm widths will be a minimum of 8 m and bench face angles no greater than 70°. Berms in the South Sector will be widened to 10 m and bench face angles laid back to a 60° in order to reduce the risk of possible planar failures.

5.9.1.3 *Inter-ramp Slope Angles*

The inter-ramp slope angles are primarily determined by kinematics and bench geometry. The critical wall of the open pit is the south foot wall within the South Sector of the pit. This wall is oriented in the same direction as the schistosity and primary jointing of the rock mass in the pit area. The inter-ramp angle of the South Sector of the pit will be no greater than 35° to mitigate the risk of multiple-bench planar failures. This inter-ramp slope angle can be achieved through the development of 12-m-high single benches, with a bench face angle of 60° and minimum berm width of 10 m. No significant kinematic controls were identified in other design sectors of the proposed pit, and slope angles are primarily determined by bench geometry. Utilizing 12-m-high single benches, with a minimum berm width of 8 m and maximum bench face angle of 70°, an

inter-ramp angle of 44° is achievable in the North, East, and West pit sectors. The inter-ramp slopes of the design sectors were used for the Lerchs Grossman pit optimization and pit design.

5.9.1.4 *Estimated Groundwater Inflows*

In situ hydrogeological testing was performed during the drilling of the geomechanical holes. Packer tests were performed at 15-m intervals using the Inflatable Packers International water inflated packer system. Falling head response tests, logged using an electronic transducer, were performed in conjunction with the packer testing. Test data from the in situ hydrogeological testing were compiled and plotted by depth to determine trends between lithology, depth, or pit sector. The test data show that the rock in the open pit area typically exhibits low permeability of approximately 1×10^{-5} cm/s) with higher permeability rock of 1×10^{-4} to 1×10^{-3} cm/s observed within the upper 50 to 75 m of bedrock. Artesian conditions were observed in the south and west areas of the open pit. The groundwater levels in the north and east areas of the pit are typically no deeper than 10 m.

Numerical modelling (MODFLOW) was used, incorporating the above measurements and the mine plan, to estimate the amount of water that is expected to seep into the open pit during mining.

5.9.1.5 *Pit Operation*

Pre-stripping at the open pit will begin during the Construction phase as a means of developing aggregate for site development and construction of the TMF Stage 1 main embankment dam. In the first year of Construction, access roads will be built from the pit to the process plant site and TMF, and crusher and conveyor excavations will have commenced. By the final year of Construction, overburden stripping and waste pre-stripping will be completed and 30 Mt of material will have been mined.

Ore will be extracted using conventional shovel and truck open pit mining operations. The overall life of mine strip ratio is relatively low at 0.76 : 1.00 waste to ore. The overall mining rate will be 60 Mt/a for most of the mine life. Cut-off grades will be varied to allow higher-grade material to be processed in advance of low grade. The mine has been designed for operations with hydraulic shovels in the 42 m³ range and trucks in the 227 t class with typical support equipment associated with this type of primary mining equipment.

The open pit mine development plan consists of five pit development phases expanding to a single large open pit. These five phases will be mined sequentially with overlap of up to three phases. A total of 30.9 Mt will be mined in preproduction. The Phase 1 (starter) pit will be approximately 1,600 m long in the east-west direction and 700 m wide in the north-south direction with a depth of approximately 230 m. Pushbacks are typically 120 to 200 m wide and will be developed out from the initial starter pit in all directions. The ultimate pit will be 2,400 m long and 1,670 m wide with a depth of approximately 375 m.

The Phase 1 pit will be developed over the first five years of mining. The Phase 2 pushback is an east/south expansion of the Phase 1 pit that also expands the mine at depth. The Phase 3 pushback is a west/north expansion of the Phase 1 and Phase 2 pit that further expands the mine at depth. The Phase 4 pushback is a southern up-dip expansion of the Phase 1, Phase 2, and Phase 3 pit.

Finally, the Phase 5 pushback is a northern down-dip expansion of the Phase 1, Phase 2, and Phase 3 pit. With the exception of the Phase 1 pit, all other phases are initiated before the subsequent phase is completed to ensure ore continuity to the concentrator.

The dewatering system for the open pit will pump all seepage and precipitation inflows out of the pit from suitably located pit sumps and direct it to the TMF. The system will keep the pit bottom dry during normal operating conditions. The design capacity for the dewatering system is controlled by the pit inflows during the 1-in-10-year, 24-hour storm event. It was assumed that the water will be removed over a 10-day period, during which time mining operations can continue in other active areas of the pit. The peak operational design capacity of the pumping system ranges from 100 L/s during the first phase of the pit, to 400 L/s for the final pit.

The pit dewatering pump system will use 18-inch high-density polyethylene DR9 pipeline to convey the water from the bottom of the pit to the TMF. A pit pump station will be installed in the pit bottom sump. A series of four identical booster pump stations were sized for staged installation as the pit depths and pit areas, and consequently design flows, increase annually. Water will be pumped from the pit via a direct route along the South Wall of the pit, with booster pumps placed approximately every 100 m of vertical rise. The maximum pipeline length is estimated to be approximately 2,400 m.

5.9.1.6 *Explosives Manufacture and Storage*

The explosives manufacture and storage facility established during the Construction phase (Section 5.7.1.11) will continue to be operated by an explosives contractor for the duration of mining. The location of the explosives manufacture and storage facility is shown on Figure 5.1-2.

5.9.2 **Ore Processing**

Run-of-mine ore will be hauled to the primary crusher located south west of the pit. Crushed ore will be conveyed to the coarse ore stockpile and subsequently to the crushing, grinding, and flotation sections of the process plant.

The proposed ore process plant for the Project is a conventional concentrator for a large tonnage, low-grade copper deposit, designed for simplicity of operation and to maximize recovery. The run-of-mine ore is reduced through three stages of comminution (crushing and grinding) and the copper minerals recovered by flotation, with rougher/scavenger concentrates regrind and cleaned to final commercial concentrate grades. The concentrator is designed to process a nominal 70,000 t/d of copper sulphide ore and produce a copper concentrate.

The flow of ore will be through crushing, grinding, and mechanical rougher/scavenger flotation tank cell banks. The rougher/scavenger concentrate is then cleaned through two stage column flotation cleaning to increase the quality of the concentrate. The rougher/scavenger concentrate will be sent through a regrind circuit and reprocessed through the cleaners to increase copper grade to commercial levels.

Final concentrate from the second cleaner column will be densified through a thickener and dried in filter presses to achieve concentrate moisture of approximately 8%. This concentrate will be trucked offsite for shipping to smelters.

The process plant will consist of the following operations and facilities:

- primary crushing;
- overland conveying;
- crushed material stockpile and reclaim;
- primary grinding circuit, including a SAG mill, two ball mills, and hydrocyclones for classification;
- copper rougher and scavenger flotation;
- rougher and scavenger concentrate regrinding;
- copper cleaner flotation;
- copper concentrate thickening, filtration and stockpiling, including off site;
- concentrate handling; and
- tailings slurry disposal to the TMF and open pit for solids storage and recycling of process water.

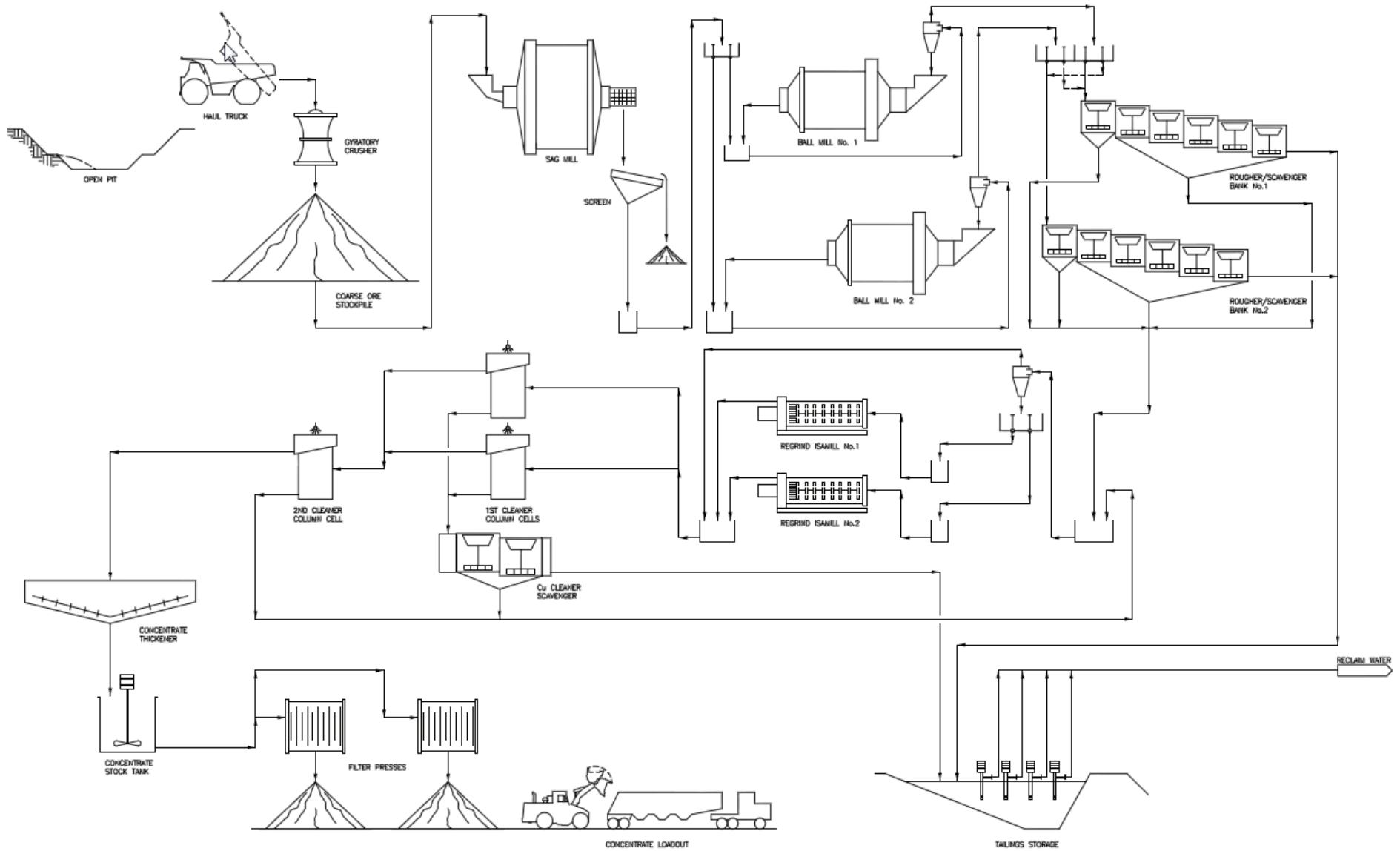
A simplified flowsheet of the process is presented in Figure 5.9-3 and a more detailed description of the processing steps in the concentrator follows. Figure 5.9-4 provides a plan view of the mine plant site that shows the mill building, truck shop, warehouse and associated infrastructure.

5.9.2.1 *Primary Crushing and Overland Conveyance*

The conventional gyratory crusher facility will crush the run-of-mine ore at an average rate of 4,167 t/hour for the downstream grinding process. The major equipment and facilities in this area include a gyratory crusher, an apron feeder, a hydraulic rock breaker, a sacrificial collecting conveyor, an overland belt conveyor to transport the crushed material to the stockpile, and dust suppression systems.

The run-of-mine ore will be trucked from the open pit to the primary crusher by haul trucks. The run-of-mine ore will be reduced to a product size of 80% of it finer than 200 mm using the primary crusher. A rock breaker will be installed to break any oversize rocks that may clog the dump pocket of the primary crusher. The crushed material will be discharged underneath the crusher and then onto an apron feeder. The apron feeder will convey the crushed materials onto a sacrificial conveyor and then to a 1.1 km overland conveyor which transports the crushed material to the coarse ore stockpile. The crushing facility will be equipped with a dust suppression/collection system to control fugitive dust that will be generated during crushing, material loading, and related operations.

Figure 5.9-3
Process Flowsheet



5.9.2.2 *Coarse Ore Stockpile and Reclaim*

The stockpile for the crushed material will have a live capacity of 70,000 t/d. The material will be reclaimed from this stockpile by three 1,829 mm by 6,135 mm apron feeders (two operating, one standby) at a nominal rate of 3,170 t/hour. The apron feeders will feed a 1,524-mm-wide belt conveyor at a controlled rate. The conveyor will transport the crushed material to the SAG mill. The conveyor belt will be equipped with a belt scale. The reclaim area will be equipped with a dust collection system to control fugitive dust that will be generated during the loading and the transportation of the crushed material.

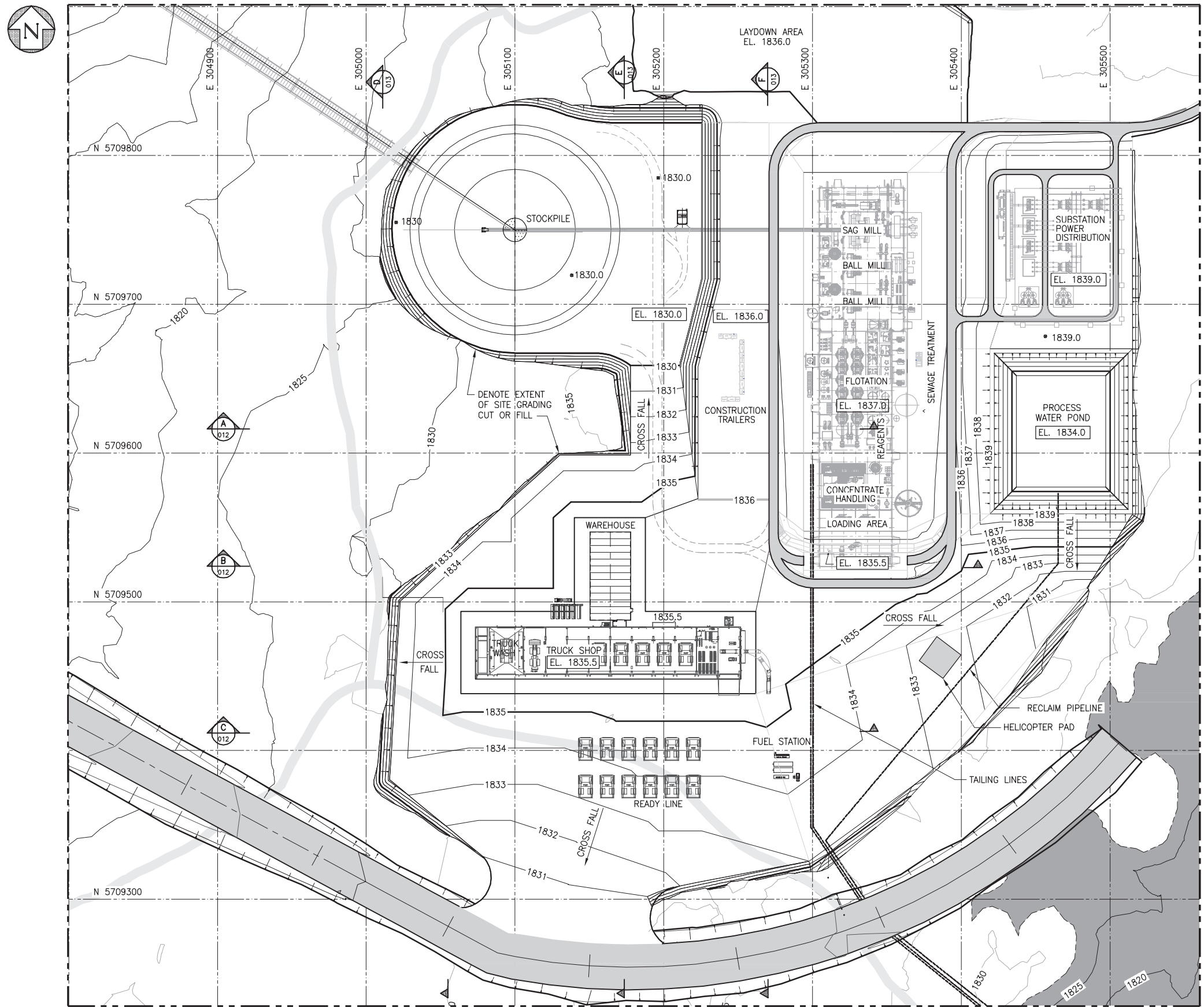
5.9.2.3 *Grinding and Classification*

The primary grinding circuit will be a semi-autogenous ball mill circuit encompassing a two stage grinding process which incorporates a SAG mill and two ball mills in closed circuit with classifying hydrocyclones. The grinding will be conducted as a wet process at a nominal rate of 3,170 t/hour of circuit feed. Lime will be added to the SAG mill feedbelt to raise the pH to 11, and aid selectively in flotation. The circuit has been designed for the future installation of a pebble crusher should it be required; however, comminution testwork and analysis to date suggest that pebble crushing is unlikely to be required. The grinding circuit will include:

- SAG mill 11.6m \varnothing x 6.7m long (38 ft x 22 ft), 21MW;
- SAG mill discharge pulp distributor;
- two ball mills 7.3m \varnothing x 12.8m long (24 ft x 42 ft), 13MW each;
- two 4,300-mm by 10,000-mm vibrating screens (one operation, one standby);
- four hydrocyclone feed slurry pumps (two operation, two standby); and
- two hydrocyclone clusters, each with eight 800-mm hydrocyclones.

The crushed material from the stockpile will be reclaimed at a controlled feed rate and fed to the SAG mill. The mill will discharge onto a vibrating screen with the oversize being conveyed to a bunker outside the grinding building for disposal, or manual re-entry into the process. The screen undersize will be pumped to a distribution box which will split the flow into two streams. The split slurry will report separately to two ball mill discharge/hydrocyclone feed pump boxes. Each ball mill will be operated independently in closed circuit with a hydrocyclone cluster. The feed to each of the ball mills will be the underflow of each mill's cyclone cluster. The hydrocyclone overflow advances downstream to the rougher/scavenger flotation process with a particle size of 80% passing 180 micrometres (μm) and containing approximately 35% solids by weight. The hydrocyclone underflow will report back to the ball mill. The circulating load of the ball mill circuit will be approximately 250% of the circuit new feed. Ball charge systems will be provided to add grinding media to the mills to maintain grinding charge.

Figure 5.9-4
Harper Creek
Plant Site



PLANT SITE -- PLAN
SCALE 1:1750

NOTES:

1. COORDINATES ARE RELATIVE TO UTM NAD83 ZONE 10N
2. LIDAR MAP TOPOGRAPHY SUPPLIED BY KNIGHT PIESOLD LTD.
3. ELEVATIONS ARE IN METRES.

PRELIMINARY
Date: 07/DEC/2011

Source: Allnorth Consultants Limited, 2011.

5.9.2.4 *Flotation and Regrind Circuit*

The hydrocyclone overflow will gravity flow to the flotation circuits to recover the copper minerals. The recovery process will consist of rougher/scavenger mechanical flotation, concentrate regrinding, and two stages of cleaner column flotation. A final cleaner scavenger train on the first cleaner cell will process the cleaner tails to recover residual copper minerals.

Copper Rougher/Scavenger Flotation Circuit

There will be two rougher/scavenger flotation banks taking the cyclone overflow product of each of the two ball mills. The hydrocyclone overflow will gravity flow to each of the rougher/scavenger flotation trains. The resulting scavenger tailings will be the final tailings which will gravity flow to the TMF. The rougher/scavenger concentrate will be pumped to the regrinding circuit. The rougher/scavenger flotation circuits will include twelve 300 m³ rougher/scavenger flotation tank cells; six cells per each train.

Standard flotation reagents to be added to the rougher/scavenger flotation will be PAX (potassium amyl xanthate) as collector, and MIBC (methyl isobutyl carbinol) as a frother. Provision has been made for additional reagents should they be required.

Regrind Circuit

The rougher/scavenger flotation concentrate together with the copper cleaner/scavenger concentrate and the second cleaner tails will be reground to 80% passing 20 to 25 µm to improve the liberation of the target minerals prior to the subsequent upgrading processes. The equipment used for the regrind will include:

- two IsaMill™ M10000 horizontal grinding mills;
- one hydrocyclone cluster consisting of ten 250-mm hydrocyclones, nominally for dewatering; and
- two hydrocyclone feed pumps (one operation and one standby).

The feed slurry will be pumped from the regrind pump box through the regrind cyclone to densify the slurry with the underflow being split into two flows and then fed into the two IsaMills. The regrind cyclones are not meant for classification as this will be done within the IsaMills; however finished material from the rougher circuit will be removed in these cyclones and advanced to the cleaner circuit. Slurry lime may be added to the regrinding hydrocyclone feed pumpbox to maintain a slurry pH of approximately 11 for the downstream cleaner flotation.

5.9.2.5 *Cleaner Flotation Circuit*

The reground rougher/scavenger concentrate will be pumped to the first cleaner flotation column cells. The concentrate from the first cleaner columns will be sent to the second cleaner column. The concentrate from the second cleaner column will be the final copper concentrate and will be directly pumped to the copper concentrate thickener.

The tailings from the first cleaner will be fed through a cleaner scavenger bank of mechanical flotation cells with the concentrate being pumped back to the regrind circuit for further processing. The tailings of the second cleaner will also be pumped to the regrind circuit for further processing. The equipment used in the cleaner scavenger circuit will include:

- two 170 m³ column cells operated in parallel (first cleaner column cells);
- one 170 m³ column cell (second cleaner column cell); and
- two 50 m³ tank cells (cleaner scavenger cells).

5.9.2.6 Concentrate Handling

The final cleaner flotation concentrate will be dewatered by high-rate thickening followed by pressure filtration, and then stockpiled prior to shipment to the smelters.

The final concentrate will be pumped to the concentrate thickener. Flocculant will be added to the thickener feed to aid the settling process. The thickened concentrate with 60% solids will be pumped to the concentrate stock tank and then be fed to the pressure filters for further dewatering. The filter cakes from the filter will contain less than 8% water and will be stockpiled before trucking to the off-site concentrate handling facility in Vavenby for shipping to the smelters.

5.9.2.7 Tailings

The rougher/scavenger and cleaner scavenger flotation tailings will be pumped separately to the TMF.

The water from the pond will be reclaimed by pumps installed on the reclaim water barge. The reclaimed water will be pumped to the process water pond for distribution to the points of usage.

The tailings handling, including the tailings embankment construction, is detailed in Section 5.8.2.

5.9.2.8 Reagent Handling and Storage

Various standard chemical reagents will be added to the process slurry streams to facilitate the copper flotation process. Reagents used in the process will include:

- PAX;
- provision for second collector, if needed;
- lime;
- MIBC;
- flocculant; and
- anti-scalant.

Reagent solutions will be stored in separate holding tanks and added to the addition points as required by processes using metering pumps. PAX will be added to the grinding and flotation circuits to modify the mineral particle surfaces and enhance the floatability of the valuable mineral particles into the various concentrate products. Most lime will be added dry to the SAG mill feed belt but some quicklime will be slaked on site and the lime slurry will be added to the primary grinding and regrinding circuits to depress pyrite flotation. MIBC will be used as a frother. Fresh water will be used for the preparation of the solid reagents, including PAX, lime, and flocculant to the required solution strength. The strength of the diluted reagent solutions for PAX will be 20% by weight while the lime content will be 15% by weight. Each reagent will have its own preparation system, including a bulk handling system and mixing and holding tanks.

A lime silo has been designed to store the lime required by the process for at least seven days. Lime will be delivered in bulk and will be off-loaded pneumatically into the silos. A lime slaking system has been provided for preparing milk of lime which will be pumped to the points of addition using a closed loop system. Flocculant will be prepared in the standard manner as a dilute solution of less than 0.5% solution strength for conditioning and further diluted prior to use. The liquid reagents, including MIBC, 3418A (Aerophine®, if required) and anti-scalant, will not be diluted and will be pumped directly from the bulk containers to the points of addition using metering pumps. The mixing and holding tanks will be equipped with level indicators and instrumentation to ensure that spills do not occur during normal operation. Appropriate ventilation, eye-wash stations, safety showers, fire and safety protection, and Material Safety Data Sheet stations will be provided at the reagent preparation areas.

5.9.2.9 *Assay and Metallurgical Laboratory*

The assay laboratory will be equipped with the necessary analytical instruments to provide all routine assays for the mine, the process plant, and the environmental departments. The most important of these instruments includes:

- Atomic Absorption Spectrophotometer;
- X-ray Fluorescence Spectrometer;
- fire assay equipment;
- sulphur and carbon determination furnace (Leco); and
- Inductively Coupled Plasma Mass Spectrometer.

The metallurgical laboratory will undertake all necessary testwork to monitor metallurgical performance and, more importantly, to improve process flowsheet unit operations and efficiencies. The laboratory will be equipped with laboratory crushers, ball and stirred mills, particle size analyzers, test sieves and shakers, flotation cell filtering and settling equipment, balances, and pH and Oxidation Reduction Potential meters.

5.9.2.10 *Water Supply*

Two separate water supply systems for freshwater and process water will support the operation. Freshwater will be used primarily for the following:

- fire water for emergency use;
- cooling water for mill motors and mill lubrication systems;
- gland seal service for the slurry pumps;
- reagent preparation;
- process water make-up; and
- potable water supply.

Freshwater required for the process will be sourced from the TMF and will be pre-treated prior to being sent to a fresh/fire water storage tank.

Potable freshwater will be supplied from a local well, as described in Section 5.11.2 below. The potable water will be treated and stored in the potable water storage tank prior to delivery to various service points.

All process water not requiring pre-treatment will be distributed to the plant site from the process water pond. The majority of the process water will be reclaimed water from the TMF supernatant pond, but will also include pit dewatering and potentially contact water from the non-PAG waste rock and LGO sediment collection ponds. The balance of the required process water will be freshwater from the fresh/fire water storage tank. The concentrate thickener overflow will be reused in the process circuit.

5.9.3 **Overburden and Waste Rock Management**

Waste rock, overburden, and LGO stockpiles have been located peripheral to the open pit and within the TMF as required to accommodate the scheduled quantity of each material type. PAG waste will be placed in the TMF for subaqueous disposal. Non-PAG waste rock will be placed within the valley located to the southwest of the proposed pit, as well as used for TMF embankment construction. Overburden will be placed to the east of the pit and used for road and dam construction.

5.9.3.1 *Overburden and Topsoil Stripping and Stockpiling*

Topsoil stockpiles will be established across the Project Site and include/but not limited to the north topsoil stockpile located northwest of the open pit, the east topsoil stockpile located southeast of the open pit, the west topsoil stockpile located west of the TMF, and the south topsoil stockpile located south of the TMF. These stockpiles will be re-vegetated during Construction and Operations to preserve the topsoil for application during late Operations and Closure. A single overburden stockpile will be located east of the open pit.

5.9.3.2 *Waste Rock Storage Facilities*

Total waste rock to be mined from the open pit is estimated at 543.7 Mt, including 39 Mt of overburden. Some overburden will be used for road and dam construction and the balance will be placed in a stockpile located to the east of the open pit for reclamation at the end of mine life. A total of 265 Mt of non-PAG waste rock will be mined. Approximately 21 Mt will be used for initial dam construction and for potentially creating bases below the low grade stockpiles. An additional 110 Mt will be hauled to the TMF for dam raises throughout the mine life. The balance of the non-PAG waste will be placed in a stockpile located within the valley to the west of the open pit. Waste stockpile overall final slopes will be 1.5H : 1V. PAG and unclassified waste rock totalling approximately 237 Mt will be placed within the TMF as part of the long-term management requirements for the site.

PAG waste rock will be disposed of within the TMF basin along with the tailings material and site contact water. PAG waste rock will be hauled and stockpiled in benches at a similar rate to the annual TMF dam raises to limit sub-aerial exposure time, and provide a guarantee of subaqueous PAG material disposal on a stage by stage basis. The tailings cover will subsequently be inundated by the supernatant pond.

5.9.3.3 *Low-grade Ore Stockpiles*

Two LGO stockpiles will be created over the 24 years of mining, for processing in the final five years (Year 24 through Year 28). One LGO stockpile will be located south of the open pit (PAG LGO stockpile), and the other (non-PAG LGO stockpile) within the TMF. Perimeter ditches will be constructed around the PAG LGO and runoff will be collected in a sedimentation pond that will be pumped to the plant site process water pond.

5.9.4 **ML/ARD Management**

The overall strategy to manage ML/ARD is for the storage facilities for waste rock, LGO, overburden (including topsoil), and tailings to be located peripheral to the open pit and/or within the TMF, as required to accommodate the scheduled quantity of each material type. Potential PAG waste rock and overburden will be placed in the upper TMF and be stored in a permanently saturated condition. Non-PAG waste rock will be placed within the valley located to the south west of the proposed pit, as well as used for TMF embankment construction. Non-PAG overburden will be placed to the east of the pit and used for road and dam construction. Topsoil will be stockpiled in two locations, north and northwest of the TMF. The tailings will be transported to the TMF via two pipelines. Rougher tailings will be disposed sub-aerially to beaches whereas cleaner tailings will be deposited sub-aqueously. Mining operations will cease in the open pit in Year 24 and the mine will begin processing LGO stockpiles thereafter. The tailings deposition from processing of the LGO will continue in the open pit, rather than in the TMF. The TMF has been designed to provide for secure and permanent storage of more than 585 Mt of tailings and 237 Mt of PAG waste rock from the proposed mining operation. Figure 5.1-2 shows the location of the waste dumps and stockpile locations in relation to the open pit, processing plant, and TMF.

Appendix 5-D, Mine Waste and Water Management Design Report, and Section 24.9, provides a detailed description of the Project's envisaged management of ML/ARD.

5.9.5 Operation Equipment Fleet

The equipment fleet will incorporate large scale units which have been well proven in existing operations. In total, the mine will operate one diesel rotary drill, three electric rotary drills, three 42 m³ electric hydraulic shovels, one 18 m³ wheel loader, up to 28 mine haul trucks of 227 t capacity, and a fleet of support equipment.

5.9.6 Fuel Supply, Storage, and Distribution

The transportation, storage, dispensing, and use of fuels at the site will be conducted in compliance with all relevant government laws and regulations. Prior to transporting or positioning fuel tanks at the Project Site, the fuel supplier(s) will be required to provide a copy of their fuel spill contingency plan. At a minimum, re-fuelling operations will necessitate the following activities:

- re-fuelling operators to be in attendance for the duration of the fuelling operation;
- a fuel metering system to be implemented as a control measure and contractors to be required to use card access and report fuel usage to the Engineering, Procurement, and Construction Management team on a weekly basis;
- having spill protection kits at hand; and
- prohibiting smoking.

5.9.7 Explosives Manufacture, Storage, Transportation, and Use

A qualified explosives contractor will be contracted to establish manufacture, storage, and delivery services of explosives during both the Construction and Operations phases. The proposed explosives manufacture and storage facility is shown on Figure 5.1-2 and the description of the facilities, storage, transportation, and use provided in Section 5.7.1.11 above is relevant to the Operations phase.

5.9.8 Borrow Sources

Geotechnical information based on actual site conditions indicates that concrete aggregates, structural backfill, granular base, road base, and sub-base can be supplied from the borrow pits established at the open pit and tailings facility impoundment locations in particular.

A new section of road, approximately 2 km in length, will be needed to connect the upgraded Vavenby/Saskum FSR to the plant site (Figure 5.8-4). Additional borrow sources will thus be created along the route to provide material for the necessary upgrades.

The cofferdam will be constructed entirely of locally borrowed Zone S material from the southeast side of the TMF impoundment, located within 2 km of the dam (Figure 5.8-2).

5.9.9 Security

Overall security of the Project Site is the responsibility of HCMC. A gate will be installed at the entrance to the mine site and monitored and controlled remotely by security located at the warehouse to ensure the physical integrity of the facilities, and control and record the access of people to restricted working areas. Vehicles and people will be inspected upon entry (for fitness to work and authority to enter) and upon exiting the site to check for unauthorized removal of materials from the Project Site.

Project security relating to owner supplied materials, plant and equipment brought onto the site for operational purposes will be the responsibility of HCMC until the material is turned over to the contractor. Upon withdrawal by a contractor of material, plant, or equipment from the Owner's warehouse or laydown area, the contractor will take custody and assume the responsibility for the proper care and security of such equipment and materials.

The security of the contractor's designated areas and facilities, including material, plant, and equipment, will be the responsibility of each contractor.

5.9.10 Concentrate Handling and Transport to Rail Load-out Facility

The copper concentrate will be dewatered using filter presses and stockpiled inside the process plant building load-out area. The concentrate will be reclaimed and loaded into B-train side-dump trucks using a front-end loader. The copper concentrate will be trucked approximately 24 km to an off-site rail load-out facility near Vavenby. The off-site facility will be capable of storing two days' worth of concentrate production. The proposed haul route for the concentrate between the Project Site and the rail load-out facility is shown on Figure 5.8-4. The copper concentrate will be then transported by train to Vancouver for shipment to overseas smelters.

Traffic from the Project Site to the rail load-out facility is expected to consist of approximately 20 truck-loads per day, each carrying approximately 40 tonnes of concentrate. It is expected that these trucks could complete a round trip in two hours. Concentrate haulage will be undertaken on an extended day shift operation. These trucks will be radio controlled which will minimize the requirement for pull outs and allow scheduling to avoid shift change periods when personnel buses would be on the road. It will not be necessary to plan for two-way traffic over the entire route.

Scheduled Vavenby bridge maintenance will require night shift hauls for short periods

5.9.11 Rail Load-out Facility Operations

The copper concentrate will be stored in an off-site facility capable of storing two days of concentrate production at a time. The facility will consist of a 1,400 m² building with a raised dumping area for concentrate trucks and bunker walls to contain the concentrate. A rail scale and mechanism for cover removal will be constructed along one wall and a wheel loader, provided by the load-out contractor, will be used to load the train cars.

5.10 WATER MANAGEMENT

5.10.1 Water Management Objectives

The site water management plan describes strategies and provides guidance for the control of water from the Project Site during Construction and Operations, and after Closure. The objective of the water management plan is to ensure sufficient water is available to support the process water requirements, while mitigating environmental effects to downstream receiving waters. Water will be controlled in a manner that minimizes erosion in areas disturbed by construction activities and prevents the release of sediment-laden water to the receiving environment. This includes the collection and diversion of surface water runoff, sediment control ponds, and pump-back systems. The key facilities that were considered in the development of the water management plan are:

- open pit;
- mill;
- TMF;
- overburden stockpile;
- north, south, east, and west topsoil stockpiles;
- non-PAG waste rock stockpile;
- PAG waste rock stockpile;
- non-PAG and PAG LGO stockpiles;
- diversion channels and water management pipelines;
- TMF seepage collection ponds; and
- non-PAG waste rock stockpile water management pond; and
- non-PAG LGO stockpile water management pond.

The following sections describe the water management strategies, design elements, and facilities through the Construction (pre-production) and Operations phases.

[Appendix 5-D](#), Mine Waste and Water Management Design Report, provides a detailed description of the Project's envisaged management of site water.

5.10.2 Water Management and Sediment Control

The aim of the water management plan is to use water efficiently within the Project Site to support the milling of ore and to divert non-contact fresh water to the maximum extent practical. The water management plan involves collecting and managing site runoff from disturbed areas and maximizing the recycle of process water. Surplus water will be stored on site within the TMF and used as process water through the first 24 years of Operations. Process water for the final four years of Operations will primarily be sourced from the supernatant pond created within the open pit

following the transfer of tailings disposal from the TMF to the open pit. The process water supply sources for the Project are as follows:

- precipitation runoff from the Project Site facilities;
- water recycle from the TMF supernatant pond (Years 1 to 23) and the open pit (Years 24 to 28); and
- groundwater from open pit dewatering.

Sediment and erosion control strategies will include establishing diversion and runoff collection ditches, constructing sediment control ponds, and stabilizing disturbed land surfaces to minimize erosion.

Activities that have the potential to require sediment and erosion control include clearing vegetation and stripping topsoil, stockpiling topsoil, and constructing roads, waste rock stockpiles, and other infrastructure. Potential hazards from these activities, in the absence of planned mitigation measures, include increased surface erosion from disturbed areas, increased sediment load to downstream receiving environments, and siltation or erosion of downstream watercourses or waterbodies.

Sediment mobilization and erosion will be managed throughout the site by:

- installing sediment controls prior to construction activities;
- limiting the extents of disturbance as much as is practical;
- reducing water velocity across the ground, particularly on exposed surfaces and in areas where water concentrates;
- progressively rehabilitating disturbed land and constructing drainage controls to improve the stability of rehabilitated land;
- protecting natural drainages and watercourses by constructing appropriate sediment control devices such as collection and diversion ditches, sediment traps and sediment ponds;
- restricting access to rehabilitated areas; and
- constructing surface drainage controls to intercept surface runoff.

Installation of temporary erosion and sediment control features in the form of best management practices will be the first step towards controlling sediment and erosion during Construction. All temporary sediment and erosion control features will require regular maintenance. The temporary erosion and sediment control features will be reclaimed after achieving soil and sediment stabilization.

5.10.3 Water Management Plan

5.10.3.1 Construction

The Construction and Operations water management strategies for the Project have been developed by identifying the size and position of the planned Project Site facilities, and by establishing estimated catchment area boundaries based on the proposed Project Site development concept.

Water management during the construction of the TMF, open pit, waste rock and overburden stockpiles, and associated facilities will consist of the following components:

- water management and sediment control structures will be established, including temporary sediment ponds, cofferdams, diversion ditches and pumping systems;
- the southeast diversion channel will be constructed along the southern part of the TMF facility to divert clean water from the upslope catchment areas around the TMF;
- a series of temporary ponds and small pumping systems will be required during construction of the cofferdam to prevent sediment-laden water from entering the downstream receiving environment;
- following closure of the cofferdam and construction of the TMF seepage collection pond, temporary ponds can be released or pumped to the TMF;
- all runoff from the open pit will be collected in a sediment pond within the ultimate pit down-gradient of the pre-stripping area. The runoff from this pond will then be released to the receiving environment during the construction period; and
- water management ponds will be constructed below the LGO stockpiles and will act as sediment ponds during the construction period with sediment-free water being released to the receiving environment during this time.

Details for the water management plan during construction for the cofferdam stage and Stage 1 main embankment are included in Figures 5.8-1 and 5.8-2, respectively.

A construction water management strategy was developed for the pre-production period of the TMF. The strategy provides guidance for the timing of initial cofferdam and starter dam construction through to start-up of the process plant. The strategy incorporated the following requirements:

- provide time for sufficient water collection for commissioning of the process plant and process start-up, assuming a 1 in 20-year low (dry) precipitation scenario;
- the minimum pond volume prior to start-up is assumed to be 8 Mm³, which is equivalent to approximately two months of process water; and
- the maximum pond volume prior to start-up of the process plant is assumed to be 12 Mm³, and any additional water above this pond volume will be released to the receiving environment until process start-up.

5.10.3.2 Operation

An operational water management strategy was developed for the TMF. The strategy provides guidance for annual operation of the facility throughout the life of the Project. The water management strategy incorporated the following requirements.

- Full and secure storage of site contact water in the TMF following process start-up until the end of mining operations.
- Process water will be discharged into the TMF with the tailings.

- Tailings supernatant water will be reclaimed and pumped back to the mill for process water requirements.
- The TMF embankment staging is designed to contain four consecutive years of the 1 in 20-year high (wet) precipitation scenario. Thereafter, the embankment is designed to contain the median precipitation scenario for the remaining life of the mine.
- A tailings deposition strategy will be implemented to selectively develop tailings beaches along the embankments, thereby producing an extensive low permeability zone that facilitates seepage control and maintains the operational supernatant pond away from the crest of the embankment. Selective tailings deposition will ensure that the beaches are saturated, thus reducing the potential for dust generation.
- The water management ponds downstream of the PAG LGO and the non-PAG waste rock stockpile will collect sediment-laden runoff and infiltration from the waste stockpiles. The water from these ponds will be pumped to the TMF for storage and recycling, although if water quality is suitable the water could then be released to the downstream environment.
- The TMF water management pond will collect seepage and sediment-laden runoff, which will be pumped to the TMF for storage and recycling, although if water quality is suitable the water could then be released to the downstream environment.

Following completion of active mining operations in Year 24, reclaim water will continue to be sourced from the TMF through Year 24, although tailings deposition will commence within the open pit. The final four years of Operations will continue with tailings deposition in the open pit; however, reclaim water will no longer come from the TMF, but instead be derived from the open pit. The TMF pond will receive natural runoff until such time as it reaches the invert of a spillway, which will be constructed during the Closure phase of the mine. No additional TMF embankment raises are planned after Year 23.

The general arrangements for site-wide water management plans include the water management strategy, the location of the proposed water management ponds and pipelines, and the location of contact and non-contact water diversion ditches. Specific design elements of the water management plans are discussed in the following section.

5.10.4 Design Elements

5.10.4.1 Cofferdam

The cofferdam was designed to provide storage capacity for four months (September through December) of statistically wet conditions for the Project Site area, in addition to the runoff from the 1-in-10-year 24-hour precipitation event with freeboard allowance. Pumping systems for the cofferdam will be available to restore the cofferdam water levels to normal operating conditions within seven days following a flood event. The general arrangement (site plan) of the cofferdam is provided as Figure 5.8-1.

5.10.4.2 *Water Management Ponds*

Water management (sediment control) ponds are used to detain runoff from disturbed areas so that sediment can settle out and be captured. These ponds will be situated downstream of the TMF embankment, PAG LGO stockpile and non-PAG waste rock stockpile. The ponds will provide a collection point for surface runoff and infiltration from the stockpiles as a result of precipitation in these catchment areas, and for seepage through the embankment. All water collected will be pumped to the TMF supernatant pond for long term storage and use as reclaim water for process purposes.

Runoff collection ditches will be used during construction and operation to intercept runoff water and divert it to the water management ponds where it can be effectively managed with appropriate sediment control measures. Collection ditches may be either temporary or permanent structures and will be sized to convey runoff in accordance with the design specifications for the water management ponds.

The water management ponds have been sized to store the runoff from the 1-in-50-year 24-hour precipitation event with freeboard allowance. Pumping systems will be designed to maintain the water management pond levels during the peak summer freshet, and to restore water levels to normal operating conditions following a flood event.

5.10.4.3 *Water Management Pipelines and Pumping Systems*

The pipelines and pumping systems for the water management ponds were designed to convey peak mean monthly runoff, which occurs during the month of June. The runoff at this time is due to events that result from a combination of snowmelt and rainfall. The pumping systems are capable of conveying the peak mean monthly runoff flow without storage. The ponds provide a contingency to the system in excess of the design pipeline flows, and are capable of storing the 1-in-50-year precipitation event.

Open pit dewatering will be completed using a staged surface water in-pit pumping system. The water collected in the open pit dewatering system will be delivered to the TMF for recycle to the milling process. The open pit dewatering pipeline and pump system was sized to manage the 1-in-10-year 24-hour precipitation event, groundwater seepage, average annual inflows, and an additional 20% surge capacity. The dewatering plan in the pit allows ten days for dewatering for the design event. Mining activities in the open pit can be relocated if necessary to accommodate accumulated pit water.

5.10.4.4 *Diversion Ditches*

The Project Site is in an area of high annual precipitation with a mean annual precipitation of approximately 1,050 mm (at an elevation of 1,680 m). The TMF is anticipated to have a surplus of water over the life of the Project. Fresh water diversions have been designed to minimize management of non-contact water for as long as practical. These open channel diversions include water management to the north and south of the main access road between the plant site and open pit, and a diversion along the southeast side of the TMF facility.

The southeast diversion channel will divert the runoff from approximately 2.1 km² of undisturbed catchment area. This southeast diversion scheme will serve a dual purpose: to divert surplus water away from the TMF and to offset the flow reductions in the tributary downstream of the TMF. The southeast diversion channel was sized to convey the 1 in 200 year return period event. The channel has been designed as an open channel with a trapezoidal shape approximately 1 m wide at the bottom and a minimum depth of 1.5 m.

5.10.4.5 *Water Balance Results*

The water balance indicates that the TMF is in surplus conditions during all years of Operations.

A surplus water discharge from the TMF during Operations was not considered practical as part of the Project design, due to water quality considerations. As a result, all water will be stored in the TMF from the start of Operations until Year 31. The pond size was considered unrestricted during Operations and reaches a maximum volume of 170 Mm³ in Year 23. Towards the latter part of Year 24, the TMF pond volume begins to decrease, as tailings are deposited in the open pit, while reclaim water continues to be sourced from the TMF. For Years 25 through 28, reclaim water is sourced from the open pit, and the TMF pond receives natural runoff until it reaches the assumed spillway elevation and begins discharging to T Creek in Year 31. It has been assumed that the water level within the open pit will remain about 25 m below the minimum crest elevation of the open pit. Annually, water will be pumped from the open pit pond and directed to the TMF.

From a watershed perspective, modelled results (Knight Piésold 2014) indicate that flows would generally be reduced from pre-mine conditions in the receiving watercourses during the Operations phase. Flows in T Creek, Harper Creek downstream of T Creek, and Jones Creek would recover during and after closure of the mine but would not equal pre-mine conditions. Flows in P Creek, Harper Creek above T Creek and Baker Creek would remain reduced during and after Closure.

[Appendix 5-D](#), Mine Waste and Water Management Design Report, provides a detailed description of the Project's envisaged water management approach.

5.11 SUPPORT AND ANCILLARY INFRASTRUCTURE

5.11.1 Fuel Storage

The transportation, storage, dispensing and use of fuels at the site will be conducted in compliance with all relevant government laws and regulations.

Diesel fuel for the mining, process, and ancillary facilities will be supplied from a diesel fuel storage facility, consisting of four above-ground 75,000 L-capacity diesel fuel storage tanks suitable for four days of on-site usage, together with the necessary loading and dispensing equipment. The facility will be located near the truck shop and will include an appropriately sized gasoline storage tank that will accord with the regulations relevant to such storage, for the small number of gasoline-powered vehicles envisaged. A dedicated fuel truck (bowser) will transport diesel to the mining equipment operating in the pit and fuel replacement will be a daily occurrence from an off-site terminal, as described in Section 5.7.2.5 above.

Fuel tanks will be self-diked or be positioned over an impervious mat surrounded by an impervious dike. The tanks are to be positioned where spills, should they occur, are least likely to flow towards water courses, waterbodies, or streams. The storage facilities will be located away from main-frame construction activities and will be inspected on a regular basis to ensure compliance with regulations. Re-fuelling hoses will have a design pressure rating of at least 150% of the maximum head of the system. Fuel oil drums will be limited to a quantity that supports only the current activity and minor equipment maintenance.

5.11.2 Potable Water Supply

Potable water supply will be provided from groundwater wells drilled for this purpose, envisaged to be located in the undisturbed area north of the TMF. Abstraction volumes will be scaled to the demand dependent on personnel numbers; on average approximately 175 L per person per day is assumed. A storage capacity for fresh water of 2,600 m³ is planned, together with 600 m³ of fire water. Conventional water treatment including disinfection will be provided, consistent with public health requirements. The necessary regulatory authorisation for such abstraction, treatment and storage will be sought.

5.11.3 Dangerous Goods and Hazardous Materials

The management of hazardous materials is will be undertaken by applying a purpose-designed management plan, as described in Section 24.7.

Clear labelling of packaging and rigorous storage policies are the cornerstones behind the management of dangerous goods and hazardous materials. These cornerstones will be achieved through a Workplace Hazardous Materials Information System.

A suitable area will be identified as a landfarm, where contaminated soil and other materials can be handled and treated in a controlled and secure fashion. Bioremediation of soil contaminated with hydrocarbons would be a case in point. The landfarm will be provided with a suitable substrate and be properly fenced. Its location would likely be within the Mine Site Area or possibly in proximity to overburden or topsoil stockpiles.

5.11.4 Mine Maintenance Facility

The main purpose of the mine maintenance facility is to provide maintenance and servicing to mining equipment. The truck shop will comprise five regular service bays, two welding bays, and two preventative maintenance bays.

Attached to the west side of the building will be a heavy vehicle wash bay. The used wash water will drain to a central sump where it will flow to a settling pond for treatment prior to being discharged to the TMF.

Along the north side of the truck shop will be a corridor for the safe movement of parts and material along the length of the building without having to encroach into the truck bays. Above this corridor is a mezzanine with offices and lunch and meeting rooms for the maintenance staff. Also contained

within the maintenance shop building is the mine dry, which will provide lockers and showers for the workers at the beginning and end of each shift. The truck shop, wash, and mine dry will all be housed in a pre-engineered metal building approximately 31 m wide by 177 m long by 21 m high.

5.11.5 Access and Site Roads

Allowances in the pit designs were made for 36-m-wide roads including ditches and berms. Roads will have a maximum gradient of 10%.

Surface haulage roads will connect the pit ramps to the crusher, the low grade stockpiles, the waste rock stockpiles, the overburden stockpile, and the TMF embankment. These roads will be constructed using non-PAG waste rock and overburden. As in the pit, roads will have a running surface three times the width of the largest vehicle using the road with allowance for ditches and berms. Roads will have a maximum grade of 10% but may be constructed to 8% to improve haulage cycle times and reduce truck component wear. The main haulage roads to the crusher, plant site, and TMF, as well as a construction haulage road to the TMF site will be built during pre-production. Other roads will be constructed during the normal course of mine operations.

5.11.6 Traffic Management

A gate will be installed at the entrance to the Project Site and remotely monitored and control by security. The gate will ensure the physical integrity of the facilities, and control and record the access of people to restricted areas.

Additional gates may be installed on other FSRs that enter the Project, after consultation with the BC Ministry of Forests, Lands and Natural Resource Operations (BC MFLNRO) and BC Ministry of Energy and Mines (BC MEM). The locations of the additional gates, for example on the Jones Creek FSR, will be assessed during the Construction Phase to maximize safety without impacting other road users.

The Project will not use KP Road to access the rail load-out facility, and it will remain gated. This will avoid difficult traffic conditions at the intersection of KP Road and Highway 5.

Although cell phone coverage of the area became available in 2012, two-way radios will be used for site communications and a radio control process will be implemented to manage traffic movement as required.

5.11.7 Procurement

A plan for expediting will be prepared based on the Project schedule and equipment lists. The extent to which purchase orders are expedited will be based on complexity, manufacturing cycle time, and schedule criticality. Equipment, materials not provided by contractors, certain facility and equipment rentals, and consumables will be purchased by the procurement group on behalf of HCMC using the Owner's standard terms and conditions, modified as required to meet Project-specific requirements.

In general, suppliers will be selected based on quality, price, and delivery and preference will be given to local suppliers when practical. The Construction Manager will organize bulk material purchases such as pipe, cable, cable trays, etc. Pre-engineered buildings will be tendered on a lump sum design, fabricate, and erect basis including crane rails, doors, windows, and insulation.

5.11.8 Emergency Procedures

Section 24.4 of Chapter 24, Environmental Management and Monitoring Plans, presents the preliminary Emergency Response Plan, which outlines measures to protect workers, the environment, and mine property.

The Emergency Response Plan addresses three levels of response in an emergency, namely containment, notification, and mobilization. It is a proactive document that outlines avoidance and mitigation measures in the case of an emergency. The premise of the plan is that during an emergency, employees must first ensure their own safety and then contain the emergency as quickly as possible. If unable to contain the emergency a series of escalating responses will be initiated.

A suitably equipped first-aid station will be located within the warehouse building at the plant site, where an ambulance will also be stationed. Personnel trained to the prescribed level of first-aid competency will be present at all the Project worksites and will staff the first-aid station as necessary.

5.12 PROJECT SCHEDULE

The development schedule for the Project is shown in Table 5.12-1 below.

Table 5.12-1. Harper Creek Project Development Schedule

Key Project Milestone	Milestone Date
Environmental Assessment Certificate issued	Second Quarter 2015
<i>Mines Act</i> Permit issued: Project released for construction	Second Quarter 2016
Start Construction phase	Second Quarter 2016
Mills delivered	Third Quarter 2017
BC Hydro provided power	Second Quarter 2018
Mechanical completion	Second Quarter 2018

The overall Project execution period for construction from start to mechanical completion is approximately 24 months; and assumes financing is in place to allow all phases of the Project to proceed at their projected start times.

The Project schedule will be continually revised and updated. More detailed schedules will be developed for each work package and will be used to revise the master baseline Project schedule. The detailed package schedules will consider interfaces, resource constraints, delivery times, contract scopes, detailed engineering and procurement times, as well as inputs from contractors. The resulting detailed Project schedule will be used to manage performance. Deviations from detailed schedules will be rolled up monthly and used to measure impacts on the overall schedule.

Construction manpower is based on a 70-hour construction contractor work week with crew rotations established by the contractors but which will, generally be three weeks on site and one week off. Manpower loading indicates a peak requirement for 600 construction workers on site.

5.13 WORKFORCE REQUIREMENTS

The Project is predicted to result in employment benefits to the region (Regional District of Thompson-Nicola) and the province, as well as Canada as a whole. Benefits will be realized directly through employment, and directly and indirectly through enhanced business opportunities. The additional spending will drive job creation by local businesses leading to a higher level of general employment and, consequently, higher personal income.

The affected communities include incorporated and unincorporated communities as well as First Nations communities and Indian Reserves. The Project is expected to create employment opportunities for local workers directly at the Project site.

For the Construction phase, HCMC will solicit competitive bids from qualified companies to perform the engineering, procurement, and construction management activities for the Project. An Owner's team will be established which will potentially include a project manager, mine manager, maintenance superintendent, mill superintendent, environmental supervisor, and safety and security supervisor.

Employment estimates are based on labour requirements for the Construction and Operations phases. Employment represents hours spent on the job by a typical worker in an industry and it is given in person-years. Person-years represents one year of work in the given industry by one person. One year of work usually comprises 2,080 hours, and in many mining industry positions this implies 12-hour days with two weeks on the job and two weeks off the job (or similar shift rotation).

Person-years is used, rather than the number of potential positions, as there is a large number of various shifts, different job requirements, and different positions that would be difficult to categorize and consequently evaluate the impact of the Project on employment (i.e., the total number of hours that individuals may work in different jobs over the year varies substantially). Person-years, consequently, standardizes this approach.

5.13.1 Construction Phase Workforce

It is estimated that 600 construction persons will be required at the peak which occurs in the second construction season when work is focused on the civil, mechanical, and electrical work.

Construction personnel will be housed on site in a typical modular camp. The camp will provide single occupancy rooms but workers will share common laundry, washroom, dining, and recreational facilities. The camp will be leased for the term of the Construction period and removed once Construction is completed.

5.13.2 Operations Phase Workforce

The Operations phase of the Project is expected to create a total of 11,248 person-years of direct Project employment over the life of the mine (28 years). Of that, 6,936 person-years of employment will be in mining (up to 319 jobs), 2,856 person-years (approximately 102 jobs) in milling, and 1,036 person-years (approximately 37 jobs) in site services. An estimated 15 jobs will be created in administration. In the ninth year of the Operations phase, the employment will peak at 466 positions. HCMC predicts that approximately 12 to 15% of all direct jobs will be held by local workers. Operations personnel will reside offsite in local communities such as Vavenby, Clearwater, and the surrounding area.

5.13.3 Closure Phase Workforce

The Closure and Post-Closure phases of the Project will provide limited employment opportunities. However, specific estimates are not yet available as Closure is in the distant future.

5.14 PROJECT COSTS

The Project is also predicted to result in economic benefits to the region, province, and country as a whole, through business opportunities to supply goods and services directly and indirectly to the Project, as well as other spin-off economic benefits associated with workers spending their incomes within their communities and elsewhere. Direct Project spending on local goods and services will support businesses, enhancing the economic development in the communities. In addition, the Project will contribute tax revenues to local, provincial, and federal governments.

To fully assess possible direct, indirect, and induced economic benefits of the Project, an economic impact model, the BC Input-Output Model, developed and maintained by BC Stats, was used. Direct Project impacts relate to Project activities such as direct Project spending and direct Project employment. Direct supplier impacts measure the impacts of the Project on BC industries supplying goods and services directly to the Project. Indirect impacts measure the impacts on BC industries further back in the supply chain. Induced impacts measure the impacts that spending by workers (employed by the Project or by direct/indirect suppliers) will have on the economy.

The estimated initial capital cost of this Project, including Provincial Sales Tax and bonding, is \$1,025.8 million (Q1 2014, +15/-5%), including a contingency amount of \$90.7 million. Total life of mine operating cost for the Project is estimated at \$8.18/t milled (+15/- 5%). The estimate includes mining, process, general and administrative costs, and site services. The unit costs are based on an annual ore production rate of 25,550,000 t/a (or 70,000 t/d), and operation of 365 d/a.

During Operations, the total Project spending is predicted at \$5,829.7 million. Direct Project activities are expected to contribute \$1,152.4 million to BC's GDP; an additional \$2,465.2 million in BC's GDP and \$1,269.9 million to GDP across Canada are expected to result from indirect and induced activities. Tax revenue derived from direct activities during the Operations phase is estimated at \$435.4 million; Project-related indirect and induced activities are further expected to contribute \$407.6 million.

The Project will be subject to income and/or revenue taxes as follows:

- Canadian corporate income tax: 15%;
- BC corporate income tax: 10%;
- BC mineral tax (as determined);
- net current proceeds tax at 2%; and
- net revenue tax at 13%.

REFERENCES

1992. *Canadian Environmental Assessment Act*, SC. C. 37.
1996. *Mines Act*, RSBC. C. 293.
2002. *Environmental Assessment Act*, SBC. C. 43.
2012. *Canadian Environmental Assessment Act, 2012*, SC. C. 19. s. 52.
- Reviewable Projects Regulation, BC Reg. 370/2002.
- Law List Regulations, SOR/94-636.
- Comprehensive Study List Regulations, SOR/94-638.
- Establishing Timelines for Comprehensive Studies Regulations, SOR/2011-139.
- Ash, C. H. and C. P. Riveros. 2001. *Geology of the Gibraltar copper-molybdenite deposit, east-central British Columbia (93B/9)*. British Columbia Ministry of Energy, Mines and Petroleum Resources, Paper 2001-1, p.1 19-133:
- Bailey, S. L., S. Paradis, and S. T. Johnston. 2001. *New insights into metavolcanic successions and geochemistry of the Eagle Bay Assemblage, southcentral British Columbia*. Geological Survey of Canada, Current Research 2001-A8, 25 p:
- BC MEM. 2013. *Mining: Part of Sustainable Development in British Columbia*.
<http://www.empr.gov.bc.ca/mining/sustainability/Pages/default.aspx> (accessed August 2014).
- Bysouth, G. D., K. V. Campbell, G. E. Barker, and G. K. Gagnier. 1995. Tonalite-trondhjemite fractionation of peraluminous magma and the formation of the syntectonic porphyry copper mineralization, Gibraltar Mine, central British Columbia. In *Porphyry Deposits of the Northwestern Cordillera of North America*. Ed. T. G. Schroeter. Canadian Institute of Mining, Metallurgy and Petroleum, Special Volume 46, p.201-213.
- Calderwood, A. R. and P. van der Heyden. 1990. *Geochronometry of the Thuya, Takomkane, Raft and Baldy batholiths, south-central British Columbia*. Paper presented at Geological Association of Canada – Mineralogical Association of Canada, Joint Annual Meeting, Vancouver, BC: Program with Abstracts, Volume 15, p.A19.
- Casselmann, M. J., W. J. McMillan, and K. M. Newman. 1995. Highland Valley porphyry copper deposits near Kamloops, British Columbia: A review and update with emphasis on the Valley deposit. In *Porphyry Deposits of the Northwestern Cordillera of North America*. Ed. T. G. Schroeter. Canadian Institute of Mining, Metallurgy and Petroleum, Special Volume 46, p. 161-191.
- Cathro, M. S. and D. V. Lefebure. 2000. *Several new plutonic-related gold, bismuth and tungsten occurrences in Southern British Columbia*. British Columbia Ministry of Energy, Mines and Petroleum Resources, Paper 2000-1, p.207-223:
- Fraser, T. M., C. R. Stanley, Z. T. Nikic, R. Pesalj, and D. Gore. 1995. The Mount Polley alkalic porphyry copper-gold deposit, south-central British Columbia. In *Porphyry Deposits of the*

- Northwestern Cordillera of North America*. Ed. T. G. Schroeter. Canadian Institute of Mining, Metallurgy and Petroleum, Special Volume 46, p.609-622.
- Hoy, T. 1996. *Harper Creek: a volcanogenic sulphide deposit within the Eagle Bay assemblage, Kootenay Terrane, southern British Columbia*. British Columbia Ministry of Energy, Mines and Petroleum Resources, Paper 1997-1, p.199-209:
- Hoy, T. and F. Goutier. 1986. *Rea Gold (Hilton) and Homestake volcanogenic sulphide-barite deposits, southeastern British Columbia*. British Columbia Ministry of Energy, Mines and Petroleum Resources, Paper 1986-1, p.59-68:
- Knight Piésold. 2012. *Harper Creek Project Reconnaissance Terrain Mapping*. Prepared for Harper Creek Mining Corp. by Knight Piésold Ltd.: Vancouver, BC.
- Knight Piésold. 2014. *Harper Creek Project Watershed Modelling*. Prepared for Harper Creek Mining Corporation by Knight Piésold Ltd.: Vancouver, BC.
- Logan, J. M. 2000. *Plutonic-related gold-quartz veins in Southern British Columbia*. British Columbia Ministry of Energy, Mines and Petroleum Resources, Paper 2000-1, p.193-206:
- Logan, J. M. 2001. *Prospective areas for intrusion-related gold-quartz veins in southern British Columbia*. British Columbia Ministry of Energy, Mines and Petroleum Resources, Paper 2001-1, p.231-252:
- Logan, J. M. 2002. *Intrusion-related mineral occurrences of the Cretaceous Bayonne magmatic belt, southeast British Columbia*. Geoscience Map 2002-1. British Columbia Ministry of Energy, Mines and Petroleum Resources:
- Logan, J. M. and M. G. Mihalynuk. 2005. *Regional geology and setting of the Cariboo, Bell, Springer and Northeast Porphyry Cu-Au Zones at Mount Polley, South-Central British Columbia*. British Columbia Ministry of Energy, Mines and Petroleum Resources, Paper 2005-1, p. 249-270:
- MEND. 1991. *New Methods for Determination of Key Mineral Species in Acid Generation Prediction by Acid-Base Accounting, April 1991*. Norecol Environmental Consultants.: Vancouver, BC.
- Merit. 2014. *Technical Report & Feasibility Study for the Harper Creek Copper Project: July 31, 2014*. Prepared for Yellowhead Mining Inc. by Merit Consultants International Inc.: Vancouver, BC.
- Mortensen, J. K., D. K. Ghosh, and F. Ferri. 1995. U-Pb geochronology of intrusive rocks associated with copper-gold porphyry deposits in the Canadian Cordillera. In *Porphyry deposits in the northwestern Cordillera of North America*. Ed. T. G. Schroeter. Canadian Institute of Mining, Metallurgy and Petroleum Special Volume 46, p. 142-158.
- Mortimer, N. 1987. The Nicola Group: Late Triassic and Early Jurassic subduction-related volcanism in British Columbia. *Canadian Journal of Earth Sciences*, Volume 24: 2521-36.
- Naas, C. O. 2012a. *Report on the Condemnation Drilling Program on the Harper Creek Project*. Prepared for Yellowhead Mining Inc. by CME Consultants Inc., March 13, 2012:
- Naas, C. O. 2012b. *Technical Report on the Phase VIII Exploration Program of the Harper Creek Property*. Prepared for Yellowhead Mining Inc. by CME Consultants Inc., January 31, 2012:
- Nelson, J. A. and R. Friedman. 2004. Superimposed Quesnel (late Paleozoic-Jurassic) and Yukon-Tanana (Devonian-Mississippian) arc assemblages, Cassiar Mountains, northern British

- Columbia: field, U-Pb, and igneous petrochemical evidence. *Canadian Journal of Earth Sciences*, Volume 41 (10): p. 1201-35.
- Okulitch, A. V. 1979. *Lithology, stratigraphy, structure and mineral occurrences of the Thompson-Shuswap-Okanagan area, British Columbia*. Geological Survey of Canada, Open File 637:
- Panteleyev, A., D. G. Bailey, M. A. Bloodgood, and K. D. Hancock. 1996. *Geology and mineral deposits of the Quesnel River-Horsefly map area, central Quesnel Trough, British Columbia*. British Columbia Ministry of Energy, Mines and Petroleum Resources, Bulletin 97, 155 p:
- PEA. 2011. *2011 Technical Report and Preliminary Assessment of the Harper Creek Project*. Prepared for Yellowhead Mining Inc by Wardrop, A Tetra Tech Company, March 31, 2011:
- Ross, K. V., C. I. Godwin, and K. M. Dawson. 1995. Geology, alteration and mineralization of the Ajax East and Ajax West copper- gold alkalic porphyry deposits, southern Iron Mask batholith, Kamloops, British Columbia. In *Porphyry Deposits of the Northwestern Cordillera of North America*, Schroeter. Ed. T. G. Schroeter. Canadian Institute of Mining, Metallurgy and Petroleum, Special Volume 46, p.565-580.
- Schiarizza, P. 1986a. *Geology of the Eagle Bay Formation between the Raft and Baldy Batholiths (82M/5, 11, 12)*. Ministry of Energy Mines and Petroleum Resources Paper 1986-1, p.89-94:
- Schiarizza, P. 1986b. *Geology of the Vavenby Area (82M/5, 11, 12)*. British Columbia Ministry of Energy, Mines and Petroleum Resources, Open File Map 1986-5, scale 1:50,000:
- Schiarizza, P. and A. Boulton. 2006. *Geology and mineral occurrences of the Quesnel Terrane, Canim Lake Area (NTS 092P/15), southcentral British Columbia*. British Columbia Ministry of Energy, Mines and Petroleum Resources, Paper 2006-1, p.163-184:
- Schiarizza, P., S. Hefferman, and J. Zuber. 2002. *Geology of Quesnel and Slide Mountain terranes west of Clearwater, south-central British Columbia (NTS 92P/9, 10, 15, 16)*. British Columbia Ministry of Energy, Mines and Petroleum Resources, Paper 2002-1, p.83-108:
- Schiarizza, P. and V. A. Preto. 1987. *Geology of the Adams Plateau-Clearwater-Vavenby Area, British Columbia*. Ministry of Energy Mines and Petroleum Resources Paper 1987-2, 88p:
- SRK. 2012a. *Harper Creek Feasibility Study – Preliminary Findings on Metal Leaching and Acid Rock Drainage (ML/ARD) Potential*. Prepared by SRK Consulting Inc.: Vancouver, BC.
- SRK. 2012b. *Harper Creek ML/ARD Memorandum*. Prepared by SRK Consulting Ltd., Stephen Day, for Yellowhead Mining Inc. February 1, 2012: