SNC·LAVALIN

COMPREHENSIVE ENVIRONMENTAL IMPACT ASSESSMENT AND ACTION PLAN

Mount Polley Mine

Tailings Storage Facility Breach

Mount Polley Mining Corporation (MPMC)

SNC-LAVALIN INC.

August 2014
FINAL
Project n°621717

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF APPENDICES

1 INTRODUCTION

1.1 BACKGROUND

The Mount Polley Mining Corporation (MPMC) owns and operates the Mount Polley copper-gold mine located 56 kilometres (km) northeast of Williams Lake, British Columbia (BC) (see Figure 1 in Appendix B). The mine operated from August 1997 to September 2001, was placed on care and maintenance from September 2001 to March 2005 due to poor metal prices, and has been operating again since March 2005 (Minnow, 2014). Currently, mine life is expected to extend to 2023. Since March 2005, mining has been active at six open pits and in one underground mine accessed through the Wight Pit, with several additional areas identified as targets for future development. The Mount Polley Mine facilities also include a crusher and mill, waste rock disposal sites, a Tailings Storage Facility (TSF), seepage collection ponds, a surface water collection system, a settling pond, and access roads.

Early on August 4, 2014 a breach of the TSF tailings dyke occurred that resulted in approximately 10 million cubic meters of water and tailings being released over a hillside into Polley Lake, along Hazeltine Creek and into Quesnel Lake. This release resulted in the following physical impacts to the downstream environment:

- Erosion and scour of the embankment separating the TSF from Polley Lake, as well as the riparian zone along Hazeltine Creek
- Deposition of trees and debris in Polley Lake, along the sides of the erosion scar associated with Hazeltine Creek, and in the confluence of Hazeltine Creek into Quesnel Lake
- Deposition of tailings and scoured earth within Polley Lake, Hazeltine Creek, and the confluence of Hazeltine Creek into Quesnel Lake

Figures 2 and 3, in Appendix B, depict the condition of the TSF and surrounding lands prior to and following the release, respectively.

The Province of British Columbia issued Pollution Abatement Order No. 107461, dated August 6, 2014, to MPMC (the "Order"). Section 7 of the Order requires MPMC to submit an Action Plan by August 15, 2014 that is based on a comprehensive assessment of the impacts associated with the tailings release.

1.2 Purpose and Scope

The objective of this report is to comply with the specific requirements of Section 7 of the Order. To achieve this objective, we have consolidated the requirements for assessment and mitigation of the impacts associated with the Mount Polley Mine tailings dam breach, as required by the Order and related communications (including a letter from the Director to MPMC dated August 10, 2014), into a single comprehensive response plan. The scope of this report includes the following information in this respect:

- A review of the setting and environment that existed prior to the release for context to the assessment and action components of the plan
- A plan for assessing impacts to the terrestrial and aquatic environments that were affected by the tailings release
- A description of the processes to be implemented to develop specific actions in response to the tailings breach and to mitigate the impacts identified above
- A plan for monitoring potential existing and future impacts to water, sediment, soil, lands, and aquatic and terrestrial life
- A program to inform and consult with stakeholders
- A schedule and program for reporting the progress and results of this Plan

Appendix A reconciles the requirements of the Order and the Director's letter to MPMC of August 10, 2014 with the information and plans that are included in this report.

This report addresses the specific requirements of Section 7 of the Order, as described below.

Based on the comprehensive EIA, develop and submit to the Director by August 15, 2014 for approval, an Action Plan detailing measures relative to the comprehensive EIA to be taken to:

a) *Fully characterize the materials that were released into the receiving environment (including their expected behaviour in the receiving environment, settling rates, etc.);*

Section 2.1.2 of this report summarizes the characterization information that is relevant to the tailings solids and water.

b) *Fully recover or otherwise manage mine-affected materials and sediments currently in the receiving environment;*
c) *Define Site mitigation and/or mitigate residual risks to the environment;*

The Action Plan for recovering and managing the mine-affected materials and sediments released to the environment, as well as mitigation and the associated risks to the environment is provided as Section 4 of this report.

d) *Assess and monitor the impacts and risks posed by the mine-affected materials and sediments currently in the receiving environment, as well as from the recovery and management efforts themselves; and*

Section 3 of this report describes the assessment process that will be implemented to fully characterize the nature and extent of impacts associated with the release. Section 5 describes the monitoring being implemented during the recovery and management of mine sediments currently in the receiving environment.

e) *Report on the implementation of Action Plan measures on a weekly basis to regulatory agencies and stakeholders.*

Section 6 of this report describes the process for informing Stakeholders, and Section 7 describes the reporting scope and schedule to the Province.

This report also addresses the specific requirements related to Section 7 of the Order set out in the Director's letter to MPMC dated August 10, 2014 which are copied below:

Additionally, it is expected that the detailed comprehensive Environmental Impact Assessment required under Section 7 of the Order will address and consider the following:

a. *Water quality should be analysed for all parameters that may be impacted due to the tailings release and subsequent environmental effects (e.g. debris introduction into lakes);*
b. *Sediment analysis should focus on fine sediment, less than 63 micron (see Baseline Guidance Document referenced below);*
c. *Water sampling in Quesnel River downstream should be determined based on sample results upstream (if levels exceed guidelines, downstream sites need to be sampled);*
d. *Sediment toxicity sampling in Hazeltine Creek up and downstream should be conducted whenever something changes in the sediment, e.g. when new tailings or sediments are moved into the area.*

1.3 BASIS OF INFORMATION

The information used to construct this report was obtained from publically available information regarding the lands and waters surrounding the Mount Polley Mine, reports and studies completed on behalf of MPMC, information and data gathered since the release event, and observations made during site visits. The Bibliography section of this report provides a complete list of the information that was reviewed.

1.4 ROLES AND RESPONSIBILITIES

Table 1 provides a summary of the roles and responsibilities for the individuals and companies that are participating in the response to the tailings release. The summary includes identification of the qualified professionals that have been identified to lead specific aspects of this response. The roles and responsibilities of these companies and individuals may be modified from time to time based on the progress of the comprehensive Environment Impact Assessment and Action Plan, its priorities, and as new information is developed. MPMC will inform the Province of any changes to these roles and responsibilities, should they occur, as part of the normal reporting functions as presented in Section 7.

Table 1 Roles and Responsibilities

Area of Responsibility	Description	Company	Qualified Professional
Project Coordination	Planning, management, reporting	SNC-Lavalin	Gordon Johnson, P.Eng.
Aquatic Impact Assessment	Assessment and action plan	SNC-Lavalin	Cory Bettles, M.Sc., R.P.Bio.(BC)
Terrestrial Impact Assessment	Assessment and action plan	SNC-Lavalin	Shawn Hilton, R.P.Bio. (BC)
Contamination Assessment	Toxicity risk assessment	SNC-Lavalin	Janice Paslawski, PhD, P.Eng. (BC)
Stream Channel Rehabilitation	Design, implementation, verification	SNC-Lavalin	Leif Burge, M.Sc., PhD., PAG (BC)
Ministry Liaison Technical Support	EIA Support and technical workshop coordination	Caribou Environmental Quality	Norm Zirnhelt, R.P.Bio.
Geochemistry and Source Characterization	Full Characterization of source materials	SRK Consulting	Stephen Day, M.Sc., P.Geo.
Fisheries Biology	Technical Advice on Fisheries Impacts	Independent Consultant	Maurice Lirette, R.P.Bio
EIA Review and Monitoring	Project Management, Company Environmental Manager	MPMC	Jack Love, R.P.Bio.
Aquatic Monitoring Program	Design, implementation, reporting	Minnow Environmental	Pierre Stecko, R.P.Bio.
Stakeholder Consultation	Management, implementation	MPMC	Steve Robertson, P.Geo.

2 SITE DESCRIPTION

2.1 Tailings Storage Facility

2.1.1 General

The TSF is contained within one overall embankment that is approximately 5.2 km in length. The embankment is subdivided into three sections; referred to as the Main Embankment, Perimeter Embankment and South Embankment. Heights vary along the embankment and are approximately 55 m, 37 m and 29 m for the Main Embankment, Perimeter Embankment and South Embankment respectively.

Tailings are transported from the mill to the impoundment by a High-Density Polyethylene (HDPE) pipeline that is approximately 7 km long. The combined tailings are deposited in the TSF as a slurry. Decanted tailings water (clarified supernatant) is returned to the process as the solids settle out in the TSF.

2.1.2 Tailings Composition

2.1.2.1 Solids

The composition of the Mount Polley Mine tailings and of the supernatant water contained in the TSF were fully characterized prior to the release. The solids fraction of the tailings reflects the mineralogy and composition of the mined ore. The main minerals are potassium feldspar and albite-altered breccias. Trace minerals that are recovered as ore include chalcopyrite with minor amounts of bornite, covellite, chalcocite, magnetite and digenite.

The milling process involves grinding the ore to form a fine-grained process feed followed by extraction of the valuable minerals using flotation. The process does not significantly alter the chemical composition of the ore, but rather selectively extracts metal-containing minerals from the slurry. Some chemical additives are introduced in the extraction process, primarily to assist in clarifying the water. As such, the composition of the tailings solids reflects the composition of the host rock, which is primarily feldspar and quartz. Acids, salts and/or organic compounds are not present in concentrations that are potentially harmful to the environment.

The primary elements of potential concern in the tailings solids are heavy metals, which may be present in elevated concentrations relative to normal rock in the area. Table 2 provides a summary of the total and leachable metals concentrations. The concentrations of these metals are generally consistent with their respective concentrations in natural sediments of the area, which suggests that the tailings solids are relatively benign. The metals that are present in elevated concentrations are not significantly leachable.

An important consideration from the perspective of the release of the tailings is the behaviour of these metal compounds in the changed environment and their potential bio-availability. It is noted that leachate extraction tests conducted in the laboratory are not necessarily indicative of the solubility of components in natural conditions. Further geochemical characterization of the tailings is planned, as described in Appendix C.

2.1.2.2 Supernatant

Like the tailings solids, the supernatant in the TSF was subjected to thorough characterization prior to the release. Review of Table 3 indicates that the quality of the supernatant is relatively good. For example, the concentrations of all metals tested comply with Canadian drinking water criteria. The concentrations of metals, such as selenium, copper and cadmium, have been measured above Provincial criteria for protection of freshwater aquatic life. Like the tailings solids, an important consideration related to potential toxicological response is associated with the presence and potential bioavailability of the heavy metals present in the water that was released.

The tailings supernatant also contains higher pH and dissolved solids than the natural waters of Hazeltine Creek and Polley Lake; however, this issue is likely of lower concern.

Table 2 Tailings Solids Composition (2010 – 2014)

Element	Average Total Concentration in Solid Form (mg/kg)	Average Leachable Concentration (Jan., 2011, mg/L)
Aluminum (Al)	19139	0.276
Antimony (Sb)	0.43	0.001
Arsenic (As)	12.32	0.005
Barium (Ba)	222	0.040
Beryllium (Be)	0.63	0.00025
Bismuth (Bi)	1.85	0.00025
Cadmium (Cd)	0.16	0.00025
Calcium (Ca)	28122	17.4
Chromium (Cr)	20.3	0.00025
Cobalt (Co)	17.4	0.0003
Copper (Cu)	931	0.0134
Iron (Fe)	49651	not tested
Lead (Pb)	5.35	0.00005
Lithium (Li)	17.0	0.0099
Magnesium (Mg)	10969	3.4
Manganese (Mn)	652	0.0085
Mercury (Hg)	0.49	0.00025
Molybdenum (Mo)	5.37	0.0317
Nickel (Ni)	104.61	0.00025
Phosphorus (P)	1405	not tested
Potassium (K)	2121	13.7
Selenium (Se)	1.04	0.00295
Silver (Ag)	116.01	0.000025
Sodium (Na)	1438.16	30.3
Strontium (Sr)	192.12	0.193
Thallium (Tl)	0.025	0.0005
Tin (Sn)	1.5	0.00098
Titanium (Ti)	1525	not tested
Uranium (U)	15.61	0.00034
Vanadium (V)	180.54	0.0086
Zinc (Zn)	59.44	0.005

Table 3 Tailings Impoundment Supernatant Water Quality (2009 - 2014)

	Summary Statistics		
Date/Time	Mean	Maximum	Minimum
Comment			
Conductivity (in-situ) (µs/cm)	1352	2001	766
pH (in-situ) (pH)	8.54	9.94	7.30
Temperature (in-situ) (Degrees Celcius)	9.0	21.8	1.2
Hardness (as CaCO3) (mg/L)	543	970	313
Total Suspended Solids (mg/L)	9.5	54.9	1.5
Total Dissolved Solids (mg/L)	1080	2450	730
Chloride (Cl) (mg/L)	27.7	44.0	17.7
Sulphate (mg/L)	647	1100	397
Ammonia (as N) (mg/L)	0.284	0.719	0.0348
Nitrate (as N) (mg/L)	5.68	8.15	3.42
Nitrate and Nitrite (as N) (mg/L)	6.29	8.33	4.44
Nitrite (as N) (mg/L)	0.140	0.917	0.016
Total Nitrogen (mg/L)	7.05	10.50	3.62
Phosphorus (P) Total (mg/L)	0.0236	0.0850	0.0035
Aluminum (Al)-Dissolved (mg/L)	0.0191	0.0547	0.0082
Iron (Fe)-Dissolved (mg/L)	0.015	0.015	0.015
Antimony (SB)-Total (mg/L)	0.00222	0.00516	0.00087
Arsenic (As)-Total (mg/L)	0.00223	0.00377	0.00125
Barium (B)-Total (mg/L)	0.0780	0.108	0.0392
Cadmium (Cd)-Total (mg/L)	8.316E-05	0.0005	0.00001
Copper (Cu)-Total (mg/L)	0.0137	0.0641	0.0020
Chromium (Cr)-Total (mg/L)	0.0005386	0.00209	0.0003
Iron (Fe)-Total (mg/L)	0.266	1.69	0.033
Lead (Pb)-Total (mg/L)	0.00018	0.00115	0.000025
Mercury (Hg)-Total (mg/L)	1.7857E-05	0.000025	0.000005
Manganese (Mn)-Total (mg/L)	0.0350	0.1160	0.0063
Molybdenum (Mo)-Total (mg/L)	0.205	0.287	0.125
Nickel (Ni)-Total (mg/L)	0.00062	0.00165	0.00025
Silver (Ag)-Total (mg/L)	0.0000126	0.000049	0.000005
Selenium (Se)-Total (mg/L)	0.0241	0.0346	0.0158
Sodium (Na)-Total (mg/L)	89.8	119.0	55.9
Zinc (Zn)-Total (mg/L)	0.0024	0.0062	0.001
Dissolved Organic Carbon (mg/L)	5.98	10.70	2.45

Note 1: Results below MDL are represented as 0.5*MDL

2.2 Aquatic Environment

2.2.1 Hazeltine Creek

A comprehensive study of Hazeltine Creek and Polley Lake was completed in support of applications submitted to discharge tailings supernatant to Hazeltine Creek (Minnow, 2014). Hazeltine Creek flows approximately 10 km from Polley Lake to Quesnel Lake and currently drains a watershed area of 112 km^2. Most of Hazeltine Creek has a moderate gradient of <2%, with the exception of a steep section of >7% gradient that is located between 5.8 to 7.0 km downstream of Polley Lake. Stream morphology consisted of mostly riffle-run sequences with flow typically confined within a well-defined meandering channel containing substrate predominantly in the gravel-cobble size category and bordered by relatively steep banks. Morphology of the steep section is step-pool, dominated by large substrate and bedrock. This is an erosive reach with few depositional areas. Flow in Hazeltine Creek is primarily snowmelt driven, with the majority of runoff occurring in April and May. Mean annual peak flow is 1.4 m^3/s, with a mean annual discharge (MAD) of 0.19 m^3/s (MPMC, 2009), and a mean annual unit runoff of 7.1 L/s/km^2 (KPL, 2014).

Water quality of Hazeltine Creek has pH values greater than neutral, and moderate values of alkalinity and hardness. Baseline monitoring of upper Hazeltine Creek documented average natural concentrations of dissolved aluminum, total copper, total organic carbon and phosphorous that were greater than British Columbia Water Quality Guidelines (BCWQG) for the protection of aquatic life, and these parameters continued to be elevated following mine development (Minnow, 2014).

Mature rainbow trout move into upper Hazeltine Creek from Polley Lake in the spring to spawn, and rainbow trout use Hazeltine Creek for rearing. Lower Hazeltine Creek supports a more diverse fish community than upper Hazeltine Creek due to its accessibility from Quesnel Lake, and the presence of barriers to fish which are located approximately 2.6 to 3.8 km upstream of the Hazeltine Creek mouth. A total of 13 fish species (Chinook, coho, and sockeye salmon, bridgelip sucker, burbot, largescale sucker, longnose dace, longnose sucker, mountain whitefish, peamouth chub, rainbow trout, redside shiner, and white sucker) have been documented in lower Hazeltine Creek below these barriers.

The benthic invertebrate community of Hazeltine Creek was evaluated during baseline studies and in 1999, 2002 and 2007. Benthic invertebrate community characteristics were relatively stable over the period and represent a healthy environment that includes metal tolerant fly larvae. Densities typically vary between 6,000 and 33,000 organisms per m^2. Recent monitoring of Chlorophyll A in periphyton indicate concentrations approximately 1 order of magnitude below the provincial guideline threshold of 100 mg/m^2.

Investigations of selenium concentrations in periphyton, benthic invertebrates and rainbow trout collected in Hazeltine Creek have been conducted in recent years due to an observation of selenium loading in Polley Lake. Selenium tissue concentrations for periphyton, benthic invertebrates and rainbow trout have all been less than half of the threshold of 20 mg/kg dry weight, above which adverse effects can occur in sensitive fish species.

2.2.2 Polley Lake

Polley Lake is a long (6.17 km) narrow (0.65 km) lake oriented along a northwest to southeast axis. Total surface area of the lake is 450 hectares, an average depth of 18 m and it has a current watershed area of 17 km^2 at its outlet. Total volume is calculated to be 62 Mm^3 and the average hydraulic residence time is estimated to be approximately 16 years.

Polley Lake is a dimictic (two turnovers per year) lake, with well-developed thermal stratification in summer months and a summer thermocline depth typically between 5 and 15 m. In winter months, water temperature increases gradually with depth. In all seasons, dissolved oxygen concentrations decrease with greater depth and low dissolved oxygen events (at depth) were observed both before and after mine development.

The water quality of Polley Lake has been characterized on numerous occasions since the mine was first subject to application and approval. The water generally has pH values slightly greater than neutral and moderate values of alkalinity and hardness. A baseline water quality evaluation conducted in 1989, prior to mine operation, reported mean total copper and phosphorus concentrations that were equal to or greater than their BCWQG, with similar results observed since the mine was put into service. All other analytes measured during all years of the baseline assessment (1989 - 1996) were below guideline values. More recent analyses indicate variable concentrations of a number of parameters, including general chemical parameters and specific metals, some reducing and some, such as selenium, increasing with time (Minnow, 2014).

Sediment quality in Polley Lake was assessed prior to the development of the mine as part of baseline studies conducted for Mount Polley Mine (MPMC, 1990) and more recently (Minnow, 2014). Baseline concentrations of metals that exceeded BC sediment quality guidelines included chromium, mercury, nickel, arsenic, copper, iron, manganese, and selenium.

Sediment quality analyses completed following the initiation of mine operations are consistent with baseline values in that arsenic, chromium, iron, manganese, mercury, and nickel concentrations remain higher than the guideline concentrations.

Fish surveys conducted prior to and following mine development have indicated the presence of both rainbow trout and long-nose sucker within Polley Lake.

The red-side shiner is also reported on the Provincial database, but was not captured during the surveys. The lake supports a rainbow trout recreational fishery, which appears to have stayed consistent over time.

The benthic invertebrate community of Polley Lake was assessed during baseline studies as well as in 1999, but has not been evaluated since. Both the density and richness of taxon measured at each station are highly variable, without apparent explanation. The benthic environment of Polley Lake and its tributaries was verified as being sufficiently robust so as to provide a viable fish food source.

2.2.3 Quesnel Lake

Quesnel Lake is a large, deep fjord lake in northeastern BC that comprises three arms (east, west and north), with the eastern arm closest to the Mount Polley Mine site and tailings facility.

The lake is predominantly fed by the Mitchell and Horsefly Rivers and Niagara Creek (which collectively supply 64% of inflow), and flows out through the Quesnel River, which ultimately drains into the Fraser River. The mouth of Hazeltine Creek, where tailings material entered Quesnel Lake, is located in the west arm of the lake, downstream of the mouths of the Mitchell and Horsefly Rivers and Niagara Creek.

Quesnel Lake is one of the deepest lakes in Canada, with maximum depths of more than 500 m, and steep sides greater than 45^o in some areas. The lake has a surface area of 266 km^2, and a volume of 41.8 km^3. The eastern arm is the deepest area of the lake, while the western arm is shallower with a maximum depth of 113 m and is separated from the rest of the lake by a shallow sill 35 m in depth.

The lake is dimictic (two turnovers per year), and oligotrophic (nutrient poor). The lake is thermally stratified for most of the year, typically becoming isothermic for brief periods in the spring and the fall. In the west arm, due to its shallow depth, internal low-frequency waves (e.g. seiches) and this thermal regime it is likely that there is some vertical mixing of water through the water column during the spring and fall. During the balance of the year, it is well stratified thermally, indicating minimal mixing.

A total of 15 fish species (chinook salmon, coho salmon, sockeye salmon, kokanee, lake trout, bull trout, rainbow trout, mountain whitefish, burbot, largescale sucker, longnose sucker, longnose dace, northern pikeminnow, peamouth chub, and redside shiner) have been documented in Quesnel Lake.

Spawning adult salmon migrate up the Quesnel River into the west end of Quesnel Lake, with the majority of sockeye returning to Horsefly River and Mitchell River (Nidle et.al.1994) as well as Summit Creek (Hillaby J., 2011) and various small streams in the east arm or along the shores of the lake (Nidle et.al.1994). Horsefly River is limited to one dominant run of sockeye, which spawns on a four-year cycle and one subdominant run also on a four-year cycle. The Salmonid Enhancement Program of DFO has a spawning channel on Horsefly River with capacity for approximately 22,000 adult sockeye, that was built in 1988 - 1989 to enhance the sockeye salmon run in the sub-dominant years (Hillaby J., 2011).

2.3 TERRESTRIAL ENVIRONMENT

2.3.1 Soil

Large parts of the Canadian Cordillera were covered by an interconnecting mass of valley and piedmont glaciers at several different times during the Pleistocene. This mass is known as the Cordilleran Ice Sheet. Most of the Interior Plateau features prominent land forms that are the results of glacial and glacial fluvial processes. These include such things as drumlins, kames, eskers and melt-water channels.

Morainal tills are the most extensive sediments in the vicinity of the Mount Polley Mine. These are sediments laid down by glacial ice with little or no reworking by melt-water. As a result, these tills tend to be massive or crudely stratified and poorly sorted with a wide range of particle sizes.

Soils are formed from the parent material interacting over time with topography, climate and biota. Soil mapping was completed by the British Columbia Soil Survey in 1984 and shows that the area impacted by the tailings release was covered by Luvisol and Gleysol soils orders. These are derived from morainal till sediments, glacial lacustrine sediments and colluvium.

Poorly drained areas are represented by organic soils (Meisols and Fibrisols) and Gleysols.

2.3.2 Vegetation

The Mount Polley Mine is located within the Cariboo Forest Region. The biogeoclimatic zone representing this area is the Interior Cedar Hemlock Zone, which is further subdivided into two subzones, as the Cedar and the Wet. The mine site, including Polley Lake, is in the Cedar Subzone (Lord, 1984).

Tree species which are characteristic of this zone are western red cedar, white spruce, and Rocky Mountain Douglas fir. Within this zone, an abundant moss layer would typically be present under a closed canopy.

Cut blocks in the area have been reforested with commercial species, and many of the cut blocks are heavily represented by deciduous shrubs and trees including willows, alder, raspberries, aspen and cottonwood. Many perennial and annual herbaceous species also occur including fireweed, sedges, grasses and clover.

2.4 LAND USE

Land use in the area comprises traditional land use, logging, mining, cattle ranging, and recreation. With few exceptions, most of the land near the mine site is Crown owned.

The area in general is used traditionally by First Nations groups that are local to the Williams Lake area (Northern Shuswap and Treaty Society and Esk'etemc First Nation, Province of BC, 2014).

Forest harvesting has occurred over significant portions of the lands surrounding Mount Polley Mine. Clear-cut logging of selected blocks has been the typical harvesting pattern. All, or nearly all, of these cut blocks have been re-forested or in some cases re-planted for a combination of silviculture and cattle grazing uses. Logging did not intrude on the riparian habitat on either side of Hazeltine Creek or the shores of Polley Lake or Quesnel Lake where Hazeltine Creek flows into Quesnel Lake.

Both Polley Lake and Quesnel Lake are used for recreation. Recreation activities around Polley Lake include fishing and two recreational properties that are used by Mount Polley Mine staff. A small camp site is also located on the west side of Polley Lake. Recreational use of Quesnel Lake is more diverse and intensive. A recreational area is located in Likely, BC, which is located approximately 10 km north of the outlet of Hazeltine Creek into Quesnel Lake, where the lake transitions into Quesnel River. There are approximately 300 permanent and seasonal residences in Likely.

The Mount Polley Mine area is reported to have low heritage resource potential (MPMC, 1990). Although archaeological sites may be present in the area, these sites would be expected to be small and of low importance.

The dense forest cover would have made discovery and assessment of these sites difficult, and historical disturbance caused primarily by logging would likely have disturbed or destroyed any historical sites located within the area affected by the tailings release.

2.4.1 Wildlife

The steep and undulating topography, long, snowy winters, and generally wet cool summers creates a diversity of habitats, which meet the needs for life requisites of a wide array of species. In the vicinity of the mine, these habitats have been influenced by human activities such as mining and clear-cut logging, and the area consists of a patchwork of forested and non-forested areas, interspersed with streams, lakes and small wetlands.

Based on a search of the iMap BC (2014) database, there are no ungulate winter ranges, wildlife habitat areas or mapped occurrences of species at risk[1] in the immediate area. Important wildlife habitat has been identified only outside of the study area, north and east of Quesnel Lake, for mule deer, mountain caribou and grizzly bear (MSRM, 1995; iMap BC, 2014).

[1] Species At Risk are defined as species listed as endangered, threatened, or special concern under the Species At Risk Act and/or the BC Conservation Data Centre.

3 COMPREHENSIVE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PLAN

3.1 GENERAL

The term Impact Assessment is used in this document to address the comprehensive Environmental Impact Assessment (EIA) that is referred to in the Order. Assessment of the impacts associated with the tailings release will be completed within the area affected by the release and deposition, and within the water bodies adjacent to this area. Figure 4 in Appendix B illustrates the general Study Area for the Impact Assessment work. Two areas are illustrated on this figure, as follows.

1. The inner area that represents the zone directly disturbed by the tailings release. Impact assessment in this zone will include hydrology, fish habitat, benthic communities, sediment quality, soil quality, and vegetation. The boundaries of this area are defined by the area of visible damage and material deposition above the water level, as well as the zone of significant, measurable deposition below the water level in Polley and Quesnel lakes.
2. The outer area represents the surrounding water bodies that are potentially affected by the release and deposition. Impact assessment in this zone will include water quality and fish health assessment, and land use. The boundaries of this area are defined by Polley Lake, the high-water level in Hazeltine Creek, and Quesnel Lake from the boundary of the east arm with the main lake, to the outlet of the Lake down-gradient of Likely, BC.

The bounds of these study areas may be adjusted during the process of completing the Impact Assessment and Action Plan. This would only be done after careful consideration of the data collected to that point and subject to consultation with regulatory stakeholders.

Sampling, monitoring and testing will be completed in accordance with Water and Air Baseline Monitoring Guidance for Mine Proponents and Operators and the BC Field Sampling Manual, as these documents are applicable. Where these guidelines are not applicable, sampling, monitoring and testing will be implemented in accordance with industry-standard protocols adopted to this project.

3.2 AQUATIC ENVIRONMENT

3.2.1 Hydrology

3.2.1.1 Hazeltine Creek

The hydrology and geomorphology of Hazeltine Creek downstream of the Mount Polley Mine are dominated by direct impacts to the channel (erosion and deposition) by the flow of water and material and the remobilization of the mine material.

We will assess these impacts by determining the previous condition of the channel, the present condition of the channel, the volume and physical characteristics of the deposited material, the volume of natural material eroded from the floodplain and channel, and the volume and timing of discharge events that could remobilize the material.

3.2.1.2 Polley and Quesnel Lakes

The lake environments downstream of the Mount Polley Mine will include potential impacts to benthic communities due to direct sediment deposition, and potential sediment toxicity that may inhibit re-establishment of impacted benthos. The potential for longer-term water quality impacts due to potential leaching of metals within the sediments and to downstream areas if those sediments are remobilized at a later date will also be considered.

In order to assess the potential impacts arising from this influx of sediment, sediment samples will be collected through core sampling; core samples will be obtained via a boat in a distribution designed around the bathymetry of the lakes. The sampling will clarify our understanding of the dispersion and settling of the tailings within the lakes, as well as the chemistry and physical properties of the tailings.

To assess the hydrologic regimes associated with Hazeltine Creek, Polley Lake and Quesnel Lake we will perform a gap analysis to determine data availability and sufficiency from a number of sources related to Hazeltine Creek, Polley and Quesnel Lakes. Where data gaps exist, field work will be undertaken to close those gaps. We will assess the distribution of released tailings through the Lakes, and analyze sediment samples (from both natural and tailings units) for particle size. The thickness of the deposited sediments at the various sampling locations around the lakes will serve to demonstrate sediment transportation and deposition patterns which, in combination with particle size data, may be used to assess the potential for remobilization of sediment within the lakes. The sampling programs described here will also serve to collect data to assess other (i.e. chemical) properties of the sediment. The effect of increased water levels on both lakes will be determined by a shoreline impact and erosion study following methods developed by the BC Ministry of Environment (MoE) (Guthrie & Law, 2005).

3.2.2 Water Quality

The potential short and long-term impacts on water quality from suspended sediment associated with both terrestrial and submerged tailings will be assessed. This will include assessment of potential water quality impacts that may result from contact of terrestrial tailings with rainfall/freshet/swash zone river water, diffusion of contaminants from tailings pore-water to the overlying water body, and/or seepage of pore-water through deposits tailings.

The water quality assessment will consist of the following:

- Characterization of the quality of background groundwater and surface water
- Characterization of probable short and longer term fate and transport of contaminants of concern
- Targeted characterization of contaminants of concern in the water column of receiving water bodies
- Water toxicity evaluation

The surface water quality evaluation will be conducted following a reference condition approach in order to identify potential risk using ambient conditions (conditions in the absence of the tailings spill source) as a baseline. This approach may require identification of reference sites to characterize each aquatic system under evaluation. It is anticipated that reference sites for Quesnel Lake can be located in Quesnel Lake. Pre-incident water quality information will also be used if available. If additional information is required, reference sites from similar regional and/or local water bodies will be characterized to identify baseline conditions for these water bodies. Bootjack Lake may represent a potential reference site for Polley Lake. An adjacent creek or un-impacted tributary to Hazeltine creek could be used to identify reference conditions for Hazeltine Creek.

Based upon preliminary review of watershed information it is likely that characterization of impacted surface water will require multi-depth grid sampling in Quesnel and Polley Lakes. The locations of reference sites and the number of subsamples per site would be identified in the work plan for the assessment. Typically, five or more sampling stations, with at least three subsamples per station, will be required to characterize reference conditions for each aquatic system under evaluation.

Water quality will be characterized for chemicals of potential concern (COPCs) as part of this evaluation. COPCs will be determined using tailings geochemical and geotechnical data sets that have already been established by MPMC (see Section 2.1.2). Preliminary review of the data suggests COPCs that should be assessed are selenium, cadmium, copper, iron, sulphate, molybdenum, organic carbon and nitrate.

Chronic (long-term) and acute (short-term) toxicity evaluation will be conducted to provide an alternate lines of evidence to evaluate ecological risk posed to aquatic receptors (e.g. fish, benthic organisms, algae). Analysis will take place in the assessment area defined through the chemical analytical program described in the previous paragraph. Toxicity results will be used as a line of evidence to inform of potential impacts as well as evaluate the relevance of modelled risks and discount those risks if not supported by the results of toxicity testing.

3.2.3 Sediment Quality

The potential short and long-term impacts to sediment quality will be assessed by implementing a comprehensive sampling program to evaluate the following:

- Potential contaminants that may become bio-available from sediments impacted by tailings, particular those that could be released via oxidized or reduced conditions in the sediment profile
- Pore-water quality in the mine-affected sediment profile as a current indication of the bioavailability of contaminants and as a clear, measurable means to validate the performance of remedial strategies once implemented
- Sediment toxicity
- Benthic macro-invertebrate community structure
- Uptake studies

The sediment quality evaluation will be conducted following the same process used to establish the water quality. The observed sediment quality relative to the reference condition will also provide an indication of the extent of the tailings impact zone in the aquatic environment.

The sediment toxicity evaluation will be conducted to provide an alternate line of evidence to evaluate ecological risk posed to aquatic receptors. Analysis will take place in the Study Area illustrated in Figure 4 (Appendix B) and as defined by further sampling and analyses of sediments. The turnaround time for toxicity testing can be approximately one month and would need to be considered within the schedule to be implemented for remedial response and regulatory approvals. Organism-level assessment endpoints such as survival and growth will be evaluated and similarly assessed for suitability.

Tissue analysis will be conducted on resident species (e.g. site caught fish) to identify if uptake of metals is occurring, and to provide exposure point concentrations for the human health and ecological risk assessment. Comparison to reference condition tissue data would be completed to provide a baseline for the evaluation.

3.2.4 Fish and Aquatic Habitat

Impacts to fish and aquatic habitat will be assessed within bounds of the Study Area illustrated in Figure 4 (Appendix B). Polley Lake contains a confirmed population of rainbow trout and longnose sucker, which were isolated from downstream populations due to documented migration barriers. The lower portion of Hazeltine Creek provided spawning and rearing habitat for fish species resident to Quesnel Lake, in addition to potential available habitat to additional fish species from Quesnel Lake. These include: three species of anadromous salmon, five species of resident salmonids, burbot, four species of suckers, and four minnow species.

The aquatic resources and habitat assessment would consist of the following evaluations:

- Literature review and gap analysis of available baseline data for fish and fish/aquatic habitat values collected in the vicinity of, and for the mine site;
- Adaptive approach to planning field studies and assessments of impacts to aquatic species and habitat based on collaboration with concurrent EIA components, and new information which becomes available during the course of the assessments;
- Assessment of impacts on adult (spawning) and juvenile (rearing) fish within the Study Area; and
- Review, characterization, and quantification of pre-incident fish and aquatic habitat of Hazeltine Creek, which is aimed to feed into creek rehabilitation design.

One potential tool for the evaluation of impacts would be a reference condition approach. Reference sites described for water quality. The locations of reference sites and the number of subsamples per site will be identified in a detailed study design (work plan) aimed to inform the assessment. The reference sites may be selected outside the identified Study Area; however every effort will be made to select adequate sites in the near vicinity or within the Study Area, where feasible. The objective will be to utilize the data gathered in these reference sites, as well as the data already obtained by MPMC (Minnow, 2014) and other historical baseline information as a basis for recovering, managing and/or mitigating impacts associated with the release of mine-affected materials and to rehabilitate Hazeltine Creek.

3.3 Terrestrial Environment

3.3.1 Soil and Vegetation

The potential short and long-term impacts to soil and vegetation resulting from the release of mine-affected materials will be assessed by implementing a survey of the Study Area shown in Figure 4 (Appendix B). Habitat loss can be quantified by overlaying a map of the disturbed area with existing Terrestrial Ecosystem Mapping (TEM) and Vegetation Resources Inventory (VRI) mapping.

Both TEM and VRI mapping are available, although the TEM will need to be updated with recent mine development and other activities (e.g., forestry) to understand ecosystem composition and structural stage prior to the event. The spatial boundary for the Study Area is illustrated in Figure 4.

A preliminary list of species and ecosystems to be addressed can be refined based on the biogeoclimatic subzone and mapped ecosystems present in the affected area - as identified by the TEM. The list of assessed species and ecosystems should be further refined with input from First Nations communities, government representatives and the public so that a focused assessment on key valued components is completed. The location and abundance of particular plant species within the Study Area will first be determined based on existing data from previous vegetation studies, which can be refined by surveying plant species that are present in adjacent areas that are similar to those affected by the release.

3.3.2 Wildlife

The proposed Study Area illustrated in Figure 4 (Appendix B) will be used to determine wildlife potentially affected by the release. A preliminary list of potentially affected species can be refined based on the biogeoclimatic subzone and habitat types present in the affected area - as identified by the TEM. The list of assessed species should be further refined with input from First Nations communities, government representatives and the public so that a focused assessment on key valued components is completed.

Once the focal species list is refined, wildlife ratings tables will be compiled using recognized standards, as appropriate in order to evaluate habitat suitability. The completed ratings tables will be used to produce draft habitat suitability maps for specific species. These suitability maps will be compared with field data in similar habitats adjacent to the site and updated as necessary. The final versions of the habitat suitability mapping will be used to determine the amount of suitable habitat lost for the selected species. In addition to the identification of suitable habitat, all relevant wildlife studies previously completed in the general and immediate area of the tailings release will be reviewed. Any spatially defined wildlife feature will be added to the database for quantification of loss, if it occurred in the affected area.

3.4 Land Use

The land use in the immediate area of the TSF is primarily for mining related purposes. However, land use in the areas of Polley Lake, Hazeltine Creek and Quesnel Lake have significance to local First Nations groups, local residents and business in the tourism industry in the context of water, food and recreational use. These stakeholders will be consulted to ensure mitigation strategies adequately capture their concerns with the tailings release and related impacts. Further information regarding stakeholder consultation is provided in Section 6.

3.5 Toxicological Risk Assessment

3.5.1 Data Review

SNC-Lavalin will perform a data review of relevant site files to evaluate potential data gaps related to completing the risk assessment and understanding the COPC present in the source. The scope of the evaluation will include a review of site-specific and regional reports available, a review of historical analytical data and surrounding topography and hydrology information. Information gathered in this data review will be used to tailor the field investigations for each site, to be undertaken as part of the site characterization detailed below.

Should timing and regulatory approval allow, we propose an iterative approach to the risk assessment whereby a preliminary risk assessment is used to initiate the identification of all receptors and pathways and evaluate worst case conditions at points in time. This approach facilitates the development of a risk assessment model allowing predicted conditions to be compared with regulatory acceptable incremental risk levels. This approach would be used for both human health as well as ecological risks.

3.5.2 Human Health Risk Assessment Approach

The human health risk assessment will consist of a deterministic Detailed Quantitative Human Health Risk Assessment (DQHHRA) conducted as per Health Canada and BC MoE guidance, and will include the following components:

- Problem Formulation: Characterization of the site setting (includes site geology, hydrogeology, land use, surrounding land and water use, climate, etc.), identification of COPCs for the protection of human health (contaminants associated with the tailings release), identification of human receptors of concern (residents, recreational visitors and other groups who may interact with the site in a specific way), including sub-populations (e.g., First Nations communities), identification of the pathways by which the identified receptors of concern have the potential to be exposed to the COPCs (water ingestion, consumption of country foods which may have experienced COPC uptake, swimming, direct contact with tailings or impacted water, inhalation of exposed tailings as dust); development of a human health conceptual site model.
- Exposure Assessment: Estimation of the exposure point concentrations for the COPCs for human receptors - these will initially be the results of the modeling if media concentrations are not available, and will be later refined using measured concentrations in the various media if risk is predicted based on modeled concentrations. Quantitative evaluation of exposures to human receptors will be completed using Health Canada exposure intake equations including consideration of country foods exposure assumptions.

- Toxicity Assessment: Identification of human health protective Toxicity Reference Values (TRVs) for the COPCs. TRVs for human health will be obtained using the USEPA Integrated Risk Information System (BC MoE preferred source) where available. When not available, BC MoE recommended sources, including Health Canada, will be used.
- Risk Characterization: Non-cancer and cancer risks to human receptors will be quantified and compared to the BC MoE negligible risk levels of 1 for non-carcinogens and $1x10^{-5}$ for carcinogens.
- Uncertainty Analysis: The sources of uncertainty in the DQHHRA will be reviewed and evaluated to ensure that the conclusions are protective of human health.

3.5.3 Ecological Risk Assessment Approach

The ecological risk assessment will consist of a preliminary screening level ecological risk assessment (SLERA) to screen for data gaps and sensitive input parameters. Following screening, a deterministic weight of evidence based Detailed Quantitative Ecological Risk Assessment (DQERA) will be conducted, based generally on BC MoE and Environment Canada guidance. A risk evaluation approach that relies on multiple Lowest Observable Effect (LOE) is typically undertaken as an assessment uncertainty reduction measure. A single LOE risk analysis may not provide an acceptable degree of certainty regarding the risk conclusion, therefore multiple LOE consisting of differing types of both qualitative and quantitative information are used to form a weight of evidence (WOE) based final conclusion regarding risk. By using a WOE approach, the confidence in the estimate of risk can be increased.

The individual lines of evidence to be used to complete a weight of evidence (WOE) evaluation may consist of the following:

- Terrestrial Plant Risk LOE
    - Comparison of soil quality to established phytotoxicity benchmarks;
    - Comparison of tissue residues from the site and from reference sites; and,
    - Biological toxicity tests.
- Soil Invertebrate Risk LOE
    - Comparison of soil quality to established soil invertebrate toxicity benchmarks;
    - Comparison of tissue residues from the site and from reference sites;
    - Biological toxicity tests; and,
    - Community structure measures.

- Mammal/Bird Risk LOE (single LOE with measured exposure point data)
  - Predictive food web models based on soil (terrestrial food web) and sediment (aquatic food web) quality and incorporation of plant and invertebrate tissue quality data collected as part of the plant and invertebrate risk LOE evaluation.
- Benthic Invertebrate Risk LOE
  - Comparison of sediment quality to established sediment toxicity benchmarks;
  - Comparison of tissue residues from the site and from reference sites;
  - Biological toxicity tests; and,
  - Community structure measures.
- Bottom Dwelling Fish Risk LOE
  - Comparison of sediment quality to established sediment quality benchmarks;
  - Comparison of sediment pore water quality to established water quality benchmarks (assess early and developmental life stages);
  - Fish survey endpoint measurement; and,
  - Sediment toxicity testing.
- Pelagic Fish Risk LOE
  - Comparison of surface water quality to established water quality benchmarks;
  - Comparison of sediment pore water quality to established water quality benchmarks (assess early life stage);
  - Fish survey endpoint measurement; and,
  - Surface water toxicity testing involving relevant species (i.e. rainbow trout).
- Amphibian Risk LOE
  - Comparison of sediment quality to established solid phase media amphibian toxicity benchmarks. These benchmarks are generally unavailable; therefore, pore-water represents a better point of comparison given the higher bioavailability of COPC in pore water compared to sediment and the slightly greater availability of liquid based toxicity reference values for amphibians;
  - Comparison of sediment pore water quality to established water quality benchmarks relevant to amphibians; and potentially.
  - Toxicity testing (e.g. per ASTM E2591 - 07(2013)), if considered required.
- Aquatic Plant Risk LOE (single LOE for two differing media)
  - Comparison of surface water quality to established water quality benchmarks;
  - Comparison of sediment pore water quality to established water quality benchmarks.

The DQERA structure will be generally similar to that of the DQHHRA, although a WOE evaluation will be incorporated into the structure.

The components of the DQERA are as follows:

- Problem Formulation: Characterization of the site setting (includes site geology, hydrogeology, land use, surrounding land and water use, climate, etc.), identification COPCs for the protection of ecological health (contaminants associated with the spill), identification of valued ecosystem components and ecological receptors of concern (species at risk, surrogate receptors for feeding guilds), identification of the pathways by which the identified receptors of concern have the potential to be exposed to the COPCs; development of a ecological health conceptual site model.
- Exposure Assessment: Estimation and/or identification of the exposure point concentrations for the COPCs for ecological receptors - these will initially be the results of the modeling if media concentrations are not available, and will be later refined using measured concentrations in the various media if risk is predicted based on modeled concentrations. Quantitative evaluation of exposures to ecological receptors will be completed using standard food chain modeling techniques.
- Toxicity Assessment: Identification of ecological health protective TRVs for the COPCs.
- Risk Characterization: Risks to ecological receptors will be quantified and compared to a hazard quotient of 1 or related to background hazard quotients.
- Evaluation of the LOE (toxicity data, community structure indices, etc.).
- Identification of the WOE evaluation framework for each receptor group under investigation and assessment of WOE based outcome.
- Uncertainty Analysis: The sources of uncertainty in the DQERA will be reviewed and evaluated to ensure that the conclusions are protective of ecological health.

At the conclusion of the DQHHRA and DQERA, COPC requiring risk management will be understood and areas of the site requiring risk management will be identified. Based on the COPC requiring management, the location of the impacted area and the receptors considered to be potentially unacceptably affected by the COPC, risk management/remedial options will be identified for each management area.

Breakdown of the site into identifiable management areas, each of which may differ in terms of COPC composition, physical attributes and receptors considered potentially affected, allows for efficient management approach identification rather than treating the whole site as one management zone. The final objective of the risk assessment process will be to achieve regulatory approval related to implementation of the selected risk management/remedial approaches for each affected area of the site.

4 ACTION PLAN BASED ON COMPREHESIVE EIA

4.1 WATER MANAGEMENT

Water management strategies are developed for the following aspects, as described below:

- Water that accumulates in the TSF
- Water that is present in the active mine and mineral processing area
- Water that is accumulating in Polley Lake
- Water flowing into Hazeltine Creek

The water that accumulates in the secured TSF will be managed within the TSF, either behind the temporary berm or within depression contained within the TSF. Tailings solids that are suspended in this water will be allowed to settle out. The resulting supernatant will be transferred to inactive mining pits if and as required to maintain desired fluid levels in the TSF.

Mine and process area runoff is currently directed to the TSF. Where and as feasible, mine water will be directed to inactive mine pits to reduce the levels of water that are directed to the TSF. As water levels accumulate in the inactive mine pits, it may be beneficial to treat and release this water. If this is required, it will be managed by separate assessment and application to the MoE.

The level of water in Polley Lake has risen approximately 1.7 m as a result of the TSF breach. Water is currently being transferred by pumps to allow water levels to return to normal. Additional options for transferring this water will be examined going forward, including transfer into one of the adjacent lakes or into an unaffected drainage course or a medication of the pump around infrastructure.

Flow in Hazeltine Creek will continue through the assessment activities described in this plan. During rehabilitation of Hazeltine Creek it will be necessary to manage water in the active work areas such that these flows do not adversely affect the quality of the rehabilitation work and to minimize the ongoing release of tailings solids and suspended sediments into Quesnel Lake.

4.2 TAILINGS IMPOUNDMENT TEMPORARY REPAIRS

A temporary berm is currently being constructed across the location of the breach, inside of the footprint of the Perimeter Embankment. The purpose of this temporary berm is to contain residual tailings and stabilize the area for safe access for additional geotechnical investigations. The nature of the repair work is described in MPMC's submission to the MoE that is dated August 13, 2014.

4.3 Aquatic Habitat Restoration

4.3.1 Access Construction

Work through the tailings debris area and in the vicinity of Hazeltine Creek, Polley and Quesnel Lakes where either assessment or mitigation actions are required will necessitate the construction of access roads and path through the forest to these areas. As much as possible, for work near lake shorelines, access will be from the water side. Trees felled for access roads will be retained for possible use in restoration of impacted areas and or roads created. Any roads or access paths constructed will be decommissioned, soil replaced and re-vegetated using native plants following the conclusion of all anticipated mitigation work in these areas. Where possible access needs will be conducted in area disturbed by the breach.

4.3.2 Hazeltine Creek

A rehabilitation plan for Hazeltine Creek will follow from the outcome of the comprehensive EIA (see Section 3). The following tasks will be implemented to develop the Action Plan:

1. Perform an options analysis for mitigation/remediation of tailings deposits and the construction and/or rehabilitation of the Hazeltine Creek channel
2. Determine the design characteristics for the Hazeltine Creek channel from the:
   - Design criteria outlined in the preferred option;
   - Analysis of aerial photographs and data from previous reports;
   - Boundary conditions (valley slope, width, depth, and shape) imposed by the new topography as documented by Lidar or other data collected post breach; and
   - Design flows from results of the updated hydrological analysis.
3. Design the Hazeltine Creek channel using:
   - The boundary conditions previously identified;
   - A hydraulic and sediment transport analysis (HEC-RAS or similar) to aid in channel design that meets the requirements as specified in the options analysis;
   - Factors associated with the outlet from Polley Lake; and
   - Any modifications needed in the delta that flows into Quesnel Lake.

4.3.3 Polley and Quesnel Lakes

Pending results of the comprehensive EIA, an Action Plan will be developed to determine appropriate rehabilitation requirements for Polley and Quesnel Lakes.

Building on the EIA and the toxicological analysis mentioned previously, this will include:

- An analysis of the potential mobility of tailings material within the lakes under high-flow conditions and lake turn-over
- Assessment of potential ecological impacts arising from tailings deposition in ecologically sensitive areas (e.g. spawning beaches and benthic invertebrate habitat)
- Assessment of the physical and ecological impacts of changing water levels
- Assessment of potential impacts that could arise from remedial activities
- An options analysis for measures to:
    - Minimize tailings mobility;
    - Minimize the leaching of toxic constituents from tailings (if applicable); and
    - Ensure that spawning beaches, benthic habitats and other ecologically sensitive areas are functional and able to support ecosystem requirements.

Based on the above analyses, a rehabilitation plan will be developed around the chosen remedial option, with the goals of restoring pre-incident ecological and hydrological function, and to address issues related to potential toxicity of the mine-affected materials that are present. It will be necessary to weigh the potential impacts of remediation activities against the expected impacts arising from managing and mitigating impacts associated with the mine-affected materials that remain in the environment.

4.3.4 Methodologies

Works in and about a stream as defined under the BC *Water Act* (i.e. includes stream and lake systems) will be managed as a high risk Emergency Works[1]. Additional mitigation activities such as temporary diversion dams, pumping and treating of water, fish salvages, and recovery of contaminants related mortalities to remove them from the food chain may be implemented (as required) to further protect aquatic life and habitat, water quality and downstream water users.

Timing is an important consideration for the implementation phase of the Action Plan. Fish species that spawn in the fall will be taken into consideration with respect to stabilizing sediments and improving water quality.

---

[1] http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf Section 7.8 Standards and Best Practices for Emergency Works

Habitat rehabilitation in Hazeltine Creek will be based on approximating the pre-existing channel morphology. Location and alignments will be dependent on evaluation from a geotechnical and geochemical level, and may not correspond to previous condition. Consolidation and/or removal options for sediments may also require an altered alignment of the rebuilt channel.

Habitat components quantified during the comprehensive impact assessment will be inputted into channel design for rehabilitation. The design will include provision for habitat features such as Large Woody Debris (LWD) and riffle and pool structures to mimic natural conditions. Spawning gravels will also be included in the design. Spawning habitat in the upper reach of Hazeltine Creek downstream of Polley Lake, and habitats downstream of the bedrock influenced migration barriers will be considered. Channel rehabilitation will need to address sedimentation control, particularly from any mine affected sediments. Riparian habitat restoration will be paramount in the recovery of natural function as fish habitat.

The establishment of endpoints for addressing long term recovery and monitoring frequency of key fish and/or aquatic receptors will be dependent on results from the comprehensive EIA.

4.4 Terrestrial Environment

4.4.1 Debris Recovery

Coarse woody debris from the event has been deposited below the TSF extending to Polley Lake and Quesnel Lake. Floating debris is currently being recovered in Quesnel Lake.

A survey of the Study Area illustrated in Figure 4 will be completed to determine the volume of land-based debris not yet recovered and the risks associated with the materials (re-mobilization, environmental quality, aesthetics, etc.). A collection program will be implemented depending on the results of the survey. Some coarse woody debris may be useful for creating aquatic habitat, shoreline stabilization, soil amendment to improve soil physical conditions, and/or to create microsites for vegetation establishment.

4.4.2 Tailings Recovery, Management and Impact Mitigation

The Action Plan for recovery, management and/or mitigation of impacts associated with mine-affected materials that have been deposited above water will be established based on the results of the comprehensive EIA and the toxicological risk assessment.

A set of practical and viable management options will be developed for subsequent feasibility evaluation. These options may include:

- Excavation and transfer of tailings materials back to the mine site TSF
- Management in-place.
- Geotechnical stabilization coupled with drainage and erosion control measures
- Strategies to re-vegetate the site, including the establishment of self-sustaining native vegetation that may control erosion and enhance habitat value

Feasibility of management options will be evaluated using the following criteria:

- health and ecological risk
- technical feasibility
- regulatory input
- environmental impacts and uncertainties associated with implementation
- Stakeholder input

4.4.3 Reclamation and Re-vegetation

A Digital Elevation Model (DEM), updated TEM and wildlife habitat mapping will enable description of the habitat types and terrain (elevation, topography, aspect etc) of the affected and immediately surrounding areas which can then be used to plan reclamation. The information will be used to map out Reclamation Units (RUs) for which reliable and ecologically appropriate reclamation and re-vegetation strategies will be developed.

Reclamation objectives will be developed for each RU (or RU group) based on the existing and anticipated end land use being determined as part of the impact assessment and based on anticipated post remediation conditions as described above. Reclamation objectives on mine sites in BC typically aim to stabilize disturbed areas, restore drainage patterns, and provide sustainable and ecologically appropriate vegetation communities that are compatible with end land uses.

Candidate species of trees, shrubs and herbaceous plants for use in reclamation will be identified based on results of the preferred remedial option and the characteristics of the RU (i.e., drainage, aspect, etc.). Native seed mixes will be evaluated based on availability and their ability to meet reclamation objectives. Agronomic seed mixtures often provide short term benefits through aggressive establishment and will be considered in areas where immediate stabilization is considered paramount. These can be used alone or, based on longer term objectives, can be used in combination with brush mats or other techniques to improve the establishment and success of native species (grasses, trees or shrubs). It is noted that much of the affected area of tailings deposition lends itself to developing a strategy that is complimented by encroachment of native species from adjacent lands.

The nutrient status and physical properties of the tailings deposited below the TSF release require characterization to determine if the material is a suitable growth medium for the plants that may be considered for reclamation and re-vegetation efforts. Samples collected as part of the scope described in Section 4.2.2 will be selectively analyzed for key nutrient parameters including total carbon, total nitrogen, available nitrogen (min-N), and available phosphorous. The data will be evaluated to confirm if nutrients are considered potentially growth limiting and to determine if and what soil amendments may be necessary (e.g., coarse woody debris, wood chips, and other locally available amendments, fertilizers, etc.). Potential phytotoxicity of soils will also be evaluated based on analytical data from the risk assessment.

Soil properties will be reviewed to establish if soil (tailings) physical conditions may be potentially growth limiting (i.e., bulk density, water retention characteristics). The need for backfill or covers will be established and testing for nutrient status and physical properties of candidate source materials will be completed as required. The TEM will identify possible borrow source locations for characterization and investigation.

5 MONITORING PROGRAM

5.1 Current Monitoring Program

5.1.1 General

A Preliminary Environmental Impact Assessment (PEIA) was initiated by MPMC in response to Section 2 of the Order issued by the MoE on August 5, 2014. The receiving environments of Quesnel Lake and Polley Lake have been the focus of the PEIA. The following sections describe the various programs that have been initiated and are currently ongoing and that are expected to be integrated into the Comprehensive EIA described in Section 3.

Details on the sampling program are summarized in Table 4, below, and locations are illustrated in Figure 5 in Appendix B. As results become available, the design of the sampling program is being evaluated and adjustments may be made from time to time depending on these results.

5.1.2 Surface Water Impact Assessment

The objective of the water quality monitoring is to measure the relevant regulated analytical parameters, which include total and dissolved metals, nutrients and bacteria. Water quality results are being compared to applicable BCWQGs for the protection of drinking water and aquatic life.

As of August 14, 2014, thirty-six water sampling locations have been established to assess and monitor water quality in Quesnel Lake in the area of the mouth of Hazeltine Creek, and at other potentially affected locations on Quesnel Lake. Sampling locations also include potential baseline reference locations at more remote up-gradient locations on Quesnel Lake. Three daily water quality sampling locations have been established adjacent to the shore of Polley Lake.

The following is a detailed list of analytical parameters currently being evaluated:

- Total and dissolved metals (including mercury);
- Anions: sulphate, chloride, fluoride;
- Nutrients: total ammonia, nitrate, nitrite, total nitrogen, total Kjeldahl nitrogen, orthophosphate, total phosphorous, dissolved phosphorous; and
- Bacteria: coliforms and e. coli.

Samples have been collected at least once from all locations between August 6 and August 13, 2014. At ten and 4, and HAD-1 samples are being collected daily. Samples are typically collected from within 30 cm of the surface.

Table 4 Summary of Monitoring Program for Mount Polley Tailings Release Preliminary Environmental Impact Assessment

Monitoring Program	Sampling Location IDs	Total Number of Sampling Locations	Comments
Surface Water Quality[1]	**Quesnel Lake**: QUL-1 through QUL-26, QUL-28, QUL-30, QUL-31, QUL-32 (QLR-2), QUL-33 (QLR-1), QUL-40, QUL-41, QUL-42, Raft Cr Rec Site **Polley Lake**: POL-2, POL-3, POL-4 **Polley Discharge to Hazeltine Creek**: HAD-1 **Quesnel River**: QUR-1 (includes QURU-1x & QUR-3)	35 Quesnel Lake 3 Polley Lake 1 Discharge from Polley Lake 1 Quesnel River	Field monitoring at each sampling location generally consists of measuring the following parameters: pH, specific conductivity, temperature, dissolved oxygen, and Secchi disk depth recorded. Data collection has been on a daily basis at fourteen locations QUL-3, QUL 9, QUL-17 to QUL-22, QUL-26, QUL-28, POL-2, POL-3, POL-4, HAD-1. An automated ISCO sampler has been installed at the Quesnel River Research Station (QRRC) which collected samples up to three times daily for laboratory analysis.
Water Quality Profile	QUL-18, QUL-21, QUL-26	3	Samples collected at three site-specific depths relative to measured thermocline.
Surface Water Toxicity[2]	QUR-1	1	
Coliform and e. coli	QUL-30, QUL-31, POL-1, POL-2	4	
Sediment Quality[4,5]	QUL-14, QUL-15, QUL-16, and 7 others to be determined.	10	Eight locations have been established. Five replicates are collected at each of the eight sampling locations.

Notes:

[1]Surface Water Quality samples are submitted for laboratory analysis of total and dissolved metals (BCWQG AW and DW detection limits), pH, anions, nutrients, dissolved organic carbon, total suspended sediment, total dissolved solids, and turbidity.

[2]Surface Water Toxicity testing includes rainbow trout (96 hr), Daphnia magna (48 hr LC50), fathead minnow (7 day test)

[3] Drinking Water Quality includes coliform/e. coli

[4] Sediment Quality Tier 1 sampling includes particle size, total organic carbon, and total metals analysis (<63 µm). Tier II sampling additionally includes

[5] Sediment Quality Tier II includes toxicity testing using Hyalella and Chironomus organisms, Tessier extraction (metals), Shake Flask Metals, and Acid-base accounting (ABA).

At locations QUL-18, QUL-21, and QUL-26 water samples were collected from three depths relative to the thermocline measured at each of the locations (above, at, and below).

An automated ISCO sampler was installed on the shoreline at the Quesnel River Research Centre (QRRC) and is fully functioning as of August 14, 2014. The ISCO sampler collects water samples three times a day (at 8 PM, 3 AM, 12 PM) and mine staff retrieve them daily and transport them for laboratory analysis. Samples will be analyzed for total metals, anions, pH, specific conductivity, and turbidity. A multi-probe (and data-logger) is currently measuring turbidity, pH, temperature, dissolved oxygen, and electrical conductivity every fifteen minutes.

5.1.3 Sediment Quality Assessment in Quesnel Lake

A sediment sampling program (eight locations in total) has been established to confirm the quality of sediment near the mouth of Hazeltine Creek, at far-field locations, and also at two reference locations. Samples are being collected at two locations (littoral and profundal location) in close proximity of the mouth of Hazeltine Creek. A third location just south of the delta of Hazeltine Creek has also been sampled. Far-Field locations near Mitchell Bay, and at two locations towards the town on Likely, BC have also been sampled. Two reference locations have also been selected to provide an understanding of background conditions throughout the lake. Data will be used to preliminarily evaluate impacts to sediments in the area and aid in the design of a more detailed program.

Results will be compared to reference criteria included in the BC *Contaminated Sites Regulation*, as well as the working guidelines for sediments contained within the BC MoE's A Compendium of Working Water Quality Guidelines for British Columbia. Results are also expected to be used as part of a comprehensive EIA including ecological and human health risk assessments as necessary to develop appropriate remedial options for the affected areas. All samples are being analyzed for particle size, total organic carbon, and total metals (<63 µm diameter). Samples from locations near Hazeltine Creek and from one of the reference locations will have each of the five replicates collected and analyzed for toxicity using *Hyalella* and *Chironomus* organisms, Tessier extraction (metals), Shake Flask Metals, and Acid-Base Accounting. At least one of the replicates at each of the other locations will be analyzed for these parameters.

5.1.4 Fish Capture and Sampling

Permits for twelve individuals of the each of the species rainbow trout, lake trout, burbot, kokanee, Chinook salmon and sockeye salmon were sought proactively by MPMC and approvals recently obtained. The sampling program and activities will be implemented to evaluate the potential accumulation of COPC in the fish that are sampled.

5.1.5 Quality Control/Quality Assurance

Sampling, monitoring and testing will be completed in accordance with Water and Air Baseline Monitoring Guidance for Mine Proponents and Operators and the BC Field Sampling Manual, as these documents are applicable. Where these guidelines are not applicable, sampling, monitoring and testing will be implemented in accordance with industry-standard protocols adopted to this project.

Field duplicate samples are being collected at an approximate 1 in 10 frequency (10%) for all laboratory analytical parameters. Relative percent differences (RPDs) will be calculated for each pair of duplicate samples collected and appropriate actions taken to investigate elevated RPDs.

Field blanks and equipment blanks are being collected at an approximate 5% frequency (1 in 20 samples). Filter and de-ionized water blanks will be collected on a monthly basis. Laboratory and tabulated data will be reviewed for QA/QC purposes and to identify any possible issues related to both field sampling and laboratory analytical procedures. All data quality waivers will be reviewed and summarized.

5.2 Longer Term Monitoring Program

A longer term monitoring program will be implemented following completion of the comprehensive EIA to monitoring the potential effects associated with implementing of the Action Plan and to continue to verify that safe water and sediment quality is being maintained. The principles and methods of the longer term monitoring program will be the same as those of the Current Program. The frequencies of sampling and the number of locations will be adjusted to account for the results of the current monitoring program and the nature and levels of activity associated with the Action Plan. In general, the longer term monitoring program sampling locations will be selected to verify acceptable water and sediment quality at the following locations:

- In Polley and Quesnel Lakes adjacent to the area of deposition of mine-affected materials
- In Quesnel Lake and Quesnel River adjacent to Likely
- At suitable locations representing background conditions
- In Hazeltine Creek following its rehabilitation

6 STAKEHOLDER CONSULTATION PROGRAM

6.1 General

Stakeholder communications in response to the release from the TSF of the Mount Polley Mine fall into two basic categories, First Nations, and Communications and Community Relations.

6.2 First Nations Communications

MPMC has well established relationships with both the Williams Lake Indian Band (WLIB) and the Soda Creek Band (SCB). MPMC has Brownfields benefits agreements with both groups that provide funding and frameworks that address employment, training and communications. MPMC, WLIB and SCB meet monthly for Implementation Committee meetings where a wide range of issues are discussed. Additional communications have been undertaken since the release from the TSF and will continue based on feedback from band representatives. MPMC also met with representatives of both Canim Lake Band and Canoe Creek Band during the week of August 4th and held a community information meeting at the Canim Lake Band office in order to reach out to First Nations neighbours.

6.3 Community Communications

MPMC has historically had community meetings twice a year to keep the local community informed of activities and plans at the Mount Polley Mine. These meetings were most often held in Williams Lake, BC.

Since the incident, MPMC has held weekly community meetings in Likely, BC and will continue to do so until both MPMC and the community members feel it is appropriate to reduce the meeting frequency, at which time the schedule may be changed to bi-weekly or monthly meetings, or perhaps a non-patterned frequency based on milestones rather than the calendar. The purpose of these meetings is to update the community regarding MPMC's response, activities that have occurred and those that are planned. These meetings will evolve to accommodate the needs of the community while ensuring that community stakeholders remain fully informed.

6.4 Postings on Website

MPMC will continue to post the results of its impact assessment and actions on the company website. Weekly reports that describe the results of monitoring programs will continue to be presented on the website as will regular project updates. Similar information continues to be posted on the Province of BC's website dedicated to this incident response, and MPMC will continue to cooperate in this process.

6.5 SIGNIFICANT MILESTONE COMMUNICATIONS

Specific presentation and consultation will be implemented to describe, discuss and obtain feedback regarding major milestones in the response process. These milestones include, but are not necessarily limited to, the following:

- Completion of the comprehensive impact assessments
- Development of the action plans to recover, manage and/or mitigate impacts identified by these assessments
- Completion of the action plans to recover, manage and/or mitigate impacts identified by these assessments

7 SCHEDULE AND REPORTING

7.1 WEEKLY

Consistent with the Order and the Ministry of Environment's letter of August 10, 2014, weekly reporting will be provided on each Friday of the week and will provide a high level summary of the following:

a) Monitoring that occurred during the preceding week and what is planned for the upcoming week, including where sampling is occurring and what is being sampled for
b) Any modifications to the sampling/monitoring program
c) Any gaps identified in the monitoring program and next actions
d) Visual observations from each day during sampling (e.g impacts)
e) A list of all the sampling sites with a map that is updated as it changes

7.2 SEPTEMBER 15, 2014 REPORT

Consistent with the Order a formal written update will be provided by September 15, 2014 that provides for:

a. a listing of the qualified professionals, including their qualifications, who contributed to the formal written report;
b. a summary of the preliminary EIA and results;
c. a summary of the comprehensive EIA and results;
d. a description of clean-up activities, mitigation measures, site restoration and management actions that were implemented as a result of the preliminary and comprehensive EIAs;
e. recommendations for additional mitigation and restoration measures, if appropriate; and
f. a proposed ongoing monitoring program.

7.3 OTHER REPORTING

Stand-alone reports will also be prepared on an as needed basis to describe the following additional aspects related to the planning and implementation of activities described in this report:

- Detailed work plans for impact assessments (comprehensive EIAs) as described in Section 3 of this report
- Design reports describing the Action Plan to recovery, manage and/or mitigate impacts associated with the mine-affected materials that have been released into the environment
- Implementation reports describing execution of the Actions Plan
- The results of monitoring programs implemented to characterize the potential impacts of the release and associated abatement activities within and around the perimeter of the Study Area as described in Section 5 of this report

These reports will be submitted for regulatory review, comment, and where necessary, authorization. The timing of these reports will be determined with the Province, having regard for the progress and outcomes of the impact assessment work that is described in Section 3.

SNC-LAVALIN INC.

Gordon J. Johnson, M.Sc., P.Eng.
Managing Director, Environment & Water

8 BIBLIOGRAPHY

Mount Polley Mining Corporation. 1990. Stage 1 Environmental and Socioeconomic Impact Assessment, Mount Polley Mine. Report prepared in support of mine permit applications.

Minnow Environmental Inc. (Minnow). 2014. Aquatic Environmental Description Report Mount Polley Mine Discharge of Treated Water to Polley Lake. Report prepared to support permit to release treated water from the tailings impoundment.

Geowest Environmental Consultants Ltd (GEOWEST). 2001. Terrestrial Ecosystem Mapping with Wildlife Interpretations for the Eastern Cariboo Area, East of Williams Lake, British Columbia. Volume 1: Terrestrial Ecosystem & Bioterrain Mapping with Expanded Legends for Terrestrial Ecosystem Units. Prepared for Province of British Columbia Ministry of Environment, Lands and Parks, Williams Lake, BC.

Steen, O.A. and A. Coupe. 1997. A Field Guide to Forest Site Identification and Interpretation for the Cariboo Forest Region. Ministry of Forests Research Program, Ministry of Forests, BC.

Ministry of Sustainable Resource Management (MSRM). 1995. Cariboo-Chilcotin Land Use Plan. Ninety-day Implementation Process Final Report. Province of British Columbia, February 15, 1995.

IMap BC. 2014. Government of British Columbia, Data BC Mapping Tool. Available at: http://maps.gov.bc.ca/ess/sv/imapbc/ [Accessed August 13, 2014].

USGS. 2014. PHREEQC geochemical modeling software (Version 3.0.4.7711) & PHAST reactive transport modeling software (Version 2.4.7-8914). August 13, 2014. United States Geological Survey. Reston, Virginia, United States.

Fisheries and Oceans Canada (DFO). 2014. Pre-season Run Size Forecasts for Fraser River Sockeye (*Oncorhynchus nerka*) Salmon in 2014. Can. Sci. Advis. Sec. Rep.

Nidle *et.al.*1994 B. H. Nidle, K. S. Shortreed and K. V. Masuda. 1994. limnological Data from the 1985-1990 Study of Quesnel lake. Biological Sciences Branch Department of Fisheries and Oceans. Canadian Data Report of Fisheries and Aquatic Sciences 940

Hecht, S.A., D.H. Baldwin, C.A. Mebane, T. Hawkes, S.J. Gross, and N.L. Scholz. 2007. An overview of sensory effects on juvenile salmonids exposed to dissolved copper: Applying a benchmark concentration approach to evaluate sublethal neurobehavioral toxicity. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-83, 39 p. Hillaby J., 2011

Ministry of Environment (MoE). 2012. Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators

Guthrie, R.H. & Law, P.D. 2005. Lakeshore Erosion Hazard Mapping. BC Ministry of Environment, Technical Handbook TH 1, Naniamo BC

APPENDIX A

RECONCILIATION OF REQUIREMENTS
POLLUTION ABATEMENT ORDER (the "Order") No. 107461

RECONCILIATION OF REQUIREMENTS

POLLUTION ABATEMENT ORDER (ORDER) No. 107461

REQUIREMENTS OF ORDER No. 107461

The following provides the specific requirements of Order No. 107461 (in italics) followed by the location within this document (or elsewhere) where these requirements are addressed.

1. *Immediately take action, under the direction of a suitably qualified professional, to abate the discharge of mine-affected materials and sediments from the impoundment facility, and specifically into Polley Lake, Hazeltine Creek and Quesnel Lake. A written summary of actions taken must be submitted to the Director on August 13, 2014*

Immediate actions being taken to abate the discharge of mine-affected materials and sediments from the impoundment facility are described in Section 4.2. A written summary of actions taken was filed with the Director by MPMC on August 13, 2014.

2. *Immediately retain a suitably qualified professional to initiate a preliminary Environmental Impact Assessment (EIA) and provide the name of the qualified professional to the Director for approval by August 6, 2014.*

Qualified professionals retained to initiate the preliminary EIA were identified in MPMC's response dated August 6, 2014. Satisfaction of Section 2 of the Order was confirmed by letter from the Director to MPMC dated August 10, 2014.

3. *Retain a suitably qualified professional to initiate a comprehensive Environmental Impact Assessment (EIA) and provide the name of the qualified professional to the Director for approval by August 13, 2014.*

Qualified professionals retained to initiate the comprehensive EIA were identified in MPMC's response dated August 13, 2014. Section 1.3 of this report summarizes the roles and responsibilities of qualified professionals identified to lead the implementation of the impact assessment and actions described in this report.

4. *Upon completion of the preliminary EIA, immediately implement clean up activities, mitigation measures and management actions as required by the EIA.*
5. *Upon completion of the comprehensive EIA, immediately implement clean up activities, mitigation measures, site restoration and management actions as required by the comprehensive EIA.*

Section 4 of this report describes the processes to be implemented for the continued clean up, mitigation and management actions to be implemented pursuant to the findings of the impact assessment. Further definition of these actions will be provided on completion of the comprehensive impact assessments.

6. *Based on the preliminary EIA, develop and submit to the Director by August 6, 2014 for approval, an Action Plan detailing measures relative to the preliminary EIA to be taken to:*
   a. *Characterize the materials that were released into the receiving environment (including their expected behaviour in the receiving environment, settling rates, etc.);*
   b. *Recover or otherwise manage mine-affected materials and sediments currently in the receiving environment;*
   c. *Mitigate residual risks to the environment;*
   d. *Assess and monitor the impacts and risks posed by the mine-affected materials and sediments currently in the receiving environment, as well as from the recovery and management efforts themselves; and*
   e. *Report on the implementation of Action Plan measures on a weekly basis to regulatory agencies and stakeholders.*

These aspects were addressed in MPMC's response dated August 6, 2014. Further details regarding each of these aspects are provided in this report, as follows: (a) and (d) characterization of released materials and assessment of risks posed by mine-affected materials are described in Section 3; (b) and (c) recovery, management and mitigation of impacts posed by mine-affected materials are described in Section 4; (d) monitoring of impacts posed by mine-affected materials is described in Section 5; and, (e) reporting is described in Section 7.

7. *Based on the comprehensive EIA, develop and submit to the Director by August 15, 2014 for approval, an Action Plan detailing measures relative to the comprehensive EIA to be taken to:*
   a. *Fully characterize the materials that were released into the receiving environment (including their expected behaviour in the receiving environment, settling rates, etc.);*
   b. *Fully recover or otherwise manage mine-affected materials and sediments currently in the receiving environment;*
   c. *Define Site mitigation and/or mitigate residual risks to the environment;*
   d. *Assess and monitor the impacts and risks posed by the mine-affected materials and sediments currently in the receiving environment, as well as from the recovery and management efforts themselves; and*
   e. *Report on the implementation of Action Plan measures on a weekly basis to regulatory agencies and stakeholders*

Section 1.2 describes where these requirements are addressed in this report.

8. *Prepare and submit a formal written update by September 15, 2014. The update report is to include at a minimum:*
   a. *A list of all other qualified professionals who contributed to the report, and a summary of their qualifications;*
   b. *A summary of the preliminary EIA and results;*
   c. *A summary of the comprehensive EIA and results;*
   d. *A description of clean up activities, mitigation measures, site restoration and management actions that were implemented as a result of the preliminary and comprehensive EIA;*
   e. *Recommendations for additional mitigation and restoration measures, if appropriate; and*
   f. A proposed ongoing monitoring program.

These requirements will be addressed in a written update that will be provided by September 15, 2014.

REQUIREMENTS OF DIRECTOR'S LETTER

The following provides the additional requirements set out in the Director's letter to MPMC dated August 10, 2014 (in italics) followed by the location within this document (or elsewhere) where these additional requirements are addressed.

i. *Provide in writing to the Ministry of Environment more detail on how to recover mine affected material and sediment:*
   a. *while diverting water from Polley Lake (e.g. log booms and silt screens), and*
   b. *once safe access to Hazeltine Creek is possible.*

ii. *Provide in writing to the Ministry of Environment more detail on how to mitigate residual risk to the environment from mine affected material;*

The processes and methods for developing comprehensive plans to recover, manage and/or mitigate impacts associated with mine-affected materials and sediment are presented in Section 4 of this report.

iii. *Provide, in additional to the daily calls, a written report by 4pm on Friday each week to the Ministry of Environment that includes a high level summary of:*
   a. *monitoring that occurred during the week and what is planned for the upcoming week, including where sampling is occurring and what is being sampled for;*
   b. *any modifications to the sampling/monitoring program;*
   c. *any gaps identified in the monitoring program and next actions;*
   d. *visual observations from each day during sampling (e.g impacts); and*
   e. *a list of all the sampling sites with a map that is updated as it changes and provided as soon as possible;*

Weekly reporting will be completed as specified above and as described in Section 7 of this report.

iv. *Additionally, it is expected that the detailed comprehensive Environmental Impact Assessment required under Section 7 of the Order will address and consider the following:*
   a. *Water quality should be analysed for all parameters that may be impacted due to the tailings release and subsequent environmental effects (e.g. debris introduction into lakes);*
   b. *Sediment analysis should focus on fine sediment, less than 63 micron (see Baseline Guidance Document referenced below);*
   c. *Water sampling in Quesnel River downstream should be determined based on sample results upstream (if levels exceed guidelines; downstream sites need to be sampled)*

d. *Sediment toxicity sampling in the Hazeltine Creek up and downstream, e.g. when new tailings or sediments are moved into the area.*

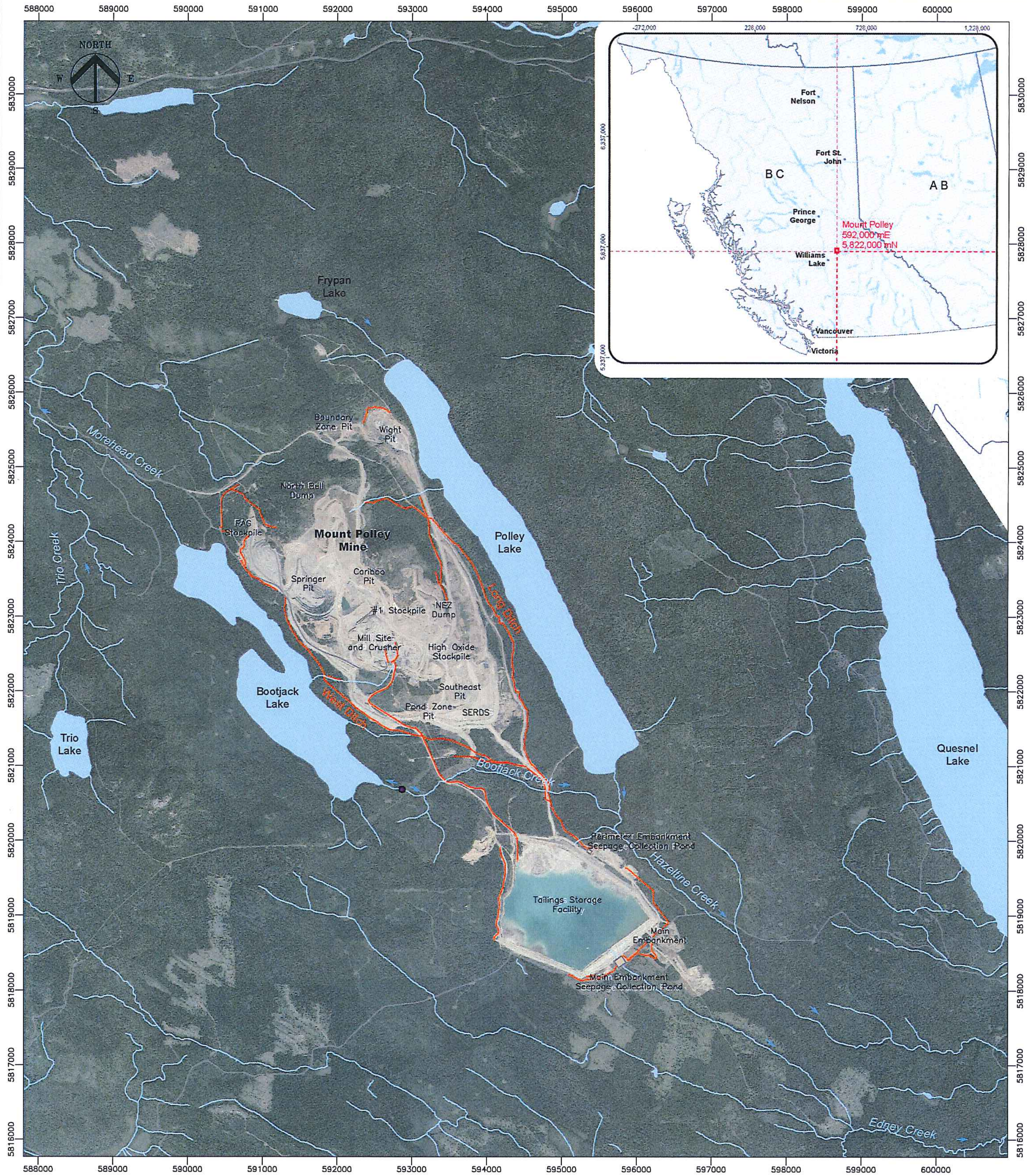
Descriptions of the impact assessment programs for each of these elements of the overall EIA are described in Section 3 of this report. Monitoring activities in the receiving environment that are currently being implemented and those planned during the mitigation programs are described in Section 5 of this report.

Referenced Guidance Document: Please be advised that field and lab methods should follow the Water and Air Baseline Monitoring Guidance for Mine Proponents and Operators.
(http://www.env.gov.bc.ca/epd/industrial/mining/pdf/water_air_baseline_monitoring.pdf)

and BC Field Sampling Manual
(http://www.env.gov.bc.ca/wsd/data_searches/field_sampling_manual/field_man_03.html)

APPENDIX B

FIGURES



LEGEND

0 0.5 1.0 1.5 2.0 2.5 KM

- Embankment Pond
- Waterbody
- Water Collection Ditch
- Creek
- Road
- Bootjack Creek Dam
- Water Flow Direction

REFERENCE DRAWINGS

FIGURE 1.1	JULY 2014	MINNOW ENVIRONMENTAL OVERVIEW PLAN
DWG. NO.	DATE	DESCRIPTION

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
0	–	–	–	–

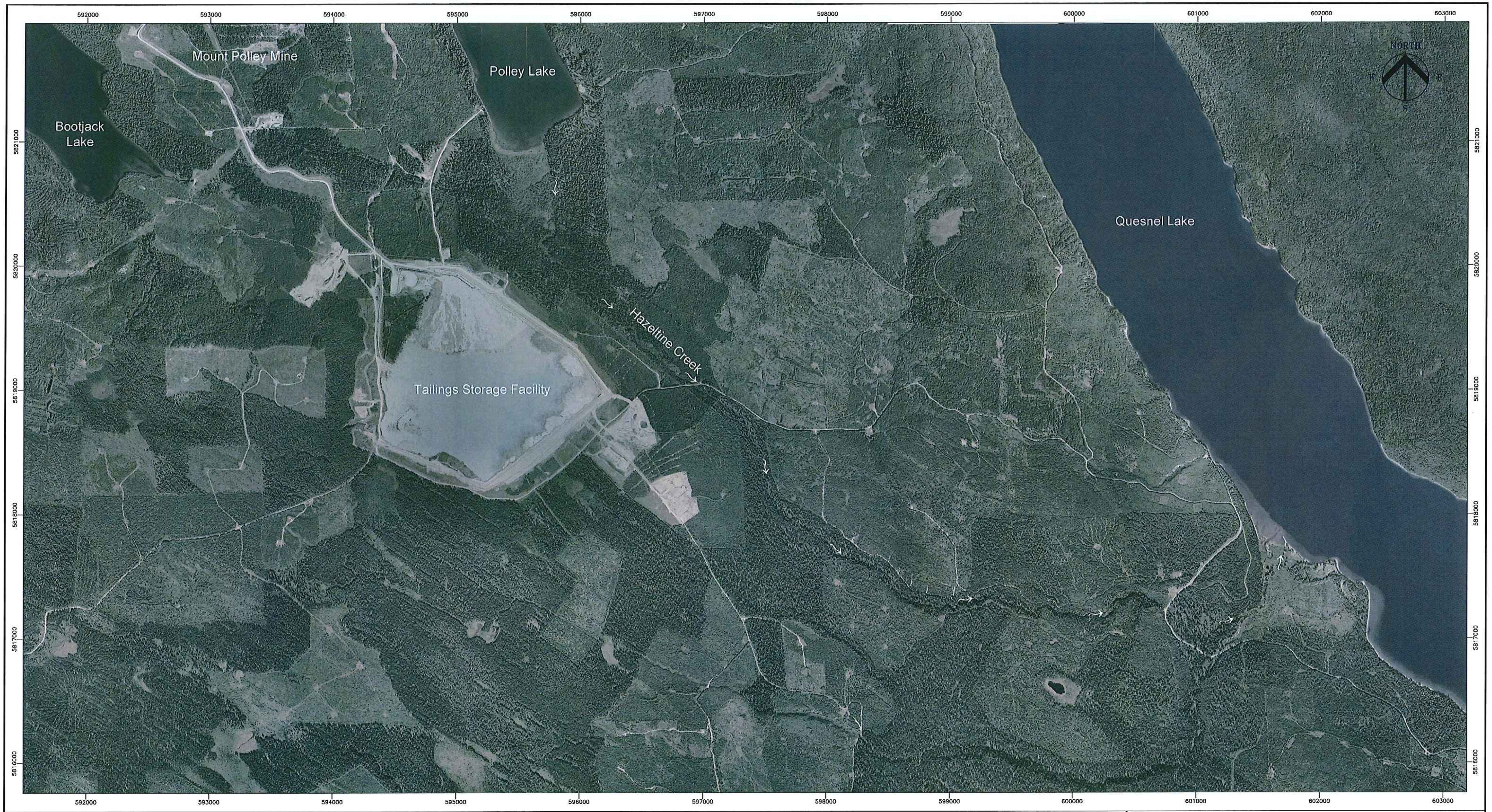
SNC · LAVALIN

CLIENT NAME: MPMC

PROJECT LOCATION: MOUNT POLLEY MINE BRITISH COLUMBIA

FIGURE 1: SITE LOCATION MAP

DWN BY: CDM	SCALE: 1:70,000	DATE: 2014 08 12	SERIES No: REV.: 0
CHK'D: GJ	PLOT: 20140815.1156	CADFILE: 621717R00	621717-001



LEGEND

0 500 1000 1500
METRES

NOTES

1. ORIGINAL DRAWING IN COLOUR.

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
–	–	–

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
0	–	–	–	–

SNC·LAVALIN

CLIENT NAME: MPMC	PROJECT LOCATION: MOUNT POLLEY MINE BRITISH COLUMBIA

FIGURE 2: SATELLITE IMAGE OF MOUNT POLLEY MINE - PRE-RELEASE

DWN BY: CDM	SCALE: 1:30,000	DATE: 2014 08 14	SERIES No: REV.: 0
CHK'D: GJ	PLOT: 20140815.1151	CADFILE: 621717R00	621717-002

LEGEND

0 500 1000 1500
METRES

NOTES

1. ORIGINAL DRAWING IN COLOUR.

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
–	–	–

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
0	–	–	–	–

SNC • LAVALIN

CLIENT NAME: MPMC

PROJECT LOCATION: MOUNT POLLEY MINE BRITISH COLUMBIA

FIGURE 3: SATELLITE IMAGE OF MOUNT POLLEY MINE - POST-RELEASE

DWN BY: CDM	SCALE: 1:30,000	DATE: 2014 08 14	SERIES No: REV.: 0
CHK'D: GJ	PLOT: 20140815.1150	CADFILE: 621717R00	621717-003

LEGEND

WATER QUALITY, FISH AND FISH HABITATS

TERRESTRIAL IMPACTS AND SEDIMENTS

NOTES

1. ORIGINAL DRAWING IN COLOUR.

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
–	2004 12 31	GOOGLE EARTH PRO SATELLITE IMAGERY

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
0	–	–	–	–

0 1 2 3 4 KM

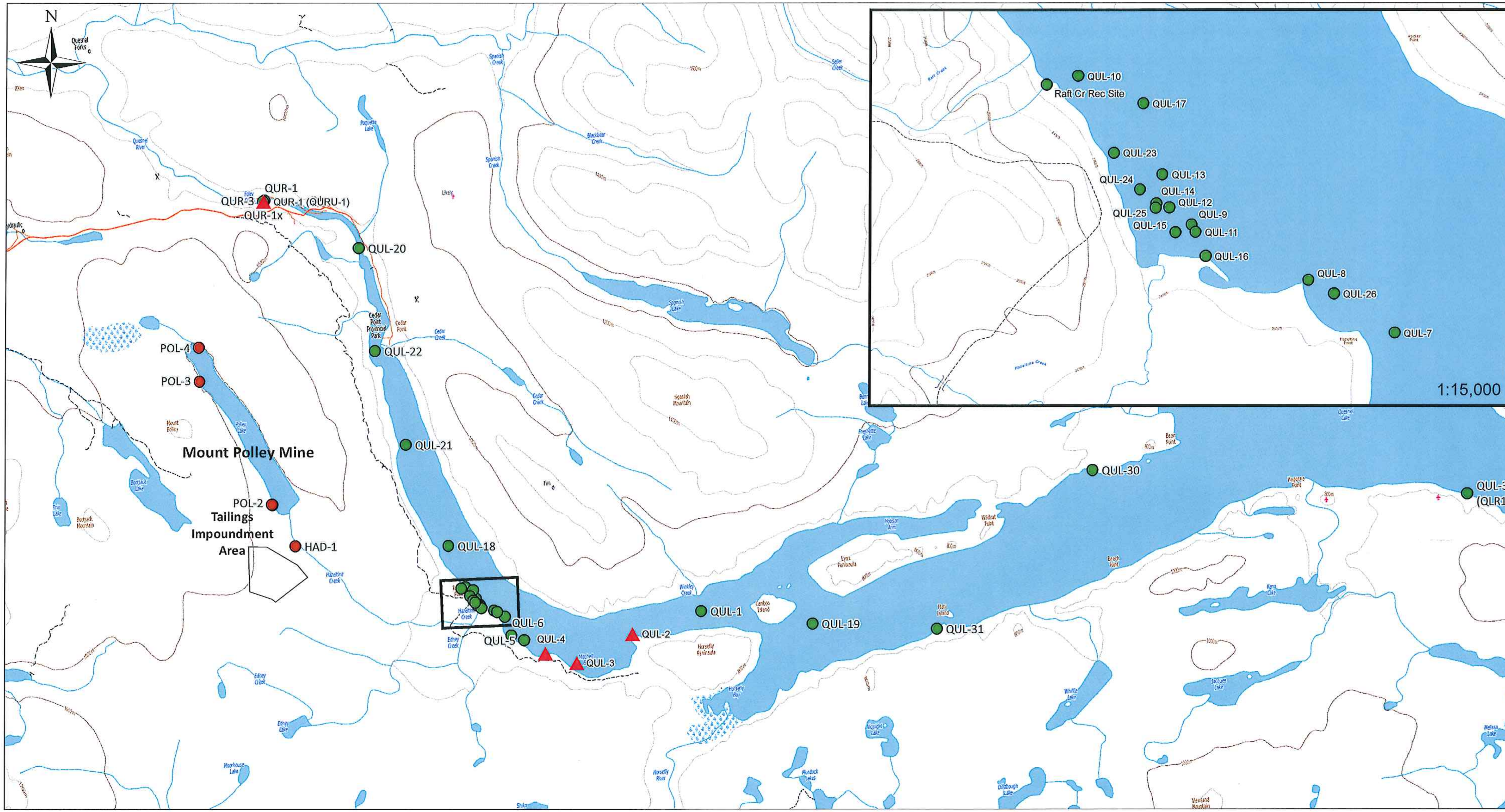
SNC · LAVALIN

CLIENT NAME: MPMC

PROJECT LOCATION: MOUNT POLLEY MINE BRITISH COLUMBIA

FIGURE 4: STUDY AREAS FOR IMPACT ASSESSMENT

DWN BY: CDM	SCALE: 1:80,000	DATE: 2014 08 12	SERIES No: REV.: 0
CHK'D: GJ	PLOT: 20140815.1150	CADFILE: 621717R00	621717-004



LEGEND

- Daily Sample Sites
- Quesnel Lake Sampling Sites
- Polley Lake Sampling Sites
- Tailings Impoundment Area

NOTES

1. Original in colour.
2. Numerical scale reflects full-size print. Print scaling will distort this scale, however scale bar will remain accurate.
3. Intended for illustration purposes, accuracy has not been verified for construction or navigation purposes.

REFERENCES

0 625 1,250 2,500 3,750 5,000 Meters

1. Toporama WMS service provided by NRCAN. http://data.gc.ca/eng/open-government-licence-canada
2. GPS Data Collected using an eTrex. Accuracy expected to be approximately +/- 3.5m.

SNC · LAVALIN

CLIENT NAME: MPMC

PROJECT LOCATION: Mount Polley Mine, British Columbia

Figure 5: Current Monitoring Locations

BY: CJW	SCALE: 1:125,000	DATE: 2014/08/15	REF No:	REV: 0
CHK'D: GJ	PROJ COORD SYS: NAD 1983 UTM Zone 10N		621717-005	

MXD Path: P:\Current Projects\Mount Polley\621717\CAD\621717-005_SampleLocPlan.mxd

Project Path: P:\Current Projects\Mount Polley\621717\

APPENDIX C

GEOCHEMICAL CHARACTERIZATION OF TAILINGS

Mount Polley Mine Tailings Spill Geochemical Characterization Plan

Prepared for

Mount Polley Mining Corporation

Prepared by

SRK Consulting (Canada) Inc.
1CI008.003
August 2014

Mount Polley Mine Tailings Spill Geochemical Characterization Plan

August 2014

Prepared for

Mount Polley Mining Corporation
580 Hornby Street, Suite 200
Calgary, AB T2P 4K7
Canada

Tel: +1 604 669 8959

Prepared by

SRK Consulting (Canada) Inc.
2200–1066 West Hastings Street
Vancouver, BC V6E 3X2
Canada

Tel: +1 604 681 4196
Web: www.srk.com

Project No: 1CI008.003

File Name: GeochemPlan_Report_1CI008-003_SJD_CBK_20140815

Table of Contents

1 Introduction

In response to spillage of tailings from the Mount Polley Mine (MPM) on August 4, 2014, the Province of British Columbia issued a Pollution Abatement Order (the PAO) on August 5, 2014. In the PAO, requirement 7a indicated the following:

- Fully characterize the materials that were released into the receiving environment (including their expected behaviour in the receiving environment, settling rates, etc.)

SRK was retained to assist with responding to the PAO with the first step involving development of a plan to geochemically characterize the tailings as part of an Action Plan required by the PAO to be submitted on August 15, 2014. This report provides the geochemical characterization plan which includes a review of existing data, a geochemical conceptual model to guide sampling design, and a sampling and analysis plan. The purpose of the plan is to acquire data that can be used to make decisions about management of the spilled tailings and assess environmental impacts from the spill. The plan has been developed to address expected data needs though specific management approaches could lead to additional data requirements which will be addressed subsequently.

2 Design of the Characterization Plan

2.1 Current Understanding

To develop this plan, SRK reviewed data provided by Mount Polley Mining Corporation (MPMC) to the BC Ministry of Environment (http://www.env.gov.bc.ca/eemp/incidents/2014/mount-polley.htm) on the geochemical characteristics of MPM tailings as they relate to metal leaching (ML) and acid rock drainage (ARD) potential. ML potential indicates the likelihood for water coming into contact with the tailings to dissolve (leach) parameters regulated for water quality. ARD potential determines the likelihood that weathering of the tailings will result in acidic waters, which in turns increases leaching of some chemical constituents of mine tailings. Understanding of ML/ARD potential is important when selecting options for managing the tailings both inside and outside the impoundment because the eventual disposal conditions will determine water quality.

SRK is not aware of appropriate data to directly characterize ML potential resulting from weathering of the tailings (for example, humidity cells) at MPM and therefore sampling and analysis will be required as discussed below.

Data on ARD potential obtained by monthly sampling of tailings between January 2012 and May 2014 indicated that average sulphur concentrations were 0.09% (range 0.047 to 0.44%) and average neutralization potentials were 26 kg $CaCO_3$/t. Standard measures of ARD potential indicate ARD potential is considered to be very low for tailings discharged to the impoundment in 2012, 2013 and 2014.

2.2 Geochemical Conceptual Model

A geochemical conceptual model (GCM) was formulated using the above current understanding to guide development of the plan. The main features of the model are:

- MPM tailings contain sulphide and carbonate minerals which when exposed to atmospheric conditions may react to yield water soluble components. The rate at which these reactions occur and significance to water quality depends on the chemical and physical characteristics of the tailings, and the conditions in the impoundment, Polley Lake, Hazeltine Creek and Quesnel Lake. Tailings underwater react less rapidly than those exposed to air.
- The composition of the tailings in the impoundment depends on the types of ores processed from different parts of MPM since the mine started in 1997. Progressive filling of the impoundment indicates that the tailings deposit will be layered with the deepest tailings reflecting earliest production at MPM.
- The composition of the spilled tailings deposited in Polley Lake, Hazeltine Creek and Quesnel Lake will reflect tailings produced at different times but due to the nature of the breach it will not likely be possible to determine where tailings from different parts of the impoundment were deposited outside the impoundment.

2.3 Program Design

The main requirement of the plan is to reliably constrain the geochemical characteristics of the tailings to provide input into management plans and water quality impact assessments.

Based on the foregoing, stratigraphic sampling of the remaining tailings inside the impoundment will provide a structured indication of tailings characteristics with sampling of the tailings deposited outside the impoundment to confirm that the spilled tailings have the same geochemical characteristics as the tailings inside the impoundment.

3 Sampling Plan

3.1 Sampling Locations

3.1.1 Stratigraphic Sampling of Tailings in the Impoundment

Four drill holes would be completed to collect tailings from the surface to the underlying foundation. Two locations will target sandier tailings deposited closest to spigotting points and two locations will characterise finer tailings. Exact locations will be selected based on logistical, safety and tailings history considerations.

Samples will be collected continuously on intervals of approximately four metres. Adjustments to the sampling intervals will be made based on field observations of mineralogy, colour, and texture.

3.1.2 Hazeltine Creek Tailings

SRK currently understands that spilled tailings occur along Hazeltine Creek from Polley Lake to Quesnel Lake. The thickness of tailings along that length is variable and is being determined by others. A sampling plan will be developed following the completion of the survey of tailings distribution.

3.1.3 Water Saturated Tailings in Polley and Quesnel Lake

Samples from the newly formed tailings deltas in Polley and Quesnel Lake would be sampled by dredging or coring. Details of the sampling plan will be developed in cooperation with other consultants. Due to the lower geochemical risk from submerged tailings, sampling intensity would be lower than for exposed tailings.

3.2 Sampling Procedures

All samples would be collected in the same general manner regardless of location including the following aspects:

- Identity of field personnel.
- Climatic conditions at the time of sampling.
- Date and time of sampling.
- Photography of site before and after sampling.
- Location coordinates using a GPS.
- If water is present, field measurements of pH, conductivity, water temperature and redox potential.
- Equipment decontamination between samples using standard protocols for soil sampling.
- Visible mineralogy (sulphide and carbonate minerals).
- Physical appearance including grain texture, colour, and relative moisture content.

Field observations will be recorded in notebooks with numbered pages.

Chain of custody protocols will be followed to ensure sample integrity.

3.3 Geochemical Testing Procedures

Geochemical testing methods will include but not necessarily on all samples:

- Particle size distribution by sieve analysis.
- Moisture content.
- Solids chemical analysis for element concentrations.
- Total inorganic carbon and neutralization potential by titration methods.
- Total sulphur (Leco) and sulphate sulphur (HCl leach).
- Water soluble contaminant characterization using shake flask extraction (SFE) tests.
- Mineralogical characterization.
- Pending initial results, laboratory kinetic testing using columns and humidity cells.

3.4 Sampling Data Quality Assurance and Quality Control

In order to ensure data quality and assess variability, SRK will collect additional samples as follows:

- Replicates. 10% of all samples will be collected as replicates to evaluate variability at sampling locations. This will be done in the field by collecting a sample immediately adjacent to a pre-existing sample. For drill samples, the replicate will be collected by sampling cuttings twice from the same interval. For surface samples, the replicates will be collected from a location approximately 1 m from the original sample.
- Field blanks. Field blanks will be preparing using pure quartz sand.
- Duplicates. 10% of all samples recovered will also have duplicates created by splitting the field sample in the laboratory.
- Standard reference materials. The commercial laboratory will use standard reference materials as additional checks to confirm data validity.
- Laboratory blanks. For procedures involving water analysis, reagent and method blanks will be run.

4 Closing

This sampling plan has been prepared using currently available information and is expected to be modified as more is learnt from site history and geochemical interpretations of existing data.

This report, Mount Polley Mine Tailings Spill Geochemical Characterization Plan, was prepared by SRK Consulting (Canada) Inc.

ORIGINAL SIGNED BY

Chris Kennedy, PGeo
Senior Consultant (Geochemistry)

and reviewed by

ORIGINAL SIGNED BY

Stephen Day, PGeo
Corporate Consultant (Geochemistry)

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

Disclaimer—SRK Consulting (Canada) Inc. has prepared this document for Bennett Jones LLP. Any use or decisions by which a third party makes of this document are the responsibility of such third parties. In no circumstance does SRK accept any consequential liability arising from commercial decisions or actions resulting from the use of this report by a third party.

The opinions expressed in this report have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.


SNC·LAVALIN
605 – 5th Avenue SW, Suite 2100
Calgary, Alberta, Canada T2P 3H5
Tel.: +1.403.294.2100
Fax: +1.403.253.1975
www.snclavalin.com