Hallam Knight Piésold Ltd.
ENVIRONMENTAL CONSULTANTS

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YOUR REFERENCE
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DavidPow047/95

April 04, 1994

Mr. David Pow
Ministry of Energy, Mines and Petroleum Resources
Resources Management Branch
1652 Quinn Street
Prince George, B.C.
V2N 1X3

COPY

Dear Mr. Pow

Re: Mount Polley Interim Reclamation Plan

Please find enclosed eight (8) copies of the Mount Polley Interim Reclamation Plan for distribution by your office to the relevant recipients of the NEMDRC. Eight copies have also been forwarded to the Manager, Reclamation and Permitting, MEMPR in Victoria.

If you have any questions or comments, please do not hesitate to contact the undersigned.

Yours truly,
HALLAM KNIGHT PIÉSOLD LTD.

DANIEL J. ROYEA, B. Sc., R.P.Bio.
Project Biologist

encl:

cc: John Errington, Manager, Reclamation and Permitting, MEMPR
Imperial Metals Corporation

(..\h1221\letters\davidpow.047)

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IMPERIAL METALS CORPORATION

THE MOUNT POLLEY MINE PROJECT

INTERIM RECLAMATION PLAN

MARCH, 1995

Prepared by:

HALLAM KNIGHT PIÉSOLD LTD.

IMPERIAL METALS CORPORATION, MOUNT POLLEY PROJECT

A RECLAMATION AND CLOSURE PLAN RESPECTING THE MT. POLLEY PROJECT

INTERIM REPORT

APPLICATION FOR A RECLAMATION PERMIT PURSUANT TO SECTION 10 OF THE BRITISH COLUMBIA MINES ACT

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Reclamation Plan Overview

The overall reclamation objective for the Mount Polley Project is to characterize the pre-mine site and develop workable plans which will ensure that the operations area can be reclaimed to a level of capability equal to, or better than, that which existed prior to disturbance on an average property basis.

Phased Approach

The Mount Polley development schedule requires preparation of the mill site area in May 1995 and portions of the tailings impoundment area and access road in July 1995. The remainder of construction will occur in 1996.

A permitting and approval process was developed for the Mount Polley Project which recognizes this time frame. A phased approach (as outlined in correspondence from the Mine Review and Permitting Branch, February 6, 1995) is being used to develop the Reclamation Plan. This will allow the company to begin certain aspects of construction prior to receiving a complete Reclamation and Work Systems Permit.

The phased approach includes presentation of this Interim Reclamation Plan prior to mill site preparation and submission of a Final Reclamation Plan prior to full construction, scheduled for 1996.

Interim Reclamation Plan

This Interim Reclamation Plan is being submitted as a prerequisite to proceed with mill site soil salvage and overburden removal in May 1995. Specific soils investigations of this 20 ha area were conducted as per the requirements outlined by the Ministry of Energy, Mines and Petroleum Resources, Reclamation Branch.

In addition to the soil survey information, other critical elements of the Interim Reclamation Permit Application include:

- o Detailed layouts of project components;
- o Estimates of disturbed areas from mine site development;

- o Terrain mapping;
- o Biogeoclimatic site mapping to the sub-zone and variant levels of detail;
- o Forest cover maps interpreted to reflect wildlife habitat values in the areas of disturbance and in the project area in general;
- o Capability assessments for the following existing land use values:

  - ungulate habitat mapping;
  - forest cover mapping;
  - forage capability mapping; and
  - agriculture capability mapping (as an indicator of vegetative productivity).

General descriptions of the environmental setting, the mining program, disturbances and reclamation prescriptions and scheduling comprise the bulk of this report.

Capability Assessments

The three principal land use types in the project area are forestry, wildlife habitat and grazing. Although detailed agricultural capability has been defined for the mill site area, at present, only general capabilities for each of these land uses have been determined for most of the land base which will be impacted by the project. Site conditions have not yet allowed the necessary on-site investigations.

Field studies will be conducted after snow melt to refine the capability assessments, which will in turn be used to determine the precise end land use objectives.

End Land Use

Two areas of further work are required prior to developing end land use prescriptions in more specific detail than that found in this report: refining the capability assessments as discussed above, and discussions with present land managers (primarily Ministry of Forests) and stakeholders of the area.

The Ministry of Forests has already established programs for managing the land base for forestry, wildlife and grazing land uses. Further discussions with the Ministry of Forests will be undertaken to incorporate the Mount Polley project into existing land use planning.

Consultation with the nearby UBC Alex Fraser Research Forest may also offer opportunities for cooperative work to implement the goals of mine reclamation.

Although prescribing specific end land uses for each disturbed area would be premature at this stage, conceptual land use prescriptions based upon relative levels of pre-disturbance land capability were provided for preliminary cost modelling exercises.

Reforestation of disturbed areas, which provides both wildlife and forestry values, was the dominant prescription, while development of grazing habitat was prescribed for the mill site. These objectives are possible for all post-mining land areas with the exception of the open pit development.

Realistically, post closure options for the open pit are limited and will result in changes to end land use. Flooding of the open pit will result in creation of additional aquatic habitat and some cliff habitat in the region. This will increase the diversity of habitat types and open new ecological niches for colonization. From a net environmental benefit perspective, this is regarded as potentially advantageous, as increased biodiversity with no loss of regionally limited habitat may result.

Once the pre-mine capability assessment is refined, detailed end land uses will be defined and included as a key component of the Final Reclamation Plan.

Baseline Monitoring Environmental Program

A comprehensive environmental monitoring program for the Mount Polley project is presently being developed with regulatory agencies.

Several components, including water quality, meteorology, hydrology and wildlife surveys were initiated in March 1995, and the remaining components, including fisheries, air quality, limnology, vegetation surveys and aquatic monitoring will be implemented in April and May, 1995. Program details and initial results will be presented in a separate document.

This program will continue through construction, operations and post-closure phases of the project to ensure protection of the environment.

Report Format

This Interim Reclamation Plan forms the foundation for all reclamation planning for the Mount Polley mine development. The document is dynamic in nature - as additional characterization work is conducted prior to disturbance, the revised information and refined end land use prescriptions will supplement the present material.

In addition, during operations, the results obtained from research test plots will further refine the end land use prescriptions.

As this document will be subject to frequent updates, it has been bound in a 3-ring binder to facilitate replacing superseded information. All printed material will include the date on each page, and a summary sheet for each update will list the dates of the most current version of each section.

Mapping in this Interim Reclamation Plan consists mainly of line drawings, but additional presentation formats (including GIS and orthophoto techniques) are being investigated for future editions

SECTION 1.0 - INTRODUCTION

1.1 OVERVIEW

The Mount Polley project is a gold/copper porphyry deposit located in the Cariboo Region of central British Columbia. The name of the project is derived from Mount Polley, a low mountain that rises about three hundred meters above the rolling and forested terrain.

The mining method that will be employed is open pit mining, ultimately involving three adjoining pits. The scheduled mining rate is 13,700 tonnes per day. At this rate, the lifespan of the mine is expected to be 14 years.

Processing of the ore will consist of crushing, grinding and froth flotation, producing a copper-gold concentrate at the rate of approximately 150 tonnes per day. The concentrate will be shipped in containers by truck for overseas smelting.

1.2 OWNERSHIP AND LAND TENURE

The Mount Polley copper/gold project is wholly owned by Imperial Metals Corporation (IMC) and lies on Crown Lands. Mineral claims consist of 342 units representing a total surface area of 8,550 ha.

A fishing cabin stands within the IMC claim block, on the shoreline of the northeast end of Bootjack Lake on the only parcel of private land (L12023) on that lake. Two additional private parcels are at the north end of Polley Lake outside the IMC claim block. One has a private hunting/fishing cabin (L11559) which is about 7 m to 8 m in elevation above the lake. The other parcel (L11560) has an abandoned caretakers cabin several metres above lake level that was historically associated with water diversion facilities.

Land tenure for other uses (forestry, grazing, trapping, and guided outfitting) are detailed in Section 2.0.

1.3 LOCATION AND ACCESS

The Mount Polley Project is located in the Fraser Plateau physiographic region in central British Columbia approximately 56 km northeast of Williams Lake and 8 km southwest of the town of Likely (Figure 1.1). Topographically the area consists of north-south trending ridges of moderate elevation and relief. The mine is positioned on a ridge straddling the Polley Lake / Hazeltine Creek and the Bootjack Lake / Morehead Creek watersheds. Both of these watersheds are contained within the Quesnel River drainage system.

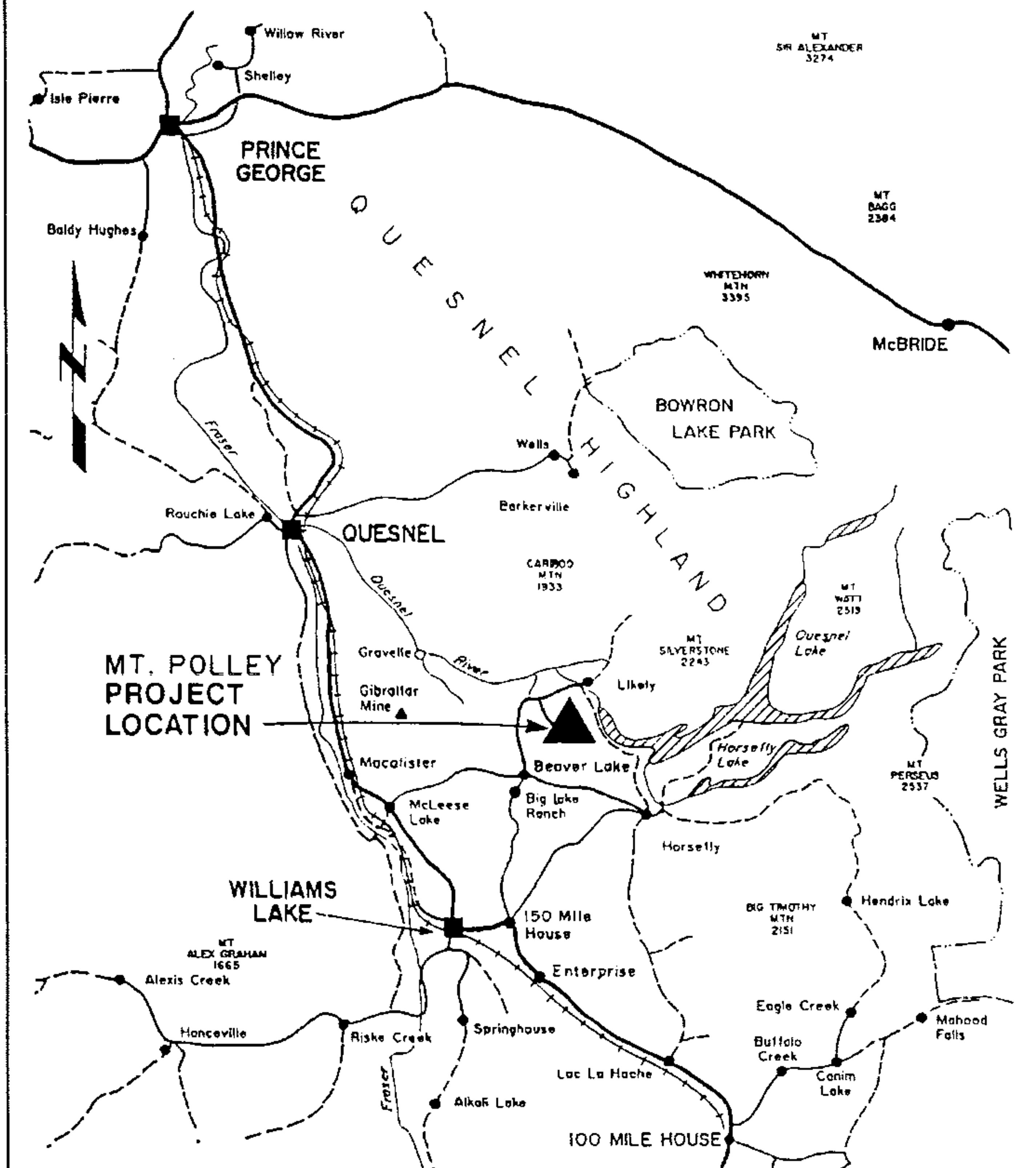
Access to the mine site from 150 Mile House is north along secondary highway No. 115 for 60 km to Morehead Lake and south from the Bootjack Lake turn-off for another 14 km on a forest service road to the property. Polley Lake and Hazeltine Creek can be accessed by the Ditch Road which leads south from the secondary highway No. 115 near Likely, following the contours along the western side slopes high above Quesnel Lake to Polley Lake and Hazeltine Creek. An alternate access route is via the Gavin Lake road further to the west.

Commercial forest harvesting has been the principal land use in the project area for many years. As a result, logging roads are well established throughout the area and provide access to all prominent landmarks in the vicinity of the project.

1.4 MINE INFRASTRUCTURE LAYOUT

The mine will be operated on a phased development schedule. Project infrastructure will eventually consist of the mill site, three open pits, waste rock and tailings storage areas, as well as the main access, road, powerline and tailings pipeline. The layout of these infrastructure components is shown in Figure 1.2.

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
LOCATION PLAN



Source: Imperial Metals Corporation

FIGURE 1.1

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2.3.2 Mount Polley Climate

During the 1989 summer exploration season Imperial Metals Corporation installed a weather station at Mount Polley in the general vicinity of where the mill and the central pit will be located. This weather station recorded precipitation, minimum and maximum temperature, and relative humidity.

There are no long term records of any of these parameters from the site or from any nearby site with similar elevation and surrounding terrain. The Atmospheric Environment Service (AES 1981) provides a compilation of data from weather stations that meet a set of minimum standards. Long term data from a series of these regional weather stations was used to extrapolate certain climatic parameters and provide estimates of what could be expected at the location of the Mount Polley weather station (Mount Polley Stage 1 Report, 1990). Regional meteorology stations are shown in Figure 2.5.

Mean monthly temperature records from the Mount Polley weather station (1142 m) ranged from 13.7°C in July to minus 10.7°C in January. Based on regional analysis, mean annual temperature is 2.6 ± 1.4°C.

The total annual precipitation at 1,142 m is estimated to be 856 mm with a standard deviation of 119 mm. On average, 511.1 mm of that is expected as rain and 344.9 mm is expected as snow. As an indication of the effect of elevation at this location the estimate for the surface of Bootjack Lake (elev. 986 m) would be about 737 mm annual precipitation.

Possible 24-hour maximum rainfall and snowfall (moisture) for the Mount Polley area was estimated from regional stations. Twenty-four hour maximum rainfall ranges from 32.3 mm at Horsefly BCFS to 79.9 mm at Barkerville and maximum 24-hour snowfall ranges from 27.4 mm at Likely to 58.5 mm at Barkerville. The maximum 24-hour precipitation event on record was 71.1 mm at Barkerville. Short duration rainfall intensity curves (Figire 2.6) display maximum precipitation estimates.

Regional precipitation data indicate that a relatively even distribution of precipitation can be expected throughout the year at the site. Slightly greater precipitation may be expected in the periods July to August and December to January, while March through May are drier months.

Snowfall at the weather station elevation of 1142 m represents approximately 40% of the annual precipitation and could reasonably be expected during all months from October to April.

Evaporation measurements are taken only during the frost-free season (AES 1981). The network of evaporation pans in B.C. is quite sparse. Regional average evaporation for the frost-free period is 423 mm. This does not include losses by sublimation or evaporation outside the frost-free period.

The meteorological database will be improved through climatic monitoring using a multiparameter automatic meteorology station, installed in March 1995.

2.3.3 Air Quality

The Mount Polley area is remote from any sources of substantial industrial air emissions, and is also remote from any significant concentration of vehicular or residential sources of atmospheric emissions. Seasonal pollen and fugitive dust are expected to be the main airborne material.

The slightly undulating terrain around Mount Polley suggests unobstructed atmospheric exchanges and the absence of prolonged inversions. Major storm tracks are from the west off of the Pacific Ocean.

There is no existing air quality baseline data for the Mount Polley area, however, a dustfall monitoring program is scheduled to be initiated prior to construction activities and will continue throughout mine life.

2.4 SURFACE AND GROUNDWATER

2.4.1 Description of the Watershed

The general trend of drainage in this part of the Fraser Plateau is north and east, ultimately discharging from the Quesnel River into the Fraser River. The origin of the Quesnel River is located near Likely at the outlet of Quesnel Lake.

The Mount Polley Project is located near the divide of two small watersheds within this system (Figure 2.7). The western watershed, which includes drainage from Bootjack Lake, Trio Lake and Morehead Lake, discharges to the Quesnel River via Morehead Creek. The eastern watershed includes Polley Lake, which discharges to the southeast via Hazeltine Creek, and the Edney Creek drainage which enter the western arm of Quesnel Lake. Bootjack Creek is a small tributary of Hazeltine Creek.

Drainage patterns of these small watersheds was modified for historic placer gold mining in this region of the Cariboo. Bootjack Creek originally discharged to Bootjack Lake, but was diverted into Hazeltine Creek below Polley Lake.

Presently, approximately 60% of the drainage in the Mount Polley area discharges into the Morehead Lake watershed, the remainder enters the Hazeltine Creek watershed. The diversion of Bootjack Creek resulted in the transfer of approximately 14 km^2 of drainage area from the Bootjack to the Polley Lake system.

Some stream flows are ephemeral and occur during and after events of prolonged precipitation and surface infiltration.

2.4.2 Surface Water Hydrology

A comprehensive program of stream monitoring in the Mount Polley Area was initiated by Imperial Metals Corporation in the spring of 1989. Regional hydrology stations are presented in Figure 2.8. There are no long term stream flow or precipitation records for locations within the project drainage system. Therefore, hydrologic assessments utilized comparison of regional data with site-specific data. An additional approach using channel geometry and known flow characteristics to estimate peak flows and return periods.

2.4.2.1 Mean Annual Runoff

Regional analysis was undertaken to provide an estimate of mean annual runoff. Table 2.2 presents the measured and calculated unit runoff estimates for regional stations and for the project site. Moffat Creek near Horsefly (08KH019), provided similar values to site specific data measured at the outlet of Morehead Lake. This station's long term mean annual runoff is approximately 6 $l/s/km^2$ which is at the upper end of the range predicted by regional analysis. Mean annual unit runoff estimates based on site data was 7.5 $l/s/km^2$ for Hazeltine Creek. Monthly variation ranged from approximately 1 $l/s/km^2$ in late summer and winter to 19 $l/s/km^2$ in May for the project area. Hazeltine Creek is projected to have a unit area runoff of 8.23 $l/s/km^2$ with a high estimate of 9.87 $l/s/km^2$ (+20%) and a low estimate of 6.58 $l/s/km^2$ (-20%).

A comprehensive hydrological monitoring program is being intiitaed in late fall 1995 to refine and monitor site flows during construction, operations, and closure.

2.4.2.2 Extreme High and Low Flows

The predicted 200-year return mean annual flow is estimated at 12.0 $l/s/km^2$. Maximum instantaneous flows were calculated using the rational method and were used for design of diversion ditches and spillways. The maximum instantaneous flow was estimated at 5.83 m^3/s for an area of 5 km^2 and a concentration time of 109 minutes.

Low flow estimates for a 10-year return 7-day minimum are 0.25 $l/s/km^2$ and 0.24 $l/s/km^2$, respectively for the two streams, Bootjack Creek at the weir and Hazeltine Creek at the weir. Annual low flow estimates for a 1 in 10-year return period are 65% of the mean annual flow.

2.4.3 Surface Water Quality

Streams

The watercourses draining into the Morehead Lake system include Morehead Creek (from Bootjack Lake) and two small tributary streams 4K and 6K Creeks (Figure 2.8). Table 2.3 presents comparative data for the three of these streams monitored for water quality in 1989. The data are presented as mean concentrations. Additional data from late 1989 and 1990 is presented in Appendix D. 4K and 6K Creeks exhibit elevated conductivity (89.6 to 359 umhos/cm), dissolved solids (70 to 190 mg/L), alkalinity (40.4 to 128 mg/L $CaCO_3$), and total and dissolved iron (0.35 to 1.42 mg/L, and 0.14 to 0.76 mg/L, respectively). 6K Creek displayed occasional higher than normal turbidity (1.2 to 20.4 NTU) and elevated concentrations of total and dissolved copper (0.002 to 0.011, and 0.002 to 0.011 mg/L, respectively). Perhaps this reflects the area of high organic soils and poor drainage in the headwaters of these two creeks.

Morehead Creek displayed seasonal variations in total phosphorus (0.008 mg/L in December to 0.041 mg/L in November), nitrate (<0.005 mg/L in August and September to 0.098 mg/L in November), and ammonia nitrogen levels (<0.005 mg/L in March and June to 0.051 mg/L in November). This may be related to cattle grazing and the beaver activity during low flow. Total and dissolved aluminum (0.025 to 0.16 mg/L, and 0.008 to 0.023 mg/L, respectively) and iron (<0.03 to 0.49 mg/L, and <0.03 to 0.31 mg/L, respectively) were the only metals to show any variability between sampling periods. The watercourses draining in a southeasterly direction towards Quesnel Lake include Bootjack Creek, Hazeltine Creek, Edney Tributary Creek and North Dump Creek (which drains the northeast slope of Mount Polley). The results of the 1989 water quality monitoring program for these streams is reported in Table 2.3.

Bootjack Creek displayed some fluctuations in conductivity (111 to 207 umhos/cm), dissolved solids (74 to 180 mg/L), sulphates (3.0 to 8.5 mg/L), nitrate nitrogen (<0.005 to 0.058 mg/L), total Kjeldahl nitrogen (0.14 to 0.36 mg/L), and total aluminium levels (0.057 to 0.75 mg/L). All other parameters were relatively stable or near the analytical detection limit for each sampling period. Hazeltine Creek displayed seasonal variability in conductivity (120 to 184 umhos/cm), dissolved solids (74 to 180 mg/L), alkalinity (63 to 104 mg/L $CaCO_3$), orthophosphate (0.005 to 0.022 mg/L), total phosphorus (0.008 to 0.039 mg/L), nitrate (<0.005 to 0.054 mg/L), nitrite (0.001 to 0.008 mg/L), and ammonia nitrogen (<0.005 to 0.019 mg/L), total and dissolved arsenic (<0.0001 to 0.0009 mg/L, and <0.0001 to 0.0008 mg/L, respectively), copper (0.001 to 0.019 mg/L, and 0.001 to 0.004 mg/L, respectively), and iron (0.04 to 0.40 mg/L, and <0.03 to 0.35 mg/L, respectively). In general, the concentrations of these parameters are low compared with the federal CCME guidelines for the protection of aquatic life.

Throughout the late 1989 and 1990 sampling period, the provincial and federal water quality guidelines for the protection of aquatic life were exceeded for a number of parameters (Appendix

D). 4K Creek exceeded guidelines for total aluminum (1 out of 7 samples), total chromium (1 of 7 samples), total iron (all samples), total manganese (3 of 7 samples), and total mercury (1 of 7 samples). 6K Creek exceeded guidelines for total aluminum (1 of 7), total copper (1 of 7), total iron (2 of 7), and total manganese (2 of 7). North Dump Creek was greater than guidelines for total and dissolved aluminum (5 of 7, and 2 of 7, respectively), total copper (4 of 7), total iron (2 of 7), and total mercury (2 of 7). Edney Creek also contained some high metals and exceeded guidelines for total and dissolved aluminum (6 of 7, and 5 of 7, respectively), total chromium (2 of 7), total copper (1 of 7), total iron (6 of 7), total mercury (1 of 7), total nickel (2 of 7), and total silver (1 of 7). Occasional exceedences were also seen for these metals at the remaining stations on Morehead Creek, Bootjack Creek, the bog, and Hazeltine Creek. Trio Lake and Trio Creek did not exceed guidelines during the 1990 surveys.

The Edney Creek tributary drains the small bog that is encompassed in the proposed tailings storage site. This very small stream exhibited wide seasonal fluctuations in conductivity (60 to 348 umhos/cm), turbidity (< 1.0 to 8.2 NTU), dissolved solids (50 to 320 mg/L), alkalinity (23.4 to 204 mg/L $CaCO_3$), total and dissolved aluminium (0.064 to 0.73 mg/L total), arsenic (0.0004 to 0.0012 mg/L total), copper (<0.001 to 0.006 mg/L total), and iron (0.16 to 0.82 mg/L total). Total and dissolved mercury and total zinc also showed some variability above their detection limits during the fall- winter low flow periods. North Dump Creek is an intermittent stream that drains the northeastern slope of Mount Polley from an area proposed for a waste rock dump. The flow was sampled on three occasions in 1989 and featured occasional elevated conductivity, turbidity, dissolved solids, alkalinity, sulphate, phosphate, total phosphorous, nitrate nitrogen, total and dissolved aluminium, arsenic, copper, iron and mercury. The results of the water quality investigations of the tributary streams in the Mount Polley study area in 1989 have documented both seasonal variability and consistency among the parameters measured. In general, the majority of the nutrients, as well as the concentrations of total and dissolved metals were present at extremely low levels.

The tributary streams displayed somewhat higher variability than was noted for the lakes. The lakes tended to damp out fluctuations. This phenomenon is probably explained by the seasonal fluctuations of the flow regime responding to storm events which, through erosion, create elevated turbidity, dissolved solids, and nutrient load.

Lakes

The surface waters of the lakes in the Mount Polley Study area (Morehead, Bootjack, Polley and Kay) were sampled on several occasions in 1989 to document seasonal trends in water quality parameters. A summary of the mean and range of the 1989 values measured in the surface waters from the four basins is presented in Table 2.4. All four of the lakes are significantly alkaline with substantial reserves of calcium carbonate, total dissolved solids and conductivity and with low turbidity and suspended solids. The lakes draining northwest (Bootjack and Morehead Lakes) differ somewhat with the lakes draining southeast (Kay and Polley Lakes). The southeast flowing lakes are slightly higher in pH, much higher in conductivity, dissolved solids, alkalinity, nitrate (Polley Lake), and lower in ammonia, suspended solids and total and dissolved iron. All other parameters were present at low levels near the detection limits for the analyses. As with most of lakes in this region, the lakes are low in mineral and organic content. Notable anomalies found in the lakes were the high ammonia nitrogen concentrations in July (0.41 mg/L) and August (0.22 mg/L) in Morehead Lake and high nitrate (0.16 mg/L) in Polley lake in July. In general, baseline lake water quality is below the provincial and federal water quality guidelines for the protection of aquatic life.

Additional water sampling of Bootjack, Kay and Polley Lakes at various depths was done as part of the limnological studies. The limnological studies and the extensive water quality monitoring program during 1989 provides solid baseline data for comparison with future investigations and monitoring results.

Water chemistry results indicate that both Polley and Kay Lakes have higher alkalinity, conductivity, dissolved solids and pH than Bootjack Lake. Total iron tends to accumulate in the hypolimnion of all three lakes but only Kay Lake exhibits elevated dissolved iron concentrations. Nutrients (P and N) are accumulated in the hypolimnion of Polley and Kay Lakes but not Bootjack. Ortho-phosphate concentrations are elevated in the deep waters of Polley and Kay to Polley Lake. Kay Lake on the other hand shows hypolimnetic accumulation of all four forms of nitrogen measured.

Phosphorus loadings were modelled in the Stage 1 assessment using a number of methods. All results concluded that there would be minimal if not negligible effects from phosphorous loadings in surface and ground waters. From further modelling it was determined that water quality effects from phosphorus loadings will be relatively insignificant. Bootjack Lake is projected to increase by 4 μg/L in total phosphorus, 2 μg/L in dissolved phosphate, and 1 μg/L in ortho-phosphate during peak May discharges. Morehead and Polley lakes phosphorus concentrations are expected to rise by 3 μg/L, 2 μg/L, and 1μg/L for the same May high flow period. These concentrations are expected from mine water, and waste rock runoff (Hallam Knight Piésold Ltd. 1991). Downstream of these lakes, the concentrations will decrease more with the added dilution.

2.4.4 Groundwater Flow Regimes

Mount Polley intrusive and volcanic rocks that underlie most of the project area have generally low hydraulic conductivities. The dominant directions of groundwater flow in the pit is expected to be southwestern, towards Bootjack Lake. Surficial sediments in the project area are dominantly dense tills of low permeability. A thin soil veneer which overlies the dense till will conduct groundwater; however, the limited thickness of the soil profile should limit the flow quantities to very small amounts.

The pit area measured permeability of bedrock formations are less than 1 x 10^{-5} cm/s, but occasional zones of high permeability (10^{-4} cm/s to 10^{-3} cm/s) were encountered. These high permeability zones are often associated with zones of intensely fractured bedrock, but were also observed in zones of relatively intact core. The geometric mean of all the permeability tests is 8.4 x 10^{-6} cm/s. The groundwater table in the pit area was measured at depths of about 30 m in higher elevation boreholes and at about 3 to 10 m at lower elevations.

Figures 2.9 to 2.12 show the groundwater flow regimes through three different stages of the project.

The predominant rock types encountered consisted of intrusion breccia, syenodiorite and monzonite porphyry with occasional dyke rocks. Several fracture zones were identified and occasional clayey or sandy zones of fault gouge were also encountered. In general, the fault gouge is expected to provide lower permeability zones which restricts groundwater movement perpendicular to the predominant rock structure. In general, the rock quality in the proposed open pit area is variable. Highly fractured zones up to 100 m in thickness were encountered in several drill holes. Also, zones of very weak and highly altered rock were recognized at various intervals in most drill holes. The uniaxial compressive strength of intact rock varied from very high (>200 MPa) to very low, (<5 MPa). Zones of increased fracturing and more intense alteration are recognized to be generally associated with faulting and also with the contacts between the intrusive geologic units. The regional geology and local fault zones are shown on Figure 3.2. The discontinuities in the rock mass generally reflect the regional trend as the dominant joint set strikes about 167° and dips about 74° to the north-east. A weaker joint set is approximately orthogonal to the main set and strikes about 030° and dips at about 18° to the north-west. The discontinuities were generally rough and often healed with calcite and chlorite. Therefore, the primary joint set is expected to provide the predominant influence for groundwater inflows to the open pit.

The baseline groundwater recharge rate along the west side of Polley Lake is approximately 117 m^3/hr (430 Igpm). Open pit dewatering will intercept a small portion of this groundwater flow since most of the development is located to the east of the groundwater divide. The resulting groundwater inflows to Polley Lake will be reduced to approximately 100 m^3/hr (370 Igpm). The estimated mean annual runoff into Polley Lake, of which groundwater forms a part, is 4.6 x 10^{-6} m^3, or 525 m^3/hr A change of 17 m^3/hr will not therefore be of major significance. A similar adjustment to groundwater inflows into Bootjack Lake will also occur. This could be as much as 27 m^3/hr (100 Igpm) in the ultimate stages of the West pit development, but because of the restrictions on groundwater movement normal to the regional structure and transient effects, is likely to much less than this.

After closure, the phreatic surface will rise in the depleted pits until steady state conditions are once again established. By extrapolation of average precipitation conditions and groundwater recharge rates, it is estimated that the pits will infill with water to the steady state condition in approximately

50 years. The groundwater inflows to Bootjack and Polley Lakes will then be re-established to approximate the baseline conditions.

Although the planned West pit base ultimately reaches an elevation of 950 m, which is approximately 36 m below the Bootjack Lake surface. With over a half a kilometer of horizontal separation, and a regional bedrock structure favourably aligned to minimize the probability of a significant high permeability conduit between Bootjack Lake and the bottom of the West pit, groundwater inflow from Bootjack Lake is considered to be remote. Pit blasting patterns will include controlled blasting techniques which minimize fracturing and rock breakage and will not result in the degradation of the bedrock between Bootjack Lake and the open pit.

2.4.5 Groundwater Quality

Groundwater was collected from three holes in the pit area on August 10, 1989 and November 25, 1989 and additional groundwater was collected during 1990. Results are included in Appendix D. It is recognized that open pit dewatering will intercept this groundwater and will utilize it to the maximum practical extent as mill process make-up water.

Groundwater quality from drill holes in the open pit area has been compared to B.C. Approved and Working Water Quality Criteria. This is an inappropriate comparison of an effluent to water quality criteria applicable to the receiving environment. When untreated groundwater quality from drill holes in the open pit is compared to the Pollution Control Objectives for the Mining, Smelting and Related Industries of British Columbia (1979), the levels of metals, with the exceptions listed below, are all of better quality than A-Level Objectives. The exceptions are aluminum in 1 out of 8 samples, copper in 3 out of 8 samples, and manganese in 3 out of 8 samples. However, aluminum and copper on all occasions are of better quality than the maximum allowable discharge limit. These comparisons are based on untreated groundwater. However, all mine water is to be treated in mine water settling ponds and after settling groundwater is expected to be of higher quality than reported in the Stage I Report. Groundwater infiltration into the pit will be preferentially used as make-up water to the mill.

In general, tailings seepage from the facility will partially replace existing groundwater recharge over the area, and construction of the facility will reduce the catchment area and corresponding surface water flows in the Edney Tributary, downstream of the facility. A worst case impact assessment was carried out in the Stage 1 assessment. The resulting annual and monthly flows for January and May were used together with supernatant and baseline water quality data to estimate the resulting concentrations in Edney Tributary for aluminum, arsenic, copper and iron. Unfortunately no baseline water quality data exists for Edney Creek at the confluence. However, the project concentrations of the above metals in Edney Creek can be inferred from the reported dilution ratios of 10:1 and 17:1 for January and May, respectively.

No baseline analyses were carried out for molybdenum, and analyses for molybdenum in the supernatant water are not considered representative, molybdenum loadings cannot be assessed at this time. A comparison of the inferred concentrations in Edney Creek at the confluence with Edney Tributary with the water quality criteria published by the B.C. Ministry of Environment (Pommen, Approved and Working Criteria, 1989) indicates that the concentrations of the metals considered will be within fresh water quality objectives. It should be pointed out that the analyses are extremely conservative, assumes upper bond seepage quantities, no dilution or adsorption in the tailings facility or groundwater, and a continuous discharge of groundwater in January, when impacts are significantly more severe than in May.

2.4.5.1 Supernatant Disposal on Mine Closure

There will be no discharge of supernatant from the tailings storage area during mine operations. On mine closure the surface of the tailings area will be partially drained with most supernatant to be transferred to the open pit. Tailings supernatant quality when compared to the B.C. Pollution Control Objectives for the Mining, Smelting and Related Industries (1979) is generally of high quality. Most parameters examined are superior to the Level A Objectives. Aluminum, arsenic, copper, iron and molybdenum marginally exceed Level A Objectives. The current planning is to transfer the supernatant to the open pit on mine closure; however, in order to provide the necessary receiving water quality protection, this water could be released on mine closure under the following scenarios:

a) In a controlled manner relative to available dilution in the receiving environment;
b) In a controlled manner after suitable dilution from rain fall and snowmelt;
c) In a controlled manner after treatment with lime to reduce dissolved metals.

The approach taken will depend on the volume and quality of supernatant and applicable criteria at the time of mine closure.

2.4.5.2 Long-term Discharge from Underdrains

During operations the water quality of the underdrainage flows will initially be similar to the tailings supernatant, and will be collected in the collection ponds and continuously recycled to the tailings facility. As operations continue, the quantity of flow will decrease and the water quality will tend towards rainwater as the percent of precipitation infiltration in the underdrain flow increases. The quality of flow in the long-term will decrease to the order of 20 m^3/hr after mine closure based on 20% infiltration of precipitation over an area of 50 ha. The long-term water quality will tend towards pure rainfall and will potentially include the rainwater leachable metals indicated by the Carbonic Acid waste extraction test results. This shows elevated concentrations in the extract for arsenic (0.097 mg/L), copper (.006 mg/L) and zinc (0.008 mg/L). These concentrations do not pose any hazard to livestock, and when considered in conjunction with downstream flows will not result in any significant change in downstream surface water quality.

2.5 FISHERIES AND AQUATIC RESOURCES

2.5.1 Limnology

Four lakes have figured prominently in the considerations relating to the Mount Polley Project development. These are Bootjack Lake, Polley Lake, Morehead Lake, and Kay Lake (also known locally as Fry Pan). Morehead Lake is a man-made and relatively shallow reservoir. The other three are all natural lakes that have had varying degrees of public access and manipulation for the purpose of water storage and/or diversion.

Bootjack Lake is essentially a long and narrow basin with two depressions whose depths exceed 15 m and are separated by a somewhat shallower sill and narrow constriction. Polley Lake is a long narrow lake that is almost twice as deep and has almost twice the surface area and four times the volume of Bootjack Lake. Polley Lake does not have multiple depressions. Shoal areas occur at both ends of the lake but are severely restricted along the steep sides of the basin. One permanent stream enters Polley Lake from the north draining Kay Lake. This small stream between these two lakes flows through swamp and meadow and is heavily braided with numerous beaver dams and minimal recognizable surface flow. The steep slopes on either side of Polley Lake are drained by intermittent drainage channels, but no permanent streams. Polley Lake is some 64 m lower in elevation than Bootjack Lake and has a maximum depth 35 m.

The outlet of Polley Lake forms Hazeltine Creek which flows a distance of 7,900 m to its confluence with Edney Creek drainage, 500 m upstream of the discharge to Quesnel Lake. Bootjack Creek is a 2,800 m long tributary of Hazeltine Creek that flows in an easterly direction to its confluence 450 m down stream of the Polley Lake outlet.

Kay Lake is much smaller and has a single depression with surprising depths for such a small surface area. Its shoreline resembles a bog with floating vegetative mats. There is no distinguishable inlet stream and the outlet is impounded by beaver dams. Morehead Lake was created by damming Morehead Creek and flooding the stream and surrounding meadows. It is a shallow lake with depths usually less than 6 m (Ron Williams, personal communication). Small tributary streams flowing into Morehead Lake include Morehead Creek which contains the discharge from Bootjack Lake, Trio Lake, 4K Creek and other intermittent drainages off of the hill sides. A concrete culvert and long spillway mark the downstream discharge from Morehead Lake. The ditch on the east side of the lake which had been used to carry lake discharge to the placer mines has subsequently been abandoned and blocked.

In Bootjack Lake both basins thermally stratify with the epilimnion extending down to a depth of six meters. The two basins exhibit similar patterns of stratification with only minor indications of differences in the hypolimnion in the vicinity of 10 m in depth. Both the June and October surveys indicate that the lake was probably mixing throughout at those times. In mid-summer the hypolimnion of both basins exhibits some reduction in dissolved oxygen. These patterns reflect productive lake conditions, and probable light attenuation in maximum depths. Based on these observations Bootjack Lake would be more nearly characterized as a mesotrophic lake that does not encounter anoxic conditions.

In Polley Lake thermal stratification is apparent with the epilimnion extending down to a depth of approximately 7 m. The hypolimnion extends from around 14 m to the bottom. In late fall thermal stratification was still evident but was being eroded by decreasing temperatures in the epilimnion. The narrow, deep and north-south orientation of Polley Lake and the steep slopes surrounding it probably shield it from wind action more than Bootjack Lake is shielded and results in a somewhat different stratification pattern. The absence of oxygen depression in mid-summer in the water of the hypolimnion followed by only modest depressions in late fall suggests that Polley Lake is somewhat less productive than is Bootjack Lake and is closer to what is probably an early mesotrophic characterization.

In Kay Lake strong stratification is apparent with the epilimnion extending to approximately 4 m depth in mid-summer. By late fall erosion of stratification occurred with the epilimnion extending to a depth of about 8 m. The small size of the lake and the protection afforded by the surrounding hills and forest protect the lake surface from the strong winds that erode stratification more rapidly in larger lakes. The hypolimnion extends from a depth of approximately 8 or 9 m to the bottom. The pattern of dissolved oxygen distribution demonstrates marked hypolimnetic depression of oxygen in the summer. It does not, however, result in anoxic conditions. Given these patterns one would expect relatively high productivity in the lake with accompanying relatively high oxygen demand in hypolimnetic waters. This would probably still allow characterization of Kay Lake as being mesotrophic and perhaps more toward dystrophic than either Bootjack and Polley Lakes on this productivity scale. The heavily organic deposits on the lake margins and the peaty soils surrounding it support that characterization.

2.5.2 Fisheries Resources

2.5.2.1 Regional

Fisheries resources in the Quesnel River and Quesnel Lake system consists of diverse populations of sport fish including anadromous chinook and coho salmon and resident kokanee, rainbow and lake trout, Dolly Varden char, whitefish and several forage species. In addition, large populations of Horsefly sockeye salmon annually migrate from the Fraser River to spawn in tributary streams which drain into Quesnel Lake. Salmonoid enhancement facilities have been constructed by the

Department of Fisheries and Oceans on the Horsefly River for sockeye and on the Quesnel River for chinook to improve survival of upper Fraser River stocks. The lakes in the vicinity of Mount Polley provide good recreational angling for rainbow trout which are produced naturally and maintained without stocking although the watercourses have been previously modified for early placer mining operations. In 1989 initial baseline fisheries studies of the lakes and streams were conducted.

2.5.2.2 Local Fisheries

No streams flow into Bootjack Lake that would support spawning, thus the rainbow trout are restricted to spawning downstream in Morehead Creek, which they must share with fish from both Trio and Morehead Lakes. The storage dam and spillway located at the outlet of Morehead Lake prohibit the return of any fish or their offspring that migrate down the spillway. In addition, an active beaver dam also restricts movement of trout both to and from Bootjack Lake. Given this, it would appear that fish production in these three lakes may be limited by spawning area available. Large numbers of juvenile trout were captured with baited Gee traps in the streams in June, August and October. This suggests the streams may be the principal nurseries where trout rearing occurs. Recruitment into the lake population depends on the rearing and successful returns to the lake of the offspring. Because of their apparent success in coexisting with rough fish, Bootjack Lake rainbow trout populations are being investigated as a potential source of brood stock for the provincial fish culture program (Demers, M., personal communication). Fisheries biophysical inventory is presented on Figure 2.13 to show the habitat characteristics and species distributions.

Rearing salmonoid populations ranged from $0.071/m^2$ (Upper Hazeltine Creek) to $1.50/m^2$ in Bootjack Creek, the highest density of rearing juvenile rainbow trout in the entire study area. The results illustrate the importance of Bootjack Creek and Hazeltine Creek for rearing of Polley Lake rainbow trout populations. Reconnaissance along all the streams revealed numerous locations where trout were actively spawning at that time. The greatest frequency of spawning was in the upper reaches of Morehead Creek and Hazeltine Creek but spawning was common in all creeks.

The Edney/Hazeltine Creek system is physically divided by topography which creates water velocity barriers in a steep gradient canyon located 1,650 m upstream of the Edney Creek confluence. This canyon barrier isolates the rainbow trout populations in the headwater lakes and streams and prevents encroachment by the mixed resident and anadromous salmonoid and forage fish populations found in the lower reaches. In lower Hazeltine and Edney Creeks mixed populations of rainbow trout, mountain whitefish, burbot, suckers, rearing juvenile chinooks, and adult sockeye salmon were documented in 1989. The lower reaches of Hazeltine and Edney Creeks are low gradient streams consisting of deep pools and riffles, large log jams and areas with excellent spawning gravels for salmon. On the Morehead Creek system the barrier is even more dramatic. A waterfalls exists about 1,500 m upstream of the confluence with the Quesnel River and the spillway at the outlet of Morehead Lake further divides the system to migrating fish. Watercourses located at higher elevations such as Bootjack Creek, upper Hazeltine Creek, upper Edney Creek, upper Morehead Creek, 4K Creek and 6K Creek are also relatively low gradient streams associated with the lake systems and are used mainly by rainbow trout populations for spawning and rearing.

The lower reaches of Morehead Creek, near the Quesnel River, were investigated on October 20, 1989 with baited Gee traps. The creek contained good populations of rearing chinook salmon. The lower reaches of Hazeltine Creek and Edney Creek sampled in May, August and October 1989 always contained rearing populations of rainbow trout. Juvenile chinook salmon (greater than 1 year old) were found there in August and October, suggesting they entered the stream from Quesnel Lake. Lower Edney Creek provided good spawning habitat for sockeye salmon when it was inventoried in October 1989, coinciding with record runs returning to the Horsefly River System. Heavy spawning activity by sockeye was evident in this reach at that time.

Headwater lakes in the vicinity of Mount Polley were historically used for water storage in connection with early placer mining. The redirection of flow from Bootjack Lake by the construction of an earth-filled dam in about 1913 at the southern end of the lake prevented further use of important spawning and nursery areas in Bootjack and Hazeltine Creeks by the trout populations from Bootjack Lake. The outlet of Bootjack Lake presently consists of a large excavated channel which redirects flow to Morehead Lake. A beaver dam at the outlet of Bootjack Lake restricts movement of rainbow trout both to and from the stream habitat particularly during the summer low flow period. Nevertheless, during the fish inventory of May 31 - June 2, 1989 rainbow trout populations were observed in large numbers spawning in the vicinity of the Morehead Creek bridge crossing when the water temperature was 14.5° C. It is not certain which lake they came from. The spawning habitat between Morehead, Bootjack and Trio Lakes is probably used by spawners from all three systems.

2.5.2.3 Fish Tissue Analyses

In October 1989 nine sexually mature rainbow trout were captured using a 2.0 inch monofilament gill net in Bootjack Lake. Metal analysis was conducted of muscle and liver tissues from these fish to establish baseline conditions prior to mining operations. Metal concentrations varied among fish. Metals that were above the detection limits are as follows:

	Tissue	Liver
Copper	0.83 - 1.86 mg/kg	205 mg/kg
Iron	14.7 - 33.5 mg/kg	1042 mg/kg
Manganese	0.49 - 1.31 mg/kg	4.66 mg/kg
Lead	0.05 - 0.30 mg/kg	0.10 mg/kg
Zinc	19.9 - 27.1 mg/kg	162 mg/kg

2.5.3 Sediments

Sediments were collected from Bootjack Lake and Polley Lake. Sediment samples were analyzed in the laboratory for metal concentrations, distribution of particle size and relative concentration of combustible (organic) fractions. Samples collected from deep water in all three lakes show relatively high concentrations of organics and low concentrations of large particle sizes. The sediment material in these circumstances is what would be expected in lakes exhibiting relatively high pelagic productivity. The continual settling of dead and dying plankton organisms to the deeper water creates these sediments characterized by high concentration of fine particles and high organics. These sediments would overlay any sand and gravel deposit that might have been left in the basin at the time of lake formation during the last glaciation.

At the shallower stations these analyses illustrate a transition from the deep water sediments to the shallower shoals where sand and silt composition are predominant. Wave disturbance of the shoals probably reduces the accumulation of organic sediments unlike in deeper parts of the lake.

Bootjack Lake sediments have generally higher concentrations of copper than Polley Lake. Deep water sediments show greater accumulations of chromium, copper, mercury, molybdenum and nickel (in addition, Polley Lake sediments are elevated in arsenic, lead and manganese).

2.5.4 Benthic Invertebrates

As an early step in the development of an ongoing environmental monitoring program for the Mount Polley mining operation benthic invertebrate samples were collected to document baseline conditions in the lakes. Results using diversity indices are summarized below:

	BOOTJACK LAKE				POLLEY LAKE	
DATE (1989)	Aug 18				Aug 19	
Sampling Stations	LN	B2	B3	LS	B	L
Depth (M)	12	7	3	11	8	20
Group 3 Organisms	4	-	-	-	-	-
Group 2 Organisms	316	7	81	12	90	7
Group 1 Organisms	9	2	2	7	-	-
Total No. of Organisms (N)	329	9	83	19	90	7
Total No. of Taxa (S)	17	5	9	8	13	6
Diversity (d)	2.61	1.88	0.97	2.71	2.55	2.52
Total No. of Organisms/m^2	6663	172	158	364	1723	134

The invertebrate populations of Bootjack Lake on August 18, 1989 consisted predominantly of Group 2 pollution facultative organisms composed of Chironomidae species which are commonly associated with lake bottom substrates. Pollution tolerant Group 1 organisms were found at all sampling locations in low numbers represented by Tubificidae. Pollution sensitive Group 3 organisms were found in low numbers only at the north basin at 11.0 m depth. This location contained the highest total number of organisms/m^2 (6,663), the highest number of taxa per sample (17) and high diversity (2.61).

Benthic populations near shore (Station B2) were low in numbers (9) and diversity of species present (1.88). In the south basin populations consisted of similar species dominated by Group 2 organisms (Chironomidae larvae) at both the shallow and deep sites. Total number of organism/m^2 was higher on the shallow depth (1583) compared to (364) and the diversity was lower (0.97 compared to 2.71).

In Polley Lake on 19 August 1989 the shallower sampling site contained a diverse population of benthic organisms/m^2 (1723) dominated by Group 2 Gammaridae, Pelecypoda and several Chironomidae species. The deeper site contained lower numbers of organisms/m^2 (134) represented by only a few taxonomic groups (6). Species diversity was similar for both sites.

2.5.5 Zooplankton

Zooplankton samples were collected from the water column in the lakes to establish baseline conditions for the monitoring program. The following data summary describes the results of the 1989 sampling program:

	BOOTJACK LAKE			POLLEY LAKE		KAY LAKE
Date (1989)	Aug 18	Aug 18	Oct 16	Aug 19	Oct 16	Oct 17
Sampling Location	LN	LS	LS	L	L	L
Tow Distance (m)	7	7	10	7	15	12
Total No. of Organisms (N)	157	85	137	344	2851	142
Total No. of Taxa (S)	9	12	13	9	15	9
Diversity (d)	2.03	2.84	2.72	2.30	1.29	2.65
Total No. Per m^3	345.4	1,700.6	1,412.9	625.7	2,162.7	1,785.6

The zooplankton community in the August 18 - 19, 1989 survey for Bootjack and Polley Lakes displayed wide variability in the species present, relative abundance of organisms density and species dominance between lakes and also between basins in Bootjack Lake. The south basin of Bootjack Lake contained the highest number of species present (12) and highest diversity (2.84) but no species was clearly dominant and the cladoceran, *Daphnia rosea* was the most abundant zooplankton species present. In the north basin only 9 species were represented and diversity was lower (2.03). A notifier, *Keratella quadrata* and *Cladoceran ocelli* were dominant species. In Polley Lake only 9 species were present with a cladoceran, *Daphnia galeata mendota*, and copepods, *Cryptocyclops bicolour*, and *Ospranticum labronectum* being dominant.

The communities in the October survey again displayed considerable variety in species presence, relative abundance of organisms, density and species dominance as well as changes since August. The south basin of Bootjack Lake contained 13 zooplankton species with the notifers, *Asplanchna sp.* and *Kellicottia longispina* now being dominant. Species diversity was also the highest observed (2.72). Polley Lake now contained the highest number of species present (15) dominated by a copepod, *Cryptocyclops bicolour*. The very high density of unidentifiable cladeceran nauplii distorted the diversity index (1.29) and the total density estimates. The other two dominant species found in the August survey were present but at low levels. Kay Lake contained 9 species in the October survey with two copepods, *Ectocyclops phaleratus* and *Paracyclops fimbriata poppei* the most abundant zooplankton present. Once again high nauplii density created distortions in some indicators.

These differences may be reflections of differences in the basins (nutrient availability, phytoplankton productivity, physical-chemical environment, predation, etc). Only long term trends will clarify that. The Mount Polley samples contained several species widely distributed in B.C. including *Cryptocyclops bicolour*, *Daphnia pulex*, *D. rosea*, *Diacyclops bicuspidatus*, *Ectocyclops phaleratus*, *Leptodora kindti*, and *Tropocyclops prasinus*. Also present in the study area were several species that tend to be found in more saline and more alkaline environments. These included *Daphnia schoedleri*, *D. magna*, *D. similis*, *Moina hutchinsoni*, *Paracyclops fimbriatus* (Pennack, 1989).

2.5.6 Phytoplankton

Phytoplankton samples were also collected from the lakes in August and October in conjunction with the limnology studies. The following data summary describes the results of the 1989 sampling program:

	BOOTJACK LAKE			POLLEY LAKE		KAY LAKE
Date (1989)	Aug 18	Aug 18	Oct 16	Aug 19	Oct 16	Oct 17
Sampling Location	LN	LS	LS	L	L	L
Sampling Depth (M)	4	4	4	6	4	3
Total No. of Organisms (N)	264	275	140	502	402	331
Total No. of Taxa (S)	19	19	23	19	21	17
Diversity (d)	1.77	2.08	2.87	1.39	2.38	2.27
Total No. per ml	252.9	263.5	134.1	480.9	385.1	317.1

The August sampling of both basins of Bootjack Lake contained 19 phytoplankton taxa, and a cryptophyte species, *Chroomonas acuta* was dominant at both sites. Polley Lake also contained 19 species and the highest density (480.9 per ml) and was also dominated by *Chroomonas acuta*.

During the October survey total taxa and diversity had increased in Bootjack and Polley Lakes. The Kay Lake contained 17 species, a moderate species diversity (2.27) and moderate density (317.1 per ml). The dominant species continued to be *Chroomonas acuta* in all three lakes. In Bootjack and Polley Lakes a blue-green algae, *Aphanizomenon flos-aquae* displayed a strong seasonal response (bloom) in October but was not even present in Kay Lake.

2.6 VEGETATION

The project area is located within the Cariboo Forest Region. The biogeoclimatic zone representing this area is the Interior Cedar Hemlock Zone. Two subzones are recognized as the Cedar and Wet. The mine site, including Polley and Bootjack Lakes, is in the Cedar Subzone (Lord 1984). Tree species which are characteristic of this zone are Western red cedar (*Thuja plicata*), white spruce (*Picea glauca*), and Rocky Mountain Douglas fir (*Pseudotsuga menziesii*). Within this subzone abundant moss layer would typically be present under a closed canopy. This interior zone is typified by cool wet winters and warm dry summers (Figure 2.14).

The mine, mill, and waste dumps lie in the moist cool subzone of the Interior Cedar Hemlock Zone and includes the Cedar-Moss and the Spruce - Horsetails associations. The Cedar-Moss association includes submesic and mesic areas on 10 to 34% slope with a north to northeast aspect. Dominant species in this association include western red cedar, subalpine fir, falsebox, prince's pine, and red-stemmed feathermoss. The Spruce - Horsetails association occurs at the toe slopes in hygric areas. Dominant plant species in this association include hybrid white spruce, western red cedar, black twinberry, red-osier dogwood, devil's club, horsetails, soft-leaved sedges, American brooklime, and leafy mosses.

Blue listed plant species in the area include Hudson Bay sedge (*Carex helionastes*), fragile sedge (*Carex membranacea*), slender sedge (*Carex tenera*), arctic eyebright (*Euphrasia arctica var. disjuncta*), Macoun's buttercup (*Ramuniculus macounii var. oreganus*), and smooth cliff fern or woodsia (*Woodsia glabella*) (Conservation Data Centre 1995). These species have not yet been identified to occur on the property and a detailed survey would be required to determine if the proposed mine affects the distribution of these plant species.

The tailings area is situated in a lower relief area south of the deposit. Two swampy areas occur in the proposed tailings area which likely comprise a Scrub Birch-Sedge-Sphagnum association comprising sparse spruce and species of willow, scrub birch, Laborador tea, sedges and sphagnum moss. Drier areas are in the Spruce-Subalpine Fir-Thimbleberry association. A vegetation survey is required to confirm this.

Vegetation was sampled for purposes of determining baseline metal levels for wildlife browse and cattle grazing. Five sites were sampled and included species of alder, bilberry, willow, clover and grasses. Species selected reflect the existing plant communities at each site. Because the sites are different and have different logging and revegetation histories, all the same plant species are not present at all sites. These metal levels are presented in the Stage 1 assessment and will be used for comparison purposes for long term monitoring.

2.7 WILDLIFE AND WILDLIFE HABITAT

2.7.1 Ecosystem Classification

The Mount Polley Project area is in the Souther Interior Mountains Ecoprovince of British Columbia, as described by Demarchi et al. (1990). This ecoprovince occupies the southeastern corner of British Columbia, and it includes the Rocky, Selkirk, Monashee, and Cariboo Mountains, as well as the nearby Quesnel, Shuswap and Okanagan Highlands.

The Mount Polley Project area is within the Quesnel Highlands Ecosection of Demarchi et al. (1990). These highlands represent a transition between the Fraser and Nechako Plateaus to the west, and the Cariboo Mountains to the East. The Quesnel, Shuswap and Okanagan Plateaus are all fairly highly dissected areas, where upland surfaces are relatively small. The annual precipitation may be higher in the Quesnel Highlands than in the Shuswap Highlands to the south.

Inspection of aerial photos indicates that much of the Quesnel Highland has been glaciated, and drumlins and glacial flutings are common features of lower elevations. There is no evidence of mountain or cirque glaciation in the Mount Polley Project area, although all of the area appears to have been glaciated during one or more stages of Cordilleran glaciation. Both Polley Lake and Bootjack Lake appear to be glacially overdeepened lakes, where glacier ice scoured, straightened and enlarged pre-existing valley structures. The shoreline of Polley Lake is particularly steep-sided and regular, suggesting that the lake occupies a flooded U-shaped valley that was formed by the movement of glacier ice.

2.7.2 Biogeoclimatic Zones

The Mount Polley Project area is in the Horsefly moist cool variant of the Interior Cedar Hemlock Biogeoclimatic Zone (ICHmk3). The ICH zone occurs at lower to middle elevations (from 400 to 1500 m) in the southeastern interior of British Columbia. This zone also extends southward into eastern Washington, Montana and Idaho. There is an outlier of the ICH zone in the Skeena and Nass Valleys of northwestern British Columbia. The distribution of the ICHmk subzone is much more restricted, occurring in the lower Bull and Elk River valleys, the Golden area of the Rocky Mountain trench, and the upper Shuswap and lower Quesnel Highlands (Ketcheson et al. 1991).

The ICH has an interior continental climate that produces cool wet winters and warm dry summers. Next to the Engelmann spruce-subalpine fir zone, this is one of the wettest zones in the interior of the province. Mean annual temperatures in the zone range from 2° to 9°C. Average temperatures are below freezing from 2-5 months of the year. Across the zone, the mean annual precipitation is from 500 to 1200 mm, of which 25-50% falls as snow (Ketcheson et al. 1991).

The cool snowy winters and the warm dry summers are an important factor in determining the wildlife capability of the ICHmk subzone. At Mount Polley, the snowpack is more than 1 m deep by the end of the winter, a factor that limits the area's capability for ungulates. Animals that use the Mount Polley area in the spring summer or fall must either be snow-adapted, or must migrate out of the area. Aerial surveys of the Mount Polley area in March 1995 produced no observations of ungulates in the mine development area, but several tracks along the shoreline of both Polley and Bootjack Lakes suggest that moose used the frozen lake surfaces as a convenient north-south migration corridor.

2.7.3 Vegetation

According to biogeoclimatic maps of the Cariboo Forest Region, the Mount Polley project area is within the Horsefly moist cool variant of the Interior Cedar-Hemlock Biogeoclimatic Zone, the ICHmk3. Steen (1989) has developed an initial ecosystem classification for the ICHmk3 subzone, which under the old system of forest classification, was the ICHe2.

The dominant trees species on upland sites include Douglas-fir, western red cedar, hybrid spruce and subalpine fir. Lodgepole pine, trembling aspen and paper birch are also present in the early stages of plant succession. The forests in lower valley bottoms are often dominated by spruce and black cottonwood. Western hemlock is lacking in the ICHmk (Ketcheson et al. 1991).

The driest sites, on steep south-facing slopes and ridge crests, belong to the ICHe2/2 and ICHe2/3 site series of Steen (1989). They are dominated by open to closed forests of Douglas-fir and western red cedar. Common shrub species in the understorey are saskatoon, soopolallie, and common herbs include pussytoes, wild strawberry, white-flowered hawkweed and rough-leaved ricegrass. Juniper haircap moss and lichens dominate the forest floor on very dry sites, while rough-leaved ricegrass, wavy-leaved moss and dog's-tongue lichen are characteristic species of slightly moister sites. In open forests with a well-developed understorey of saskatoon and grasses, drier sites may offer cover and forage for mule deer in summer. A few of the shrub and herb species are berry-producing, which may be an important factor for bears and for birds such as cedar waxwing, bohemian waxwing, American robin and other thrushes.

"Zonal" sites are those of average moisture and nutrient conditions, on moderate to gentle slopes. As described by Steen (1989), the zonal site series in the Mount Polley Project area are the ICHe2/1 and ICHe2/4. These sites are on gentle slopes, from 0 to 49%, generally on till blankets, which are sometimes mantled with colluvial veneers where slopes are fro 35 to 50°. The dominant trees on these sites are western red cedar and subalpine fir, with an understorey of falsebox, black huckleberry, bunchberry, round-leaved violet, and foamflower. The herb and shrub layers are relatively poorly developed, and the forest floor tends to be carpeted with feather mosses, especially red-stemmed feathe rmoss. The shrub and herb layer is particularly poorly developed on north and northeast-facing slopes, and the understorey tends to be carpeted with feathermosses. Such sites would be particularly poor ungulate habitat, offering little in the way of forage for Mule Deer, Moose or Caribou. Falsebox may be a forage species in these habitats.

Lower toe slopes tend to have a richer herb and shrub understorey, which Steen (1989) has described as the ICHe2/6 and ICHe2/7. As moisture and nutrient levels increase, sites become increasingly dominated by hybrid white spruce and subalpine fir in the tree canopy. The shrub layer is much better developed than on zonal sites, and is dominated by devil's club (up to 40% in some places), thimbleberry, black twinberry, black gooseberry and red-osier dogwood. The shrub layer is also much lusher, and is dominated by species such as oak fern, fringed aster, wild sarsaparilla, lady fern and sweet-cicely. Leafy mosses and ragged mosses become increasingly important in the moss layer. Mature and older forests in this association tend to be dominated by species that are of relatively low palatability to ungulates, the main exception being red-osier. However, many of the dominant shrub species are good berry-producers, a feature that may be important to bears and certain songbirds.

Wet sites are found at the toes of long slopes, in riparian habitats and in topographic depressions, and they correspond to the ICHe2/8 and ICHe2/9 site series of Steen (1989). Forests that develop on moraines and fluvial terraces are often dominated by hybrid spruce and western red cedar, with an understorey of red-osier, black twinberry, devil's club, horsetails, soft-leaved sedge, American brooklime and various mosses. These areas may be important foraging areas for bears, and wintering areas for moose and mule deer. Horsetail, sedges and red-osier are particularly important forage species. Very wet areas with organic soils are dominated by shrublands and sedge fens: scrub birch, labrador-tea, pink spiraea, sedges and sphagnum mosses are the dominant plants. Where willows are a significant component of the vegetation, these shrub carrs may be important wintering areas for moose; however, where scrub birch, Labrador-tea and spiraea are the only important shrub species, the value for ungulates is likely to be low.

The Mount Polley Project area was subject to extensive clearcut logging in the 1970's, and forest regeneration has had varying degrees of success in the past 25 years. It could be speculated that clearcut logging has actually have improved the area's habitat capability as summer habitat for moose and mule deer, by removing the tree canopy and allowing more light on the herb and shrub understoreys. However, a more complete evaluation of this speculation must await field evaluation.

2.7.4 Preliminary Wildlife Habitat Classification for the Mount Polley Project Area

According to Mr. Marcel Demers[1], no formal system of wildlife habitat classification has been developed for the Cariboo Forest Region or the Horsefly Forest District. There is no wildlife habitat mapping for the Horsefly Forest District in general, or for the Mount Polley Project area in particular.

Table 2.5 is a preliminary wildlife habitat classification for the project area, which has been proposed for the purposes of this project. It is based partly on the classification given by Ketcheson et. al. (1991) for the Interior Cedar-Hemlock Zone, of Banner et al. (1993) for the Prince Rupert Forest District and of the Wildlife Branch (1994) for the Omineca Sub-Region of the Prince George Region. Hallam Knight Piésold Ltd. has interpreted the distribution of these habitats in the Mount Polley Project area, with the aid of recent colour aerial photographs of the project area, at 1:16,000 scale. The distribution of these habitats is shown on Figure 2.15.

With an elevation range of 920 (Polley Lake) to 1260 m (the summit of Mount Polley), all of the Mount Polley Project area is considered to be within the Interior Cedar - Hemlock Zone. There are no alpine and subalpine habitats in the Mount Polley Project area, although the summit of Mount Polley is close to the lower elevation limits of the Engelmann Spruce - Subalpine fir zone. There are no large avalanche tracks, talus slopes or other mountain features that would be considered significant wildlife habitats nor do any cliffs or canyons occur in the project area. There is no arable agriculture in the project area. Man-made habitats include logging clearcuts, the mining camp at Mount Polley, and a network of roads for logging and mineral exploration.

[1] Wildlife Branch, Ministry of Environment Lands and Parks, Williams Lake, pers. comm. to Dan Royea, Hallam Knight Piésold Ltd.

Prior to European contact, the primeval vegetation of the project area was probably a continuous closed forest, dominated by western redcedar and subalpine fir on zonal sites, by Douglas-fir and lodgepole pine on drier sites, and by western red cedar, hybrid spruce and black cottonwood on lower sites. Much of the proposed mine development area was clearcut in the 1970's, and is now covered by open, young seral forests.

2.7.4.1 Clearcuts, Burns and Young Seral Forests in the ICH Zone

Depending on the type and amount of shrub and herb regeneration that has taken place, clearcuts and young seral forests probably good forage and cover for mule deer and moose, particularly in the spring, summer and early fall. Much of the mine development area is covered by a radiating pattern of young trees and clearings, which are likely to provide a good mix of cover and forage for mule deer. According to Ketcheson et al. (1991), ruffed grouse, downy woodpecker, black-backed woodpecker, three-toed woodpecker, olive-sided flycatcher, western bluebird and Townsend's solitaire are representative species of young seral forests in the Interior Cedar-Hemlock Zone in general. These species are expected to occur in Mount Polley Project area, but their occurrence has not yet been confirmed.

2.7.4.2 Mid-Seral Forests in the ICH Zone

Mid-seral stands in the ICH may have many of the same species as mature and older stands, discussed below. The number of individuals and the diversity of species may increase somewhat a mid-seral stands mature, and as the complexity and structural diversity of the habitat increases. However, species that prefer open woodlands, herb-dominated habitats or shrub-dominated habitats (e.g. Townsend's solitaire, mountain bluebird, deer mouse) are likely to decrease.

2.7.4.3 Mature and Old Growth Forests in the ICH Zone

According to Ketcheson et al. (1991), moose, mule deer, black bear, wolverine, marten, southern red-backed vole, various owls, pileated woodpecker, Steller's jay, gray jay, varied thrush, golden-crowned kinglet, Townsend's warbler, bohemian waxwing, red crossbill, winter wren and mountain chickadee are representative species of mature and old growth forests in the Interior Cedar-Hemlock Zone in general. These species may also occur in Mount Polley Project area, but their presence has not been confirmed.

2.7.4.4 Forests on South-facing Slopes

The distribution of open forests on south-facing slopes in the project area is shown on Map 4. These slopes may be significant for moose and mule deer in the late winter, spring and summer. Due to favourable insolation, these slopes are likely to have a lighter snow cover than average during the winter. These slopes are likely to be snow-free earlier in the season, and to green up earlier, than most other habitats. Even with a favourable insolation regime, south-facing slopes in the project area are likely to be too deeply covered with snow to be suitable for mule deer in the winter. However, in spring, these slopes may be important for mule deer, due to rapid snowmelt and early green-up. For the same reasons, they may also be important for bears emerging from winter hibernation. Ketcheson et al. (1991) list several other species that they consider to be closely associated with south-facing slopes (e.g. yellow-bellied marmot, rubber boa, elk), but it is doubtful that these species occur in the Mount Polley area.

2.7.4.5 Non-forested Rock Cliffs and Talus

Rocky cliff and talus habitats do not occur in the Mount Polley Project area.

2.7.4.6 Riparian Forest Habitat Complex

There are no riparian forest habitats in the Mount Polley Project area, such as would be associated with rivers or large creeks with channel widths greater than 5 m. The project area does not contain any landscape features that are typically associated with large streams, and which may be significant to wildlife, such as:

- alluvial fans
- oxbows
- floodplains
- alluvial terraces
- meander scrolls
- canyons
- braided channels
- backwaters
- gallery forests

Ketcheson et al. (1993) provide a long list of species that they believe to be associated with riparian meadows, wetlands and floodplains in the ICH zone. Many of these species, particularly the reptiles, are likely to be found only in the lower reaches of the Kootenay and Columbia Rivers, at places such as the Creston Marshes.

2.7.4.7 Riparian Habitats near Small Streams

There are two riparian areas associated with small streams in the Mount Polley Project area, on Hazeltine Creek and Bootjack Creek. Both of these are small creeks, with channels less than 5 m wide. Bootjack Creek is entrenched in a ravine for much of its length, with two small wetlands near its inlet and one near its outlet. The riparian zone of Hazeltine Creek is somewhat more conspicuous on aerial photographs than that of Bootjack Creek. Hazeltine Creek has an area of shrub carr and sedge meadow near its mouth in Polley Lake, and smaller areas of shrub carr in its upper reaches. There are no lakes or backwaters associated with either creek. Both creeks are fish-bearing. Beaver, muskrat, mink, bufflehead, spotted sandpiper, spotted frog, wood frog and western toad are the main wildlife species that are likely to be found in the riparian zones of small creeks such as these. Depending on the associated vegetation, these creeks may provide above-average habitat for black bears, moose and mule deer.

2.7.4.8 Shrub Carr / Sedge Fen Habitat Complex

Small examples of this complex are found near the outlet of Bootjack Lake, and about 500 m downstream from the outlet, and along Hazeltine Creek, The largest shrub carr and fen complex in the project area is at the south end of Polley Lake. No large ponds are associated with this complex. Inspection of airphotos indicates there are a few widenings of Hazeltine Creek, which may be due to beaver damming. At the south end of Polley Lake, fen and shrub carr grade into a swamp forest.

Airphoto interpretation indicates that these shrub carrs are unlikely to be good waterfowl habitat, because of the limited amount of pond or marsh development. In other parts of the BC interior, sedge fen and shrub carrs are good to very good moose habitat, particularly where willows are an important component of the vegetation. A few moose tracks were seen in these habitats during aerial surveys of the mine area in March 1995, but no moose were seen. For the present analysis, riparian habitats along Bootjack and Hazeltine Creeks can be considered Class 3 or Class 4 winter range, and Class 3 summer range for moose. Due to heavy winter snow accumulations, these habitats should be considered Class 5 or Class 6 winter range for deer.

2.7.4.9 Marsh / Shallow Open Water Habitat Complex

If a marsh is defined as a permanently flooded wetland dominated by tall emergent plants such as cattails, bulrushes, or reeds, then there are no marshes in the Mount Polley Project area. If a shallow open water habitat is defined as one which is dominated by lush beds of submergent plants such as yellow pond lily, hornwort, milfoil or pondweeds, then there are no shallow water habitats in the Mount Polley Project area.

2.7.4.10 Small and Medium-sized Lakes (< 1000 ha)

Bootjack Lake and Polley Lakes belong to this category. Both lakes support a good to very good sports fishery based on rainbow trout. The presence of fish could provide habitat for some species of fish-eating wildlife, such as common loon, common merganser, belted kingfisher, mink and river otter. The presence of these species has not been documented for the mine area, however. In other parts of British Columbia, the main waterfowl species on small, deep lakes such as these is Barrow's Goldeneye.

The Canada Land Inventory assigned a rating of 6-JZ to both Bootjack and Polley Lakes, This rating implies severe limitations to waterfowl production. The major limitations are excessively deep waters and a limited area of marsh edge development.

2.7.4.11 Large Lakes and Reservoirs (> 1000 ha)

If large lakes are defined as those with an area greater than 1000 ha then there are no large lakes in the Mount Polley Project area.

2.7.4.12 Urban Areas

The Wildlife Branch (1994) defines urban areas as man-made habitats, such as residential, commercial and industrial areas. Agricultural lands are considered a distinct habitat type. There are no urban areas in the Mount Polley Project area. However, a small exploration camp has operated there in the past, and a mill, offices and other infrastructure related to the development of the Mount Polley mine are proposed for the area. Isolated camps such as these sometimes create a habitats for wildlife that would not otherwise be available. Isolated mining camps often host small breeding populations of barn swallows and cliff swallows, that nest in the eaves of buildings. Deer mice are a common resident in camp buildings. Gray jays and common ravens frequently become tame, and learn to beg scraps. Solid waste management to prevent black bears from becoming habituated to humans is an important consideration.

Urban areas are used by a variety of native wildlife species, such as common raven, deer mouse and gray jay. Moose, fox, black bear and coyote may occasionally enter this habitat. The main wildlife concern associated with urban areas is the need for a system of garbage disposal that minimizes bear problems.

2.7.4.13 Transportation / Transmission Corridor

Transportation and transmission corridors are linear facilities that are dedicated to carrying people, goods, and services from one point to another. Tree growth is removed and suppressed along these corridors, and the vegetation is kept in an early stage of plant succession (Wildlife Branch 1994). There are no major road or powerline corridors in the project area. However, there is a large network of logging and skid roads throughout the area, an a further network of roads to reach exploration drilling sites. Roads such as these typically occupy a small proportion of the land area, but they may be significant to wildlife in the following ways.

Early stages of forest succession often include plants that are palatable to wildlife, such as willows, prickly rose, fireweed and elderberry. Commercial seed mixes are sometimes sown to stabilize roadsides and ditches, and they often contain plants that are palatable to wildlife, such as Kentucky bluegrass, red fescue, timothy and red clover. Consequently, moose, deer, grizzly bear and black bear sometimes forage along transportation and transmission corridors. Where winter snows are deep, moose, coyotes and wolves sometimes travel along plowed roads and rail lines, and may be killed in collisions with vehicles. Forest road networks make the back-country more accessible to outdoor recreationists, to the point that unregulated hunting and wildlife harassment become a concern for wildlife managers.

2.7.4.14 Agricultural Areas

There are no agricultural areas in the Mount Polley Project area. Due to deep snows, steep slopes and thin soils, the project area has no capability for arable agriculture. Livestock grazing is practiced on forest lands in the Mount Polley Project area during the summer.

2.7.5 Rare, Threatened and Endangered Species

The provincial Red List includes species that are considered to be endangered or threatened in British Columbia (Harper 1993). The British Columbia Conservation Data Centre (CDC) maintains a tracking list of the locations of records of rare plants and animals in British Columbia. The CDC has supplied Hallam Knight Piésold Ltd. with a tracking list of rare and threatened wildlife in the Horsefly Forest District (Sharon Hartwell, CDC, letter to Jenifer Hill).

The CDC indicates that the Prairie Falcon (*Falco mexicanus*) has been recorded in the Horsefly Forest district, but no particulars of this record have been made available at the present time. The Prairie Falcon is considered endangered in British Columbia, where its primary range is in the Okanagan and Thompson Valleys, in the Ponderosa Pine - Bunchgrass Biogeoclimatic Zone. Its range in Canada includes the southern portions of Alberta and Saskatchewan. The Mount Polley Project area is unlikely to provide breeding habitat for this species, and it is likely that this falcon record is for a non-breeding vagrant.

The provincial Blue List includes species or subspecies that are considered "vulnerable" or "sensitive," but are not threatened in British Columbia (Harper 1993). the CDC has also supplied Hallam Knight Piésold Ltd. with a tracking list of rare and threatened wildlife in the Horsefly Forest District (Sharon Hartwell, CDC, letter to Jenifer Hill). The Blue-listed species in the Horsefly Forest District include great blue heron, short-eared owl, american bittern, sandhill crane, bald eagle, wolverine, fisher, woodland caribou and grizzly bear. None of these species have been recorded from the project area.

The great blue heron is associated with large lakes, rivers, and the sea coast, in shallow waters where it can hunt for its principal prey, fish. The short-eared owl is a characteristic bird of open country, and it breeds on prairies, aspen parklands and the arctic tundra. In winter its habitat is prairies, coastal marshes, and agricultural areas. It is unlikely to find suitable habitat in the Mount Polley Project area. The American bittern is a bird of marshes, particularly those dominated by cattails or bulrushes. there is no suitable habitat for this species in the project area. The sandhill crane breeds on large muskegs, marshes and on the arctic tundra; the project area is unlikely to have suitable breeding habitat for this species. It is conceivable that Polley Lake or Bootjack Lake may have bald eagles, either as transients or as summer residents, but their occurrence at these lakes has not been documented.

The fisher is characteristically associated with lowland riparian spruce-cottonwood forests, and is reputed to be an important predator of porcupine. It is conceivable that caribou, wolverine and grizzly bear may have occurred in the project area in historic times, but there is no record of their occurrence in the project area in the Wildlife Log for Mount Polley.

2.8 LAND USE AND CAPABILITY

2.8.1 Forest Resources

The project lies in the Interior Cedar - Hemlock biogeoclimatic zone. With very few exceptions, the land in the project area is Crown owned. Predominant land use activity on these lands, including the Mount Polley project area, has been commercial forest harvesting. Supervision of this activity has been the responsibility of the Ministry of Forests. They have provided up-to-date Forest Cover Maps which include the Mount Polley project area. Figure 2.16 was produced from these maps.

Forest harvesting through clearcut techniques has occurred over significant portions of the Mount Polley project area and its surroundings. Many of these cut blocks have been re-planted for commercial timber species, although in some cases, select blocks were re-planted for a combination of silviculture and cattle grazing uses. Cut blocks planted for cattle grazing generally occur to the south of Polley Lake.

The following describes the forest cover types presently occurring at the proposed mine site and tailings area. Table 2.6 summarizes the percent forest coverage of each mine component which will be affected by mining and Table 2.7 summarizes the percentage logged of each component area.

Forest capability varies greatly over the project area due to varying stages of regeneration from previous logging activity, mine exploration activity, and scattered marshy areas. Overall forest capability is medium to good class timber in the north and west waste dumps and the north pit. Low capability is predominant in the location of the south waste dump, west pit, central pit and mill site. The tailings area overall has poor forest capability with scattered stands of good to medium class.

The proposed west waste dump is dominated by Douglas fir, with lesser densities of lodgepole pine and spruce in the 101 to 120 year age class. Approximately 15% of this was logged in 1975 but was not replanted.

Adjacent to this, approximately 50% of the north waste dump was logged as part of the same 1975 cutblock. The unlogged portion comprises mainly Douglas fir, lodgepole pine, spruce, and some western red cedar.

Approximately 65% of the south waste dump was logged in the 1970s with only 5% planted in 1978. The naturally regenerating forest consists mainly of red cedar with subdominant subalpine fir and some Douglas fir and spruce. The trees in the unlogged areas range anywhere from 101 to 250 years with a large range of heights (10.5 to 37.4 m) and range of crown closure (0 to 65%).

In the proposed open pit areas, the north pit had approximately 25% logged in 1975 that is naturally regenerating with spruce and subalpine fir. The remaining unlogged portion varies considerably with dominant species of lodgepole pine, spruce, and Douglas fir. The younger forest (101 to 120 years) is dominated by lodgepole pine and Douglas fir ranging from 10.5 to 28.4 m in height and the older forest (141 to 250 years) dominated by spruce ranging 28.5 to 37.4 m in height.

Approximately 60% of the forest in the west pit was logged in 1972 and is regenerating with red cedar, subalpine fir, and some spruce. The remaining unlogged portion is in the 121 to 140 year age range and is dominated by lodgepole pine and Douglas fir.

Similar to the west pit, approximately 60% of the central pit falls in the same cutblock as the 1972 cut in the west pit area. The tree age classes in the unlogged portion is 101 to 120 years dominated by lodgepole pine and Douglas fir.

The entire mill site was logged in 1972 and was not replanted. Regeneration comprises red cedar, subalpine fir, and some spruce ranging in height from 0 to 10.4 m.

The majority (75%) of the tailings area was logged from 1970 to 1983 and replanted from 1975 to 1986 with spruce. The unlogged portions of the proposed tailings area consist of approximately 9% marsh, 10% spruce forest ranging from 141 to 250 years, and 10% western red cedar forest of 251+ years.

Reforestation to commercial forest standards is prevalent throughout the area. The forest cover map provides information about native species composition and time periods of harvesting and reforestation. As the young replanted coniferous trees are growing, vegetation currently predominating on the cut blocks differs with the age of the disturbance, topography, soil type, drainage and a number of other factors. 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.

2.8.2 Range Management

Areas disturbed by logging have created opportunity for cattle grazing under a permit system administered by the Ministry of Forests. In some cases whole cut blocks have been revegetated with a combination of forage species for cattle as well as commercial timber species. Road sides, abandoned roads and tracks, and log landing areas have typically been planted with species suitable for cattle grazing. The seclected species include several domestic grasses and legumes, as well as clover.

Specific seed mixtures have been selected for specific site characteristics and range management strategies. These programs have resulted in the creation of summer grazing areas on Crown owned lands by regional ranchers. The ranches are located in the Beaver Valley and Big Lake areas, to the south and east of the project. Table 2.8 lists the individual ranchers who have grazing permits in the Mount Polley project area and describes their general grazing locations, herd size and applicable season.

None of the land in the project area is included in the Agricultural Land Reserve (ALR). Areas represented by ALR lands are south of the project near the Gavin Lake road and north of the project near Hydraulic, (Agricultural Land Commission, personal communication). One rancher, s.22 grazes 105 cattle in the area west of Morehead and Bootjack Lakes, but north of Mount Polley. He advised Imperial Metals Corporation that he normally puts the cattle in this area around the first of August and they stay until early October. s.22 grazes his herd of 105 cattle in the project area from May 16 to Oct. 15. Two other ranchers, s.22 s.22 graze their herds in the summer south of Bootjack and Polley Lakes in the vicinity of the Gavin Lake Road. Several cut blocks in the vicinity of Bootjack Creek are used for grazing and either have been revegetated or are in a transitional stage from 1970s logging (Figure 2.17).

The herds intermingle while grazing. s.22 grazes approximately 250 head of cattle and s.22 approximately 75. Both ranchers turn their cattle out in these areas in late spring (May 16 and May 10, respectively) and they return in mid October. They identified a spring used by their cattle near the Gavin Lake Road south of Polley Lake (shown in Figure 2.18) and asked to have it preserved for cattle watering. Contact with each of these ranchers was established in 1988 by Imperial Metals Corporation to verify their grazing activities, and to discuss potential points of contact and mechanisms for avoiding conflicts between the mine and grazing. It was also confirmed that the most productive and successfully revegetated grazing areas are located south of Polley Lake and outside of the project area (personal communication, Lyle Resh).

2.8.3 Livestock

Plant tissue metals were analyzed to determine if low Cu/Mo ratios in local vegetation were present, which could have significance for grazing livestock or wildlife in the Mount Polley area. From this assessment, the concentration of both metals in plant tissue and the Cu/Mo ratios were observed to be extremely variable. The variability is not consistent with site geochemistry, location of the ore body or plant species. It appears therefore that the low ratios occasionally observed are aberrations for which no appreciable concern is warranted.

2.8.4 Hunting, Guiding and Trapping

Because the area around Mount Polley has had a substantial history of logging, the road development has been extensive. As a result vehicle access is relatively easy to most areas around both sides of Bootjack and Polley Lakes. Furthermore, these accesses connect with major north-south and east-west forestry roads making looped circuits for hunter access relatively simple. Hunting throughout the region is a common recreational activity and the habitats for moose and deer are common enough to attract local as well as more distant hunters. B.C. resident hunters, alone and in groups, have been frequently seen on the roads during hunting season by the exploration and monitoring staff. Out-of-province hunters are obliged to use guide/outfitters to assist them in hunting. The boundary between territories of two such guides runs through Mount Polley (Figure 2.18). The Mount Polley project area does not, however, form a major part of either of these guiding territories, nor does it represent the most attractive habitats for moose, which is the species most commonly sought by these hunters. Moose habitats elsewhere in the guiding areas typically would receive maximum attention by resident and non- resident hunters.

Both of the guide/outfitters in question have been contacted, by Imperial Metals Corporation. They are aware of the project and confirm that the project area would form only a minor element in their annual hunting and guiding activity. Both recognized that no shooting areas around the mine would be necessary for safety and agreed they could make adjustments. Black bear have been harvested in the past from Mount Polley, particularly in early spring as they emerge from hibernation. Grouse and rabbits are often killed along the road sides and elsewhere by passing hunters who usually are seeking deer and moose. Waterfowl hunters find this a very unsatisfying area for hunting because of the very low population numbers and the small and widely spaced habitat types. Other areas in the Cariboo are better suited, more productive and are more widely used.

Several species of fur bearers including beaver, marten, fisher, fox, mink, muskrat, squirrel, weasel, lynx, otter and coyote have historically been trapped from the trapline encompassing the study area. Figure 2.19 illustrates the trapline areas registered in the vicinity of the Mount Polley project. The Mount Polley project is in one corner of the trapping area registered to Trapper Numbered 502T056.

2.8.5 Recreation

Recreational activities in the study area are primarily centred around lake fishing, hunting and camping. The natural populations of rainbow trout in the lakes attract local residents and more distant visitors. B.C. Fisheries and Wildlife personnel in Williams Lake supplied the following information about recreational fishing activity on Polley and Bootjack Lakes. An August 1982 creel census yielded the following results:

	Catch Rate per Hour	Fish per Angler Day
Polley Lake	1.9	8.4
Bootjack Lake	0.94	6.6

Estimated angler days (from aerial surveys May - October).

	1987	1988	1989	Mean
Polley Lake	4,392	3,461	2,629	3,494
Bootjack Lake	3,432	3,109	2,510	3,017
Total	7,824	6,570	5,139	6,511

Based on the above and considering those Cariboo lakes which are not stocked with fish from hatcheries, a ranking system of fish productivity and heavy fishing pressure would place Polley Lake in the top three and Bootjack Lake among the top ten (M. Lirette, personal communication).

The Forest Service maintains campgrounds that are equipped with boat launch ramps, campsites, toilets and picnic tables on both Bootjack and Polley Lakes. Observations by the exploration and monitoring crews indicate these facilities are used steadily throughout the camping season, often by fishermen with car top or trailored boats or canoes. Hunters often use the campsites as well. Because no fees are collected for the use of these campsites, no accurate records exist of there rate of utilization or seasonal patterns. Hiking, nature study, cross country skiing, snowmobiling and automobile touring might be expected as minor components in the recreational use of the area, particularly on the network of logging roads and tracks.

A fishing cabin stands on the shoreline of the northeast end of Bootjack Lake on the only parcel of private land (L12023) on that lake. Two private parcels are at the north end of Polley Lake. One has a private hunting/fishing cabin (L11559) which is about 7 m to 8 m in elevation above the lake. The other parcel (L11560) has an abandoned caretakers cabin several metres above lake level that was historically associated with water diversion facilities.

Southwest of Bootjack Lake, about 15 km, the University of British Columbia operates the Alex Fraser Research Forest, for purposes of research, education and demonstration. Associated with that facility the Canadian Forestry Association operates special summer camps for outdoor learning and adventure particularly for youth. Occasional use is made of some parts of the Mount Polley project area by groups from this camp.

The Morehead Lake Resort on the Likely Road at the north end of Morehead Lake is the closest rental accommodation to the project site. Hunters, fishermen and travellers occasionally stay in the cabins and enter the project area. Parcels of private land with cabins and homes can be found near Morehead Lake, along the Likely Road and in the vicinity of the community of Hydraulic. Occasionally people from these residences also enter some parts of the project area for recreation purposes.

2.8.6 Native Use and Land Claims

There are no reserves in the Mount Polley project area or nearby. However, the chiefs of the Cariboo Tribal Council have asserted that the area falls within the aboriginal land claims of the Soda Creek Indian Nation, and the Shuswap Nation.

2.8.7 Heritage Resources

An overview assessment of the heritage resources of the Mount Polley project area was conducted by Points West Heritage Consulting Ltd. The full report of that assessment has been filed with the Archaeology and Outdoor Recreation Branch in Victoria. A summary from the report is reproduced below.

The majority of the development area is typified by low heritage resource potential. Several isolated areas were assessed as having low-moderate potential. All have experienced some disturbance and involve narrow corridors. Two locations have moderate heritage resource potential. One (Area A) is an area adjacent to Bootjack Lake which was one of three proposed location of tailings and reclamation ponds and the other involves a narrow corridor of development (transmission line). The former area appears to be undisturbed; the latter had been disturbed.

As no tailings pond development is proposed for the areas adjacent to Bootjack Lake and the new location is not typified by moderate or greater potential, it is recommended that no further heritage resource investigation is required in advance of development. The potential for intact heritage resources within such narrow and disturbed corridors is not sufficient on its own to justify detailed field investigation.

Table 2.2

IMPERIAL METALS CORPORATION
MOUNT POLLEY PROJECT
Unit Runoff Estimates

	Moffat	Hazeltine	Morehead	Bootjack
Unit runoff [1] ($l/s/km^2$)	20.79	31.21	53.38	23.44
Adjustment for lake level	0.00	-2.94	-19.09	0.00
Prorated Mean Annual Runoff [2] ($l/s/km^2$)	6.05	8.23	9.98	6.82
Low estimate MAR [3] ($l/s/km^2$)	4.84	6.58	7.98	5.46
High estimate MAR [3] ($l/s/km^2$)	7.26	9.87	11.97	8.19

Notes:

[1] For period of record, 13 April to 18 June 1991.
[2] Based on Mean Annual Unit Runoff for Moffat Creek of 6.05 $\ell/s/km^2$
[3] Based on a range of ±20%

(...\H1221\reclamat\runoff.tbl)

Table 2.3

Imperial Metals Corporation
Mt Polley Project

1989 Surface Water Quality Means

	4 K Creek	6 K Creek	Morehead Creek	Edney Creek	North Dump Creek	Hazeltine Creek	Bootjack Creek
pH	7.77	7.51	7.27	7.61	7.77	7.48	7.53
Conductivity	202.20	138.42	80.87	160.68	127.07	150.83	158.00
Turbidity NTU	2.24	6.00	3.13	3.80	2.70	1.52	1.68
Suspended Solids	4.64	23.18	8.29	6.50	3.13	3.27	4.84
Dissolved Solids	156.00	116.00	57.06	140.000	110.00	110.63	117.44
Alkalinity							
as (CaCO3)	99.76	72.26	37.23	87.5	59.90	83.85	80.84
Sulphate	<1.0	1.30	1.93	2.60	7.33	1.48	5.5
Chloride	0.66	0.68	0.66	1.12	0.80	0.85	0.82
O-Phosphate	0.0048	0.0162	0.0056	0.0072	0.0036	0.012	0.004
T-Phosphorous	0.031	0.0225	0.017	0.029	0.038	0.023	0.028
Nitrate	0.0065	0.0075	0.024	0.0148	0.025	0.022	0.027
Nitrite	0.084	0.0013	0.0015	0.001	0.002	0.0046	0.0012
Ammonia	0.0052	0.0182	0.021	0.0062	<0.005	0.0086	0.005
Tot. Kjeldahl	0.323	0.30	0.29	0.387	0.42	0.41	0.263
TOTAL METALS							
Aluminium	0.033	0.0962	0.088	0.297	0.2	0.09	0.291
Arsenic	0.00052	0.00046	0.00027	0.0005	0.00026	0.0004	0.00026
Copper	0.001	0.006	0.0046	0.0038	0.017	0.005	0.0028
Iron	0.684	0.53	0.243	0.466	0.14	0.265	0.16
Lead	<0.001	0.001	0.001	0.001	0.001	<0.001	0.0012
Mercury	0.000064	0.000054	0.000087	0.00008	0.00010	<0.00005	0.000064
Zinc	<0.005	0.0066	0.005	0.0064	0.0063	0.005	0.005
DISSOLVED METALS							
Aluminium	0.014	0.0332	0.016	0.180	0.142	0.044	0.0487
Arsenic	0.00048	0.0004	0.00026	0.00046	0.00027	0.00035	0.00026
Copper	0.0012	0.0056	0.0039	0.0034	0.017	0.002	0.0022
Iron	0.468	0.302	0.109	0.318	0.12	0.195	0.13
Lead	<0.001	0.001	0.001	0.001	0.001	<0.001	<0.001
Mercury	<0.00005	0.000054	0.000063	0.000058	0.00010	<0.00005	0.00005
Zinc	<0.005	0.006	0.005	0.005	<0.005	<0.005	<0.005

Rsults expressed as milligrams per litre except for pH, Conductivity (umhos/cm), and Turbidity (NTU)

(..\H1221\reclamat\tables\tab2-4 wk4)

Table 2.4

Imperial Metals Corporation
Mt Polley Project

1989 Lake Water Quality

	Moorhead Lake	Bootjack Lake	Kay Lake	Polley Lake
pH	7.31	7.06	7.97	7.65
Conductivity	88.88	74.35	124.00	121.50
Turbidity NTU	6.72	1.40	1.35	1.13
Suspended Solids	11.26	14.65	3.00	2.90
Dissolved Solids	68.72	52.78	110.00	86.53
Alkalinity as (CaCO3)	46.12	37.8	67.15	62.83
Sulphate	1.18	1.92	<1.0	2.93
Chloride	0.74	0.68	<0.5	0.68
O-Phosphate	0.0042	0.0043	0.006	0.005
T-Phosphorous	0.024	0.0167	0.027	0.019
Nitrate	<0.005	<0.005	<0.005	0.049
Nitrite	0.0018	<0.001	0.001	0.001
Ammonia	0.157	0.012	0.032	0.012
Tot. Kjeldahl	0.36	0.24	0.31	0.37
TOTAL METALS				
Aluminium	0.075	0.07	0.092	0.068
Arsenic	0.00026	0.00023	0.00015	0.00018
Copper	0.0032	0.0035	0.0035	0.002
Iron	0.174	0.07	0.06	<0.03
Lead	<0.001	<0.001	<0.001	<0.001
Mercury	0.000084	<0.00005	<0.00005	<0.00005
Zinc	0.0052	<0.005	<0.005	0.005
DISSOLVED METALS				
Aluminium	0.012	0.0085	0.027	0.014
Arsenic	0.00024	0.00023	0.00015	0.00013
Copper	0.0026	0.0033	0.001	0.002
Iron	0.074	0.038	0.04	<0.03
Lead	<0.001	<0.001	<0.001	<0.001
Mercury	0.000072	<0.00005	<0.00005	<0.00005
Zinc	0.005	<0.005	<0.005	<0.005

Rsults expressed as milligrams per litre except for pH, Conductivity (umhos/cm), and Turbidity (NTU)

(..\H1221\reclamat\tables\tab2-5.wk4)

Table 2.5 Preliminary wildlife habitat classification for the Mount Polley Project area. This classification was developed by Hallam Knight Piésold Ltd., with reference to Ketcheson et al. (1991), Banner et al. (1993) and Wildlife Branch (1994).

Habitat Type			Presence in Mount Polley Area
1	Alpine Habitats		No
2	Habitats of the Engelmann Spruce - Subalpine Fir Zone		
	2.1 Engelmann Spruce - Subalpine Fir Forest		
	2.2.1	Young stands (0-40 years)	No
	2.2.2	Mid-seral stands (40-120 years)	No
	2.2.3	Mature and Old Growth (120 years+)	No
	2.2 Avalanche Track		No
3	Forest Habitats of the Interior Cedar-Hemlock (ICH) Zone		
	3.1 Clearcuts and burns(0-20 years+)		Yes
	3.2 Young stands (20-40 years)		Yes
	3.3 Mid-seral stands (40-120 years)		Yes
	3.4 Mature and Old Growth Stands (120 years+)		Yes
	3.5 Doulgas-Fir - Lodgepole Pine Forest (South Slopes)		Yes
	3.6 Rocky cliffs and talus		No
4	Wetland and Aquatic Habitats		
	4.1 Riparian Forest Complex		No
	4.2 Riparian Habitats near Small Streams		Yes
	4.3 Shrub Carr / Sedge Fen Habitat Complex		Yes
	4.4 Marsh / Shallow Open Water Habitat Complex		No
	4.5 Small and Medium-sized Lakes (< 1000 ha)		Yes
	4.6 Large Lakes and Reservoirs (> 1000 ha)		No
5	Man-Made (Anthropogenic) Habitats		
	5.1 Urban Areas		No
	5.2 Transportation / Transmission Corridor		Yes
	5.3 Agricultural Areas		No

Table 2.6

Imperial Metals Corporation
Mt. Polley Project

Forest Cover Types in Relation to Mine Components

Mine Component	Poly #	Comp* %	Species	Age (yrs)	Height (m)	Crown Closure(%)	Capability Class	Year Logged	Year Planted
West Waste Dump	336	80	Douglas fir, lodgepole pine, spruce	101-120	19.5-28.4	56-65	Medium		
	209	15	Spruce, subalpine fir, (lodgepole)	1-20	0-10.4	6-15	Medium/Good	1975	
	334	5	Lodgepole pine, douglas fir, (spruce)	101-120	19.5-28.4	56-65	Medium		
North Waste Dump	209	50	Spruce, subalpine fir, (lodgepole)	1-20	0-10.4	6-15	Medium/Good	1975	
	342	20	Douglas fir, lodgepole, spruce, (ced)	141-250	28.5-37.4	56-65	Good		
	339	15	Spruce, douglas fir (subalpine fir)	141-250	28.5-37.4	26-35	Good		
	368	5	Douglas fir, spruce, (red cedar)	141-250	28.5-37.4	56-65	Good		
	336	5	Douglas fir, lodgepole pine, spruce	101-120	19.5-28.4	56-65	Medium		
	372	3	Red cedar, subalpine fir, (doug fir)	141-250	19.5-28.4	56-65	Poor		
	370	2	Dougals fir, (subalpine fir)	141-250	28.5-37.4	16-25	Good		
South Waste Dump	199	60	Red cedar, subalpine fir, spruce	21-40	0-10.4	26-35	Low/Medium	1972	
	345	15	Douglas fir, red cedar, subalpine fir	141-250	28.5-37.4	0-5	Good		
	343	10	Red cedar, subalpine fir, (spruce)	101-120	10.5-19.4	56-65	Poor		
	341	10	Subalpine fir, spruce, (red cedar)	101-120	19.5-28.4	26-35	Medium		
	186	5	Douglas fir, spruce, red cedar (aspen)	1-20	0-10.4	0-5	-	1975	1978
North Pit	209	25	Spruce, subalpine fir, (lodgepole)	1-20	0-10.4	6-15	Medium/Good	1975	
	338	25	Lodgepole pine, douglas fir	101-120	10.5-19.4	36-45	Poor		
	339	25	Spruce, douglas fir (subalpine fir)	141-250	28.5-37.4	26-35	Good		
	336	25	Douglas fir, lodgepole pine, spruce	101-120	19.5-28.4	56-65	Medium		
West Pit	199	60	Red cedar, subalpine fir, spruce	21-40	0-10.4	26-35	Low/Medium	1972	
	337	40	Lodgepole pine, douglas fir	121-140	10.5-19.4	36-45	Poor		

..... Continued

Table 2.6 Continued

Imperial Metals Corporation
Mt. Polley Project

Forest Cover Types in Relation to Mine Components

Mine Component	Poly #	Comp* %	Species	Age (yrs)	Height (m)	Crown Closure(%)	Capability Class	Year Logged	Year Planted
Central Pit	199	60	Red cedar, subalpine fir, spruce	21-40	0-10.4	26-35	Low/Medium	1972	
	338	35	Lodgepole pine, douglas fir	101-120	10.5-19.4	36-45	Poor		
	702	5	Red cedar, subalpine fir, (doug, spr)	1-20	0-10.4	26-35	Low/Medium	1972	
Mill Site	199	90	Red cedar, subalpine fir, spruce	21-40	0-10.4	26-35	Low/Medium	1972	
	702	10	Red cedar, subalpine fir, (doug, spr)	1-20	0-10.4	26-35	Low/Medium	1972	
Tailings Facility	14	20	Spruce, (cottonwood)	1-20	0-10.4	16-25	Poor/Good	1970	1975
	159	15	Spruce	1-20	0-10.4	6-15	Poor/Good	1983	1985
	17	15	Spruce	1-20	0-10.4	6-15	Low/Medium	1979	82-86
	681	10	Spruce, cottonwood	1-20	0-10.4	6-15	Poor/Medium	1979	83,86
	51	10	Red cedar, (douglar fir)	251+	19.5-28.4	76-85	Poor		
	12	5	Spruce, subalpine fir	141-250	10.5-19.4	36-45	Poor		
	4	5	Marsh	-	-	-	-		
	688	5	Spruce	1-20	0-10.4	6-15	-	1983	1985
	149	5	Spruce, red cedar, (cottonwood)	1-20	0-10.4	86-95	Medium/Poor	1978	1981
	68	5	Marsh	-	-	-	-		
	2	5	Spruce	141-250	28.5-37.4	56-65	Good		
	9	1	Spruce	1-20	0-10.4	6-15	Low/Good	1979	83-86

* Approximate percentage area of mine component.

(h1221\reclamat\forest.unt)

Table 2.7

Imperial Metals Corporation
Mt. Polley Project

Forest Status and Areas

Mine Component	Area (ha)	Percent Unlogged	Percent Logged
West Waste Dump	11.3	85 %	15%
North Waste Dump	56.8	50%	50%
South Waste Dump	51.7	35%	65%
North Pit	14.7	75%	25%
West Pit	29.9	40%	60%
Central Pit	25.4	35%	65%
Overburden Stockpile	2.8	0%	100%
Mill Site	27.9	0%	100%
Tailings Facility	238.2	30%	70%

(h1221\reclamat\forest2.unt)

Table 2.8

Imperial Metals Corporation
Mt. Polley Project

Ranchers in the Mount Polley Area

Rancher	Number of Cattle	Grazing Period
s.22	105	May 16 - Oct. 15
	250	May 16 - Oct. 15
	75	May 10 - Oct. 15
	105	May 10 - Oct. 31

Source: L. Resh, Ministry of Forests, Cariboo Forest Region, Unpublished data.

HALLAM KNIGHT PIESOLD LTD. ENVIRONMENTAL CONSULTANTS - VANCOUVER, B.C.		IMPERIAL METALS CORPORATION
DESIGNED	MBS	MT. POLLEY PROJECT
DRAWN	VY	TERRAIN CLASSIFICATION SHEET 1 OF 2 FIGURE 2.1
CHECKED	DJR	
APPROVED		

DATE MARCH 14, 1995 | SCALE AS SHOWN | DRG. NO. H1221 | REV.

DRG. NO.	DESCRIPTION
REFERENCE DRAWINGS	

REV.	DATE	DESCRIPTION	APPROVED
REVISIONS			

REV.	DATE	DESCRIPTION	APPROVED
REVISIONS			

TEXTURE

Symbol	Name	Size(mm)	Other Characteristics
a	blocks	>256	angular particles
b	boulders	>256	rounded & subrounded particles
k	cobbles	64–256	rounded & subrounded particles
p	pebbles	2–64	rounded & subrounded particles
s	sand	.062–2	
$	silt	.002–.062	
c	clay	<.002	
d	mixed fragments	>2	mix of rounded and angular particles
g	gravel	>2	mix of boulders, cobbles and pebbles
x	angular fragments	>2	mix of rubble and blocks
r	rubble	2–256	angular particles
m	mud	<.062	mix of clay and silt
y	shells	–	shell or shell fragments
e	fibric	well-preserved fibre; (40%) identified after rubbing	
u	mesic	intermediate decomposition between fibric and mesic	
h	humic	decomposed organic material; (10%) identified after rubbing	

SURFACE EXPRESSION

Symbol	Name	Description
a	moderate slope	Unidirectional surface; >15° to ≤26°
b	blanket	A mantle of unconsolidated material; >1m thick
c	cone	A cone or segment of a cone; >15°
d	depression	A lower area enclosed by higher surrounding terrain
f	fan	A segment of a cone; up to 15°
h	hummocky	Hillocks and hollows, irregular in plan; 15–35°
j	gentle slope	Unidirectional surface; >3° and ≤15°
k	moderately steep	Unidirectional surface; >26° and ≤35°
m	rolling	Elongate hillocks; 3 to 15° ; parallel forms in plan
p	plain	Unidirectional surface; up to 3°
r	ridged	Elongate hillocks; 15 to 35° ; parallel forms in plan
s	steep	Steep slopes; >35°
t	terraced	Step-like topography
u	undulating	Hillocks and hollows; up to ≤15° ; irregular in plan
v	veneer	Mantle of unconsolidated material; 10cm to 1m thick

SURFICIAL MATERIALS

Symbol	Name	(Assumed Status of Formative Process)	Description
A	anthropogenic	(A)	Man-made or man-modified materials
C	colluvial	(A)	Products of mass wastage
D	weathered bedrock	(A)	In situ, decomposed bedrock
E	eolian	(I)	Materials deposited by wind action
F	fluvial	(I)	River deposits
F^G	glaciofluvial	(I)	Ice contact fluvial materials
I	ice	(A)	Permanent snow, glaciers and icefields
L	lacustrine	(I)	Lake sediments; includes wave deposits
L^G	glaciolacustrine	(I)	Ice contact lacustrine materials
M	morainal	(I)	Material deposited directly by glaciers
O	organic	(A)	Accumulation/decay of vegetative matter
R	bedrock	(–)	Outcrops/rock covered by less than 10cm
U	undifferentiated	(–)	Layered sequence; three materials or more
V	volcanic	(I)	Unconsolidated pyroclastic sediments
W	marine	(I)	Marine sediments; includes wave deposits
W^G	glaciomarine	(I)	Ice contact marine sediments

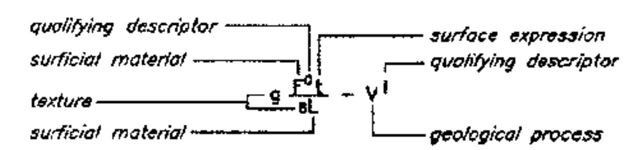
GEOLOGICAL PROCESSES

Symbol	Name	(Assumed Process Status)	Description
A	avalanches	(A)	Terrain modified by snow avalanches
B	braiding	(A)	Diverging/converging channels; unvegetated bars
C	cryoturbation	(A)	Sediments modified by frost heaving and churning
D	deflation	(A)	Removal of sand and silt by wind action
E	channelled	(I)	Channel formation by meltwater
F	slow mass movement	(A)	Slow downslope movement of masses of cohesive or non-cohesive material and/or bedrock
H	kettled	(I)	Depressions due to the melting of buried glacier ice
I	irregular channel	(A)	A single, clearly defined main channel displaying irregular turns and bends
J	anastamosing channel	(A)	A channel zone where channels diverge and converge converge around many vegatated islands
K	karst	(A)	Processes associated with the solution of carbonates
M	meandering channel	(A)	Channel characterized by a regular pattern of bends with uniform amplitude and wave length
N	nivation	(A)	Erosion beneath and along the margin of snow patches
P	piping	(A)	Subterranean erosion by flowing water
R	rapid mass movement	(A)	Rapid downslope movement of dry, moist or saturated debris
S	solifluction	(A)	Slow downslope movement of saturated overburden across a frozen or otherwise impermeable substrate
U	inundation	(A)	Seasonally under water due to high watertable
V	gully erosion	(A)	Parallel/subparallel ravines due to running water
W	washing	(A)	Modification by wave action
X	permafrost	(A)	Processes controlled by the presence of permafrost
Z	periglacial processes	(A)	Solifluction, cryoturbation and nivation processes occurring within a single unit

MAP UNIT LETTER NOTATION

A terrain map unit symbol is composed of a combination of letters which designate different characteristics of the terrain. The relative position of letters within the symbol indicates the characteristics that they represent.

SAMPLE TERRAIN UNIT SYMBOL

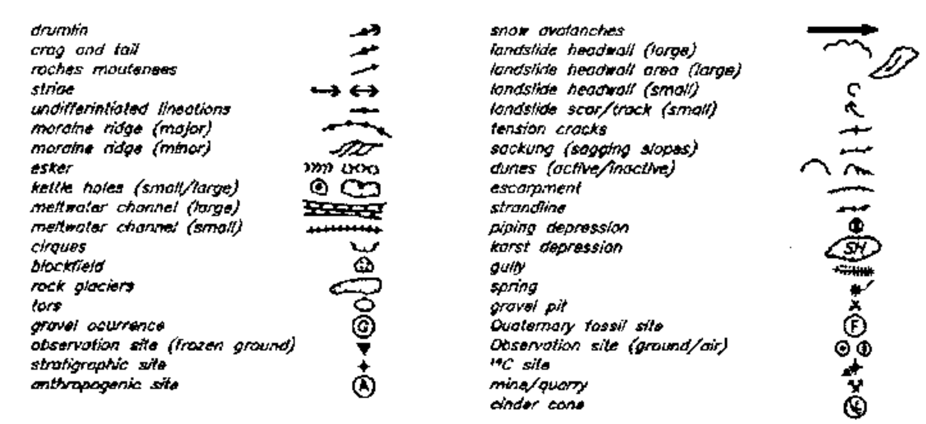


This map unit consists of a gravelly glaciofluvial terrace that overlies sandy lacustrine materials and is modified by gullies that are no longer active.

Explanatory Notes

1. Units consisting of two or more types of terrain are designated by two or more groups of letters separated by slashes and/or dots

ON-SITE SYMBOLS



QUALIFYING DESCRIPTORS

Symbol	Name	Description
G	glacial	Used to qualify surficial materials where there is evidence that glacier ice affected the mode of deposition of materials
A	active	Used to qualify surficial materials and geological processes with regard to their current state of activity
I	inactive	

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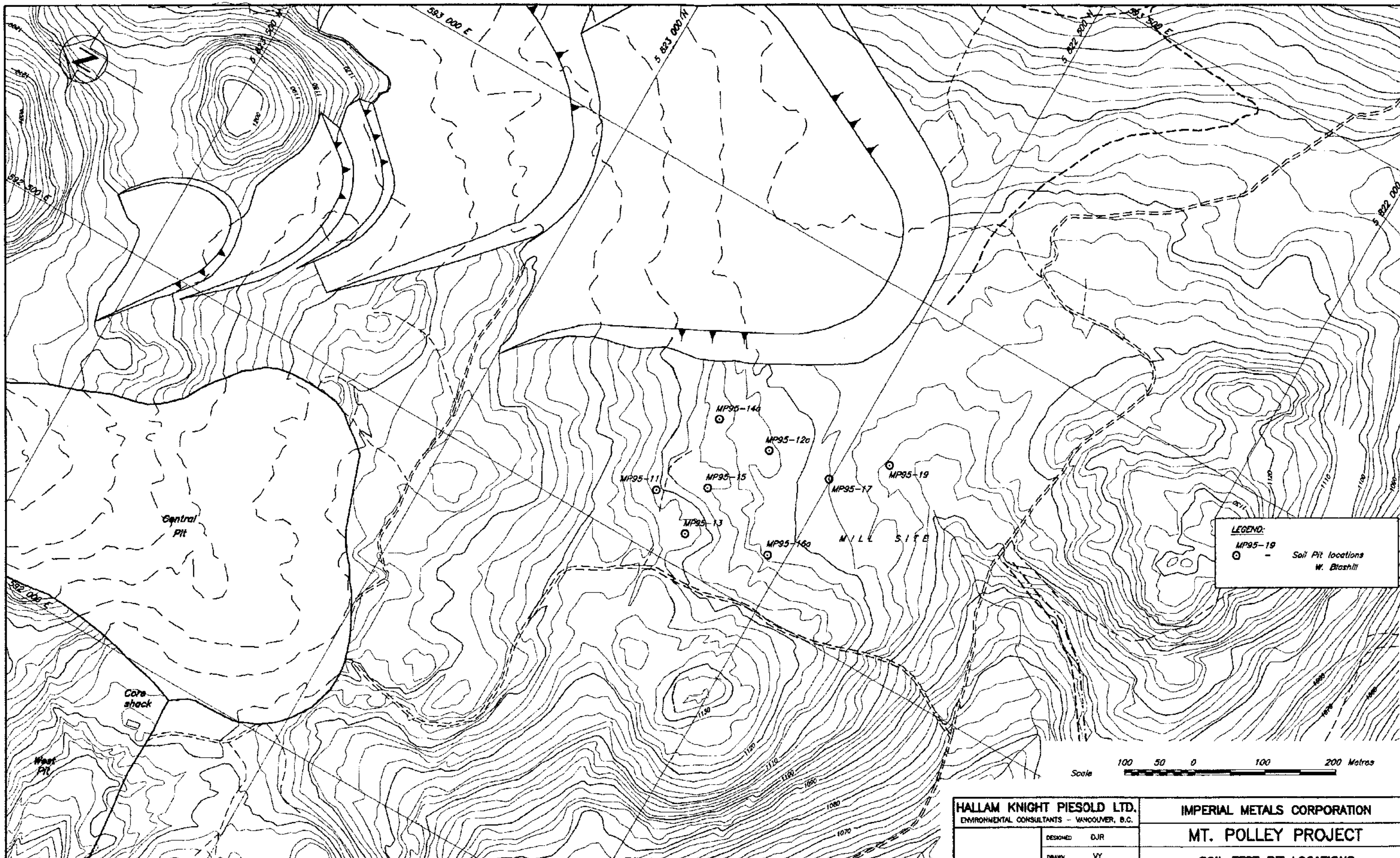
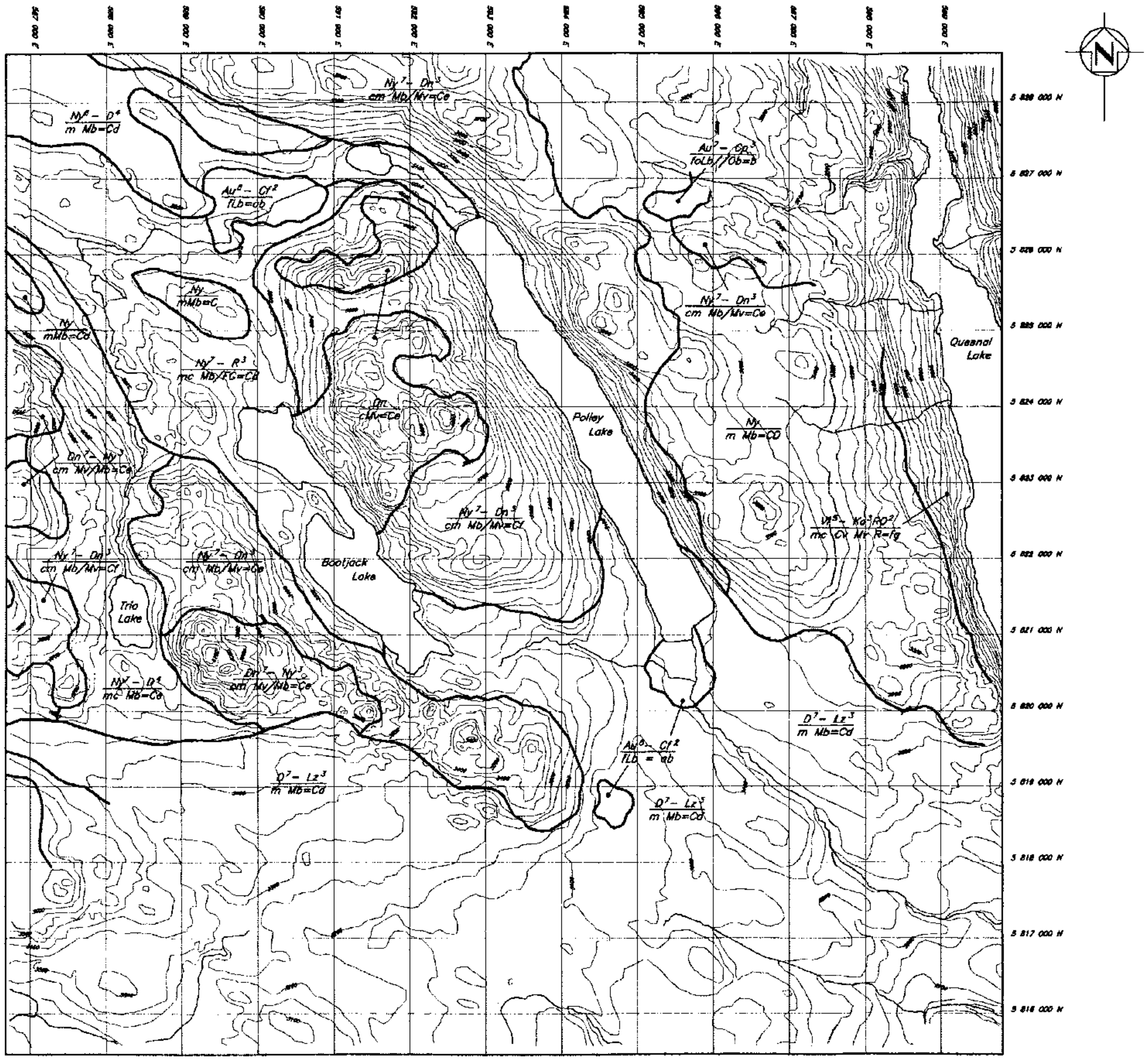
DESIGNED MBS	MT. POLLEY PROJECT
DRAWN W.A.Lahoda	TERRAIN CLASSIFICATION LEGEND SHEET 2 OF 2 FIGURE 2.1
CHECKED DJR	
APPROVED	
DATE MARCH 14, 1995	SCALE AS SHOWN — DRG. NO. H1221 — REV. A

DRG. NO.	DESCRIPTION	REV.	DATE	DESCRIPTION	APPROVED	REV.	DATE	DESCRIPTION	APPROVED
REFERENCE DRAWINGS		REVISIONS				REVISIONS			



ORG. NO.	DESCRIPTION	REV.	DATE	DESCRIPTION	APPROVED	REV.	DATE	DESCRIPTION	APPROVED		
REFERENCE DRAWINGS		REVISIONS				REVISIONS					

HALLAM KNIGHT PIESOLD LTD. ENVIRONMENTAL CONSULTANTS – VANCOUVER, B.C.		IMPERIAL METALS CORPORATION
	DESIGNED DJR	MT. POLLEY PROJECT
	DRAWN VY	SOIL TEST PIT LOCATIONS MARCH 1995 FIGURE 2.2
	CHECKED DJR	
	APPROVED	
DATE MARCH 15, 1995	SCALE AS SHOWN	DRG. NO. H1221 REV.



NOTE:
Contours are in feet.

Scale 1000 500 0 1000 2000 3000 Metres

HALLAM KNIGHT PIESOLD LTD. ENVIRONMENTAL CONSULTANTS – VANCOUVER, B.C.	IMPERIAL METALS CORPORATION
DESIGNED DJR	MT. POLLEY PROJECT
DRAWN VY	SOILS AND LANDFORMS IN THE MOUNT POLLEY AREA SHEET 1 OF 2 FIGURE 2.3
CHECKED –	
APPROVED	
DATE ———	SCALE AS SHOWN
DRG. NO. H1221	REV. —

DRG. NO.	DESCRIPTION	REV.	DATE	DESCRIPTION	APPROVED	REV.	DATE	DESCRIPTION	APPROVED
REFERENCE DRAWINGS		REVISIONS				REVISIONS			

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
SOILS AND LANDFORMS MAP LEGEND

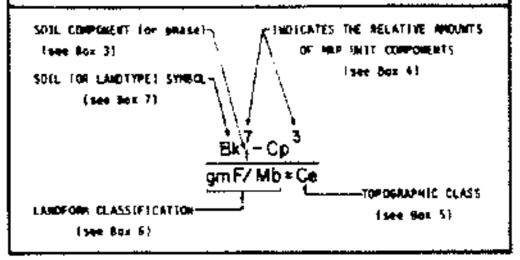
1. Explanatory Notes

The information contained in the following boxes explains some important characteristics of the soils and landforms that were mapped at a reconnaissance level of investigation. Each of the individual boxes is cross referenced.

The information provided in this legend is brief. Further details on the soils and their environment are provided in the soil reports and maps for adjoining soil survey areas No. 24,25,31,36 and 40. The report and maps Soils of the Horsefly Area is in preparation for printing.

This key describes all soils and landforms mapped at a scale of 1:50 000 for maps 93A/3,4,5,6,11,12,13,14

2. Example



3. Soil Components

Where soil components are used they are shown and characterized in Box 7. Some map unit numbers refer to soil component numbers used in adjoining survey areas.

4. Composite Units

Composite units are employed where two or three types of map unit components are intermixed or occupy such small areas that they cannot be designated as separate units at the scale of mapping.

Numbers show the relative amounts of each soil or land type component of a map unit as: 9 (90%), 8 (80%), 7 (70%), 6 (60%), 5 (50%), 4 (40%), 3 (30%), 2 (20%), 1 (10%).

The components of the denominator are described in Boxes 5 and 6.

5. Topographic Classes[1]

Simple Topography	Complex Topography	Slope
Single Slopes (regular surface)	Complex Slopes (irregular surface)	%
A depressional to level	a nearly level	0-0.5
B very gently sloping	b gently undulating	0.5-2
C gently sloping	c undulating	2-5
D moderately sloping	d gently rolling	5-9
E strongly sloping	e moderately rolling	9-15
F steeply sloping	f strongly rolling	15-30
G very steeply sloping	g hilly	30-60
H extremely sloping	h very hilly	over 60

[1]Ref. The System of Soil Classification for Canada 1974, (revised).

6. Landform Classification

gMb/F[G]

Texture (Particle Size)
- c - coarse
- m - medium
- f - fine
- g - gravelly
- *l - loamy
- *s - sandy
- *cl - clayey

(* used in Box 7 only)

Genetic Material
- C - colluvial
- E - eolian
- F - fluvial
- L - lacustrine
- M - morainal (till)
- O - organic
- R - bedrock

Surface Expression
- a - apron
- b - blanket
- f - fan
- h - hummocky
- m - rolling
- p - plain
- r - ridged
- t - terraced
- v - veneer

Modifying Process
- G - glacio

/ means component on left side of slash is more abundant than that on the right side
// means component on the left is considerably more abundant
no symbol means components are about equal in amount

8. Forest Zonation Symbols[1]

Biogeoclimatic zones and subzones are used instead of forest zones.

AT	Alpine Tundra Zone
ESSFb	Engelmann Spruce - Subalpine Fir (wet subzone)
IWHa	Interior Western Hemlock (cedar subzone)
IWHb	Interior Western Hemlock (wet subzone)
SBSb	Subboreal Spruce (Douglas fir - white spruce subzone)
SBSc	Subboreal Spruce (white spruce - subalpine fir - Douglas fir subzone)
IDF b	Interior Douglas fir (pinegrass subzone)

[1]Ref. Annas & Coupé 1979

9. Drainage Classes

r	Rapidly drained	The soil moisture content seldom exceeds field capacity in any horizon except immediately after water additions.
w	Well drained	The soil moisture content does not normally exceed field capacity in any horizon (except possibly the C) for a significant part of the year.
m	Moderately well drained	The soil moisture in excess of field capacity remains for a small but significant period of the year.
i	Imperfectly drained	The soil moisture in excess of field capacity remains in subsurface horizons for moderately long periods during the year.
p	Poorly drained	The soil moisture in excess of field capacity remains in all horizons a larger part of the year.
vp	Very poorly drained	Free water remains at or within 12 inches (30 cm) of the surface most of the year.

10. References

E.L.U.C. Secretariat, 1976 - Terrain Classification System

Canada Soil Survey Committee (C.S.S.C.), 1978 - The Canadian System of Soil Classification, Can. Dep. Agric. Publ. 1646

Annas, R.M. and R. Coupe 1979. Biogeoclimatic zones and subzones of the Cariboo Forest Region.

Soil Survey Reports No. 2, 4, 10, 25, 31, 36.

Background Materials

Holland, S.S., 1976 - Landforms of British Columbia: A Physiographic Outline, B.C. Dept. of Mines and Petroleum Resources, Bull. 48

Soil Data File contains physical and chemical data of most soil associations described in the area.

Maps and reports available from and information from SDF (see key):

The Map Library
Assessment and Planning Division
Ministry of Environment
Parliament Buildings
Victoria, B.C.
V8V 1X4

11. Credits

Mapping by T. Lord, Agriculture Canada

Mapping correlated by T. Lord, Agriculture Canada

Date of field mapping: 1971-73

Photography used for Mapping:

Date: 1970

Scale: 80ch ,40ch

Drafted by Cartography Section, Resource Analysis Branch, Ministry of Environment, Victoria, British Columbia

Date: 1972

Revision Dates: 1976, 1980, ___, ___.

Base map provided by Map Production Division, Surveys and Mapping Branch, Ministry of Environment, Victoria, British Columbia

7. SOIL ASSOCIATION DESCRIPTIONS

Symbol	Map Unit	Biogeoclimatic Zones and Sub-Zones (see Box 8)	Soil Parent Material (see Box 6)	Most Common Soil	Most Common Soil Drainage (see Box 9)	Comments
Au	Ahbau	SBS b,c	l & clM	Orthic Luvic Gleysol	p	associated with Chief soils
B	Bednesti	SBS b	lL	Brunisolic Gray Luvisol	m	in soil Reports No. 2, 4, 10, 31
Cf	Chief	SBS b,c	O	Typic Mesisol	vp	in Soil Reports No. 2, 31
Cp	Captain Creek	IWH b, ESSF b	glm	Orthic Humo-Ferric Podzol	m	seepage areas common
D	Deserters	SBS b	gslm	Brunisolic Gray Luvisol	m	drumlinized areas of Fraser Plateau
Dn	Dragon	SBS b, IWH a	slMv	Orthic Humo-Ferric Podzol	w	on high areas of the plateau
(E)	eroded phase					
Hr	Heger	SBS b, ESSF b	gsC	Eluviated Dystric Brunisol	w	associated with lithic soils overlying metamorphic rock
Ko_1	Keno Lake	IWH b	gsM	Orthic Humo-Ferric Podzol	w	
Ko_2	Keno Lake	IWH b	gsM	Orthic Humo-Ferric Podzol	w	associated with imperfectly drained soils
Lz	Lanezi	IWh a	lm	Luvisolic Humo-Ferric Podzol	m	similar to Dominion soils
Ny	Nyland	SBS b	lM	Podzolic Gray Luvisol	m	similar to Dominion soils (Report 23)
R	Ramsey	SBS b, IWH b	gsFG	Orthic Humo-Ferric Podzol	r	wetter valleys
RO	Rockland	land type				
Vi	Viewland	ESSF b	gslM	Lithic Humo-Ferric Podzol	r	similar to Keno Lake soils

SOILS LEGEND

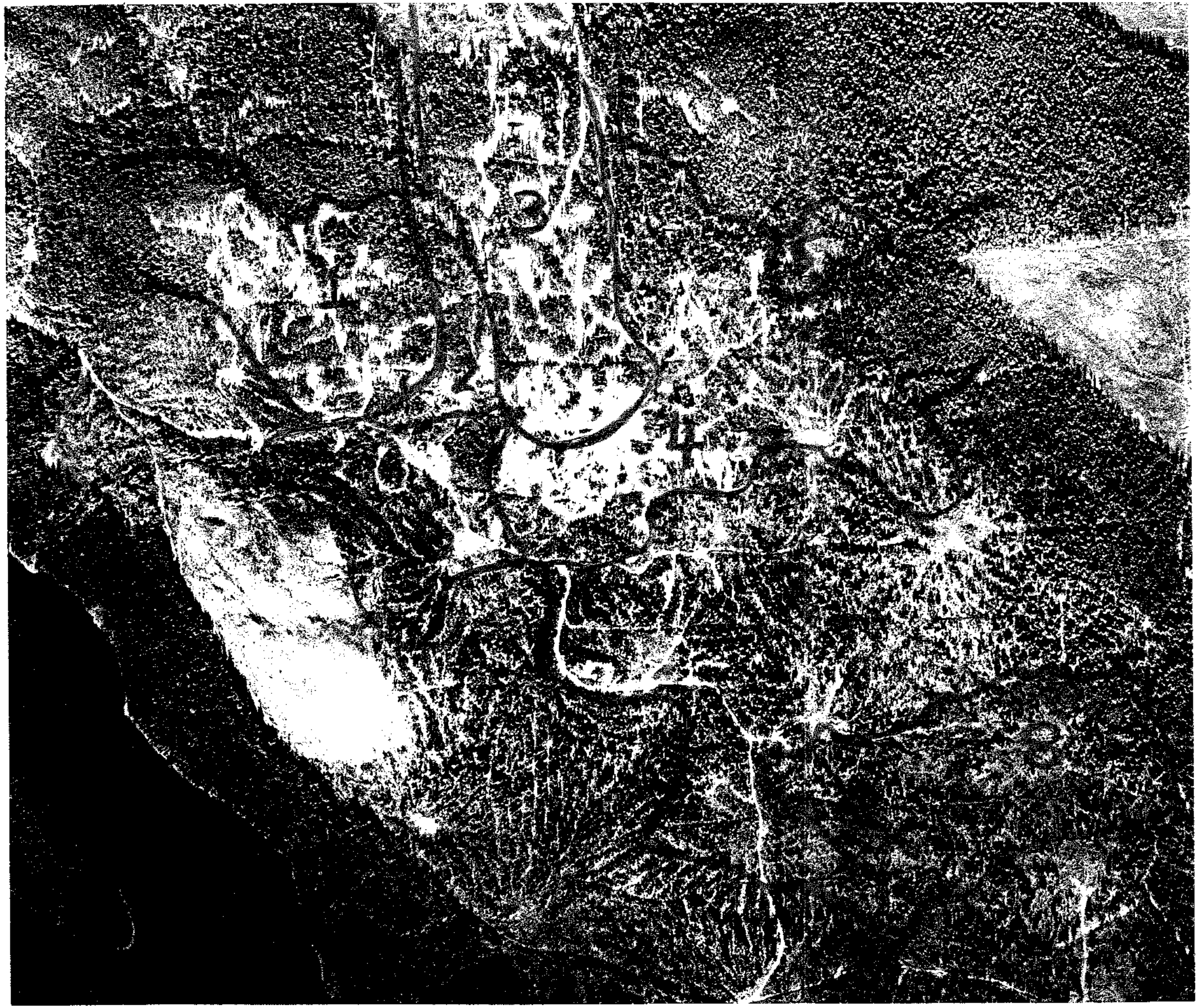
For the Horsefly River — Keithley Creek Map Area

Sheet 2 of 2

Mar. 23, 1995

HALLAM KNIGHT PIESOLD LTD.
ENVIRONMENTAL CONSULTANTS

FIGURE 2.3



LEGEND

UNIT #	TERRAIN SYMBOL	AGRICULTURAL CAPABILITY
1	Cv/Mv over Rka	7T (3C)
2	Ma	6T (3C)
3	Mv//Cv over Rak	6T (3C)
4	Mvb over Rj	4^{P}_{T} (3C)
5	Ob	O7W (3C)
6	Mbv over Rj	4^{P}_{T} (3C)
7	Mj/Mb over Rju	4^{P}_{T} (3C)
8	Obv over L^G	O7W (3C)

Terrain Symbols

C - colluvial
M - morainal
L^G - glacio-lacustrine
R - Bedrock
O - organic
k - moderately steep
a - apron
v - veneer
b - blanket
j - gentle slope
u - undulating
/ - component to the left is more extensive.
// - component to the left is considerably more extensive.

Agricultural Capability

7 - Soils have no capability for arable culture or permanent pasture.
6 - Soils are capable only of producing perennial forage crops, and improvement practices are not feasible.
4 - Soils have severe limitations that restrict crop range or require special conservation.
O - organic soils
T - adverse topography
P - stoniness
W - excess water
(3C) - limitations of climate to agricultural production.

IMPERIAL METALS CORPORATION

MT. POLLEY PROJECT

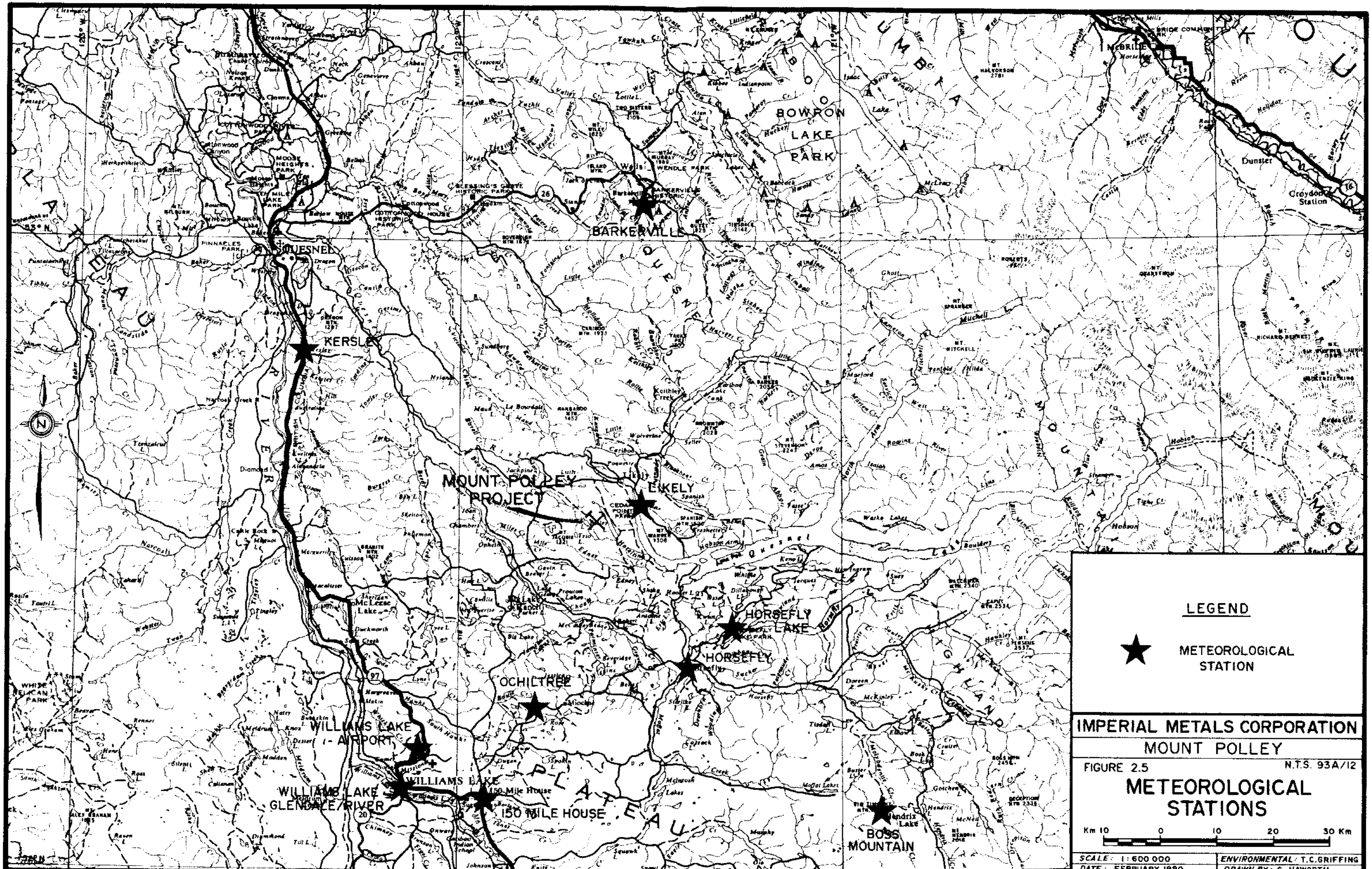
MARCH 1995 SOILS MAP

(W. Blashill)

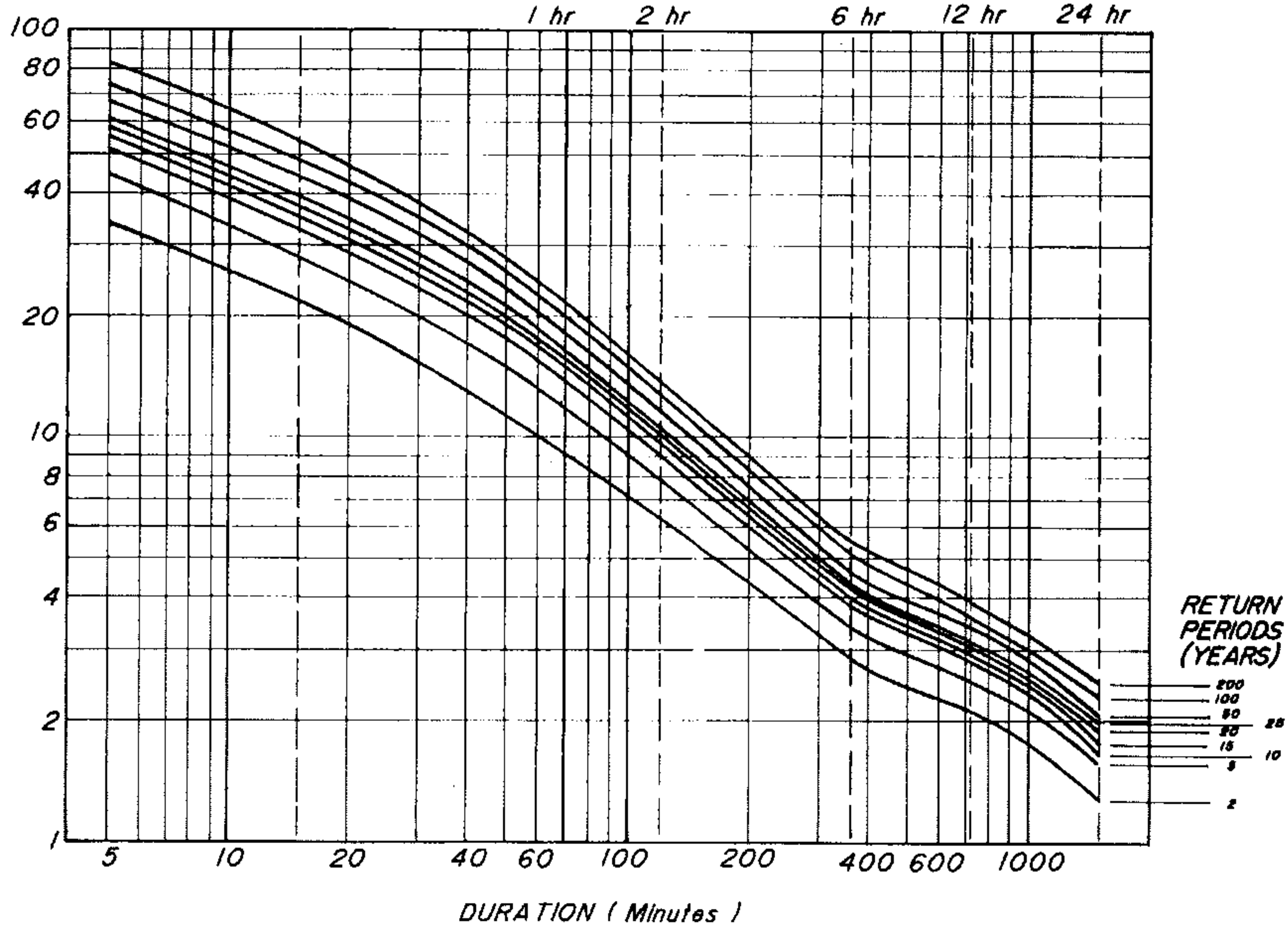
Mar. 30, 1995

HALLAM KNIGHT PIESOLD LTD.
ENVIRONMENTAL CONSULTANTS

FIGURE 2.4

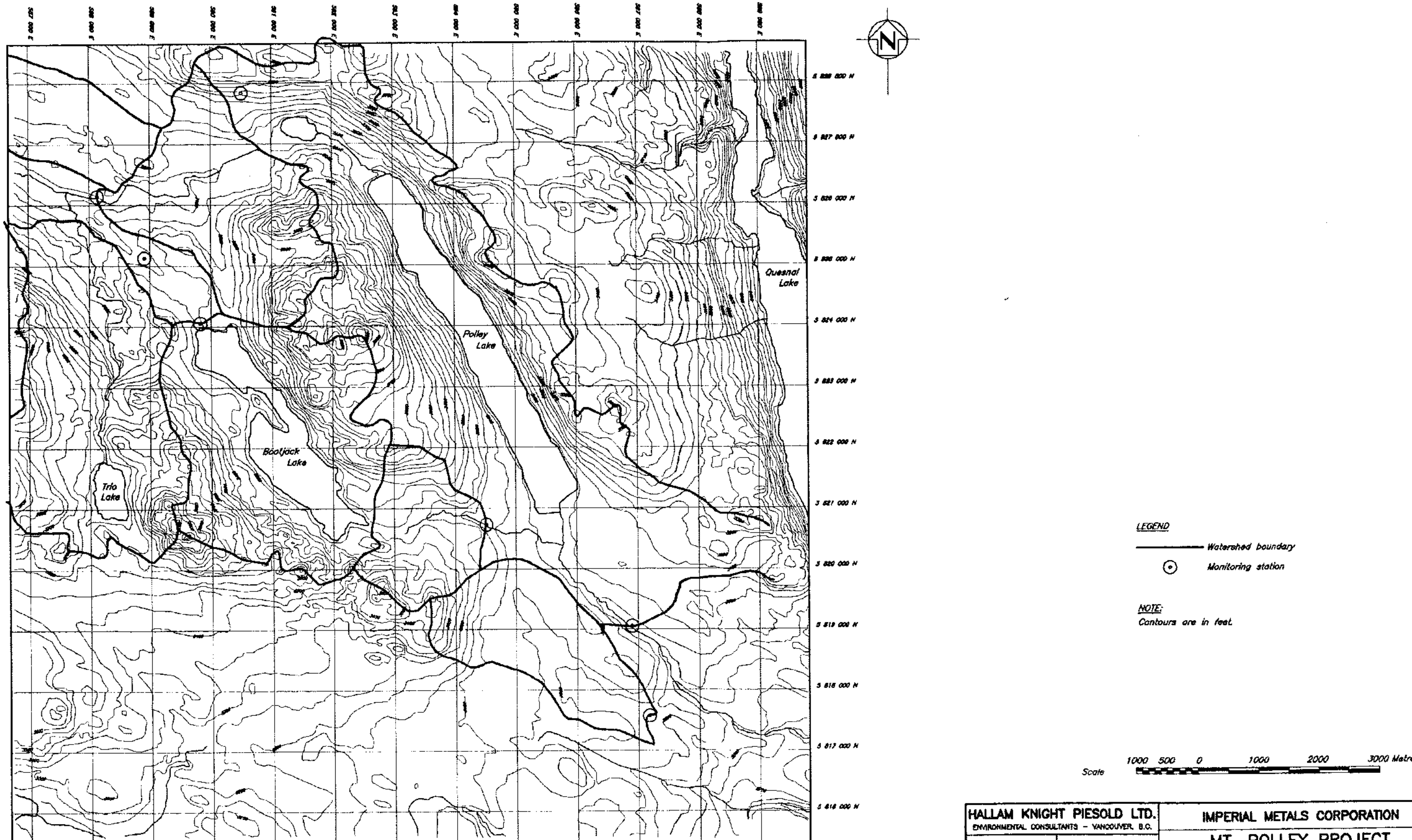

LEGEND
METEOROLOGICAL STATION
IMPERIAL METALS CORPORATION
MOUNT POLLEY
FIGURE 2.5
N.T.S. 93A/12
METEOROLOGICAL STATIONS
Km 10 0 10 20 30 Km
SCALE: 1:600 000
DATE: FEBRUARY 1990
ENVIRONMENTAL: T.C.GRIFFING
DRAWN BY: S. HAWORTH
MOUNT POLLEY PROJECT
BARKERVILLE
KERSLEY
LIKELY
HORSEFLY LAKE
HORSEFLY
OCHILTREE
WILLIAMS LAKE AIRPORT
WILLIAMS LAKE
WILLIAMS LAKE GLENDALE RIVER
150 MILE HOUSE
BOSS MOUNTAIN
QUESNEL
BOWRON LAKE PARK
PLATEAU
Dunster
McBride
Croydon Station

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
SHORT DURATION RAINFALL INTENSITY - DURATION - FREQUENCY DATA FOR MINE SITE



HALLAM KNIGHT PIESOLD LTD.
ENVIRONMENTAL CONSULTANTS

FIGURE 2.6

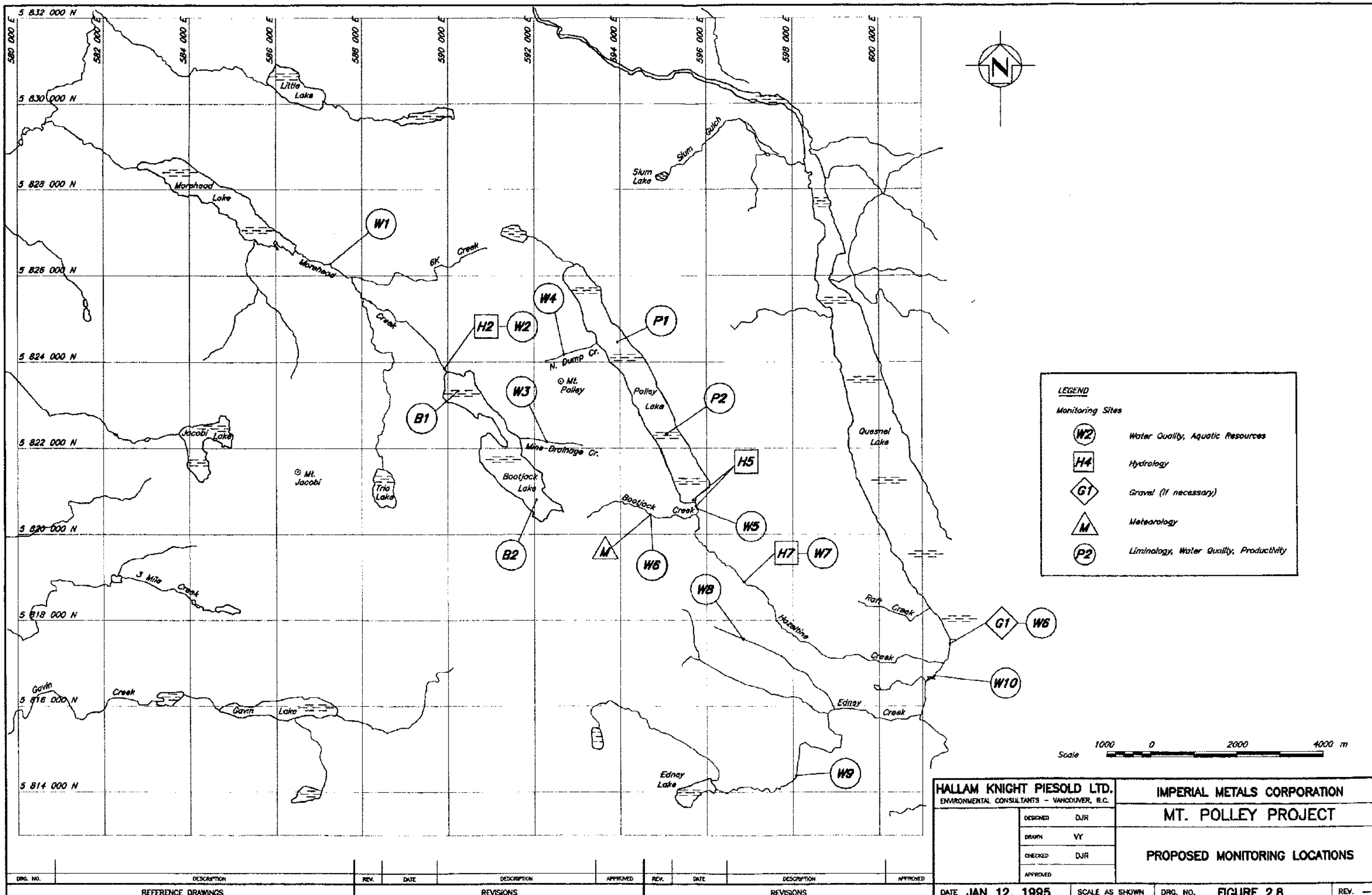


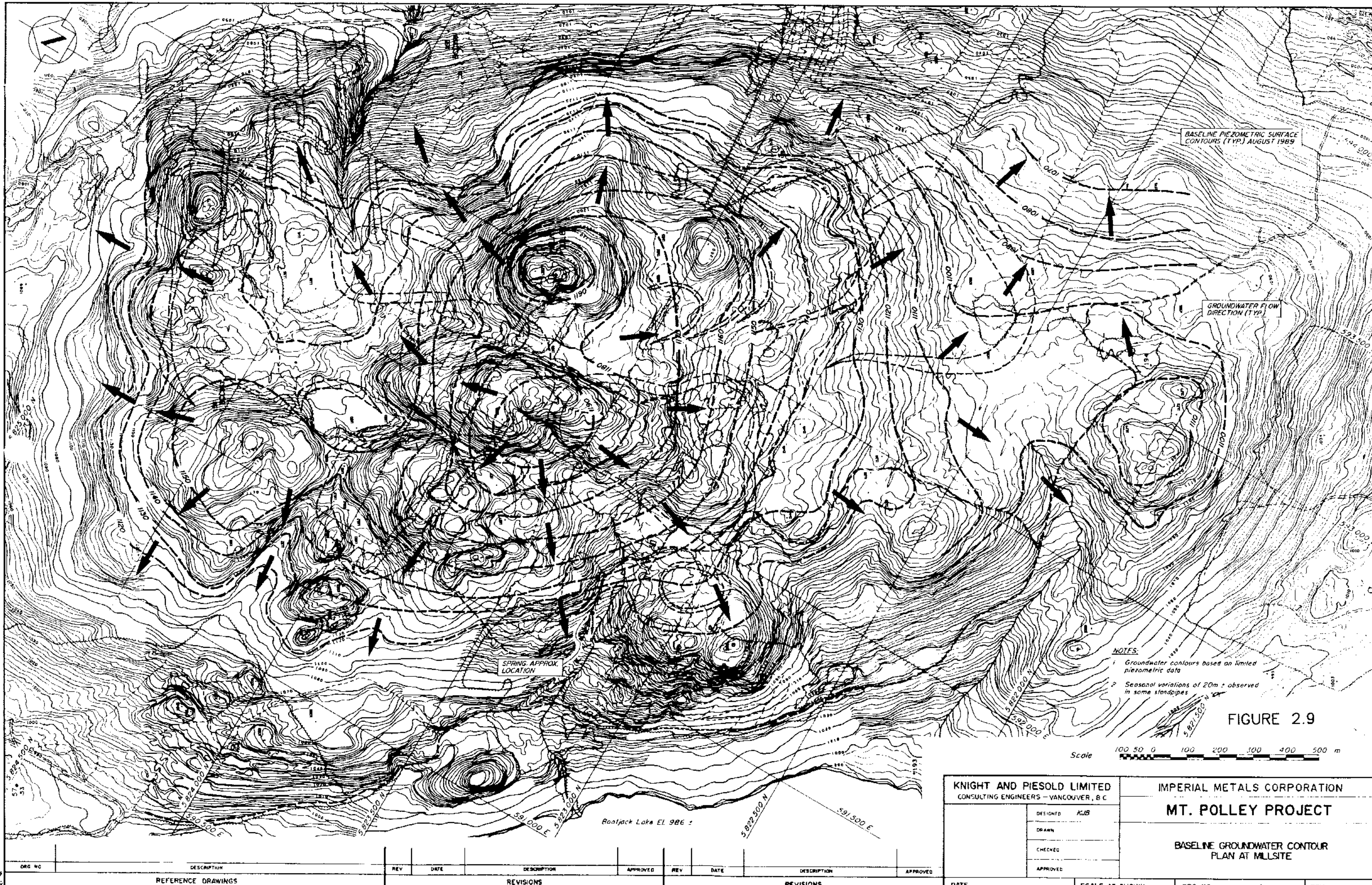
HALLAM KNIGHT PIESOLD LTD. ENVIRONMENTAL CONSULTANTS – VANCOUVER, B.C.		IMPERIAL METALS CORPORATION	
DESIGNED	DJR	MT. POLLEY PROJECT	
DRAWN	VY	WATERSHEDS IN THE MOUNT POLLEY AREA FIGURE 2.7	
CHECKED	–		
APPROVED			
DATE	———	SCALE AS SHOWN	DRG. NO. H1221 REV. –

DRG. NO.	DESCRIPTION
REFERENCE DRAWINGS	

REV.	DATE	DESCRIPTION	APPROVED
REVISIONS			

REV.	DATE	DESCRIPTION	APPROVED
REVISIONS			

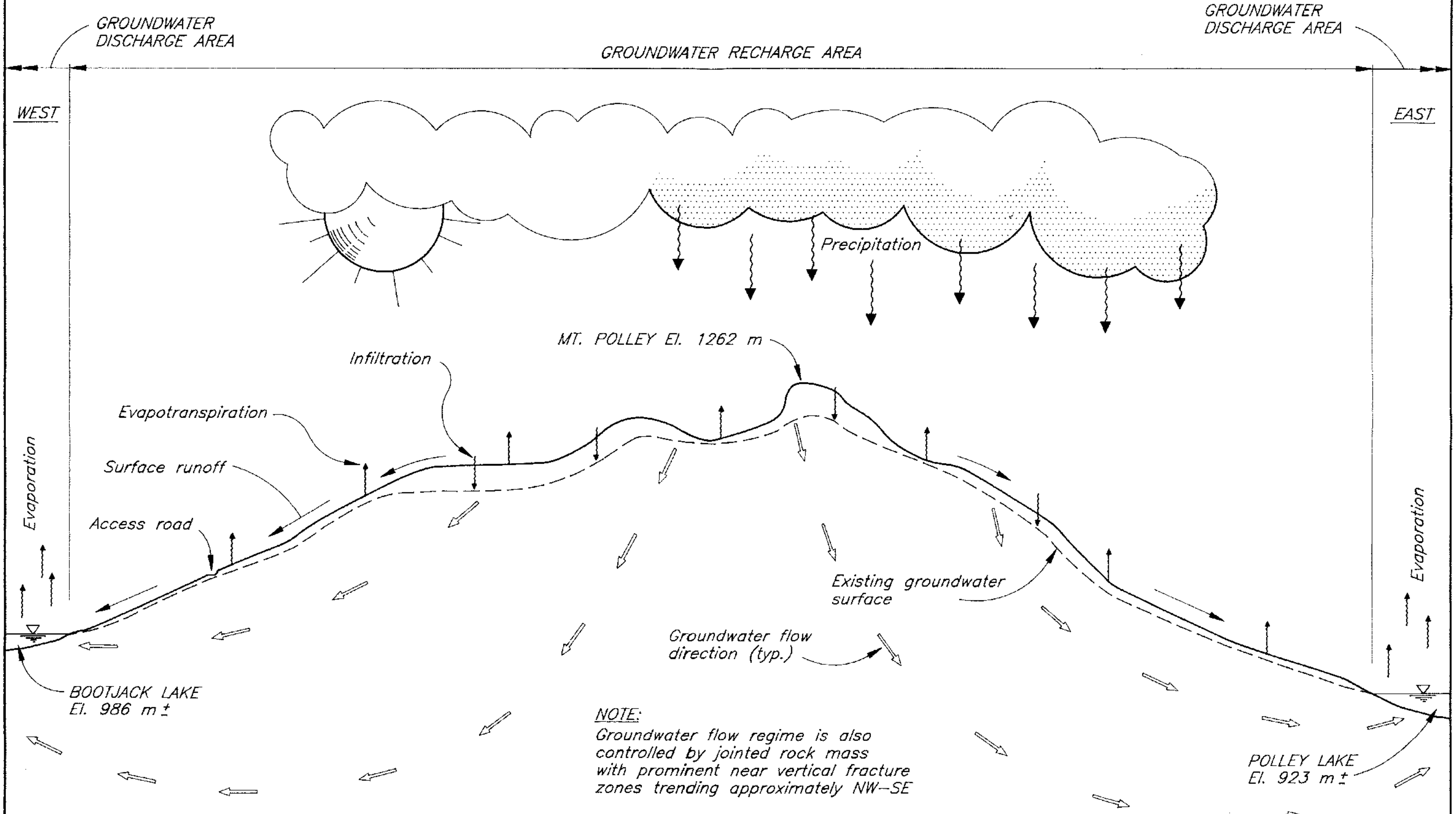

N
5 832 000 N
5 830 000 N
5 828 000 N
5 826 000 N
5 824 000 N
5 822 000 N
5 820 000 N
5 818 000 N
5 816 000 N
5 814 000 N
580 000 E
582 000 E
584 000 E
586 000 E
588 000 E
590 000 E
592 000 E
594 000 E
596 000 E
598 000 E
600 000 E
Little Lake
Morehead Lake
Morehead
Creek
6K Creek
Slum Lake
Slum Gulch
N. Dump Cr.
Mt. Polley
Polley Lake
Mine Drainage Cr.
Jacobi Lake
Mt. Jacobi
Trio Lake
Bootjack Lake
Bootjack Creek
3 Mile Creek
Quesnel Lake
Raft Creek
Hazeltine Creek
Edney Creek
Edney Lake
Gavin Creek
Gavin Lake
W1
W2
W3
W4
W5
W6
W7
W8
W9
W10
H2
H5
H7
B1
B2
P1
P2
M
G1
LEGEND
Monitoring Sites
W2 Water Quality, Aquatic Resources
H4 Hydrology
G1 Gravel (if necessary)
M Meteorology
P2 Liminology, Water Quality, Productivity
Scale
1000 0 2000 4000 m
HALLAM KNIGHT PIESOLD LTD.
ENVIRONMENTAL CONSULTANTS - VANCOUVER, B.C.
DESIGNED DJR
DRAWN VY
CHECKED DJR
APPROVED
IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
PROPOSED MONITORING LOCATIONS
DATE JAN 12, 1995
SCALE AS SHOWN
DRG. NO. FIGURE 2.8
REV. -
DRG. NO.
DESCRIPTION
REFERENCE DRAWINGS
REV.
DATE
DESCRIPTION
APPROVED
REVISIONS
REV.
DATE
DESCRIPTION
APPROVED
REVISIONS


BASELINE PIEZOMETRIC SURFACE CONTOURS (TYP.) AUGUST 1989
GROUNDWATER FLOW DIRECTION (TYP)
SPRING APPROX. LOCATION
Bootjack Lake El. 986 ±
NOTES:
1. Groundwater contours based on limited piezometric data
2. Seasonal variations of 20m ± observed in some standpipes
FIGURE 2.9
Scale 100 50 0 100 200 300 400 500 m
KNIGHT AND PIESOLD LIMITED
CONSULTING ENGINEERS – VANCOUVER, B.C.
DESIGNED KJB
DRAWN
CHECKED
APPROVED
IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
BASELINE GROUNDWATER CONTOUR PLAN AT MILLSITE
DATE
SCALE AS SHOWN
DRG NO
REV
DRG NO
DESCRIPTION
REFERENCE DRAWINGS
REV
DATE
DESCRIPTION
APPROVED
REVISIONS
REV
DATE
DESCRIPTION
APPROVED
REVISIONS

IMPERIAL METALS CORPORATION

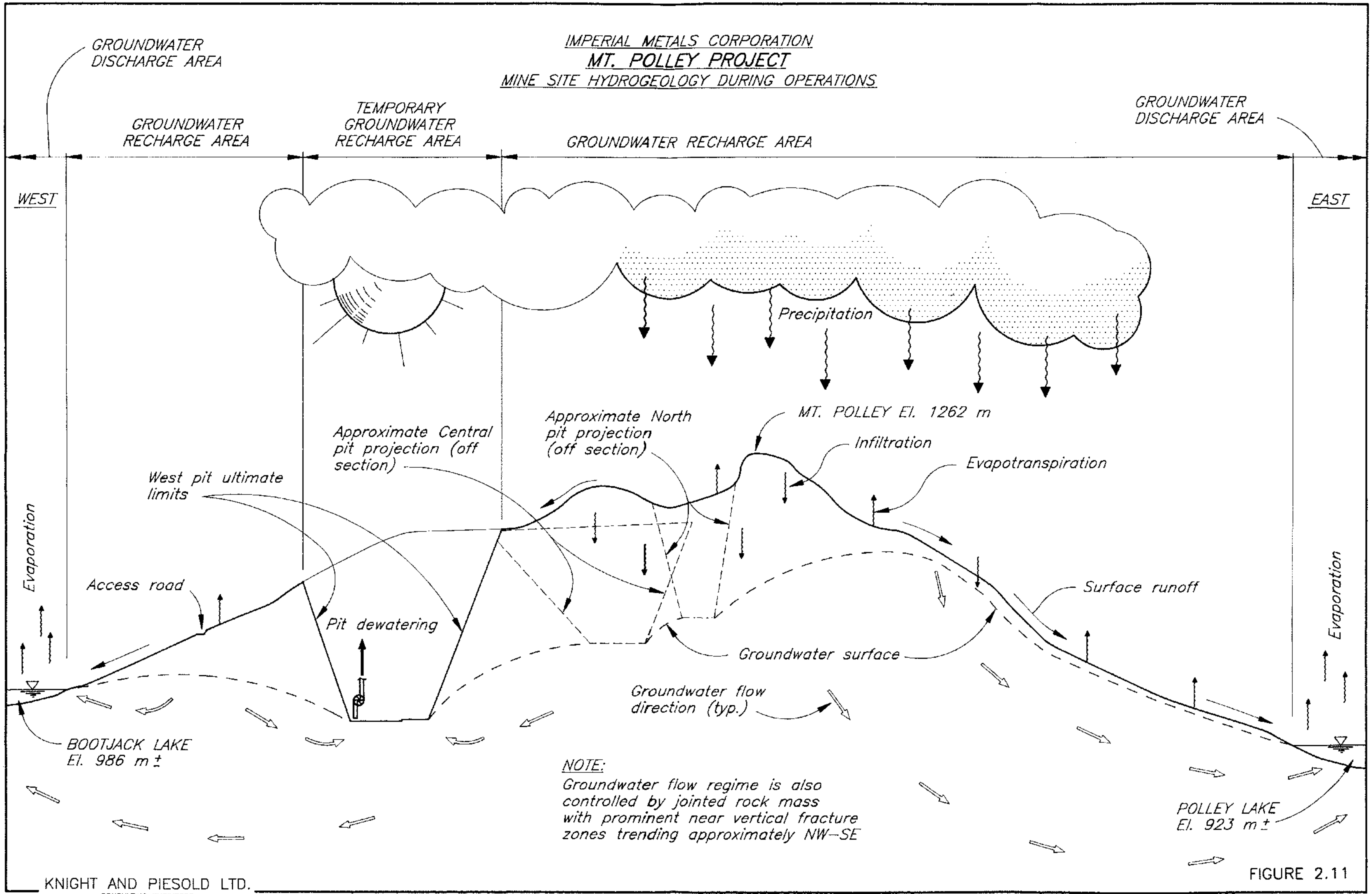
MT. POLLEY PROJECT

BASELINE MINE SITE HYDROGEOLOGY



KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

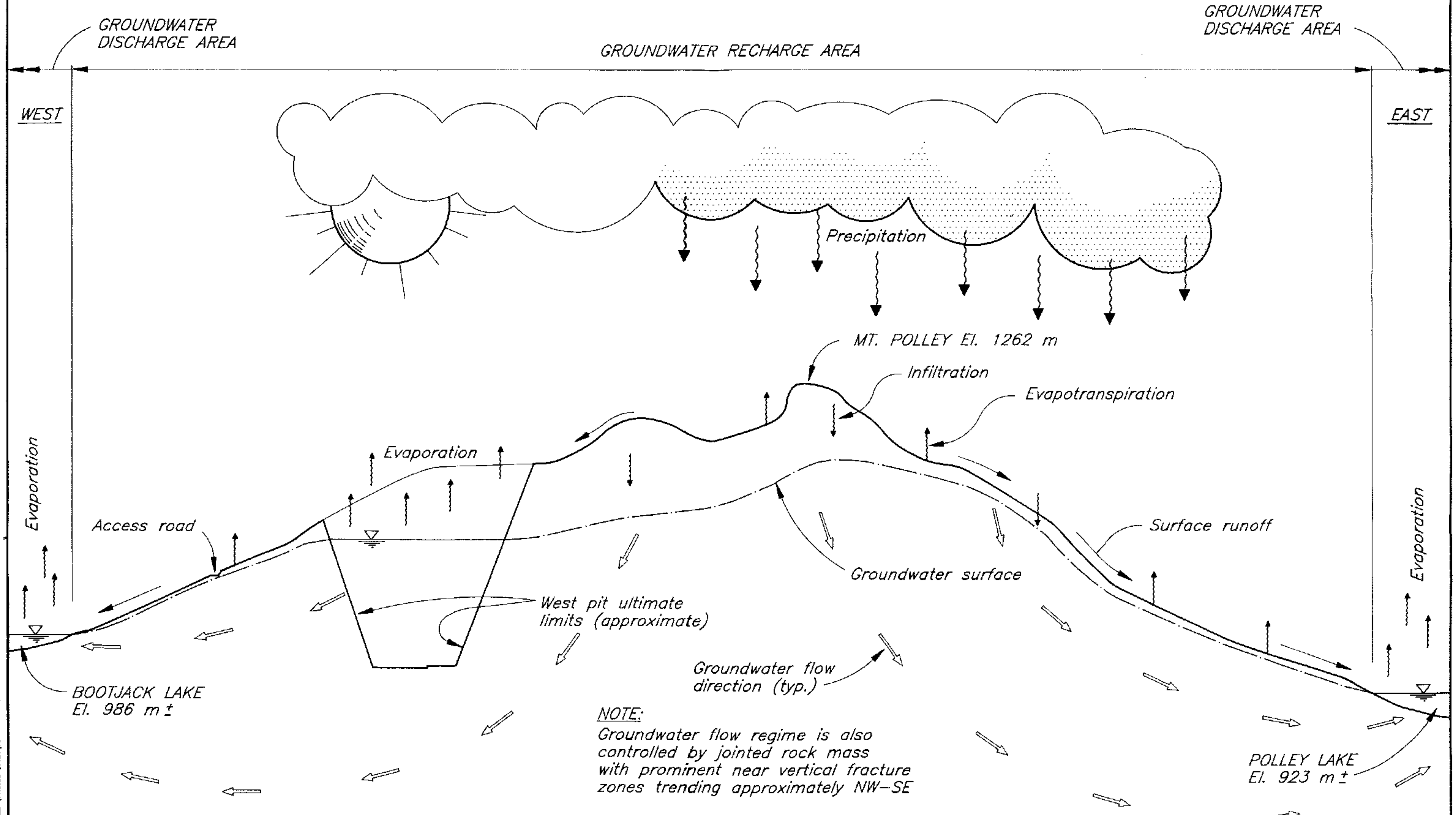
FIGURE 2.10


IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
MINE SITE HYDROGEOLOGY DURING OPERATIONS
GROUNDWATER DISCHARGE AREA
GROUNDWATER RECHARGE AREA
TEMPORARY GROUNDWATER RECHARGE AREA
GROUNDWATER RECHARGE AREA
GROUNDWATER DISCHARGE AREA
WEST
EAST
Precipitation
MT. POLLEY El. 1262 m
Approximate North pit projection (off section)
Approximate Central pit projection (off section)
Infiltration
Evapotranspiration
West pit ultimate limits
Evaporation
Access road
Pit dewatering
Surface runoff
Evaporation
Groundwater surface
Groundwater flow direction (typ.)
BOOTJACK LAKE El. 986 m±
NOTE:
Groundwater flow regime is also controlled by jointed rock mass with prominent near vertical fracture zones trending approximately NW–SE
POLLEY LAKE El. 923 m±
KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS
FIGURE 2.11

IMPERIAL METALS CORPORATION

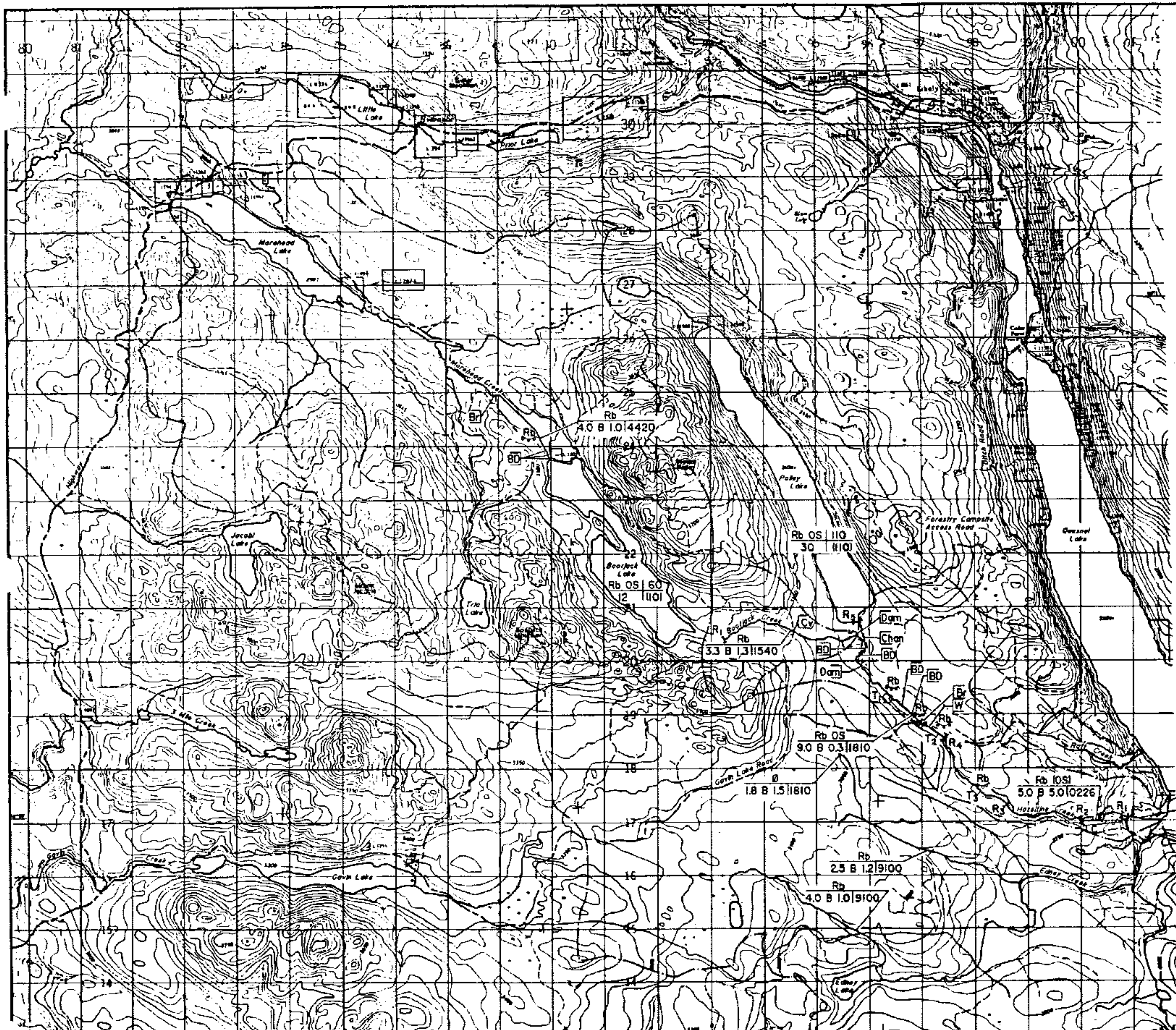
MT. POLLEY PROJECT

LONG TERM SITE HYDROGEOLOGY AFTER CLOSURE



KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

FIGURE 2.12



AQUATIC BIOPHYSICAL

STREAM SYMBOL

Rb Ch (Co)
9 B 1.5|2341

Fish Species
Rainbow trout (present)
Chinook (migration)
Coho (probable)

Channel Components (see Box 4)
Width = 9 metres
Valley flat to channel ratio is between 2 and 5
Average reach slope = 1.5%

Box (Substrate) Materials (see Box 3)
Fines = 20%
Gravels = 30%
Larges = 40%
Bedrock = 10%

CHANNEL COMPONENTS

1. Channel width in metres. Equal to distance between rooted vegetation, including islands.

2. Valley flat to channel ratio. The ratio between width of valley flat and width of channel.

Map Designation	Ratio
A	0-2
B	2-5
C	5-10
D	10+
E	N/A (e.g. Fan or delta)

3. Slope (elevation gain/reach length) calculated as an average for the reach, expressed as a percentage; measured from topographic base map.
   >3% rounded off to the nearest percent
   <3% rounded off to 1 decimal place.

BED (SUBSTRATE) MATERIALS

Fines, gravels, larges and bedrock are listed in sequence to nearest 10%, expressed as an integer.

1. Fines 'F': materials in the 0-2 mm size class
   Gravels 'G': materials in the 2-64 mm size class
   Larges 'L': materials greater than 64 mm
   Bedrock 'R': consolidated materials

2. F, G, L or R used alone indicates 90-100% reach is in that size class.

3. A trace of bedrock (0-5%) may be indicated by R following the 3 material components (e.g. 253R). Traces (0-5%) of fine, gravel, or large material are indicated by a 0 (e.g. 0073).

LAKE SYMBOL

General: Fish Species / Max. depth | T.D.S. / Littoral area

1. Fish species
2. T.D.S.: total dissolved solids, if available
3. Maximum depth: measured to nearest metre
4. Littoral area: measurement or visual estimate of % of total area <6m. When estimate is made, the symbol is placed in parenthesis.

FISH SPECIES

1. Fish Species Abbreviations (known or inferred in this map area at time of survey).

Map Abbrev.	Common Name	Map Abbrev.	Common Name
Ø	no fish detected at time and place of sampling	Gr	Arctic grayling
		GSg	Green sturgeon
		HW	Humpbacked whitefish
AC	Arctic char	In	Inconnu
Act	anad. (sea-run) Cutthroat trout	Ko	Kokanee
		LMB	Largemouth bass
ADV	anad. Dolly Varden char	LT	Lake (trout) char
		LW	Lake whitefish
AEB	anad. Eastern Brook trout (char)	MW	Mountain whitefish
		NP	Northern pike
AGB	anad. Brown trout	OS	forage, coarse fishes
AS	Atlantic salmon	P	Perch, general
BB	Burbot (Ling)	Pk	Pink salmon
BCB	Black crappie	PMB	Pumpkinseed
BS	Bass/sunfish, gen.	PW	Pigmy whitefish
BW	Broad whitefish	Rb	Rainbow trout
CA	Arctic cisco	RW	Round whitefish
Ch	Chinook salmon	Sa	Salmon, general
CL	Lake cisco(tullibee)	Sg	Sturgeon, general
Cm	Chum salmon	Sk	Sockeye salmon
Co	Coho salmon	SMB	Smallmouth bass
Cp	Carp	Sp	fish observed, unidentified
CS	Least cisco		
Ct	Coastal Cutthroat trout	St	Steelhead trout
		Tr	trout, general
DV	Dolly Varden char	WF	Whitefish, general
EB	Eastern Brook trout char	WP	Walleye
		WSg	White Sturgeon
Eu	Eulachon	YCt	Yellowstone & West-slope Cutthroat trout
GB	Brown trout		
GE	Goldeneye	YP	Yellow perch

2. OS - indicates known but non-sport or non-commercial species, data bank must be consulted for complete species list.

3. Absence of any fish species symbol indicates that no sampling information was available.

4. (Co) - indicates probable but unconfirmed presence.

5. Sk] - indicates reach used by species for migration only, no resident population.

6. Ch - Underlined fish abbrev. indicates special circumstances. Refer to B.C. Aquatic Data Base for clarification.

7. Note: no specific symbol exists for a barren stream. When such a condition is suspected, it may be indicated by (Ø which is an inference that if sampling took place, fish would not be detected.

LEGEND

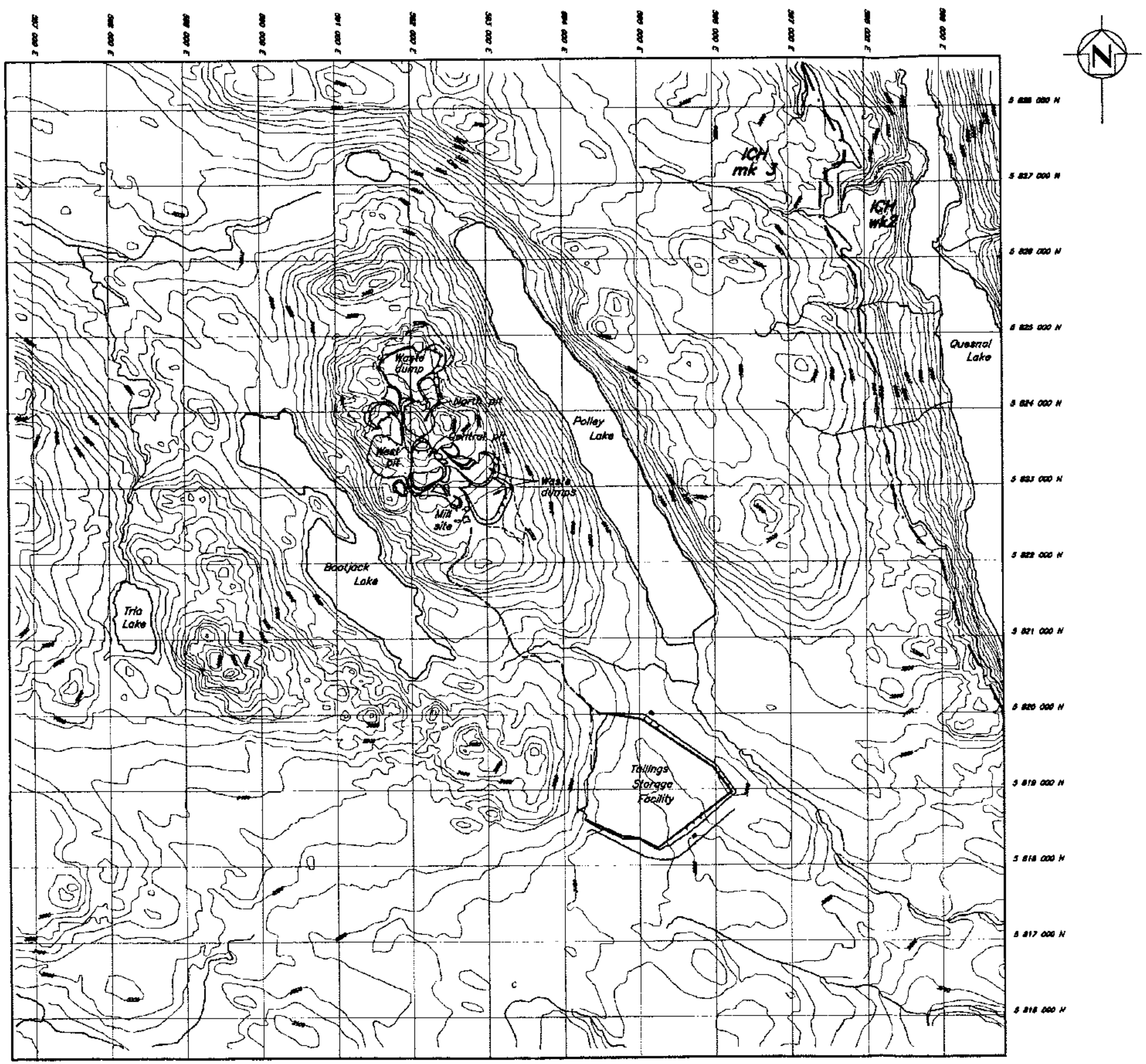
- R_1 Upstream extent of Reach 1
- B Bridge
- Cv Culvert
- BD Beaver Dam
- Chan
- DAM
- T_1 Transects (3 Cross sections)
- Rb Rainbow Trout Spawning

Species / Channel Components | Substrate Materials — Fisheries Biophysical

Scale 1000 500 0 1000 2000 3000 4000 m

HALLAM KNIGHT PIESOLD LTD. ENVIRONMENTAL CONSULTANTS - VANCOUVER, B.C.	IMPERIAL METALS CORPORATION
DESIGNED	MT. POLLEY PROJECT
DRAWN	
CHECKED	FISHERIES BIOPHYSICAL INVENTORY
APPROVED	
DATE / SCALE AS SHOWN	FIGURE 2.13 / REV

DWG NO.	DESCRIPTION	REV.	DATE	DESCRIPTION	APPROVED	REV	DATE	DESCRIPTION	APPROVED
REFERENCE DRAWINGS		REVISIONS				REVISIONS			



LEGEND

ICH mk 3 = Quesnel moist cool Interior Cedar Hemlock variant

ICH wk2 = Horsefly wet cool Interior Cedar Hemlock variant

NOTE:
Contours are in feet.

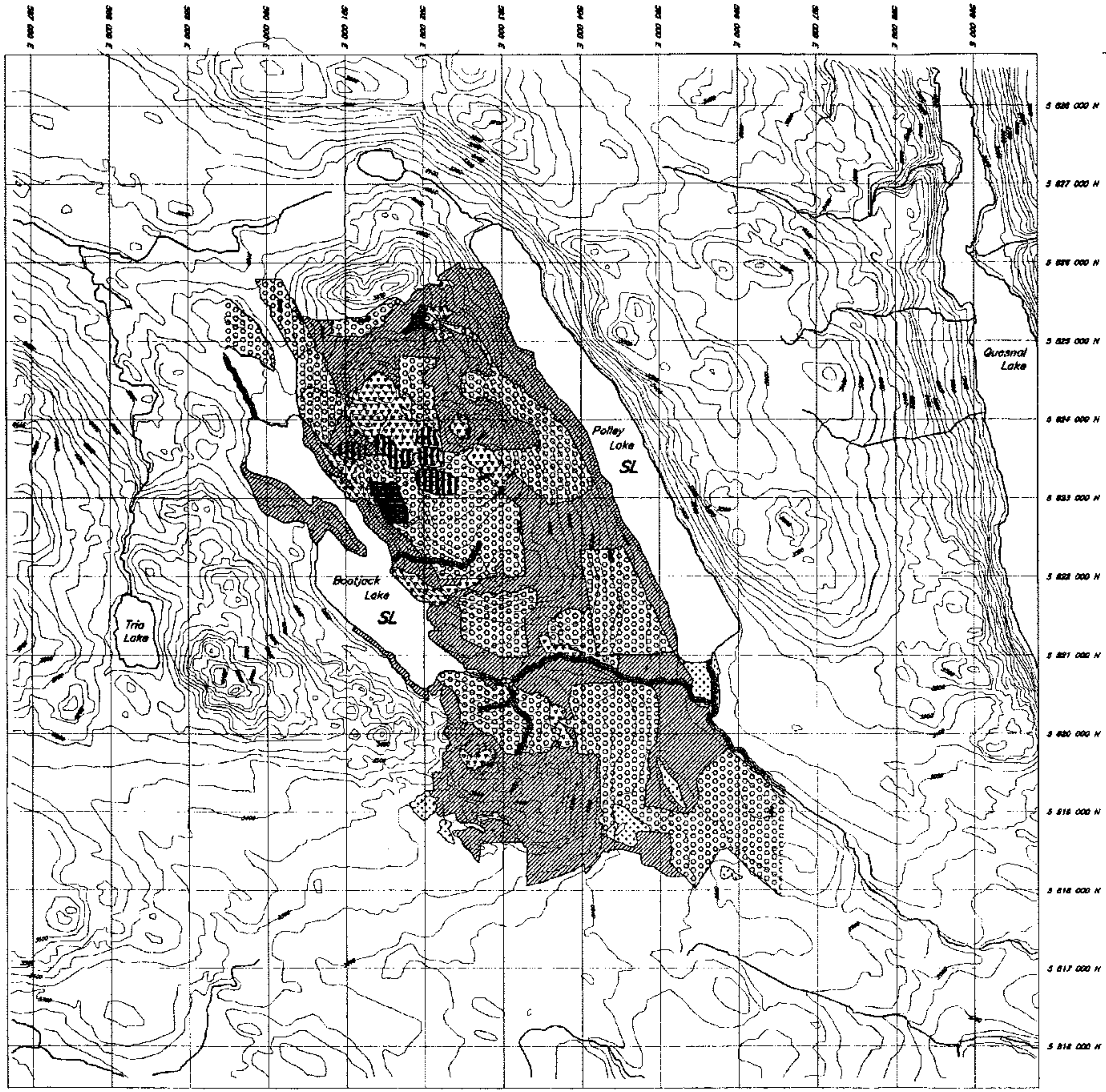
Scale 1000 500 0 1000 2000 3000 Metres

HALLAM KNIGHT PIESOLD LTD. ENVIRONMENTAL CONSULTANTS - VANCOUVER, B.C.	IMPERIAL METALS CORPORATION
DESIGNED DJR	MT. POLLEY PROJECT
DRAWN VY	BIOGEOCLIMATIC UNITS FIGURE 2.14
CHECKED –	
APPROVED	
DATE	SCALE AS SHOWN
DRG. NO. H1221	REV. –

DRG. NO.	DESCRIPTION
REFERENCE DRAWINGS	

REV.	DATE	DESCRIPTION	APPROVED
REVISIONS			

REV.	DATE	DESCRIPTION	APPROVED
REVISIONS			



LEGEND

FOREST HABITATS OF THE INTERIOR CEDAR-HEMLOCK (ICH) ZONE

- Clearcuts and Burns (0-20 years+)
  Young Stands (20-40 years)
- Mid-seral Stands (40-120 years)
- Mature and Old Growth Stands (120 years+)
- Douglas-Fir-Lodgepole Pine Forest (South Slopes)

WETLAND AND AQUATIC HABITATS

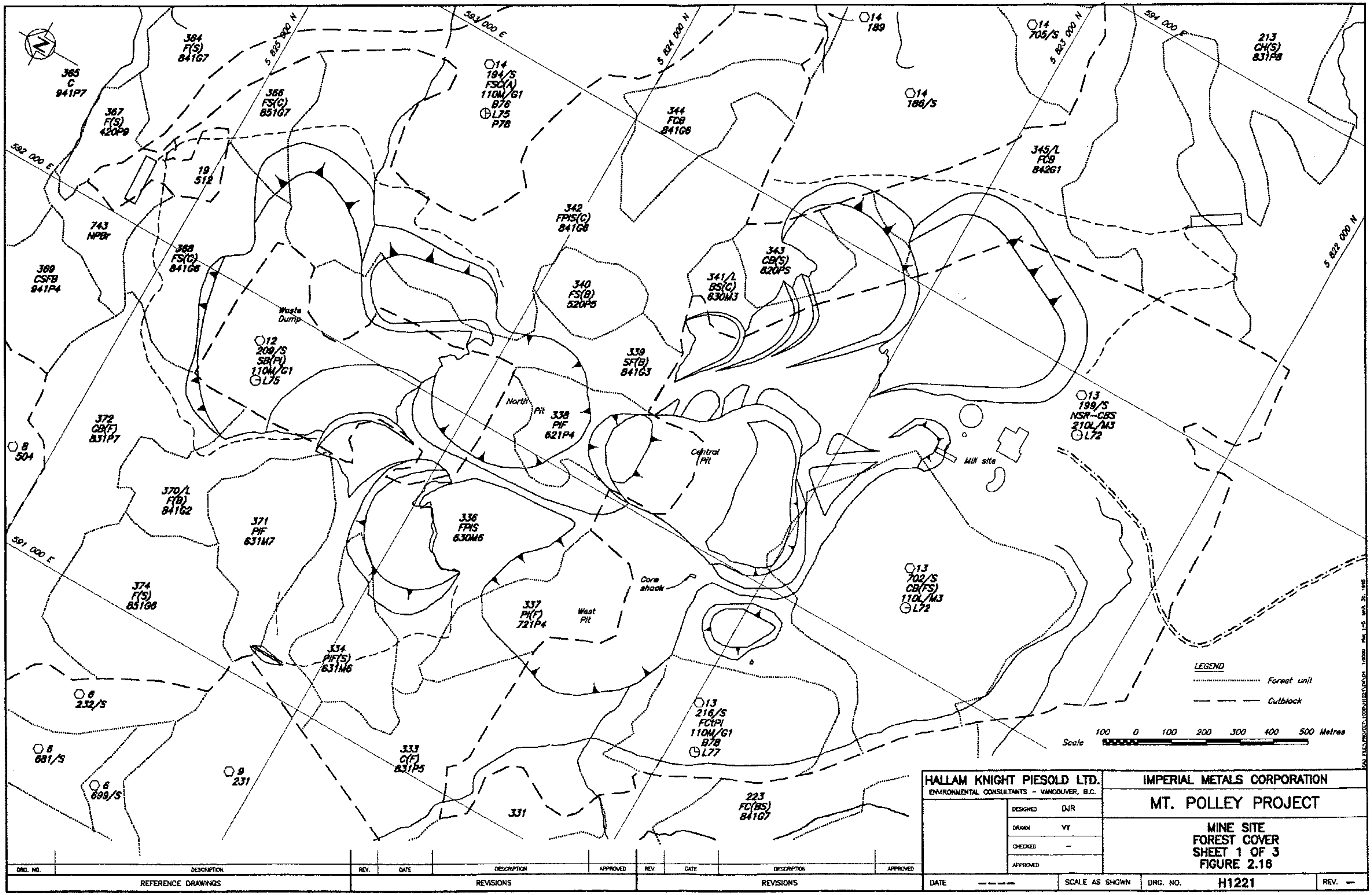
- Riparian Habitats near Small Streams
- Shrub Carr / Sedge Fen Habitat Complex
- SL Small and Medium-sized Lakes (<1000 ha)

NOTE: Contours are in feet.

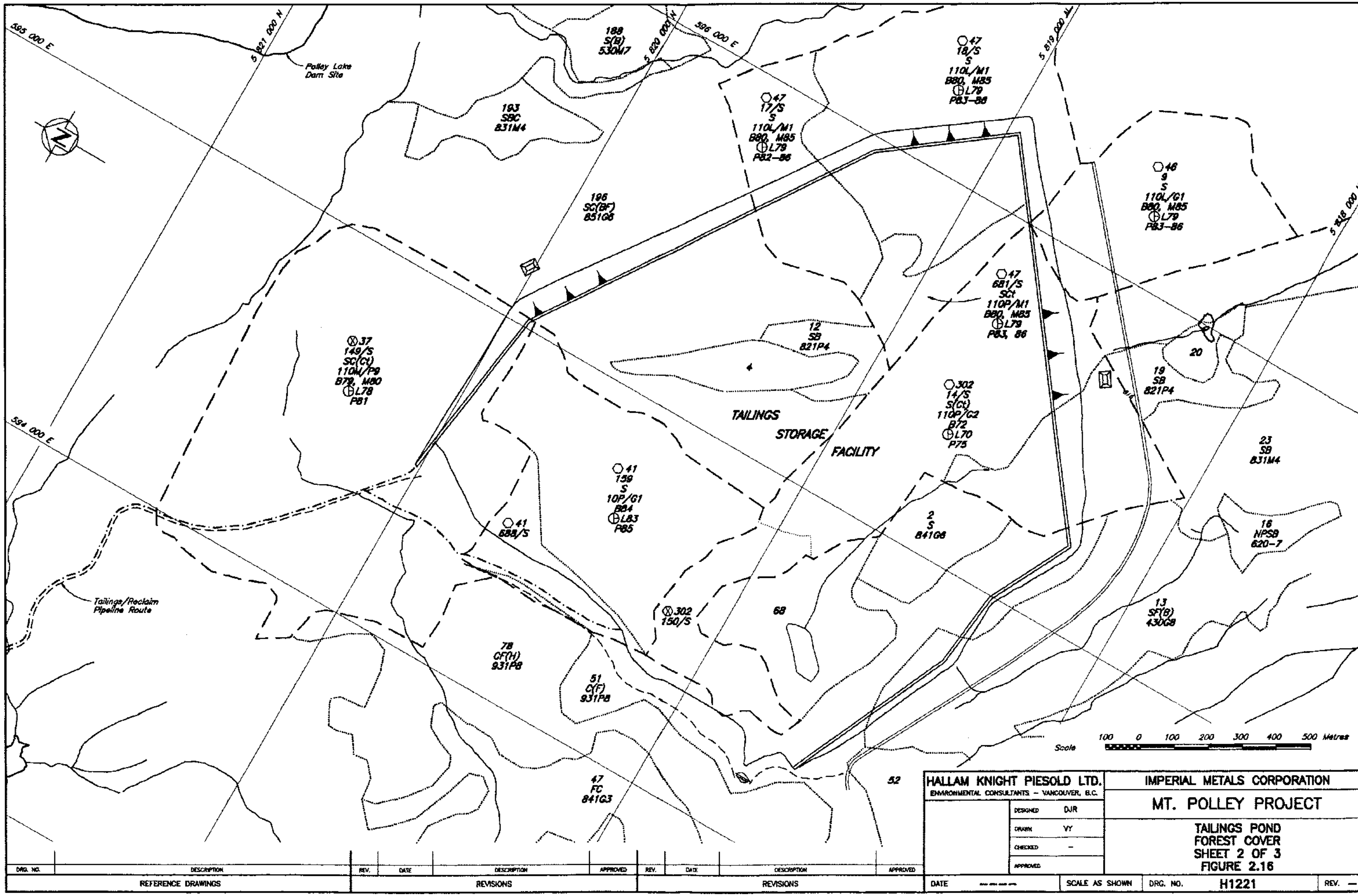
Scale 1000 500 0 1000 2000 3000 Metres

HALLAM KNIGHT PIESOLD LTD. ENVIRONMENTAL CONSULTANTS – VANCOUVER, B.C.		IMPERIAL METALS CORPORATION
DESIGNED	DJR	MT. POLLEY PROJECT
DRAWN	NAR	WILDLIFE CAPABILITY FIGURE 2.15
CHECKED	–	
APPROVED		
DATE MAR. 31, 1995	SCALE AS SHOWN	DRG. NO. H1221 REV. –

DRG. NO.	DESCRIPTION	REV.	DATE	DESCRIPTION	APPROVED	REV.	DATE	DESCRIPTION	APPROVED
REFERENCE DRAWINGS		REVISIONS				REVISIONS			



Waste Dump
North Pit
Central Pit
West Pit
Core shack
Mill site
LEGEND
Forest unit
Cutblock
Scale 100 0 100 200 300 400 500 Metres
592 000 E
593 000 E
594 000 E
591 000 E
5 825 000 N
5 824 000 N
5 823 000 N
5 822 000 N
HALLAM KNIGHT PIESOLD LTD.
ENVIRONMENTAL CONSULTANTS - VANCOUVER, B.C.
DESIGNED DJR
DRAWN VY
CHECKED -
APPROVED
IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
MINE SITE
FOREST COVER
SHEET 1 OF 3
FIGURE 2.16
DATE
SCALE AS SHOWN
DRG. NO. H1221
REV. -
DRG. NO.
DESCRIPTION
REFERENCE DRAWINGS
REV.
DATE
DESCRIPTION
APPROVED
REVISIONS



595 000 E
5 821 000 N
Polley Lake Dam Site
5 820 000 N
596 000 E
5 819 000 N
5 818 000 N
594 000 E
188 S(B) 530M7
193 SBC 831M4
196 SC(BF) 851G8
47 17/S S 110L/M1 B80, M85 L79 P82-86
47 18/S S 110L/M1 B80, M85 L79 P83-88
46 9 S 110L/G1 B80, M85 L79 P83-86
47 681/S SCt 110P/M1 B80, M85 L79 P83, 86
37 149/S SC(Ct) 110M/P9 B79, M80 L78 P81
12 SB 821P4
TAILINGS STORAGE FACILITY
302 14/S S(Ct) 110P/G2 B72 L70 P75
19 SB 821P4
20
23 SB 831M4
16 NPSB 620-7
41 159 S 10P/G1 B84 L83 P85
41 688/S
2 S 841G8
302 150/S
68
13 SF(B) 430G8
Tailings/Reclaim Pipeline Route
78 CF(H) 931P8
51 C(F) 931P8
47 FC 841G3
52
Scale
100 0 100 200 300 400 500 Metres
HALLAM KNIGHT PIESOLD LTD.
ENVIRONMENTAL CONSULTANTS – VANCOUVER, B.C.
DESIGNED DJR
DRAWN VY
CHECKED –
APPROVED
IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
TAILINGS POND FOREST COVER SHEET 2 OF 3 FIGURE 2.16
DATE
SCALE AS SHOWN
DRG. NO. H1221
REV. –
DRG. NO. DESCRIPTION
REFERENCE DRAWINGS
REV. DATE DESCRIPTION APPROVED
REVISIONS
REV. DATE DESCRIPTION APPROVED
REVISIONS

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
FOREST COVER MAP LEGEND – SHEET 3 OF 3

FOREST LAND

FOREST LAND (FORESTED)

Species Composition

Species are listed in their order of predominance. Major species are listed first followed by minor species in brackets.

Species Symbols:

- F – Douglas fir
- C – Western red cedar
- H – Hemlock
- B – Balsam (True fir)
- S – Spruce
- Sb – Black spruce
- Cy – Yellow cedar
- Pw – Western white pine
- Pa – Whitebark pine
- Pl – Lodgepole pine
- Py – Yellow pine
- L – Larch
- Ct – Cottonwood
- D – Red alder
- Mb – Broadleaf maple
- Bi – Birch
- A – Aspen

EXAMPLE OF A FOREST COVER LABEL

Label: ⬡12 / 66Es/LA / SB/Pl / 210P2 / B74 ⊕L72 P76

- ⬡12 – Silviculture opening Number and Symbol
- 66 – Polygon Number
- Es – E.S.A. Category
- L – Secondary element
- A – Qualifier
- SB(Pl) – Species composition
- 2 – Age class code
- 1 – Height class code
- o – Stocking class code
- P – Site class code
- 2 – Crown closure class code
- B74 ⊕L72 P76 – History symbols and codes

HISTORY SYMBOLS

CLASS AND SYMBOL	CODE	HISTORY
Stand Tending ⊖	J	Juvenile spacing
	M	Mistletoe control
	W	Brushing + weeding
	R	Conifer release
	S	Sanitation spacing
	P	Pruning
	T	Commercial thinning
	F	Fertilization
Site Preparation ⦶	M	Mechanical
	B	Broadcast burn
	S	Spot burn
	C	Chemical
	G	Grass seeded
	MS	Mechanical + spot burn

HISTORY SYMBOLS

CLASS AND SYMBOL	CODE	HISTORY
Disturbance ⊖	L	Logging
	B	Wildlife
	W	Windthrow
	I	Insect
	D	Disease
	K	Fume kill
	S	Slide
	F	Flooding
Regeneration ⦶	P	Planted

SECONDARY ELEMENTS

- L – Multi-layered stand
- S – Separate silviculture description is available in the data base.
- V – Veteran component

QUALIFIERS

- A – Complex stand
- E – Environmentally sensitive area (see below)
- I – Inoperable

STOCKING CLASS CODES

CODE	APPLIES TO	LIMITS No. of trees/hectare, d.b.h. Limits
0	all immature #	N.A.
1	all mature #	≥76/ha, 27.5 cm + d.b.h.
2	all mature	<76/ha, 27.5 cm + d.b.h.
Subdivision of 2: 3	mature, with leading species Pl	≥311/ha, 17.5 cm + d.b.h. and ≥50% of stems 7.5 cm + d.b.h. are ≥12.5 cm d.b.h.
Subdivision of 2: 4	mature, with leading species Pl	<311/ha, 17.5 cm + d.b.h. or ≥311/ha, 17.5 cm + d.b.h. and <50% of stems 7.5 cm + d.b.h. are ≥12.5 cm d.b.h.

	All deciduous species Pl; Pa	All coniferous species except Pl and Pa
Immature	1–80 Yrs.	1–120 Yrs.
Mature	≥81 Yrs.	≥121 Yrs.

ENVIRONMENTALLY SENSITIVE AREA (E.S.A.) CATEGORIES

CONSTRAINT CLASS	E.S.A. CATEGORY	E.S.A. DESCRIPTION
High	Es	Areas having severe soil and steepness problems.
	Ep	Areas having severe regeneration problems.
	Ea	Areas having severe snow chute and avalanche problems.
	Er	Areas where recreational values are exceptionally high.
	Ew	Areas of critical importance to wildlife.
	Eh	Areas where water values are exceptionally high.
Moderate	E2r	Areas where recreation values are high but less than Er.
	E2w *	Areas where wildlife values are important but less than Ew.
	E2h	Areas where water values are important but less than Eh.
Nil		Management practises on these lands are subject only to operational constraints consistent with the policies of the Forest Region.

* Important areas for grizzly bears along salmon producing streams are identified by <E2wb

CROWN CLOSURE CLASS CODES

CODE	LIMITS (percentage)
0	0–5
1	6–15
2	16–25
3	26–35
4	36–45
5	46–55
6	56–65
7	66–75
8	76–85
9	86–95
10	96–100

AGE CLASS CODES

CODE	LIMITS (Years)
1	1–20
2	21–40
3	41–60
4	61–80
5	81–100
6	101–120
7	121–140
8	141–250
9	251+

HEIGHT CLASS CODES

CODE	LIMITS (Metres)
1	0–10.4
2	10.5–19.4
3	19.5–28.4
4	28.5–37.4
5	37.5–46.4
6	46.5–55.4
7	55.5–64.4
8	64.5+

SITE CLASS CODES

CODE	SITE
L	Low
P	Poor
M	Medium
G	Good

	SYMBOL	STREAM VALUE TO FISH AND STREAM SENSITIVITY TO HARVESTING
Fisheries	▲	Nil
	■	Low
	●	Moderate
	◆	High

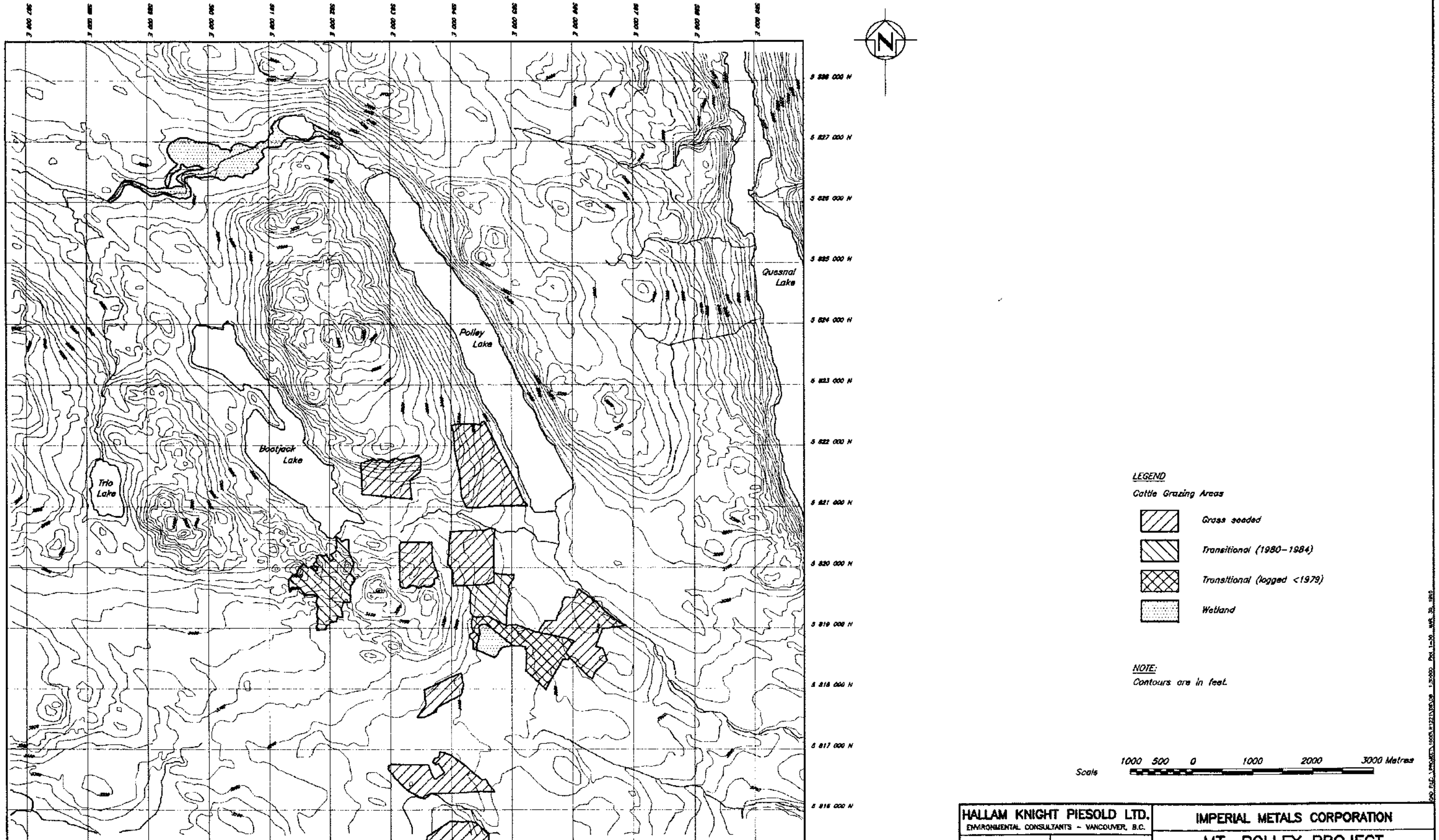
Note: Absence of fisheries symbols indicates information not available.

CAD FILE: \PROJECT\1000\H1221\FIG\B3 FIX 1=1

Mar. 30, 1995

HALLAM KNIGHT PIESOLD LTD.
ENVIRONMENTAL CONSULTANTS

FIGURE 2.16



HALLAM KNIGHT PIESOLD LTD.
ENVIRONMENTAL CONSULTANTS – VANCOUVER, B.C.

IMPERIAL METALS CORPORATION

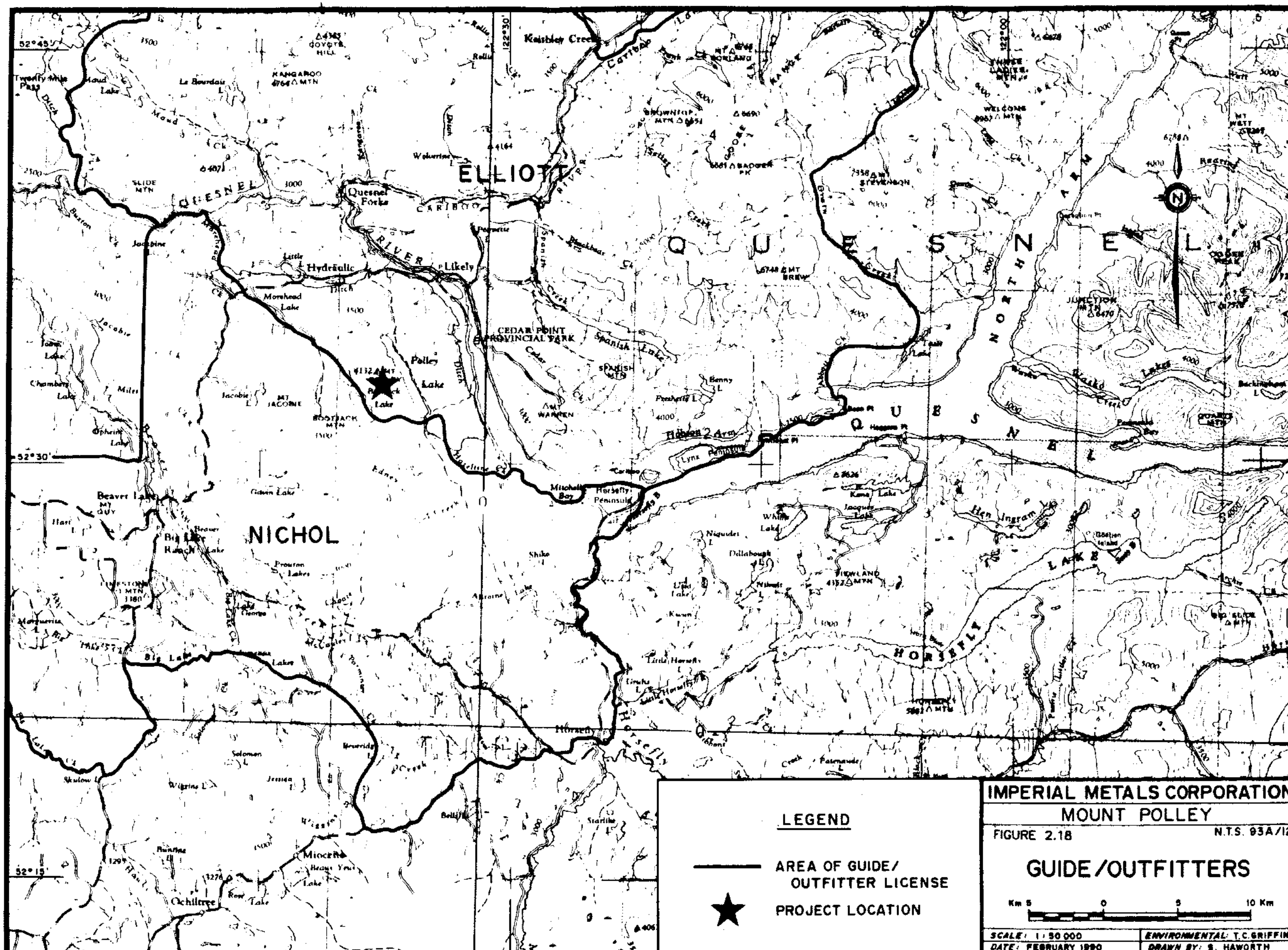
MT. POLLEY PROJECT

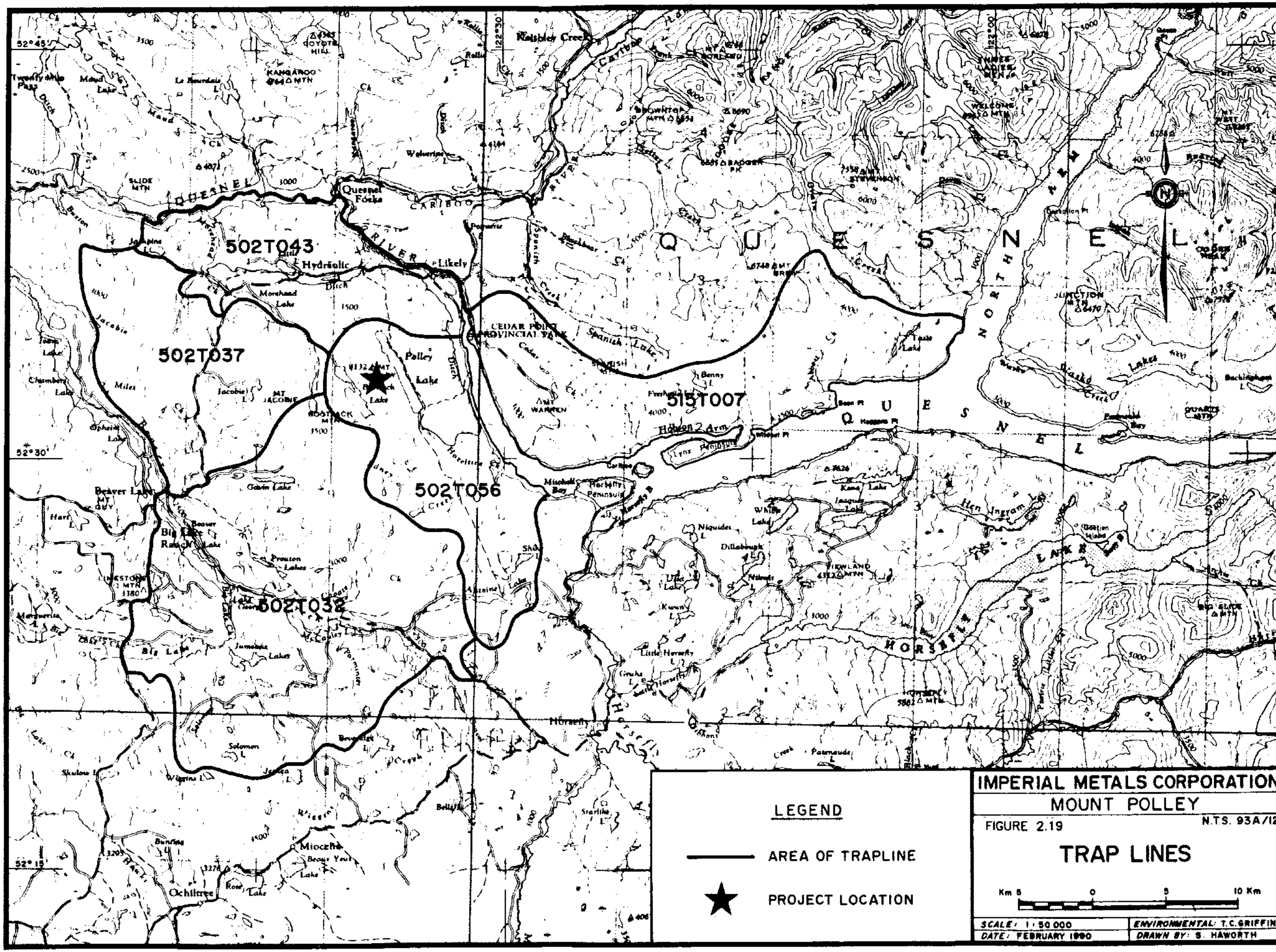
CATTLE GRAZING AREAS
FIGURE 2.17

DESIGNED	DJR
DRAWN	VY
CHECKED	–
APPROVED	

DATE	———	SCALE AS SHOWN	DRG. NO.	H1221	REV. –

DRG. NO.	DESCRIPTION	REV.	DATE	DESCRIPTION	APPROVED	REV.	DATE	DESCRIPTION	APPROVED
REFERENCE DRAWINGS		REVISIONS				REVISIONS			


IMPERIAL METALS CORPORATION
MOUNT POLLEY
FIGURE 2.18
N.T.S. 93A/12
GUIDE/OUTFITTERS
Km 5 0 5 10 Km
SCALE: 1:50 000
ENVIRONMENTAL: T.C.GRIFFING
DATE: FEBRUARY 1990
DRAWN BY: S. HAWORTH
LEGEND
AREA OF GUIDE/ OUTFITTER LICENSE
PROJECT LOCATION
ELLIOTT
QUESNEL
NICHOL
QUESNEL
NORTH ARM
HORSEFLY
Quesnel Forks
Hydraulic
Likely
Polley Lake
CEDAR POINT PROVINCIAL PARK
Spanish Lake
Horsefly
Ochiltree
52°45'
52°30'
52°15'
122°30'
122°00'



502T043
502T037
502T056
502T032
515T007
QUESNEL
QUESNEL
Likely
Hydraulic
Quesnel Forks
CEDAR POINT PROVINCIAL PARK
Polley Lake
Spanish Lake
Horsefly
Big Lake Ranch
Beaver Lake
LEGEND
AREA OF TRAPLINE
PROJECT LOCATION
IMPERIAL METALS CORPORATION
MOUNT POLLEY
FIGURE 2.19
N.T.S. 93A/12
TRAP LINES
Km 5 0 5 10 Km
SCALE: 1:50 000
DATE: FEBRUARY 1990
ENVIRONMENTAL: T.C.GRIFFING
DRAWN BY: S. HAWORTH

SECTION 3.0 - MINING PROGRAM

3.1 GEOLOGY AND MINEABLE RESERVES

3.1.1 Regional Geology

The Mount Polley deposit occurs in an alkalic intrusive complex within the Quesnel Belt (formerly Quesnel Trough) which is an allochthonous terrane of predominantly Upper Triassic-Lower Jurassic, mafic to intermediate volcanic rocks that lie along the eastern margin of the Intermontane Belt (Figure 3.1). The northwesterly trending Quesnel Belt, which includes rocks of the Quesnel River, Nicola, Takla, Stuhini and Rossland Groups (Panteleyev, 1987), is 35 km wide. The Quesnel terrane is a fault-bounded region flanked to the east by Precambrian to Palaeozoic rocks of the Barkerville and Slide Mountain Terranes (Struik, 1986) and to the west by rocks of the Cache Creek terrane.

The intrusive complex hosting the Mount Polley deposit is one of several alkalic complexes in the Cordillera that lie within the belts up to several hundred kilometres long. All alkalic plutons and associated porphyry deposits occur within the Intermontane Zone and coincide with the outcrop area of the Upper Triassic Nicola-Takla-Stuhini volcanic assemblages. The isotopic age of these deposits falls in the 175 to 198 Ma range, with Mount Polley dated at 185 $\pm$ 7 Ma. (Christopher and Douglas, 1976, Hodgson et al., 1976).

Alkaline-suite porphyry deposits, of which Mount Polley is an example, are recognized as a separate deposit type, distinct from the calc-alkaline porphyry deposits (Barr et al., 1976). Other significant deposits include Copper Mountain, Afton, Mount Milligan, Lorraine, Gnat Lake and Galore Creek.

In comparison to calc-alkaline deposits, alkaline deposits lack appreciable amounts of molybdenite and are usually richer in gold and silver.

3.1.2 Property Geology

The Mount Polley intrusive complex is located between Bootjack Lake on the west side and Polley Lake on the east side (Figure 3.2). The intrusion is a tilted laccolith approximately 6 km long and up to 2 to 3 km thick at the centre (Hodgson et al., 1976). Six lithologically distinct phases are recognized, of which five comprise one or more stacked lenses concordant with the northeast-dipping host strata, and the sixth, the Cu-Au-bearing breccia which is partly concordant and partly discordant.

The principal lithological phases of the intrusive complex recognized are mafic pseudoleucite syenite, pseudoleucite syenite, syenodiorite, monzonite porphyry (M1) and intrusive breccia.

Several younger rocks intrude the complex. There are two stages of monzonite porphyry dykes known as M2 and M3, respectively. M2 dykes occur adjacent to intrusion breccia and this unit is similar to the main mass of monzonite porphyry. M3 dykes are common in the upper portion of the laccolith and as fragments in the Mount Polley breccia. Pyroxenite gabbro has been encountered in several holes east of Bootjack Lake and its surface area has been interpreted mainly from the ground magnetic surveys. These intrusions are considered to be coeval with augite porphyry dykes, the youngest intrusives in the laccolith, that cut all phases east of Bootjack Lake with the exception of the pyroxenite gabbro lens.

The volcanic rocks are coeval with the alkalic complex and are represented by augite trachyte basalts and lesser analcite trachyte basalts and abundant pyroclastics. Pyroclastic deposits in the immediate area adjacent to the mineralized zones are mainly feldspathic crystal and lapilli tuffs. Polymictic volcanic breccia that represents a lahar deposit is systematically distributed on both east and west side of the complex.

3.1.3 Gold - Copper Mineralization

The Mount Polley porphyry-copper-gold deposit is hosted by intrusive and crackle breccia in monzonite porphyry or in crackle breccia in lapilli crystal tuff. Work by Imperial Metals Corporation has outlined two principal zones of significant Cu-Au mineralization known as the Central and West Zone.

A third breccia, known as the Mount Polley breccia, is barren and is considered to be younger than the Cu-Au-bearing breccias. These breccia zones are separated by a major north-south striking fault. Figures 3.3 and 3.4 are north-south geological cross sections through the Central and West Zone along 3195N and 3865N.

Magnetite, chalcopyrite, minor pyrite, trace bornite and native gold are the primary ore minerals in the deposit. Supergene minerals include malachite, amorphous chrysocolla, native copper, cuprite, digenite and covellite.

Magnetite and chalcopyrite occur as disseminations and in fractures and drusy cavities. In the southern section of the Central Zone there are small skarn-like concentrations of massive magnetite with blebs or stringers of chalcopyrite hosted by intrusive breccia or tuff that form high-grade sections of the deposit when chalcopyrite is abundant.

The Central Zone is a tabular sill-like body of mineralized intrusion breccia with a northerly strike and a moderately eastward dip. The zone measures 1,100 m along strike and is 200 m to 450 m in width. The West Zone forms the core of a westerly-plunging pipe of mineralized intrusion breccia measuring 450 m in diameter and extending to a drilled depth of 275 m. A pyrite "halo" measuring 4,500 m by 1,000 m is located to the east of the pits and lies outside and structurally above the two main mineralized breccia zones.

The laccolith displays a complex history of rock alteration in which a wide variety of hydrothermal minerals formed at different periods during its intrusive and post-intrusive history. The most intense alteration developed contemporaneously with mineralization in three coaxial zones: a central zone of potash feldspar-biotite-diopside; intermediate garnet-epidote zone; and a peripheral epidote zone. Alteration effects, not directly related to mineralization, include pervasive moderately intense sericitic and argillic deuteric alteration of feldspars and syenodiorite, monzonite porphyry and post-mineral monzonite porphyry dykes, and intense argillic alteration of feldspars and shear zones.

Structurally, four main episodes of deformation are recognized at the Mount Polley deposit. The first was the intrusion of the high-level laccolith with formation of the intrusive breccia. The next and most important stage was the formation of crackle breccia by phreatic activity which resulted in shattering and fine comminution of the intrusion breccia and adjacent rock units within the complex. Au-Cu mineralization was deposited during this stage. Post-mineralization events include block faulting which tilted the strata near the close of the Upper Triassic volcanism and uplift and erosion during the Tertiary and Quaternary periods. Although several parts of the deposit, in particular the upper portions of the Central Zone, are strongly oxidized as a result of weathering during this erosional period, the very limited amount of supergene copper mineralization formed reflects the very low pyrite content of the deposit.

3.1.4 Ore Reserves

The Mount Polley ultimate pit mineable reserves, using 0.39% copper equivalent cutoff, are estimated at:

Probable:	48,771,000 tonnes at 0.383% Cu and 0.556 g Au/tonne
Possible:	2,631,000 tonnes at 0.322% Cu and 0.461 g Au/tonne
Total Mineable:	51,402,000 tonnes at 0.380% Cu and 0.551 g Au/tonne

In addition 26,192,000 tons of low grade material grading 0.218% Cu and 0.242 g Au/tonne will be stockpiled for possible processing when mineable reserves are exhausted.

An inverse distance cubed method with 20 m x 20 m x 10 m blocks utilizing geostatistical method to assess continuity of grade and the search distance was used in estimating ore reserve. Due to the presence of a high grade area at the south end of the Central Zone a 25 m search distance was used in this part of the deposit, whereas a 50 m search distance was applied to the reminder of the deposit.

The ratio of oxide copper and total copper for the above reserve is 27% and the waste to ore ratio is 1.76:1.

Due to various levels of oxidation in the ore body, copper and to a lesser degree gold recovery are affected. Based on metallurgical testwork, the average recoveries are estimated at 76.6 % for copper and 79.8 % for gold for the first 10 years of the mine life. Higher tonnage of oxide copper ore in the first year results in copper recovery of 57.9 %, but the losses are offset by higher than average copper and gold grades in this area.

A single acid leach test on +48 mesh tailings fraction was performed to evaluate dump leaching of coarse waste material. The test demonstrated that acid leaching is not economically viable due to high acid consumption, which amounted to over 27 kg of acid per kg of copper leached.

Low magnetite concentrate grades achieved by preliminary wet magnetic separation tests and the need for regrinding the concentrate make it unlikely that magnetite recovery from the Mount Polley ore will be economic. Further testing of tailings would be required to fully evaluate the economics and, if feasible, design the equipment suitable for commercial magnetite production.

3.2 MINE PLAN

3.2.1 General Description

Mount Polley open pit process plant and waste rock disposal sites will be situated on the ridge of land which rises to an elevation of 1,220 m above sea level between Bootjack and Polley Lake. The ultimate open pit will consist of three interconnected pits, namely the Central, North and West Pit (Figure 3.5). The Central and North Pits will extend approximately 1,100 m in a north-south direction and the Central and West Pits approximately 1,110 m in an east-west direction. The total area of the open pits at the conclusion of operations will be approximately 60 ha.

The final pit outline contains approximately 48.8 million tonnes of ore and 85.9 million tonnes of waste including 26.2 million tons of low grade material for a total excavation of 134.7 million tonnes. Ore will be hauled to the primary crusher situated to the south of the West Pit. Feed to the mill will be 13,700 tonnes per day, 5,000,000 tonnes per year for a projected mine life of 9.8 years, followed by a possible 4.2 years' production from the low grade stockpile, based on known resreves.

3.2.2 Open Pit

The mining method proposed for Mount Polley is a conventional open pit truck shovel operation. The mining will commence in the Central Pit Stage 1 and progress through Central Pit Stage 2, North Pit and West Pit. Overburden will be stockpiled for reclamation purposes. Ore will be hauled to the primary crusher by mechanical drive haulage trucks. Some rehandling and blending of high oxide ore is expected to be required to meet mill specifications.

A geotechnical investigation program was completed to determine design constraints for the proposed open pit, waste dumps and tailing storage facility. Geotechnical testwork for the open pit consisted of field mapping, test pit excavations, diamond drilling and permeability testing. The results of this geotechnical investigation provided criteria for the design of the open pit wall slopes. The mine will be developed in 10 m benches with two benches combined at the final wall with 8.5 m berms every second bench. This results in a 52° overall wall slope between ramps. Ramps will be 17.5 m wide with a maximum grade of 10%.

The open pit area is covered with a veneer of colluvium, glacial till and forest litter with bedrock exposed in some areas but generally at a depth of 1.5 m - 7.6 m. The predominant rock types are intrusive breccia, syenodiorite and monzonite porphyry with occasional dyke rocks. In general the rock quality of the proposed pit walls is variable. Highly fractured zones and weak highly altered rocks were recognized in drill holes. Zones of fracturing and intense alteration are generally associated with faulting and contacts between intrusive geological units. Discontinuities were generally rough and often healed with calcite or chlorite. Some smooth, polished slick-sided joints were also identified. Rock strength is moderate to high, and stability will be controlled by the geologic structures.

For final pit wall bench design it is proposed that controlled blasting be used to develop a relatively steep bench face (70° to 75°) which could be scaled with the truck loading equipment.

The open pit was designed by using the MINTEC MEDSYSTEM DIPPER mine design software. A series of pits were examined and an ultimate pit selected.

3.2.3 Pit Operation

The open pit will be developed using conventional open pit mining techniques and equipment. The mining equipment fleet will consist of the following units:

Drills	1 -	300 mm diesel rotary blasthole
	1 -	150 mm tank drill
Loaders	1 -	9.2 m^3 diesel powered hydraulic shovel
	1 -	10.7 m^3 front end loader
Haulage Trucks	5 -	90 tonne capacity haulage trucks
Bulldozers-Tracked	2 -	Cat. D-9 size
Utility Loader	1 -	Cat. 936 ITC

Road Grader	1 -	Cat. 14G
Service Equipment	1 -	Lube & fuel truck
	1 -	Shuttle bus
	4 -	Supervisors pick-up
	1 -	Ambulance
	1 -	Blasters truck
	1 -	Water truck
	1 -	Sand truck

The production rate during the first 5 years of the mine life will average approximately 25,000 t/d. This rate will increase in year 6, as West Pit stripping commences, and peak in year 10 at 50,000 t/d.

Ore will be loaded by electric shovel or rubber tire loader into 90 tonne capacity mechanical drive trucks and hauled to the primary crusher or to stockpiles as necessitated by mill blending requirements. Waste will be loaded and hauled to appropriate waste dumps.

Roads have been designed for a maximum 10% uphill loaded haul. Roads will be 17.5 m in width, crowned for proper drainage and will incorporate suitable ditches and berms.

The open pits will be cleared, grubbed, stripped and the overburden stockpiled. Additional materials from proposed dump areas will also be stripped and stockpiled to ensure that the completed dump surfaces can be covered with 0.15 m of overburden in the reclamation process.

3.2.4 Pit Dewatering

The inflow of water from groundwater and precipitation is estimated to be in the order of 43 m^3/hr. This water will be directed to a sump in the bottom of the pit and dumped either to a surface water sediment pond or to the tailings dump box in the mill. Surface runoff from the mine area, roads and waste dumps will be collected in surface ditches which flow to settlement ponds, and then directed for mill process use.

The quality monitoring of pit and surface runoff water will emphasize three primary concerns: suspended solids, dissolved and suspended metal concentrations and elevated nitrogen compounds from nitrate explosive residues. Extensive testing as part of the geotechnical investigation demonstrated that acid mine drainage will not be a factor in pit water or elsewhere on the project (see Section 3.3).

3.2.5 Mining Sequence

The mining sequence will be Central Pit Stage 1, Central Pit Stage 2, North Pit and West Pit.

The Central Pit Stage 1 was selected for mining early in the project life because of the higher metal values associated with this area. This pit is also notable for the high oxidation of ore on the upper benches. This highly oxidized material also carries high copper equivalent grades. A development strategy has been adopted to minimize the metallurgical risk associated with this oxidized material.

Approximately 2.36 million tonnes of oxide ore containing greater than 75% oxidized copper will be stockpiled during the preproduction period and the first and second years. This ore grade material will be brought to the mill during years 3, 4, 5, 6, 7 and 8.

Once the preproduction period is completed, the pits are mined with overlap to smooth the strip ratio and resultant equipment and manpower requirements. The production rate in years-1 through 4 will average 9.1 million tonnes per year. The schedule calls for simultaneous mining of up to three pits during this period to balance the overall strip ratio in the long term mine plan. In year-6, West Pit development accelerates to 17.8 million tonnes annually. This production increase results in additional equipment requirements.

The phasing of the various pits is shown below:

```
                   YEAR OF MINE LIFE

                1  2  3  4  5  6  7  8  9  10  11  12  13  14

Central 1       **********
Central 2         *************
North                       *************
West                              ********
Low Grade Stockpile                 ************************
```

3.3 WASTE ROCK DISPOSAL

3.3.1 Waste Rock Storage Areas

The operations will result in the production of approximately 86 million tonnes of waste rock over the life of the mine. The location of the waste rock storage areas, which are shown in Figure 3.5, have been selected on the basis of haul distance, haul profile (within the constraints of slope stability), environmental and economic considerations.

Areas designated for waste rock storage will be logged, grubbed and cleared prior to mining. Topsoil and overburden required for reclamation will be removed and stockpiled separately in a designated location for recovery at the end of mining.

Waste rock disposal sites will be constructed by end dumping, recontoured to an ultimate slope of 2:1 (26.5°), covered with a layer of overburden/topsoil and revegetated. Individual dumps will not exceed 50 m in height. The top surface of the stockpiles will be reconfigured with topographic highs and lows (ridges and depressions) to blend in with the surrounding topography and create habitat diversity, while at the same time, draining toward the open pits. The final surfaces will then be covered with a layer of overburden/topsoil and revegetated.

Low grade ore and waste will be segregated with low grade ore placed in a location that it can be easily recovered, with minimal dilution and at the shortest possible haul distance to the crusher. Waste from the Central Pit will initially provide material for road construction. Oxidized waste will be placed toward the south of the waste rock site such that it can be readily reclaimed during years-3 through 8. Un-oxidized waste from deeper parts of the Central Pit will be hauled out to the lower southeast dump.

Waste from the North Pit benches 1190 through 1220 will be hauled to the northwest waste dump. Waste from the 1170 and 1180 benches will go to the northeast dump and waste material from below 1180 to the north dump.

Waste from the West Pit will be hauled to the southwest dump and may be hauled to backfill the Central Pit. Some acceleration of the Central Pit mining schedule or staging of the West Pit may optimize haulage costs.

3.3.2 Waste Characterization Program

3.3.2.1 Whole Rock and Multi-Element Composition

The orebody contains three main rock types: intrusion breccia, syenodiorite and monzonite porphyry, containing 60 to 90 percent feldspar minerals including plagioclase and orthoclase and 10 to 25 percent pyroxene and amphibole. Whole rock and multi-element chemical analyses of each of these major rock types is shown in Table 3.1 and Table 3.2.

One of the favourable features of the Mount Polley orebody is the abundance and widespread occurrence of acid consuming carbonate minerals; calcite ($CaCO_3$) and minor dolomite ($Ca, Mg Fe(CO_3)_2$). The carbonate minerals which were formed during the regional metamorphism and by intense hydrothermal alteration which generated the copper-gold mineralization through the following reactions:

- The alteration of plagioclase feldspar by addition of water containing carbon dioxide formed an assemblage consisting of epidote, albite and calcite.

- The hydrolysis of albite generated an assemblage consisting of sericite, ankerite-dolomite and quartz.

- Progressive breakdown of hydrous ferromagnesian minerals (pyroxene and amphibole) resulted in an alteration assemblage consisting of chlorite, calcite, magnetite and quartz.

The carbonate minerals occur in the form of clusters and grains distributed throughout the ore and waste lithologies and in form of the vein gangue minerals in association with chalcopyrite and pyrite.

The low sulphate generation rates obtained in the humidity cell tests are the results of several favourable factors, including:

- low sulphide content of the ore and waste
- partial oxidation of primary sulphides
- favourable morphology of pyrite
- absence of rapidly oxidizing sulphide species
- widespread formation of acid consuming carbonate minerals
- close association of carbonates and sulphides

3.3.2.2 Mineralogy, Pyrite and Carbonate Speciation

Petrographic examinations of the Mount Polley ore and waste have been carried out over the last 25 years and more recently by Harris Exploration Services of Vancouver, revealing a variety of sulphide minerals at low concentration. These studies supplement the observations made by drill site geologists during systematic core logging.

In order of their abundance in the orebody, sulphide minerals comprise chalcopyrite ($CuFeS_2$), pyrite (FeS_2) and traces of bornite (Cu_5FeS_4).

Due to oxidation of primary sulphides, chalcopyrite is often replaced by secondary copper minerals chalcocite (Cu_2S), covellite (CuS) and digenite (CuS). Other oxidation products include malachite ($Cu_2CO_3(OH)_2$) and chrysocolla ($CuSiO_3.2H_20$). The oxidation of the orebody replaced an average of 27% chalcopyrite with secondary copper minerals. The degree of oxidation of the orebody varies and in the Central and West pits it is much more pronounced than in the North pit.

Chalcopyrite occurs as irregular magnetite-chalcopyrite-calcite veinlets 1 to 4 mm thick, scattered grains 0.01 to 1 mm associated with magnetite, or in drusy cavities with magnetite and calcite.

Pyrite within the orebody is notably rare and in most mineralized rock samples found in trace amounts only. It has been observed as 0.1 to 2 mm disseminated euhedral grains peripheral to the chalcopyrite-magnetite-calcite veinlets or occasionally as coarse grained pyrite-calcite fracture fillings. The oxidation of pyrite in the orebody produced iron oxide minerals limonite ($H_2Fe_2O_4(H_2O)_x$) and hematite (Fe_2O_3).

The only other sulphur bearing mineral identified in the orebody is gypsum ($CaSO_4.2H_2O$), which occurs as thin veinlets 1 to 2 mm thick seen in the highly oxidized sections.

The total average sulphide mineral content within the pit limits is estimated at less than 1%, of which more than one half represents copper sulphides. This low concentration of sulphides and pyrite in particular, provides a limited source of sulphur for acid generation. The coarse grained, euhedral morphology of pyrite and absence of dusty or framboidal species suggests its low rate of oxidation to be expected.

3.3.2.3 Pyrite Halo

A pyritic alteration halo, located outside and structurally above the orebody, strikes in a northwesterly direction and dips to the north-east with the enclosing intrusive complex, as shown on Figure 3.6. The halo was recognized in the early phases of exploration of the deposit and roughly delineated by induced polarization surveys and drilling. The halo represents disseminations and veinlets of pyrite at various depths from surface with an estimated pyrite content above 3%. Near the surface the halo is oxidized and replaced by iron oxides.

The pyrite halo lies under the proposed eastern and northern waste dumps, where no rock excavations are planned.

3.3.2.4 Static Acid-Base Accounting Test Program

Since the waste rock stockpiles will be used for stockpiling waste, low grade ore and high oxide ore, a comprehensive program of acid-base accounting and humidity cell testing has been undertaken in an effort to determine the potential for the stockpiles to generate acid.

Acid-base accounting tests were performed in two phases. The Phase I program included a broad assessment of various lithologies in the orebody in an effort to identify any rock type with a higher acid forming potential. A total of 30 composite samples from 23 holes covering the three proposed open pits to a depth of 183 m (Figure 3.7) were collected and tested at Envirochem Services Ltd. of North Vancouver, B.C. The composites were randomly selected at 1 m intervals from NQ drill core over each lithologic interval and analyzed for total sulphur, neutralizing potential (NP) and total acid generating potential (AP calculated on the basis of total sulphur).

The results of this phase indicated that no particular lithology with high acid forming potential is present in the orebody. The acid forming potential of ore, low grade material and waste was established to be a function of sulphur content which is directly related to the pyrite and to a lesser degree chalcopyrite content of the host lithology. The Phase I results are plotted on Figure 3.8 using a conversion factor of 31.25 kg $CaCO_3$ per 1% S, and assuming a standard pyrite oxidation. The Phase I samples are classified as follows:

	No. of Samples	Hole #	Location
Acid Forming	2	MP-134	North Pit
Potentially Acid Forming	3	MP-76, MP-100, MP-135	Central, West, North Pit
Non-Acid Forming	25	MP-31, MP-39, MP-42, MP-69 MP-80, MP-107, MP-110 MP-113, MP-115, MP-116 MP-117, MP-118, MP-123, MP-128, MP-135, MP-139, MP-141, MP-142, MP-133	Central, West, North Pit
Total	30		

Phase II testing consisted of systematic sampling within the ultimate pit limits in an effort to evaluate the entire host rock volume. A total of 64 samples were randomly taken at 30 m intervals from 12 boreholes and submitted to Coastech Research, of North Vancouver, B.C. for acid-base accounting tests using the same procedure as in Phase I. The results are plotted on Figure 3.9. The samples were classified as follows:

	No. of Samples	Hole #	Location
Potentially Acid Forming	2	MP-150	West Pit
Non-Acid Forming	62	MP-124, MP-126, MP-140 MP-150, MP-106, MP-108 MP-121, MP-122, MP-68 MP-102, MP-103, MP-105	Central, North, West Pit
Total	64		

The average net neutralization potential of the 64 samples was 24.4 kg $CaCO_3$/t. No samples with negative neutralization potential values were identified by the Phase II testing. The total sulphur content ranged from 0.01% to 2.93%, with an average value of 0.13%.

In order to derive a weighted net neutralization potential for the waste rock stockpiles, the suite of 94 acid-base accounting tests were tabulated according to rock type; intrusion breccia, syenodiorite and monzonite porphyry (Tables 3.3, 3.4 and 3.5, respectively). Average paste pH, total sulphur (%), acid generating potential (AP), neutralization potential (NP) and net neutralization potential (NNP) were then calculated for each sample. Results are summarized as follows:

Rock Type	Paste pH	Total S (%)	AP	NP	NNP
Intrusion Breccia	8.76	0.24	7.54	28.66	21.12
Syenodiorite	8.68	0.14	4.42	30.19	25.78
Monzonite Porphyry	8.69	0.03	1.08	24.44	23.36

On the basis of average NP and AP values, the NP/AP ratio for intrusion breccia averaged 3.8:1 (range 0.4:1 to 68.3:1), NP/AP ratio for syenodiorite averaged 6.8:1 (range 0.7:1 and 87.7:1) and the NP/AP ratio for monzonite porphyry average 22.6:1 (range 5.6:1 to 81.6:1). However, because of differences among sample size, the weighted NP/AP ratio for intrusion breccia, syenodiorite and monzonite porphyry were 8.9:1, 45.1:1 and 44.9:1, respectively.

On the basis that the waste rock would comprise approximately 72% intrusion breccia, 14% syenodiorite and 12% monzonite porphyry, the weighted NP/AP ratio for the waste rock stockpiles, would be in the order of 18:1.

An acid-base accounting test on a composite sample of tailings from pilot-scale metallurgical testing gave the following results:

Percent sulphur	-	0.02	
Paste pH	-	8.22	
Acid generating potential	-	0.63	(kg $CaCO_3$/t)
Neutralization potential	-	24.6	(kg $CaCO_3$/t)
Net neutralization potential	-	24.0	(kg $CaCO_3$/t)
NP/AP Ratio	-	39:1	

3.3.2.5 Kinetic Humidity Cell Test Program

Three humidity cell tests were carried out on the ore and waste samples and one on the tailings. The following is a list of individual samples with general location used to produce a composite sample for humidity cell testing:

Composite	Samples	Location
C64	64 samples from Phase II Testing	Central Pit, North Pit, West Pit
C3	MP-150 300-400 MP-150 400-500 MP-150 500-600	West Pit

The samples were subjected to alternating cycles of dry air, moist air and leaching over a period of 13 weeks. Results, which are presented in Tables 3.6 to 3.9 indicate that the waste will be non-acid generating. pH values remained in the range of 7.47 to 8.97 throughout the test period, while acidity and sulphate generation rates declined. Except for calcium and magnesium, metal levels in leachate were below detection levels using ICP methodology. In overall terms these data indicated no potential for acid generation from the samples and no significant leachability of metals from the host rock.

Humidity cell testwork on tailings provided the results similar to those obtained from the ore and waste samples.

3.3.2.6 Internal Pyritic Waste

Detailed core logging and subsequent acid-base accounting tests indicated that there is a area of pyritic material with net acid generating potential located near the north end of the North Pit, as shown on Figure 3.10. This material, which comprises slightly oxidized rock, does not, however, extend into the pit walls. Based on the acid-base accounting data, it is expected that minor pockets of acid generating material will be exposed during mining.

In order to test the neutralization potential of the waste rock from the North Pit, a composite sample was prepared by crushing and blending equal weights of seven samples from the North Pit with two samples representing the pyritic ore, sample 2105-CMP89, as reported below.

Composite	Samples	Location
2105-CMP89	MP-133	North Pit
	MP-134A	
	MP-134B	
	MP-135	
	MP-136	
	MP-139A	
	MP-139B	

As with the previous studies the North Zone composite was subjected to alternating cycles of dry air, moist air and leaching over a period of 10 weeks. Results, which are presented in Tables 3.6 and 3.8 indicate that the waste will be non-acid generating. As in the previous testing pH values remained in the range of 7.92 to 8.97 throughout the test period, while acidity and sulphate generation rates declined, albeit not to the same extent. Similarly, except for calcium, magnesium, manganese, molybdenum and zinc, metal levels in leachate were below detection levels using ICP methodology. The slightly higher sulphate generation rates and metals in this test compared to the results observed in samples C64 and C3 were believed to be the result of the included pyritic material.

The identification, handling and disposal of pyritic waste is described in Section 3.3.3.2, below.

3.3.2.7 Pit Wall Rock

Acid-base accounting tests of core from holes drilled along the pit perimeter in which an elevated pyrite content was observed by drill site geologists were included in the above static testwork in order to evaluate the acid generating potential of the pit walls. On the basis of test results obtained, there is no indication that any acid mine drainage from pit walls will occur. Any locally derived acid on a micro scale is expected to be buffered by calcite readily available in wall rock, providing environmental protection not only during mine life but also after the mine closure. The neutralizing ability of carbonate rich wall rock lithologies is not in doubt and sampling performed is considered statistically representative.

3.3.3 Waste Rock Handling Program

3.3.3.1 Segregation of Waste

As noted above, waste characterization studies have identified only one source of pyritic material within the Mount Polley deposit. It occurs as a lens of ore located in the extreme end of the north pit and will be processed in the mill. Since the high sulphur content is associated with ore, it is unlikely that potential acid generating materials will be encountered in waste material.

However, it is possible that small pockets of pyritic material may be encountered during mining of the deposit. If these materials are ore grade material they will be processed in the mill. If they are low grade ore they will be delivered to the low grade stockpile located within the southeast dumps near the mill for future processing. If the material is designated as waste it will be subject to special handling and selectively placed within any one of the waste rock dumps, as described in Section 3.3.3.3 below.

3.3.3.2 Identification of Potentially Acid Generating Material

During mining, the "low level" ARD monitoring program shall be under the direction of the mine geologist. The field based program will involve visual inspection of waste muck piles for evidence of sulphide minerals. Changes in rock type or lithology through the mining sequence will be identified.

In the normal course of events, cuttings from every blast hole will be assayed for copper and gold. The material within each blast will be categorized as ore, low grade ore or waste. At month end, the waste blast hole cuttings will be composited by blast and submitted for acid-base accounting. As a matter of record, these values will be matched to tonnage moved from individual blasts to the waste rock disposal sites. This procedure will determine the future direction of the ARD program and confirm the observations of the mine geologist.

Any material suspected or confirmed as having an NP/AP ratio of less than 1.5:1 or identified as being potentially acid generating material, will be flagged with ribbons in the pit and subjected to special handling.

Instructions will be given to the equipment operators (haul truck operators) to distribute the material in layers across the face of the active dumps. Haulage units will be routed to various dumping locations such that a build-up of the target material in any one area is avoided.

The disposal process will be the responsibility of the mine supervision. Designated areas within the waste rock dumps will be selected in accordance with the waste disposal plans to ensure that any potentially acid generating material is placed on top of acid consuming material and ultimately covered with a layer of acid consuming material.

3.3.3.3 Segregation of Low Grade Ore

Low grade ore will be stockpiled in the southeast dump on top of waste rock within easy recovery distance of the mill. The low grade ore placed on top of the waste rock will be kept separate from the waste using survey and assay data to maintain an inventory map of position, grade and quantity of material within the stockpile. This information is needed in order to minimize dilution during the recovery process.

3.4 METALLURGY AND PROCESS PLANT

Crushing and grinding in the process plant will liberate the valuable minerals from the gangue material in the ore. This will be followed by flotation of the valuable minerals into a concentrate, which will be subsequently thickened and dewatered for delivery to smelters.

The Mount Polley process plant is designed to treat 5,000,000 tonnes of copper-gold ore each year at 600 t/hr.

3.4.1 Ore Characteristics

The description of the Mount Polley ore mineralogy is given in Section 3.1.3. Due to oxidation processes within the orebody, approximately 27% of the primary sulphides, mainly chalcopyrite, have been replaced by digenite, covellite, cuprite, native copper, malachite, azurite and amorphous chrysocolla.

3.4.2 Metallurgy

Metallurgical bench and pilot plant testing by Coastech Research Inc. in Vancouver and Hazen Research Inc. in Golden, Colorado, was carried out in order to establish metallurgical parameters for the full scale operation.

Work at Coastech Research Inc. has primarily involved flotation and resulted in a two step process in order to recover both sulphide and oxide copper. Sulphides are floated first using conventional collector and frother combinations. This is followed by conditioning with sodium sulphide to sulphidize oxide copper minerals assisting them to float in a subsequent oxide flotation circuit. Sulphide concentrates are reground to improve liberation from gangue materials before cleaning. A separate cleaning circuit is provided for oxide minerals.

Work at Hazen Research Inc. has been done to establish grinding work indices in order to calculate power requirements for grinding the ore.

3.4.3 Process Description

The process is shown on the flowsheets presented in Figures 3.11 through 3.14.

3.4.3.1 Primary, Secondary, Tertiary Crushing and Ore Handling

Ore is crushed through three stages to produce a 16mm product for the grinding circuit, and stored in a 15,000 tonne stockpile. Sized rock for the pebble mill is removed from the secondary crusher feed and stored in a 2000 tonne surge pile.

3.4.3.2 Grinding

Rod mills receive crusher product from storage and reduce it to ball mill feed size at a rate of about 600 tonnes pre hour. Product from the ball mills is reduced to pebble mill feed size and reduced there to flotation feed, sized at 68% - 200 mesh. Pumps and hydrocyclone classify pulp to process the ore efficiently to the required product size.

3.4.3.3 Flotation

A combination of column and mechanical cells combine to recover rougher and scavenger concentrates for regrinding and subsequent cleaning to produce high grade concentrates. Because of the variable nature of the ore (head grades and degree of oxidation) the circuit has been designed with flexibility to permit accommodation of this variability.

3.4.3.4 Concentrate Dewatering

Combined concentrates from the sulphide and oxide flotations are thickened and stored in a stock tank that provides surge between thickening and filtering.

Two pressure filters reduce the moisture content of the final concentrate to 8% for shipment.

A conveyor deposits filtered concentrate in a storage area accessible to a front end loader and the truck loading area.

3.4.4 Concentrate Handling and Transport

3.4.4.1 Introduction

Each year approximately 60,000 tonnes, (66,000 tons) of copper/gold concentrate will be transported to Vancouver and loaded aboard ships for delivery to an off-shore smelter.

Front end loaders will fill 20 tonne containers which will be trucked to Williams Lake and transferred there to railroad cars. This closed container handling system will eliminate the losses that are attendant on the transshipment from truck to load out shed to railcar.

On arrival at Vancouver Wharves the containers will be emptied into a storage shed and the concentrate accumulated to quantities suitable for ocean shipment.

B.C. Rail, which is already involved in container traffic, will provide this intermodal service.

3.4.5 Mill Reagents

Some Mount Polley reagents will be received in drums while others will arrive in bulk form as water solutions, or organic liquids. Mixing and storage tanks, heated when necessary, will provide up to 48 hour supplies of reagent ready for feeding by metering pumps.

One spare system will be provided for trials of experimental reagents, and a ventilation system will ensure that build up of noxious fumes does not occur in the area.

The following is a list of reagents used and their expected quantities:

		tonnes/year
Potassium amyl xanthate	60 g/tonne	150
Aero 3302	5 g/tonne	25
Aero 208	20 g/tonne	100
MIBC	10 g/tonne	50
Sodium hydrosulphide	400 g/tonne	1800
Flocculant	0.17 g/tonne	0.85

3.4.5.1 Instrumentation and Control Philosophy

It is planned that the entire processing operation, with the exception of the crushing plant, will be controlled through a central programmable controller. This PLC and its principal auxiliary components will be located in a control room in the concentrator building and will communicate with remote I/O stations at the fresh water pumphouse, the water head tanks, the reclaim water pump barge and the reclaim water booster pumphouse by way of an overhead data highway cable.

An on-stream analyzer (OSA) will provide for assays on 12 streams instead of 5, to provide up-to-date information on the changing ore and operating results. This will provide sufficient information to allow the flotation operators to control recovery and concentrate grades. The use of an OSA will minimize the requirements for assaying personnel who would otherwise be required to provide these control assays. The OSA package includes the X-ray analyzer (including X-ray tube and spectrometer) and computer hardware and software for data collection and analysis. The computer is powerful enough to be used for control of reagent dosages or other process variables if necessary in a future control scheme. The streams from the OSA can be used for shift composite samples for metallurgical accounting purposes.

3.5 TAILINGS DISPOSAL

3.5.1 General

The principal objectives for the design of the tailings impoundment are to ensure complete protection of the regional groundwater and surface water flows both during operations and in the long-term and to achieve effective reclamation at mine closure. Further details may be found in "Tailings Storage Facility Design Report 1625/1" (Knight Piésold Ltd. 1995).

The principal requirements of the design are as follows:

(i) Permanent, secure and total confinement of all solid waste materials within an engineered disposal facility.

(ii) Control, collection and removal of free draining liquids from the tailings during operations for recycling as process water to the maximum practical extent.

(iii) The inclusion of monitoring features for all aspects of the facility to ensure performance goals are achieved.

(iv) Staged development of the facility to distribute capital expenditure over the life of the project.

The design basis and criteria for the tailings storage facility, including the embankments, surface water diversion system and tailings and reclaim pipework systems are based in part on the review comments by the Ministry of Energy, Mines and Petroleum Resources (MEMPR) and on the appropriate and conservative design parameters from hazard classification, seismic data, hydrological studies and geotechnical site investigations.

A LOW hazard classification or consequence category has been assessed for the tailings impoundment. This implies that the consequences of failure consist of a low economic loss and low environmental impact. Seismic design parameters relevant to this category have been used for design of the facility during operations. A Design Basis Earthquake (DBE) corresponding to the 1 in 475 year return period event has been adopted, and corresponds to the National Building Code of Canada standard.

For closure and post-closure conditions a conservative HIGH consequence category has been selected for design. Specifically, the embankment has been designed to accommodate a maximum design earthquake (MDE) corresponding to 50% of the maximum credible earthquake (MCE) and has been designed to accommodate the Probable Maximum Flood (PMF) event.

3.5.2 Design Features

The tailings storage facility incorporates the following features which are illustrated on Figure 3.15 for initial construction and on Figure 3.16 for the final arrangement:

- A low permeability liner comprised of existing glacial till over much of the tailings basin and a constructed glacial till liner immediately upstream of the main tailings embankment.

- A partial underdrain extends under the constructed basin liner and conveyance pipework will transfer seepage to a recycle pond below the Main Embankment.

- A groundwater recovery well system for monitoring the seepage quality and recovery as necessary.

- A zoned Main Embankment will be constructed from low permeability glacial till material excavated from within the tailings basin. The Main Embankment incorporates drainage provisions to ensure embankment stability and minimize seepage losses. Drainage water and seepage will be collected in a seepage collection pond and returned to the mill process.

- Perimeter and South Embankments will also be constructed as required by the rising tailings level. The perimeter embankment also incorporates drainage provisions which will transfer seepage to a separate recycle pond for return to the mill process.

- All embankments will be incrementally expanded during operations in order to provide the requisite storage capacity for tailings solids and process water with additional freeboard for the PMP and wave run-up.

- Tailings delivery pipework will be installed from the mill site to the Main Embankment. Tailings will flow by gravity for the entire life of the tailings storage facility. Pipework will include multiple spigot offtakes to allow control of tailings beach development and the location of the supernatant pond. Emergency discharge points will be located to ensure total containment of tailings materials within the impoundment.

- A reclaim barge channel will be excavated and a barge, pump and pipework will be installed to transport supernatant water back to the mill for recycle.

- Diversion ditches will be installed to divert the required surface runoff into the tailings storage facility to supplement the process water requirements. The diversions will have flow control structures to ensure that excess water from storm events is directed out of the facility as required to maintain a process water balance.

3.5.3 Tailings Storage Capacity

The tailings facility has been designed to contain 68.6 million tonnes of tailings solids at an average dry density of 1.28 t/m^3 (1.1 t/m^3 for Year 1, 1.2 t/m^3 for Year 2 and 1.3 t/m^3 for Years 3 through 14). Additional storage capacity has been incorporated into the design by including 2 million m^3 of storage for process (reclaim) water on top of the tailings surface.

3.5.4 Reclaim Water Storage Capacity

The design of the tailings storage facility includes for the provision of about 2 million m^3 of storage for reclaim water on top of the tailings surface. This water will be required as a source of make-up water prior to mill start-up and during the cold winter months when surface runoff directed into the impoundment is at a minimum.

The volume of the process water pond will be managed on the basis of operating experience. The design of the overall water management system allows for selective diversion into the impoundment of surface runoff from the mill site, waste dumps and from an undisturbed catchment area adjacent to the tailings facility. Additional water will only be abstracted from Polley Lake (at a maximum volume of 300,000 m^3/yr) if a process water shortfall is encountered and available surface runoff volume is not sufficient to maintain milling operations.

3.5.5 Staged Development

The tailings embankments have been designed for staged development during operations in order to minimize initial capital expenditures and maintain an inherent flexibility to allow for variations in operation and production throughout the life of the mine.

The initial embankment (Stage Ia) will be constructed to El. 927 metres to provide adequate storage for 1 full year of surface runoff, including the 1996 freshet, which is required for mill start-up.

Stage Ia construction will be limited to the Main Embankment. Stage Ib is a downstream raise and will be constructed to El. 931 metres, either as part of the 1995 work or as a separate construction program in 1996. Stage Ib will provide adequate storage for approximately 1 year of production. This sequence will allow for uncertainties in the actual start-up date and ensures that adequate freeboard will be maintained throughout the construction program in the following year.

On-going requirements for embankment construction are shown on Figure 3.17 and on Figure 3.18. The Stage Ic embankment raise will provide incremental storage capacity for approximately 1 year of production. The ongoing embankment raises will require fill to be placed on competent tailings beaches. A coarse bearing layer of waste rock or alluvium may be required for the initial staged expansions on the tailings beach. On-going expansions may include coarser tailings sand which can be produced by selective cycloning at the tailings impoundment.

Tailings deposition will be managed to prevent wind erosion and dust problems by wetting the tailings surface as required.

3.6 WATER MANAGEMENT PLAN

Imperial Metals Corporation (IMC) are prepared to limit the requirements for fresh make-up water to the minimum volume required for potable water (24.9 m^3/hr) and to utilize alternative sources for the supply of additional make-up water required in the milling process.

A fundamental consideration for the supply of process water to the milling circuit is that an adequate volume of water must be available during the cold winter months when precipitation accumulates as snow and surface runoff is at a minimum. Also, a sufficient volume of water is required for mill start-up. The previous water balances, conducted in 1991, indicated that a volume of about 1.26 million m^3 of make-up water would be required during the first year of operation. The make-up water requirements were also projected to decrease during on-going operations as the mine development expanded and additional surface runoff was utilized in the process. These previous analyses illustrated that a certain volume of water in storage would be required prior to start-up and to allow milling to continue through the winter months.

In the revised water management plan, IMC recognize that the tailings impoundment can be utilized as a water reservoir both prior to start-up and during operations, thus eliminating the need for the Polley Lake dam. However, in order to provide sufficient water for mill start-up and for winter operations, particularly during the initial years of mine development, it is necessary to construct the tailings impoundment at least one year prior to mill start-up in order to capture enough surface runoff water.

Knight Piésold Ltd. have conducted a comprehensive series of water balances to evaluate the volumes of surface runoff water that are available throughout the life of the mine and have conducted extensive sensitivity analyses wherein over 1000 different combinations of wet and dry precipitation conditions have been evaluated. These water balances, described in Report on Project Water Management (Knight Piésold Ref. No. 1624/1, February 6, 1995), indicate that the requirement for the Polley Lake dam can be eliminated by:

- Selectively diverting approximately 1.5 million m^3 of surface runoff into the tailings impoundment prior to start-up.
- Providing a minimum volume of about 1.5 million m^3 of water in storage on the tailings surface during on-going operations in order to provide sufficient process water during the cold winter months when surface runoff is minimal.
- Allowing for contingency water extraction of about 300,000 m^3 annually from Polley Lake or Hazeltine Creek during peak flow months. This contingency water supply would only be required for a combination of very dry years during the first few years of operation.

The revised water management strategy, wherein a much smaller reservoir of make-up water is maintained on the tailings surface as compared to the previously proposed Polley Lake live storage, represents a greater risk for the mine operators during periods of extended drought. However, this risk is minimized by including the contingency extraction provision of 300,000 m^3/yr. The likelihood that this volume of water would be required is very low (estimated to be less than 5%). It is proposed that this 300,000 m^3 volume will be extracted at a maximum rate of about 150,000 m^3/month during the peak flow period at spring freshet so that the impact on the fisheries resource will be minimal.

The surface area of Polley Lake is about 3.75 million m^2, and removal of 150,000 m^3 of water will only result in a 4 cm reduction in the lake level. Since the average annual fluctuation in the lake level is expected to be about 50 cm, and since the contingency make-up water would only be removed when the lake level is elevated during spring freshet, a lake drawdown of 4 cm will be insignificant.

This water management plan is designed to ensure no surface discharge from the tailings storage facility, nor from the open pits. Make-up water will be obtained from surface runoff from the mill site first, the waste dumps second, and finally catchment area B. Any contingency make-up water will be obtained from extensions to catchment area B and then from Polley Lake during freshet via a permanent pumphouse (maximum 300,000 m^3/yr). Catchment area A, Bootjack Creek will not be used in the water management plan.

Potable water will be obtained from Polley Lake. Imperial Metals Corporation is presently investigating groundwater sources that may replace the Polley Lake potable water supply.

3.7 ANCILLARY FACILITIES AND SERVICES

The ancillary facilities are located for easy off-site access and arranged to separate the traffic patterns of light vehicles and delivery trucks from the mine haul trucks. Two parking lots, designed to accommodate haulage trucks and cars are located at the plant site.

3.7.1 Plant Location and Layout

The proposed plant site, located at 5 822 500 UTM north, 592 600 UTM east was chosen in conjunction with the suitable topography and proximity to the open pit. The site is situated on a gentle south facing slope at an elevation of 1,110 m above sea level. The process plant will be founded on the bedrock, estimated to be at a depth between 1.5 m and 5.2 m from the surface.

3.7.2 Administrative Offices

An administration building made up of portable trailer units, located on the south side of the plant site will accommodate office personnel.

3.7.3 Maintenance Shops, Warehouse, Analytical Services

The maintenance shops, assay office and sample preparation, warehouse, and mine and mill offices, and mens and womens dry are housed in a three storey, 27 foot section of the mill building, located between the grinding and flotation-dewatering sections.

Analytical facilities include wet assay laboratory, balance room and instrument room, the latter housing an atomic absorption machine. A fume collection system exhausts the assay room hoods independently of the remainder of the building. The wet assay laboratory is provided with a perchloric fume hood.

3.7.4 Power Supply and Distribution

The project power requirement, estimated at 25 MW will be supplied by B.C. Hydro by an overhead transmission line tapped at the 69 KV line (Circuit 60L30) in the vicinity of McLeese Lake, north of Williams Lake. This line, which originates at Soda Creek Substation, presently supplies Gibraltar Mine.

The total length of the line is 54 km. From McLeese Lake to Beaver lake (approximately 34 km) the line will be located adjacent to the road within the 30 m road easement. At Beaver Lake the line will intersect the paved road to the community of Likely. At approximately 38 km, the proposed line will cross the road to Likely and follow the Gavin Lake Forest Service access road. From Gavin Lake the line will leave the Forest Service Road and follow a more direct route to the mine site. Extensive logging activity in this last portion of the route and the related road construction offset any advantage of following the road.

3.7.5 Fuel Storage & Handling

Diesel fuel will be delivered to the site in tanker trucks by one of the major fuel suppliers. It will be delivered to and stored in bulk storage tanks on the property in the plant area, west of the fine ore stockpile. The tanks will be sized to provide storage for two weeks' requirements. The tanks will be provided with an adequate berm in accordance with fuel storage regulations. A diesel and gasoline dispensing station will be located nearby.

3.7.6 Water Supply

Water is required for mineral processing, fire protection and potable purposes. To supply these needs process water will be stored in the tails impoundment and pumped to the site for distribution. Ground water wells and Polley Lake will supply potable and fresh water.

Both environmental and economic considerations require that water usage be minimized, thus to the greatest extent possible the tailings slurry water will be reclaimed and reused. There will be no excess tailings water to be disposed off.

With provision for sedimentation, the pit drainage, rock dump drainage and plant site drainage will be of acceptable quality for discharge to the environment. This water will normally be used as process water in the mill, or released if it is of acceptable quality.

3.7.6.1 Process Water

Process water requirements for slurrying tailings to the disposal area are 1,039 m^3/hr. This is the average rate, based on 5,000,000 tonnes of ore throughput per year at a steady rate over 365 days per year, with the slurry 35 percent solids by volume.

3.7.6.2 Fire Protection

Fire protection requirements are 330 m^3/hr, applied in one hour. This water is required only at start-up and after a fire, and is not included in the water balance. The volume is very small compared to other usages.

3.7.6.3 Potable Water Requirements

Based on a staff of 161, and 200 l/person/day for showering and other domestic uses the average flow requirements is 1.4 m^3/hr, and it will be obtained from Polley Lake or ground water wells.

3.7.6.4 Potable Water Distribution

The potable/fire water head tank will store a volume, in the upper part of the tank, sufficient to supply the average potable water requirements for two hours. The potable water will be delivered to the mill via a potable water line, and any excess will be used to supplement reclaim water.

The required fire water storage will be reserved in the lower part of the tank. In the event of fire, it will be delivered to the mill via a dedicated fire water pipeline.

3.7.6.6 Sanitary Sewage

Sewage from the plant and service buildings will flow by gravity to a septic tank at the lower end of the site. The effluent will be pumped into the tailings line. The effluent will be thoroughly mixed, diluted, and oxidized in the tailings line and tailings disposal area.

3.7.6.7 Reclaim Water

Reclaim water will be pumped from the tailings disposal area to the reclaim water head tank, adjacent to the mill building.

Four 250 H.P. vertical turbine pumps mounted in a barge floating in the tailings pond will pump up to 6000 U.S. gal/min. to an intermediate pump station equipped with four identical pumps to send the reclaim water the rest of the way to the reclaim tank.

3.7.7 Roads

3.7.7.1 Access Roads

The main access to the site will be via the 14 km forestry access road from Road No. 114, the Likely Road, north of the site.

In accord with B.C. Ministry of Energy, Mines and Petroleum Resources (MEMPR) standard for resource roads, the proposed road width is 9 m. The existing road, bridges and culverts will require improvement to a 40 t load limit, with gravel surface, and to reduce sharp curves and dips. This road design will be updated in a road report to be completed in early April.

3.7.7.2 On-Site Roads

The plant site grading will have suitable fill and subgrade specifications and gravel surfacing.

An access road parallel to the tailing disposal and reclaim water lines will also be constructed.

3.7.7.3 Fuel Storage and Dispensing

The location for the proposed 150,000 L diesel storage tanks, spill containment area, and filling/dispensing access, is shown in Figure 3.15. The yard arrangement shown provides sufficient access for large vehicles.

Propane will be used for heating buildings and in certain equipment in the mill. There is sufficient space on or adjacent to the site for location of propane tanks. Underground piping will be required between the tanks and the buildings.

3.7.7.4 Concentrate Transport

Mill concentrate will be transported using appropriate closed container B-train haulage trucks and move the concentrate from the mine to appropriate ports or direct haulage to smelters.

3.7.8 Refuse Disposal

Industrial and municipal refuse generated by the proposed operations will be disposed of separately.

Industrial waste from the mine, mill and maintenance facilities such as broken rods, drill bits, and shop scrape metal will be collected separately by the surface crews and buried within the waste rock stockpile. This refuse will be levelled by bulldozer in layers not exceeding 1 m, compacted and covered with a minimum 2 m of waste rock.

Municipal refuse such as domestic and office garbage including putrescible wastes will be collected in covered metal containers located at strategic locations around the operations. This material will be burned in a forced fire incinerator and the ash disposed of in a landfill trench and covered by waste rock and till, or picked up for delivery to an approved landfill on the site or in the region.

3.7.9 Sewage Disposal

The tailings disposal area will receive all aqueous effluent including sewage and washdown water.

A septic tank will be used for primary sewage treatment. A gravity sewer collection system of pipes will convey sewage effluent from the mill, repair shop, warehouse, laboratory, dry and administration building to the buried septic tank located at the low point of the plant site. The solid waste in the septic tank will be retained and treated while the liquid portion will overflow into the pump chamber to be discharged to the tailings impoundment.

Grease and sediment from the water used in the dry will be collected in a grease trap before entering the gravity line and disposed of in trenches and backfilled immediately. A waste oil intercepter may also be installed in the truck washdown bay.

Portable washrooms, which will be cleaned out regularly, will be used at the mine.

3.7.10 Chemical Waste Disposal

The milling operation will not produce any chemical wastes. Any reagents spilled accidentally will be collected and returned to the mill circuit.

Chemical wastes from the assay laboratory will be collected regularly and placed in an industrial chemical repository and returned to a contract chemical reduction service for disposal. Acid and alkaline laboratory wastes will be neutralized, diluted to acceptable levels and disposed of to the tailings disposal site.

Waste oil from the maintenance shop will be collected in a tank and returned to an oil refining depot or be used for refuse incineration.

A spill contingency plan for chemical waste including ore concentrate will be developed prior to operation start-up.

Table 3.1

MOUNT POLLEY PROJECT - WHOLE ROCK ANALYSES OF PRINCIPAL LITHOLOGICAL UNITS

SAMPLES	SiO2 %	Al2O3 %	Fe2O3 %	MgO %	CaO %	Na2O %	K2O %	TiO2 %	P2O5 %	MnO %	Cr2O3 %	Ba PPM	La PPM	Zr PPM	Y PPM	Nb PPM	LOI %	SUM %
1	51.15	17.87	8.34	2.53	4.02	5.75	3.16	.66	.29	.11	.001	4382	28	70	28	48	5.1	99.75
2	57.49	15.79	7.06	1.75	4.80	4.80	4.42	.52	.22	.20	.001	1254	25	62	17	51	1.5	99.64
3	55.90	17.19	8.10	2.44	3.46	4.71	4.60	.75	.29	.09	.001	1838	26	73	26	40	1.3	99.58
4	52.00	17.89	8.09	3.03	5.97	3.36	4.31	.72	.30	.13	.001	1692	25	55	20	60	3.5	99.61
5	52.56	17.39	7.89	2.69	7.87	3.94	3.71	.66	.33	.15	.002	2251	27	66	26	36	2.1	99.69
6	49.17	18.12	9.11	3.63	6.37	3.43	3.23	.77	.36	.22	.001	1917	25	44	19	83	4.9	99.86
7	59.13	16.04	3.87	1.39	4.50	2.00	9.37	.32	.13	.07	.004	1498	25	54	16	25	2.6	99.69
8	60.22	16.83	5.70	1.25	1.43	2.66	9.19	.30	.14	.04	.005	1555	25	114	16	57	1.6	99.66
9	61.07	17.33	4.32	1.31	3.11	5.87	4.78	.43	.14	.13	.001	1291	25	96	24	24	1.1	99.83
10	48.60	14.87	7.72	7.00	7.02	3.19	1.88	1.24	.57	.13	.053	3497	47	110	18	35	6.8	99.69
11	53.13	16.56	6.96	4.72	4.52	4.59	3.40	1.10	.47	.10	.029	1339	41	131	14	32	4.0	99.63
12	48.28	12.99	10.00	7.94	11.09	1.65	3.41	.57	.32	.21	.032	1680	25	33	13	24	3.0	99.80
13	48.07	15.42	10.52	4.41	11.02	1.44	4.66	.71	.43	.33	.003	1995	25	36	15	42	2.0	99.77
std 90-4	66.03	11.29	3.55	1.02	1.70	1.42	2.21	.61	.22	.09	.008	806	35	306	25	23	11.5	99.83

LITHOLOGY

Sample #

1	Intrusion breccia, clay alteration
2	Intrusion breccia/syenodiorite in glassy monzonite porphyry
3	Intrusion breccia/syenodiorite in glassy monzonite porphyry
4	Syenodiorite
5	Syenodiorite
6	Syenodiorite
7	Monzonite porphyry, glassy
8	Monzonite porphyry, glassy
9	Monzonite porphyry, glassy
10	Mafic dyke
11	Mafic dyke
12	Augite porphyry, weak K-spar alteration of matrix
13	Augite porphyry, weak K-spar alteration of matrix

Table 3.2

MOUNT POLLEY PROJECT - MULTIELEMENT ANALYSES
OF PRINCIPAL LITHOLOGICAL UNITS

SAMPLE#	Mo PPM	Cu PPM	Pb PPM	Zn PPM	Ag PPM	Ni PPM	Co PPM	Mn PPM	Fe %	As PPM	U PPM	Au PPM	Th PPM	Sr PPM	Cd PPM
1	9	974	5	36	.2	5	17	370	5.73	12	5	ND	1	25	1
2	1	2464	10	36	1.8	4	8	250	4.91	8	5	ND	1	56	1
3	1	1073	4	52	.4	6	11	323	5.84	10	5	ND	1	45	1
4	34	1789	9	35	.4	7	15	384	5.70	9	5	ND	1	35	1
5	1	211	4	45	.2	4	13	390	5.26	9	5	ND	1	36	1
6	1	164	10	37	.1	1	18	887	6.68	14	5	ND	1	74	1
7	94	748	5	20	.3	4	18	208	2.44	6	5	ND	1	20	1
8	21	1550	4	27	.3	4	11	144	4.01	6	5	ND	1	14	1
9	2	299	12	75	.3	6	5	224	2.47	4	5	ND	1	40	1
10	1	64	2	77	.1	114	21	434	4.72	2	5	ND	1	204	1
11	1	44	9	99	.3	64	16	518	4.22	21	5	ND	1	160	1
12	1	122	2	123	.3	33	21	733	5.84	13	5	ND	1	44	1
13	1	319	38	477	.3	10	20	1418	6.48	31	5	ND	1	74	1
STD C/AU-R	18	41	45	137	7.8	67	31	1019	4.12	45	25	8	35	47	19

SAMPLE#	Sb PPM	Bi PPM	V PPM	Ca %	P %	La PPM	Cr PPM	Mg %	Ba PPM	Ti %	B PPM	Al %	Na %	K %	W PPM	Au* PPB
1	3	2	73	1.31	.099	3	12	.93	859	.06	7	5.82	.93	.07	1	20
2	2	10	119	1.07	.068	6	2	.12	348	.07	8	.42	.05	.07	1	136
3	2	2	178	.85	.187	7	15	.99	227	.17	3	.96	.05	.10	1	107
4	2	5	87	1.79	.110	5	11	1.18	50	.13	13	2.38	.11	.13	1	39
5	2	2	128	2.46	.129	6	6	.52	383	.10	13	1.74	.03	.07	1	11
6	2	2	169	2.43	.123	6	10	1.67	297	.15	16	3.01	.21	.12	1	4
7	2	2	61	1.96	.053	5	5	.25	48	.05	8	.44	.03	.08	1	17
8	2	3	181	.47	.043	3	8	.53	43	.07	4	.48	.02	.10	1	158
9	2	2	60	.63	.057	5	6	.11	271	.09	5	.30	.03	.07	1	10
10	3	2	99	2.63	.214	16	102	2.86	1586	.15	2	2.06	.11	.12	1	3
11	3	2	87	2.00	.186	29	54	1.98	269	.24	5	1.49	.08	.07	1	4
12	2	2	166	1.79	.117	4	79	1.63	34	.10	12	1.81	.01	.08	1	5
13	2	2	169	2.38	.164	8	14	1.80	36	.16	38	8.48	.08	.06	1	12
STD C/AU-R	15	20	59	.48	.097	36	55	.89	178	.06	35	2.05	.06	.14	11	470

LITHOLOGY

Sample #

1 Intrusion breccia, clay alteration
2 Intrusion breccia/syenodiorite in glassy monzonite porphyry
3 Intrusion breccia/syenodiorite in glassy monzonite porphyry
4 Syenodiorite
5 Syenodiorite
6 Syenodiorite
7 Monzonite porphyry, glassy
8 Monzonite porphyry, glassy
9 Monzonite porphyry, glassy
10 Mafic dyke
11 Mafic dyke
12 Augite porphyry, weak K-spar alteration of matrix
13 Augite porphyry, weak K-spar alteration of matrix

Table 3.3

MOUNT POLLEY PROJECT
ACID BASE ACCOUNTING TESTS - INTRUSION BRECCIA

(Where AP is zero, the Total Sulfur is assumed as 0.01%)

Sample	Paste pH	Total S %	AP	NP	NNP	NP/AP	From feet	To feet	Interval	NP/AP*Int
MP-100	8.14	0.64	20.0	33.4	13.4	1.7	20	469	449	750
MP-102	8.80	0.04	1.3	10.1	8.9	8.1	10	100	90	727
MP-102	8.80	0.05	1.6	16.8	15.2	10.8	100	200	100	1075
MP-102	8.80	0.05	1.6	25.1	23.5	16.1	200	300	100	1606
MP-102	8.80	0.13	4.1	27.8	23.7	6.8	300	400	100	684
MP-102	9.00	0.21	6.6	25.2	18.6	3.8	400	500	100	384
MP-102	8.90	0.16	5.0	45.6	40.6	9.1	500	600	100	912
MP-103	8.80	0.05	1.6	25.3	23.7	16.2	300	400	100	1619
MP-103	9.00	0.04	1.3	15.0	13.8	12.0	400	500	100	1200
MP-103	8.70	0.34	10.6	23.1	12.5	2.2	500	596	96	209
MP-105	9.20	0.08	2.5	19.4	16.9	7.8	10	100	90	698
MP-105	9.00	0.03	0.9	29.4	28.5	31.4	100	200	100	3136
MP-105	9.10	0.03	0.9	20.0	19.1	21.3	300	400	100	2133
MP-105	9.20	0.08	2.5	29.2	26.7	11.7	400	500	100	1168
MP-106	8.90	0.06	1.9	24.3	22.4	13.0	15	100	85	1102
MP-106	8.90	0.04	1.3	23.6	22.4	18.9	200	300	100	1888
MP-106	8.90	0.07	2.2	24.2	22.0	11.1	300	400	100	1106
MP-108	8.20	0.01	0.3	11.0	10.7	35.2	10	100	90	3168
MP-108	8.70	0.04	1.3	23.5	22.3	18.8	300	400	100	1880
MP-113	8.15	0.17	5.3	48.8	43.5	9.2	529	600	71	652
MP-121	8.70	0.07	2.2	9.4	7.2	4.3	10	100	90	387
MP-121	9.10	0.12	3.8	15.1	11.4	4.0	100	200	100	403
MP-121	9.30	0.14	4.4	15.5	11.1	3.5	200	300	100	354
MP-121	9.20	0.06	1.9	20.1	18.2	10.7	300	400	100	1072
MP-121	9.30	0.13	4.1	15.8	11.7	3.9	400	500	100	389
MP-121	9.60	0.11	3.4	19.1	15.7	5.6	500	600	100	556
MP-122	8.50	0.42	13.1	38.0	24.9	2.9	100	200	100	290
MP-122	8.70	0.21	6.6	41.9	35.3	6.4	200	300	100	638
MP-122	8.70	0.16	5.0	46.0	41.0	9.2	300	400	100	920
MP-122	8.80	0.12	3.8	48.4	44.7	12.9	400	500	100	1291
MP-124	9.30	0.02	0.6	42.7	42.1	68.3	100	200	100	6832
MP-124	8.70	0.10	3.1	9.4	6.3	3.0	200	300	100	301
MP-124	9.10	0.18	5.6	15.1	9.5	2.7	300	400	100	268
MP-124	8.20	0.06	1.9	16.0	14.1	8.5	400	500	100	853
MP-126	8.50	0.30	9.4	25.5	16.1	2.7	10	100	90	245
MP-126	8.20	0.26	8.1	52.4	44.3	6.4	200	300	100	645
MP-126	8.40	0.17	5.3	28.0	22.7	5.3	300	400	100	527
MP-126	8.60	0.14	4.4	15.8	11.4	3.6	400	500	100	361
MP-126	8.20	0.05	1.6	74.5	72.9	47.7	500	600	100	4768
MP-128C	9.02	0.11	3.4	30.6	27.2	8.9	450	600	150	1335
MP-134A	8.14	2.93	91.6	36.6	-55.0	0.4	10	384	374	149
MP-136	8.19	1.00	31.3	38.6	7.4	1.2	10	600	590	729
MP-139B	8.59	0.13	4.1	50.3	46.2	12.4	165	280	115	1424
MP-142	8.22	0.23	7.2	33.7	26.5	4.7	119	488	369	1730
MP-150	8.60	0.06	1.9	19.6	17.7	10.5	10	100	90	941
MP-150	8.70	0.06	1.9	29.4	27.5	15.7	100	200	100	1568
MP-150	8.60	0.84	26.3	84.2	58.0	3.2	200	300	100	321
MP-150	8.80	0.67	20.9	29.1	8.2	1.4	300	400	100	139
MP-150	8.90	0.34	10.6	26.3	15.7	2.5	400	500	100	248
MP-150	8.60	0.47	14.7	25.9	11.2	1.8	500	600	100	176
MP-39B	9.09	0.01	0.3	11.5	11.2	36.8	79	203	124	4563
MP-86	8.25	0.55	17.2	24.9	7.7	1.4	10	400	390	565
Total	455.39	12.54	391.88	1490.20	1098.33	577.48			6853.00	61086.26
Average	8.76	0.24	7.54	28.66	21.12	3.8			131.79	1174.74

Number of Agregated Samples	52	
Total Sampled Length	6853	Feet
Weighted Average NP/AP Ratio	8.9	

Table 3.4

MOUNT POLLEY PROJECT
ACID BASE ACCOUNTING TESTS - SYENODIORITE

Sample	Paste pH	Total S %	AP	NP	NNP	NP/AP	From feet	To feet	Interval	NP/AP*Int
MP-105	9.10	0.06	1.9	22.3	20.4	11.9	200	300	100	1189
MP-105	9.30	0.09	2.8	42.7	39.9	15.2	500	600	100	1518
MP-106	8.80	0.02	0.6	16.4	15.8	26.2	100	200	100	2624
MP-106	9.30	0.03	0.9	44.2	43.3	47.1	400	500	100	4715
MP-107	8.44	0.01	0.3	27.4	27.1	87.7	10	583	573	50241
MP-108	9.00	0.04	1.3	21.5	20.3	17.2	400	500	100	1720
MP-108	9.10	0.13	4.1	37.5	33.4	9.2	500	600	100	923
MP-115	8.34	0.66	20.6	46.3	25.7	2.2	38	300	262	588
MP-116	8.64	0.07	2.2	28.9	26.7	13.2	44	260	216	2854
MP-117	8.71	0.01	0.3	23.4	23.1	74.9	10	400	390	29203
MP-118	8.33	0.01	0.3	27.1	26.8	86.7	10	398	388	33647
MP-122	8.00	0.04	1.3	40.4	39.2	32.3	30	100	70	2262
MP-123	8.70	0.01	0.3	15.3	15.0	49.0	10	190	180	8813
MP-124	9.20	0.02	0.6	29.2	28.6	46.7	10	100	90	4205
MP-126	8.60	0.31	9.7	22.5	12.8	2.3	100	200	100	232
MP-128A	8.39	0.07	2.2	23.6	21.4	10.8	10	170	160	1726
MP-133	8.61	0.01	0.3	22.0	21.7	70.4	6	400	394	27738
MP-134B	8.05	1.53	47.8	34.6	-13.2	0.7	384	500	116	84
MP-135	8.35	0.02	0.6	34.1	33.5	54.6	10	505	495	27007
MP-138A	8.51	0.06	1.9	65.5	63.6	34.9	60	165	105	3668
MP-140	8.90	0.06	1.9	26.9	25.0	14.3	10	100	90	1291
MP-140	8.60	0.14	4.4	41.3	36.9	9.4	100	200	100	944
MP-141B	7.75	0.32	10.0	34.2	24.2	3.4	322	364	42	144
MP-31	8.63	0.01	0.3	20.1	19.8	64.3	6	100	94	6046
MP-39A	8.83	0.01	0.3	19.6	19.3	62.7	4	275	271	16997
MP-68	8.70	0.20	6.3	38.7	32.5	6.2	10	100	90	557
MP-68	8.80	0.16	5.0	31.6	26.6	6.3	100	200	100	632
MP-68	9.10	0.14	4.4	20.0	15.6	4.6	200	300	100	457
MP-68	9.10	0.08	2.5	27.4	24.9	11.0	300	400	100	1096
MP-69	8.56	0.01	0.3	19.9	19.6	63.7	10	400	390	24835
MP-80	8.19	0.05	1.6	31.4	29.8	20.1	30	400	370	7436
Total	268.93	4.38	136.88	936.00	799.13	959.42			5886.00	265392.67
Average	8.68	0.14	4.42	30.19	25.78	6.8			189.87	8561.05

Number of Agregated Samples 31
Total Sampled Length 5886 feet
Average NP/AP Ratio 45.1

DRAFT

Table 3.5

MOUNT POLLEY PROJECT
ACID BASE ACCOUNTING TESTS - MONZONITE PORPHYRY

Sample	Paste pH	Total S %	AP	NP	NNP	NP/AP	From feet	To feet	Interval	NP/AP*Int
MP-103	8.90	0.01	0.3	17.2	16.9	55.0	10	100	90	4954
MP-103	8.90	0.01	0.3	22.5	22.2	72.0	100	200	100	7200
MP-103	8.90	0.01	0.3	24.8	24.5	79.4	200	300	100	7936
MP-106	9.30	0.05	1.6	8.8	7.2	5.6	500	600	100	563
MP-108	8.70	0.04	1.3	16.5	15.3	13.2	100	200	100	1320
MP-108	8.70	0.02	0.6	33.2	32.6	53.1	200	300	100	5312
MP-110	8.22	0.01	0.3	22.4	22.1	71.7	10	300	290	20787
MP-128B	8.79	0.05	1.6	21.8	20.2	14.0	250	450	200	2790
MP-141A	8.43	0.16	5.0	59.2	54.2	11.8	20	322	302	3576
MP-39C	9.11	0.01	0.3	25.5	25.2	81.6	103	241	138	11261
MP-42	7.62	0.01	0.3	16.9	16.6	54.1	14	300	286	15467
Total	95.57	0.38	11.88	268.80	256.93	511.50			1806.00	81165.76
Average	8.69	0.03	1.08	24.44	23.36	22.6			164.18	7378.71

Number of Agregated Samples	11
Total Sampled Length	1806 feet
Average NP/AP Ratio	44.9

Table 3.6

MOUNT POLLEY PROJECT

HUMIDITY CELL TEST - SAMPLE 2105 - C64

Cycle	Days	pH	Conductivity (mS/cm3)	Alkalinity (mg/L CaCO3)	Acidity (pH 4.5) (mg/L CaCO3)	Acidity (pH 8.3)	Cum. Acidity (pH 8.3) (mg CaCO3/kg)	Sulphate (mg/L)	Cumulative Sulphate (mg/kg)
1	7	7.78	83	3.2	0.0	23.0	9.3	30	12.1
2	28	7.67	143	22.3	0.0	6.3	11.6	30	23.3
3	35	7.81	117	19.1	0.0	2.5	12.5	25	32.4
4	42	7.88	74	22.0	0.0	2.3	13.5	5	34.5
5	49	7.92	66	47.8	0.0	0.9	13.9	10	39
6	56	8.2	93	227.9	0.0	0.8	14.2	15	46.8
7	63	8.38	84	37.1	0.0	0.0	14.2	10	51.8
8	70	8.06	54	23.3	0.0	0.8	14.5	5	54.1
9	77	8.27	52	24.2	0.0	0.0	14.5	5	56.5
10	84	8.3	57	20.2	0.0	0.0	14.5	5	58.9
11	91	8.06	85	20.2	0.0	1.0	14.9	10	62.7
12	98	8.49	73	21.7	0.0	0.0	14.9	10	66.5
13	105	8.75	71	41.9	0.0	0.0	14.9	5	68.3

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Table 3.7

MOUNT POLLEY PROJECT

HUMIDITY CELL TEST - SAMPLE 2105 - C64

WATER EXTRACT ICP ANALYSIS (MG/l)

Cycle	Ag	Al	As	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	Pb	Sb	Zn
	0.01	0.5	0.05	0.1	0.05	0.5	0.01	0.02	0.02	0.01	0.2	5	0.05	0.01	0.01	1	0.01	0.05	0.05	0.01
1	<0.01	<0.5	0.05	<0.1	<0.05	9.1	<0.01	<0.02	<0.02	<0.01	<0.2	<5	1.10	<0.01	0.02	5	<0.01	<0.05	<0.1	<0.01
2	0.06	<0.5	0.10	<0.1	0.25	13.0	0.01	0.02	0.02	<0.01	<0.2	5	1.75	0.01	0.05	6	0.03	0.10	0.20	<0.01
3	<0.01	<0.5	<0.05	<0.1	<0.05	11.0	<0.01	<0.02	<0.02	<0.01	<0.2	5	1.35	<0.01	0.02	7	<0.01	<0.05	<0.10	<0.01
4	<0.01	<0.5	<0.05	0.2	<0.05	6.5	<0.01	<0.02	<0.02	<0.01	<0.2	<5	0.65	0.01	0.01	5	<0.01	<0.05	<0.10	<0.01
5	<0.01	<0.5	<0.05	<0.1	<0.05	6.0	<0.01	<0.02	<0.02	<0.01	<0.2	<5	0.70	<0.01	0.20	2	<0.01	<0.05	<0.10	<0.01
6	<0.01	<0.5	0.05	<0.1	<0.05	1.0	<0.01	<0.02	<0.02	<0.01	<0.2	<5	1.20	<0.01	<0.01	5	<0.01	<0.05	<0.10	<0.01
7	<0.01	<0.5	<0.05	<0.1	<0.05	7.5	<0.01	<0.02	<0.02	<0.01	<0.2	<5	1.10	<0.01	0.10	4	<0.01	<0.05	<0.10	<0.01
8	0.01	<0.5	<0.05	<0.1	0.05	5.5	<0.01	<0.02	<0.02	<0.01	<0.2	<5	0.80	0.01	0.01	2	<0.01	<0.05	<0.10	0.05
9	0.03	<0.5	<0.05	<0.1	0.10	6.5	<0.01	<0.02	<0.02	0.02	<0.2	<5	0.90	0.01	<0.01	2	<0.01	0.05	0.10	<0.01
10	0.08	<0.5	0.10	<0.1	0.20	8.0	0.01	0.02	0.02	0.06	<0.2	<5	1.20	0.02	0.03	3	0.03	0.15	0.15	0.06
11	<0.01	<0.5	0.05	<0.1	<0.05	9.5	<0.01	<0.02	<0.02	0.03	<0.2	<5	1.50	0.07	0.01	4	<0.01	<0.05	0.05	0.03
12	<0.01	<0.5	<0.05	<0.1	<0.05	8.0	<0.01	<0.02	<0.02	<0.01	<0.2	<5	1.05	<0.01	0.05	4	<0.01	<0.05	<0.05	<0.01
13	<0.01	<0.5	<0.05	<0.1	<0.05	4.7	<0.01	<0.02	<0.02	<0.01	<0.2	<5	0.70	<0.01	<0.01	3	<0.01	<0.05	<0.05	<0.01

Table 3.8

MOUNT POLLEY PROJECT

HUMIDITY CELL TEST - SAMPLE 2105 - C3

Cycle	Days	pH	Conductivity (mS/cm3)	Alkalinity (mg/L CaCO3)	Acidity (pH 4.5) (mg/L CaCO3)	Acidity (pH 8.3)	Cum. Acidity (pH 8.3) (mg/L CaCO3)	Sulphate (mg/L)	Cumulative Sulphate (mg/kg)
1	7	7.75	387	24.4	0.0	1.5	0.6	50	19.4
2	28	7.47	400	22.5	0.0	2.8	1.7	55	41.4
3	35	7.59	409	13.3	0.0	1.5	2.3	35	55.7
4	42	8.03	450	20.5	0.0	0.3	2.4	20	64.7
5	49	7.57	395	20.8	0.0	0.9	2.8	25	74.6
6	56	8.01	546	24.5	0.0	0.9	3.3	15	82.8
7	63	8.37	543	25.2	0.0	0.0	3.3	20	93.6
8	70	7.88	504	19.1	0.0	1.3	3.9	5	96.1
9	77	8.03	544	19.4	0.0	0.8	4.4	5	98.9
10	84	8.04	544	20.2	0.0	0.6	4.7	10	104.3
11	91	7.94	400	17.5	0.0	0.6	5.0	5	106.3
12	98	8.34	405	18.0	0.0	0.0	5.0	5	108.3
13	105	8.67	390	18.4	0.0	0.0	5.0	5	110.3

Table 3.9

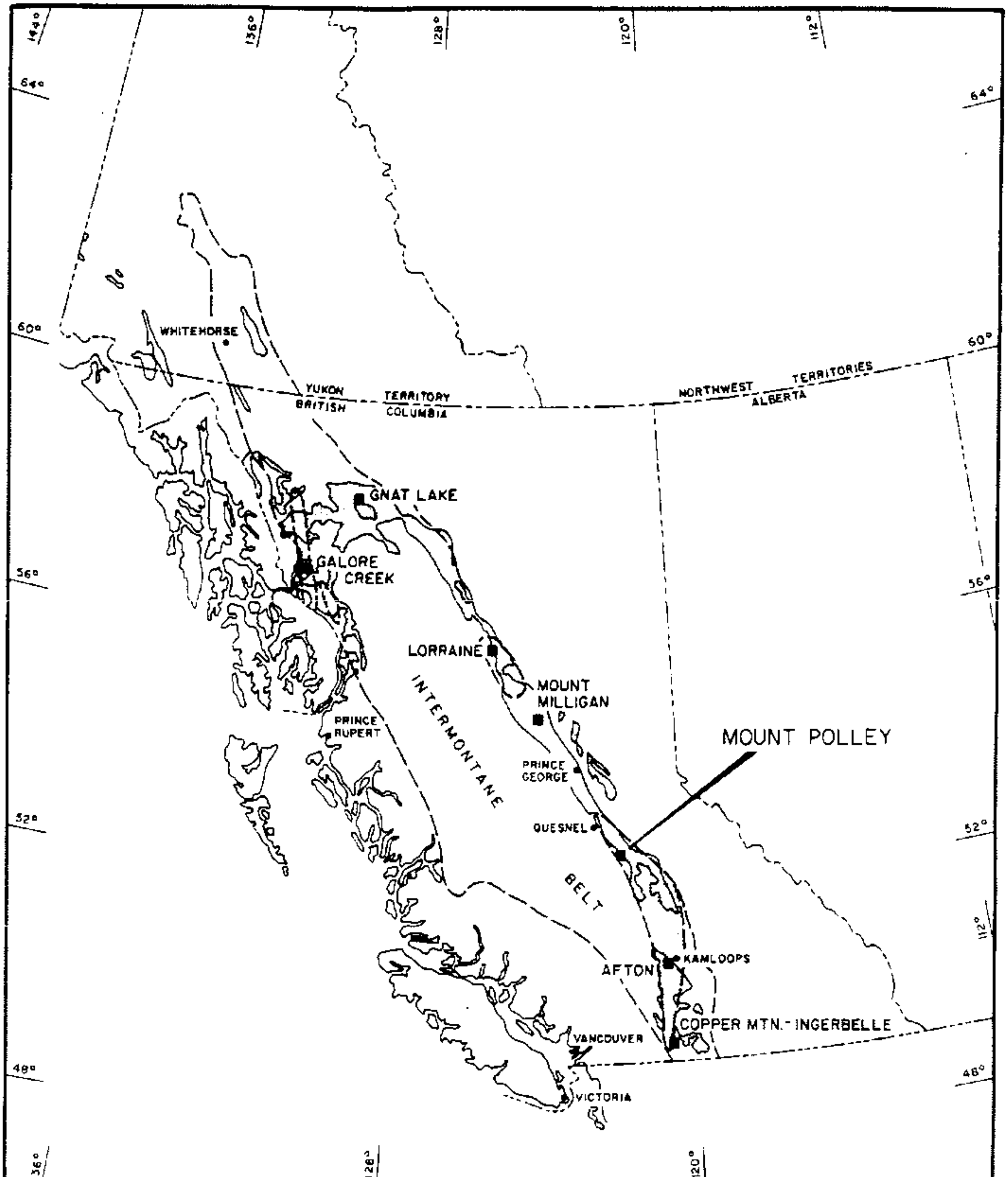
MOUNT POLLEY PROJECT

HUMIDITY CELL TEST - SAMPLE 2105 - C3

LEACHATE ANALYSIS

WATER EXTRACT ICP ANALYSIS (mg/L)

Cycle	Ag	Al	As	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	Pb	Sb	Zn
	0.01	0.5	0.05	0.1	0.05	0.5	0.01	0.02	0.02	0.01	0.2	5	0.05	0.01	0.01	1	0.01	0.05	0.05	0.01
1	<0.01	<0.5	0.05	<0.1	<0.05	25.0	<0.01	<0.02	<0.02	<0.01	<0.2	<5	3.45	0.04	0.50	10	<0.01	<0.05	0.05	<0.01
2	0.07	<0.5	0.15	<0.1	0.25	21.0	0.01	0.02	0.02	<0.01	<0.2	5	2.75	0.02	0.37	7	0.03	0.15	0.20	<0.01
3	<0.01	<0.5	<0.05	<0.1	<0.05	14.8	<0.01	<0.02	<0.02	<0.01	<0.2	5	1.85	<0.01	0.23	7	<0.01	<0.05	<0.05	<0.01
4	<0.01	<0.5	<0.05	<0.1	<0.05	10.0	<0.01	<0.02	<0.02	<0.01	<0.2	<5	1.20	0.02	0.13	5	<0.01	<0.05	<0.05	<0.01
5	<0.01	<0.5	<0.05	<0.1	<0.05	12.0	<0.01	<0.02	<0.02	<0.01	<0.2	<5	1.50	<0.01	0.17	4	<0.01	<0.05	<0.05	<0.01
6	<0.01	<0.5	<0.05	<0.1	<0.05	1.0	<0.01	<0.02	<0.02	<0.01	<0.2	<5	1.00	<0.01	0.11	4	<0.01	<0.05	<0.05	<0.01
7	<0.01	<0.5	<0.05	<0.1	<0.05	9.5	<0.01	<0.02	<0.02	<0.01	<0.2	<5	1.40	0.01	0.12	4	<0.01	<0.05	<0.05	<0.01
8	0.01	<0.5	0.05	<0.1	0.05	7.5	<0.01	<0.02	<0.02	<0.01	<0.2	<5	1.15	<0.01	0.05	3	<0.01	<0.05	<0.05	<0.01
9	<0.03	<0.5	0.05	<0.1	0.10	9.5	<0.01	<0.02	<0.02	0.01	<0.2	<5	1.35	0.02	0.05	4	0.01	0.05	0.10	0.01
10	0.08	<0.5	0.10	<0.1	0.20	11.0	0.01	0.02	0.02	0.06	<0.2	<5	1.75	0.03	0.08	4	0.04	0.15	0.15	0.09
11	<0.01	<0.5	0.05	<0.1	<0.05	8.0	<0.01	<0.02	<0.02	0.03	<0.2	<5	1.80	0.34	0.03	4	<0.01	<0.05	0.10	0.12
12	<0.01	<0.5	<0.05	<0.1	<0.05	5.5	<0.01	<0.02	<0.02	<0.01	<0.2	<5	0.90	<0.01	0.04	2	<0.01	0.05	0.10	0.01
13	<0.01	<0.5	<0.05	<0.1	<0.05	4.9	<0.01	<0.02	<0.02	<0.01	<0.2	<5	0.80	<0.01	<0.01	4	<0.01	<0.05	<0.05	<0.01



LEGEND

ALKALIC VOLCANIC AND INTRUSIVE COMPLEXE

AFTER BARR ET AL (1976)

IMPERIAL METALS CORPORATION

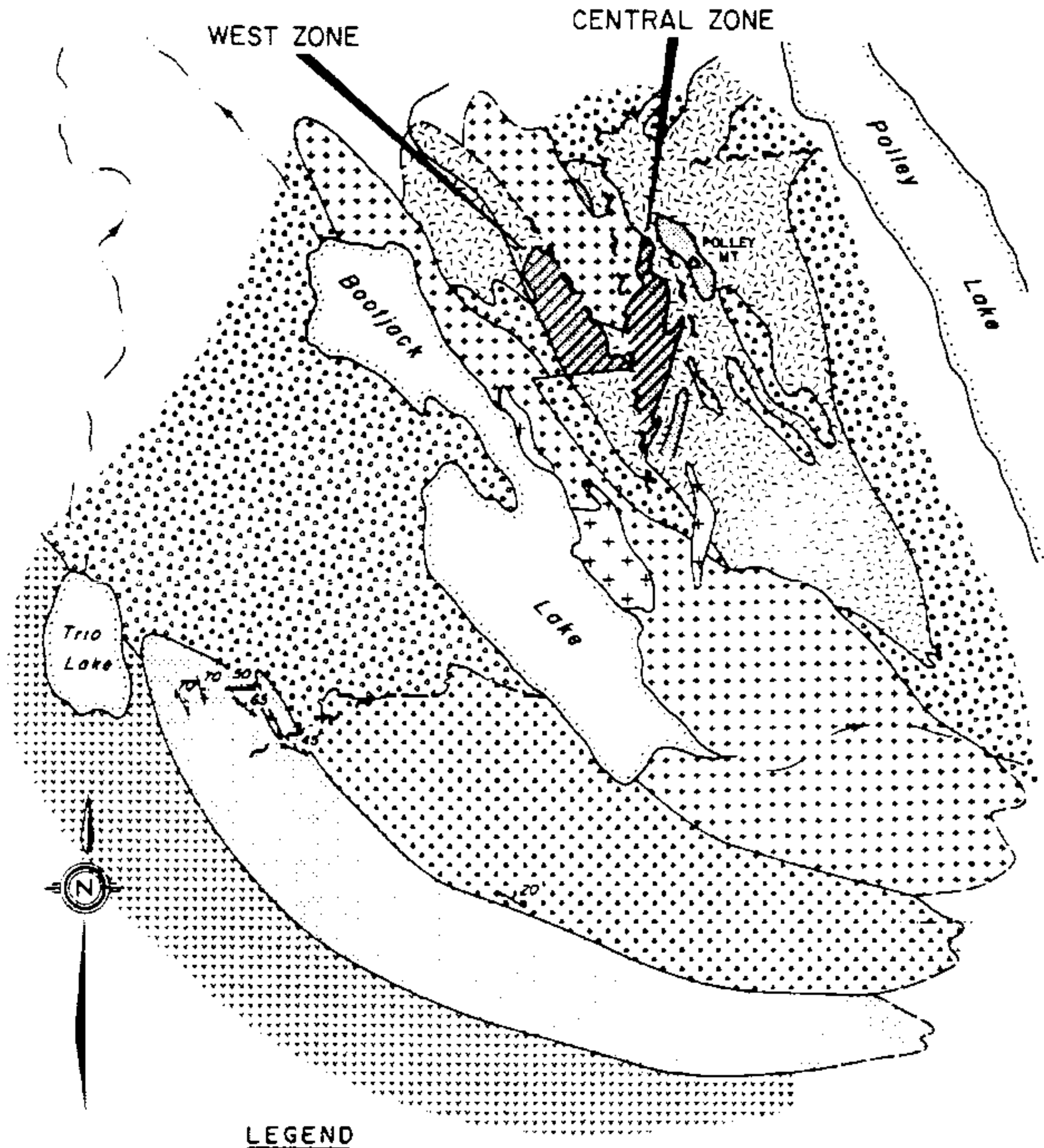
MOUNT POLLEY

FIGURE 3.1 N.T.S. 93A/12

REGIONAL GEOLOGY

0 200 400 600

SCALE	1:10,000,000	GEOLOGIST	K. McNAUGHTON
DATE	DECEMBER, 1989	DRAWN BY	J. CORKUM



LEGEND

LACCOLITH

- PYROXENITE
- INTRUSION BRECCIA
- MONZONITE PORPHYRY
- SYENODIORITE
- PSEUDOLEUCITE SYENITE
- MAFIC PSEUDOLEUCITE SYENITE

UPPER TRIASSIC STRATA

- CRYSTAL AND LAPILLI TUFF
- TRACHYBASALT
- 70 IGNEOUS FOLIATION
- FAULT

AFTER HODGSON ET AL (1976)

IMPERIAL METALS CORPORATION

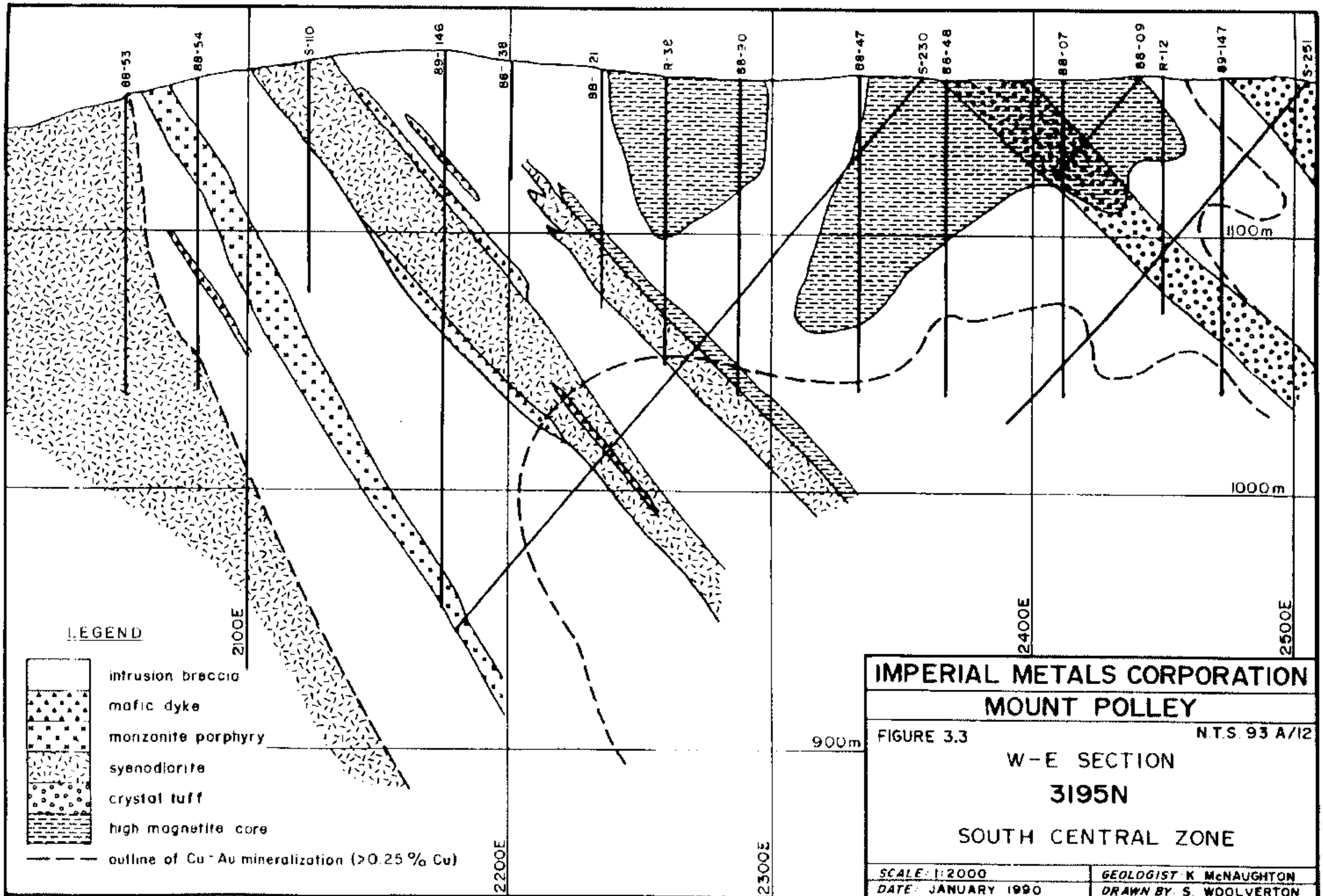
MOUNT POLLEY

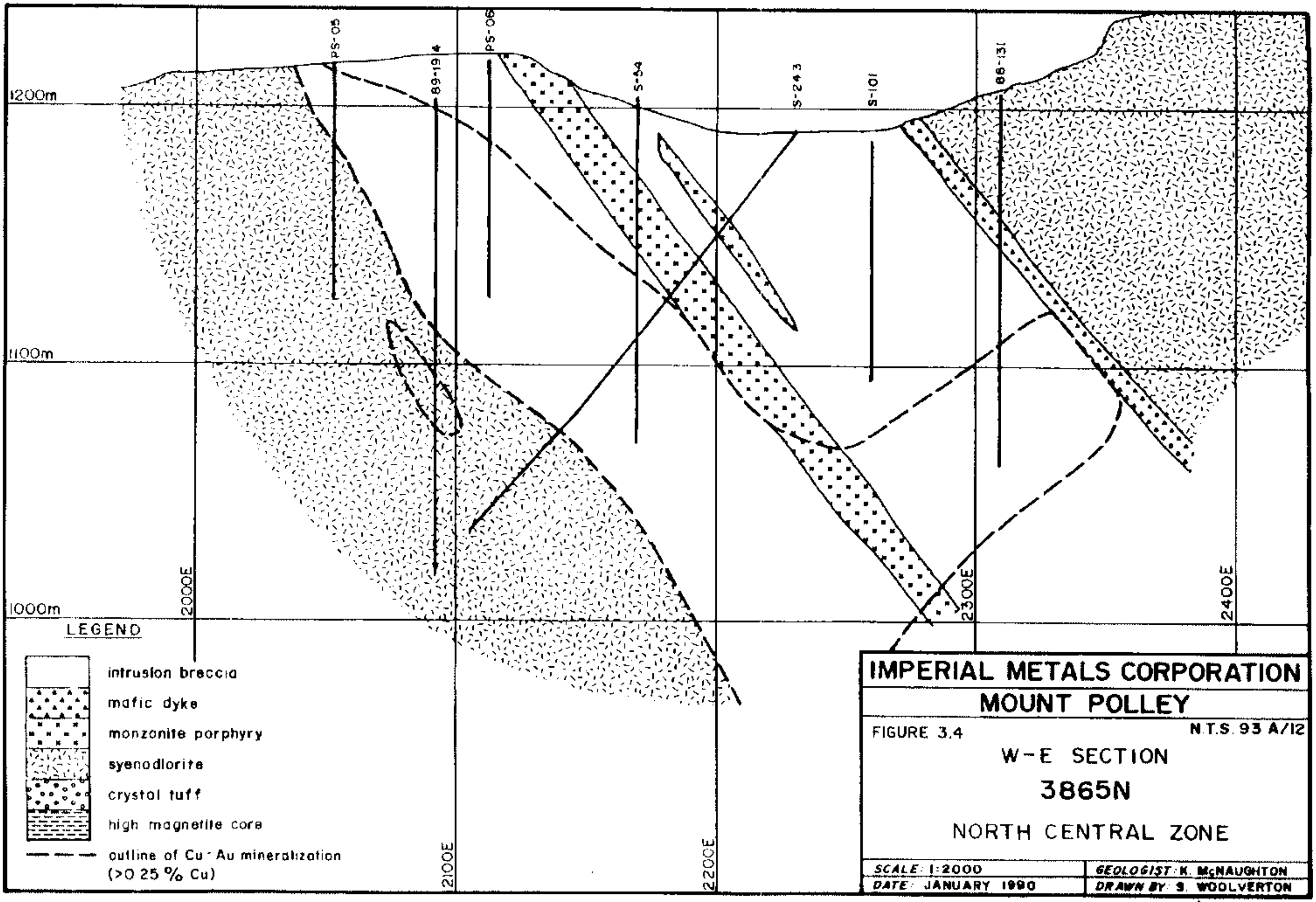
FIGURE 3.2 | N.T.S. 93A/12

PROPERTY GEOLOGY

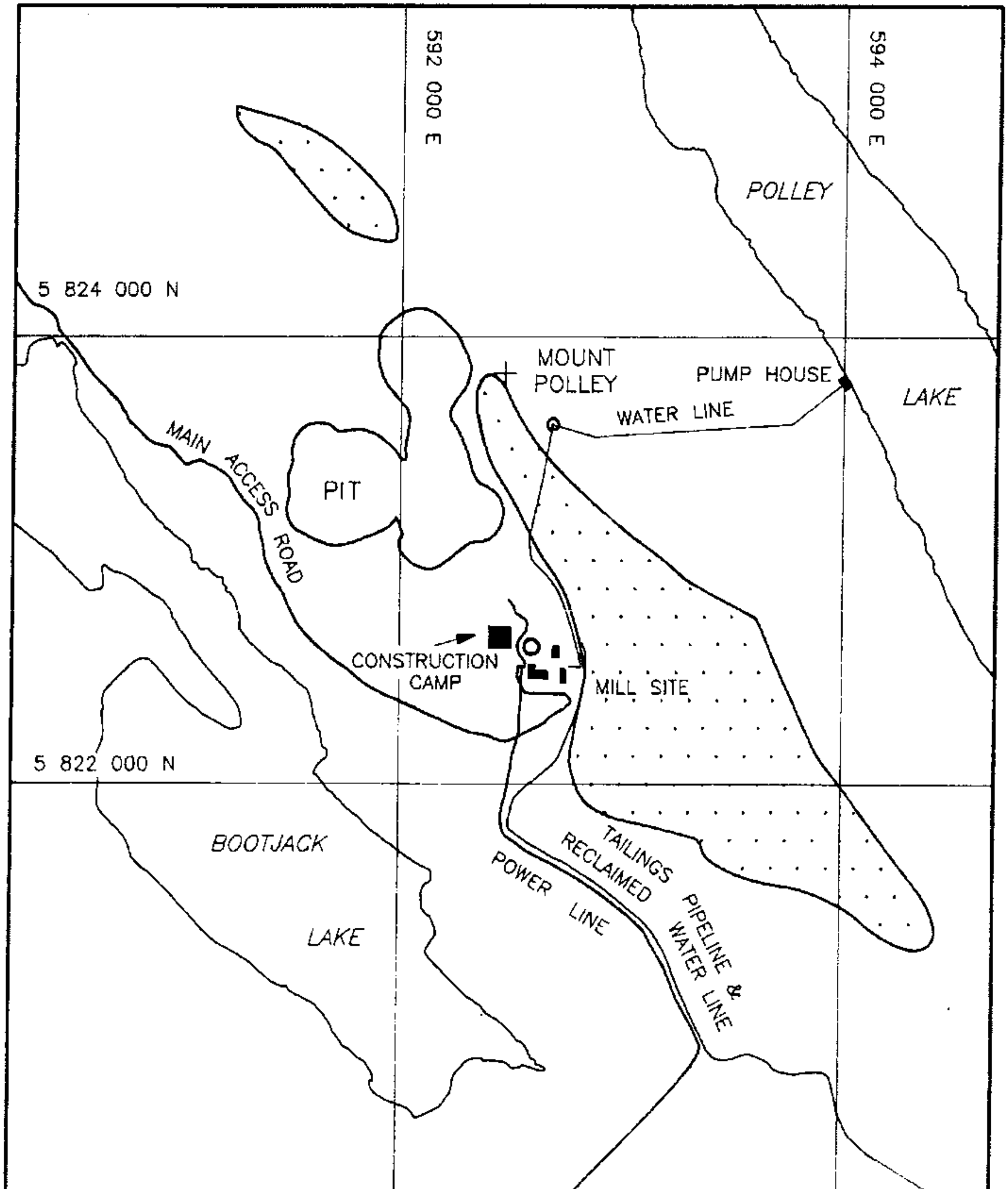
km 0 1 2 km

SCALE		GEOLOGIST:	K. McNAUGHTON
DATE:	DECEMBER, 1989	DRAWN BY:	J. CORKUM


88-53
88-54
S-110
89-146
88-38
88-21
R-32
88-30
88-47
S-230
88-48
88-07
88-09
R-12
89-147
S-251
1100m
1000m
900m
2100E
2200E
2300E
2400E
2500E
LEGEND
intrusion breccia
mafic dyke
monzonite porphyry
syenodiorite
crystal tuff
high magnetite core
outline of Cu-Au mineralization (>0.25 % Cu)
IMPERIAL METALS CORPORATION
MOUNT POLLEY
FIGURE 3.3
N.T.S. 93 A/12
W-E SECTION
3195N
SOUTH CENTRAL ZONE
SCALE: 1:2000
DATE: JANUARY 1990
GEOLOGIST: K. McNAUGHTON
DRAWN BY: S. WOOLVERTON


PS-05
89-194
PS-06
S-54
S-243
S-101
88-131
1200m
1100m
1000m
2000E
2100E
2200E
2300E
2400E
LEGEND
intrusion breccia
mafic dyke
monzonite porphyry
syenodiorite
crystal tuff
high magnetite core
outline of Cu - Au mineralization
(>0.25 % Cu)
IMPERIAL METALS CORPORATION
MOUNT POLLEY
FIGURE 3.4
N.T.S. 93 A/12
W-E SECTION
3865N
NORTH CENTRAL ZONE
SCALE: 1:2000
DATE: JANUARY 1990
GEOLOGIST: K. McNAUGHTON
DRAWN BY: S. WOOLVERTON


Sediment control ditch
Sediment control pond
Sediment control ditch
MP89-226 (4.6)
2% Slope
Waste dump El. 1160.00
MP89-225 (19.8)
Dump reclamation line
2% Slope
Overburden clear line
MP89-224 (3.0)
Dump reclamation line
Waste dump El. 1180.00
2% Slope
MP89-223 (10.7)
Overburden clear line
NORTH PIT
Fresh/Fire head tank
Reclaim water head tank
Overburden stockpile
MP89-219 (4.6)
MP89-218 (3.0)
MP89-220 (4.6)
MP89-217 (5.2)
Waste dump El. 1160.00
MP89-221 (3.0)
Overburden stockpile
MP89-188
Potable water treatment and head tank
2% Slope
MP89-187
Dump reclamation line
MP89-216 (5.5)
Waste dump El. 1140.00
2% Slope
Sediment control ditch
Sediment control pond
Pit water sediment pond
Overburden stockpile
MP89-228 (3.0)
Overburden stockpile
2% Slope
Waste dump El. 1190.00
CENTRAL PIT
El. 1180.00
(infilled with waste rock during later stage of development)
Dump reclamation line
El. 1140.00
MP89-208 (4.6)
MP89-211 (7.6)
MP89-207 (4.6)
MP89-209 (4.6)
MP89-215 (9.1)
MP89-210 (4.6)
Mill site sediment pond
Tailings and reclaim pipelines
WEST PIT
Overburden stockpile
Sediment control dam
Dump reclamation line
Sediment control ditch
Spill prevention and sediment control ditches
NOTE Details of waste dumps overburden stockpiles, sediment control features and millsite supplied by Wright Engineers Ltd.
Bootjack Lake El. 986 ±
594 000 E
593 500 E
593 000 E
592 000
591 500 E
591 000 E
590 500 E
5 822 500 N
5 822 000 N
5 821 500 N
5 823 000
5 823 500 N
5 824 000 N
5 824 500 N
5 825 000 N
LEGEND
MP89-216 (5.5) Borehole location / Approx. overburden depth (m)
Scale 100 50 0 100 200 300 400 500 m
FIGURE 3.5
KNIGHT AND PIESOLD LIMITED
CONSULTING ENGINEERS - VANCOUVER, B.C.
IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
GENERAL ARRANGEMENT OF OPEN PIT AND WASTE DUMPS
DESIGNED KJB
DRAWN RDT
CHECKED KJB
APPROVED
DATE DEC. 20, 1989
SCALE AS SHOWN
DRG. NO. 1621.100
REV
FEB 19 1990 LAYOUT MODIFIED AS PER W.E.L.
REFERENCE DRAWINGS
REVISIONS
REVISIONS



LEGEND

Pyrite Halo (>3% pyrite)	Road
Proposed Pit	Transmission Line
Building	Pipeline

IMPERIAL METALS CORPORATION

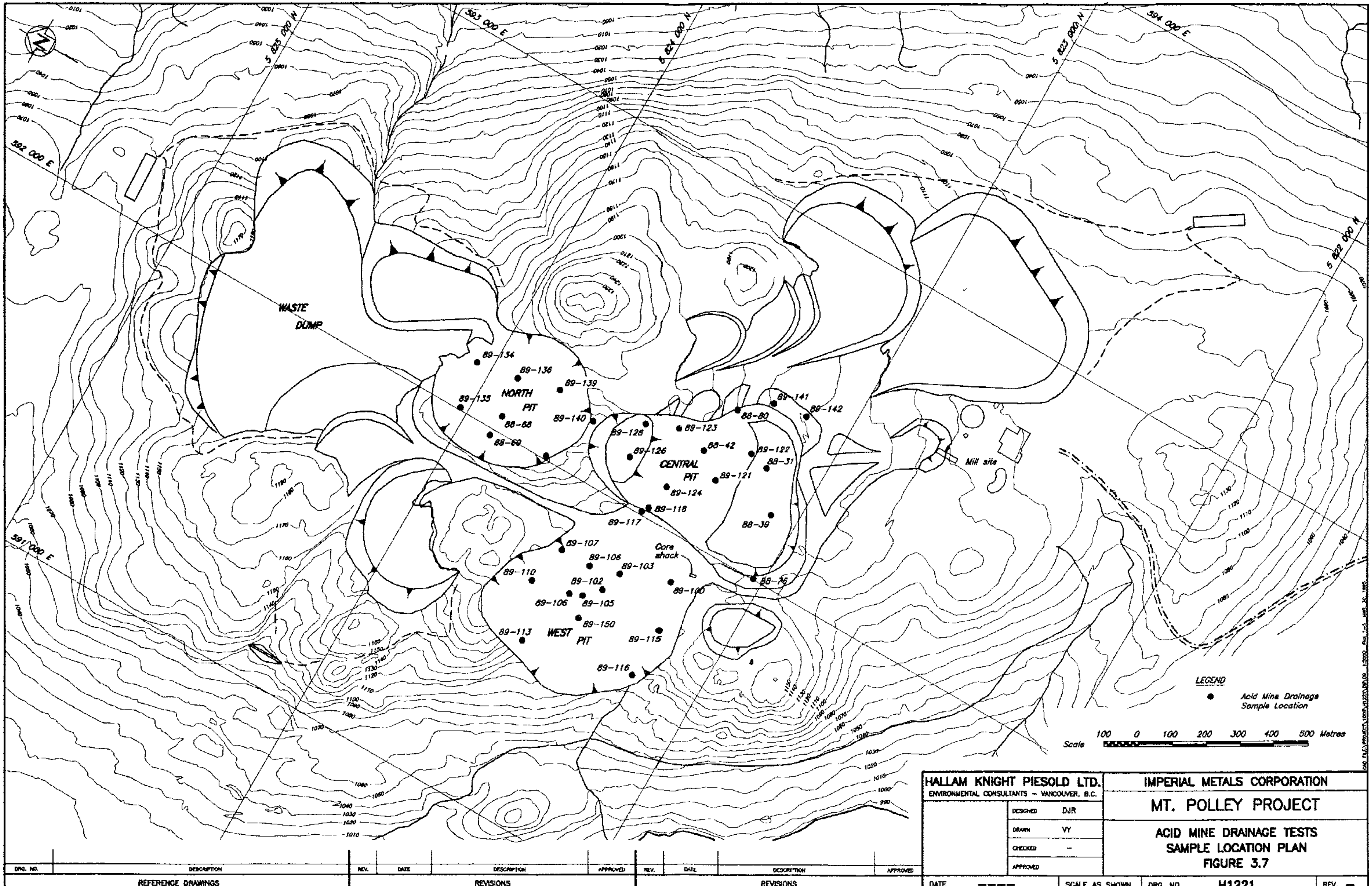
MOUNT POLLEY

FIGURE 3.6 — N.T.S. 93A/12

SURFACE PROJECTION OF PYRITE HALO

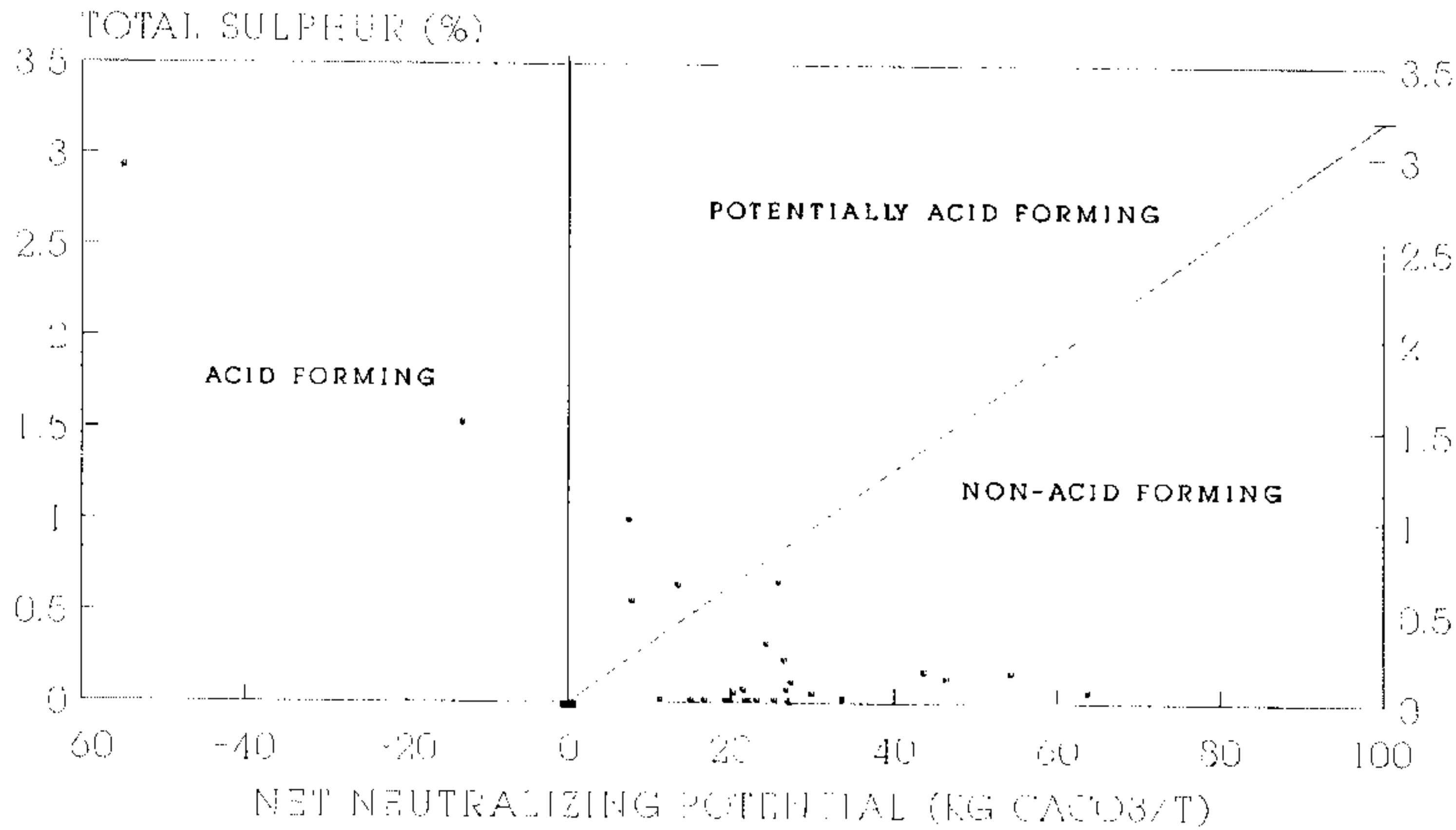
Metres 250 0 250 500 750 1000 Metres

SCALE: 1:25 000	GEOLOGIST: R. PESALJ
DATE: DECEMBER 1990	DRAWN BY: S. HAWORTH


WASTE DUMP
NORTH PIT
CENTRAL PIT
WEST PIT
89-134
89-136
89-139
89-135
89-140
88-68
88-69
89-126
89-123
88-42
88-80
89-141
89-142
89-122
88-31
89-121
89-124
89-118
89-117
88-39
89-107
89-108
89-103
89-110
89-102
89-100
89-106
89-105
89-150
89-113
89-115
89-116
88-36
Core shack
Mill site
592 000 E
593 000 E
594 000 E
591 000 E
5 825 000 N
5 824 000 N
5 823 000 N
5 822 000 N
LEGEND
Acid Mine Drainage Sample Location
Scale 100 0 100 200 300 400 500 Metres
HALLAM KNIGHT PIESOLD LTD.
ENVIRONMENTAL CONSULTANTS – VANCOUVER, B.C.
IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
ACID MINE DRAINAGE TESTS
SAMPLE LOCATION PLAN
FIGURE 3.7
DESIGNED DJR
DRAWN VY
CHECKED –
APPROVED
DRG. NO. DESCRIPTION
REFERENCE DRAWINGS
REV. DATE DESCRIPTION APPROVED
REVISIONS
REV. DATE DESCRIPTION APPROVED
REVISIONS
DATE ----
SCALE AS SHOWN
DRG. NO. H1221
REV. –

ACID NEUTRALIZING POTENTIAL

MOUNT POLLEY ACID - BASE ACCOUNTING



PHASE I TESTING

FIGURE 3.8

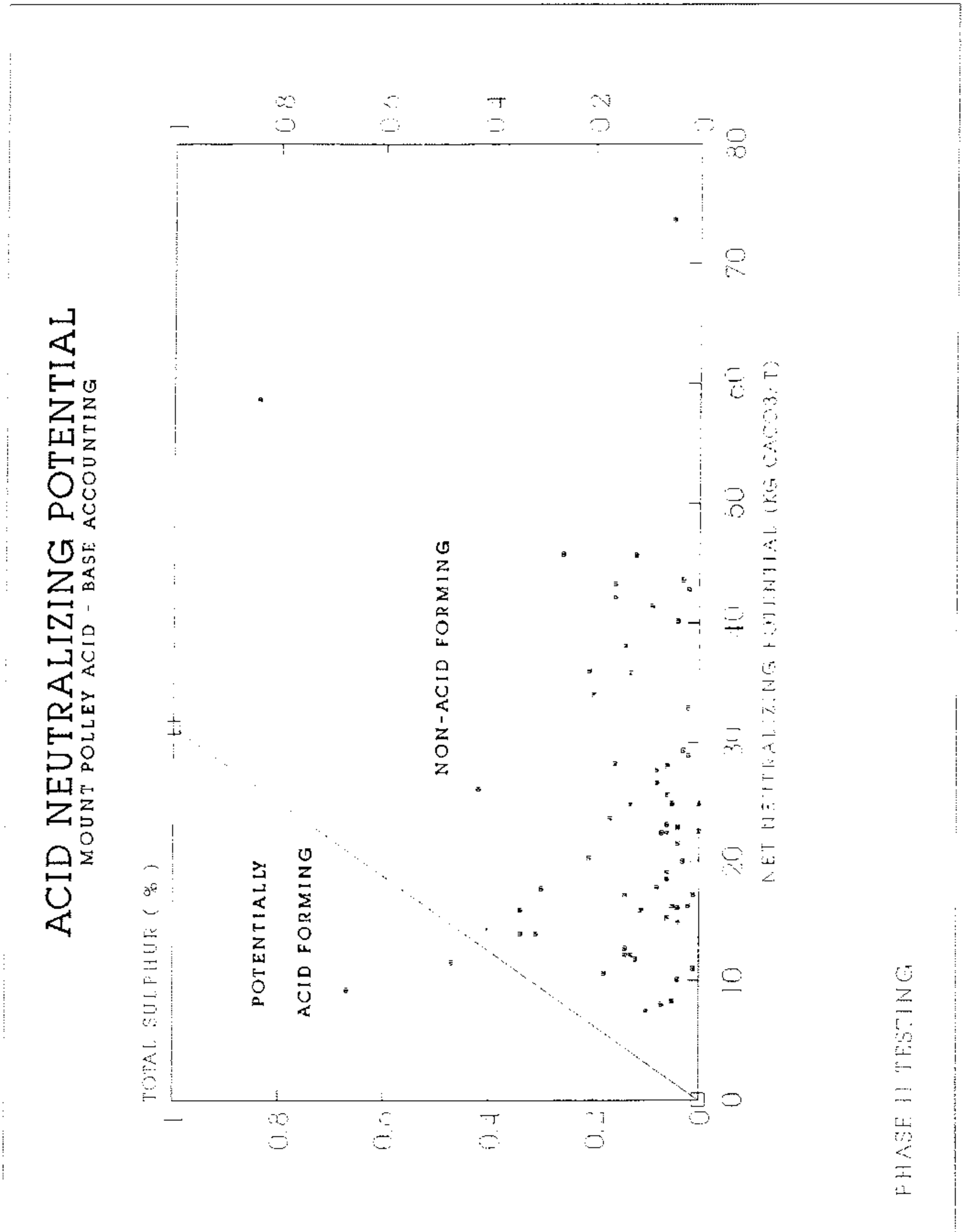

ACID NEUTRALIZING POTENTIAL
MOUNT POLLEY ACID - BASE ACCOUNTING
TOTAL SULPHUR (%)
POTENTIALLY
ACID FORMING
NON-ACID FORMING
NET NEUTRALIZING POTENTIAL (KG CACO3/T)
PHASE II TESTING

FIGURE 3.9

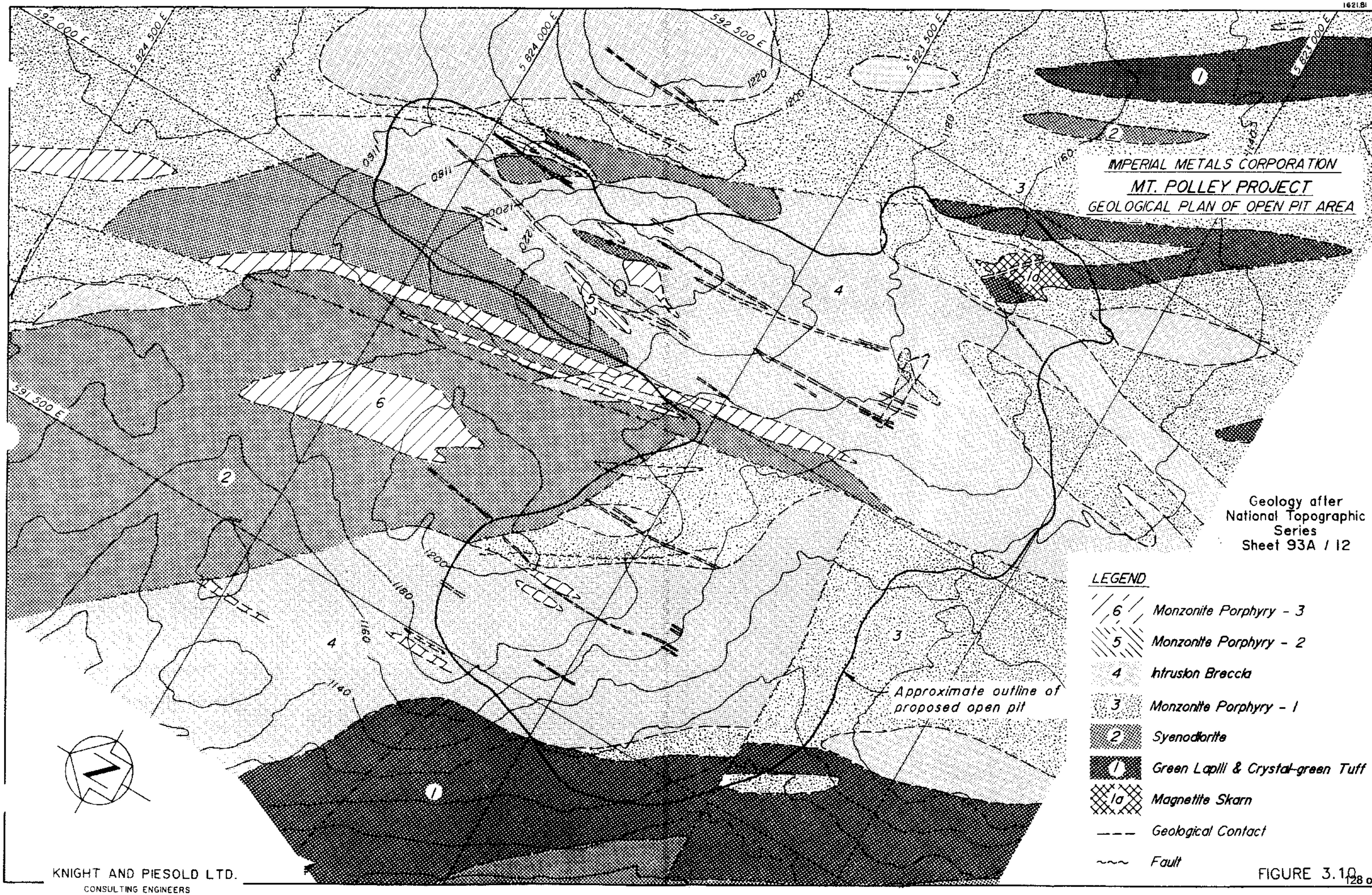
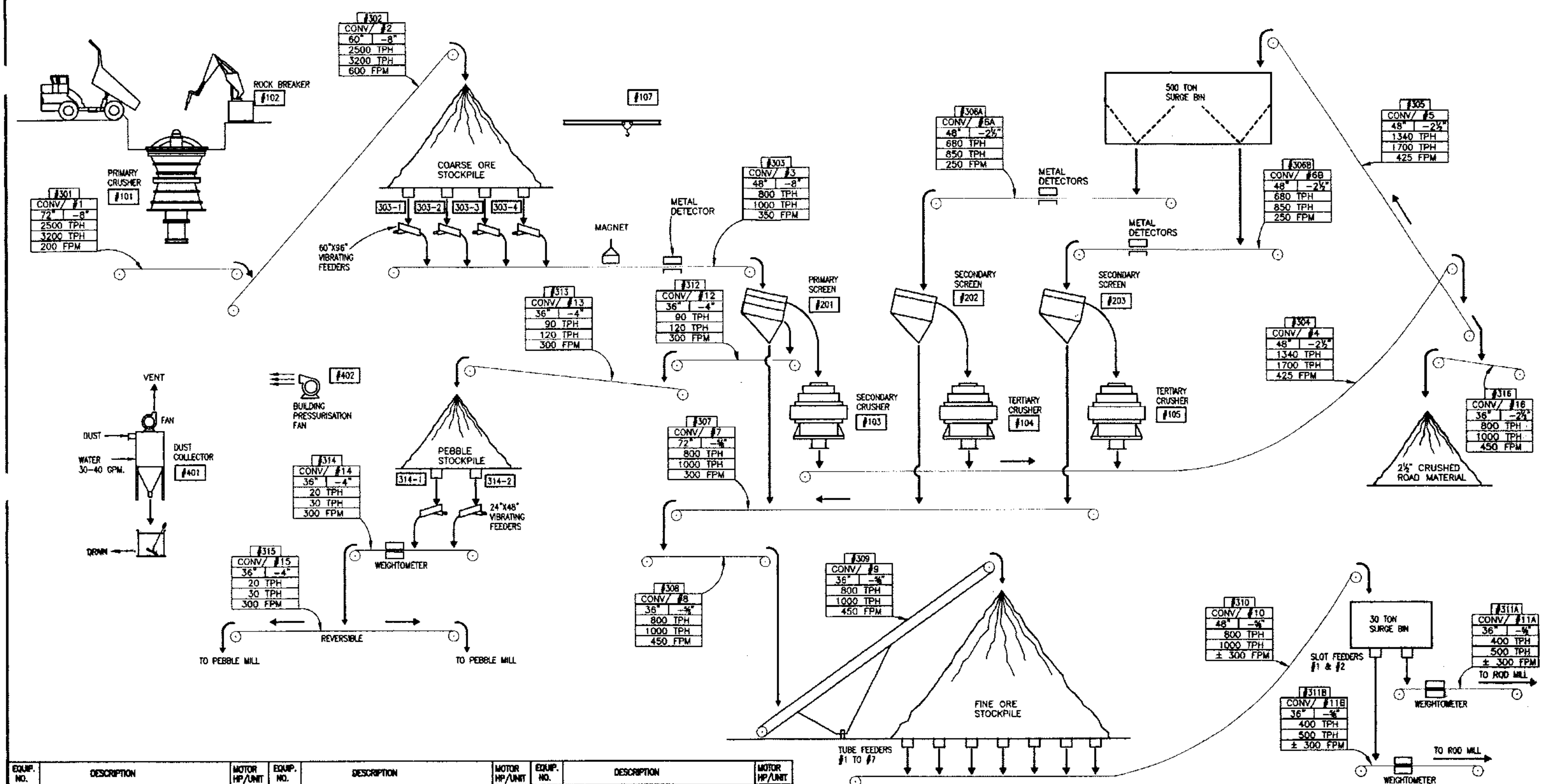
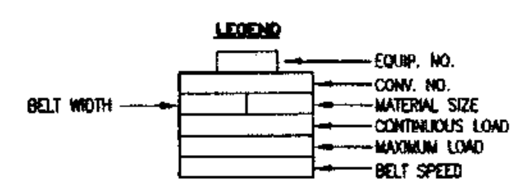

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
GEOLOGICAL PLAN OF OPEN PIT AREA
Geology after
National Topographic
Series
Sheet 93A / 12
LEGEND
6 Monzonite Porphyry - 3
5 Monzonite Porphyry - 2
4 Intrusion Breccia
3 Monzonite Porphyry - 1
2 Syenodiorite
1 Green Lapili & Crystal-green Tuff
1a Magnetite Skarn
Geological Contact
Fault
Approximate outline of
proposed open pit
592 000 E
592 500 E
591 500 E
5 824 500 E
5 824 000 E
5 823 500 E
5 823 000 E
1220
1200
1180
1160
1140
KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

FIGURE 3.10



EQUIP. NO.	DESCRIPTION	MOTOR HP/UNIT	EQUIP. NO.	DESCRIPTION	MOTOR HP/UNIT	EQUIP. NO.	DESCRIPTION	MOTOR HP/UNIT
101	54" X 74" GYRATORY CRUSHER (C.S.)	500	303	CONV. #3 – 48"X530'-0" LG.	150	316	CONV. #16 – 36"X130'-0" LG.	75
102	ROCK BREAKER		304	CONV. #4 – 48"X150'-0" LG.	75			
103	7'-0" STANDARD CONE CRUSHER (C.S.)	350	305	CONV. #5 – 48"X300'-0" LG.	200	303-1	VIBRATING FEEDER #1	10
104	7'-0" S.H. CONE CRUSHER (C.S.)	350	306A	CONV. #6A (FEEDER) –48"X260'-0"LG	100	303-2	VIBRATING FEEDER #2	10
105	7'-0" S.H. CONE CRUSHER (C.S)	350	306B	CONV. #6B (FEEDER) –48"X260'-0"LG	100	303-3	VIBRATING FEEDER #3	10
						303-4	VIBRATING FEEDER #4	10
107	44/11 TON BRIDGE CRANE (C.S.)	25+10	307	CONV. #7 – 72"X75'-0" LG.	60	314-1	VIBRATING FEEDER #5	3
			308	CONV. #8 – 36"X360'-0" LG.	50	314-2	VIBRATING FEEDER #6	3
201	8'X20' TRIPLE DECK SCREEN (C.S.)	2x25	309	CONV. #9 (STACKER) –36"X130'-0"LG	75	401-1	DUST COLLECTOR	
202	8'X20' SINGLE DECK SCREEN (C.S.)	2x25	310	CONV. #10 – 48" X 360'-0"LG	100	401-2	USED FAN & MOTOR	300
203	8'X20' SINGLE DECK SCREEN (C.S.)	2x25	311A	CONV. #11A – 36" X 45'-0"LG	15	402	BUILDING FAN 100,000 CFM	40
			311B	CONV. #11B – 36" X 45'-0"LG	15			
			312	CONV. #12 – 36"X40'-0"LG	15			
			313	CONV. #13 – 36"X450'-0"LG	15			
301	CONV. #1 – 72"X30'-0" LG.	75	314	CONV. #14 – 36"X190'-0"LG	15			
302	CONV. #2 – 60"X460'-0"LG	500	315	CONV. #15 – 36"X30'-0"LG (REVERSIBLE)	15			



REV.	DATE	ISSUED FOR	REVISION DESCRIPTION	BY

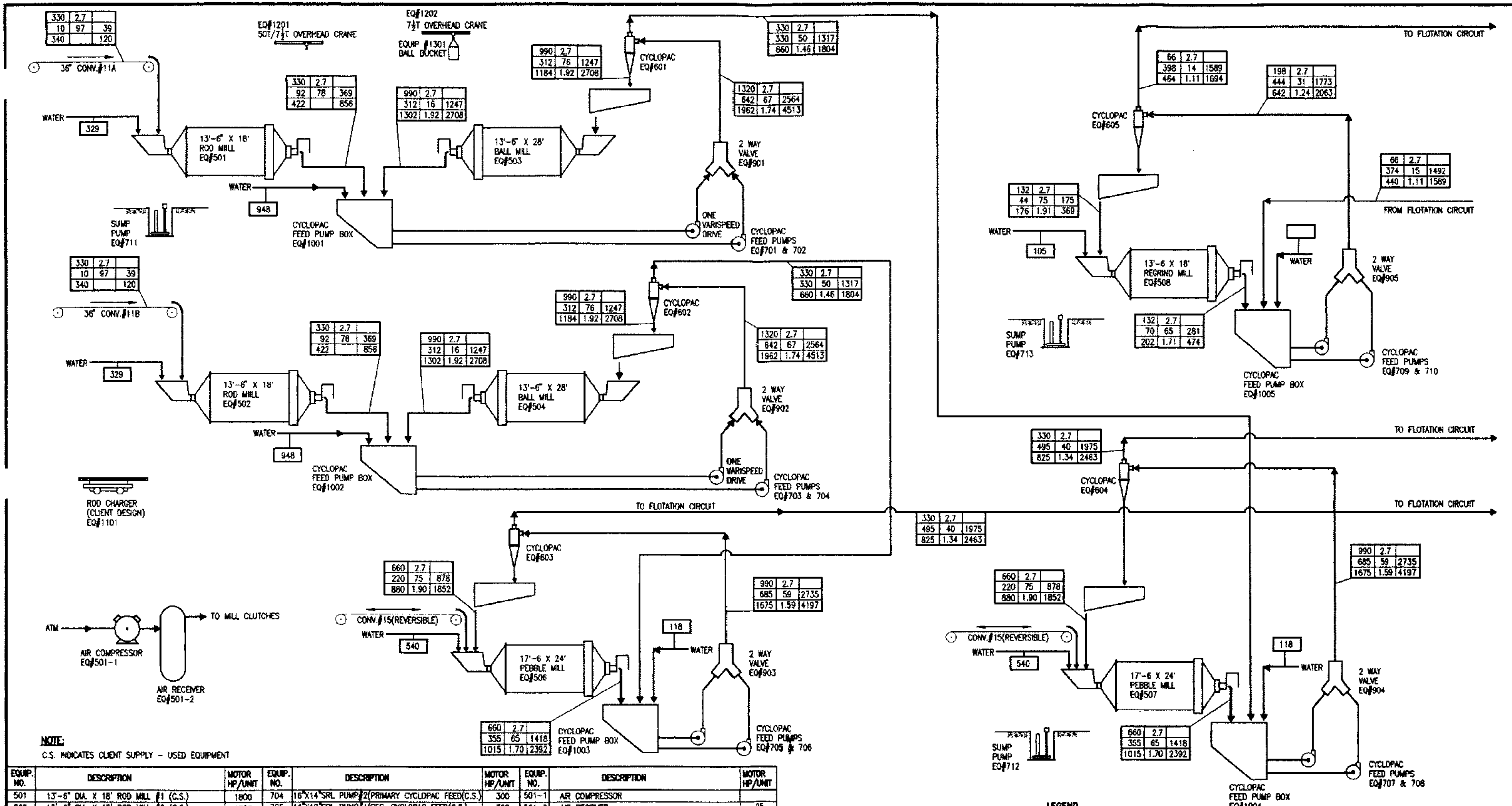
DESIGNED G B | DRAWN J T | CHECKED | DATE FEB 95 | CLIENT APPROVAL | SCALE NONE

C.S.F.M. Engineering Ltd.
VANCOUVER, CANADA

MOUNT POLLEY PROJECT
WILLIAMS LAKE, B.C.

PROCESS FLOWSHEET CRUSHING & SCREENING

PROJ. No. 9511 | FIGURE 3.11



NOTE:
C.S. INDICATES CLIENT SUPPLY - USED EQUIPMENT

EQUIP. NO.	DESCRIPTION	MOTOR HP/UNIT	EQUIP. NO.	DESCRIPTION	MOTOR HP/UNIT	EQUIP. NO.	DESCRIPTION	MOTOR HP/UNIT
501	13'-6" DIA. X 18' ROD MILL #1 (C.S.)	1800	704	16"X14"SRL PUMP #2(PRIMARY CYCLOPAC FEED(C.S.)	300	501-1	AIR COMPRESSOR	
502	13'-6" DIA. X 18' ROD MILL #2 (C.S.)	1800	705	14"X12"SRL PUMP #1(SEC. CYCLOPAC FEED(C.S.)	300	501-2	AIR RECEIVER	25
503	13'-6" DIA. X 18' BALL MILL #1 (C.S.)	3600	706	14"X12"SRL PUMP #2(SEC. CYCLOPAC FEED(C.S.)	300			
504	13'-6" DIA. X 18' BALL MILL #2 (C.S.)	3600	707	14"X12"SRL PUMP #1(SEC. CYCLOPAC FEED(C.S.)	300	1001	PRIMARY CYCLOPAC #1 FEED PUMP BOX	
506	17'-6" DIA. X 24' PEBBLE MILL #1 (C.S.)	2750	708	14"X12"SRL PUMP #2(SEC. CYCLOPAC FEED(C.S.)	300	1002	PRIMARY CYCLOPAC #2 FEED PUMP BOX	
507	17'-6" DIA. X 24' PEBBLE MILL #2 (C.S.)	2750	709	10"X8"SRL PUMP #1(REGRIND CYCLOPAC FEED(C.S.)	100	1003	SECONDARY CYCLOPAC #1 FEED PUMP BOX	
508	13'-6" DIA. X 18' REGRIND MILL (C.S.)	1800	710	10"X8"SRL PUMP #2(REGRIND CYCLOPAC FEED(C.S.)	100	1004	SECONDARY CYCLOPAC #2 FEED PUMP BOX	
						1005	REGRIND CYCLOPAC FEED PUMP BOX	
601	PRIMARY CYCLOPAC #1 (C.S.)		711	SUMP PUMP (PRIMARY MILLS) (C.S.)	25			
602	PRIMARY CYCLOPAC #2 (C.S.)		712	SUMP PUMP (PEBBLE MILLS) (C.S.)	25	1101	ROD CHARGER	10
603	SECONDARY CYCLOPAC #1 (C.S.)		713	SUMP PUMP (REGRIND MILLS) (C.S.)	25			
604	SECONDARY CYCLOPAC #2 (C.S.)							
605	REGRIND CYCLOPAC (C.S.)		901	2 WAY VALVE (PRIMARY CYCLOPAC #1 FEED)	15	1201	OVERHEAD CRANE 50T/7½T (C.S.)	25+10
			902	2 WAY VALVE (PRIMARY CYCLOPAC #2 FEED)	15	1202	OVERHEAD CRANE 7½ T	10+5
701	16"X14"SRL PUMP #1(PRIMARY CYCLOPAC FEED(C.S.)	300	903	2 WAY VALVE (SECONDARY CYCLOPAC #1 FEED)	15			
702	16"X14"SRL PUMP #2(PRIMARY CYCLOPAC FEED(C.S.)	300	904	2 WAY VALVE (SECONDARY CYCLOPAC #2 FEED)	15	1301	BALL BUCKET	
703	16"X14"SRL PUMP #1(PRIMARY CYCLOPAC FEED(C.S.)	300	905	2 WAY VALVE (REGRIND CYCLOPAC FEED)	15			

LEGEND

SOLIDS	S.T.P.H.	S.G. SOLIDS	
WATER	S.T.P.H.	% SOLIDS	U.S.G.P.M.
SLURRY	S.T.P.H.	% SOLIDS	U.S.G.P.M.

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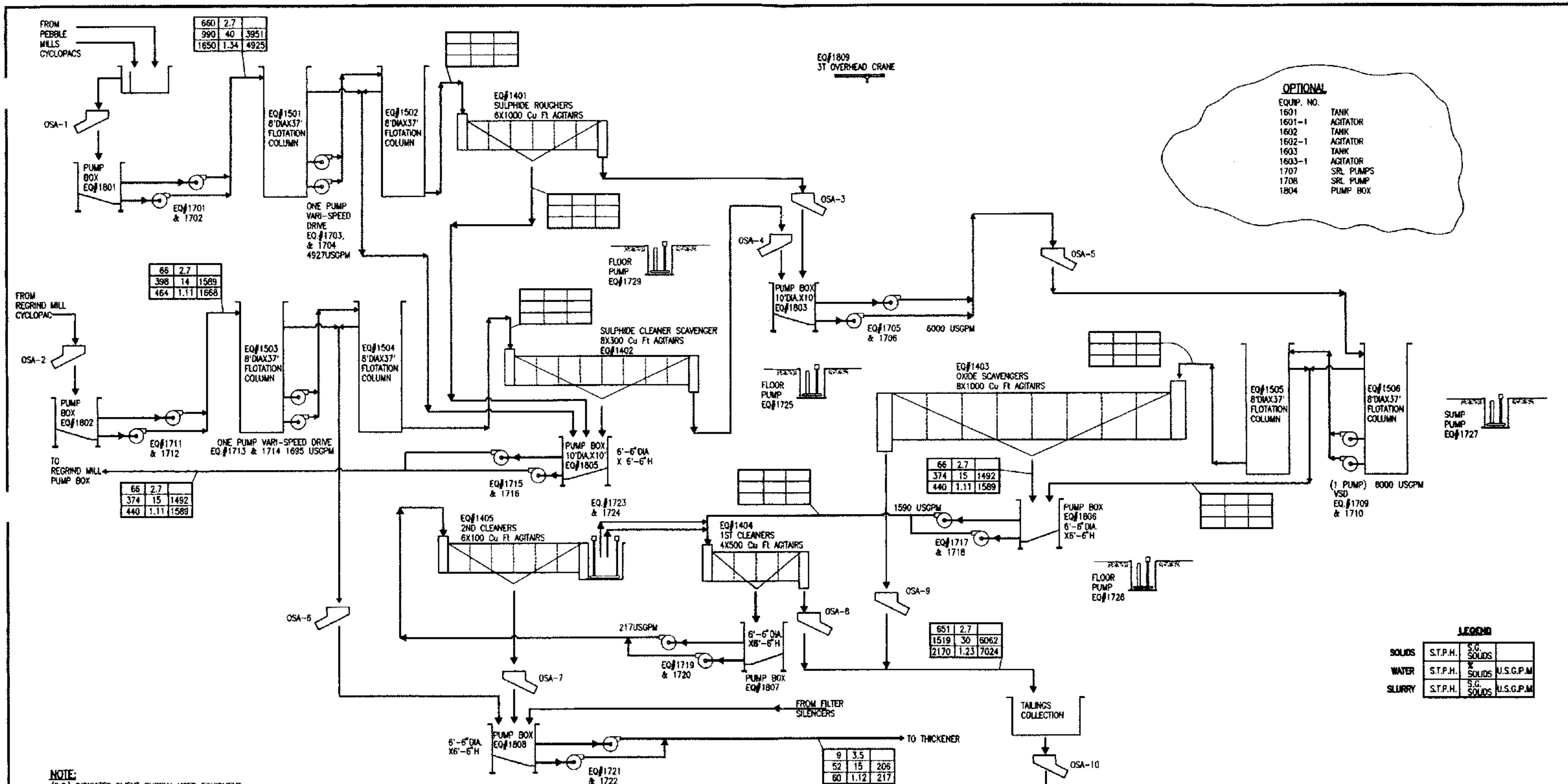
C.S.F.M. Engineering Ltd.
VANCOUVER, CANADA

MOUNT POLLEY PROJECT
WILLIAMS LAKE, B.C.

PROCESS FLOWSHEET
GRINDING

DESIGNED G B | DRAWN J T | CHECKED | DATE FEB 95 | CLIENT APPROVAL | SCALE NONE

PROJ. No. 9511 | FIGURE 3.12 | REV.



NOTE:
(C.S.) INDICATES CLIENT SUPPLY-USED EQUIPMENT

EQUIP. NO.	DESCRIPTION	MOTOR HP/UNIT	EQUIP. NO.	DESCRIPTION	MOTOR HP/UNIT	EQUIP. NO.	DESCRIPTION	MOTOR HP/UNIT
1401	6 X 1000 Cu Ft FLOTATION CELLS (C.S.)	6 X 60	1601-1	AGITATOR (OPTIONAL)		1725	3½ SUMP PUMP (SULPHIDE CLEANER AREA)(C.S.)	25
1402	8 X 300 Cu Ft FLOTATION CELLS (C.S.)	8 X 40	1602-1	AGITATOR (OPTIONAL)		1726	3½ SUMP PUMP (CLEANERS AREA) (C.S.)	25
1403	8 X 1000 Cu Ft FLOTATION CELLS (C.S.)	8 X 60	1603-1	AGITATOR (OPTIONAL)		1727	3½ SUMP PUMP (ACID LEACH AREA)(C.S.)	25
1404	4 X 500 Cu Ft FLOTATION CELLS (C.S.)	4 X 50				1728	3½ SUMP PUMP (OXIDE SCAVENGER AREA)(C.S.)	25
1405	6 X 100 Cu Ft FLOTATION CELLS (C.S.)	6 X 25				1729	3½ SUMP PUMP (SULPHIDE ROUGH AREA)(C.S.)	25
			1701&2	14" X 12" SRL PUMPS (C.S.)	2X100			
			1703&4	14" X 12" SRL PUMPS (C.S.)	2X75	18001	COLUMN FEED PUMP BOX	
1501	8' DIA X 37' FLOTATION COLUMN		1705&6	14" X 12" SRL PUMPS (C.S.)	2X100	18002	COLUMN FEED PUMP BOX	
502	8' DIA X 37' FLOTATION COLUMN		1707&8	PUMPS (OPTIONAL)		18003	SULPHIDE ROUGHER & CLEANER TAILS PUMP BOX	
1503	8' DIA X 37' FLOTATION COLUMN		1709&10	14" X 12" SRL PUMPS (C.S.)	2X75	18004	PUMP BOX (OPTIONAL)	
1504	8' DIA X 37' FLOTATION COLUMN		1711&12	10" X 8" SRL PUMPS (C.S.)	2X60	18005	SULPHIDE ROUGHER & CLEANER CONC.PUMP BOX	
1505	8' DIA X 37' FLOTATION COLUMN		1713&14	10" X 8" SRL PUMPS (C.S.)	2X25	18006	OXIDE SCAVENGERS CONC. PUMP BOX	
1506	8' DIA X 37' FLOTATION COLUMN		1715&16	10" X 8" SRL PUMPS (C.S.)	2X50	18007	1ST CLEANERS CONC. PUMP BOX	
			1717&18	10" X 8" SRL PUMPS (C.S.)	2X50	18008	2ND CLEANERS CONC. PUMP BOX	
1601	TANK (OPTIONAL)		1719&20	8" X 6" SRL PUMPS (C.S.)	2X15	18009	3T OVERHEAD CRANE (C.S.)	5+3
1602	TANK (OPTIONAL)		1721&22	10" X 8" SRL PUMPS (C.S.)	2X25			
1603	TANK (OPTIONAL)		1723&24	3½ VERTICAL PUMPS (C.S.)	2X11	OSA1to10	ONSTREAM ANALYZER SAMPLERS	

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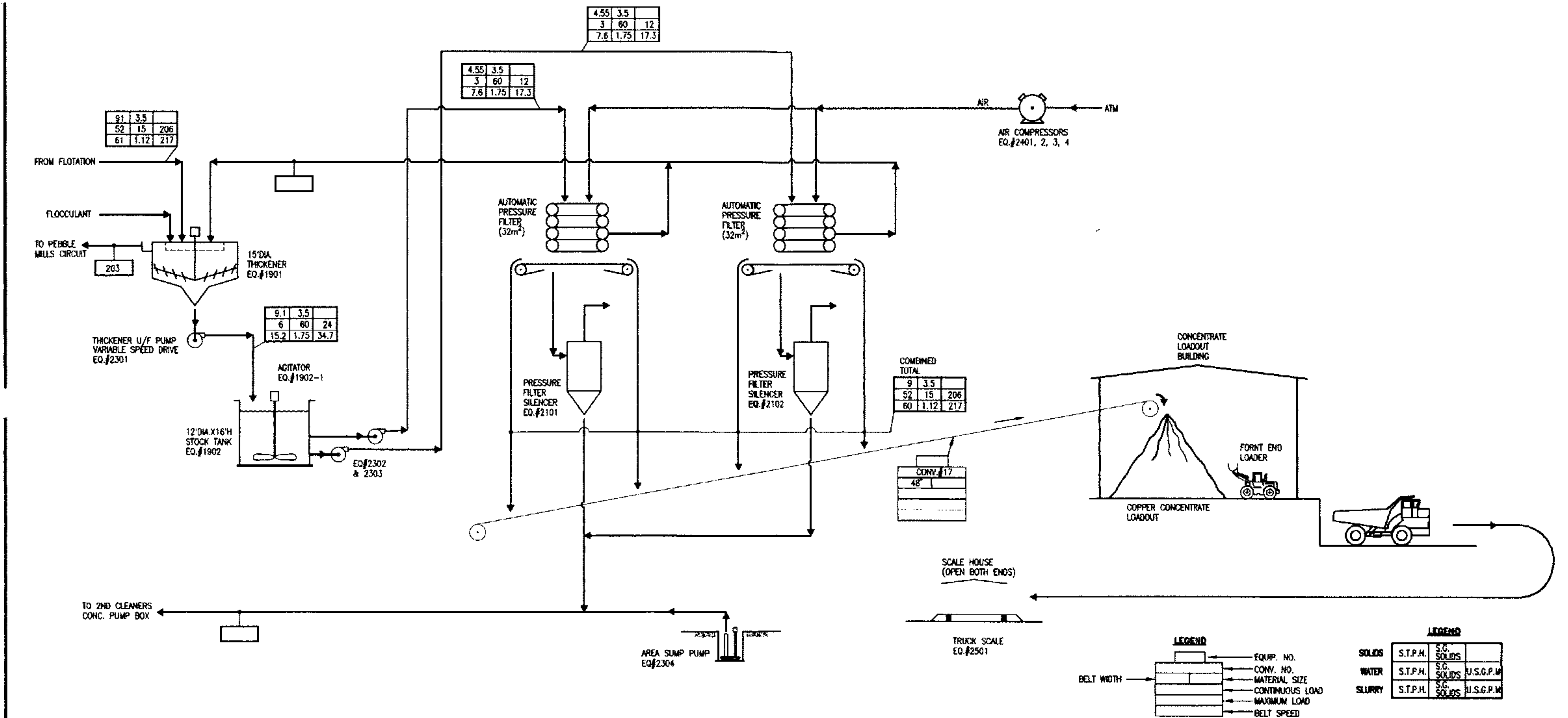
VANCOUVER, CANADA

MOUNT POLLEY PROJECT
WILLIAMS LAKE, B.C.

PROCESS FLOWSHEET FLOTATION

PROJ. No. 9511 | FIGURE 3.13



NOTE:
(C.S.) INDICATES CLIENT SUPPLY-USED EQUIPMENT

EQUIP. NO.	DESCRIPTION	MOTOR HP/UNIT	EQUIP. NO.	DESCRIPTION	MOTOR HP/UNIT	EQUIP. NO.	DESCRIPTION	MOTOR HP/UNIT
1901	15'DIA. HIGH CAPACITY THICKENER TANK	10	2201	CONV. #17 - 48" X 70'-0" LG.		2401	AIR COMPRESSOR (C.S.)	500
1902	12' DIA X 16' H STOCK TANK					2402	AIR COMPRESSOR (C.S.)	500
1902-1	STOCK TANK AGITATOR	25				2403	AIR COMPRESSOR (C.S.)	400
						2404	AIR COMPRESSOR (C.S.)	400
2001	32 m² AUTOMATIC PRESSURE FILTER (C.S)		2301	THICKENER U/F PUMP (4" O.D.S.) (C.S.)	75			
2002	32 m² AUTOMATIC PRESSURE FILTER (C.S.)		2302&3	FILTER STOCK TANK PUMPS (C.S.)	2X40			
			2304	AREA SUMP PUMP (C.S.)	25	2501	TRUCK SCALE (C.S.)	
2101	PRESSURE FILTER SILENCER (C.S.)							
2102	PRESSURE FILTER SILENCER (C.S.)							

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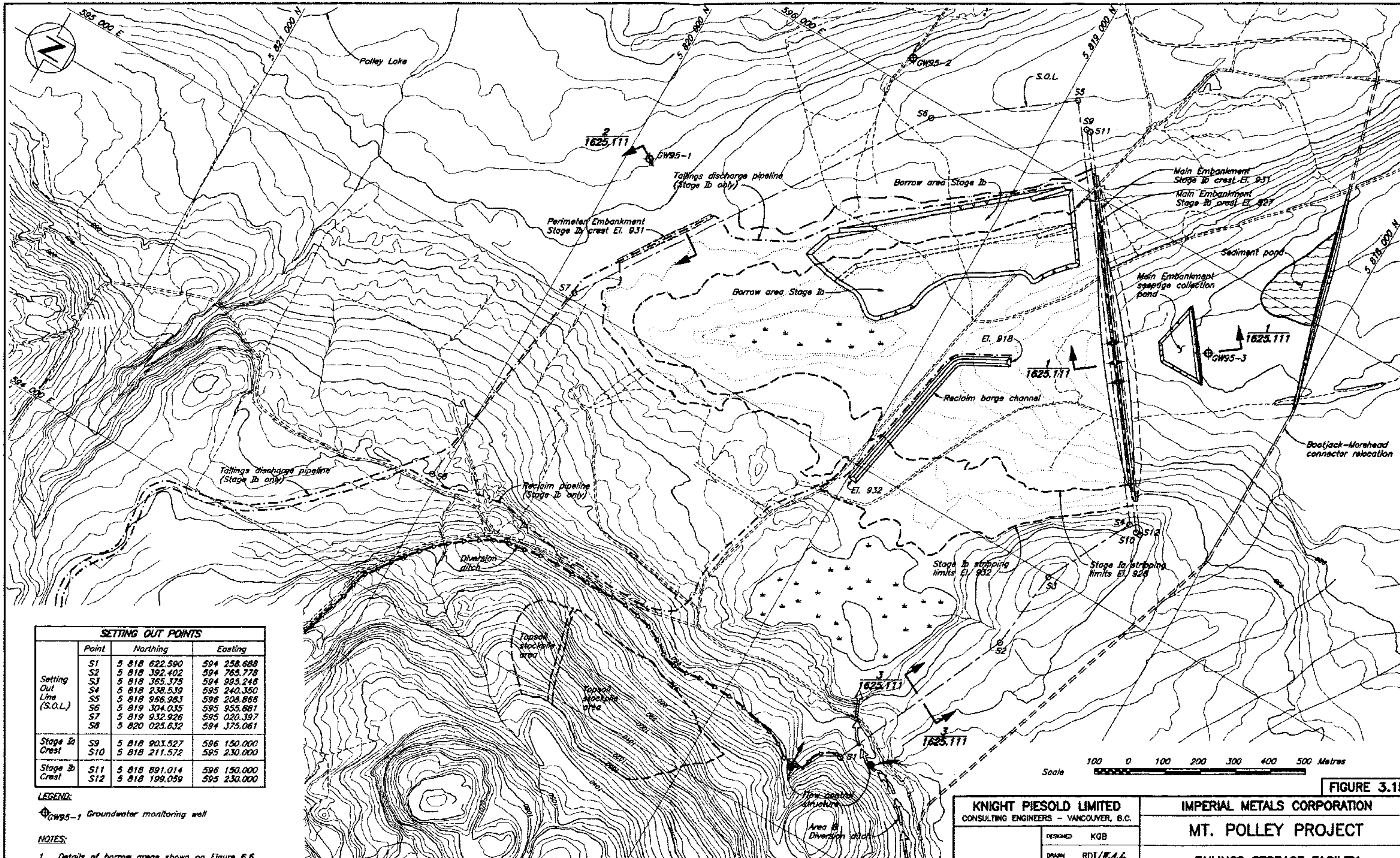
C.S.F.M. Engineering Ltd.
VANCOUVER, CANADA

MOUNT POLLEY PROJECT
WILLIAMS LAKE, B.C.

PROCESS FLOWSHEET DEWATERING

PROJ. No. 9511 | FIGURE 3.14 | Rev.



SETTING OUT POINTS			
	Point	Northing	Easting
Setting Out Line (S.O.L.)	S1	5 818 622.590	594 258.688
	S2	5 818 392.402	594 765.778
	S3	5 818 365.375	594 995.248
	S4	5 818 238.539	595 240.350
	S5	5 818 966.983	596 208.866
	S6	5 819 304.035	595 955.661
	S7	5 819 932.926	595 020.397
	S8	5 820 025.632	594 375.061
Stage Ia Crest	S9	5 818 903.527	596 150.000
	S10	5 818 211.572	595 230.000
Stage Ib Crest	S11	5 818 891.014	596 150.000
	S12	5 818 199.059	595 230.000

LEGEND:

GW95-1 Groundwater monitoring well

NOTES:

1. Details of borrow areas shown on Figure 6.6

FIGURE 3.15

KNIGHT PIESOLD LIMITED
CONSULTING ENGINEERS - VANCOUVER, B.C.

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CHECKED
APPROVED

IMPERIAL METALS CORPORATION

MT. POLLEY PROJECT

TAILINGS STORAGE FACILITY
STAGE Ia/Ib TAILINGS IMPOUNDMENT
GENERAL ARRANGEMENT

DATE MAR. 30, 1995 | SCALE AS SHOWN | DRG. NO. 1625.110 | REV. A

DRG. NO.	DESCRIPTION	REV.	DATE	DESCRIPTION	APPROVED	REV.	DATE	DESCRIPTION	APPROVED
REFERENCE DRAWINGS		REVISIONS				REVISIONS			

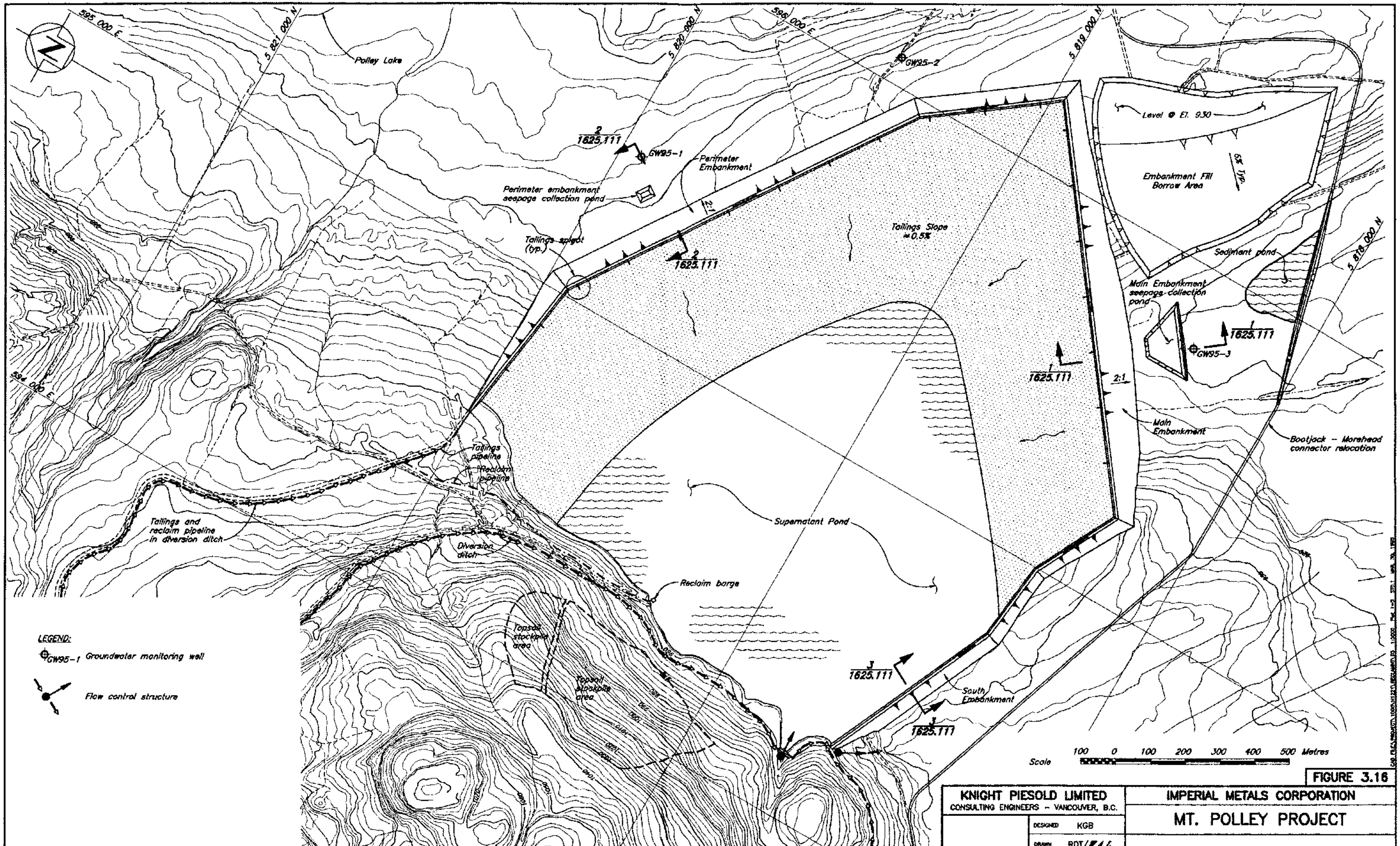
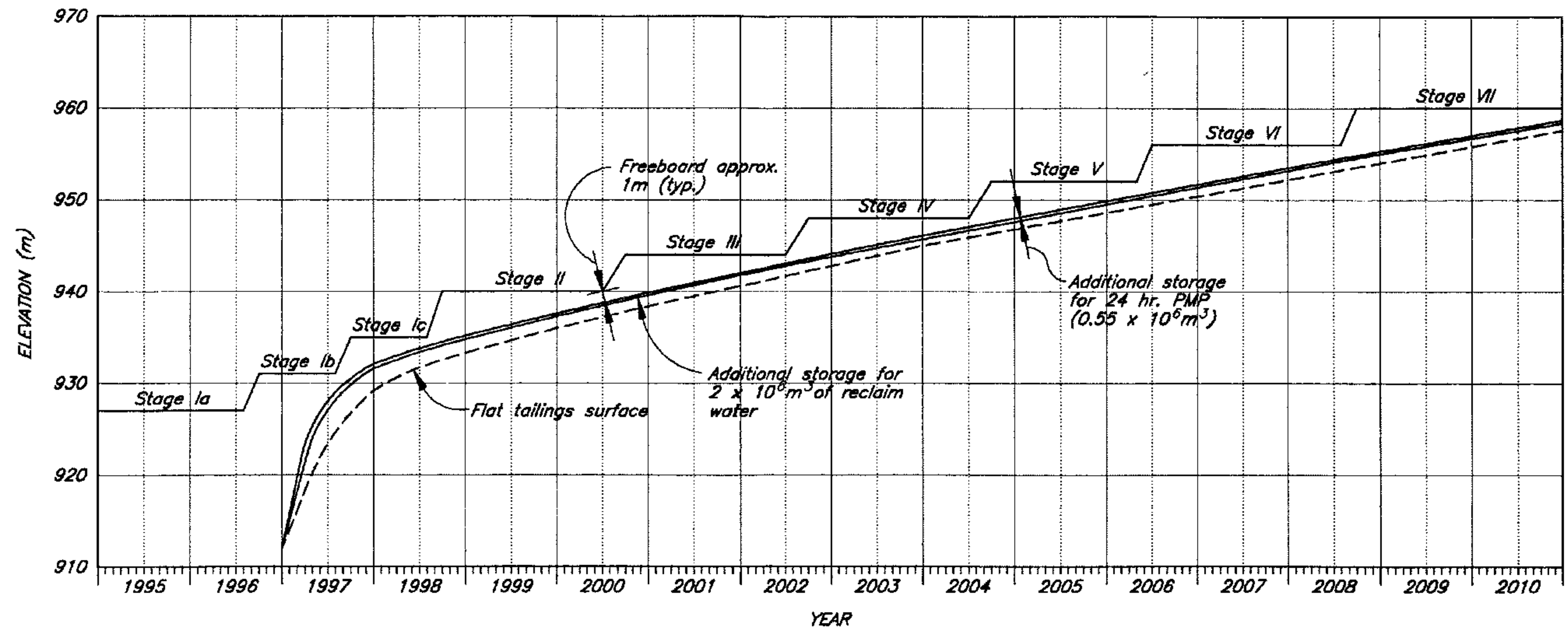


FIGURE 3.16

KNIGHT PIESOLD LIMITED CONSULTING ENGINEERS - VANCOUVER, B.C.	IMPERIAL METALS CORPORATION
DESIGNED KGB	MT. POLLEY PROJECT
DRAWN RDT/W.A.L.	TAILINGS STORAGE FACILITY FINAL ARRANGEMENT
CHECKED	
APPROVED	
DATE MAR. 30, 1995	SCALE AS SHOWN — DRG. NO. 1625.130 — REV.

DRG. NO.	DESCRIPTION	REV.	DATE	DESCRIPTION	APPROVED	REV.	DATE	DESCRIPTION	APPROVED
REFERENCE DRAWINGS		REVISIONS				REVISIONS			

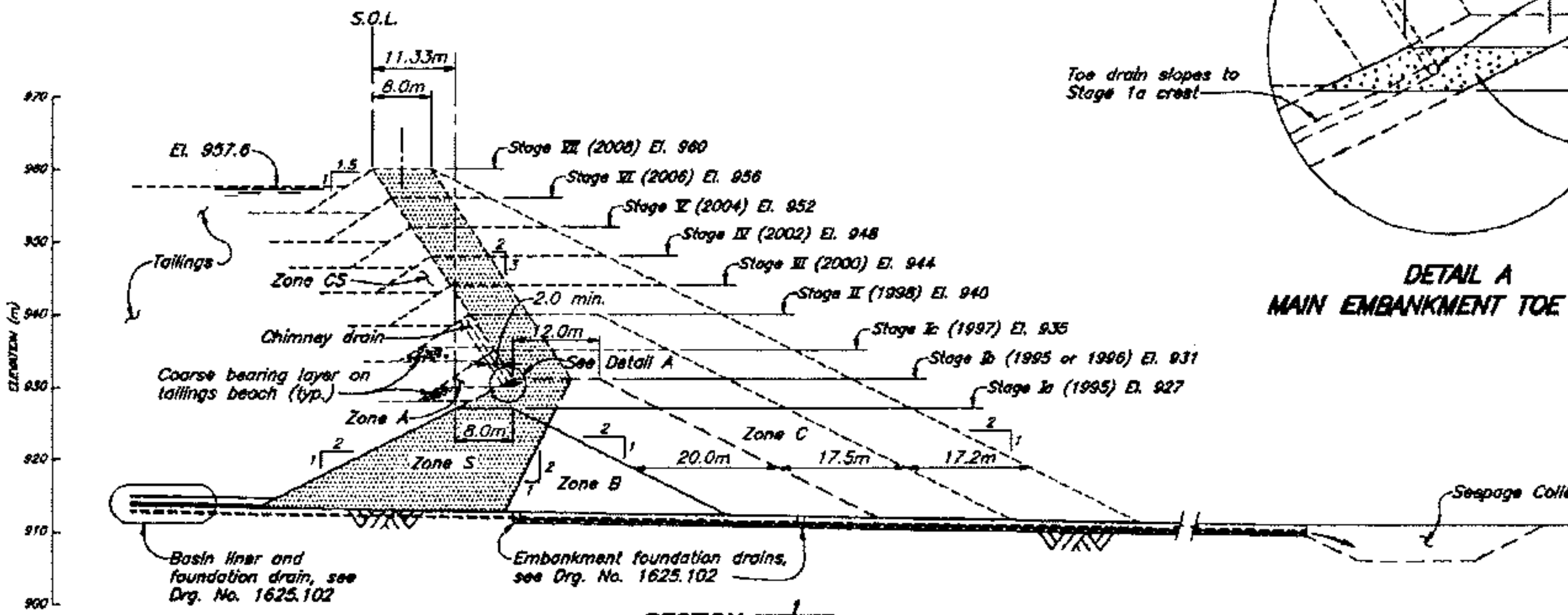
IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
TAILINGS AREA FILLING SCHEDULE AND STAGED CONSTRUCTION



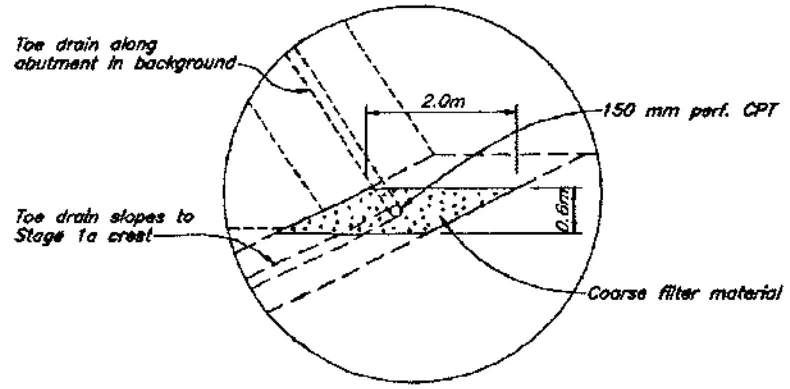
NOTE:
Embankment raises will be re-evaluated during mine operation to ensure that adequate storage capacity and embankment freeboard are maintained throughout the life of the mine.

Mar. 30, 1995
HALLAM KNIGHT PIESOLD LTD.
ENVIRONMENTAL CONSULTANTS

FIGURE 3.17

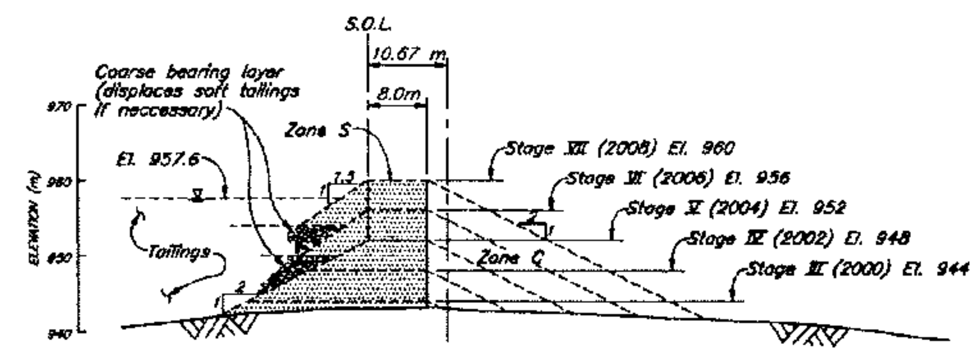


SECTION 1/1625.110
MAIN EMBANKMENT

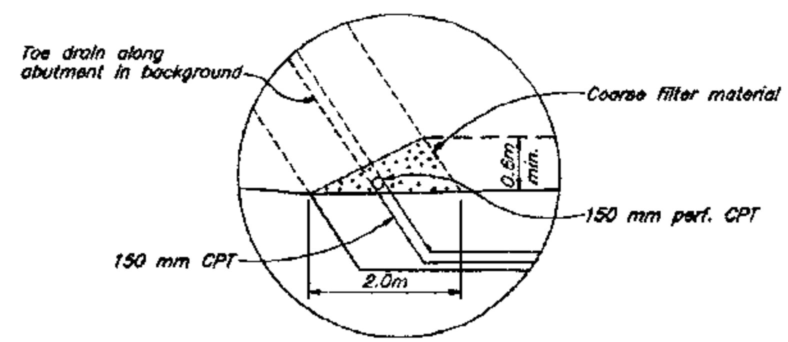


DETAIL A
MAIN EMBANKMENT TOE DRAIN

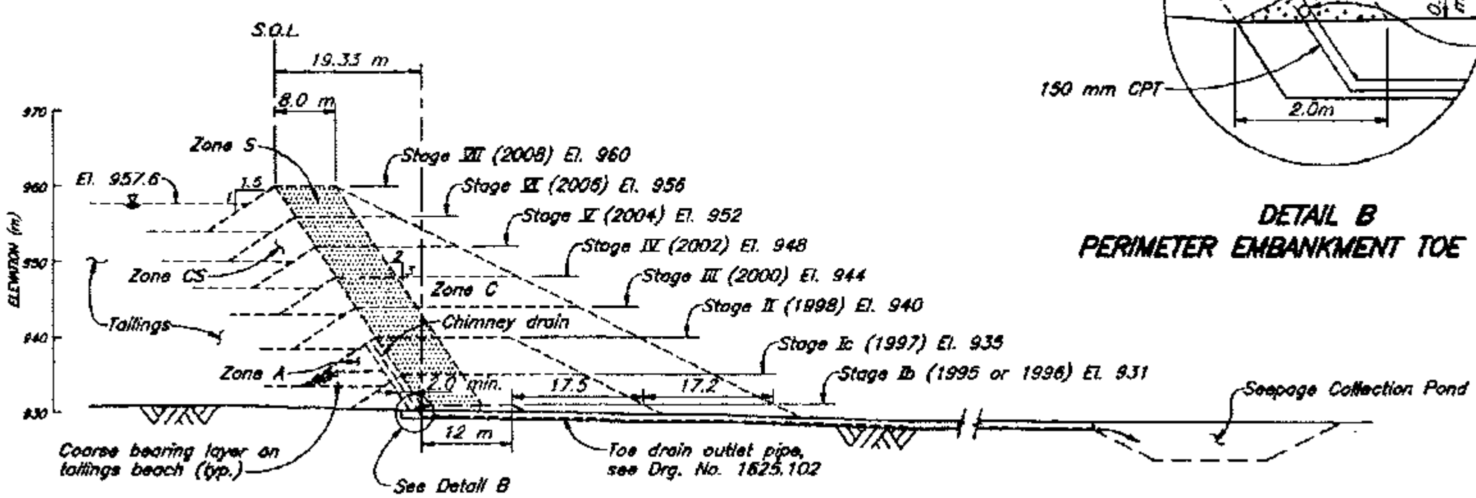
ZONE	MATERIAL TYPE	PLACEMENT AND COMPACTION REQUIREMENTS
Coarse Bearing Layer	Free draining durable waste rock fill or coarse sandy gravel	Placed and spread in maximum 1.0 m thick layers. Compaction as directed by the Engineer.
Chimney/Toe Drain	Filter sand	Placed and spread in maximum 1.0 m thick layers. Vibratory compaction as directed by the Engineer.
S	Glacial till	Placed, moisture conditioned and spread in maximum 300 mm thick layers (after compaction). Vibratory compaction to 95% of modified proctor maximum dry density.
A	Glacial till	Placed, moisture conditioned and spread in maximum 600 mm thick layers (after compaction). Vibratory compaction to 90% of modified proctor maximum dry density.
B	Glacial till	Placed, moisture conditioned and spread in maximum 600 mm thick layers (after compaction). Vibratory compaction to 90% of modified proctor maximum dry density.
C	Random fill	Glacial till or other approved material placed in maximum 600 mm thick layers (after compaction). Vibratory compaction as required by the Engineer.
CS	Cycloned sand	Placed and spread in maximum 1.0 m thick layers. Vibratory compaction as directed by the Engineer.



SECTION 3/1625.110
SOUTH EMBANKMENT



DETAIL B
PERIMETER EMBANKMENT TOE DRAIN



SECTION 2/1625.110
PERIMETER EMBANKMENT

NOTES

1. Embankment raises will be re-evaluated during mine operation to ensure that adequate storage capacity and embankment freeboard are maintained throughout the life of the mine.

Scale 10 5 0 10 20 30 40 50 m

FIGURE 3.18

KNIGHT PIESOLD LIMITED
CONSULTING ENGINEERS – VANCOUVER, B.C.

DESIGNED KGB
DRAWN RDT/W.A.L.
CHECKED
APPROVED

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
TAILINGS STORAGE FACILITY
TAILINGS EMBANKMENT
SECTIONS AND DETAILS

DWG. NO.	DESCRIPTION	REV.	DATE	DESCRIPTION	APPROVED	REV.	DATE	DESCRIPTION	APPROVED
REFERENCE DRAWINGS		REVISIONS				REVISIONS			

DATE MAR. 30, 1995 | SCALE AS SHOWN | DRG. NO. 1625.111 | REV. 1

SECTION 4.0 - DISTURBANCES

4.1 CURRENT AND PROJECTED AREAS OF DISTURBANCE

Land disturbance in the Project area during the current post-exploration / pre-construction period is relatively limited. Cleared areas from exploration phase work include a core shack and core rack area, access roads and a drill road network in the open pit area. These areas will coincide with project infrastructure and will be utilized during the operations phase.

The majority of the projected land disturbances from the project will occur during the two year construction period currently slated for spring 1995 to fall 1996.

Work slated for 1995 includes clearing and stripping of the mill site in May 1995 and a portion of the tailings impoundment in July 1995. Upgrading of the access road and construction of the realigned portion of this road will also be scheduled for 1995. The remainder of construction operations would be conducted in 1996.

During operations, the number and size of disturbed areas will increase due to the gradual expansion of the open pits and through additions to the waste rock dumps and the tailings impoundment. However, drainage control measures such as runoff collection ditches will be installed outside of the ultimate boundaries during initial construction stage work for these facilities. Therefore, for the purposes of this study it is assumed that land disturbance areas at the outset of production are essentially equivalent to those at the end of mine life.

Preliminary design drawings at a 1:20,000 scale were used to calculate areas of disturbance using a digital planimeter for site infrastructure components. As designs are finalized, the disturbance estimates will be refined. The estimated areas of land requiring reclamation measures due to development of principal project components are discussed below and are presented in Table 4.1.

There will be three open pits, the Central, North and West, which will disturb 25.5, 14.9 and 24.3 ha, respectively. The total area of disturbance is estimated to cover 64.7 ha.

There will be three waste rock storage areas. The east and north dumps are estimated at 52 and 56 ha respectively, while the west dump is estimated at 9 ha. Total area for the waste dumps is equal to 117 ha.

The tailings storage area, including the supernatant and seepage reclaim system and the water storage and diversion system will disturb 248 ha.

Surface plant and ancillary facilities including the mill, warehouse/office complex, maintenance buildings, crusher and conveyor system is estimated at 20 ha.

The cumulative mine site area disturbances, as detailed above, total approximately 450 ha.

The final access road design report is scheduled for completion in April 1995 and the powerline routing by the end of 1995. The access road will involve upgrading a significant portion of the existing road in addition to an additional new realigned section. Once plans are finalized, areas of disturbance from linear project components will be quantified. Average disturbance widths will be conservatively specified as 30 m for the haul roads, 10 m for mine site access roads and 10 m for the powerline.

The powerline alignment is likely to traverse areas of extensive timber harvesting, and will not require additional clearing. The resulting disturbed area will be calculated taking this into account.

4.2 SALVAGE AND TREATMENT OF SURFICIAL MATERIALS

All disturbance areas with the exception of the pit walls will benefit from the reuse of surficial materials during revegetation activities. Soil salvage is a critical component of reclamation planning which will provide the soil material necessary to reclaim the mine site to meet end land use objectives. Proper salvage and stockpiling of surficial materials will be maximized to facilitate future reclamation requirements. General reclamation strategy prescriptions are described in Section 5.5

A primary objective of the Interim Reclamation Plan is to describe pre-disturbance soils of the plant site area prior to scheduled work in May 1995. This is presented in the following sub-section and will be elaborated upon once further investigations are completed in the snow free period.

Studies to describe soil types and depths for salvage operations were conducted in the mill site area in late March 1995 and will be expanded to include the tailings impoundment area and the remainder of the mine site area during the 1995 pre-construction period.

Salvage and treatment of surficial materials in the open pit areas and in the tailings impoundment, waste rock storage areas and access road / utility corridor areas will be discussed further once mine planning is sufficiently refined, soil surveys are completed and selection of soil stockpile areas is completed.

4.2.1 Plant Site Area

The soil survey identified three soil types to be salvaged and stockpiled. These include the Luvisols, the Podzols and Brunisols, and the Organic soils. The average topsoil thickness on the upland soil types is 50 cm, and includes the rooting zone of existing vegetation. Surface humus layers (LFH) average 16 cm thick. The limited area of wetland contains organic layers up to 200 cm thick.

Soil salvage operations will remove all soil material to the base of the B soil horizon (Bm, Bf and Bt) and LFH layers throughout the office/mill site on the morainal parent material. Scrapers (earthmovers) are recommended for this task. Morainal parent material (C horizons) that may be suitable for contouring/reclamation will be scraped and stockpiled separate from the B and O material. The B horizon lower limit for salvage will be visually assessed using the presence of roots and soil colour. There is only a slight difference in colour between the Bt and the C. This will require on-site evaluation at the commencement of stripping. The Bf and Bm are more easily distinguished from the C. Depth criteria will also be applied to avoid mixing topsoil with the Ck horizon.

The Organic soil around the concentrator building should be removed and stored separately from other horizons. The organic material is easily recognized by its black colour and mucky nature.

There is approximately 15 ha of morainal parent material and 5 ha of organics on the office/mill site. The preliminary calculations suggest there will be 75,000 m^3 of B material and 24,000 m^3 of LFH humus layers stripped for stockpiling. Total volume of LFH and B horizons for stockpiling will be 99,000 m^3. The LFH will be mixed with the B horizon for storage. Due to the low bulk density of the LFH layers, they may become compressed in the stockpile. Soil replacement will return soil layers closer to original bulk densities.

The organic soil volumes stripped will total 100,000 m^3 from the office/mill site.

Discussion of stockpiling the above soils is found in Section 5.6.2.1. Stockpiled material will be contoured and seeded to minimize erosional processes during storage and will be quantified, flagged and mapped to facilitate future recovery and use during reclamation work.

4.2.2 Tailings Impoundment

The staged development of the tailings impoundment is described in Section 3.5.5, and disturbances for the 1995 (Ia - elevation 927 m, 705,000 m^2 area of disturbance) and 1996 (Ib - elevation 931 m, 1,082,000 m^2 of disturbance) construction seasons. Most of the burrow areas for the staged development of the impoundment will be located within the tailings basin and will be covered by the rising tailings surface. External burrow areas will be shaped to maximum slopes of 3h:1s and will allow for surface drainage to prevent ponding. The external burrow areas will be reclaimed during the final year of operation, once the final embankment raise has been completed.

Detailed prescriptions for salvage and treatment of surficial materials from the tailings impoundment on mine planning is refined and soil surveys are completed to describe soil characteristics, estimate volumes and select soil stockpile areas.

Reclamation of the downstream slopes of the tailings embankments will commence after year-2 once the final embankment toe has been established. Since the embankment will be raised using a modified centreline method of construction, the downstream slope of each subsequent raise can be reclaimed as it is completed.

4.3 WATER RESOURCE USE

The overall water management plan is described in "Report on Project Water Management" (Knight Piésold Reference No. 1624/1, Feb. 1995). It is designed to ensure no surface discharge from the tailings storage facility, nor from the open pits. Make-up water will be obtained from surface runoff from the mill site first, the waste dumps second, and finally catchment area B. Any contingency make-up water will be obtained from extensions to catchment area B and then from Polley Lake during freshet via a permanent pumphouse (maximum 300,000 m^3/yr). Catchment area A, Bootjack Creek will not be used in the water management plan.

Potable water will be obtained from Polley Lake. Imperial Metals Corporation is presently investigating groundwater sources that may replace the Polley Lake potable water supply. Maximum use of Polley Lake would result in a relatively insignificant 4 cm drop in surface elevation in comparison to the usual annual 50 cm drop.

4.4 DRAINAGE CONTROL AND PROTECTION OF WATERCOURSES

The project water management strategy incorporates a comprehensive series of ditches, drains, spill control measures, sediment control and collection ponds to enable the mine development to operate in a carefully controlled manner which maximizes the protection of existing water courses around the project area.

The drainage control provisions include runoff collection ditches, sediment ponds and recycle provisions for surface runoff and groundwater collected at the open pit, mill site and waste dumps. All open pit water and tailings water will be recycled to the mill process and no surface discharge to water courses will occur from these areas. The tailings discharge pipework and reclaim water pipelines include spill control provisions to ensure that any uncontrolled spills due to line rupture will be diverted to the tailings area and not enter existing water courses. The surface runoff control ditches at the project area have been designed to transfer peak flows from 1 in 10 year storm events without over-topping. Sediment control ponds are also situated down-gradient of the mine, mill, waste dumps and tailings impoundment to provide protection of watercourses both during construction and during operations. Additional details of the ditches and sediment control measures provided at the tailings impoundment are described in the "Tailings Storage Facility Design Report" (Knight Piésold Ltd. Reference No. 1625/1, 1995).

4.5 MONITORING AND MAINTENANCE

The existing water quality database is being supplemented with an expanded network of baseline monitoring stations. Extensive water quality sampling is scheduled for 1995, including stratified weekly sampling during critical hydrological periods. Permanent aquatic monitoring stations will be established during the 1995 baseline data collection period to provide control sites and potential impact zone sample analysis for all creeks potentially affected by the mine operation. The on-going regular operational monitoring program and post-closure monitoring program will include a biological (aquatic effects) component using benthic macroinvertebrates and periphyton.

Regular monitoring of sediment control ponds, culverts, bridges and ditches will occur during operations, and a regular maintenance program to ensure the proper functioning of these installations will be implemented. An overview of a recommended environmental monitoring program for operational and post operational (reclamation) phases is outlined in Table 4.2.

The regular monitoring of all operations will continue for one or two years following closure and then be gradually phased out when consistent results indicate that the operations have been successfully decommissioned. The primary focus of the post-closure monitoring program will be receiving water quality reclamation success and achievement of reclamation capability targets as mining and milling operations are phased out and reclamation procedures are implemented.

A Reclamation Research Program will be initiated in the early phases of mining with the objective of establishing the necessary methods and materials required for implementing a successful abandonment plan by the time operations are closed, and to validate plant growth, wildlife and cattle grazing use and reclamation techniques as early as possible.

Even though reclamation procedures will have been developed through a site-specific reclamation research program, it will be necessary to monitor all reclamation initiatives for several years past mine closure to ensure that revegetation is self-sustaining and conducive to projected end land uses. Some areas may require soil amendments or reseeding / replanting up to five years after mine closure. Further, it is anticipated that it will be necessary to continue the surface and groundwater monitoring program, albeit to a lesser degree of rigor, following mine closure to confirm the long-term protection of the receiving environment, which is a primary objective of the decommissioning process.

Table 4.1

Mount Polley Project
Projected Areas of Disturbance

Infrastructure	Area (ha)
Mill Site	20
Tailings Impoundment	248
Open Pits	
Central	25.5
North	14.9
West	24.3
Waste Dumps	
East	52
North	56
West	9
TOTAL	449.7

Note: does not include linear developments such as roads or powerlines

DRAFT

Table 4.2
Recommended Environmental Monitoring Program

Area	Source/ Location	Analyses	Material	Frequency
Sources (Effluents and Emissions)				
Open Pit	Waste Rock	Acid-Base Accounting	Blasthole Cuttings	By Bench
	Low Grade Ore	Acid-Base Accounting	Blasthole Cuttings	By Bench
	Wall Rock	Acid-Base Accounting	Panels/Leachate	Monthly
	Mine Water	Heavy Metals/Physical Sulphates/Nitrogen/pH	Mine Water Settling Pond	Monthly
Waste Rock Dump	Seepage	Heavy Metals/Physical	Settling Pond	Monthly
	Water	Sulphates/Nitrogen/pH	Inflow/Outflow	Monthly
Tailings	Solids	Acid-Base Accounting	Tailings Solids	Quarterly/Composite
	Supernatant	Physical/Heavy Metals	Reclaim Barge	Monthly, Quarterly Bioassay
	Seepage Reclaim	Sulphates/Nitrates	Reclaim Pond	Monthly
	Piezometers	"	Main Dam	Quarterly
Drinking Water	Domestic Intake	Total and Fecal Coliform Heavy Metals	After Treatment	Quarterly
Receiving Environment				
Morehead Creek	Downstream of Bootjack Lake Outlet	Physical/Heavy Metals	As Per Baseline	Monthly, QA/QC
		Sulphates/Nitrates/pH	Water Quality	Monthly, QA/QC
		Fish Tissue	Heavy Metals	Replicated
	D/S of 6K Creek	Benthic Macroinvertebrates	Population Characteristics	Annually, Replicated
		Periphyton	Species/Dominance/Chl-a	Annually, Replicated
		Sediments	Heavy Metals/LOI	Annually, Replicated
Bootjack Creek	D/S of Tailings Line	"	"	"
Tailings Area Diversion	Above and Below Tailings Area	"	"	"
Hazeltine Creek	At Outlet and Below Tailings Area	"	"	"
Edney Creek	Control and Downstream of Ntub and D/S of Hazeltine confluence	"	"	"
Waste Dump Area Diversion	Above and Below Waste Rock Dump	"	"	"
Plant Site	Climate	Temp/Precip/Snow/Wind/Solar Rad	Meteorology	Daily
	Dustfall Mon.	Total dustfall, heavy metals	Ambient Air Quality	Weekly
Reclamation	Reclamation Plots	Soil Characteristics	Reclamation	On-going
	Reclamation Trials	Soil Amendments	Research Program	"
	Reclaimed Areas	Vegetation Species,	Growth/Productivity	"
		Wildlife Use ;	Periodic Observations	"
		Browse/Pellet Groups		"
		Grazing Use	Periodic Observations	"

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SECTION 5.0 - RECLAMATION & CLOSURE PLAN

5.1 RECLAMATION OBJECTIVES

In accordance with requirements under the *B.C. Mines Act* and *Health, Safety and Reclamation Code for British Columbia*, the primary objective of the proposed Reclamation Plan will be to return all areas disturbed by mining operations to their pre-mining use and capability. For the Mount Polley operations area, this comprises forested wildlife habitat that supports grazing, hunting, guiding, trapping and recreational uses. The following goals are implicit in achieving this primary objective:

- the long-term preservation of water quality within and downstream of decommissioned operations;
- the long-term stability of engineered structures including the waste rock dumps, tailings impoundment and open pits;
- the removal and proper disposal of all access roads, structures and equipment not required beyond the end-of-mine-life;
- the long-term stabilization of all exposed erodible materials;
- the natural integration of disturbed lands into surrounding landscape, and restoration of the natural appearance of the area after mining ceases, to the greatest possible extent; and
- the establishment of a self-sustaining vegetative cover consistent with existing forestry, grazing and wildlife needs.

As an overall approach to achieving these objectives, the Reclamation Plan is sufficiently flexible to allow for future changes in the mine plan and to incorporate information obtained from the ongoing reclamation research program.

5.2 LAND USE AND CAPABILITY OBJECTIVES

Land types in the Mount Polley project area include an integrated mixture of forested slopes, open meadows, wetlands and riparian units. These land types support several land uses.

Current primary land uses are as follows:

- compatible habitat for ungulates including moose and mule deer, large furbearers including black bear, coyote and wolf; small mammals including weasel, fisher, fox, mink, squirrel, lynx and marten; riparian species including beaver, muskrat, otter, raptors and waterfowl; and fisheries primarily rainbow trout;

- rangeland for cattle grazing by local ranchers; and

- forest harvesting.

Secondary land uses include both hunting, trapping and guided hunting and recreational capability.

Mine operations will disrupt these existing land uses to some degree during the projected fourteen year mine life. The reclamation program objectives are to specifically restore the primary land uses, namely, the area's capability for forestry in terms of species and density (stems per hectare), wildlife capability in terms of habitat quality (cover and forage) and rangeland in terms of forage quality, for the post operating period. Successful implementation of the reclamation objectives will allow the post-closure mine site to eventually sustain levels of wildlife utilization, forestry, grazing, hunting, trapping, fishing, guided hunting and recreation that currently exist. Topographical changes resulting from mining operations, such as open pit, tailings and waste rock storage facilities, will necessitate that each reclamation unit be planned accordingly.

The current assessments of land capability in the Mount Polley area, which are presented in detail in Section 2.8, are summarized below. It should be reemphasized that capability assessments for forestry, wildlife habitat and grazing will be refined from site investigations conducted in the pre-construction period, and contact with appropriate land managers and end users. Detailed pre-disturbance capability will be presented in updates to this Reclamation Plan.

Forestry: The project area lies entirely within the Interior Cedar Hemlock biogeoclimatic zone, and specifically, the Horsefly moist cool (ICHmk3) variant. Dominant tree species in the project area include Douglas fir, subalpine fir, western red cedar, spruce, and lodgepole pine.

Overall forest capability is medium to good class timber in the north and west waste dumps and the north pit. Low capability is predominant in the location of the south waste dump, west pit, central pit and mill site. The tailings area overall has poor forest capability with scattered stands of good to medium class.

The area has been actively harvested for many years, and discussions with Ministry of Forests, Horsefly District to determine how harvesting and silviculture prescriptions can be changed to accomodate mine development are underway. Updates to this plan will detail Timber Licence holders, relevant 5-year plans, silviculture prescriptions, history and success etc., adjusted for the mine project activities.

The University of British Columbia maintains the Alex Fraser Research forest, approximately 15 km south of Bootjack Lake for research, education and demonstration purposes. Associated with this facility, the Canadian Forestry Association operates youth summer camps during the summer months.

Wildlife Habitat: As mentioned previously, much of the Mount Polley project area has been subject to intensive timber harvesting. The area considered Class 4 range for ungluates due to heavy snow accumulations in winter. Man-made habitats include logging clearcuts, the mining exploration infrastructure at Mount Polley, and a network of roads for logging and mine exploration.

Depending on the type and amount of shrub and herb regeneration that has taken place, clearcuts and young seral forests probably provide good forage and cover for mule deer and moose, particularly in the spring, summer and early fall. The number of individuals and the diversity of species may increase somewhat as mid-seral stands mature, and as the complexity and structural diversity of the habitat increases.

There are two riparian areas associated with small streams in the Mount Polley Project area, on Hazeltine Creek and Bootjack Creek. Beaver, muskrat, mink, bufflehead, spotted sandpiper, spotted frog, wood frog and western toad are the main wildlife species that are likely to be found in the riparian zones of small creeks such as these. Depending on the associated vegetation, these creeks may provide above-average habitat for black bears, moose and mule deer.

For the present analysis, riparian habitats along Bootjack and Hazeltine Creeks can be considered Class 3 or Class 4 winter range, and Class 3 summer range for moose. Due to heavy winter snow accumulations, these habitats should be considered Class 5 or Class 6 winter range for deer.

The surrounding terrain offers little habitat diversity. There are no large avalanche tracks, talus slopes or other mountain features that would be considered significant wildlife habitats, nor are there any cliffs or canyons in the project area. In addition, arable agricultural lands are not found in the project area.

Grazing: The Williams Lake Ministry of Forest office coordinates a regional range program in which clearcut areas are replanted as rangeland. Liaison with the program managers has been initiated to assist in determining the Mount Polley

Suitable grazing areas are situated in an area that is generally south of the project although these areas are rated as moderately poor for grazing. These areas are in old clear-cut areas that have natural regrowth or have been appropriately seeded for grazing. Four local ranchers use the project area during the summer months from May to October.

Trapping: The claims area is entirely within the boundary of Registered Trapping Reserve TR502T056. Fur harvest returns for the period 1984 through 1988 indicate that the Mount Polley provides good returns of marten, beaver and muskrat and lower numbers of mink, weasel and squirrel. Occasional fox, coyote and lynx are trapped in some years.

Resident Hunting: Hunting is a relatively common past time among area residents and target species are primarily moose and mule deer. Due to the extensive network of logging roads, access for resident hunters to the project site is very good, however the area is not a popular hunting destination as ungulate values are lower in the site area than in the surrounding area.

Guided Outfitting: Guide outfitters are required by Out of province hunters are obliged to use licensed guide outfitters to hunt in B.C. The boundary between two guide outfitters bisects the project area, and it has been reported that the project area does not constitute a significant area for the guide outfitter operations due to low numbers of moose, the primary target species of their clientele. Black bear have infrequently been harvested from the project area in the past.

Recreation and Fishing: Recreational activities in the study area are predominantly lake fishing, hunting and camping. The natural populations of rainbow trout in both Bootjack and Polley lakes attract local residents and more distant visitors. These lakes are considered among the best recreational fishing lakes in the Caribou region. The Forest Service maintains campgrounds on both lakes which are heavily utilized in the summer months. Mine planning will attempt to reduce aesthetic impacts for these users and creel surveys will be conducted to determine if the presence of the mine is impacting the recreational experience for users.

5.3 RECLAMATION UNITS

Reclamation of the Mount Polley project area is expected to be relatively simple, requiring standard decommissioning and closure procedures for an estimated 450 ha of disturbed area in the mine site area. Extensive ARD testing completed to date confirms that waste rock will be acid consuming and tailings, which are essentially benign, are to be deposited in a conventional system. Special closure requirements will not be required.

For purposes of reclamation, the project has been subdivided into seven Reclamation Units, depending on type of material and potential reclamation strategies. They are:

- the surface plant facilities;
- the open pits;

- the waste rock storage areas and associated water control systems;
- the tailings disposal system and supernatant/seepage reclaim facilities, and associated water control systems;
- topsoil storage areas;
- the access roads; and
- the powerline corridor.

The overall reclamation plan, complete with vegetation and habitat objectives for each unit, is discussed in the following subsections. Once mining plans are more refined and additional site investigations have been conducted, these plans will be refined and graphically presented on base maps.

Areas and end land use objective for each reclamation unit is presented in Table 5.1. Specific preparation requirements, soil amendments and plant species for each reclamation unit are presented in Sections 5.6.1, 5.6.3 and 5.6.4, respectively.

5.3.1 Surface Plant Facilities

The Surface Plant Facilities Reclamation Unit consists of:

- the crusher;
- the concentrator;
- the electrical substation;
- mine maintenance-shops-offices complex;
- the laboratory;
- the explosives storage and handling facility;
- fuel storage facilities; and
- potable water systems.

5.3.1.1 Structures and Equipment

All Surface Plant structures and equipment, including the concentrator, crusher, mine maintenance-shops-offices complex and ancillary surface facilities including the site power distribution system not required for future use will be dismantled and removed from the site. Most equipment and building shells will be sold for salvage value. Non-salvageable materials will be buried within the waste rock storage area and/or burned with the residues buried within the waste rock storage area. Water intake systems and all above ground pipe work will be lifted and removed from site. Below ground pipe work, such as fire, sewage and communications lines, will remain buried. Above ground foundations will be broken down to ground level, covered with stockpiled soils and prepared for reforestation.

Should some of the administration and service buildings or facilities have a use beyond mine closure, it may be possible to transfer these to potential users (government, First Nations, trappers, guided hunters) at the end-of-mine-life for activities in the greater region.

Once facilities have been removed and covered with glacial till, this approximately 20 ha area will be revegetated as moderately productive forest. The ground will be scarified, as required, fertilized in accordance with soil requirements, seeded and replanted with approximately equal numbers of commercially grown seedlings of red cedar, spruce, and subalpine fir at a density of 1100 stems/ha (3 m staggered centres) using the services of a commercial tree planting (reforestation) company. Riparian and moist boggy areas will be planted with a combination of native willow and other species adapted to wet soil regimes. It is expected that naturally occurring species (eg. fireweed, scrub birch etc.) will rapidly colonize riparian areas on their own.

5.3.1.2 Fuels, Reagents and Toxic Materials

All tanks and fuel storage facilities will be emptied of their contents before they are removed from their foundations. Tank residues will be transferred by a proven and reputable waste oil reprocessing company and/or Special Waste recycling company, as appropriate. Unused reagents and laboratory chemicals will be repackaged and shipped to a Special Waste disposal facility. Contaminated soils will be collected and stockpiled for treatment by a commercial soil remediation firm. Foundations and confining bunds/walls will be broken down and covered with glacial till, seeded and reforested with major tree species.

5.3.2 Open Pits

Approximately 3.7 km of 2 m high metal fencing will be erected around the open pit complex at the end of open pit mining (year-9) as a safety measure. These fences would be maintained throughout the latter part of mine life and for an indefinite period.

It is proposed to flood the open pits to the elevation of phreatic stability. It is unknown at present what this eventual flooded elevation will be. Flooding the open pit will eliminate the oxidation process in submerged rock surfaces and provide long term control of any acid generation material exposed during excavations. Only a portion of the north pit wall is potentially acid generating, leaving only the upper portions of the open pit exposed to the atmosphere. Exposed slopes will be at a post-mining average slope of 1:1 or 45°.

5.3.2.1 Flooding the Open Pit

Upon cessation of mining, diversion channels that had been constructed upstream of the open pit before mining commenced would be reconfigured to divert surface runoff from above into the open pits. In addition, the collected supernatant in the tailings reservoir could be pumped back to the pits to accelerate the filling process.

Filling estimate calculations have not been finalized at present. Assuming that 80% of the rock volume removed for mining will be replaced by water, the total volume of water is in the order of 60.6 x 10^6 m^3. Natural groundwater inflow at a rate of 43 m^3/hr produces a filling period of approximately 160 years from this source alone. This estimated filling period will be refined by including direct precipitation; waste rock area water diversion redirection and tailings pond supernatant pump back.

Once the pit is filled to phreatic stability, the groundwater flow regimes and groundwater recharge to the surrounding watershed would, for the most part, return to pre-mining conditions. The flooded open pit complex would eventually create a lake having a surface area of 35.1 ha.

5.3.2.2 Pit Slopes

need beach for pits, plant with soil cover

Requirement under the Mines Act to maintain open pit benches during mining more or less precludes reclamation of the upper pit walls until mining operations cease. After mining ceases, it will not be possible to access many of the benches with equipment. Once pit layouts are finalized, it is proposed to investigate opportunities for recontouring uppermost benches, given limitations of the equipment to operate on slopes of 1:1, to remove the bench definition. The slope could then be covered with a layer of soil, fertilized, seeded and hand planted with native tree species.

Pre-disturbance land area of the pit slope area is estimated at 23 ha. The potential to reclaim the exposed walls of the open pit as partially revegetated habitat will also be investigated. Wherever possible, sloughs and accumulations of rock fines may be hand planted with a mixture of commercially reared species of regionally-occurring dominants on steep, xeric sites in the study area. All areas accessible by foot will be fertilized and seeded with hand cast grass-legume mix. It is expected that there will be a considerable level of mortality, but with time, those plants which find niches and succeed are expected to colonize the best available habitat and eventually provide a partial vegetative screen.

5.3.3 Waste Rock Storage Areas

The waste rock storage areas will be constructed through end dumping. Dump heights will be minimized to minimize resloping costs and provide access for reclamation. Current areal estimates for the combined waste rock storage areas is approximately 123 ha.

Material deposition from dumping will result in segregation of fines to the upper layers due to natural settling processes and this top surface of fines will be graded over larger material to provide good draining substrate for the replaced soil layer. Overall final slopes will be reclaimed to approximately 26.5°.

In order to integrate the final surface of the waste rock storage area into the surrounding terrain, final loads will be dumped in the centers of the areas to imitate the typical rolling hill forms, the crests of each dump will be dozed or rolled over, and the side slopes of the final lift and top of the waste rock storage area will be smoothed and re-contoured to avoid concentration of runoff and to blend with the area's gently rolling landform.

The surfaces will be scarified and lightly surfaced with soil stockpiled during the stripping operations. The surfaces will be fertilized, seeded with a grass-legume mix and then planted with original forest cover species (Table 2.6).

Haul roads and any exposed embankments within the waste area will be recontoured, scarified, fertilized and seeded. Final unreclaimed surfaces will be fertilized, seeded with a grass-legume mix, and planted with original forest cover species.

Waste rock seepage water quality will be monitored to ensure that waste rock dump runoff and seepage are of suitable quality for direct release to the environment. If appropriate, the waste rock dump settling seepage collection system and runoff settling pond will be redirected to supplement flooding of the open pits. Once this contribution is no longer warranted, the seepage collection systems and settling ponds will be breached and the natural drainage system reinstated. The margins of all water courses will be revegetated with riparian species of plant.

5.3.4 Tailings Storage System

As the tailings have been confirmed non-acid generating, the tailings surface will be decommission as a mixed forested / wetlands complex with a gradual transition towards a ponded area at the outflow spillway. A conceptual level estimate of relative areas for each habitat type is presented in Table 5.2. The downstream face of the tailings dam will be revegetated progressively as each embankment lift is completed, starting after year-2, once the final toe position and slope have been established.

On mine closure, surface facilities will be removed in stages, salvaged and sold. The tailings delivery system will be dismantled and removed immediately following cessation of operations, but the supernatant reclaim barge, reclaim pumps and reclaim water line will be utilized for supplementary flooding of the open pit and eventually dismantled and removed. The seepage reclaim pond, seepage reclaim pumps and seepage recovery wells will be retained for one or two years after closure or until monitoring results indicate that tailings area seepage is of suitable quality for direct release to the environment. At that time, the seepage reclaim pond and pumps will be removed. However, the seepage recovery wells and monitoring piezometers in the tailings dam will be retained and capped for use as long term monitoring devices.

A dual level spillway will be required, designed to accommodate the 1-in-200 year flood flows and the second capable of accommodating the Probable Maximum Flood (PMF) within the tailings basin. The lower spillway, which will include the outflow channel, will be constructed in competent ground to the south of the main embankment and discharge to the Edney Creek north tributary drainage. The elevation of this spillway and outflow channel will be designed to establish a set water elevation over the tailings surface (15% coverage) and allow for sufficient freeboard at the crest of the main embankment. A secondary, or emergency spillway, will be designed to accommodate the PMF and maintain sufficient freeboard below the top of the main embankment. This secondary spillway is required in the event that beavers, ice or debris block the main spillway and outflow channel. The spillways and discharge channel will be designed to ensure stability for all hydrological and geotechnical conditions.

Before the final tailings impoundment flooding to the required pond elevation, the contours of the area between the crest of the main embankment and final water level will be sculptured using conventional earthmoving equipment to create a series of small bays and channels which will become a margin environment conducive to the creation of waterfowl breeding and staging habitat. The tailings embankments and the upland portions of the exposed tailings beach will be covered with a layer of soil, stockpiled during construction, and revegetated with indigenous species of conifer and deciduous tree, willow and marsh land grasses. The moist transition zone between the topsoiled beach and submerged tailings will be revegetated as a early seral stage meadow, leading to aquatic tolerant, emergent and submerged aquatic species of plant. Native vegetation species, occurring in areas where drainage is impeded or swampy, will be utilized for these transition zones. Where necessary, the final tailings surface will be treated with amendments suitable for sustaining permanent growth. The shoreline will then be planted with native emergent plant species for cover. Most of the expected species may transplanted from nearby wetlands of a similar aspect and elevation or propagated from root cuttings, turf squares or offsets.

The advice of organizations such as the B.C, Fish and Wildlife Branch, Ducks Unlimited and local trappers/guided outfitters will be sought during final design.

Final seeding of the embankment slopes with grasses and legumes will provide a stable vegetation mat that resists erosion. Once open pit flooding is complete, the surface water diversion system will be dismantled to allow for natural runoff to fill the tailings area.

5.3.5 Soil Storage Pads

Determining the locations of soil storage areas is dependant upon site investigations in the snow free period. These areas will constitute approximately 21 ha within the waste rock storage facilities area and reclamation objectives are similar. As soil stockpiles are depleted, the underlying surfaces will be fertilized, seeded with a grass-legume mix and then planted with original forest cover species

5.3.6 Mine Access Roads

All exploration roads and minor areas of disturbance will be re-contoured, scarified and revegetated as appropriate in the early stages of mine operations.

All access roads not required beyond the end of mine life will be reclaimed as forested lands. Access roads required for post-closure monitoring and site maintenance access total approximately 10 ha and will be reclaimed as grasslands for grazing and wildlife browse. Culverts will be removed and cross drainage would be reinstated. Side cast material and cut banks will be recovered and resloped with a backhoe and spread over the road surface. Cut banks will be re-contoured below the angle of repose to mitigate future slumping. Surface runoff channels will be upgraded to accommodate design capacity, stabilized with large rocks and cleaned out to minimize the possibility of new channels interfering with newly prepared areas. The surface will then be hydroseeded with rangeland seed mixtures.

5.3.7 Powerline Right-of-Way

The alignment of the powerline, and thus its area of disturbance has not been finalized at this time. The major disturbance along the powerline will result from clearing the right-of-way. The amount of disturbance to surficial materials along the powerline right-of-way will be minimal and restricted to pole installations and 4 wheel drive access. Once the timber has been removed, slash from the clearing process will be windrowed and burned but for the most part, soil resources, vegetative propagules and viable root systems will be relatively unaffected and should recolonize disturbed soils rapidly.

On completion of the powerline, the right-of-way will be hand seeded with a grass-legume seed mix. Shrubs and forbs will be allowed to re-establish themselves. Reseeding will be repeated in subsequent years until a self-sustaining cover is established. Maintenance of the line will be restricted to hand cutting as required.

Final removal of the powerline and poles will be contingent on requirements of power to the region at the end of mine life. If the line is no longer desired, all infrastructure will be removed for salvage value, and the routing will be hand planted with appropriate native tree species.

5.4 RECLAMATION RESEARCH

5.4.1 Objectives of the Research Program

An important component of the Reclamation Plan is an ongoing reclamation research program with the objective of establishing the necessary methods and materials required to implement a successful abandonment plan that will meet with the stated objectives of returning all disturbed lands to pre-mining use and capability, when the operations are closed. The program will be administered by the site Environmental Manager in co-ordination with mine surface crews and using mine equipment.

Some reclamation research work was initiated during the baseline studies program. Typical soil samples from various vegetation zones represented on the claims area will be collected and analyzed, and indigenous species of plants will be catalogued. Extensive work has been carried out assessing the acid generation potential of waste rock and tailings which form the basis for the closure options selected for the tailings, open pits and waste rock storage areas.

At the completion of mining, it is expected that the reclamation research program will have fostered the development of local knowledge and experience required to develop an effective reclamation abandonment plan. Expertise developed from on-site research will be supplemented, where necessary, with information developed by the Ministry of Energy Mines and Petroleum Resources (MEMPR), studies completed by other operations, associations with University faculties, consultants with agronomic expertise and commercial nurseries.

5.4.2 Reclamation Research Program Outline

The Reclamation Research Program will initially consist of three primary elements:

- detailed characterization of soils in the mine site and tailings impoundment areas;
- establishing a series of test plots on various disturbed materials; and
- documenting natural recolonization successes.

Detailed soils mapping and soil chemistry analysis is being conducted for the Mount Polley operations area. These data are necessary to assess the amount of available soils in the area, possible nutrient deficiencies and candidate species for reclamation.

As soon as mining commences, test plots will be established in the following locations for purposes of evaluating potential impediments that may be encountered in reclaiming specific units, as follows:

- disturbed soils and soils and overburden stockpiles;
- specially designated site within the waste rock storage areas;

- tailings embankment and isolated tailings deposition zone; and
- disturbed riparian areas.

Test plots will be designed to test such variables as soil chemistry, soil amendments (fertilizers, sand, wood chips, peat, lime), site preparation, seeding times, seed mixtures and adaptability of tree seedlings. Successes and failures will provide natural direction to the research, such that the outcome of the selected approach for reclaiming each unit will be predictable.

A program of documenting which species of plant are most successful in the natural recolonization of disturbed areas, will also be implemented shortly following operations start-up, in order to provide direction to the reclamation research. Generally, early successional species and those most preferred by wildlife provide clues to the most likely candidates for use in test plots.

5.4.3 Research Scale-up, Reclamation Trials

Since test plot information is normally based on small scale optimum conditions, the information acquired from test plots must be applied successfully on a successively larger scale before they can be deemed applicable. These scale-ups are termed reclamation trials and are normally applied to areas of 1 to 2 ha in size.

A series of reclamation trials will be implemented early in the mining program on areas that have been finalized, for example, completed portions of the waste rock dump, outer embankments of the tailings area, unused exploration roads, and margins of diversion channels. Information obtained from reclamation trials can then be scaled-up to reclaimed areas as they become available on an on-going basis.

5.5 RECLAMATION STRATEGY

At current ore reserve estimates and the stated production rate scheduling, the mine life is expected to be approximately 14 years. Reclamation of the development area will be approached on the basis of four distinct phases to match the overall development schedule.

Prior to the start of mining, Phase I will involve initial preparation of the mill site, access road and a portion of the tailings pond in 1995 and approximately 1 year will be required to strip the starter pit, develop the initial working benches and develop a start-up stockpile.

Full production, and Phase II, will commence in year-1 and continue through to the end of open pit development in year-9.

Processing of the low grade stockpile during Phase III will extend the mine life into year-14. Phase IV, mine closure will occur in year-15+.

A regular monitoring program, consisting of benthos, water quality and vegetation metal uptake sampling and analysis will be conducted through all Phases of reclamation.

5.5.1 Phase I (Year-0)

Phase I would commence during the latter part of construction and continue through into the first year of operations. Reclamation efforts would be directed toward initiating an immediate start on a stabilization program to protect exposed surfaces from erosion. Soils and overburden from the stripping of the open pit, waste rock and tailings dam sites will be stockpiled during construction. Exposed slopes will be contoured to promote runoff and seeded as soon as possible after snow melt to provide a measure of stabilization. Priority areas are:

- soils and overburden stockpiles;
- areas exposed during construction;
- road sidecasts and disturbances near streams;
- road cuts with long steep sidecasts;
- shoulders and sidecasts of access roads; and
- the powerline right-of-way.

5.5.2 Phase II (Year-1 to Year-9)

The second component of the reclamation program will be initiated in the first year of production and continue until the open pits are fully developed in year-9. A moving five-year plan will be formulated each year outlining annual reclamation initiatives. The results, which will be updated annually and submitted to MEMPR will in effect constitute a reclamation account, and will include:

- the amount of disturbed land at the beginning of the period;
- the amount of additional lands to be disturbed during the period;
- the amount of disturbed area to be prepared, fertilized, seeded and planted;
- the amount of remaining disturbed land at the end of the period;
- results of ongoing test plot experimentation;
- the initiation of additional test work as required; and
- the continuation of previous stabilization work and the undertaking of larger scale rehabilitation of abandoned or phased out areas.

Priorities are as follows:

- revegetating areas with riparian vegetation around streams, diversions and water storage ponds;
- removal, scarifying and seeding of unused exploration roads;
- re-contouring and capping completed portions of waste rock dumps;
- reforesting disturbed areas around the warehouse complex and mill site, as appropriate;
- seeding of the final outside faces and crest of the tailings dikes; and
- re-seeding of the powerline as required.

An on-site reclamation research program will also be implemented during the first year of operations to assess intermediate and long-term requirements. Experimental plots will be established on recently disturbed surfaces, such as exposed and submerged tailings, soil and overburden stockpiles, waste rock and upper most pit benches.

An on-site reclamation research program will better prepare personnel to undertake final reclamation of the property. The program will be sufficiently flexible to permit experience, methodology and new techniques to provide direction in the program. Efforts will be made to introduce native species into the program by selecting plants that are found to be rapid colonizers of disturbed ground. Four or five years may be necessary to select appropriate species and to determine the best methods of transplanting them.

Reclamation trials will be initiated as soon as areas large enough to accept them become available. Specific areas include the lower lifts of waste rock dumps, open pit benches and the outer face of the main tailings embankment. These will be used to examine various reclamation procedures such as seed mixes, liming rates, and fertilizer applications developed in experimental test plots. Experimental trials will also be directed toward establishing growth from natural seeds and establishing an appropriate mixture of deciduous and coniferous vegetation. Successes and failures will provide valuable information on applicability of various approaches well before mine closure.

5.5.3 Phase III (Year-9 to Year-14) Low Grade Stockpile Processing

Measures established in Phase II will continue in Phase III. The long-term goals which include the removal of all facilities from the property, decommissioning the tailings impoundment, filling of the open pits and re-establishing a self-sustaining cover on remaining disturbed sites, will commence in year-9 and continue through the final year of mine production and into Phase IV.

Since the open pits and most of the waste rock storage areas will be phased out in year-9, closure activities in this Phase will include:

- redirecting the open pit and unused waste rock diversion channels into the open pit;
- re-contouring the surface of the completed waste rock storage areas;
- scarifying, capping and revegetating the remaining lifts and top of unused waste rock storage areas;
- recontouring the selected berms of the open pit;
- planting the open pit roads and berms, as appropriate; and
- reclamation of depleted soil and overburden stockpiles.

5.5.4 Phase IV (Year-15+) Mine Closure and Decommissioning

The final phase of the program, which includes ongoing monitoring, will continue several years beyond cessation of operations.

As the procession of the low grade stockpile is completed, the various mine infrastructure components such as the mill, tailings impoundment, the majority of the maintenance complex and the remaining waste rock storage components will be phased out. At that time, the following elements, which are expected to take up to four years to complete, will be initiated:

- redirecting tailings water return to the open pit complex;
- dismantling the crusher complex and associated foundations;
- installing the tailings area spillway;
- recontouring the tailings beach (wetlands development);
- dismantling the mill building, the majority of the remaining site facilities including the offices, mine auxiliary buildings and surface pipelines, etc.;
- scarifying, seeding, fertilizing and reforesting the mill area and tailings area access roads; and
- planting, re-seeding, liming and fertilizing disturbed areas, as required.

Once stored tailings water is transferred to the open pit, the tailings area seepage reclaim system will be removed and the seepage reclaim wells will be capped. Final reclamation of the tailings impoundment area will include:

- establishing emergent and submergent vegetation in the tailings area;
- breaching the water storage dams, restoring drainage into the tailings area;
- planting the appropriate areas of the tailings surface and remaining portions of the main tailings embankment and revegetating water storage reservoirs with riparian vegetation;
- planting of the littoral zone of the open pit with aquatic plants;
- removal of the powerline and substations;
- scarifying, seeding and reforesting remaining access roads.

A post-reclamation monitoring program will be initiated on closure and will include the geotechnical, water quality and biological components necessary to ensure that the foregoing initiatives are achieving the projected goals. It is anticipated that monitoring will include:

- tailings impoundment surface movement monuments and piezometers;
- tailings area filling, surface and seepage water quality;
- open pit filling curve and open pit water quality;
- reseeding and refertilization requirements;
- tailings area wetlands development and riparian growth;
- reforestation success and wildlife and grazing use; and
- continuing benthos, water quality and vegetation metal uptake monitoring.

5.6 RECLAMATION METHODOLOGY

The following subsections provide a broad overview of the methods that will be employed during all phases of reclamation but it is expected that they will be modified in accordance with experience gained from the site-specific reclamation research program.

5.6.1 Site Preparation

All sites will require some form of preparation to provide a suitable environment for seeding or transplanting. Areas of compacted rock and till mixtures are normally the most difficult to prepare and will require scarifying to a depth of between 15 and 25 cm using available heavy equipment. Compacted waste rock surfaces can normally be "roughed up" with a bulldozer equipped with multiple rippers

not enough needs based on rooting depth ID by soil survey

Waste rock storage area slopes and crests will be re-contoured within the limitations of equipment to operate in such locations, in order to integrate their sharp relief into the surrounding terrain, to optimize slopes for plant propagation and to provide surface drainage and erosion control. A cover of salvaged soils will be placed on top of waste rock slopes and surfaces.

Where access is possible (primarily access ramps to water elevation) surface materials will be spread on the open pit benches prior to planting.

Before drainage to the tailings area is modified to allow development of the wetland pond, the area between the crest of the main embankment and final water level will be sculptured to create a environment conducive to waterfowl habitat by creating a series of small bays and channels using conventional earthmoving equipment. The top of the main tailings embankment and the upland portions of the exposed tailings beach will be tilled to a depth of a few centimetres (5 to 10 cm) using a commercial disc and harrow.

Foundations in the mill, warehousing complex and crusher area, etc. will be broken down to ground level and covered with a layer of overburden and soils. Compacted areas will be scarified to a depth of between 15 and 25 cm prior to planting. NO

For some roads, side cast material and cut banks may be recovered and resloped with a backhoe and spread over the road surface, otherwise, road surfaces will require only scarification. Cut banks will be re-contoured below the angle of repose to minimize future slumping.

Surface runoff channels will be upgraded to accommodate design capacity, stabilized with riprap and cleaned out to minimize the possibility of new channels interfering with newly prepared areas. Riparian areas will be covered, wherever possible, with organic material salvaged from the immediate site.

5.6.2 Overburden and Soil Treatment - Mill Area

Typical soils were investigated in representative locations of the major soil types in the mill site area in March 1995 and results are described in Section 4.2.1.

Soil samples were collected for analysis. These samples are being analyzed for pH, texture, cation exchange capacity, conductance, total nitrogen, total sulphur, exchangeable cations (P, K, Ca, Mg, and Na) and available metals (Al, Cu, Fe, Mn and Zn). Results will be presented in subsequent revisions of this report.

Work is scheduled during 1995 to provide a similar level of information for the rest of the disturbed areas.

5.6.2.1 Soil Salvage and Stockpile Requirements

Salvage and treatment specifics for the mill area are detailed in Section 4.2.1. The large size of the lease will mean staged development and will likely require more than one stockpile location. This can be time and cost effective since materials remain close to their replacement location.

Soil stockpiles will be discussed in more detail once mine planning is sufficiently refined, soil surveys are completed and selection of soil stockpile areas is completed. Updates to the reclamation plan will address contain results of the late spring 1995 investigations.

In general, soil stockpiles should not be located near the headwalls of steep, gullied or unstable terrain; or immediately adjacent to active streams and creeks. It is recommended that all stockpiles be located in as few areas as practical to facilitate erosion and sediment control.

Preliminary soils investigations suggest that the soil stockpile for the office/mill site could be located in terrain unit # 6 (Figure 2.4), in the area behind the present core shack. The area is gently sloping with a rock bluff to the west as a natural retaining wall. The edge of the stockpile should be at least 10 m from the steeper slope to the south.

5.6.2.2 Soil Quality and Erosion Control

The maintenance of soil quality and elimination of erosion in the stockpiles are of critical importance in meeting final reclamation objectives. The stockpiled B horizons will be of high quality. The loam soil, with generally less than 30% coarse fragments, when mixed with humus layers, will make excellent reclamation material. Care should be taken when stripping in the shallow to bedrock soils. Rock rubble from the fractured bedrock surface may become incorporated in the stockpile, reducing topsoil quality.

Carbonates were found in the parent material (Ck) in soil pit #MP95-12a. The final soil survey will verify the extent of this material. If this horizon is deemed "unfavourable substrate" after chemical analysis, stockpiles of Ck will not be used as supplemental topsoil rooting medium. Carbonates are rare in high rainfall environments, except where capillary-rise concentrates the soil solution (Bohn et al, 1979).

Soil erosion in the stockpiles will be controlled by the immediate seeding with an appropriate agronomic grass species adapted to the climatic conditions of the site. Prior to the establishment of grass cover, silt fencing will be installed along the perimeter of the stockpiles.

Hay bales will placed on the upslope side of the silt fence in locations where run-off flow from the stockpiles may be concentrated. This will slow water flow to increase the effectiveness of the silt fence. Settling ponds, lined with filter fabric, may be established if areas sensitive to high run-off are identified. The study area can experience short, intense summer rainfall events and these measures will mitigate the impacts of these storms on the stockpile. It is recommended that the bales, silt fences and ponds remain in place until soil replacement.

5.6.2.3 Soil Replacement

Following the removal of mill site infrastructure and surface preparation, the stockpiled soils will be replaced on the office/mill site. B and LFH horizons will be replaced on the upland portions, and, if terrain permits reestablishment of wetland areas, O horizons will be placed to an appropriate depth. C material may be used to build up the depth of soil on the reclamation areas, by placing a layer of it before B horizon replacement.

5.6.3 Growth Media and Soil Amendments

In order to provide for successful growth, plants require, as a minimum, a medium that allows for root penetration, adequate moisture and nutrients. Wherever possible, topsoil and overburden, primarily originating from the open pits, waste rock storage areas, plant site and tailings dam stripping will be stockpiled separately from waste rock storage areas and used for growth medium during reclamation. These stockpiles will be mapped, flagged, analyzed for soil chemistry and seeded as soon as possible to protect them as a future reclamation resource.

Preliminary soil analyses for the Mount Polley area suggests that most soils are suitable for plant growth. Use of commercial fertilizers (Nitrogen / Phosphorous / Potassium) and/or pH modifiers may be warranted for some soils once further testing of soils is completed.

The depth of material needed to retain moisture and amendment requirements will be investigated from test plots and subsequent trials. Potential amendments including lime, sand, peat, wood fibre, mulches and others will be examined during the reclamation research tests.

5.6.4 Species Selection

5.6.4.1 Grasses and Seeding

Until experimental test plots indicate better results from indigenous species, a grass mix comprising Canada Certified No.1 Weed-Free seed, selected specifically for the Caribou climate, will be used in the initial seeding of disturbed areas and overburden stockpiles. A recommended seed mixture for dry and moist sites will be selected on the basis of discussions with B.C. Ministry of Forests, commercial suppliers such as Dawson Seed Company Limited and from experience with similar environments. Typical examples of appropriate species include Timothy, Creeping Red Fescue and clover.

Seed mixtures of primarily grass and legume combinations will include rapidly establishing, short-lived species as well as slowly developing, longer-lived species. The rapidly establishing, short-lived species provide an early plant cover and protect against erosion and provide better surface conditions for more slowly establishing native species.

During the initial test plots and larger scale trials, experiments with various seed application rates, broadcasting methods and timing of planting will be tested. Seeding rates of between 50 and 75 kg/ha are typically recommended for broadcasting but seeding rates will be better defined or optimized from field trials. Initially a hand held cyclone seeder will be the most appropriate method for broadcasting seed in test plots and larger scale trials. However, methods of seeding involving the use of hydroseeders, tackifiers and emulsifiers may be required in specific exposed areas and on large scale areas to be reclaimed.

Variations in seeding rates and plantings times will be examined. Planting immediately following snowmelt may result in too short a germination period for propagation to be successful. A late fall planting allows seeds to overwinter with germination stimulated as early as possible the following spring when seeds can take advantage of lengthening daylight, optimum soil moisture conditions and warming temperatures.

5.6.4.2 Shrubs and Forbs

As experimental test results from trial plots become available, attempts will be made to harvest and propagate native seedlings and transplants of shrubs, forbs and juvenile species of deciduous tree. Efforts will focus on those local species that do well in riparian areas since they are not normally available from commercial nurseries. In order to ensure success, site reclamation staff will require a rudimentary nursery and some preliminary training in seed collection, transplanting, rooting powders and other methods of propagation. Seeds, cuttings and propagules from native species will be collected for site reproduction. Other riparian candidates that are native to the area and are already adapted to the site include a range of grasses, sedges, ribes and horsetail ferns which do well in moist areas.

5.6.4.3 Trees (Coniferous and Deciduous Species)

Coniferous species, red cedar, Douglas fir, lodgepole pine, spruce, and subalpine fir, will be established from rooted container-grown stock obtained from local commercial nurseries to ensure ecotypic compatible stock. Deciduous species such as black cottonwood, bog birch and trembling aspen are ideal regeneration species and can be readily harvested and propagated on site. Planting will be done by hand in a random or staggered pattern using contract reforestation services. Average planting densities will vary depending on the species, elevation, soil types and the visual effects desired but will average 1100 stems of combined cedar/fir/pine/spruce per hectare.

5.6.4.4 Weed Control Program

With overlapping interests for wildlife and commercial forests, a weed control program will have to be flexible and in order to protect growth of tree species while not endangering wildlife. Selected practices will have to be employed to ensure that noxious weeds are kept under control while ensuring that impacts are minimized. For example, the use of toxic herbicides is not compatible with wildlife use.

It is proposed that a weed control program consist of three primary components:

- the immediate seeding, where possible, of all disturbed areas to help eliminate incursion of weeds;
- a program of regular monitoring to identify weed occurrence; and
- implementing immediate action on a limited scale to eradicate noxious weeds.

With immediate seeding of disturbed areas using weed-free Canada Certified No.1 Seed, a regular monitoring program, and immediate action on weed control, it is expected that a localized and low intensity program will be all that is necessary to control noxious weeds, and eliminate the necessity for wide spread use of toxic herbicides.

5.7 RECLAMATION MONITORING, FACILITIES AND STAFF

The proposed reclamation research program and annual reclamation initiatives will be undertaken by mine personnel under the direction of the Safety and Environment Supervisor, augmented where required with the advice of consultants, reclamation specialists, agronomists, horticulturists, silviculturist, soils laboratories, seed and fertilizer suppliers and reforestation companies. In this way mine personnel will be able to develop or acquire practical knowledge in reclamation needs for this particular property.

Propagation of local shrubs and forbs will be carried out on-site under the direction of the mine Environmental Manager using rudimentary nursery facilities on site. The services of professional nurseries or commercial reforesters will be used where appropriate for coniferous species propagation.

Work will be carried out using in-house mine services such as drafting and surveying, available mine equipment and, where necessary, reforestation companies, commercial nurseries and rental equipment. Preparation work, such as surveying, engineering, land contouring and drainage installations will be handled by site surface personnel. Most annual reclamation initiatives will be completed by project staff using project equipment, while specialist work will be contracted out.

In addition to the equipment that the mine would have on site that would be available on a part time basis for reclamation purposes during production and available on completion of mining, it is anticipated that reclamation will require the periodic use of agricultural equipment such as a hydroseeder, harrows, ploughs and/or discs which can be rented or obtained by contracting out. Smaller, less expensive equipment, such as hand-held cyclone seeders, packsack sprayers, "weedeaters", and common gardening tools will be kept on site for such purposes.

Experimental trials, test plots, areas of natural revegetation and initial reclamation attempts will be monitored throughout the growing season by in-house personnel with the help of consultants to assess successes and failures. The information gathered will provide valuable guidance for future reclamation programs and in defining a final reclamation plan. Preparing and updating the annual Reclamation and Five-Year Plan Report will be a joint responsibility of in-house staff and consultants.

Environmental staff will be responsible for the post-closure monitoring of tailings embankment geotechnical instrumentation, tailings area surface and groundwater quality, open pit filling and water quality, plant growth, ongoing requirements and fish and wildlife habitat use.

5.8 POST-MINING LANDFORMS

The final appearance of the fully reclaimed operations area will differ, in three major respects, from its original form. The three major changes in landform will occur from development of the open pits, the waste rock dumps and the tailings storage area. In order to achieve the goals of restoring all disturbed lands to their original capability, each post-mining landform has been designed to optimize the mixture of forest, tame grass and wetlands cover types with the ultimate objective of returning all disturbed areas to productive forestry, grazing and wildlife habitat. Reclamation of the open pits and tailings impoundment will include an increase in aquatic and wetland habitat from pre-development capability with a corresponding reduction of forested habitat.

Due to the topographic alteration from open pit development and the necessity of flooding, habitat end land use of the pit area will entail a change from forested to aquatic habitat. Mining of the open pits will result in the creation of a three lobed lake of approximately 35 ha with a narrow (15 m) vegetated littoral zone with a single outlet leading to Bootjack Lake on the west side. Additional landform changes will result from the partial revegetation of the reclaimed exposed benches.

Reclamation of the waste rock storage areas will create undulating plateaus with gradually inclined side slopes. The side slopes of the final waste rock storage areas will be contoured to a slope less than the angle of repose and the crests on each lift rolled in order to integrate each storage area into the surrounding terrain. The top of the waste rock storage areas will be re-contoured such as to avoid concentration of runoff and to imitate gently rolling plateaus typical of the area. The final cover will consist of forested habitat with species composition of the pre-disturbed habitat.

Reclamation of the tailings storage area will create a mixed forest and shallow wetlands system conducive to grazing and ungulate and waterfowl production. All diversion ditches surrounding the tailings area, not required at the end of mining, will be breached and natural drainage directed into the tailings area. The main embankment will be seeded with grasses and legumes and planted with native tree species to provide a stable vegetation mat that resists erosion. The outflow channel will be directed toward a engineered spillway located on the southwest side of the main embankment.

This end land use of the tailings area maintains original habitat values of the pre-disturbance condition for wetlands and forested habitat, but will increase pond area for production of waterfowl.

Institutions such as the B.C. Fish and Wildlife Branch and Ducks Unlimited may be consulted as to the feasibility of developing the final pond to enhance its capability for waterfowl breeding and staging. The spillway in the main embankment will by design maintain the final pond at levels that are suitable for waterfowl. Using earth-moving equipment, the western shore of the final pond will be sculpted, if necessary, to create a number of inlets suitable for breeding waterfowl. The shoreline will then be planted with native emergent plant species such as cattail, bullrush and sedges for cover. Native submergent plants, such as pondweed, lily and hornwort, already exist in many of the local lakes and ponds. Tubers, offsets and other propagules may be harvested from local sources, and re-introduced into the final tailings pond.

The mill site, ancillary facilities and access roads will be levelled, cleared of demolition debris where necessary, contoured and scarified. The scarified ground will then be seeded with a grass seed mix appropriate to the elevation and the site. The mill site will then be hand-planted with native tree seedlings. All machinery, fuel tanks and other infrastructure will be removed for salvage or for re-use elsewhere. Special care will be taken to remove fuel and lubricants in a manner that avoids contaminating the soil or groundwater. All buildings will be dismantled, and re-usable materials will be salvaged and re-sold. Concrete pads and foundations will be broken into fragments and buried.

All access roads not required for post-closure monitoring or by Ministry of Forests will be ripped, scarified, seeded with native grasses and legumes, and reforested with juvenile species of tree.

5.9 RECLAMATION SCHEDULE

The overall reclamation strategy, as described in Section 5.5 has been divided into four phases to coincide with the overall mining schedule. Reclamation is scheduled to commence immediately during the first year of construction in areas such as the powerline right-of-way and unused exploration roads. A reclamation research program and annual reclamation initiatives will be implemented in year-1 followed by reclamation trials starting approximately year-5 as some disturbed areas are phased out. The majority of reclamation can not commence until open pit development is nearly complete (year-9) with additional measures implemented in year-14 as detailed in Section 5.5. Post-closure reclamation is scheduled to continue for up to 5 years after mining ceases.

In accordance with the Mines Act and Regulations, a conceptual Five-Year Reclamation Plan covering the two-year construction period, and the first three years of operation will be prepared for the final reclamation plan once mine planning is sufficiently detailed. The Five-Year Reclamation Plan will provid an accounting of:

- the amount of disturbed land at the beginning of the period;
- the amount of additional lands to be disturbed during the period;
- the amount of disturbed area to be prepared, fertilized, seeded and planted during the period; and
- the amount of remaining disturbed land at the end of the period.

Much of the first two years of development will be taken up with construction related activities and only limited areas of disturbed land can be reclaimed during these initial years of operations. As suggested by the phased approach, reclamation of appropriate disturbed areas will commence during and immediately following construction to prevent erosion and to minimize the spread of noxious weeds. Areas such as soil stockpiles, water treatment pond embankments and road sides will be reclaimed as soon as possible after construction.

Initially, operations will pursue an active reclamation research program consisting of test plots and small scale trials focusing on the confirmation of test results and progressive reclamation of mining disturbed lands as they become available. Areas selected for scaled up trials will be planned in sufficient detail to allow their assessment, selection and scheduling well in advance of implementation.

Due to the sequence of the mining plan, much of the infrastructure such as the settling ponds, diversion channels, tailings disposal area will be in use virtually up to the last day of mining. This will be reflected in the Five-Year Reclamation Plan which will indicate that only limited areas and some portions of the waste rock dump can be reclaimed before the end of mining.

An annual Reclamation Report will be filed with MEMPR at the completion of the first year of mining and then annually thereafter. In addition to an updated Five-Year Reclamation Plan the report will include:

- results of reclamation research and ongoing test plot experimentation;
- initiation of additional test work, as required;
- results of scaled-up reclamation trials; and
- the continuation of previous stabilization work and the undertaking of larger scale rehabilitation of abandoned or phased out areas.

5.10 SUSPENDED OPERATIONS, EARLY OR PREMATURE CLOSURE

Should the Mount Polley Project be suspended for an indefinite period, operations would be temporarily "mothballed" and placed under a care and maintenance program requiring a skeleton workforce that would be charged with the responsibility of carrying out certain limited reclamation activities, such as erosion prevention, fertilizing, reseeding and monitoring to ensure the maintenance of surface water quality. This would include continued operations of essential environmental protection facilities such as the waste rock storage area settling ponds and tailings area seepage reclaim facilities.

Depending on the circumstances of early closure, the mill, ancillary facilities and roads may or may not be removed and sites reclaimed immediately. Under certain scenarios, for example, unfavourable metal prices, operations may be suspended for an extended period of time, in which case, buildings would remain under care and maintenance until metal prices recovered sufficiently to warrant re-opening the mine. Alternatively, if the mine were not to be re-opened all facilities would be removed and the site reclaimed as proposed.

In the unlikely event that the Mount Polley project is forced to close before the entire reserves are exhausted because of unforseen circumstances beyond the control of the company, the operations would have to be decommissioned at an earlier stage than contemplated by the foregoing reclamation plan. However, the reclamation plan, as described in the previous subsections, is sufficiently flexible that it could be implemented at any stage of mining with few minor changes.

Since stripping of the open pits will be carried out in phases and the waste rock storage areas will be constructed through end dumping with wrap-around lifts, sufficient soils will have been removed and stockpiled in the first year of operations to provide a growth medium as planned for reclaiming waste rock storage areas at any stage of development. Thus with little additional effort waste rock storage areas could be decommissioned, as planned, at any phase of mining.

The upper portion of the open pit walls consist of predominantly non-acid generating material and runoff into the pit is expected to be alkaline. Consequently, in the case of early closure, the natural runoff would still be re-directed and the open pit flooded as planned. However, the freshwater lake that would be formed would be smaller than that ultimately contemplated at the end of mining.

Should operations be prematurely closed, the tailings area is designed such that the area can be decommissioned at any stage of production as a forested / wetlands complex. However, in the event that the tailings do not reach the final elevation as planned, the spillway will be constructed at a lower elevation than originally planned. The spillway would be designed to ensure minimum required depths for habitat enhancement. Surface reclamation and waterfowl habitat enhancement measures would be implemented as proposed.

The measures proposed for removal and disposal of site infrastructure would be implemented as proposed, in the event of premature closure of the mine.

Table 5.1

Mount Polley Project
Reclamation Units

Infrastructure	Area (ha)	End Land Use *
Plant Site	20	F / G
Open Pits	23 / 35	x / A
Waste Rock Storage Areas	123	F
Tailings Storage Area	248	F (G)
Soil Stockpiles	21	F
Access Roads	10	G
Powerline Right-of-Way	-	G -> F

* F = forested; G = grazing; A = aquatic; x = partially revegetated

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Table 5.2

Mount Polley Tailings Area
Conceptual Habitat Type Breakdown

Habitat Type	% Area	Area (ha)
Forest	77.5	192.2
Marsh Transition	7.5	18.6
Pond	15	37.2

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SECTION 6.0 - RECLAMATION COSTS

6.1 SUMMARY

The Mine Reclamation Costing Spreadsheet (v3.2) developed by the Ministry of Energy, Mines and Petroleum Resources, was used to calculate reclamation capital and operating costs.

It is recognized that reclamation of dormant areas during the active mining period is the most cost effective method of reclaiming site disturbances. However, for the purposes of this estimate, it is assumed that most areas will remain active until closure, except for the downstream slope of the tailings dam and test plots located at various locations on the site. Research and operating costs incurred prior to closure are not included.

Table 6.1, *Mine Reclamation Costing Summary*, categorizes the disturbances by mine activity (eg. pit walls, dump slopes, etc.). Final land use designations of forested habitat, rangeland or aquatic habitat have determined the prescription for each area of disturbance.

Preliminary reclamation costs have been prepared for each disturbance category and are included as Appendix B. Background costing for resloping, scarification and surface capping was prepared to support the format of the Version 3.2 spreadsheet program.

6.2 SCOPE OF WORK

6.2.1 Dump Resloping

A Caterpillar D9N size bulldozer equipped with a universal blade is proposed for resloping dumps from the repose angle of 37° to the reclaim angle of 26.5.° The costs vary according to dump height and the equipment productivity estimate. The following Tables from Appendix B detail the assumptions used to determine recontour incremental dump heights.

Table B-I	Calculation of Dozer Push Quantity and Distance for All Dumps
Table B-II	Dozer Productivity and Cost Estimate per Meter and Loose Cubic Meter for All Dumps
Table B-III	Dozer Operating Assumptions for Resloping

Table B-IV in the Appendix (Dozer Costs for Resloping Mount Polley Dumps) calculates the dozer resloping costs for the dump designs of this plan only. The other small resloping project will be the 3 ha of settling ponds located at various locations around the site. These will be removed and sloped utilizing a backhoe to pull material above the high water line of the drainage ditches.

6.2.2 Scarification and Surface Capping

All running surfaces at the mine site will be scarified using a Caterpillar D9N size bulldozer equipped with a three shank ripper attachment. Productivity was estimated at 0.86 ha per operating hour on roads, mill site and dump surfaces. The tailings area was not scarified for the final cost estimate.

Scrapers of a Caterpillar 631 size will be used for controlled placement of the growth medium to an average depth of 15 cm. The fleet will consist of one D9N bulldozer and three scrapers when capping dumps. Five scrapers will be used when capping the tailings impoundment due to the length of haul. These cost estimates are particular for the Mount Polley Mine and depend upon the geometry of the dumps and topsoil haul distances.

The following Tables from Appendix B detail the calculations for costing this work:

Table B-V	Equipment Operating Assumptions for Scarification and Surface Capping
Table B-VI	Costs for Scarification of Surface
Table B-VII	Costs for Surface Capping

6.2.3 Seeding and Fertilizing

Hydroseeders will be utilized for seeding and fertilizing slopes while the gently sloping areas will be broadcasted using an All Terrain Vehicle. The grasslands will be fall seeded and fertilized with three subsequent spring fertilizations. Tree seedlings will be planted during the same spring at 1,100 seedlings per hectare.

6.2.4 Costing by Disturbance Categories

Detailed costing by disturbance category in Table 6.1 is detailed in the following Tables in Appendix B:

Table B-1	Plant Site and Admin
Table B-2a	Pit - Lakes
Table B-2b	Pit - Walls
Table B-3a	Dump - Surfaces
Table B-3b	Dump - Slopes
Table B-3c	Settling Ponds
Table B-4a	Tailings Dam - Surface
Table B-4b	Tailings Dam - Slopes
Table B-5	Topsoil Pads
Table B-6	Roads

6.2.5 Facility Decommissioning and Lump Sum Items

The plant buildings will be dismantled and the foundations will be broken and buried. The salvage value of the crushing and milling equipment is sufficient to offset the incurred costs. The plant site reclamation has been costed in Table B-7.

The mine site cleanup involves the disposal of other solid wastes collected on site and, as such, could be considered the contingency of this cost estimate. The material of value will be offered to salvage dealers. Remaining wastes will be disposed of in an appropriate manner.

The powerline may be left intact for industrial development in the area, however, can be removed and reclaimed if necessary. The access road to the Mount Polley project area will be left open for forestry access and for mine site maintenance as required.

The cost estimate provides for five years of post-closure monitoring, including water quality, benthics and metal levels in vegetation sampling. Associated consultant charges are also included for the same period.

Table 6.1
Imperial Metals Corporation
Mt. Polley Project

Version 3.2									31-Mar-95
		MINE RECLAMATION COSTING SUMMARY REPORT							
Project Name:	Mount Polley Mine								
Permit #:	Conceptual Reclamation Plan								
Costing Year:	At Closure								
		AREA (ha)				RECLAMATION PRESCRIPTION			
Mine Activity Category	Land Use	Total Disturbed	Perm. Disturb.	Current Reclaimed	To be Reclaimed	Site Preparation	Revegetation	Maintenance	Total Cost
Area Disturbance									
					0	$0	$0	$0	$0
Pit - Walls	Ledged Rock Cliff	23.37			23.37	$25,000	$0	$0	$25,000
Pit - Lakes	Aquatic	35.05			35.05	$0	$0	$0	$0
Dump - Slopes	Mod. yield forest	37.21			37.21	$180,351	$62,682	$20,460	$263,493
Dump - Surfaces	Mod. yield forest	86.08			86.08	$163,665	$132,133	$34,432	$330,230
Roads	Ungulate summer range	9.68			9.68	$13,862	$5,808	$11,616	$31,286
Plant Site & Admin.	Grazing	20.01			20.01	$48,923	$30,715	$8,004	$87,642
Tailings Dam - Slopes	Mod. yield forest	32.63			32.63	$30,000	$0	$17,947	$47,947
Tailings Dam - Surface	Mixed Land Use	215.37			215.37	$771,240	$258,499	$73,226	$1,102,965
Settling Ponds	Ungulate summer range	3.01			3.01	$4,262	$1,806	$3,612	$9,680
Topsoil Pads	Mod. yield forest	21.01			21.01	$0	$35,402	$11,556	$46,957
					0	$0	$0	$0	$0
					0	$0	$0	$0	$0
					0	$0	$0	$0	$0
					0	$0	$0	$0	$0
Facility Decommission									$400,000
Lump Sum Items									
Monitoring - 5 years									$300,000
Water Quality									
Benthics									
Vegetation									
Engineering									$100,000
	TOTAL	483.42	0.00	0.00	483.42	$1,237,303	$527,045	$180,852	$2,745,200

Appendix A

SOIL SUMMARY

March 1995

APPENDIX A

SOIL DESCRIPTIONS

SOIL PIT # MP95-11
Orthic Humo-Ferric Podzol with a Mv over Rj landform sampled near the primary crusher.

Horizon	Depth	Description
LFH	10-0cm	Leaf / needle litter with a moder humus layer.
Bf	0-20	Strong brown (7.5YR4/6m); sandy loam; 30% coarse fragments (cf); abundant fine roots; moderate medium subangular blocky structure; friable and slightly sticky consistence.
BC	20-40	Brown (10YR4/3m); sandy loam; 45% cf; plentiful very fine roots; moderate-strong coarse subangular blocky structure; firm and slightly sticky consistence.
R	40-100+	

SOIL PIT # MP95-12a
Brunisolic Gray Luvisol with a Mj landform sampled near the concentrator building.

Horizon	Depth	Description
LFH	15-0	Leaf / needle litter with a moder humus layer.
Bm	0-20	Brown (10YR4/3m); sandy loam; 20% cf; abundant coarse roots; weak-moderate medium subangular blocky structure; very friable and slightly sticky consistence.
Btg	20-60	Brown (10YR5/3m); dark yellowish brown (10YR4/6m) mottles; loam; 20% cf; few fine roots; strong fine platey structure; friable and sticky consistence.
BC	60-120	Brown (10YR4/3m); loam; 20% cf; moderate coarse subangular blocky structure; firm and sticky consistence.
Ck	120-180	Brown (10YR4/3m); loam; 25% cf; moderate coarse subangular blocky structure; firm and sticky consistence.

SOIL PIT # MP95-13

Orthic Humo-Ferric Podzol with a Mv over Rj landform sampled near crusher conveyor.

Horizon	Depth	Description
LFH	20-0	Leaf / needle litter with a moder humus layer.
Bf	0-28	Strong brown (7.5YR4/6m); loamy sand; 25% cf; abundant coarse roots; weak-moderate fine subangular blocky structure; friable and slightly sticky consistence.
BC	28-58	Brown (10YR4/3m); loamy sand; 85% cf; abundant medium roots; moderate medium subangular blocky structure; friable and slightly sticky consistence.
R	58+	

SOIL PIT # MP95-14a

Brunisolic Gray Luvisol with a Mj landform sampled near the coarse ore stockpile.

Horizon	Depth	Description
LFH	35-0	Leaf / needle litter with a moder humus layer; abundant coarse roots.
Bm	0-30	Brown (10YR4/3m); loam; 25% cf; plentiful medium roots; weak-moderate fine subangular blocky structure; very friable and sticky consistence.
Btg	30-80	Brown (10YR4/3m); dark yellowish brown (10YR4/6m) mottles; loam; 25% cf; few fine roots; strong coarse subangular blocky structure; friable and sticky consistence.
C	80-105+	Dark grayish brown (10YR4/2m); loam; 30% cf; moderate-strong coarse subangular blocky structure; very friable and sticky consistence.

SOIL PIT # MP95-15
Orthic Dystric Brunisol with a Mv over Rj landform sampled near crusher conveyor.

Horizon	Depth	Description
LFH	3-0	Leaf / needle litter with a mor humus layer.
Bm	0-35	Brown (10YR4/3m); sandy loam; 55% cf; abundant fine roots; weak-moderate medium subangular blocky structure; slightly sticky consistence.
R	35+	

SOIL PIT # MP95-16a
Podzolic Gray Luvisol with a Mv over R landform sampled near the fine ore stockpile.

Horizon	Depth	Description
LFH	15-0	Leaf / needle litter with a moder humus layer.
Bf	0-20	Brown (7.5YR4/4m); sandy loam; 20% cf; abundant coarse roots; moderate medium subangular blocky structure; very friable and slightly sticky consistence.
Btg	20-45	Brown (10YR4/3m); dark yellowish brown (10YR4/6m) mottles; loam; 20% cf; plentiful fine roots;moderate-strong coarse subangular blocky structure; firm and sticky consistence.
BC	45-110	Brown (10YR4/3m); loam; 45% cf; weak-moderate fine subangular blocky structure; friable and sticky consistence.
R	110+	

SOIL PIT # MP95-17
Typic Mesisol with a Ob over LG landform sampled at the concentrator building.

Horizon	Depth	Description
Om	0-200	Black (10YR2/1m); mesic; abundant coarse roots.
Cg	200+	Dark greenish gray (5GY4/1m); clay loam; 10% cf; moderate-strong massive structure; sticky consistence.

SOIL PIT # MP95-19

Brunisolic Gray Luvisol with a Ov over M landform sampled near the concentrator building.

Horizon	Depth	Description
Of/LFH	40-0	Black (10YR2/1m); fibric; leaf / needle litter with a organic/moder humus layer; abundant coarse roots.
Ah	0-15	Loam; 20% cf; abundant coarse roots.
Bm	15-30	Loam; 20% cf; plentiful fine roots.
Bt	30-60	Loam; 30% cf; few fine roots.
BC	60-90	Loam; 35% cf.
C	90-130	Loam; 35% cf. 15-0 Leaf / needle litter with a moder humus layer.
Bm	0-20	Brown (10YR4/3m); sandy loam; 20% cf; abundant coarse *
Om	0-20_	
Cg	200+	Dark greenish gray (5GY4/1m); clay loam; 10% cf;

moderates

Brunisolic Gray Luvisol with a Ov over M landform sampled_

Horizon	Depth	Description
Of/LFH	40-0	Black (10YR2/1m); fibric; leaf / needle litter w

Horizon		Depth	Texture	Gravel	Cobble	Stones	Total(cf %)	Root Ab	Root Size	Struct Grade	Class	Kind	Consistency	Colour
LFH		10-0												
Bf		0-20	sl	20	10		30	A	F	M	M	SBK	friable	7.5YR4/6
BC		20-40	sl	20	15	10	45	P	V	MS	C	SBK	firm	10YR4/3
R		40-100+												
Soil Classification	O.HFP													
Terrain Type	Mv over Rj													
Humus Form	Moder													
Drainage Class	Well													
Rooting Depth	40 cm													
Seepage Depth														
Root Restriction Type	Rock													
Root Restriction	40 cm													
Soil Pit # MP95-11														

Horizon		Depth	Texture	Gravel	Cobble	Stones	Total(of %)	Root Ab	Root Size	Struct Grade	Class	Kind	Consistency	Colour
LFH		15-0												
Bm		0-20	sl	15	5		20	A	C	WM	M	SBK	v. friable	10YR4/3
Btg		20-60	l	15	5		20	F	F	S	F	PL	friable	10YR5/3
BC		60-120	l	10	10		20			M	C	SBK	firm	10YR4/3
Ck		120-180	l	15	10		25			M	C	SBK	firm	10YR4/3
Soil Classification	BR.GL													
Terrain Type	Mj													
Humus Form	Moder													
Drainage Class	Moderately-well													
Rooting Depth	60 cm													
Seepage Depth														
Root Restriction Type														
Root Restriction														
Soil Pit # MP95-12a														

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Horizon		Depth	Texture	Gravel	Cobble	Stones	Total(cf %)	Root Ab	Root Size	Struct Grade	Class	Kind	Consistency	Colour
LFH		20-0												
Bf		0-28	ls	15	5	5	25	A	C	WM	F	SBK	friable	7.5YR4/6
BC		28-58	ls	15	30	40	85	A	M	M	M	SBK	friable	10YR4/3
R		58 +												
Soil Classification	O. HFP													
Terrain Type	Mv over Rj													
Humus Form	Moder													
Drainage Class	Well													
Rooting Depth	58 cm													
Seepage Depth														
Root Restriction Type	Rock													
Root Restriction	58 cm													
Soil Pit # MP95-13														

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Horizon		Depth	Texture	Gravel	Cobble	Stones	Total(cf %)	Root Ab	Root Size	Struct Grade	Class	Kind	Consistency	Colour
LFH		35-0						A	C					
Bm		0-30	l	15	10		25	P	M	WM	F	SBK	v. friable	10YR4/3
Btg		30-80	l	15	10		25	F	F	S	C	SBK	friable	10YR4/3
C		80-105	l	20	10		30			MS	C	SBK	v. friable	10YR4/2
Soil Classification	BR.GL													
Terrain Type	Mj													
Humus Form	Moder													
Drainage Class	Moderately-well													
Rooting Depth	50 cm													
Seepage Depth														
Root Restriction Type														
Root Restriction														
Soil Pit # MP95-14a														

Horizon		Depth	Texture	Gravel	Cobble	Stones	Total(cf %)	Root Ab	Root Size	Struct Grade	Class	Kind	Consistency	Colour
LFH		3-0												
Bm		0-35	sl	20	30	5	55	A	F	WM	M	SBK		10YR4/3
R		35 +												
Soil Classification	O. DYB													
Terrain Type	Mv over Rj													
Humus Form	Mor													
Drainage Class	Well													
Rooting Depth	35 cm													
Seepage Depth														
Root Restriction Type	Rock													
Root Restriction	35 cm													
Soil Pit # MP95-15														

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Horizon		Depth	Texture	Gravel	Cobble	Stones	Total(cf %)	Root Ab	Root Size	Struct Grade	Class	Kind	Consistency	Colour
LFH		15-0												
Bf		0-20	sl	15	5		20	A	C	M	M	SBK	v. friable	7.5YR4/4
Btg		20-45	l	15	5		20	P	F	MS	C	SBK	firm	10YR4/3
BC		45-110	l	30	15		45			WM	F	SBK	friable	10YR4/3
R		110+												
Soil Classification	PZ.GL													
Terrain Type	Mv over R													
Humus Form	Moder													
Drainage Class	Moderately-well													
Rooting Depth	50 cm													
Seepage Depth	70 cm													
Root Restriction Type														
Root Restriction														
Soil Pit # MP95-16a														

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Horizon		Depth	Texture	Gravel	Cobble	Stones	Total(cf %)	Root Ab	Root Size	Struct Grade	Class	Kind	Consistency	Colour
Om		0-200	mesic					A	C					10YR2/1
Cg		200+	cl	10			10			MS		MA		5GY4/1
Soil Classification	Typic Mesisol													
Terrain Type	Ob over L'G													
Humus Form	Organic													
Drainage Class	Poorly													
Rooting Depth	50 cm													
Seepage Depth	0 cm													
Root Restriction Type														
Root Restriction														
Soil Pit # MP95-17														

Horizon		Depth	Texture	Gravel	Cobble	Stones	Total(cf %)	Root Ab	Root Size	Struct Grade	Class	Kind	Consistency	Colour
Of/LFH		40-0						A	C					
Ah		0-15	I	15	5		20	A	C					
Bm		15-30	I	15	5		20	P	F					
Bt		30-60	I	20	10		30	F	F					
BC		60-90	I	20	15		35							
C		90-130+		20	15		35							
Soil Classification	BR.GL													
Terrain Type	Ov over M													
Humus Form	Organic/moder													
Drainage Class	Imperfectly													
Rooting Depth	60 cm													
Seepage Depth	0 cm													
Root Restriction Type														
Root Restriction														
Soil Pit # MP95-19														

Figure 1: Soil pit #MP95-11: Shallow to bedrock podzolic soil on morainal veneer over rock.

Figure 2: Soil pit #MP95-12a: Luvisolic soil developed on deep, calcareous till parent material.

Figure 3: Soil pit #MP95-13: Sub-xeric podzolic soil on shallow to fragmented bedrock parent material.

Figure 4: Soil pit #MP95-14a: Luvisolic soil on deep morainal parent material

Figure 5: Soil pit #MP95–15: Brunisol developed on very shallow till over bedrock

Figure 6: Soil pit #MP95 – 16a: Podzolic gray luvisol on a morainal veneer over rock. The till in this area was up to 20' thick.

Figure 7: Soil pit #MP95-17: Typic mesisol organic soil formed over a poorly drained glacio-lacustrine parent material.

Figure 8: Soil pit #MP95-19: An organic/humus veneer over a Brunisolic gray luvisol formed in deep till parent material. These shallow organics are found in the "wetland" fringe areas.

Appendix B

COSTING DETAIL

Table B-summary
Imperial Metals Corporation
Mt. Polley Project

Version 3.2 — 31-Mar-95

MINE RECLAMATION COSTING SUMMARY REPORT

Project Name: Mount Polley Mine
Permit #: Conceptual Reclamation Plan
Costing Year: At Closure

Mine Activity Category	Land Use	AREA (ha) Total Disturbed	Perm. Disturb.	Current Reclaimed	To be Reclaimed	RECLAMATION PRESCRIPTION Site Preparation	Revegetation	Maintenance	Total Cost
Area Disturbance									
					0	$0	$0	$0	$0
Pit - Walls	Ledged Rock Cliff	23.37			23.37	$25,000	$0	$0	$25,000
Pit - Lakes	Aquatic	35.05			35.05	$0	$0	$0	$0
Dump - Slopes	Mod. yield forest	37.21			37.21	$180,351	$62,682	$20,460	$263,493
Dump - Surfaces	Mod. yield forest	86.08			86.08	$163,665	$132,133	$34,432	$330,230
Roads	Ungulate summer range	9.88			9.88	$13,862	$5,808	$11,616	$31,286
Plant Site & Admin.	Grazing	20.01			20.01	$48,923	$30,715	$8,004	$87,642
Tailings Dam - Slopes	Mod. yield forest	32.63			32.63	$30,000	$0	$17,947	$47,947
Tailings Dam - Surface	Mixed Land Use	215.37			215.37	$771,240	$258,499	$73,226	$1,102,965
Settling Ponds	Ungulate summer range	3.01			3.01	$4,262	$1,806	$3,612	$9,680
Topsoil Pads	Mod. yield forest	21.01			21.01	$0	$35,402	$11,556	$46,957
					0	$0	$0	$0	$0
					0	$0	$0	$0	$0
					0	$0	$0	$0	$0
					0	$0	$0	$0	$0
Facility Decommission									$400,000
Lump Sum Items									
Monitoring - 5 years									$300,000
Water Quality									
Benthics									
Vegetation									
Engineering									$100,000
	TOTAL	483.42	0.00	0.00	483.42	$1,237,303	$527,045	$180,852	$2,745,200

Table 8-1
Mine Reclamation Costing Worksheet

Project Name:	Mount Polley Mine								
Reclamation Permit #:	Conceptual Reclamation Plan								
Disturbance Category:	Plant Site & Admin.								
Land Use:	Grazing								
Area to be reclaimed:	20.01								
Additional Notes:									
				RECLAMATION PRESCRIPTIONS					
A.	Depth or	Area	Dump Ht.	Unit Cost	hours/hectare	Unit Cost	Item		TOTAL $
Site Preparation	Distance	(ha)	(m)	$/hr,$/m3	hrs/ha	$/ha	Subtotal $		
Resloping									
& Bury Foundations									
		20.01	10	$110	4.20	463.932	$9,283		
			25			0	$0		
			50			0	$0		
			75			0	$0		
			100			0	$0		
			125			0	$0		
			150			0	$0		
			175			0	$0		
			200			0	$0		
			300			0	$0		
Capping (Level)									
compacted (cm)						$0	$0		
uncompacted (cm)						$0	$0		
Ripping		20.01				$128	$2,561		
Level Push							$0		
optional							$0		
Spreading Surface Cover	15.24 cm	20.01				$1,852	$37,059		
optional							$0		
optional							$0		
optional							$0		
optional							$0		
optional							$0		
optional							$0		
optional							$0		
									$48,903
B.		Area	Application	No. of Kg.	Appl. Cost	Unit Cost	Item	Subtotal $	TOTAL$
Revegetation		(ha)	Rate (kg/ha)		$/ha	$/ha	Subtotal $		
Aerial Broadcast - application						$0	$0		
Seed				0		$0	$0		
Fertilizer				0		$0	$0		
								$0	
Drill - application						$0	$0		
Seed				0		$0	$0		
Fertilizer				0		$0	$0		
								$0	
Hydroseed									
Hydroseed - application						$0	$0		
Seed				0		$0	$0		
Fertilizer				0		$0	$0		
Mulch				0		$0	$0		
Tackifier				0		$0	$0		
								$0	
Fall Broadcast Application		20.01		0	$600	$600	$12,006		
				0		$0	$0		
optional - material 2				0		$0	$0		
								$12,006	
		Area	Appl. Rate	No. of	Appl. Cost	Unit Cost	Item		
Woody species		(ha)	(stems/ha)	Plants	$/stem	$/ha	Subtotal $		
Plant Installation		20.01	1100		$1	$935	$18,709		
Seedlings				0		$0	$0		
Fertilizer tablets				0		$0	$0		
Plant protectors (installed)				0		$0	$0		
optional - material 3				0		$0	$0		
optional - material 4				0		$0	$0	$18,709	
									$30,715
C.	Years	Area	Application	No. of Kg.	Appl. Cost	Unit Cost	Subtotal $	Subtotal $	TOTAL$
Maintenance		(ha)	Rate (kg/ha)		$/ha	$/ha	per year		
Aerial Broadcast - application						$0	$0		
Seed				0		$0	$0		
Fertilizer				0		$0	$0		
								$0	
Hydroseed									
Hydroseed - application						$0	$0		
Seed				0		$0	$0		
Fertilizer				0		$0	$0		
Mulch				0		$0	$0		
Tackifier				0		$0	$0		
								$0	
Spring Maintenance Fertilize	1	20.01		0	$400	$400	$8,004		
				0		$0	$0		
optional - maint.material 2				0		$0	$0		
								$8,004	
									$8,004
Total Cost for Reclamation Prescriptions									$87,622

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Table II-2b
Mine Reclamation Costing Worksheet

	Project Name:	Mount Polley Mine								
	Reclamation Permit #:	Conceptual Reclamation Plan								
	Disturbance Category:	Pit - Walls								
	Land Use:	Ledged Rock Cliff								
	Area to be reclaimed	23.37								
	Additional Notes:	Fence around perimeter of pit walls								
					RECLAMATION PRESCRIPTIONS					
A.		Depth or	Area	Dump Ht.	Unit Cost	Hours/hectare	Unit Cost	Item		TOTAL $
	Site Preparation	Distance	(ha)	(m)	$/hr, $/m3	Hrs/ha	$/ha	Subtotal $		
	Resloping									
				10			0	$0		
				25			0	$0		
				50			0	$0		
				75			0	$0		
				100			0	$0		
				125			0	$0		
				150			0	$0		
				175			0	$0		
				200			0	$0		
				300			0	$0		
	Capping (Level)									
	compacted (cm)						$0	$0		
	uncompacted (cm)						$0	$0		
	Ripping							$0		
	Level Push							$0		
								$0		
	Fencing Around Pit Walls		1				$25,000	$25,000		
	3700 m x 2m high metal wire fencing							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
										$25,000
B.			Area	Application	No. of Kg.	Appl. Cost	Unit Cost	Item	Subtotal $	TOTAL$
	Revegetation		(ha)	Rate (kg/ha)		$/ha	$/ha	Subtotal $		
	Aerial Broadcast - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Drill - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Hydroseed									
	Hydroseed - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
	Mulch				0		$0	$0		
	Tackifier				0		$0	$0		
									$0	
	optional - application				0		$0	$0		
	optional - material 1				0		$0	$0		
	optional - material 2				0		$0	$0		
									$0	
			Area	Appl. Rate	No. of	Appl. Cost	Unit Cost	Item		
	Woody species		(ha)	(stems/ha)	Plants	$/stem	$/ha	Subtotal $		
	Plant Installation						$0	$0		
	Seedlings				0		$0	$0		
	Fertilizer tablets				0		$0	$0		
	Plant protectors (installed)				0		$0	$0		
	optional - material 3				0		$0	$0		
	optional - material 4				0		$0	$0	$0	
										$0
C.		Years	Area	Application	No. of Kg.	Appl. Cost	Unit Cost	Subtotal $	Subtotal $	TOTAL$
	Maintenance		(ha)	Rate (kg/ha)		$/ha	$/ha	per year		
	Aerial Broadcast - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Hydroseed									
	Hydroseed - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
	Mulch				0		$0	$0		
	Tackifier				0		$0	$0		
									$0	
	optional - application				0		$0	$0		
	optional - maint. material 1				0		$0	$0		
	optional - maint. material 2				0		$0	$0		
									$0	
										$0
	Total Cost for Reclamation Prescriptions									$25,000

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	Project Name:	**Mount Polley Mine**							
	Reclamation Permit #:	**Conceptual Reclamation Plan**							
	Disturbance Category:	**Pit - Lakes**							
	Land Use:	**Aquatic**							
	Area to be reclaimed	**35.05**							
	Additional Notes:								
					RECLAMATION PRESCRIPTIONS				
A.		**Depth or**	**Area**	**Dump Ht.**	**Unit Cost**	**Hours/hectare**	**Unit Cost**	**Item**	
	Site Preparation	**Distance**	**(ha)**	**(m)**	**$/hr,$/m3**	**Hrs/ha**	**$/ha**	**Subtotal $**	
	Resloping								
				10			0	$0	
				25			0	$0	
				50			0	$0	
				75			0	$0	
				100			0	$0	
				125			0	$0	
				150			0	$0	
				175			0	$0	
				200			0	$0	
				300			0	$0	
	Capping (Level)								
	compacted (cm)						$0	$0	
	uncompacted (cm)						$0	$0	
	Ripping							$0	
	Level Push							$0	
	optional							$0	
	optional							$0	
	optional							$0	
	optional							$0	
	optional							$0	
	optional							$0	
	optional							$0	
	optional							$0	
	optional							$0	
B.			**Area**	**Application**	**No. of Kg.**	**Appl. Cost**	**Unit Cost**	**Item**	**Subtotal $**
	Revegetation		**(ha)**	**Rate (kg/ha)**		**$/ha**	**$/ha**	**Subtotal $**	
	Aerial Broadcast - application						$0	$0	
	Seed				0		$0	$0	
	Fertilizer				0		$0	$0	
									$0
	Drill - application						$0	$0	
	Seed				0		$0	$0	
	Fertilizer				0		$0	$0	
									$0
	Hydroseed								
	Hydroseed - application						$0	$0	
	Seed				0		$0	$0	
	Fertilizer				0		$0	$0	
	Mulch				0		$0	$0	
	Tackifier				0		$0	$0	
									$0
	optional - application				0		$0	$0	
	optional -material 1				0		$0	$0	
	optional - material 2				0		$0	$0	
									$0
			Area	**Appl. Rate**	**No. of**	**Appl. Cost**	**Unit Cost**	**Item**	
	Woody species		**(ha)**	**(stems/ha)**	**Plants**	**$/stem**	**$/ha**	**Subtotal $**	
	Plant Installation						$0	$0	
	Seedlings				0		$0	$0	
	Fertilizer tablets				0		$0	$0	
	Plant protectors (installed)				0		$0	$0	
	optional - material 3				0		$0	$0	
	optional - material 4				0		$0	$0	$0
C.		**Years**	**Area**	**Application**	**No. of Kg.**	**Appl. Cost**	**Unit Cost**	**Subtotal $**	**Subtotal $**
	Maintenance		**(ha)**	**Rate (kg/ha)**		**$/ha**	**$/ha**	**per year**	
	Aerial Broadcast - application						$0	$0	
	Seed				0		$0	$0	
	Fertilizer				0		$0	$0	
									$0
	Hydroseed								
	Hydroseed - application						$0	$0	
	Seed				0		$0	$0	
	Fertilizer				0		$0	$0	
	Mulch				0		$0	$0	
	Tackifier				0		$0	$0	
									$0
	optional - application				0		$0	$0	
	optional - maint.material 1				0		$0	$0	
	optional - maint.material 2				0		$0	$0	
									$0
	Total Cost for Reclamation Prescriptions								

	Project Name:	**Mount Polley Mine**								
	Reclamation Permit #:	**Conceptual Reclamation Plan**								
	Disturbance Category:	**Pit - Walls**								
	Land Use:	**Wildlife habitat**								
	Area to be reclaimed	**23.37**								
	Additional Notes:	Fence around perimeter of pit walls								
					RECLAMATION PRESCRIPTIONS					
A.		Depth or	Area	Dump Ht.	Unit Cost	Hours/hectare	Unit Cost	Item		TOTAL $
	Site Preparation	Distance	(ha)	(m)	$/Hr, $/m3	Hrs/ha	$/ha	Subtotal $		
	Resloping									
				10			0	$0		
				25			0	$0		
				50			0	$0		
				75			0	$0		
				100			0	$0		
				125			0	$0		
				150			0	$0		
				175			0	$0		
				200			0	$0		
				300			0	$0		
	Capping (Level)									
	compacted (cm)						$0	$0		
	uncompacted (cm)						$0	$0		
	Ripping							$0		
	Level Push							$0		
								$0		
	Fencing Around Pit Walls		1				$25,000	$25,000		
	3700 m x 2m high metal wire fencing							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
										$25,000
B.			Area	Application	No. of Kg.	Appl. Cost	Unit Cost	Item	Subtotal $	TOTAL$
	Revegetation		(ha)	Rate (kg/ha)		$/ha	$/ha	Subtotal $		
	Aerial Broadcast - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Drill - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Hydroseed									
	Hydroseed - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
	Mulch				0		$0	$0		
	Tackifier				0		$0	$0		
									$0	
	optional - application				0		$0	$0		
	optional - material 1				0		$0	$0		
	optional - material 2				0		$0	$0		
									$0	
			Area	Appl. Rate	No. of	Appl. Cost	Unit Cost	Item		
	Woody species		(ha)	(stems/ha)	Plants	$/stem	$/ha	Subtotal $		
	Plant Installation						$0	$0		
	Seedlings				0		$0	$0		
	Fertilizer tablets				0		$0	$0		
	Plant protectors (installed)				0		$0	$0		
	optional - material 3				0		$0	$0		
	optional - material 4				0		$0	$0	$0	
										$0
C.		Years	Area	Application	No. of Kg.	Appl. Cost	Unit Cost	Subtotal $	Subtotal $	TOTAL$
	Maintenance		(ha)	Rate (kg/ha)		$/ha	$/ha	per year		
	Aerial Broadcast - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Hydroseed									
	Hydroseed - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
	Mulch				0		$0	$0		
	Tackifier				0		$0	$0		
									$0	
	optional - application				0		$0	$0		
	optional - maint.material 1				0		$0	$0		
	optional - maint.material 2				0		$0	$0		
									$0	
										$0
	Total Cost for Reclamation Prescriptions									$25,000

	Project Name:	Mount Polley Mine								
	Reclamation Permit #:	Conceptual Reclamation Plan								
	Disturbance Category:	Dump - Surfaces								
	Land Use:	Mod. yield forest								
	Area to be reclaimed:	86.08								
	Additional Notes:	Additional costing detail on separate sheets								
					RECLAMATION PRESCRIPTIONS					
A.		Depth or	Area	Dump Ht.	Unit Cost	hours/hectare	Unit Cost	Item		TOTAL $
	Site Preparation	Distance	(ha)	(m)	$/hr,$/m3	hrs/ha	$/ha	Subtotal $		
	Resloping									
				10			0	$0		
				25			0	$0		
				50			0	$0		
				75			0	$0		
				100			0	$0		
				125			0	$0		
				150			0	$0		
				175			0	$0		
				200			0	$0		
				300			0	$0		
	Capping (Level)									
	compacted (cm)						$0	$0		
	uncompacted (cm)						$0	$0		
	Ripping		86.08				$129	$11,104		
	Level Push							$0		
								$0		
	Spreading Surface Cover							$0		
	North Dump: 1180m / 1180 m	15.24 cm	43.97				$1,633	$71,803		
	East Dump: 1180m / 1140m	15.24 cm	38.46				$1,882	$72,244		
	West Dump: 1190m	15.24 cm	3.41				$1,577	$5,378		
	Central Pit Backfill: 1180m	15.24 cm	2.25				$1,394	$3,137		
	optional							$0		
	optional							$0		
	optional							$0		$163,665
B.			Area	Application	No. of Kg.	Appl. Cost	Unit Cost	Item	Subtotal $	TOTAL$
	Revegetation		(ha)	Rate (kg/ha)		$/ha	$/ha	Subtotal $		
	Aerial Broadcast - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Drill - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Hydroseed									
	Hydroseed - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
	Mulch				0		$0	$0		
	Tackifier				0		$0	$0		
									$0	
	Fall Broadcast Application		86.08		0	$600	$600	$51,648		
	(Forest seed mix - one time cost)				0		$0	$0		
					0		$0	$0		
									$51,648	
			Area	Appl. Rate	No. of	Appl. Cost	Unit Cost	Item		
	Woody species		(ha)	(stems/ha)	Plants	$/stem	$/ha	Subtotal $		
	Plant Installation		86.08	1100		$1	$935	$80,485		
	Seedlings				0		$0	$0		
	Fertilizer tablets				0		$0	$0		
	Plant protectors (installed)				0		$0	$0		
	optional - material 3				0		$0	$0		
	optional - material 4				0		$0	$0	$80,485	
										$132,133
C.		Years	Area	Application	No. of Kg.	Appl. Cost	Unit Cost	Subtotal $	Subtotal $	TOTAL$
	Maintenance		(ha)	Rate (kg/ha)		$/ha	$/ha	per year		
	Aerial Broadcast - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Hydroseed									
	Hydroseed - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
	Mulch				0		$0	$0		
	Tackifier				0		$0	$0		
									$0	
	Spring Maintenance Fertilize	1	86.08		0	$400	$400	$34,432		
					0		$0	$0		
	optional - maint.material 2				0		$0	$0		
									$34,432	
										$34,432
	Total Cost for Reclamation Prescriptions									$330,230

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	Project Name:	**Mount Polley Mine**								
	Reclamation Permit #:	**Conceptual Reclamation Plan**								
	Disturbance Category:	**Dump - Slopes**								
	Land Use:	**Mod. yield forest**								
	Area to be reclaimed:	**37.21**								
	Additional Notes:	Additional costing detail on separate sheets								
					RECLAMATION PRESCRIPTIONS					
A.		Depth or	Area	Dump Ht.	Unit Cost	Hours/hectare	Unit Cost	Item		TOTAL $
	Site Preparation	Distance	(ha)	(m)	$/hr,$/m3	Hrs/ha	$/ha	Subtotal $		
	Resloping									
	North Dump: 1190m / 1180 m									
	East Dump: 1180m / 1140m			10			0	$0		
	West Dump: 1190m		27.2	25	$110	28.10	3103.569214	$115,453		
	Central Pit Backfill: 1190m			50			0	$0		
				75			0	$0		
				100			0	$0		
				125			0	$0		
				150			0	$0		
				175			0	$0		
				200			0	$0		
				300			0	$0		
	Capping (Level)									
	compacted (cm)						$0	$0		
	uncompacted (cm)						$0	$0		
	Ripping							$0		
	Level Push							$0		
	Spreading Surface Cover							$0		
	North Dump	15.24 cm	12.03				$1,633	$19,645		
	East Dump	15.24 cm	15.55				$1,982	$30,820		
	West Dump	15.24 cm	5.59				$1,577	$8,815		
	Central Pit Backfill	15.24 cm	4.03				$1,394	$5,618		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
										$180,351
B.			Area	Application	No. of Kg.	Appl. Cost	Unit Cost	Item	Subtotal $	TOTAL$
	Revegetation		(ha)	Rate (kg/ha)		$/ha	$/ha	Subtotal $		
	Aerial Broadcast - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Drill - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Hydroseed									
	Hydroseed - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
	Mulch				0		$0	$0		
	Tackifier				0		$0	$0		
									$0	
	Full Hydroseed Application		37.2		0	$750	$750	$27,900		
	Use hydroseeder for slopes due				0		$0	$0		
	to access restrictions				0		$0	$0		
									$27,900	
			Area	Appl. Rate	No. of	Appl. Cost	Unit Cost	Item		
	Woody species		(ha)	(stems/ha)	Plants	$/stem	$/ha	Subtotal $		
	Plant Installation		37.2	1100		$1	$935	$34,782		
	Seedlings				0		$0	$0		
	Fertilizer tablets				0		$0	$0		
	Plant protectors (installed)				0		$0	$0		
	optional - material 3				0		$0	$0		
	optional - material 4				0		$0	$0	$34,782	
										$62,682
C.		Years	Area	Application	No. of Kg.	Appl. Cost	Unit Cost	Subtotal $	Subtotal $	TOTAL$
	Maintenance		(ha)	Rate (kg/ha)		$/ha	$/ha	per year		
	Aerial Broadcast application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Hydroseed									
	Hydroseed - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
	Mulch				0		$0	$0		
	Tackifier				0		$0	$0		
									$0	
	Spring Maintenance Fertilize	1	37.2		0	$550	$550	$20,460		
	Use hydroseeder for slopes due				0		$0	$0		
	to access restrictions				0		$0	$0		
									$20,460	
										$20,460
	Total Cost for Reclamation Prescriptions									$263,493

DRAFT

	Project Name:	Mount Polley Mine								
	Reclamation Permit #:	Conceptual Reclamation Plan								
	Disturbance Category:	Settling Ponds								
	Land Use:	Ungulate summer range								
	Area to be reclaimed:	3.01								
	Additional Notes:	Slopes Revegetated as Grassland during Construction / Removed & Area Revegetated in Year 3 after Closure								
					RECLAMATION PRESCRIPTIONS					
A.		Depth or	Area	Dump Ht.	Unit Cost	hours/hectare	Unit Cost	Item		TOTAL $
	Site Preparation	Distance	(ha)	(m)	$/hr, $/m3	hrs/ha	$/ha	Subtotal $		
	Resloping									
	Backhoe to open ponds and pull									
	back material past the creek high		3.01	10	$118	12.00	1416	$4,262		
	flowline.			25			0	$0		
				50			0	$0		
				75			0	$0		
				100			0	$0		
				125			0	$0		
				150			0	$0		
				175			0	$0		
				200			0	$0		
				300			0	$0		
	Capping (Level)									
	compacted (cm)						$0	$0		
	uncompacted (cm)						$0	$0		
	Ripping							$0		
	Level Push							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
										$4,262
B.			Area	Application	No. of Kg.	Appl. Cost	Unit Cost	Item	Subtotal $	TOTAL$
	Revegetation		(ha)	Rate (kg/ha)		$/ha	$/ha	Subtotal $		
	Aerial Broadcast - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Drill - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Hydroseed									
	Hydroseed - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
	Mulch				0		$0	$0		
	Tackifier				0		$0	$0		
									$0	
	Felt Broadcast Application		3.01		0	$600	$600	$1,806		
	- Use ATV for access				0		$0	$0		
					0		$0	$0		
									$1,806	
			Area	Appl. Rate	No. of	Appl. Cost	Unit Cost	Item		
	Woody species		(ha)	(stems/ha)	Plants	$/stem	$/ha	Subtotal $		
	Plant Installation						$0	$0		
	Seedlings				0		$0	$0		
	Fertilizer tablets				0		$0	$0		
	Plant protectors (installed)				0		$0	$0		
	optional - material 3				0		$0	$0		
	optional - material 4				0		$0	$0	$0	
										$1,806
C.		Years	Area	Application	No. of Kg.	Appl. Cost	Unit Cost	Subtotal $	Subtotal $	TOTAL$
	Maintenance		(ha)	Rate (kg/ha)		$/ha	$/ha	per year		
	Aerial Broadcast - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Hydroseed									
	Hydroseed - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
	Mulch				0		$0	$0		
	Tackifier				0		$0	$0		
									$0	
	Spring Maintenance Fertilize	3	3.01		0	$400	$400	$1,204		
	- Use ATV for access				0		$0	$0		
					0		$0	$0		
									$3,612	
										$3,612
	Total Cost for Reclamation Prescriptions									$9,680

Table 8-4e
Mine Reclamation Costing Worksheet

Project Name:	**Mount Polley Mine**								
Reclamation Permit #:	**Conceptual Reclamation Plan**								
Disturbance Category:	**Tailings Dam - Surface**								
Land Use:	**Mixed Land Use**								
Area to be reclaimed:	**215.37**								
Additional Notes:	**Mod. Yield Forest (77.5%) / Wetland (7.5%) / Lake (15%)**								
				RECLAMATION PRESCRIPTIONS					
A.	**Depth or**	**Area**	**Dump Ht.**	**Unit Cost**	**hours/hectare**	**Unit Cost**	**Item**		**TOTAL $**
Site Preparation	**Distance**	**(ha)**	**(m)**	**$/hr, $/m3**	**hrs/ha**	**$/ha**	**Subtotal $**		
Resloping									
Not Required									
			10			0	$0		
			25			0	$0		
			50			0	$0		
			75			0	$0		
			100			0	$0		
			125			0	$0		
			150			0	$0		
			175			0	$0		
			200			0	$0		
			300			0	$0		
Capping (Level)									
compacted (cm)						$0	$0		
uncompacted (cm)						$0	$0		
Ripping							$0		
Level Push							$0		
optional							$0		
Spreading Surface Cover	15.24 cm	215.37				$3,581	$771,240		
(total surface area)							$0		
optional							$0		
optional							$0		
optional							$0		
optional							$0		
optional							$0		
optional							$0		
									$771,240
B.		**Area**	**Application**	**No. of Kg**	**Appl. Cost**	**Unit Cost**	**Item**	**Subtotal $**	**TOTAL$**
Revegetation		**(ha)**	**Rate (kg/ha)**		**$/ha**	**$/ha**	**Subtotal $**		
Aerial Broadcast - application						$0	$0		
Seed				0		$0	$0		
Fertilizer				0		$0	$0		
								$0	
Drill - application						$0	$0		
Seed				0		$0	$0		
Fertilizer				0		$0	$0		
								$0	
Hydroseed									
Hydroseed - application						$0	$0		
Seed				0		$0	$0		
Fertilizer				0		$0	$0		
Mulch				0		$0	$0		
Tackifier				0		$0	$0		
								$0	
Fall Broadcast Application		183.06		0	$600	$600	$109,839		
(Forest and Wetland only)				0		$0	$0		
Hand Plant Wetland Species		16.153	1	16	$991	$991	$16,007		
								$125,846	
		Area	**Appl. Rate**	**No. of**	**Appl. Cost**	**Unit Cost**	**Item**		
Woody species		**(ha)**	**(stems/ha)**	**Plants**	**$/stem**	**$/ha**	**Subtotal $**		
Plant Installation		141.87	1100		$1	$935	$132,653		
Seedlings				0		$0	$0		
Fertilizer tablets				0		$0	$0		
Plant protectors (installed)				0		$0	$0		
optional - material 3				0		$0	$0		
optional - material 4				0		$0	$0	$132,653	
									$258,499
C.	**Years**	**Area**	**Application**	**No. of Kg.**	**Appl. Cost**	**Unit Cost**	**Subtotal $**	**Subtotal $**	**TOTAL$**
Maintenance		**(ha)**	**Rate (kg/ha)**		**$/ha**	**$/ha**	**per year**		
Aerial Broadcast - application						$0	$0		
Seed				0		$0	$0		
Fertilizer				0		$0	$0		
								$0	
Hydroseed									
Hydroseed - application						$0	$0		
Seed				0		$0	$0		
Fertilizer				0		$0	$0		
Mulch				0		$0	$0		
Tackifier				0		$0	$0		
								$0	
Spring Maintenance Fertilize	1	183.06		0	$400	$400	$73,226		
				0		$0	$0		
optional - maint. material 2				0		$0	$0		
								$73,226	
									$73,226
Total Cost for Reclamation Prescriptions									$1,102,965

Table 5-4b
Mine Reclamation Costing Worksheet

Project Name:	Mount Polley Mine								
Reclamation Permit #:	Conceptual Reclamation Plan								
Disturbance Category:	Tailings Dam - Slopes								
Land Use:	Mod. yield forest								
Area to be reclaimed:	32.63								
Additional Notes:	Revegetation performed during mine operation.								
				RECLAMATION PRESCRIPTIONS					
A.	Depth or	Area	Dump Ht.	Unit Cost	hours/hectare	Unit Cost	Item		TOTAL $
Site Preparation	Distance	(ha)	(m)	$/hr, $/m3	hrs/ha	$/ha	Subtotal $		
Resloping									
			10			0	$0		
			25			0	$0		
			50			0	$0		
			75			0	$0		
			100			0	$0		
			125			0	$0		
			150			0	$0		
			175			0	$0		
			200			0	$0		
			300			0	$0		
Capping (Level)									
compacted (cm)						$0	$0		
uncompacted (cm)						$0	$0		
Ripping							$0		
Level Push							$0		
							$0		
Drainage Control		1				$30,000	$30,000		
900m rip-rap channel into							$0		
neighbouring creek							$0		
							$0		
optional							$0		
optional							$0		
optional							$0		
optional							$0		
									$30,000
B.		Area	Application	No. of Kg.	Appl. Cost	Unit Cost	Item	Subtotal $	TOTAL$
Revegetation		(ha)	Rate (kg/ha)		$/ha	$/ha	Subtotal $		
Aerial Broadcast - application						$0	$0		
Seed				0		$0	$0		
Fertilizer				0		$0	$0		
								$0	
Drill - application						$0	$0		
Seed				0		$0	$0		
Fertilizer				0		$0	$0		
								$0	
Hydroseed									
Hydroseed - application						$0	$0		
Seed				0		$0	$0		
Fertilizer				0		$0	$0		
Mulch				0		$0	$0		
Tackifier				0		$0	$0		
								$0	
optional - application				0		$0	$0		
optional - material 1				0		$0	$0		
optional - material 2				0		$0	$0		
								$0	
		Area	Appl. Rate	No. of	Appl. Cost	Unit Cost	Item		
Woody species		(ha)	(stems/ha)	Plants	$/stem	$/ha	Subtotal $		
Plant Installation						$0	$0		
Seedlings				0		$0	$0		
Fertilizer tablets				0		$0	$0		
Plant protectors (installed)				0		$0	$0		
optional - material 3				0		$0	$0		
optional - material 4				0		$0	$0	$0	
									$0
C.	Years	Area	Application	No. of Kg.	Appl. Cost	Unit Cost	Subtotal $	Subtotal $	TOTAL$
Maintenance		(ha)	Rate (kg/ha)		$/ha	$/ha	per year		
Aerial Broadcast - application						$0	$0		
Seed				0		$0	$0		
Fertilizer				0		$0	$0		
								$0	
Hydroseed									
Hydroseed - application						$0	$0		
Seed				0		$0	$0		
Fertilizer				0		$0	$0		
Mulch				0		$0	$0		
Tackifier				0		$0	$0		
								$0	
Spring Maintenance Fertilize	1	32.63		0	$550	$550	$17,947		
				0		$0	$0		
optional - maint. material 2				0		$0	$0		
								$17,947	
									$17,947
Total Cost for Reclamation Prescriptions									$47,947

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Page 1 of 1

Table B-6
Mine Reclamation Costing Worksheet

	Project Name:	**Mount Polley Mine**								
	Reclamation Permit #:	**Conceptual Reclamation Plan**								
	Disturbance Category:	**Topsoil Pads**								
	Land Use:	**Mod. yield forest**								
	Area to be reclaimed:	**21.01**								
	Additional Notes:									
					RECLAMATION PRESCRIPTIONS					
A.		Depth or	Area	Dump Ht.	Unit Cost	hours/hectare	Unit Cost	Item		TOTAL $
	Site Preparation	Distance	(ha)	(m)	$/hr, $/m3	hrs/ha	$/ha	Subtotal $		
	Resloping									
	Areas prepared during soil									
	removal.			10			0	$0		
				25			0	$0		
				50			0	$0		
				75			0	$0		
				100			0	$0		
				125			0	$0		
				150			0	$0		
				175			0	$0		
				200			0	$0		
				300			0	$0		
	Capping (Level)									
	compacted (cm)						$0	$0		
	uncompacted (cm)						$0	$0		
	Ripping							$0		
	Level Push							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
										$0
B.			Area	Application	No. of Kg.	Appl. Cost	Unit Cost	Item	Subtotal $	TOTAL$
	Revegetation		(ha)	Rate (kg/ha)		$/ha	$/ha	Subtotal $		
	Aerial Broadcast - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Drill - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Hydroseed									
	Hydroseed - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
	Mulch				0		$0	$0		
	Tackifier				0		$0	$0		
									$0	
	Fall Hydroseed Application		21.01		0	$750	$750	$15,758		
	- Use hydroseeder for slopes due				0		$0	$0		
	to access restrictions.				0		$0	$0		
									$15,758	
			Area	Appl. Rate	No. of	Appl. Cost	Unit Cost	Item		
	Woody species		(ha)	(stems/ha)	Plants	$/stem	$/ha	Subtotal $		
	Plant Installation		21.01	1100		$1	$936	$19,644		
	Seedlings				0		$0	$0		
	Fertilizer tablets				0		$0	$0		
	Plant protectors (installed)				0		$0	$0		
	optional - material 3				0		$0	$0		
	optional - material 4				0		$0	$0	$19,644	
										$35,402
C.		Years	Area	Application	No. of Kg.	Appl. Cost	Unit Cost	Subtotal $	Subtotal $	TOTAL$
	Maintenance		(ha)	Rate (kg/ha)		$/ha	$/ha	per year		
	Aerial Broadcast - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Hydroseed									
	Hydroseed - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
	Mulch				0		$0	$0		
	Tackifier				0		$0	$0		
									$0	
	Spring Maintenance Fertilize	1	21.01		0	$550	$550	$11,556		
	- Use hydroseeder for slopes due				0		$0	$0		
	to access restrictions.				0		$0	$0		
									$11,556	
										$11,556
	Total Cost for Reclamation Prescriptions									$46,957

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Table 8-8
Mine Reclamation Costing Worksheet

	Project Name:	Mount Polley Mine								
	Reclamation Permit #:	Conceptual Reclamation Plan								
	Disturbance Category:	Roads								
	Land Use:	Ungulate summer range								
	Area to be reclaimed:	9.68								
	Additional Notes:	Revegetation: Grassland / Smoothed Scarification to allow Future Maintenance Access								
					RECLAMATION PRESCRIPTIONS					
A.		Depth or	Area	Dump Ht.	Unit Cost	hours/hectare	Unit Cost	Item		TOTAL $
	Site Preparation	Distance	(ha)	(m)	$/hr, $/m3	hrs/ha	$/ha	Subtotal $		
	Resloping									
	Assume that the main access road									
	remains open for forestry access			10			0	$0		
				25			0	$0		
				50			0	$0		
				75			0	$0		
				100			0	$0		
				125			0	$0		
				150			0	$0		
				175			0	$0		
				200			0	$0		
				300			0	$0		
	Capping (Level)									
	compacted (cm)						$0	$0		
	uncompacted (cm)						$0	$0		
	Ripping		9.68				$129	$1,249		
	Level Push							$0		
	optional							$0		
	Spreading Surface Cover	15.24 cm	9.68				$1,303	$12,613		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
	optional							$0		
										$13,862
B.			Area	Application	No. of Kg.	Appl. Cost	Unit Cost	Item	Subtotal $	TOTALS
	Revegetation		(ha)	Rate (kg/ha)		$/ha	$/ha	Subtotal $		
	Aerial Broadcast - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Drill - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Hydroseed									
	Hydroseed - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
	Mulch				0		$0	$0		
	Tackifier				0		$0	$0		
									$0	
	Fall Broadcast Application		9.68		0	$600	$600	$5,808		
					0		$0	$0		
	optional - material 2				0		$0	$0		
									$5,808	
			Area	Appl. Rate	No. of	Appl. Cost	Unit Cost	Item		
	Woody species		(ha)	(stems/ha)	Plants	$/stem	$/ha	Subtotal $		
	Plant Installation						$0	$0		
	Seedlings				0		$0	$0		
	Fertilizer tablets				0		$0	$0		
	Plant protectors (installed)				0		$0	$0		
	optional - material 3				0		$0	$0		
	optional - material 4				0		$0	$0	$0	
										$5,808
C.		Years	Area	Application	No. of Kg.	Appl. Cost	Unit Cost	Subtotal $	Subtotal $	TOTALS
	Maintenance		(ha)	Rate (kg/ha)		$/ha	$/ha	per year		
	Aerial Broadcast - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
									$0	
	Hydroseed									
	Hydroseed - application						$0	$0		
	Seed				0		$0	$0		
	Fertilizer				0		$0	$0		
	Mulch				0		$0	$0		
	Tackifier				0		$0	$0		
									$0	
	Spring Maintenance Fertilize	3	9.68		0	$400	$400	$3,872		
					0		$0	$0		
	optional - maint.material 2				0		$0	$0		
									$11,616	
										$11,616
	Total Cost for Reclamation Prescriptions									$31,286

Table B-7
Facility Decomm

Facility Decommissioning	Decomm. Fixed Cost $	Salvage Value $	Item Subtotal $	TOTAL$
Plant Buildings	$0	$0	$0	
The salvage value of the milling equipment is			$0	
sufficient to cover the cost of dismantling. Plant			$0	
Site reclamation is addressed in the "Area			$0	
Disturbance" category.			$0	
			$0	
Mine Site Cleanup	$400,000	$0	$400,000	
Solid waste will be offered to salvage dealers,			$0	
remaining wastes will be disposed in the			$0	
appropriate manner.			$0	
			$0	
Powerlines: Same as per "Plant Buildings"			$0	
	$0	$0	$0	
Access road to Mount Polley remains for forestry			$0	
access and site maintenance as required.	$0	$0	$0	
			$0	
			$0	
Facility 18			$0	
Facility 19			$0	
Facility 20			$0	
				$400,000

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Calculation of Push Quantity & Distance For All Dumps

mpslope.wk
Mar-95

Resloping Using a Dozer in a Cut and Fill Application
Direction of Push: Straight Downslope

Centroid Measurements
* Measured from top of cut
** Measured from bottom of cut

Dump Geometry	Degrees
Angle of Repose	37.00
Angle of Reslope	28.00

Dozer Push Distance (m)
Slope distance(m) from centroid of cut area to centroid of fill area

Height of Dump (m)	Step Back from Crest (m)	Total Slope Length (m)	Geometry of Dozer Push: a (m)	b (m)	c (m)	d (m)	e (m)	Active Triangle: Area (m2)	Centroid* (m)	Passive Triangle: Area (m2)	Centroid** (m)	Total Dozer Push: Cut Area (m2)	Push Distance (m)
77.5	21	165	51	64	10	64	19	95	13	320	45	416	101
75.0	21	160	50	62	10	62	18	89	13	300	44	389	98
72.5	20	154	48	60	9	59	18	83	13	280	42	364	95
70.0	19	149	46	58	9	57	17	78	12	261	41	339	91
67.5	19	144	45	56	9	55	16	72	12	243	39	315	88
65.0	18	138	43	54	8	53	16	67	11	225	38	292	85
62.5	17	133	41	52	8	51	15	62	11	208	36	270	81
60.0	17	128	40	50	8	49	15	57	10	192	35	249	78
57.5	16	122	38	48	7	47	14	53	10	176	33	229	75
55.0	15	117	36	46	7	45	13	48	10	161	32	209	72
52.5	15	112	35	44	7	43	13	44	9	147	30	191	68
50.0	14	107	33	42	6	41	12	40	9	133	29	173	65
47.5	13	101	32	39	6	39	12	36	8	120	28	156	62
45.0	12	96	30	37	6	37	11	32	8	108	26	140	59
42.5	12	91	28	35	6	35	10	29	7	96	25	125	55
40.0	11	85	27	33	5	33	10	25	7	85	23	111	52
37.5	10	80	25	31	5	31	9	22	6	75	22	97	49
35.0	10	75	23	29	5	29	9	19	6	65	20	85	46
32.5	9	69	22	27	4	27	8	17	6	56	19	73	42
30.0	8	64	20	25	4	25	7	14	5	48	17	62	39
27.5	8	59	18	23	4	23	7	12	5	40	16	52	36
25.0	7	53	17	21	3	21	6	10	4	33	15	43	33
22.5	6	48	15	19	3	18	5	8	4	27	13	35	29
20.0	6	43	13	17	3	16	5	6	3	21	12	28	26
17.5	5	37	12	15	2	14	4	5	3	16	10	21	23
15.0	4	32	10	12	2	12	4	4	3	12	9	16	20
12.5	3	27	8	10	2	10	3	2	2	8	7	11	16
10.0	3	21	7	8	1	8	2	2	2	5	6	7	13
7.5	2	16	5	6	1	6	2	1	1	3	4	4	10
5.0	1	11	3	4	1	4	1	0	1	1	3	2	7
2.5	1	5	2	2	0	2	1	0	0	0	1	0	3

Dozer Cut Geometry

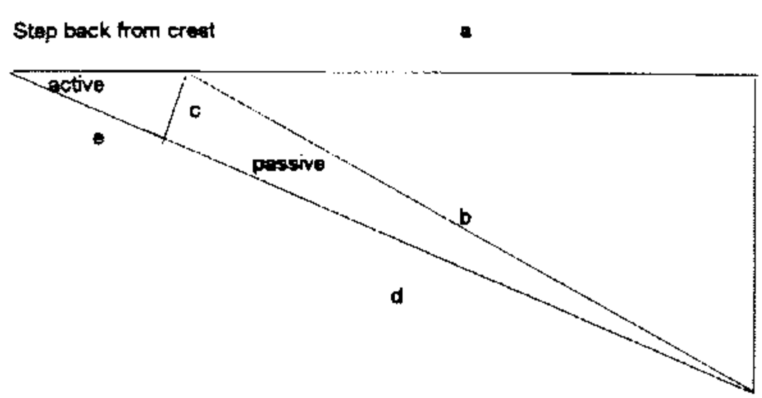

Table B-II

Dozer Productivity and Cost Estimate per Metre and Loose Cubic Metre For All Dumps

mpslope.wk4
Mar-95

Direction of Push: Straight Downslope

According to Dump Height Using a Cat D9N Dozer / Universal Blade

Dump Geometry	Degrees
Angle of Repose	37
Angle of Reslope	28

Height of Dump (m)	Cut Area (m2)	Push Distance (m)	Prod'ty (LCM/hr)	Based on Dump Crest Length Per Metre: Operating Hours	Scheduled Hours	Cost $/Metre	Cost $/LCM
77.5	416	101	228	1.83	2.74	201.66	0.485
75.0	389	98	233	1.67	2.51	184.54	0.474
72.5	364	95	238	1.53	2.29	168.58	0.463
70.0	339	91	244	1.39	2.09	153.71	0.453
67.5	315	88	252	1.25	1.87	138.04	0.438
65.0	292	85	263	1.11	1.67	122.81	0.420
62.5	270	81	274	0.99	1.48	109.11	0.404
60.0	249	78	284	0.88	1.31	96.78	0.388
57.5	229	75	295	0.77	1.16	85.55	0.374
55.0	209	72	313	0.67	1.00	73.84	0.353
52.5	191	68	331	0.58	0.86	63.67	0.334
50.0	173	65	349	0.50	0.74	54.82	0.317
47.5	156	62	366	0.43	0.64	47.08	0.301
45.0	140	59	386	0.36	0.55	40.15	0.286
42.5	125	55	407	0.31	0.46	33.93	0.271
40.0	111	52	428	0.26	0.39	28.56	0.258
37.5	97	49	450	0.22	0.32	23.91	0.246
35.0	85	46	471	0.18	0.27	19.88	0.235
32.5	73	42	504	0.15	0.22	16.03	0.219
30.0	62	39	539	0.12	0.17	12.75	0.205
27.5	52	36	575	0.09	0.14	10.05	0.192
25.0	43	33	611	0.07	0.11	7.82	0.181
22.5	35	29	658	0.05	0.08	5.89	0.168
20.0	28	26	748	0.04	0.06	4.09	0.148
17.5	21	23	839	0.03	0.04	2.79	0.132
15.0	16	20	918	0.02	0.03	1.87	0.120
12.5	11	16	918	0.01	0.02	1.30	0.120
10.0	7	13	918	0.01	0.01	0.83	0.120
7.5	4	10	918	0.00	0.01	0.47	0.120
5.0	2	7	918	0.00	0.00	0.21	0.120
2.5	0	3	918	0.00	0.00	0.05	0.120

Dozer Operating Assumptions For Resloping

Cut & Fill Resloping Using a Dozer
Direction of Push: Straight Downslope

Dozer Type:	Cat D9N
Blade Type:	Universal

Physical Availability:	80%
Usage Based on 50 min.hour:	83%
Operating Factor:	67%

Operating Cost ($/Oper.Hour): (All Found Rate)	110.46

Material:	Blasted Rock In Dumps		
Density (Insitu):	2.73	tonnes/BCM	
(In Dump):	1.82	tonnes/LC	@ 50 % Swell
(In Dump):	3079	lbs/LCY	@ 50 % Swell

Correction to Cat Handbook Productivities

Condition	Rating	Correction Factor
Operator:	Average	0.75
Material:	Loose Skpl	1.00
Weight Correction:		0.75
Grade:	Avg. -15%	1.30
Visibility:	Good	1.00
Final Surface Preparation		0.90
Overall Correction Factor:		0.66

The correction factor should be considered average for the entire project. Slot dozing may be possible in some areas but side cutting may also be necessary.

Dozing Costs

Variable according to dump height, etc.

Table B-IV

Dozer Costs For Resloping Mount Polley Dumps mpslope.wk4

Resloping Using a Dozer in a Cut and Fill Application Mar-95

Direction of Push: Straight Downslope

Dump Geometry	Degrees		
Angle of Repose	37	Dozer Type: Cat D9N	
Angle of Reslope	28	Blade Type: Universal	
		Operating Cost - All Found ($/Oper.Hr.):	$110.46

North Dumps

Design	Elevation Upper	Elevation Lower	Length (m.)	Height (m.)	Cut Area (m.2)	Slope Area (ha)	Cut Quantity (m3)	Cut Quantity (tonnes)	Prod'ty (LCM/hr)	Operating Hours	Oper. Hours per ha.	Cost $/ha.	Cost Total $
W.E.													
1	1180	1160	500	20	28	2.13	14,000	25,480	748	18.7	8.8	970.1	2,066
2	1180	1145	450	35	85	3.35	38,250	69,615	471	81.2	24.2	2673.7	8,970
						5.48	52,250	95,095	523	99.9	18.2	2012.1	11,036
1	1160	Keyed	1050	0	0	0.00	0	0	n/a	0.0	n/a	0.0	0
2	1160	1145	550	15	18	1.76	8,800	16,016	918	9.6	5.5	602.9	1,059
3	1160	1110	450	50	173	4.79	77,850	141,687	349	223.3	46.6	5146.3	24,664
						6.56	86,650	157,703	372	232.9	35.6	3927.3	25,724
Total North Dumps						12.03	138,900	252,798	417	332.8	27.7	3054.5	36,760

East Dumps

Design	Elevation Upper	Elevation Lower	Length (m.)	Height (m.)	Cut Area (m.2)	Slope Area (ha)	Cut Quantity (m3)	Cut Quantity (tonnes)	Prod'ty (LCM/hr)	Operating Hours	Oper. Hours per ha.	Cost $/ha.	Cost Total $
W.E.													
1	1160	1140	575	20	28	2.45	16,100	29,302	748	21.5	8.8	970.1	2,376
2	1160	1130	375	30	62	2.40	23,250	42,315	539	43.1	18.0	1986.6	4,761
						4.85	39,350	71,617	609	64.6	13.3	1472.8	7,137
1	1140	1115	400	25	43	2.13	17,200	31,304	611	28.2	13.2	1460.6	3,111
2	1140	1105	250	35	85	1.86	21,250	38,675	471	45.1	24.2	2673.7	4,983
3	1140	1095	700	45	140	6.71	98,000	178,360	386	254.2	37.9	4184.0	28,073
						10.70	136,450	248,339	417	327.4	30.6	3379.0	36,168
Total South Dumps						15.55	175,800	319,956	448	392.0	25.2	2785.0	43,305

West Dumps

Design	Elevation Upper	Elevation Lower	Length (m.)	Height (m.)	Cut Area (m.2)	Slope Area (ha)	Cut Quantity (m3)	Cut Quantity (tonnes)	Prod'ty (LCM/hr)	Operating Hours	Oper. Hours per ha.	Cost $/ha.	Cost Total $
W.E.													
1	1190	1155	750	35	28	5.59	21,000	38,220	471	44.6	8.0	880.7	4,925
Total West Dumps						5.59	21,000	38,220	471	44.6	8.0	880.7	4,925

Central Pit Backfill - Reslope above water elevation of 1120 m

Design	Elevation Upper	Elevation Lower	Length (m.)	Height (m.)	Cut Area (m.2)	Slope Area (ha)	Cut Quantity (m3)	Cut Quantity (tonnes)	Prod'ty (LCM/hr)	Operating Hours	Oper. Hours per ha.	Cost $/ha.	Cost Total $
W.E.													
1	1180	1120	315	60	249	4.03	78,435	142,752	284	275.8	68.5	7567.9	30,467
Total Central Pit Backfill						4.03	78,435	142,752	284	275.8	68.5	7567.9	30,467

Total All Dumps	37.20	414,135	753,726	396	1,045.2	28.1	3,103.5	115,456

Equipment Operation Assumptions
Scarification and Surface Capping

Estimate of Ripping Production - D9N

	Dumps	Dam
Overall width of rip (m)	2.64	2.64
Travel speed - 1st gear (km/hr	3.90	n/a
- 2nd gear (km/hr	n/a	6.90
Usage Based on 50 min.hour	0.83	0.83
Rip Area (ha/ Oper. Hr.)	0.86	1.52

Estimate of 631 Scraper Productivity

Rolling Resistance (%)	4%
Payload (LCM)	
Capacity Heaped (m3)	23.7
Fill Factor - Push Load (%)	95%
Load (m3)	22.5
Material Density (kg/LCM)	1420
Weight on Buggy (tonnes)	32.0
Rated Load (tonnes)	34.02
(Within Limits)	93.98%
Physical Availability	80.0%
Usage Based on 50 min.hour	83.0%
Operating Factor	66.4%

Fixed Times (min)

Wait for PushCat	0.3
Push Load	0.5
Maneuver & Spread	1.4
Total Fixed Times	2.2

Average Running Speeds (metres/min.)		(km/hr)
Loaded	300	18
Empty	500	30

Costs For Scarification of Surface

mpsurf.wk4
dfp

Thickness of Surface Capping 15.24 cm

Dozer Specs.
D9N with 3 Shank Ripper 110.46 $/Oper. Hr.
Ripping Productivity (Dumps) 0.86 ha./Oper. Hr.
(Dam) 1.52 ha./Oper. Hr.

North Dumps

	Area (ha)			Cap Material	Scarify Surface (D9N)		
Elevation	Surface	Slope	Total	Volume (m3)	Oper.Hr.	($)	($/ha)
1180	7.20	5.48	12.68	19,330	8.4	927	129
1160	36.77	6.55	43.32	66,014	42.9	4,733	129
Total	**43.97**	**12.03**	**56.00**	**85,344**	**51.2**	**5,661**	**129**

East Dumps

	Area (ha)			Cap Material	Scarify Surface (D9N)		
Elevation	Surface	Slope	Total	Volume (m3)	Oper.Hr.	($)	($/ha)
1160	17.44	4.85	22.29	33,963	20.3	2,245	129
1140	19.01	10.70	29.71	45,285	22.2	2,448	129
Total	**36.45**	**15.55**	**52.00**	**79,248**	**42.5**	**4,693**	**129**

West Dumps

	Area (ha)			Cap Material	Scarify Surface (D9N)		
Elevation	Surface	Slope	Total	Volume (m3)	Oper.Hr.	($)	($/ha)
1190	**3.41**	**5.59**	**9.00**	**13,716**	**4.0**	**439**	**129**

Central Pit Backfill

	Area (ha)			Cap Material	Scarify Surface (D9N)		
Elevation	Surface	Slope	Total	Volume (m3)	Oper.Hr.	($)	($/ha)
1180	**2.25**	**4.03**	**6.28**	**9,571**	**2.6**	**290**	**129**

Tailings Impoundment - Surface not scarified in MEMPR costing summaries

	Area (ha)			Cap Material	Scarify Surface (D9N)		
Elevation	Surface	Slope	Total	Volume (m3)	Oper.Hr.	($)	($/ha)
960	**215.37**	**32.63**	**248.00**	**377,952**	**251.0**	**15,672**	**73**

Other Disturbance Categories

	Area (ha)			Cap Material	Scarify Surface (D9N)		
Elevation	Surface	Slope	Total	Volume (m3)	Oper.Hr.	($)	($/ha)
Roads	8.71	0.97	9.68	14,745	10.1	1,121	129
Mill Site	18.00	2.00	20.00	30,480	21.0	2,317	129
Total	**26.71**	**2.97**	**29.68**	**45,225**	**31.1**	**3,438**	**129**

Total All Areas

	328.16	**72.80**	**400.95**	**611,055**	**382.5**	**30,192**	**92**

Costs For Surface Capping

mpsurf.wk4
dfp

Thickness of Surface Capping 15.24 cm

Distance expressed one-way.
Grade (%) in loaded direction.

<u>Equipment Specs.</u>
Cat 631 165.00 $/Oper.Hr. (All Found)
Haulage Productivity Dependent on conditions
Rolling Resistance 4.00%
D9N Pushcat (For 3 Scrapers) 110.46 $/Oper.Hr. (All Found)
(5 Scrapers on Tailings Impoundment due to length of haul)

North Dumps

			Scraper Haulage of Cap Material							Dozer			
Elevation	Area (ha)	Volume (m3)	Distance (m)	Grade (%)	Load (min.)	Empty (min.)	Fixed (min.)	Prod'ty (LCM/hr)	Operating Hours	Operating Hours	Cost $/ha	$/LCM	Total $
1160	12.68	19,330	500	1.00%	1.7	1.0	2.2	184	104.9	35.0	1,669	1.09	21,166
1180	43.32	66,014	475	-3.16%	1.6	1.0	2.2	190	348.3	116.1	1,623	1.06	70,304
Total	56.00	85,344						188	453.2	151.1	1,633	1.07	91,469

East Dumps

			Scraper Haulage of Cap Material							Dozer			
Elevation	Area (ha)	Volume (m3)	Distance (m)	Grade (%)	Load (min.)	Empty (min.)	Fixed (min.)	Prod'ty (LCM/hr)	Operating Hours	Operating Hours	Cost $/ha	$/LCM	Total $
1160	22.29	33,963	500	0.00%	1.7	1.0	2.2	184	184.3	61.4	1,669	1.09	37,189
1140	29.71	45,285	800	-5.00%	2.7	1.8	2.2	139	326.5	108.8	2,217	1.45	65,888
Total	52.00	79,248						155	510.7	170.2	1,982	1.30	103,077

West Dumps

			Scraper Haulage of Cap Material							Dozer			
Elevation	Area (ha)	Volume (m3)	Distance (m)	Grade (%)	Load (min.)	Empty (min.)	Fixed (min.)	Prod'ty (LCM/hr)	Operating Hours	Operating Hours	Cost $/ha	$/LCM	Total $
1190	9.00	13,716	450	-2.22%	1.5	0.9	2.2	195	70.3	23.4	1,577	1.03	14,196

Central Pit Backfill

			Scraper Haulage of Cap Material							Dozer			
Elevation	Area (ha)	Volume (m3)	Distance (m)	Grade (%)	Load (min.)	Empty (min.)	Fixed (min.)	Prod'ty (LCM/hr)	Operating Hours	Operating Hours	Cost $/ha	$/LCM	Total $
1160	6.28	9,571	350	-5.71%	1.2	0.7	2.2	221	43.4	14.5	1,394	0.91	8,757

Tailings Impoundment

			Scraper Haulage of Cap Material							Dozer			
Elevation	Area (ha)	Volume (m3)	Distance (m)	Grade (%)	Load (min.)	Empty (min.)	Fixed (min.)	Prod'ty (LCM/hr)	Operating Hours	Operating Hours	Cost $/ha	$/LCM	Total $
960	215.37	326,224	1700	-1.18%	5.7	3.4	2.2	80	4122.6	824.5	3,581	2.36	771,311

Other Disturbance Categories

			Scraper Haulage of Cap Material							Dozer			
Elevation	Area (ha)	Volume (m3)	Distance (m)	Grade (%)	Load (min.)	Empty (min.)	Fixed (min.)	Prod'ty (LCM/hr)	Operating Hours	Operating Hours	Cost $/ha	$/LCM	Total $
Roads	9.68	14,745	300	1.67%	1.0	0.6	2.2	236	62.5	20.8	1,303	0.85	12,606
Mill Site	20.00	30,480	600	-2.50%	2.0	1.2	2.2	166	183.5	61.2	1,852	1.21	37,032
Total	29.68	45,225						184	246.0	82.0	1,673	1.10	49,639

Total All Areas

	368.32	561,327						103	5446.3	1265.7	2,819	1.85	1,038,449

Appendix C

1989/90 WATER QUALITY

Shading indicates >BC guidelines for the protection of aquatic life.

Appendix C
Imperial Metals Corporation
Mt. Polley Project
1989 + 1990 Water Quality

Station	Date	Conduct.	TDS	Hardness	pH	TSS	Turbidity	Alkalinity	Cl	SO4	NH3	NO3	NO2	ortho-P
4K Creek	Aug14/90	258.0	240.0	103.0	7.64	9.3	[illegible]	138.0	1.3	2.3	0.051	<0.005	<0.001	0.018
	Sep10/90	324.0	210.0	104.0	7.48	1.3	3.8	118.0	<0.5	<1.0	0.005	0.023	<0.001	0.010
	Nov9/89	116.0	110.0		7.60	<1.0	1.7	88.1	1.1	<1.0	<0.005	<0.005	0.002	<0.001
	Jul05/90	175.0	160.0	89.7	7.29	6.0	1.6	92.1	0.8	2.6	0.047	<0.005	<0.001	<0.001
	Mar17/90	180.0	150.0	88.6	7.54	3.3	2.1	101.0	1.3	1.6	0.075	0.086	0.009	<0.001
	Jan21/90	167.0	138.0	86.2	7.28	3.3	2.7	89.7	<0.5	<1.0	0.017	0.220	0.004	<0.001
	Dec7/89	136.0	120.0	70.6	7.46	1.3	1.7	71.7	0.7	<1.0	<0.005	0.010	<0.001	0.003
	Average	193.7	161.1	77.4	7.47	3.6	2.9	98.9	0.8	1.2	0.029	0.050	0.002	0.005
	Std	72.7	47.8	35.9	0.14	3.1	1.9	24.8	0.4	0.9	0.029	0.081	0.003	0.007
	Max	324.0	240.0	104.0	7.64	9.3	6.8	138.0	1.3	2.6	0.075	0.220	0.009	0.018
	Min	116.0	110.0	0.0	7.28	0.5	1.6	88.1	0.3	0.5	0.003	0.003	0.001	0.001

Station	Date	Conduct.	TDS	Hardness	pH	TSS	Turbidity	Alkalinity	Cl	SO4	NH3	NO3	NO2	ortho-P
6K Creek	Aug14/90	236.0	220.0	91.6	7.47	<1.0	3.2	124.0	1.6	3.0	0.043	<0.005	<0.001	0.019
	Sep14/90	219.0	200.0	104.0	7.28	1.3	[illegible]	115.0	<0.5	1.5	0.028	0.012	<0.001	0.018
	Nov9/89	89.6	70.0		7.26	3.0	1.7	40.4	1.4	1.2	<0.005	<0.005	<0.001	<0.001
	Jul05/90	138.0	130.0	71.0	7.32	<1.0	1.8	72.2	0.9	3.9	0.009	<0.005	<0.001	0.005
	Mar17/90	104.0	80.0	52.5	7.24	10.0	4.3	52.8	1.0	5.7	<0.005	0.049	0.009	<0.001
	Jan21/90	251.0	107.0	61.8	7.06	9.3	1.3	58.9	<0.5	11.9	0.025	0.016	<0.001	0.004
	Dec7/89	97.5	80.0	50.8	7.39	2.0	1.2	43.0	<0.5	<1.0	<0.005	0.015	<0.001	0.001
	Average	161.9	126.7	61.7	7.28	3.8	2.7	72.3	0.8	4.0	0.018	0.014	0.002	0.007
	Std	70.8	60.6	33.6	0.13	4.1	1.6	34.0	0.6	3.9	0.016	0.016	0.003	0.008
	Max	251.0	220.0	104.0	7.47	10.0	5.4	124.0	1.6	11.9	0.043	0.049	0.009	0.019
	Min	89.6	70.0	0.0	7.06	0.5	1.2	40.4	0.3	0.5	0.003	0.003	0.001	0.001

Station	Date	Conduct.	TDS	Hardness	pH	TSS	Turbidity	Alkalinity	Cl	SO4	NH3	NO3	NO2	ortho-P
North Dump	Aug14/90	240.0	220.0	114.0	8.01	3.3	1.8	119.0	0.8	10.2	0.017	<0.005	<0.001	0.007
Creek	Sep14/90	236.0	230.0	132.0	7.41	[illegible]	[illegible]	125.0	<0.5	9.5	<0.005	0.010	<0.001	0.013
	Nov9/89	95.2	80.0		7.50	4.0	[illegible]	40.4	1.2	1.7	<0.005	0.039	0.002	<0.001
	Jul05/90	136.0	120.0	71.8	7.89	9.3	3.4	67.3	0.7	6.1	0.005	<0.005	<0.001	0.007
	Mar17/90	99.0	90.0	60.8	7.67	3.3	4.7	56.4	1.2	7.3	<0.005	0.062	0.011	0.006
	Jan21/90	135.0	110.0	72.6	7.56	4.0	<1.0	64.3	<0.5	6.7	0.014	0.037	0.002	0.003
	Dec7/89	119.0	100.0	61.4	7.71	<1.0	2.4	50.1	0.6	14.6	<0.005	0.010	<0.001	0.005
	Average	151.5	135.7	73.2	7.65	6.2	3.8	74.6	0.7	8.0	0.007	0.023	0.002	0.006
	Std	61.2	62.4	42.4	0.19	6.1	2.7	33.6	0.4	4.0	0.006	0.023	0.004	0.004
	Max	240.0	230.0	132.0	8.01	18.7	8.4	125.0	1.2	14.6	0.017	0.062	0.011	0.013
	Min	95.2	80.0	0.0	7.41	0.5	0.5	40.4	0.3	1.7	0.003	0.003	0.001	0.001

Station	Date	Conduct.	TDS	Hardness	pH	TSS	Turbidity	Alkalinity	Cl	SO4	NH3	NO3	NO2	ortho-P
Edney C.	Aug14/90	404.0	380.0	183.0	7.90	3.3	1.5	222.0	1.2	7.1	0.150	0.024	<0.001	0.002
	Sep14/90	394.0	380.0	204.0	8.01	7.0	4.6	225.0	<0.5	5.8	0.007	0.092	<0.001	<0.001
	Nov9/89	80.0	50.0		6.85	8.0	[illegible]	23.4	2.0	2.5	0.006	0.019	<0.001	0.004
	Jul05/90	126.0	120.0	72.9	7.38	4.0	[illegible]	67.6	1.1	2.8	0.019	<0.005	<0.001	0.002
	Mar17/90	77.5	60.0	42.8	7.15	4.6	[illegible]	39.4	1.4	1.0	0.015	0.088	0.009	0.009
	Jan21/90	103.0	84.0	58.1	7.25	<1.0	3.2	52.9	<0.5	<1.0	0.029	0.058	0.003	<0.001
	Dec7/89	81.4	70.0	44.8	7.35	5.3	1.1	38.3	0.6	4.6	<0.005	0.030	<0.001	0.014
	Average	178.0	163.4	86.5	7.41	4.7	4.2	95.5	1.0	3.4	0.033	0.045	0.002	0.005
	Std	152.4	149.6	76.6	0.41	2.5	2.5	88.5	0.6	2.5	0.053	0.035	0.003	0.005
	Max	404.0	380.0	204.0	8.01	8.0	8.2	225.0	2.0	7.1	0.150	0.092	0.009	0.014
	Min	80.0	50.0	0.0	6.85	0.5	1.1	23.4	0.3	0.5	0.003	0.003	0.001	0.001

Shading ...cates >BC guidelines for the protection of aquatic life.

App... C
Imperial Metals Corporation
Mt. Polley Project
1989 + 1990 Water Quality

Station	Date	Conduct.	TDS	Hardness	pH	TSS	Turbidity	Alkalinity	Cl	SO4	NH3	NO3	NO2	ortho-P
Morehead C.	Nov9/89	103.0	70.0		7.31	[illegible]	[illegible]	38.3	0.7	1.7	0.051	0.098	0.003	<0.001
	Mar17/90	78.1	60.0	34.4	7.40	2.0	2.3	36.8	1.4	4.6	<0.005	0.066	0.010	0.006
	Mar17/90	96.1	80.0	45.6	7.32	2.7	0.9	46.6	1.5	3.8	<0.005	0.190	0.005	0.002
	Jan21/90	77.5	59.0	36.4	6.97	[illegible]	1.3	34.7	<0.5	2.5	0.033	0.063	0.003	0.011
	Dec7/89	78.0	60.0	36.7	7.59	3.3	1.4	34.2	0.5	1.5	0.009	0.010	<0.001	0.005
	Average	86.5	65.8	30.6	7.32	8.1	2.7	38.1	0.9	2.8	0.020	0.085	0.004	0.005
	Std	12.1	9.1	17.7	0.22	7.7	2.7	5.0	0.6	1.3	0.022	0.066	0.004	0.004
	Max	103.0	80.0	45.6	7.59	18.7	7.4	46.6	1.5	4.6	0.051	0.190	0.010	0.011
	Min	77.5	59.0	0.0	6.97	2.0	0.9	34.2	0.3	1.5	0.003	0.010	0.001	0.001

Station	Date	Conduct.	TDS	Hardness	pH	TSS	Turbidity	Alkalinity	Cl	SO4	NH3	NO3	NO2	ortho-P
#107	Apr5/90	153.0		78.7	7.26									
#107	Nov25/89	380.0		167.0	7.63									
#146	Apr5/90	70.9		27.0	6.92									
#146	Nov25/89	81.0		30.6	6.97									
#151	Apr5/90	335.0		73.0	7.25									
#151	Nov25/89	150.0		71.2	7.50									
#231	Apr5/90	422.0		156.0	7.31									
#231	Nov25/89	1230.0		182.0	7.73									
#232	Apr5/90	485.0		208.0	7.17									
#232	Nov25/89	289.0		96.7	7.40									
#233	Apr5/90	396.0		210.0	7.35									
#233	Nov25/89	393.0		197.0	7.65									
#234	Apr5/90	383.0		98.1	7.80									
#234	Nov25/89	422.0		60.2	8.00									
#235	Apr5/90	490.0		236.0	7.52									
#235	Nov25/89	4280.0		432.0	7.28									
#236	Apr5/90	462.0		231.0	7.66									
#236	Nov25/89	574.0		177.0	8.24									

Station	Date	Conduct.	TDS	Hardness	pH	TSS	Turbidity	Alkalinity	Cl	SO4	NH3	NO3	NO2	ortho-P
Bootjack C.	Mar17/90	73.9	60.0	36.3	7.43	<1.0	2.8	32.9	1.0	6.6	0.005	0.051	0.010	0.006
Bootjack C.	Mar17/90	77.0	70.0	36.5	7.42	2.0	1.2	38.7	2.0	4.7	0.170	0.057	0.011	0.001
Bog	Mar17/90	181.0	150.0	93.4	7.32	8.0	4.5	98.3	3.5	2.5	0.260	0.064	0.007	<0.001
Hazeltine C.	Mar17/90	105.0	90.0	50.5	7.55	3.3	3.2	52.9	2.3	5.3	0.015	0.200	0.011	0.006
Polley Lake	Mar17/90	142.0	121.0	62.8	7.84	3.3	1.3	67.1	1.0	5.8	0.190	0.099	0.009	<0.001
Trio Lake	Mar17/90	86.7	90.0	38.4	7.27	4.0	1.8	42.2	1.1	3.8	0.550	0.029	0.009	0.002
Trio Creek	Mar17/90	66.0	60.0	37.4	7.40	4.0	0.9	39.5	1.0	3.3	0.180	0.072	0.020	0.002
Trio Creek	Jan21/90	85.1	67.0	41.0	7.33	2.7	1.3	37.3	<0.5	8.3	0.130	0.023	<0.001	0.005

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Appendix C
Imperial Metals Corporation
Mt. Polley Project
1989 + 1990 Water Quality

Station	Date	T-P	Kjeldahl-N	DOC	TOC	T-Al	T-As	T-Cd	T-Co	T-Cr	T-Cu	T-Fe	T-Pb	T-Mn
4K Creek	Aug14/90	0.030	0.640	18.60	18.60	0.310	0.0010	<0.0002	<0.001	0.003	0.003	1.060	0.006	0.300
	Sep10/90	0.010	0.250	15.70	15.90	0.066	0.0011	<0.0002	<0.001	<0.001	0.001	0.523	0.002	0.220
	Nov9/89	0.001				0.010	0.0004	<0.0002	<0.001	<0.001	<0.001	0.490	<0.001	0.054
	Jul05/90	0.010	0.530	13.30	16.60	0.024	0.0004	<0.0002	<0.001	<0.001	<0.001	0.524	<0.001	[illegible]
	Mar17/90	0.013	0.350	7.00	7.50	0.049	<0.0001	<0.0002	<0.001	<0.001	<0.001	0.450	<0.001	0.075
	Jan21/90	0.037	0.280	10.70	9.58	0.012	0.0005	<0.0002	<0.001	<0.001	<0.001	0.570	<0.001	0.100
	Dec7/89	0.010		13.60	12.50	0.009	0.0002	<0.0002	<0.001	<0.001	<0.001	0.350	<0.001	0.060
	Average	0.016	0.293	11.27	11.55	0.071	0.0005	0.0001	0.001	0.001	0.001	0.608	0.002	0.132
	Std	0.013	0.243	6.17	6.46	0.109	0.0004	0.0000	0.000	0.001	0.001	0.248	0.002	0.094
	Max	0.037	0.640	18.60	18.60	0.310	0.0011	0.0001	0.001	0.003	0.003	1.060	0.006	0.300
	Min	0.001	0.000	0.00	0.00	0.009	0.0001	0.0001	0.001	0.001	0.001	0.350	0.001	0.054

Station	Date	T-P	Kjeldahl-N	DOC	TOC	T-Al	T-As	T-Cd	T-Co	T-Cr	T-Cu	T-Fe	T-Pb	T-Mn
6K Creek	Aug14/90	0.032	0.410	8.75	8.75	0.060	0.0012	<0.0002	<0.001	0.002	0.002	1.150	0.003	1.800
	Sep14/90	0.020	0.640	4.78	5.11	0.034	0.0013	<0.0002	<0.001	<0.001	0.001	0.902	<0.001	0.464
	Nov9/89	0.013				0.095	0.0003	<0.0002	<0.001	<0.001	0.011	0.230	0.001	0.018
	Jul05/90	0.017	0.410	10.90	14.60	0.071	0.0002	<0.0002	<0.001	<0.001	0.004	0.280	<0.001	0.095
	Mar17/90	0.017	0.370	10.60	12.00	0.240	<0.0001	<0.0002	<0.001	<0.001	0.005	0.200	<0.001	0.028
	Jan21/90	0.010	0.270	14.00	12.10	0.056	0.0002	<0.0002	<0.001	<0.001	0.008	0.290	<0.001	0.045
	Dec7/89	0.007		26.10	25.10	0.044	0.0001	<0.0002	<0.001	<0.001	[illegible]	0.210	<0.001	0.028
	Average	0.017	0.300	10.73	11.09	0.086	0.0005	0.0001	0.001	0.001	0.005	0.463	0.001	0.397
	Std	0.008	0.233	8.16	7.80	0.071	0.0005	0.0000	0.000	0.001	0.003	0.392	0.001	0.632
	Max	0.032	0.640	26.10	25.10	0.240	0.0013	0.0001	0.001	0.002	0.011	1.150	0.003	1.800
	Min	0.007	0.000	0.00	0.00	0.034	0.0001	0.0001	0.001	0.001	0.001	0.200	0.001	0.018

Station	Date	T-P	Kjeldahl-N	DOC	TOC	T-Al	T-As	T-Cd	T-Co	T-Cr	T-Cu	T-Fe	T-Pb	T-Mn
North Dump Creek	Aug14/90	0.015	0.220	3.35	4.33	0.620	0.0004	<0.0002	<0.001	<0.001	0.009	0.120	<0.001	0.007
	Sep14/90	0.013	0.730	3.28	3.28	0.480	0.0007	<0.0002	<0.001	<0.001	0.012	0.376	0.010	0.028
	Nov9/89	0.005				0.440	0.0005	<0.0002	<0.001	0.001	0.027	0.360	0.001	0.008
	Jul05/90	0.020	0.260	7.60	9.04	0.500	0.0001	<0.0002	<0.001	<0.001	[illegible]	0.220	<0.001	0.021
	Mar17/90	0.021	0.180	6.10	7.00	0.650	0.0001	<0.0002	<0.001	0.001	0.016	0.130	0.002	0.025
	Jan21/90	0.010	0.220	7.93	7.65	0.055	0.0002	<0.0002	<0.001	<0.001	0.006	0.040	<0.001	<0.005
	Dec7/89	0.070		12.50	11.50	0.060	<0.0001	<0.0002	<0.001	<0.001	0.012	<0.03	<0.001	<0.005
	Average	0.022	0.233	5.82	6.11	0.401	0.0003	0.0001	0.001	0.001	0.015	0.180	0.002	0.013
	Std	0.022	0.245	4.06	3.86	0.246	0.0002	0.0000	0.000	0.000	0.006	0.145	0.004	0.011
	Max	0.070	0.730	12.50	11.50	0.650	0.0007	0.0001	0.001	0.001	0.027	0.376	0.010	0.028
	Min	0.005	0.000	0.00	0.00	0.055	0.0001	0.0001	0.001	0.001	0.009	0.015	0.001	0.003

Station	Date	T-P	Kjeldahl-N	DOC	TOC	T-Al	T-As	T-Cd	T-Co	T-Cr	T-Cu	T-Fe	T-Pb	T-Mn
Edney C.	Aug14/90	0.004	0.540	7.67	12.60	0.091	0.0013	<0.0002	<0.001	0.002	0.001	0.140	0.001	0.047
	Sep14/90	0.012	0.220	3.47	3.66	0.240	0.0013	<0.0002	<0.001	0.002	0.002	0.309	0.006	0.053
	Nov9/89	0.013				0.730	0.0003	<0.0002	<0.001	0.005	0.006	0.820	0.001	0.014
	Jul05/90	0.013	0.370	22.80	28.20	0.520	0.0004	<0.0002	<0.001	0.002	0.003	0.760	0.040	0.035
	Mar17/90	0.022	0.580	16.40	28.00	0.450	<0.0001	<0.0002	<0.001	[illegible]	0.009	0.380	0.002	0.035
	Jan21/90	0.023	0.440	21.80	12.10	0.330	0.0003	<0.0002	<0.001	0.001	0.003	0.590	<0.001	0.014
	Dec7/89	0.038		33.00	31.00	0.180	0.0001	0.0002	<0.001	0.001	0.004	0.520	<0.001	0.015
	Average	0.018	0.307	15.02	16.51	0.363	0.0005	0.0001	0.001	0.002	0.004	0.504	0.007	0.030
	Std	0.011	0.240	11.87	12.59	0.220	0.0005	0.0000	0.000	0.001	0.003	0.249	0.015	0.016
	Max	0.038	0.580	33.00	31.00	0.730	0.0013	0.0002	0.001	0.005	0.009	0.820	0.040	0.053
	Min	0.004	0.000	0.00	0.00	0.091	0.0001	0.0001	0.001	0.001	0.001	0.140	0.001	0.014

Shading [illegible]ates >BC guidelines for the protection of aquatic life.

App[illegible]x C
Imperial Metals Corporation
Mt. Polley Project
1989 + 1990 Water Quality

Station	Date	T-P	Kjeldahl-N	DOC	TOC	T-Al	T-As	T-Cd	T-Co	T-Cr	T-Cu	T-Fe	T-Pb	T-Mn
Morehead C.	Nov9/89	0.041				0.100	0.0003	<0.0002	<0.001	<0.001	0.005	[illegible]	0.001	0.028
	Mar17/90	0.017	0.270	2.15	8.65	0.059	<0.0001	<0.0002	<0.001	<0.001	0.002	0.080	<0.001	0.025
	Mar17/90	0.011	0.380	10.40	22.10	0.016	<0.0001	<0.0002	<0.001	<0.001	0.001	0.110	<0.001	0.036
	Jan21/90	0.014	0.270	8.10	1.45	0.035	0.0002	<0.0002	<0.001	<0.001	0.003	0.070	<0.001	<0.005
	Dec7/89	0.008		9.30	9.00	0.025	0.0001	<0.0002	<0.001	<0.001	0.004	<0.03	<0.001	0.007
	Average	0.018	0.184	5.99	8.24	0.047	0.0001	0.0001	0.001	0.001	0.003	0.131	0.001	0.020
	Std	0.013	0.174	4.62	8.76	0.033	0.0001	0.0000	0.000	0.000	0.002	0.143	0.000	0.014
	Max	0.041	0.380	10.40	22.10	0.100	0.0003	0.0001	0.001	0.001	0.005	0.380	0.001	0.036
	Min	0.008	0.000	0.00	0.00	0.016	0.0001	0.0001	0.001	0.001	0.001	0.015	0.001	0.003

Station	Date	T-P	Kjeldahl-N	DOC	TOC	T-Al	T-As	T-Cd	T-Co	T-Cr	T-Cu	T-Fe	T-Pb	T-Mn
#107	Apr5/90					[illegible]	0.0014	0.0012	0.001	0.002	[illegible]	0.070	0.002	[illegible]
#107	Nov25/89					0.140	0.0004	<0.0002	<0.001	0.001	[illegible]	<0.03	<0.001	[illegible]
#146	Apr5/90					[illegible]	0.0018	[illegible]	0.001	[illegible]	0.410	[illegible]	0.009	0.025
#146	Nov25/89					0.370	0.0015	0.0002	<0.001	0.001	[illegible]	0.280	0.003	0.011
#151	Apr5/90					[illegible]	0.0010	[illegible]	<0.001	0.002	0.072	[illegible]	0.004	0.030
#151	Nov25/89					0.740	0.0013	<0.0002	<0.001	[illegible]	[illegible]	[illegible]	0.010	0.038
#231	Apr5/90					[illegible]	0.0082	[illegible]	0.004	0.022	[illegible]	[illegible]	0.005	[illegible]
#231	Nov25/89					[illegible]	0.0085	<0.0002	0.005	0.018	[illegible]	[illegible]	0.003	[illegible]
#232	Apr5/90					[illegible]	0.0120	0.0002	0.008	[illegible]	[illegible]	[illegible]	0.010	[illegible]
#232	Nov25/89					[illegible]	0.0150	[illegible]	0.013	0.047	[illegible]	[illegible]	0.013	[illegible]
#233	Apr5/90					[illegible]	0.0410	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.061	[illegible]
#233	Nov25/89					[illegible]	0.0088	[illegible]	0.009	[illegible]	[illegible]	20.600	0.009	[illegible]
#234	Apr5/90					[illegible]	0.0340	<0.0002	<0.001	0.001	0.003	0.190	<0.001	0.010
#234	Nov25/89					4.770	[illegible]	<0.0002	0.002	[illegible]	[illegible]	[illegible]	0.004	[illegible]
#235	Apr5/90					[illegible]	0.0050	[illegible]	0.004	0.027	0.028	[illegible]	0.005	[illegible]
#235	Nov25/89					15.100	0.0079	[illegible]	0.010	0.029	[illegible]	[illegible]	0.006	[illegible]
#236	Apr5/90					0.013	0.0010	<0.0002	<0.001	<0.001	0.003	<0.03	<0.001	<0.005
#236	Nov25/89					[illegible]	0.0140	[illegible]	0.007	[illegible]	[illegible]	[illegible]	0.011	[illegible]

Station	Date	T-P	Kjeldahl-N	DOC	TOC	T-Al	T-As	T-Cd	T-Co	T-Cr	T-Cu	T-Fe	T-Pb	T-Mn
Bootjack C.	Mar17/90	0.042	0.370	12.60	19.20	[illegible]	0.0001	<0.0002	<0.001	0.001	[illegible]	0.290	0.015	0.026
Bootjack C.	Mar17/90	0.016	0.750	7.50	8.90	0.056	0.0001	[illegible]	<0.001	<0.001	0.003	0.040	<0.001	0.016
Bog	Mar17/90	0.035	1.410	34.10	43.60	[illegible]	0.0005	0.0004	<0.001	[illegible]	0.008	[illegible]	0.008	0.055
Hazeltine C.	Mar17/90	0.025	0.540	10.40	15.70	[illegible]	<0.0001	<0.0002	<0.001	0.001	0.003	0.230	<0.001	0.015
Polley Lake	Mar17/90	0.027	0.610	6.90	7.65	0.029	0.0002	<0.0002	<0.001	<0.001	0.003	0.050	<0.001	0.016
Trio Lake	Mar17/90	0.022	1.100	10.20	11.30	0.047	0.0001	<0.0002	<0.001	0.001	0.001	0.210	<0.001	0.012
Trio Creek	Mar17/90	0.015	0.610	9.50	10.80	0.046	0.0001	<0.0002	<0.001	<0.001	<0.001	0.210	<0.001	0.023
Trio Creek	Jan21/90	0.035	0.360	14.50	12.70	0.061	0.0002	<0.0002	<0.001	<0.001	0.002	0.250	<0.001	0.006

Shading indicates >BC guidelines for the protection of aquatic life.

Imperial Metals Corporation

Mt. Polley Project

1989 + 1990 Water Quality

Station	Date	T-Hg	T-Mo	T-Ni	T-Ag	T-Zn	D-Al	D-As	D-Cd	D-Co	D-Cr	D-Cu	D-Fe	D-Pb
4K Creek	Aug14/90	<0.00005	0.002	0.002	0.0001	<0.005	0.042	0.0007	<0.0002	<0.001	<0.001	0.001	0.370	0.001
	Sep10/90	<0.00005	0.003	<0.001	<0.0001	<0.005	0.017	0.0003	<0.0002	<0.001	<0.001	<0.001	0.372	0.001
	Nov9/89	<0.00005	<0.001	<0.001	<0.0001	<0.005	0.007	0.0004	<0.0002	<0.001	<0.001	<0.001	0.370	<0.001
	Jul05/90	<0.00005	<0.001	0.001	<0.0001	<0.005	<0.005	0.0004	<0.0002	<0.001	<0.001	<0.001	0.350	0.001
	Mar17/90	0.00034	<0.001	0.001	<0.0001	<0.005	0.039	<0.0001	<0.0002	<0.001	<0.001	<0.001	0.310	<0.001
	Jan21/90	<0.00005	<0.001	<0.001	<0.0001	<0.005	0.010	0.0004	<0.0002	<0.001	<0.001	<0.001	0.400	<0.001
	Dec7/89	<0.00005	<0.001	<0.001	<0.0001	<0.005	0.005	0.0001	<0.0002	<0.001	<0.001	<0.001	0.230	<0.001
	Average	0.00007	0.001	0.001	0.0001	0.003	0.018	0.0003	0.0001	0.001	0.001	0.001	0.343	0.001
	Std	0.00012	0.001	0.001	0.0000	0.000	0.016	0.0002	0.0000	0.000	0.000	0.000	0.057	0.000
	Max	0.00034	0.003	0.002	0.0001	0.003	0.042	0.0007	0.0001	0.001	0.001	0.001	0.400	0.001
	Min	0.00003	0.001	0.001	0.0001	0.003	0.003	0.0001	0.0001	0.001	0.001	0.001	0.230	0.001

Station	Date	T-Hg	T-Mo	T-Ni	T-Ag	T-Zn	D-Al	D-As	D-Cd	D-Co	D-Cr	D-Cu	D-Fe	D-Pb
6K Creek	Aug14/90	<0.00005	0.003	0.001	<0.0001	<0.005	0.023	0.0010	<0.0002	<0.001	<0.001	0.001	0.680	0.002
	Sep14/90	<0.00005	0.002	<0.001	<0.0001	<0.005	0.022	0.0003	<0.0002	<0.001	<0.001	<0.001	0.544	<0.001
	Nov9/89	<0.00005	<0.001	<0.001	<0.0001	<0.005	0.070	0.0003	<0.0002	<0.001	<0.001	0.011	0.180	0.001
	Jul05/90	<0.00005	<0.001	0.002	<0.0001	<0.005	0.035	0.0002	<0.0002	<0.001	<0.001	0.003	0.170	<0.001
	Mar17/90	0.00009	<0.001	0.001	0.0001	<0.005	0.074	<0.0001	<0.0002	<0.001	<0.001	0.005	0.180	<0.001
	Jan21/90	<0.00005	<0.001	<0.001	<0.0001	<0.005	0.048	0.0002	<0.0002	<0.001	<0.001	0.006	0.230	<0.001
	Dec7/89	0.00007	<0.001	<0.001	<0.0001	0.010	0.032	0.0001	<0.0002	<0.001	<0.001	0.008	0.140	<0.001
	Average	0.00004	0.001	0.001	0.0001	0.004	0.043	0.0003	0.0001	0.001	0.001	0.005	0.301	0.001
	Std	0.00003	0.001	0.001	0.0000	0.003	0.021	0.0003	0.0000	0.000	0.000	0.004	0.218	0.001
	Max	0.00009	0.003	0.002	0.0001	0.010	0.074	0.0010	0.0001	0.001	0.001	0.011	0.680	0.002
	Min	0.00003	0.001	0.001	0.0001	0.003	0.022	0.0001	0.0001	0.001	0.001	0.001	0.140	0.001

Station	Date	T-Hg	T-Mo	T-Ni	T-Ag	T-Zn	D-Al	D-As	D-Cd	D-Co	D-Cr	D-Cu	D-Fe	D-Pb
North Dump Creek	Aug14/90	<0.00005	0.006	<0.001	<0.0001	<0.005	0.039	0.0002	<0.0002	<0.001	<0.001	0.005	<0.030	<0.001
	Sep14/90	<0.00005	0.006	<0.001	<0.0001	<0.005	0.036	0.0001	<0.0002	<0.001	<0.001	0.012	<0.030	<0.001
	Nov9/89	<0.00005	0.003	0.003	<0.0001	0.007	[illegible]	0.0005	<0.0002	<0.001	0.001	0.025	0.300	0.001
	Jul05/90	<0.00005	<0.001	0.001	<0.0001	<0.005	0.060	0.0001	<0.0002	<0.001	<0.001	0.012	0.046	<0.001
	Mar17/90	0.00048	0.002	0.020	0.0001	<0.005	0.400	<0.0001	<0.0002	<0.001	<0.001	0.008	0.130	<0.001
	Jan21/90	<0.00005	0.002	<0.001	<0.0001	<0.005	0.045	0.0002	<0.0002	<0.001	<0.001	0.009	0.030	<0.001
	Dec7/89	0.00021	<0.001	<0.001	<0.0001	0.005	0.060	<0.0001	<0.0002	<0.001	<0.001	0.013	<0.03	<0.001
	Average	0.00012	0.003	0.004	0.0001	0.004	0.143	0.0002	0.0001	0.001	0.001	0.012	0.079	0.001
	Std	0.00017	0.002	0.007	0.0000	0.002	0.163	0.0002	0.0000	0.000	0.000	0.006	0.106	0.000
	Max	0.00048	0.006	0.020	0.0001	0.007	0.400	0.0005	0.0001	0.001	0.001	0.025	0.300	0.001
	Min	0.00003	0.001	0.001	0.0001	0.003	0.036	0.0001	0.0001	0.001	0.001	0.005	0.015	0.001

Station	Date	T-Hg	T-Mo	T-Ni	T-Ag	T-Zn	D-Al	D-As	D-Cd	D-Co	D-Cr	D-Cu	D-Fe	D-Pb
Edney C.	Aug14/90	<0.00005	0.003	0.004	<0.0001	0.005	0.044	0.0012	<0.0002	<0.001	<0.001	0.001	0.084	0.001
	Sep14/90	<0.00005	0.002	<0.001	<0.0001	<0.005	0.062	0.0007	<0.0002	<0.001	0.001	<0.001	0.071	<0.001
	Nov9/89	<0.00005	0.001	0.003	0.0006	0.011	[illegible]	0.0002	<0.0002	<0.001	0.002	0.005	0.580	0.001
	Jul05/90	<0.00005	<0.001	0.230	<0.0001	<0.005	0.190	0.0004	<0.0002	<0.001	0.001	0.002	0.480	<0.001
	Mar17/90	0.00020	<0.001	[illegible]	<0.0001	<0.005	0.370	<0.0001	<0.0002	<0.001	0.002	0.001	0.340	<0.001
	Jan21/90	<0.00005	<0.001	0.001	<0.0001	<0.005	0.300	0.0002	<0.0002	<0.001	0.001	0.003	0.500	<0.001
	Dec7/89	0.00009	0.001	0.002	<0.0001	0.006	[illegible]	0.0001	0.0002	<0.001	0.001	0.004	0.300	<0.001
	Average	0.00006	0.001	0.038	0.0001	0.005	0.254	0.0004	0.0001	0.001	0.001	0.002	0.336	0.001
	Std	0.00007	0.001	0.085	0.0002	0.003	0.203	0.0004	0.0000	0.000	0.001	0.002	0.201	0.000
	Max	0.00020	0.003	0.230	0.0006	0.011	0.630	0.0012	0.0002	0.001	0.002	0.005	0.580	0.001
	Min	0.00003	0.001	0.001	0.0001	0.003	0.044	0.0001	0.0001	0.001	0.001	0.001	0.071	0.001

Shading indicates >BC guidelines for the protection of aquatic life.

Appendix C
Imperial Metals Corporation
Mt. Polley Project
1989 + 1990 Water Quality

Station	Date	T-Hg	T-Mo	T-Ni	T-Ag	T-Zn	D-Al	D-As	D-Cd	D-Co	D-Cr	D-Cu	D-Fe	D-Pb
Morehead C.	Nov9/89	<0.00005	0.001	<0.001	[illegible]	0.006	0.023	0.0003	<0.0002	<0.001	<0.001	0.004	0.110	0.001
	Mar17/90	0.00033	<0.001	<0.001	0.0001	<0.005	0.034	<0.0001	<0.0002	<0.001	<0.001	0.002	0.030	<0.001
	Mar17/90	[illegible]	<0.001	0.001	<0.0001	<0.005	0.018	<0.0001	<0.0002	<0.001	<0.001	0.001	0.080	<0.001
	Jan21/90	<0.00005	<0.001	<0.001	<0.0001	<0.005	0.011	0.0002	<0.0002	<0.001	<0.001	0.003	0.030	<0.001
	Dec7/89	0.00009	0.001	<0.001	<0.0001	<0.005	0.012	0.0001	<0.0002	<0.001	<0.001	0.004	<0.03	<0.001
	Average	0.00012	0.001	0.001	0.0001	0.003	0.020	0.0001	0.0001	0.001	0.001	0.003	0.053	0.001
	Std	0.00013	0.000	0.000	0.0002	0.002	0.009	0.0001	0.0000	0.000	0.000	0.001	0.040	0.000
	Max	0.00033	0.001	0.001	0.0004	0.006	0.034	0.0003	0.0001	0.001	0.001	0.004	0.110	0.001
	Min	0.00003	0.001	0.001	0.0001	0.003	0.011	0.0001	0.0001	0.001	0.001	0.001	0.015	0.001

Station	Date	T-Hg	T-Mo	T-Ni	T-Ag	T-Zn	D-Al	D-As	D-Cd	D-Co	D-Cr	D-Cu	D-Fe	D-Pb
#107	Apr5/90	0.00006	0.002	<0.001	<0.0001	<0.005	0.018	0.0012	0.0010	<0.001	<0.001	0.018	<0.03	<0.001
#107	Nov25/89	0.00005	0.005	<0.001	0.0002	<0.005	0.010	0.0002	<0.0002	<0.001	<0.001	0.013	<0.03	<0.001
#146	Apr5/90	<0.00005	0.002	0.003	0.0001	0.015	[illegible]	0.0012	<0.0002	<0.001	<0.001	0.240	<0.03	<0.001
#146	Nov25/89	0.00005	0.010	0.001	<0.0001	<0.005	0.065	0.0010	<0.0002	<0.001	<0.001	0.210	<0.03	0.001
#151	Apr5/90	<0.00005	0.009	<0.001	0.0001	<0.005	0.098	0.0009	0.0002	<0.001	0.001	0.021	<0.03	<0.001
#151	Nov25/89	0.00007	0.009	0.004	<0.0001	<0.005	0.058	0.0003	<0.0002	<0.001	0.001	0.025	0.030	<0.001
#231	Apr5/90	<0.00005	0.010	[illegible]	<0.0001	[illegible]	0.090	0.0016	<0.0002	<0.001	<0.001	0.001	0.100	<0.001
#231	Nov25/89	0.00008	0.005	0.015	0.0003	0.044	0.045	0.0018	<0.0002	<0.001	0.002	0.008	2.080	0.001
#232	Apr5/90	0.00010	0.002	[illegible]	0.0002	0.072	0.034	0.0021	<0.0002	0.001	0.001	0.002	<0.03	<0.001
#232	Nov25/89	0.00020	0.002	0.062	0.0003	[illegible]	[illegible]	0.0024	<0.0002	<0.001	0.002	0.007	0.350	0.001
#233	Apr5/90	[illegible]	0.006	0.260	[illegible]	[illegible]	0.022	0.0021	<0.0002	<0.001	<0.001	0.002	<0.03	<0.001
#233	Nov25/89	0.00012	0.012	[illegible]	0.0005	[illegible]	0.027	0.0015	<0.0002	<0.001	0.001	0.001	<0.03	<0.001
#234	Apr5/90	<0.00005	0.003	<0.001	0.0002	<0.005	0.023	0.0340	<0.0002	<0.001	<0.001	0.001	<0.03	<0.001
#234	Nov25/89	[illegible]	0.003	0.005	<0.0001	0.024	0.029	0.0660	<0.0002	<0.001	<0.001	<0.001	<0.03	<0.001
#235	Apr5/90	<0.00005	0.004	0.022	<0.0001	0.029	0.073	0.0014	<0.0002	<0.001	0.001	0.006	<0.03	<0.001
#235	Nov25/89	0.00012	0.010	0.023	0.0004	0.064	0.015	0.0006	<0.0002	0.002	0.001	0.009	<0.03	<0.001
#236	Apr5/90	<0.00005	0.002	<0.001	<0.0001	<0.005	0.013	0.0010	<0.0002	<0.001	<0.001	0.003	<0.03	<0.001
#236	Nov25/89	[illegible]	0.005	0.011	0.0002	[illegible]	0.014	0.0008	<0.0002	<0.001	0.001	<0.001	<0.03	<0.001

Station	Date	T-Hg	T-Mo	T-Ni	T-Ag	T-Zn	D-Al	D-As	D-Cd	D-Co	D-Cr	D-Cu	D-Fe	D-Pb
Bootjack C.	Mar17/90	0.00018	<0.001	0.001	<0.0001	<0.005	[illegible]	<0.0001	<0.0002	<0.001	0.001	0.003	0.210	<0.001
Bootjack C.	Mar17/90	0.00014	<0.001	0.002	<0.0001	[illegible]	0.028	<0.0001	0.0003	<0.001	<0.001	0.003	<0.03	<0.001
Bog	Mar17/90	<0.00005	<0.001	0.004	<0.0001	0.042	[illegible]	<0.0001	0.0004	<0.001	0.002	0.003	0.470	0.002
Hazeltine C.	Mar17/90	[illegible]	<0.001	0.002	<0.0001	0.006	[illegible]	<0.0001	<0.0002	<0.001	0.001	0.002	0.160	<0.001
Polley Lake	Mar17/90	<0.00005	0.001	0.001	<0.0001	0.023	0.017	0.0001	<0.0002	<0.001	<0.001	0.001	<0.03	<0.001
Trio Lake	Mar17/90	<0.00005	<0.001	0.004	<0.0001	0.028	0.039	<0.0001	<0.0002	<0.001	0.001	0.001	0.130	<0.001
Trio Creek	Mar17/90	<0.00005	<0.001	0.002	<0.0001	<0.005	0.046	<0.0001	<0.0002	<0.001	<0.001	<0.001	0.140	<0.001
Trio Creek	Jan21/90	<0.00005	<0.001	<0.001	<0.0001	<0.005	0.046	0.0002	<0.0002	<0.001	<0.001	0.002	0.220	<0.001

Shading indicates >BC guidelines for the protection of aquatic life.

Appendix C
Imperial Metals Corporation
Mt. Polley Project
1989 + 1990 Water Quality

Station	Date	D-Mn	D-Hg	D-Mo	D-Ni	D-Ag	D-Zn	D-Ca	D-Mg	D-K	D-Na
4K Creek	Aug14/90	0.201	<0.00005	0.002	<0.001	<0.0001	<0.005	30.90	6.21	0.61	4.88
	Sep10/90	0.195	<0.00005	0.001	<0.001	<0.0001	<0.005	31.30	6.05	0.41	5.11
	Nov9/89	0.054	<0.00005	<0.001	<0.001	<0.0001	<0.005	19.00	3.82	0.78	3.54
	Jul05/90	0.100	<0.00005	<0.001	0.001	<0.0001	<0.005	27.00	5.28	0.16	3.75
	Mar17/90	0.075	0.00031	<0.001	<0.001	<0.0001	<0.005	26.00	5.82	0.73	4.50
	Jan21/90	0.093	<0.00005	<0.001	<0.001	<0.0001	<0.005	25.10	5.59	0.51	4.34
	Dec7/89	0.060	<0.00005	<0.001	<0.001	<0.0001	<0.005	20.80	4.42	0.90	3.46
	Average	0.111	0.00007	0.001	0.001	0.0001	0.003	25.73	5.28	0.59	4.23
	Std	0.062	0.00011	0.001	0.000	0.0000	0.000	4.64	0.87	0.25	0.66
	Max	0.201	0.00031	0.002	0.001	0.0001	0.003	31.30	6.21	0.90	5.11
	Min	0.054	0.00003	0.001	0.001	0.0001	0.003	19.00	3.82	0.16	3.46

Station	Date	D-Mn	D-Hg	D-Mo	D-Ni	D-Ag	D-Zn	D-Ca	D-Mg	D-K	D-Na
6K Creek	Aug14/90	1.460	<0.00005	0.002	<0.001	<0.0001	<0.005	27.50	5.44	0.55	7.80
	Sep14/90	0.893	<0.00005	<0.001	<0.001	<0.0001	<0.005	31.00	6.20	0.55	6.32
	Nov9/89	<0.005	<0.00005	<0.001	<0.001	<0.0001	<0.005	10.40	2.20	0.40	2.30
	Jul05/90	0.074	<0.00005	<0.001	0.002	<0.0001	<0.005	21.70	3.99	0.18	3.46
	Mar17/90	0.028	0.00009	<0.001	<0.001	<0.0001	<0.005	15.60	3.22	0.25	3.04
	Jan21/90	0.043	<0.00005	<0.001	<0.001	<0.0001	<0.005	18.50	3.70	0.22	3.66
	Dec7/89	0.027	0.00007	<0.001	<0.001	<0.0001	0.007	15.30	2.98	0.30	2.84
	Average	0.361	0.00004	0.001	0.001	0.0001	0.003	20.00	3.96	0.35	4.20
	Std	0.561	0.00003	0.001	0.001	0.0000	0.002	7.26	1.41	0.15	2.05
	Max	1.460	0.00009	0.002	0.002	0.0001	0.007	31.00	6.20	0.55	7.80
	Min	0.003	0.00003	0.001	0.001	0.0001	0.003	10.40	2.20	0.18	2.30

Station	Date	D-Mn	D-Hg	D-Mo	D-Ni	D-Ag	D-Zn	D-Ca	D-Mg	D-K	D-Na
North Dump	Aug14/90	<0.005	<0.00005	0.006	<0.001	<0.0001	<0.005	38.40	4.25	0.46	2.40
Creek	Sep14/90	0.005	<0.00005	0.004	<0.001	<0.0001	<0.005	44.70	4.79	0.51	2.89
	Nov8/89	<0.005	<0.00005	0.002	0.002	<0.0001	<0.005	14.40	1.80	0.38	1.56
	Jul05/90	<0.005	<0.00005	<0.001	<0.001	<0.0001	<0.005	24.00	2.81	0.38	1.89
	Mar17/90	0.010	0.00022	<0.001	<0.001	<0.0001	<0.005	20.20	2.46	0.26	1.68
	Jan21/90	<0.005	<0.00005	0.002	<0.001	<0.0001	<0.005	24.10	2.93	0.32	1.86
	Dec7/89	<0.005	0.00021	<0.001	<0.001	<0.0001	<0.005	20.40	2.48	0.25	1.58
	Average	0.004	0.00008	0.002	0.001	0.0001	0.003	26.60	3.07	0.37	1.98
	Std	0.003	0.00009	0.002	0.001	0.0000	0.000	10.86	1.06	0.10	0.49
	Max	0.010	0.00022	0.006	0.002	0.0001	0.003	44.70	4.79	0.51	2.89
	Min	0.003	0.00003	0.001	0.001	0.0001	0.003	14.40	1.80	0.25	1.56

Station	Date	D-Mn	D-Hg	D-Mo	D-Ni	D-Ag	D-Zn	D-Ca	D-Mg	D-K	D-Na
Edney C.	Aug14/90	0.039	<0.00005	0.003	0.001	<0.0001	<0.005	40.00	19.80	2.82	10.20
	Sep14/90	0.047	<0.00005	0.001	<0.001	<0.0001	<0.005	44.30	22.30	1.45	9.33
	Nov9/89	<0.005	<0.00005	<0.001	0.003	<0.0001	<0.005	8.20	1.80	0.50	1.50
	Jul05/90	0.019	<0.00005	<0.001	0.003	<0.0001	<0.005	18.40	6.40	0.70	3.14
	Mar17/90	0.012	0.00020	<0.001	<0.001	<0.0001	<0.005	11.00	3.64	0.71	2.21
	Jan21/90	0.014	<0.00005	<0.001	0.001	<0.0001	<0.005	14.50	5.21	0.63	2.78
	Dec7/89	0.006	0.00009	0.001	0.002	<0.0001	0.005	11.80	3.76	0.22	2.44
	Average	0.020	0.00006	0.001	0.002	0.0001	0.003	21.14	8.99	1.00	4.51
	Std	0.017	0.00007	0.001	0.001	0.0000	0.001	14.75	8.39	0.88	3.63
	Max	0.047	0.00020	0.003	0.003	0.0001	0.005	44.30	22.30	2.82	10.20
	Min	0.003	0.00003	0.001	0.001	0.0001	0.003	8.20	1.80	0.22	1.50

Shading indicates >BC guidelines for the protection of aquatic life.

Appendix C
Imperial Metals Corporation
Mt. Polley Project
1989 + 1990 Water Quality

Station	Date	D-Mn	D-Hg	D-Mo	D-Ni	D-Ag	D-Zn	D-Ca	D-Mg	D-K	D-Na
Morehead C.	Nov9/89	0.021	<0.00005	<0.001	<0.001	0.0001	0.006	10.70	2.11	0.72	2.27
	Mar17/90	0.010	0.00019	<0.001	<0.001	<0.0001	<0.005	10.40	1.99	0.80	2.36
	Mar17/90	0.011	0.00012	<0.001	<0.001	<0.0001	<0.005	13.10	3.07	0.58	2.83
	Jan21/90	<0.005	<0.00005	<0.001	<0.001	<0.0001	<0.005	10.90	2.18	0.74	2.38
	Dec7/89	0.005	0.00009	<0.001	<0.001	<0.0001	<0.005	11.10	2.14	0.85	2.32
	Average	0.010	0.00009	0.001	0.001	0.0001	0.003	11.24	2.30	0.70	2.43
	Std	0.007	0.00007	0.000	0.000	0.0000	0.002	1.07	0.44	0.11	0.23
	Max	0.021	0.00019	0.001	0.001	0.0001	0.006	13.10	3.07	0.85	2.83
	Min	0.003	0.00003	0.001	0.001	0.0001	0.003	10.40	1.99	0.58	2.27

Station	Date	D-Mn	D-Hg	D-Mo	D-Ni	D-Ag	D-Zn	D-Ca	D-Mg	D-K	D-Na
#107	Apr5/90	1.170	<0.00005	0.002	<0.001	<0.0001	<0.005	26.00	3.26	0.70	2.15
#107	Nov25/89	1.170	<0.00005	0.002	<0.001	0.0001	<0.005	54.80	7.08	0.80	2.44
#146	Apr5/90	0.015	<0.00005	0.002	0.003	<0.0001	<0.005	9.05	1.05	0.81	3.51
#146	Nov25/89	0.007	<0.00005	0.003	<0.001	<0.0001	<0.005	10.40	1.10	0.59	4.84
#151	Apr5/90	0.030	<0.00005	0.008	<0.001	<0.0001	<0.005	24.30	2.91	0.56	2.28
#151	Nov25/89	<0.005	<0.00005	0.006	<0.001	<0.0001	<0.005	23.80	2.73	0.42	2.24
#231	Apr5/90	0.400	<0.00005	0.008	0.018	<0.0001	<0.005	42.80	11.70	1.60	28.70
#231	Nov25/89	0.780	<0.00005	0.005	0.006	<0.0001	0.025	49.20	14.00	4.00	180.00
#232	Apr5/90	0.560	<0.00005	0.002	0.007	<0.0001	<0.005	70.80	7.41	0.85	23.20
#232	Nov25/89	0.210	<0.00005	0.002	0.013	<0.0001	0.011	33.40	3.15	1.13	7.97
#233	Apr5/90	0.180	<0.00005	0.005	0.007	<0.0001	<0.005	52.80	18.40	0.87	8.20
#233	Nov25/89	0.130	<0.00005	0.009	0.007	<0.0001	<0.005	46.80	19.20	1.10	8.30
#234	Apr5/90	0.010	<0.00005	0.003	<0.001	<0.0001	<0.005	18.40	12.60	2.19	55.00
#234	Nov25/89	0.036	<0.00005	0.003	<0.001	<0.0001	<0.005	16.10	9.50	1.78	68.00
#235	Apr5/90	0.094	<0.00005	0.004	0.011	<0.0001	<0.005	80.30	20.20	1.25	20.10
#235	Nov25/89	0.430	<0.00005	0.008	0.004	0.0001	<0.005	128.00	26.60	4.27	686.00
#236	Apr5/90	<0.005	<0.00005	0.002	<0.001	<0.0001	<0.005	52.00	24.10	2.43	17.70
#236	Nov25/89	0.068	0.00005	0.003	<0.001	<0.0001	<0.005	39.70	18.60	2.05	42.90

Station	Date	D-Mn	D-Hg	D-Mo	D-Ni	D-Ag	D-Zn	D-Ca	D-Mg	D-K	D-Na
Bootjack C.	Mar17/90	0.010	0.00012	<0.001	<0.001	<0.0001	<0.005	10.00	2.70	0.62	2.31
Bootjack C.	Mar17/90	0.013	0.00011	<0.001	<0.001	<0.0001	0.036	11.00	2.13	1.08	2.97
Bog	Mar17/90	0.038	<0.00005	<0.001	0.001	<0.0001	0.040	23.70	8.12	1.41	8.25
Hazeltine C.	Mar17/90	0.012	0.00014	<0.001	<0.001	<0.0001	0.006	15.50	2.80	0.61	3.13
Polley Lake	Mar17/90	0.013	<0.00005	<0.001	<0.001	<0.0001	0.013	19.50	3.34	0.70	4.84
Trio Lake	Mar17/90	<0.005	<0.00005	<0.001	<0.001	<0.0001	0.029	10.90	2.65	0.85	2.51
Trio Creek	Mar17/90	0.015	<0.00005	<0.001	<0.001	<0.0001	<0.005	10.60	2.60	0.85	2.19
Trio Creek	Jan21/90	0.005	<0.00005	<0.001	<0.001	<0.0001	<0.005	11.40	2.98	0.69	2.17

Appendix D

NOTICE OF WORK

Province of British Columbia

Ministry of Energy, Mines and Petroleum Resources
Mineral Resources Division

NOTICE OF WORK AND RECLAMATION PROGRAM ON A MINERAL PROPERTY

The information requested on this form is collected under the authority of the Mines Act (S.B.C. 1989, CHAP. 56, INDEX CHAP. 263.6) and in accordance with the Freedom of Information and Protection of Privacy Act. The information is collected for the purpose of issuing a permit under the Mines Act and may be referred to other agencies as outlined in the Health, Safety and Reclamation Code for Mines in British Columbia. If you have any questions regarding the collection and use of this information, contact the Land Management and Policy Branch in Victoria at 952-0462; or write: Land Management and Policy Branch, 4th Floor, 1810 Blanshard Street, Victoria, British Columbia, V8V 1X4.

1. **NAME OF PROPERTY:** Mount Polley

Previous Annual Work Approval Number (applicable only to those properties previously worked)

(eg. SMI91-0100500-123) PRG-1995-1101163-6616

Reclamation Permit Number, if previously issued (may be several years old) MX-GEN-78

Name of Claims: CB1, CB4, CB5, CB8, CB9, CB16, CB19, CB20, PM-1-13

2. **LOCATION:** Is any part of this Property in a Recreation Area or Park? ___ Yes X No

Are any of the surface rights of this property privately owned? ___ Yes X No (Operator responsible for contacting owner)

ame and address of private land owner:

Mining division: Cariboo All NTS map sheets (e.g. 094L/02E) 093A/12E & 5W

Latitude: 52 ° 33 ' Longitude 121 ° 38 ' Minfile No. (if known)

Access route (from nearest town to property) From 150 Mile House to Morehead Lake, then by 14 km of forestry road.

3. **OPERATOR/AGENT** (Person or Company controlling property on behalf of the owner):

Name: IMPERIAL METALS CORPORATION Telephone No.: (604) 669-8959

Company contact person: Malcolm Swallow Fax No.: (604) 687-4030

Address Suite 420 - 355 Burrard Street City Vancouver

Province B.C. Postal Code V6C 2G8

Signature of Operator/Agent [signature] M J A SWALLOW Date: March 22, 1995

4. **OWNER:** (Title Holder)

Name: IMPERIAL METALS CORPORATION Fax No:

Address City

ovince Postal Code: Telephone No:

Signature of Owner (or letter of Authorization from Owner): Date:

5. **NAME OF MANAGER:** Don Parsons — Manager's Telephone No.: (604) 687-7444
(Person responsible for management and operation of property)

To whom is correspondence sent regarding this notice? X Owner ___Operator

6. **DURATION:** Duration of work: From May 15, 1995 To December 31, 1995

7. **EXPLORATION WORK** (Non Mechanical)

Geochemical		Geophysical	
Prospecting		Geological	
Flagging/Blazing		Other	

8. **EXPLORATION WORK** (Mechanical)

Blasting		Drilling	4,572 m
Clearing Trees		Trenching	
Line Cutting	(Lease Boundary) 9,000 m		

If blasting, give details of explosives, magazines, etc.

Give number of existing explosives storage permit

9. **WATER SUPPLY** (subject to approval under the *Water Act*)

Describe the source of water supply: Bootjack Lake

Estimated quantity of water to be used: 0.009 c.f.s. Location of water intake (show on plan): East Shore

10. **WASTE WATER TREATMENT** (subject to approval under the *Waste Management Act*) including disposal of drilling mud and sludge.

Describe treatment and disposal facilities (size of settling pond, recycling, distance to nearest stream, etc). Show on plan.

The sanitary sewage will be built at the mill site. Surface runoff from disturbed areas will be collected in sedimentation ponds.

11. **ESTIMATED NUMBER OF WORKERS ON SITE** (including Contractors): 160

12. **EQUIPMENT LIST**

Note: all motorized equipment to comply with the Mining Code

	Number and Type	Size/Capacity		Number and Type	Size/Capacity
a)	1 Cat Dozer	D5	e)	2 Backhoes	3/4 cu.yd.
b)	1 Cat Dozer	D8	f)	3 Compactors	30 Ton
c)	1 Cat Dozer	D9	g)	2 Cat Wagons	24 cu.yc
d)	3 Cat Scrapers	DW21	h)	1 Motor Grader	

13. FIRST AID FACILITIES (Must comply with W.C.B. Regulations)

Describe methods of communication, emergency transportation, and type of first aid kit: Radiotelephone, ambulance and first aid supplies as required by W.C.B.

Location of nearest hospital: Williams Lake Travel time to hospital: 1.5 hours

14. SURFACE DISTURBANCE OFF MINERAL CLAIMS

Campsite: # of people .... Length: .... m Width: .... m Area: .... m²

Road access construction: Total length: 3,000 m Approximate width: 10 m Area: 30,000 m²

Other (specify) .... Area: .... m²

15. SURFACE DISTURBANCE ON MINERAL CLAIMS

(a) Settling ponds:	# 1		Length .... m	Width: .... m	Area: 1,000 m²
(b) Road construction:			Total length 12,000 m	Width: 10 m	Area: 120,000 m²
(c) Drilling:	# of sites: 30	Depth 0.5m	Length: 10 m	Width: 10 m	Area: 3,000 m²
(d) Trenching	# of trenches:	Depth:	Length: .... m	Width: .... m	Area: .... m²
(e) Test pits	# of pits 30	Depth: 5 m	Length: 4 m	Width: 4 m	Area: 480 m² *
(f) Linecutting			Length: 9,000 m	Width: 1.5 m	Area: 13,500 m²
Clearing Trees			Length: .... m	Width: - .... m	Area: 3,700,000 m² *
(h) Campsite:	# of people		Length: .... m	Width: .... m	Area: .... m²
(i) Underground work: area of surface disturbance			Length: .... m	Width: .... m	Area: .... m²
(j) Rock dumps: area of surface disturbance			Length: .... m	Width: .... m	Area: .... m²
(k) Other: describe: Construction of access road, mill & tailings dam.					Area: Incl. m²

TOTAL SURFACE AREA DISTURBED ON MINERAL CLAIMS THIS YEAR: 3,837,980 m²

PRIOR DISTURBANCE ON CLAIM 65,750 m² PLANNED RECLAMATION THIS YEAR: 480 m²

BALANCE OF UNRECLAIMED DISTURBANCE AT THE END OF PROJECT THIS YEAR: 3,837,500 m²

16. PRESENT STATE OF LAND ON WHICH WORK IS PROPOSED:

Forested: Recent clear-cut logging

Access roads (present use and condition): Existing forestry road to be improved.

Old workings (location, condition): Trenches for bulk samples left open.

* NOTE: Surface disturbance by test pit excavation and commercial timber harvest for mill site and tailings disposal area was reported earlier this year.

(Please complete reverse side of form.)

17. **RECLAMATION PROGRAM:** (All work programs require a reclamation program which must follow Guidelines for Mineral Exploration: Environmental, Reclamation and Approval Requirement)

Proposed use of land after reclamation: Forestry, wildlife, cattle grazing

Describe protective measures and proposed site reclamation methods with reference to the items listed below.

Topsoil handling (where applicable): Clear, grub and stockpile for reclamation.

Camp sites: N/A

Trenches, drill sites, major excavations: Filled, levelled, seeded

Roads: Scarified and seeded

Revegetation of disturbed areas: Native species and plants

Waste dumps: Final slope of 2:1, revegetated

Adits N/A

Drill core storage Removed from site.

Other: Industrial waste will be hauled by trucks from the mill and tailings disposal sites.

18. URANIUM/THORIUM

Is any part of this property designated as a Uranium/Thorium area? ___ Yes X No

If yes - has a survey been completed? ___ Yes X No

Note: if underground exploration or development is contemplated, an additional 'Underground Exploration Work Application for Approval' form must be completed.

This application will be returned if it is not accompanied by a legible map showing location of claim posts, property boundaries, location of property, access to property, location of work areas, roads, watercourses, proposed grid layouts, camps and other surface facilities. Preferred maps are: a) 1:50,000 topographic maps; b) claim maps; c) detailed map of area disturbed; or as required by the District Manager.

MINE PERMIT AMENDMENT APPLICATION

(UNDER THE BRITISH COLUMBIA MINES ACT)

PREPARED FOR

MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES

BY

MOUNT POLLEY MINING CORPORATION

NOVEMBER 1, 2010

PREFACE

This document is an application for an amendment to the exiting M-200 Permit (1995) held by Mount Polley Mining Corporation. This project includes expansion of current mining operations, the size of which does not warrant review under the British Columbia Environmental Assessment Act (as per British Columbia Environmental Assessment Act guidelines). This application will require approval by the Ministry of Energy, Mines and Petroleum Resources and Regional Mine Development Review Committee.

There are four First Nations groups which have interest in the area: the Tsq'escen' (Canim Lake Band), Xat'sull Cm'etem (Soda Creek/Deep Creek Band), T'exelc (Williams Lake Band) and the Stswecem'c/Xgat'tem (Canoe Creek Band/Dog Creek Band). It is anticipated that consultation with these groups will occur as part of the RMDRC process.

EXECUTIVE SUMMARY

This application is made on behalf of Mount Polley Mining Corporation, a subsidiary of Imperial Metals Corporation, owner of Mount Polley mine and property. Mount Polley mine is an open pit copper/gold mine located in central British Columbia, 56 km northeast of Williams Lake (latitude 52° 33' N and longitude 121° 38' W) and the Mount Polley property consists of 43 mineral claims encompassing 16,478 hectares and five mining leases totalling 1,867 hectares.

Mount Polley mine operated for four years from 1997 to 2001, and in September 2001, due to a sustained period of low metal prices, was shut down and placed on care and maintenance. In 2003, the discovery of a new high grade zone on the property, the Northeast zone, together with the rise in metal prices, led to the decision to reopen the mine. In August 2004, Imperial completed a feasibility study, which included an updated ore reserve statement and a new mining plan, and confirmed the viability of restarting operations at Mount Polley mine. In October 2004, a mining permit amendment and a mining lease were granted to include mining of the Northeast zone, and milling operations commenced in March 2005.

This application is being submitted as a requirement under Section 10 of the Mines Act of British Columbia to apply for an amendment to Permit M-200, and the key benefit of this project will be to increase the mine life to the end of 2016. Key components include:

- mining of the C2 and Boundary zone pits;
- construction of the Southeast rock disposal site;
- development of a temporary West Stockpile for potentially acid generating waste;
- development of a temporary East Stockpile for potentially acid generating waste; and
- construction of a South haul road joining the Springer pit and the Tailings Storage Facility.

Consultants were retained to complete work deemed to be outside the expertise of in-house personnel. Studies address all proposed work and include: storage of PAG material (SRK Consulting and Golder Associates); geotechnical analysis of the proposed footprint (Golder Associates); and soil assessment (Ronald Meister).

Wide distribution of project information and consultations with the public and First Nations are key expectations of the mine project review process. Public consultation measures taken will be in compliance with the MEMPR Public Consultation Policy, and relevant guidance may also be obtained from the Provincial Policy for Consultation with First Nations.

All work presented has been completed during open discussion with Ministry of Energy, Mines and Petroleum Resources representatives and reflects a comprehensive and accurate representation of planned mining and construction. Project planning and review conducted both internally by Mount Polley Mining Corporation and externally by consultants retained (as outlined above) confirms that all aspects of the project are feasible and abide by the regulations of all governing bodies. To date, no formal review process of any of the aforementioned work has been completed; however, Moss Giasson of Montane Environmental Services has been retained for external review.

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LIST OF ABBREVIATIONS

Application	this document, inclusive of all appendices and referenced material
ARD	acid rock drainage
BCEAA	British Columbia Environmental Assessment Act
cm	centimetre(s)
ha	hectare(s)
HDPE	high-density polyethelene
Imperial	Imperial Metals Corporation
km	kilometre(s)
m	metre(s)
MEMPR	Ministry of Energy, Mines and Petroleum Resources
Mines Act	the Mines Act of British Columbia
mm	millimetre(s)
MOE	Ministry of Environment
MOFR	Ministry of Forests and Range
MPMC	Mount Polley Mining Corporation
NAG	non acid generating
PAG	potentially acid generating
PESCP	perimeter embankment seepage control pond
Point West	Point West Heritage Consulting Limited
Procon	Procon Mining and Tunnelling Corporation
RDS	rock disposal site
RMDRC	Regional Mine Development Committee
SAG	semi-autogenous grinding
SERDS	southeast rock disposal site
SEZ	Southeast zone
South Road	the south haul road proposed in the Application
t	tonne(s)
tpd	tonne(s) per day
TSF	tailings storage facility

1. INTRODUCTION

1.1. Applicant Identification

This application is made on behalf of Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals Corporation (Imperial), owner of Mount Polley mine and property. Imperial is a Canadian mining company, with its corporate head office in Vancouver, British Columbia. Imperial is active in the acquisition, exploration, development, mining and production of base and precious metals, and key properties are: the operating Mount Polley open pit copper/gold producing mine in central British Columbia; the operating Huckleberry open pit copper/molybdenum producing mine (50% interest) in northern British Columbia; exploration stage Sterling (gold) in Nevada, USA; and development stage properties Red Chris (copper/gold), Ruddock Creek (zinc/lead), and Catface (copper), all in British Columbia.

MPMC was formed in 1996 through a joint venture between Imperial and Sumitomo Corporation (SC Minerals Canada Limited) by means of loan financing. Construction of the 18,000 tonne per day (tpd) mill feed Mount Polley mine and milling facility began in May 1996, and was completed in June 1997. Imperial increased its interest in the Mount Polley mine to 100% in December 2000 by acquiring Sumitomo's 47.5% interest. Mining operations continued until September 2001, at which time operations were suspended due to low metal prices. In August 2004, Imperial completed a feasibility study which included an updated ore reserve statement and a new mining plan, and confirmed the viability of restarting operations at Mount Polley mine. In October 2004, a mining permit amendment and a mining lease were granted, and milling operations commenced in March 2005. The official Mount Polley mine re-opening ceremony took place in September 2005.

Contact Information for Mount Polley mine is as follows:

c/o Mount Polley Mining Corporation
5720 Bootjack FSR
Likely, BC V0L 1N0
Phone: (250) 790-2215
Fax: (250) 790-2613

The individual representing MPMC in respect to this permit application is Ron Martel, and personal contact information is as follows:

Ron Martel, CCEP, CET
Environmental Superintendent
Direct line: (250) 790-2215 ext. 409
Email: rmartel@mountpolley.com

1.2. Application Background

This document and herein referenced materials, in their entirety, form the mine permit application (Application). Main components of the Application include: Project Settings and Characteristics; Project Description and Scope of Project; Reclamation Program; Acid Rock Drainage and Metal Leaching Assessment; Reclamation Cost Estimates; and Other Comments.

Project planning to date includes the aforementioned components, which have been prepared in collaboration between internal MPMC departments (Engineering and Environmental) and external consultants retained (detailed in Table 1.2.1).

Table 1.2.1 External Consultants

Consultant	Contributions
SRK Consulting Christina James, M.Sc. Stephen Day, P.Geo	• 2010 Review of Springer Zone Humidity Cell Data, Mount Polley Mine • Delay to Onset of Acidic Conditions for Springer Zone PAG Waste Rock • Estimated Springer PAG Dump Drainage Chemistry • Delay to Onset of Acidic Conditions for SEZ PAG Waste Rock
Golder Associates Arianna Piazza, M.Sc. Willy Zawadzki, M.Sc., P.Geo Don Chorley, M.Sc., P.Geo.	• Predictions of Pit Lake Formation for the Springer Open Pit - Mount Polley Mine • Geotechnical Analysis of Proposed Footprint
Ronald P. Meister, RPF, PAg.	• Soils assessment
Moss Giasson, PAg.	• Permit Review

All work presented has been completed during open discussion with Ministry of Energy, Mines and Petroleum Resources (MEMPR) representatives, and reflects a comprehensive and accurate representation of planned mining and construction. To date, no formal review process of any of the aforementioned work has been completed; however, Moss Giasson of Montane Environmental Services has been retained for external review.

1.3. Project Overview

This Application is being submitted as a requirement under Section 10 of the Mines Act of British Columbia (Mines Act) to apply for an amendment to the Mines Act Permit M-200 to include:

- mining of the C2 and Boundary zone pits;
- construction of the Southeast rock disposal site (SERDS);
- development of a temporary West Stockpile for potentially acid generating (PAG) waste;
- development of a temporary East Stockpile for PAG waste; and
- construction of a South haul road (South Road) joining the Springer pit and the Tailings Storage Facility (TSF).

The C2 and Boundary zone pits would be mined in conjunction with the Springer pit, utilizing the same mine equipment, mill, and TSF as is existing. Non-acid generating (NAG) waste from the Boundary zone pit will be stored in the already permitted Wight pit waste rock dump (i.e. the Northeast Rock Disposal Site), or in the Wight pit footprint, while the proposed SERDS will be used to store NAG from the proposed C2 pit. Neither the Boundary zone nor the C2 pit is expected to produce PAG waste. The proposed West PAG Stockpile will be used for temporary storage of PAG waste from the Springer pit before PAG is backfilled to the Springer pit for subaqueous disposal upon the completion of its development. The proposed East PAG Stockpile will be used for temporary storage of PAG waste from the Southeast zone (SEZ) pit before PAG is backfilled to the Springer pit for subaqueous disposal upon the completion of its development.

All components of the proposed amendment will occur either on Mining Leases or Mine Claim Areas, as discussed in Section 2.9: Land Status and Use. The key benefit of this project will be to increase the mine life to the end of 2016.

1.3.1. Property Overview

Mount Polley mine is an open pit copper/gold mine located in central British Columbia (Figure 1.3.1.1), 56 kilometres (km) northeast of Williams Lake (latitude 52° 33' N and longitude 121° 38' W).

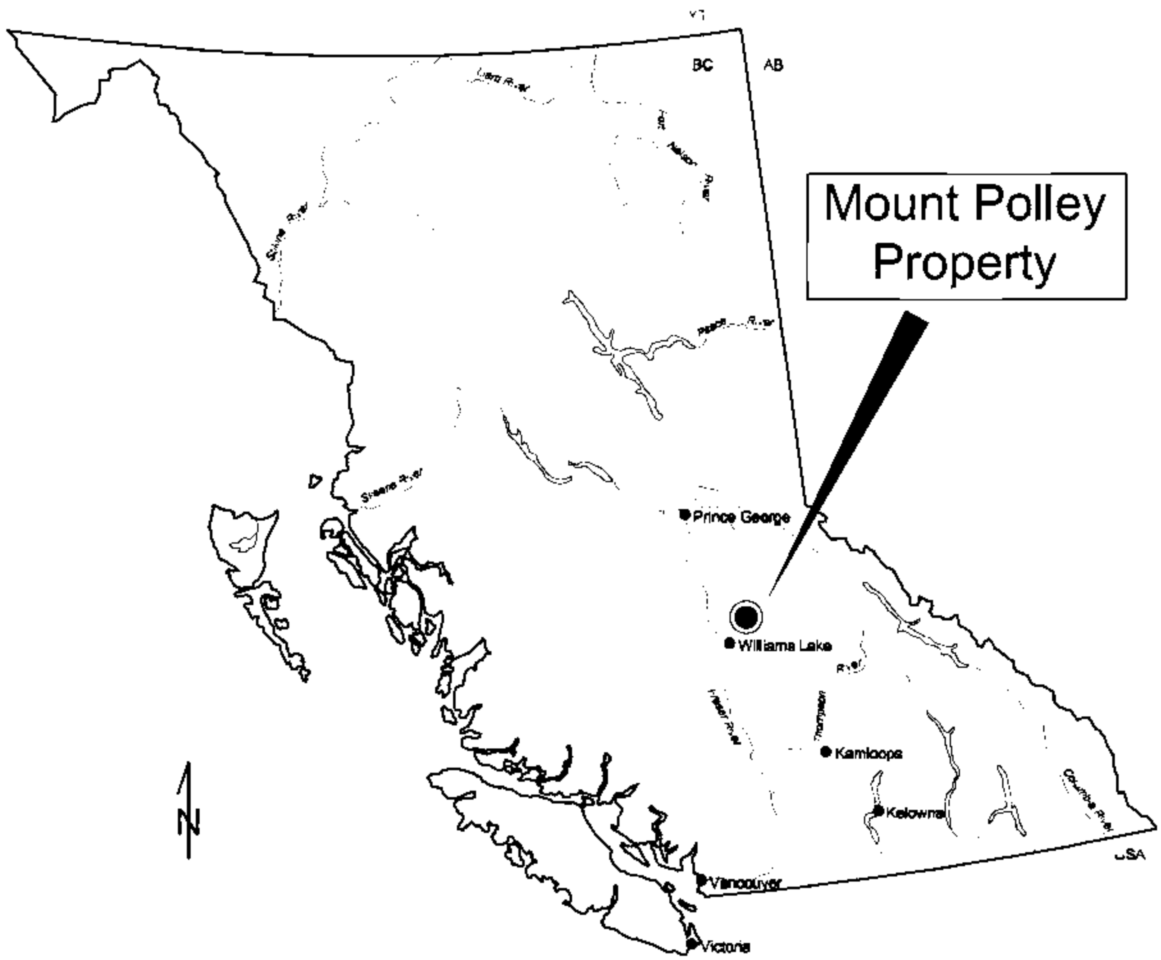

Figure 1.3.1.1 - Location Map

Currently, the property consists of 43 mineral claims encompassing 16,478 hectares (ha) and five mining leases totaling 1,867 hectares (Figure 1.3.1.2).

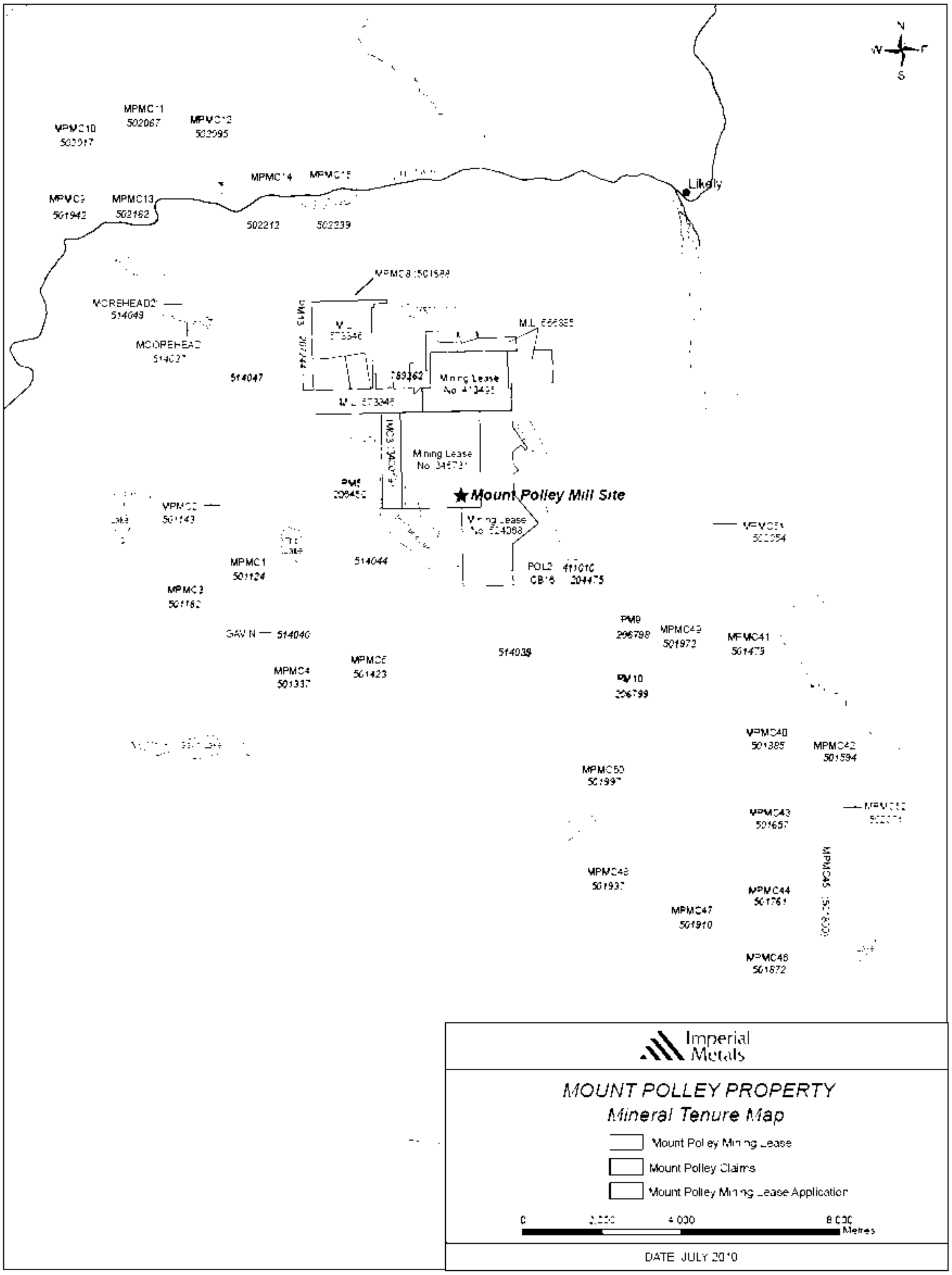

Figure 1.3.1.2 Mount Polley Claim Map

Mount Polley is an alkalic porphyry copper/gold deposit hosted within brecciated plagioclase porphyry. While the principal copper-bearing mineral is chalcopyrite, other copper minerals are present, especially in oxidized zones. These other minerals include bornite, malachite, chrysocolla, and azurite. Gold is present principally as inclusions in copper sulphides and as free liberated grains.

In late May 1996, construction of an 18,000tpd mill feed mine and milling facility began at the Mount Polley site. Construction was completed in June of 1997 and plant start-up and commissioning took place in late June, with the plant rising towards design capacity by the end of 1997. Mining continued until September of 2001, when operations were suspended due to low metal prices and exhaustion of the Cariboo pit. In the fall of 2003, the Northeast zone was discovered, with an M-200 amendment following in October 2004 and operations resuming in March 2005. The mine life currently extends to the fourth quarter of 2015, but with the components included in this amendment, mine life will be extended one year, to the fourth quarter of 2016.

1.3.2. Permit M-200 – Work Systems Approval

The Ministry of Energy and Mines, Mines Branch, Energy and Minerals Division issued Mount Polley mine an M-200 Permit in 1995. This permit allows for:

- open pit mining;
- disposal of waste in designated rock disposal sites (RDS);
- construction of the TSF;
- characterization of waste rock, soil and tailings;
- monitoring of drainage from various mine components; and
- all aspects of reclamation.

The latest amendment dated July 8, 2009 permitted the mining of the Pond Zone, Mount Polley mine's sixth open pit. Previous amendments include:

- stages four, five, and six construction of the TSF, now at 958 metre (m) elevation (May 2005, August 2006 and February 2008, respectively);
- construction of a haul road from the Northeast zone to the TSF (August 2005);
- mining of the SEZ (November 2005);
- construction and operation of a copper oxide test heap leach facility (March 2007);
- Boundary Road construction (August 2007); and
- rehabilitation of the Wight pit high wall (December 2007)

Currently, PAG material is stored in the Wight pit below a flood elevation level of 912m.

1.4. Regulatory Framework

This Application will require approval by the MEMPR and Regional Mine Development Review Committee (RMDRC). In accordance with mine project thresholds for British Columbia Environmental Assessment Act (BCEAA) review, since the proposed modifications do not increase the area of disturbance by 50% or more, or create 750ha or more of new disturbance, the Application does not require BCEAA review. The proposed expansion considers an area greater than that previously permitted by the BCEAA and MEMPR, representing an increase of 177.7 hectares (ha), or 27.8% (Figure 1.4.1). It should be noted that 28.1ha (15.8%) of this area is in the form of temporary stockpiles, from which all PAG material will be backfilled into pits before the end of mine life. The total footprint area of the proposed expansion is 224.2ha (Figure 1.4.2), while only 160.7ha of this area is "new" footprint on undisturbed ground (Figure 1.4.3).

Figure 1.4.1 – Assessment Approval Areas

Figure 1.4.1 illustrates existing permitted areas (Red – 1989 EIA, Green – 1996 M-200 Permit, Blue – M-200 Permit amendments) and proposed area (Yellow).

Figure 1.4.2 – Total Footprint Area

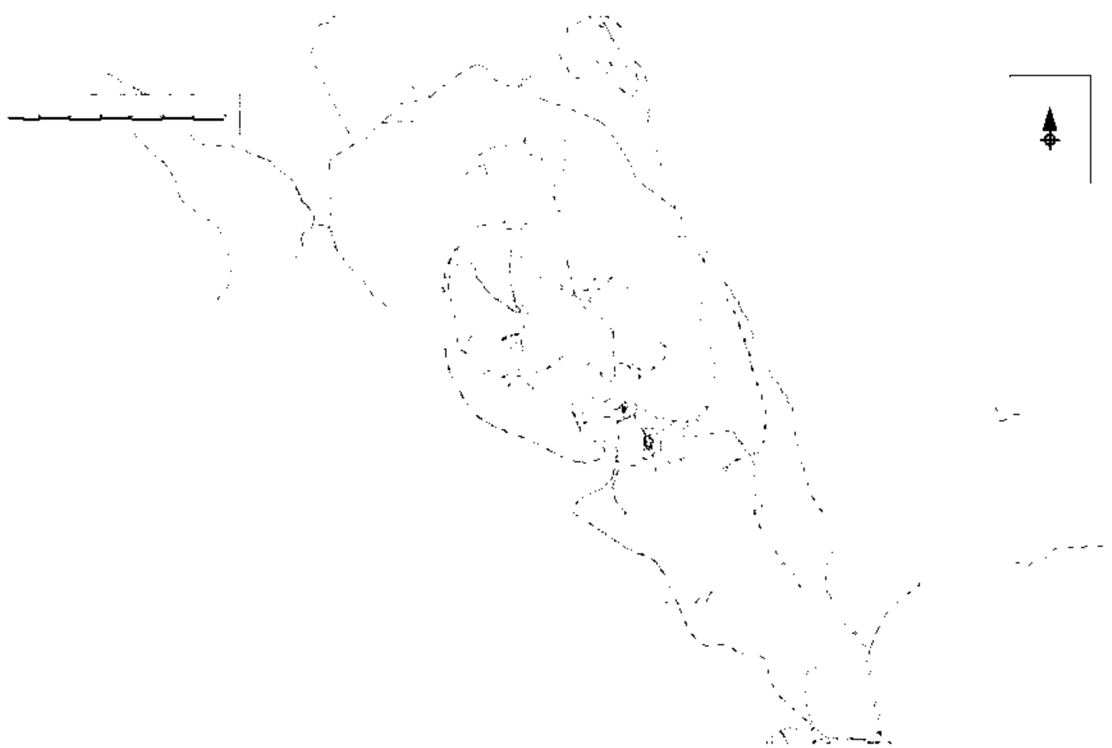

Figure 1.4.3 – New Footprint Area

Table 1.4.1 summarizes areas as outlined in Figures 1.4.1 through 1.4.3.

Table 1.4.1 Permit Area Summary

Figure 1.4.1 - Assessment Approval Areas

Document	Area (ha)	
1989 EIA	237.7	
1996 M-200 Permit	120.3	
M-200 Permit Amendments	281.0	
	639.0	
2010 Proposed	*177.7*	*27.8%*

Figure 1.4.2 & 1.4.3 - Footprint Areas

Total Footprint Area	224.2
New Footprint Area	160.7

All construction will be completed in accordance with the Mines Act, and, as such, will be subject to review and inspection by the MEMPR. Licenses and permits required in the completion of the project are as listed in Table 1.4.2.

Table 1.4.2 License and Permit Requirements and Schedule

Body	Permit/License Required	Projected Date
MEMPR	M-200 Amendment	11-Feb-10
Ministry of Forests	License to Cut	31-Dec-10

1.5. Information Distribution and Consultation

This Application serves as a project description, with a focus on potential environmental, health and safety, social, and economic impacts. Upon formation of the RMDRC, subsequent meetings will determine specific methodologies or information required for the final application.

Wide distribution of project information and consultations with the public and First Nations are key expectations of the mine project review process. Public consultation measures taken will be in compliance with the MEMPR Public Consultation Policy, and relevant guidance may also be obtained from the Provincial Policy for Consultation with First Nations.

Information distribution and consultation may take place by a variety of means – public meetings and open houses, one-on-one meetings with interested parties, publication of articles in the written media, enclosures in community newspapers, interviews on local radio and television, and by means of participation in community events, fairs, etc.

Currently, MPMC has a public liaison meeting scheduled for November 25th, 2010. All proposed information distribution and consultation activities will be summarized in Appendix I: Scheduled Consultation, which will be updated and re-submitted during the Application review process. Proposed consultation includes:

- November 1st: Draft Permit Submission to MEMPR
- November 15th: RMRDC Meeting
- November 24th: Public Liaison Meeting
- November 30th: Referral by MEMPR
- January 31st: Comments Received by MEMPR from Agencies
- February 28th: Issue Permit with Conditions

1.6. Scope of Assessment and Study Areas

As detailed in Table 1.2.1 and summarized herein, consultants were retained to complete work deemed to be outside the expertise of in-house personnel. Studies address all proposed work and include: storage of PAG material (SRK Consulting and Golder Associates); geotechnical analysis of the proposed footprint (Golder Associates); and soil assessment (Ronald Meister). Full versions of these reports are included as appendices.

1.6.1. 2010 Review of Springer Zone Humidity Cell Data, Mount Polley Mine

Given the plan to temporarily stockpile PAG material during mine operation, characterizing Acid Rock Drainage (ARD) onset was seen as an important parameter to understand. Based on the report completed by Christina James, M.Sc. and Stephen Day, P. Geo of SRK Consulting, it was projected that the estimated delays to ARD onset are between five years (sample HC9) and 19 years (sample HC15), although the five-year onset is seen as unlikely given the low sulphur content of the materials.

Seeing as PAG material storage by stockpiling is an intermediate step, with material being backfilled to the Springer pit prior to even the shortest projected ARD onset time (five years), there are no concerns with the stockpiling of the Springer pit material in the temporary West PAG Stockpile.

1.6.2. Delay to Onset of Acidic Conditions for Springer Zone PAG Waste Rock

Upon completion of mining in the Springer pit, PAG material previously stockpiled is to be re-handled, with permanent subaqueous disposal in the Springer pit. It is important that the PAG waste rock is placed underwater before it becomes acidic, so that ARD from the stockpile does not need to be managed, and the Springer pit lake is not affected by acidic salts in the PAG waste rock as it becomes inundated.

According to the report prepared by Stephen Day, P.Geo of SRK Consulting, approximately 2% of the rock may become acidic after 20 years, and 10% after 40 years, with the majority of the rock with higher NPR taking over 100 years to become acidic. It is concluded that PAG rock placed in stockpiles is not likely to become significantly acidic due to buffering provided by carbonate minerals.

1.6.3. Estimated Springer PAG Dump Drainage Chemistry

Drainage estimates were completed for the Springer PAG dump (temporary West PAG Stockpile) based on average total precipitation and designed dump mass and area. Estimates of drainage chemistry under both non-acidic (during stockpiling) and acidic conditions (long-term storage) were completed by Stephen Day, P.Geo, of SRK Consulting.

It is his conclusion that under non-acidic conditions, pH remained at 8, with concentrations of Cu *0.023mg/L*, Cd *0.0036mg/L*, Se *1.4mg/L*, and SO_4 *930mg/L*, and that under acidic conditions, it is unlikely that the pile as a whole will produce strongly acidic conditions ($pH<4$), with concentrations of Cu *340mg/L*, Cd *0.04mg/L*, Se *0.085mg/L*, and SO_4 *2400mg/L*.

1.6.4. Predictions of Pit Lake Formation for the Springer Open Pit - Mount Polley Mine

With the long-term PAG mitigation strategy of sub-aqueous disposal in the Springer pit, it is necessary to model pit lake formation in order to ensure suitable storage conditions. Based on final pit geometry, estimated precipitation and groundwater inputs, and losses due to evaporation, Arianna Piazza, M.A.Sc. (Eng.), Willy Zawadzki, M.Sc., P.Geo., and Don Chorley, M.Sc., P.Geo, of Golder Associates developed an estimate of pit lake elevations.

It is the opinion of Golder Associates that according to the above inputs, assuming a final PAG elevation of 950m, the pit lake should reach an elevation at which the PAG material is completely sub-aqueous contained after nine years. With ARD onset and drainage chemistry as included, this falls well within the 20-year projected safe timeline.

1.6.5. Delay to Onset of Acid Conditions for SEZ PAG Waste Rock

Upon completion of mining in the SEZ pit, PAG material previously stockpiled is to be re-handled, with permanent subaqueous disposal in the SEZ or the Springer pit. It is important that the PAG waste rock is placed underwater before it becomes acidic, so that

ARD from the stockpile does not need to be managed, and pit lakes are not affected by acidic salts in the PAG waste rock as it becomes inundated.

According to the report prepared by Stephen Day, P.Geo of SRK Consulting, approximately 10% of the rock might become acidic in 2 years, and 35% after 10 years. The majority of the rock with higher NPR might take over 20 years to become acidic. A number of factors complicate the actual estimate for higher NPR materials. Increasing acidification along with heating would result in accelerated oxidation and NP depletion though decreasing oxidation rates due to sulphide depletion and formation of secondary mineral coatings would result in lower oxidation rates and greater time to onset of acidic conditions.

The existing humidity cells provide partial confirmation of the calculation. One sample has an NP/AP of 0.2 and has a calculated delay to onset at room temperature of eight years. It has operated for two years and has not generated acidic leachate. Two samples with NP/APs of 0.4 and 0.9 have been operating for five years and have also not generated acidic leachate.

1.6.6. Soil Assessment

All salvageable soil (estimated volume of 638,105 m^3) can be used for reclamation. Site soil descriptions and corresponding photos can be found in Appendix H.

2. PROJECT SETTING AND CHARACTERISTICS

This section addresses: climate; geology of the deposit; land surface drainage; hydrology and water quality; fisheries and aquatic resources; surficial geology, terrain and soils mapping; soil survey and characterization for reclamation; land status and use; First Nations setting; and archaeological impact review.

2.1. Climate

As a requirement of Effluent Permit PE 11678, the collection of detailed meteorology data has been performed at the mine site. The main objective of the meteorology data collection program is to provide site-specific precipitation and evaporation data for use in water balance prediction and closure planning.

Mean monthly temperatures range from 13.7°C in July to –10.7°C in January, with a mean annual temperature of 4.0°C. Precipitation is well distributed throughout the year, ranging from 600 millimetre (mm) to 800 mm annually (averaging 755 mm), with 300 mm falling as snow. Prevailing winds are from the northwest in the winter months and from the south and southwest during the summer months. Detailed weather information can be obtained from the Annual Reclamation reports.

2.2. Geology and Description of the Deposit

Mount Polley is an alkalic porphyry copper/gold deposit. It lies in the tectono-stratigraphic Quesnel terrane or Quesnellia, which extends from south of the United States border to north-central British Columbia. The characteristic component of Quesnellia is a Middle Triassic to Early Jurassic assemblage of volcanic, sedimentary and plutonic rocks which formed in an island arc tectonic setting, outboard of the ancestral North American continental margin in the early Mesozoic. Quesnellia hosts several major porphyry copper deposits such as Highland Valley, Copper Mountain, Afton-Ajax and Mount Milligan, all generated by early Mesozoic, calc-alkalic or alkalic island-arc magmatism.

2.2.1. Geology

Mount Polley itself is a complex of intermediate intrusions which were emplaced into the Triassic sedimentary-volcanic succession in the waning stages of arc magmatism, near the end of the Triassic (around 205 Ma). Mount Polley lies in the hinge zone of the regional syncline. The intrusive complex is about six km long (north-northwest) and three km wide, lying between Polley Lake in the east and Bootjack Lake in the west. A large nepheline syenite intrusion, the Bootjack Stock, occurs south of Mount Polley. It is the same age as Mount Polley and is part of the overall intrusive centre, but is not associated with significant mineralization.

The Mount Polley intrusions are typically monzodiorite, but range from diorite (oldest) to monzonite (youngest) - not all are porphyritic. They are undersaturated in silica, and have an alkalic or shoshonitic chemical signature, with quartz being very rare. Some intrusions are texturally distinct, or form discrete dike-like bodies, but most of the igneous rocks are compositionally similar, variably altered, and have indistinct contact relations. In addition to the intrusions, there are zones of polymictic magmatic-hydrothermal breccias, some of which are related to mineralization events. These breccias, and some intrusions that are particularly rich in inclusions, have previously been incorrectly interpreted as volcanic breccias.

Hydrothermal alteration is characterized by potassic (potassium feldspar and locally biotite), albite and magnetite metasomatism, with zones of garnet or actinolite-rich calc-silicate. Mineralization and most of the alteration at Mount Polley occurred in the late stages of igneous activity.

2.2.2. Mineralization

Copper mineralization is widespread at Mount Polley, but is concentrated in zones of strong hydrothermal fracturing or brecciation. Some of these zones have become ore reserves, while others are still being explored. The strongest alteration and most extensive mineralization occurs in the Core zone of Mount Polley, consisting of the Cariboo, Bell and Springer orebodies, to which can now be added the C2 zone orebody (historically called the C2/207 zone). The Cariboo deposit was mined out in 2001 and the Bell was completed in 2008. Two km southeast of the Core zone is the Southeast zone, which straddles the contact with Nicola Group basaltic-andesitic rocks. The Pond zone, 500m southwest of the Southeast zone, consists of skarn-hosted mineralization around the southern contact of Mount Polley intrusions with Nicola Group limestone. The Northeast zone (Wight pit) and the Boundary zone, 1.5 km northeast and north of the Bell pit respectively, contain orebodies in hydrothermal breccias which have different alteration and mineralization styles and grade characteristics from the Core zone deposits.

2.2.2.1. Springer Zone

In general, high grade feed from the Springer pit consists of potassium feldspar and albite-altered breccias similar to those in the Cariboo. Copper mineralization occurs mostly as disseminated, veined and blebby chalcopyrite. Minor bornite and trace quantities of covellite, chalcocite and digenite are also present. Copper oxides (true oxides, carbonates and silicates) are present in varying quantities throughout the deposit, depending on the zone. Malachite/azurite occurs as powdery fracture-fill. Chrysocolla occurs in fractures and veinlets and as blebs of up to two centimetres (cm), and will only be abundant in the upper part of the south Springer. Magnetite content within the breccia is expected to be similar to the Cariboo ore, which w pitas found to be highly variable depending on location and correlated strongly with copper and gold grades. High grade (Cu-Au) magnetite 'pipes' like those in the South and East Lobe zones of the Cariboo have not been identified in the Springer, but as was the case in the Cariboo, they may still be found during mining. Drilling in the Springer has located zones of mineralized, magnetite and garnet-rich calc-silicate alteration. The size and configuration of the final Springer pit is still under revision as extensions of the mineralization continue to be discovered at depth and to the northwest. A 73,000 tonne (t) sample of highly oxidized copper mineralization was mined and test milled from the 1170/60 elevation of the upper south Springer in September 2001. This sample was used to test the recovery and milling characteristics of this type of high copper oxide mineralization using the existing mill. The sample had a head grade of 0.37% copper and 0.58 g/t gold, with a 70% copper oxide ratio. The recovery of copper from this test was only 16.4%, however, the gold recovery was 67.3%, showing that gold recovery is largely independent from the oxide copper content [note: copper oxide ratio = copper oxide assay in % / total copper assay in %].

2.2.2.2. C2 Zone

The centre of the C2 zone is about 200m south of the Cariboo pit. The C2 mineralization is hosted within potassium feldspar and albite-altered breccias similar to those in the Cariboo, with domains of magnetite-rich breccia, and mineralized skarn alteration. Non-sulphide copper mineralization consists of 40-60% chrysocolla, with azurite and malachite making up the rest of the oxide copper content. The sulphide portion of the ore consists mostly of fine-grained chalcopyrite with traces of bornite. The high overall copper oxide ratio originally made the C2 zone uneconomic. However, subsequent drilling (percussion and core) focused in a sub-area of the C2 zone called the Wagon Wheel has revealed a magnetite-cemented hydrothermal breccia hosting high grade copper and gold. The drilling indicates a roughly tabular gold-rich mineralized zone trending and gently plunging north towards the Cariboo pit. Step-out and infill drilling in 2006 and 2007 expanded this zone, and the rest of the C2, to the east, north and particularly to the southwest. An economic pit has now been designed for the central part of the C2 zone.

2.2.2.3. Southeast Zone

The SEZ pit was started in 2008. The pit is 1.4 km southeast of the Cariboo pit. It is an area of monzonite diking, hydrothermal breccias and mineralization, which developed around the contact between the Mount Polley intrusive rocks to the west, and more mafic, basaltic-andesitic rocks to the east. Pyrite and chalcopyrite occur disseminated in the cement-matrix in open-space or vein fillings and in veinlets extending into breccia clasts or into surrounding coherent (non or weakly brecciated) rock. Compared to other deposits at Mount Polley, potassium feldspar alteration is generally weak here, occurring in patchy zones and fracture haloes; pyrite and epidote are stronger. The mineralization is not oxidized from a few metres below surface downwards.

The gold/copper ratio is generally higher than in most other Mount Polley deposits, at between one and four (grams per tonne vs %). Gold (and silver) is closely correlated with chalcopyrite, although there are a few gold-only zones, with the gold possibly associated with pyrite or epidote. Rare molybdenite occurs in albite veins, and locally accompanies pyrite and chalcopyrite. Drilling has determined that the mineralization extends much deeper than had been outlined in earlier programs (2000-2001) to about 500m depth.

The Pond zone is 500m southwest of the SEZ pit, and is being developed in a separate open pit. Disseminated chalcopyrite and minor bornite mineralization occur in skarn-altered intrusive rocks near their contact with Nicola Group limestone. The zone forms a north-south, vertical tabular body with copper grades reaching several per cent, with gold and silver values also being high. The limestone is not exposed, but occurs close to the surface and will be beneficial for SEZ waste treatment.

2.2.2.4. Boundary/Zuke Zones

The Boundary zone is geologically similar to the Northeast zone, 600m to the east-southeast, although it differs in that its characteristic feature is magnetite-rich hydrothermal breccia in the highest grade part of the zone. Significant mineralization occurs over an area about 150m in diameter, 200m in depth from surface. It is hosted in brecciated monzonite or monzodiorite, and lesser fragmental polymictic breccia. Otherwise, the alteration and style of mineralization is similar to the Northeast zone, although copper/gold grades are generally lower, and bornite is limited. Exploration drilling in 2008 confirmed a high grade extension to the Boundary zone, at depth and to the east towards the Wight pit, known as the Zuke zone.

2.2.3. Prediction of Metal Leaching and Acid Rock Drainage Geochemistry

Given the plan to temporarily stockpile PAG material during mine operation, characterizing Acid Rock Drainage (ARD) onset was seen as an important parameter to understand. Based on the report completed by Christina James, M.Sc. and Stephen Day, P. Geo of SRK Consulting, it was projected that the estimated delays to ARD onset are between five years (sample HC9) and 19 years (sample HC15), although the five-year onset is seen as unlikely given the low sulphur content of the materials.

Seeing as PAG material storage by stockpiling is an intermediate step, with material being backfilled to the Springer pit prior to even the shortest projected ARD onset time (five years), there are no concerns with the stockpiling of the Springer pit material in the temporary West PAG Stockpile.

Upon completion of mining in the Springer pit, PAG material previously stockpiled is to be re-handled, with permanent subaqueous disposal in the Springer pit. It is important that the PAG waste rock is placed underwater before it becomes acidic, so that ARD from the stockpile does not need to be managed, and the Springer pit lake is not affected by acidic salts in the PAG waste rock as it becomes inundated.

According to the report prepared by Stephen Day, P.Geo of SRK Consulting, approximately 2% of the rock may become acidic after 20 years, and 10% after 40 years, with the majority of the rock with higher NPR taking over 100 years to become acidic. It is concluded that PAG rock placed in stockpiles is not likely to become significantly acidic due to buffering provided by carbonate minerals.

Drainage estimates were completed for the Springer PAG dump (temporary West PAG Stockpile) based on average total precipitation and designed dump mass and area. Estimates of drainage chemistry under both non-acidic (during stockpiling) and acidic conditions (long-term storage) were completed by Stephen Day, P.Geo, of SRK Consulting.

It is his conclusion that under non-acidic conditions, pH remained at 8, with concentrations of Cu *0.023mg/L*, Cd *0.0036mg/L*, Se *1.4mg/L*, and SO_4 *930mg/L*, and that under acidic conditions, it is unlikely that the pile as a whole will produce strongly acidic conditions ($pH<4$), with concentrations of Cu *340mg/L*, Cd *0.04mg/L*, Se *0.085mg/L*, and SO_4 *2400mg/L.*

With the long-term PAG mitigation strategy of sub-aqueous disposal in the Springer pit, it is necessary to model pit lake formation in order to ensure suitable storage conditions. Based on final pit geometry, estimated precipitation and groundwater inputs, and losses due to evaporation, Arianna Piazza, M.A.Sc. (Eng.), Willy Zawadzki, M.Sc., P.Geo., and Don Chorley, M.Sc., P.Geo, of Golder Associates developed an estimate of pit lake elevations.

It is the opinion of Golder Associates that according to the above inputs, assuming a final PAG elevation of 950m, the pit lake should reach an elevation at which the PAG material is completely sub-aqueous contained after nine years. With ARD onset and drainage chemistry as included, this falls well within the 20-year projected safe timeline.

Detailed information regarding metal leaching and ARD onset is as further described Section 5: Acid Rock Drainage and Metal Leaching Analysis.

2.3. Land Surface Drainage

The Mount Polley mine site is located near the eastern edge of the Fraser Plateau physiographic sub-division, which is characterized by rolling topography and moderate relief. Elevations range from 920m at Polley Lake to 1266m at the summit of Mount Polley, and the mine site is situated along a topographic height of land known as the Mount Polley Ridge. This ridge runs northeast to southwest between Polley Lake and Bootjack Lake, and extends over parts of four watersheds (Figure 2.3.1). The Polley Lake and Bootjack Creek watersheds drain into Quesnel Lake, while the Bootjack Lake and 6K Creek watersheds (both part of the larger Quesnel Lake watershed) enter Morehead Lake. The temporary West PAG stockpile, C2 pit, and much of the South Road are located in the Bootjack Lake watershed, the SERDS and temporary East PAG dump are within the Polley Lake watershed, while the southernmost portion of the South Road is within the Bootjack Creek watershed.

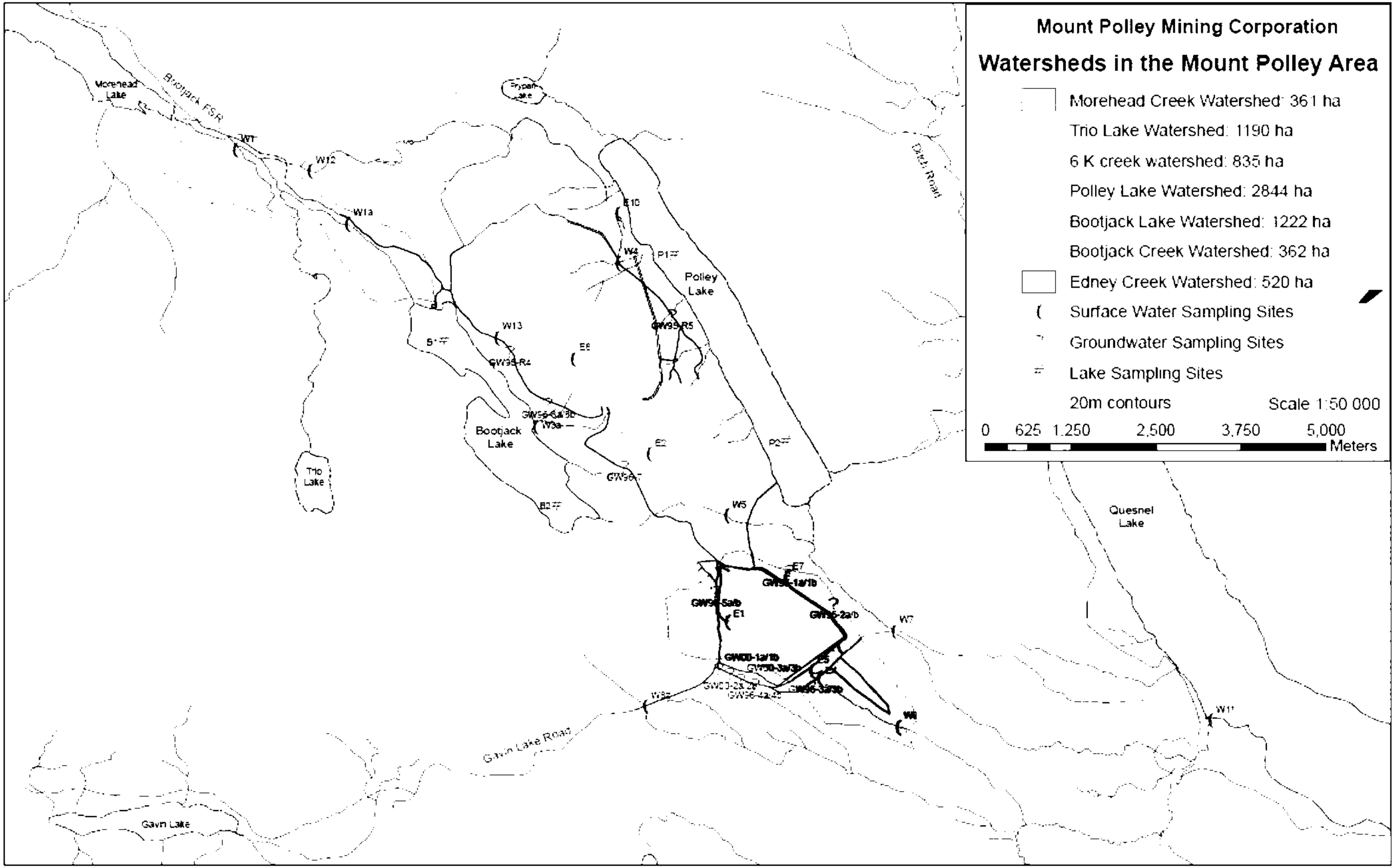

Figure 2.3.1 - Watersheds in the Mount Polley Area

2.4. Hydrology and Water Quality

Mount Polley mine's current obligations to monitor hydrological and water quality conditions around the mine site, including the drainage area are covered by PE11673 Effluent Permit Conditions as set out by the Ministry of Environment (MOE). Figure 2.4.1 shows locations of current surface and groundwater sampling sites in relation to the proposed mining and construction.

Staff gauge measurements are recorded at six surface water stations (W12, W1a, W7, W11, W4, and W8) in conjunction with water sample collection. Pressure transducers, located at two locations along Hazeltine Creek (adjacent to the TSF and at the confluence into Quesnel Lake) also record flows continuously. Flow determinations and stage discharge curves are performed at these stations and are reported in the Annual Environmental Report.

All water that interacts with mining activities is currently collected and directed to the TSF to ensure that the quality of water in the environment is maintained. A new West Ditch will be constructed along the west edge of the temporary West PAG Stockpile to contain any impacted water, prevent it from entering Bootjack Lake, and directly flow to the TSF. In addition, a Southeast Ditch will run east and connect to the existing Long Ditch (which also carries water to the TSF) and a Central Ditch will collect impacted water and pump it back to the mill site sump. Construction details are included in Section 3.4.1: Ditch Construction. Detailed water quality data is included in the Annual Environmental Report.

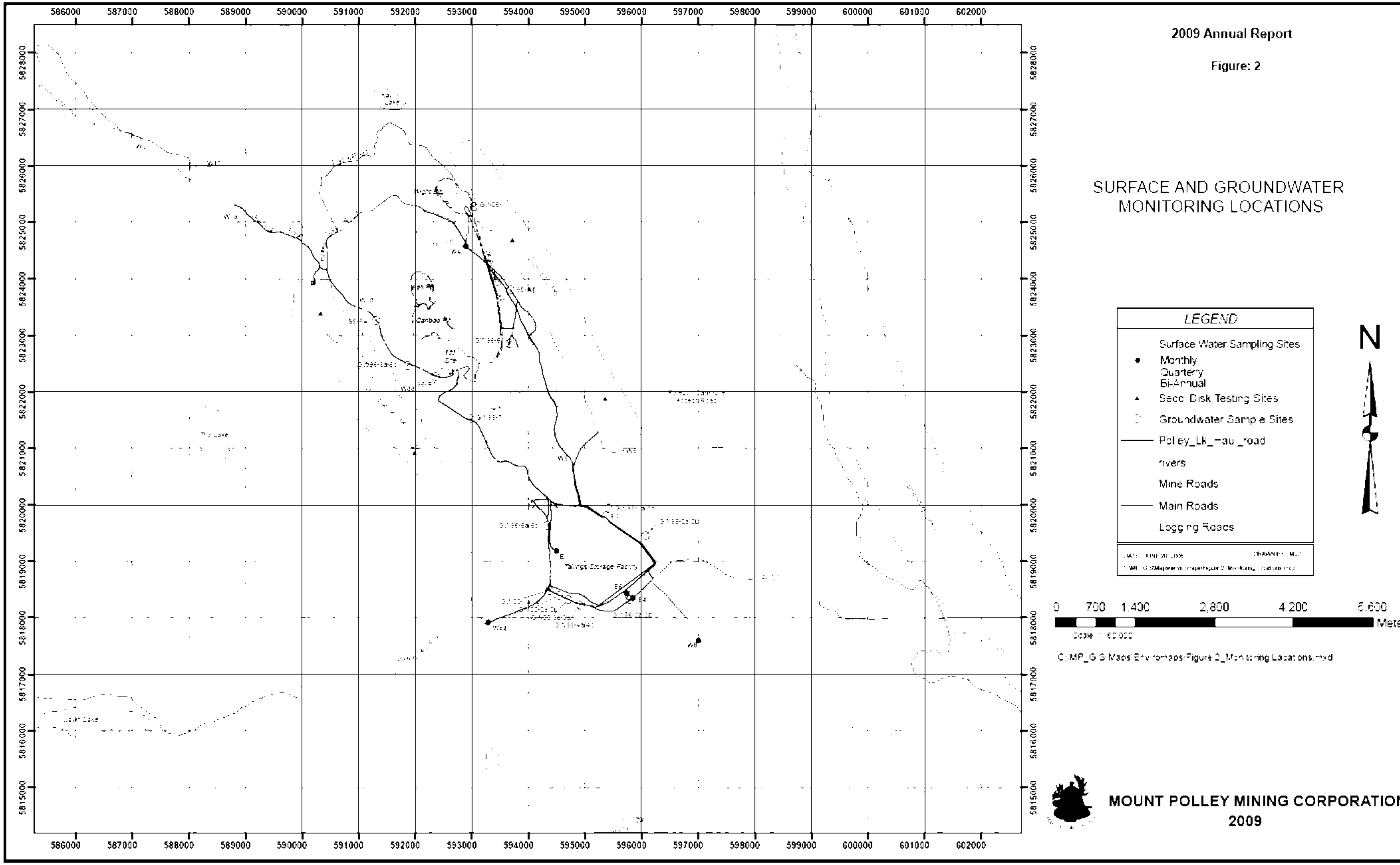

Figure 2.4.1 – Surface and Groundwater Sampling Sites

2.5. Fisheries and Aquatic Resources

The proposed waste dumps, roads and ditch collection system footprints are in areas that are not fish-bearing, with any drainage found in these areas observed as being seasonal. Utilizing best management practices during construction and operation will ensure that development of the temporary East and West PAG Stockpiles, South Road and SERDS will not impact any fish habitat.

2.6. Vegetation and Wildlife

Forest cover consists of red cedar, Douglas fir and sub-alpine fir, with lesser black cottonwood, trembling aspen and paper birch also present. Much of the surrounding area has been clear-cut by commercial logging.

The baseline wildlife and wildlife habitat assessment for the Mount Polley mine included all lands and waters that would be directly affected by original mine development. A buffer zone of 1.5 km was also included in the assessment. The baseline report concluded that the project would cause local alterations in wildlife habitat, but the alterations would be minor and short term (life of the project).

2.7. Surficial Geology, Terrain and Soils Mapping

The Mount Polley area has been affected by recent glaciation. The property hosts deposits of glaciofluvial sands and gravels, glaciolacustrine clays and silts, morainal materials, as well as colluvium.

2.8. Soil Survey and Characterization for Reclamation

All salvageable soil (estimated volume of 638,105 m^3) can be used for reclamation. Site soil descriptions and corresponding photos can be found in Appendix H.

2.9. Land Status and Use

All proposed mining and construction is on private property owned by MPMC. The works are located on:

- SERDS: M.L. 524068
- South Road: Spans M.L. 345731, Claim 514044, and M.L. 524068
- Temporary West PAG Stockpile: M.L. 345731 and IMC3 (340019)
- Temporary East PAG Stockpile: M.L. 524068
- C2 pit: M.L. 345731
- Boundary zone pit: M.L. 410495 and Claim 789262 (claim pending)

There are no surface tenures on areas known to host mineralization over the affected areas.

The affected surfaces are currently dominated by mature and immature forest cover. In order to mine the C2 and Boundary zone pits and construct the SERDS, temporary West PAG Stockpile, temporary East PAG Stockpile, South Road, harvesting of the mature timber and removal of the immature cover will be necessary. A cruise is underway, and is to be completed in November, assessing the amount of harvesting and removal to take place. All required permits for logging will be obtained from the Ministry of Forests and Range (MOFR).

Hunting throughout the region is a common recreational activity as habitats for moose and deer are common. The mine site is located in MU-2, and access to the site is prohibited under the Mines and Trespass Act. The project is within the territory of the guide/outfitter s.22 [redacted] of Likely.

Polley Lake and Bootjack Lake both have forestry recreation sites that are equipped with boat launches, campsites, toilets, and picnic tables which are used by the public on a regular basis during the camping and hunting seasons.

2.10. First Nations Setting

There are four First Nations groups which have interest in the area: the Tsq'escen' (Canim Lake Band), Xat'sull Cm'etem (Soda Creek/Deep Creek Band), T'exelc (Williams Lake Band) and the Stswecem'c/Xgat'tem (Canoe Creek Band/Dog Creek Band). It is anticipated that consultation with these groups will occur as part of the RMDRC process. Information distribution and consultation details are as included in Section 1.5: Information Distribution and Consultation, and are to be furthered in Appendix I.

2.11. Archaeological Impact Review

An overview assessment of the heritage resources of the Mount Polley project area was conducted by Point West Heritage Consulting Lt. In 1989 (Point West) - see Appendix J.

The objective of the Point West study was to determine the heritage resource potential or sensitivity of proposed development areas. This was achieved through the combination of background research, aerial photograph and topographic map interpretation and preliminary or overview reconnaissance.

The major historic events of this region of BC are related to the mining: including the Cariboo Gold Rush and latter operations. Hydraulic mining in the vicinity resulted in considerable revision to existing drainage systems. Remnants of dam constructed and ditches excavated are still evident. Background research indicated that the vicinity is within the ethnographic territory of the Fraser River Division of the Shuswap and the prehistoric sites could be encountered. Field investigation however, indicated that considerable recent logging disturbance had impacted large portions of the study area.

Heritage resource potential was assessed using documentary and predictive evidence provided through background research in conjunction with the identification of landforms suitable for various activities that is typified by low heritage resources potential. The majority of the development area is typified by low heritage resources potential. Several isolated areas were assessed as having low to moderate potential.

Additionally, results of Archaeological Overview and Preliminary Field Reconnaissance by Terraarchaeology in September 2009 covered a specific area around the Boundary Zone Pit. This area was scoped and supplied in a Notice of Work Application to conduct drilling. Findings can be found in Appendix J, in summary:

Field inspection of this area found it to have been entirely disturbed by the construction and use of forestry roads and is not located near to any aquatic features. The resultant archaeological potential of these proposed drill sites is considered to be low.

These drill sites are located on the same large, elevated plateau that is described above. They are situated between 840 and 990 m west of Polley Lake, and are between approximately 60 and 240 m removed from the eastern edge of the plateau. These sites are at 1,070-1,075 m asl. This area was predicted to have moderate archaeological potential based on the regional AOA. Field inspection of these proposed drill sites found them to be located entirely within areas that have been disturbed by road construction and use. No archaeological materials were observed within this disturbed ground. These drill sites are therefore considered to have low potential for containing archaeological sites.

3. PROJECT DESCRIPTION AND SCOPE OF PROJECT

This Application is being submitted as a requirement under Section 10 of the Mines Act to apply for an amendment to the Mines Act Permit M-200 to include:

- mining of the C2 and Boundary zone pits;
- construction of the SERDS;
- development of a temporary West Stockpile for PAG waste;
- development of a temporary East Stockpile for PAG waste; and
- construction of South Road joining the Springer pit and the TSF.

The C2 and Boundary zone pits would be mined in conjunction with the Springer pit, utilizing the same mine equipment, mill, and TSF as is existing. Non-acid generating (NAG) waste from the Boundary zone pit will be stored in the already permitted Wight pit waste rock dump (i.e. the Northeast Rock Disposal Site), or in the Wight pit footprint, while the proposed SERDS will be used to store NAG from the proposed C2 pit. Neither the Boundary zone nor the C2 pit is expected to produce PAG waste. The proposed West PAG Stockpile will be used for temporary storage of PAG waste from the Springer pit before PAG is backfilled to the Springer pit for subaqueous disposal upon the completion of its development. The proposed East PAG Stockpile will be used for temporary storage of PAG waste from the SEZ pit before PAG is backfilled to the Springer pit for subaqueous disposal upon the completion of its development.

3.1. Project History

Mount Polley property consists of 43 mineral claims encompassing 16,478 hectares and five mining leases totalling 1,867 hectares: tenure's 345731, 410495, 524068, 566385 and 573346, which expire August 22, 2026, September 29, 2034, December 19, 2035, September 21, 2037 and January 9, 2038 respectively.

Mount Polley mine operated for four years from 1997 to 2001, and in September 2001, due to a sustained period of low metal prices, was shut down and placed on care and maintenance. Exploration activity on the property was conducted during the shutdown period.

In 2003, the discovery of a new high grade zone on the property, the Northeast zone, together with the rise in metal prices, led to the decision to reopen the mine. In August 2004, Imperial completed a feasibility study, which included an updated ore reserve statement and a new mining plan, and confirmed the viability of restarting operations at Mount Polley mine.

In October 2004, a mining permit amendment and a mining lease were granted to include mining of the Northeast zone, and milling operations commenced in March 2005. The first copper concentrate shipment of approximately 11,500t was dispatched on July 10, 2005, with the official Mount Polley mine re-opening ceremony taking place in September 2005.

A number of studies by outside consultants were completed during the preparation of the permit amendment application. Acid rock drainage, metal leaching study of the rocks, and an archaeological review of access and overburden storage areas were performed with nothing of interest noted. A soil survey of these same areas was performed, and a Wildlife and Species at Risk review was completed with no issues noted. Approval was received, and a new mining lease established to facilitate production from the SEZ pit.

In 2010, production was from the Springer, SEZ and Pond zone pits, with exploration ongoing in other zones which may become feasible for production.

3.2. Location of Project and Mapping

Mount Polley mine is an open pit copper/gold mine located in central British Columbia, 56 km northeast of Williams Lake (latitude 52° 33' N and longitude 121° 38' W). A current site aerial is included as Figure 3.2.1, exhibiting the mill and crusher sites, active pits (Springer zone, SEZ and Pond zone), active underground (Zuke zone), and dumps (North Bell dump, Northeast zone dump, Highway to Heaven dump, and Cariboo dump). None of the structures as shown in Figure 3.2.1 encroach on any parks, ecological reserves, heritage sites or any such sensitive areas.

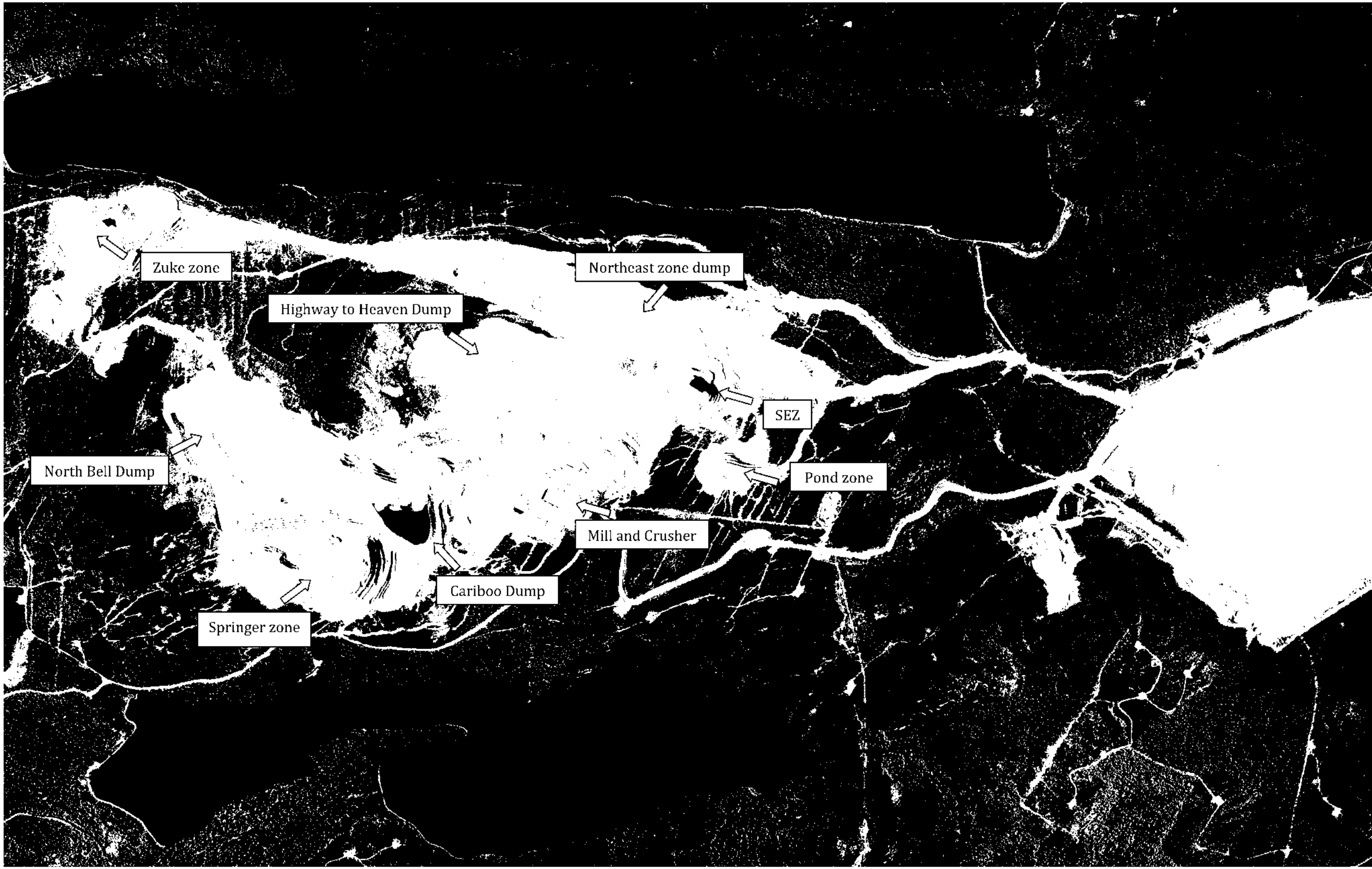

Figure 3.2.1 - Current Site Aerial

3.3. Mine Plan

Currently, operations at Mount Polley mine include the open-pit mining of the Springer, SEZ and Pond zone pits, with average daily mill throughput being 20,000t. Additionally, Procon Mining and Tunnelling Corporation (Procon) has been contracted to mine the Zuke zone, an underground ore body with access in the wall of the previously mined Wight pit. A 200,000t test leach is also ongoing.

3.3.1. Mine, Milling and Metallurgical Method

Mount Polley is an open pit copper/gold mine. The loading equipment is a combination of P&H 2100 shovels and loaders, and the haulage fleet includes Caterpillar 777 and Caterpillar 785C trucks. The primary crusher pocket has capacity to accept material from a 150t truck and ore is processed through a semi-autonomous grinding (SAG)/ball mill circuit producing a copper/gold concentrate.

In the Mount Polley mill, run-of-mine ore from the open pits is dumped into the feed pocket of the primary gyratory crusher to reduce the rock to a nominal 200mm. A hydraulic rock breaker is used to break the oversize material, and the crushed ore is discharged onto an apron feeder which feeds onto a conveyor to the coarse stockpile. Ore is reclaimed from underneath the stockpile by four vibrating feeders and conveyed to a vibrating screen.

In preparation for flotation, ore from the feed stockpile is conveyed to a grinding circuit, consisting of parallel rod mill/ball mill circuits and a pebble mill circuit; crusher product is first fed to a rod mill, and then to a ball mill. Ball mill discharge is pumped to cyclones, where the coarse particles are separated to return to the ball mill, while the finer particles proceed to the three pebble mills. Cyclones are again used to return oversize material to the mills, while the fines, now at the necessary size for mineral separation, are pumped to the flotation circuit.

The flotation circuit separates the valuable minerals from the waste rock, producing a concentrate. Initial separation is done in a rougher/scavenger circuit, where tailings flow by gravity to the TSF. Rougher concentrate is further upgraded in a cleaner circuit to produce the final product. Cleaner tailings are recycled to the rougher/scavenger circuit.

The concentrate is dewatered in two stages: settling reduces the water content to roughly 35-40%, while pressure filtration further reduces it to approximately 8%. Water removed is utilized as process water. Concentrate is stored in the load-out building and loaded on to 40t trucks for shipping.

3.3.2. Mine Plan Overview

Figure 3.3.2.1 illustrates the existing mine plan, showing topographic contours, mineral and land tenure (brown), lakes, streams, buildings (orange), roads (pink), railways, power transmission lines (green), pipelines, and the locations of all proposed construction and mining areas (Yellow – Pits, Blue – Dumps/Road Development) .

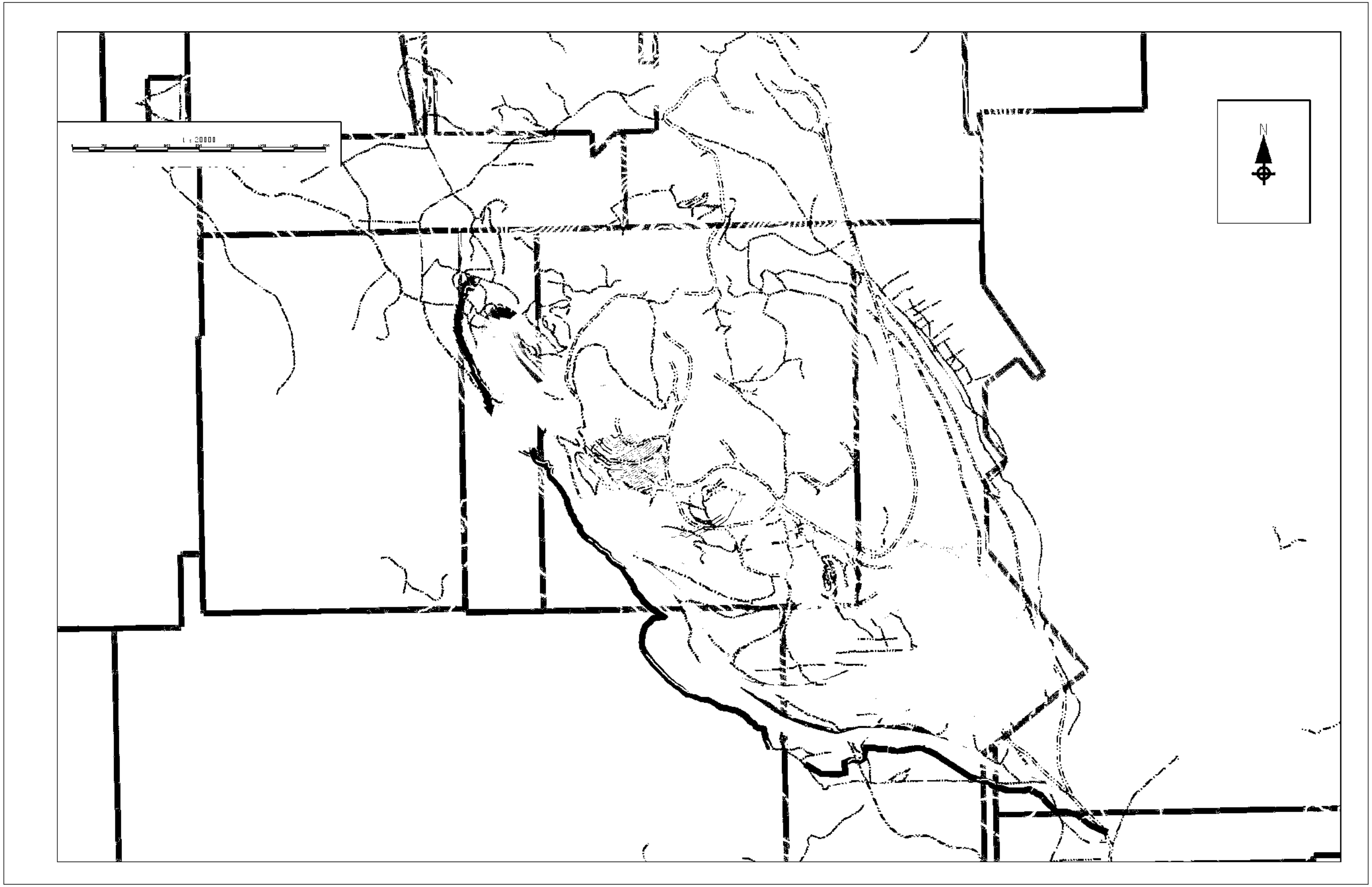

Figure 3.3.2.1 - Detailed Mine Plan

In addition to the existing Springer, SEZ, and Pond zone pits, the C2 and Boundary zone pits will be mined by conventional open pit methods, utilizing the same equipment as the Springer pit. As such, no additional equipment or infrastructure will be required to complete the proposed mining.

Processing of the Boundary zone and C2 pit ore will be through the current crusher and mill facilities, with only minor modifications to the mill potentially being required. The addition of the Boundary zone and C2 pit will extend the mine life to 2016.

3.3.3. Surface Disturbances

The development of all areas will require stripping and preparation. Logging will occur immediately prior to construction, and following approval to amend Permit M-200, permits will be obtained from MOFR to enable timber removal. Table 3.3.3.1 provides an inventory of areas disturbed to date, and projection of the land to be disturbed up to the projected end of mine life (five years).

Table 3.3.3.1 - Disturbed Areas

Mine Component	Disturbed to Date Area (Ha)	Additional Disturbed Area (Ha)	Notes
Rock Disposal Sites	167.5	124.3	Southeast Rock Disposal Site (East PAG stockpile footprint contained)
Tailings Storage Facility	245.8		
Mill Site	22.3		
Roads	108.6	45.6	South Road
Pit Areas	177.1	16.2	C2 Pit (9.7Ha) and Boundary Pit (6.5Ha)
Stockpiles	44.1	28.1	West PAG Stockpile (25.6Ha) and Soil/Overburden Stockpiles (2.5Ha)
Linear	7.8		
Exploration	26.2		
Other	27.7	12.5	Diversion Ditches (North, Central, South)
Total	827.1	226.7	
		27.4%	

3.3.4. Development Schedule

Following the required harvesting, seepage collection systems will be constructed. Next, soil salvaging and foundation preparation will take place for the South Road and waste dump sites. Springer pit development will be ongoing, and C2 and Boundary zone pits will follow. A development schedule for the aforementioned activities is included as Table 3.3.4.1.

Table 3.3.4.1 – Development Schedule

Item	Start Date	Completion
Harvesting	Dec-10	Jan-11
Ditch Construction	Jan-11	Mar-11
South Road Development	Jan-11	Mar-12
C2 Development	Jan-11	Dec-11
Soil Salvaging and Foundation Preperation	Feb-11	Mar-11
Boundary Zone Development	Jun-12	Aug-13

As can be seen in Table 3.3.4.1, proposed work as outlined in the Application will commence in January 2011, with the start of the ditch systems and South Road, and will be completed with the mining of the Boundary zone pit in August of 2013.

3.4. Detailed Project Designs

All water flow interacting with mine activities is to be contained by newly constructed ditches (North Drainage Ditch, Central Drainage Ditch and South Drainage Ditch) in addition to existing ditch systems. New ditches will divert surface water to the TSF to prevent water quality impacts on the surrounding environment. Currently, all mine water is collected in existing ditch systems, and so new construction will require catchment of only additional water as created by the proposed work (Figure 3.4.1).

Figure 3.4.1 – Ditch Systems

3.4.1. North Drainage Ditch

The North Drainage Ditch collects seepage from the temporary West PAG Stockpile located adjacent and along the length of the dump area. The ditch runs parallel to the toe of the dump at a 50m offset, located close to the Springer Pit at the northwest boundary of the property. The drainage ditch is approximately 1,000m in length, and slopes 0.3-5.0% to a sediment pond where the water is transferred back to the Springer pit. The catchment area for this system covers an area of 50 ha (Figure 3.4.1.1).

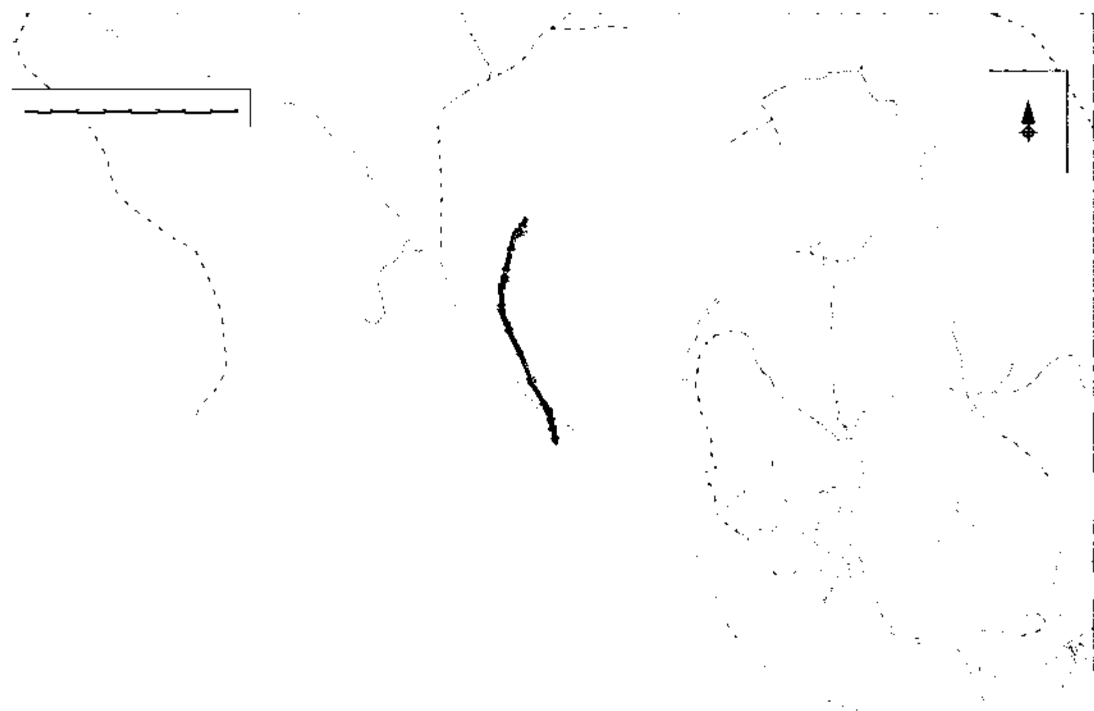

Figure 3.4.1.1 – North Drainage Ditch

3.4.2. Central Drainage Ditch

The Central Drainage Ditch collects seepage from the haul road, capturing runoff from the Springer along to the SERDS. The drainage ditch is approximately 3,000m in length, and runs parallel to the toe of the road at an offset of 50m to several hundred meters. The ditch slopes at 0.3-5.0% towards a sediment pond, where the water is transferred to the South Drainage Ditch system. The catchment area for this system covers an area of 150ha (Figure 3.4.2.1).

Figure 3.4.2.1 – Central Drainage Ditch

3.4.3. South Drainage Ditch

The South Drainage Ditch collects seepage from the haul road and SERDS. The new portion of the drainage ditch is approximately 2,500m in length and runs parallel to the toe of the SERDS at an offset of 50 meter downstream. The ditch slopes at 0.3-5.0% towards a sediment pond (already constructed for the long ditch) and water from this point flows to the TSF. The catchment area for this system covers an area of 100 ha (Figure 3.4.3.1).

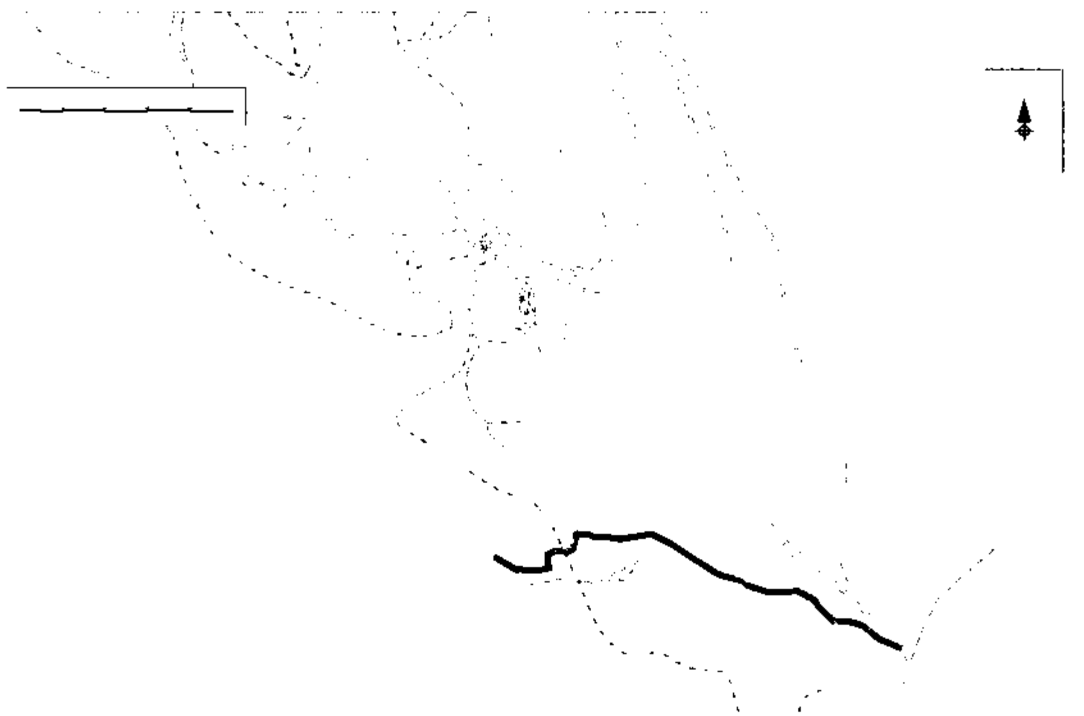

Figure 3.4.3.1 – South Drainage Ditch

3.4.4. Ditch Construction

Runoff collection ditches may be either temporary or permanent structures and will be sized to convey runoff from a 1 in 10 year 24-hour flood flow to correspond with the design specifications for the sediment control ponds. Appropriate channel lining will be specified depending on channel gradients and velocities. Some initial flushing, erosion and self-armoring are expected following construction. Small ponds with rock overflow weirs are therefore proposed to collect this initial flushing prior to discharging into natural channels. With aging, erosion and sediment runoff will be controlled to maintain comparable-to-natural conditions; therefore, permanent sediment control works are not proposed for these ditches. Regular inspection and periodic maintenance following major runoff events is anticipated.

Site-specific sections depend on topography, excavation material (till or bedrock) and design discharge. Different material gradations may be used for armoring depending upon the situation and availability of material sizes. On steep slope sections, rock weir drop structures are proposed. Spacing of the drops will vary depending upon the slope required; however, the top of the downstream drop should be higher than the bottom of the next upstream drop. In many instances these will be excavated into the slope to effectively intercept all seepage. Along the access road, stream convergences with ditches will be armored as required to prevent erosion. As required, the downslope surfaces will also be armoured to prevent scour.

Sediment control ponds will be constructed to detain runoff from disturbed areas such that sediment can settle out. All sediment control ponds will be designed according to the "Guidelines for the Design, Size, and Operation of Sedimentation Ponds used in Mining" issued by the BC Ministry of Environment, Lands, and Parks (BC MOE, 1996), where applicable.

The Mount Polley mine has settling ponds on main drainages receiving runoff from areas that were disturbed during construction and operation of the mine. These ponds will also act as seepage control ponds during operations.

3.4.5. Pit Dewatering

Dewatering in the C2 and Boundary zone pits will require a system consisting of a sump, portable transformer unit, submersible pumps, and a 6 high-density polyethylene (HDPE) pipeline. Water from the Boundary zone pit will be pumped to the Wight pit collection ditch, then re-routed to the TSF via the Long Ditch. C2 water will be re-routed to the TSF through existing ditch and pumping systems.

Total additional water volume is anticipated to be an estimated 315,000 m^3/year. Based on existing modelling, this rate will not have a significant effect on the water balance.

3.4.6. Haul Road Construction

All roads are designed, constructed and maintained in accordance with the Mines Act. Haulage roads are designed with a 27 metre width to provide for two-way traffic, and both internal pit roads and haul roads have a maximum grade of 10%. All existing traffic control plans satisfy MEMPR requirements, and construction and operation of all new roads will adhere to existing policy.

Haul road construction is designed to avoid (or minimize where possible) the potential mobilization and erosion of sediment with potential to enter into water bodies. Where avoidance is not possible, mitigation measures are adopted to reduce and prevent impacts to fish and fish habitat. The projected timing of construction projects will be reviewed to reduce potential downstream effects. For further detail, see Section 4.3: Erosion Prevention and Sediment Control Plan.

3.4.7. SERDS and Temporary East and West PAG Stockpile Construction

Development of the Boundary zone and C2 pits will require additional waste dump capacity for the disposal of approximately 10,000,000t of NAG waste rock.

Combined with the continued development of the Springer zone Pit, Pond and SEZ pits, total NAG and PAG material produced will be 68,000,000t and 18,000,000t respectively. NAG material will be stored within the SERDS or existing pits, and any waste material that is PAG will be hauled to the temporary East or West PAG Stockpile for short term storage before it is permanently stored in the Springer pit under subaqueous conditions at the end of mine life.

A foundation analysis has been completed to ensure the stability of all proposed dumps. The bases of the dumps are similar to the current East RDS, and no concerns are anticipated. The results of the analysis can be found in Appendices G, L and M.

Dumps will be constructed by end-dumping in 20m lifts from the haulage road at an overall slope of 2:1 to minimize the need for re-sloping and assist in reclamation work. Further design description is as include in Section 3.4.13: Waste Rock.

3.4.8. Open Pit Design

The Boundary zone and C2 pits will follow many of the same design principles as already existing in operating pits at Mount Polley mine. Modeling was done using the Lerch-Grossman pit optimization method, with Table 3.4.8.1 describing parameters used in design of the pits.

Table 3.4.8.1 – Open Pit Design Parameters

Design Parameter	Value
Bench Operating Height	10 or 12 metres
Interberm Height	24 metres
Bench Face Angle	65°
Safety Berm	8.5m metres
Inter-ramp Wall Angle	42-46°
Haul Road Internal Max. Grade	10%
Haul Road External Grade	7%
Haul Road Double Lane Width	27 metres
Swell Factor	33%
RDS Angle of Repose	37 degrees
RDS Angle of Reslope	2:1 (H:V)

10 metre (Boundary zone) and 12-metre (C2 zone) bench heights were chosen after considering grade control requirements, blast energy distribution using 9 7/8" blast holes, and muck pile height using P&H 2100 shovels and Caterpillar 992 loaders.

3.4.8.1. Boundary Pit

The Boundary zone pit is located 300m to the west of the Wight Pit. The current pit design has dimensions of approximately 430m long, 215m wide, and 100m deep, striking at 70 degrees from north. Access to the pit will be via a ramp grading 10%, connecting to the current Wight pit haul road. The pit is geologically similar to the Wight pit, and waste materials are expected to be non-acid generating, as they were in the Wight pit. The pit contains approximately 7 million tonnes of material, of which 900,000t is projected to be ore, (a 6:1 strip ratio). Run-off water will be contained within the drainage of the existing long ditch.

3.4.8.2. C2 Pit

The C2 zone is located between the current Springer pit and the crusher building, adjacent to the former Caribou pit. Much of the current pit design lies underneath current haul roads and stockpiles. The pit is roughly 600m long, 175m wide, a maximum of 180m deep, and strikes at 60 degrees from north. Access to the pit will be via benches which daylight to the ESE and connect directly to the west haul road. The pit contains approximately seven million tonnes of material, 2.5 million of which is projected to be ore, (a 1.8:1 strip ratio). Waste material is expected to be non-acid generating, and similar in nature to material mined from the Caribou pit. Run-off will be within the watershed of the west-ditch being planned.

Ramps are designed with a 27m road width to accommodate double lane haulage traffic using Caterpillar 777 and 785 trucks. The primary crusher pocket has capacity to accept material from a 150t truck.

All design is made in adherence to MEMPR requirements and follow the Mines Act. Design reflects both best practices in industry as well as site-specific experience obtained from past and existing open pit development at Mount Polley mine. Pit designs will be updated based on consultation during construction.

3.4.9. Access and Transportation

Existing road access from Williams Lake is 15km southeast on Highway 97 to 150 Mile House, 76km north on the Likely Highway to Morehead Lake, and then 12km east on the unpaved Bootjack Forest Service Road to the mine site. Williams Lake is approximately 75 minutes from the mine.

Recently, a three km section of road along the Bootjack Road was expanded to serve as a new primary access to Mount Polley mine. Work involved improvement of sections of the existing Frypan and Polley Lake roads to accommodate traffic travelling everyday to and from the mine.

Proposed work as included in the Application will not affect existing access and transportation for mine personnel or mine supplies and products. Road access restrictions, radio frequency use, and land tenure are all currently approved by MEMPR, and will remain so as new work will in no way affect them.

3.4.10. Processing Plant Description

The majority of mill feed in 2010 was provided by the Springer pit, while the SEZ and Pond zone pits also delivered ore to the mill. The Wight pit was completed in late 2009 and in January 2010 the Pond zone began supplying mill feed. The mill process is currently being modified to include a magnetite circuit.

C2 and Boundary zone material will be processed by the existing mill, and the current mill capacity of 20,000tpd will be sufficient to handle the additional material as modeled. All existing process streams and equipment will remain in place, and no new chemicals or hazardous materials will be introduced in the processing of ore as a result of the proposed work in this Application.

3.4.11. Tailings Storage Facility

Process tailings and captured mine water flow by a gravity pipeline and ditch lines respectively to the TSF, located 5km south of the mill. Required plant process water is recycled, being pumped by a series of eight 250hp vertical turbine pumps from the TSF, supplying tailings supernatant to a reclaim storage tank located at the mill site. The dam is currently at the 958m elevation.

The current TSF will be utilized and has sufficient design capacity to accommodate the additional tailings produced from the C2 and Boundary zone pits. TSF lifts are designed to contain the runoff from disturbed areas, pit water, as well as to store tailings produced. Adding these pits (Boundary zone and C2) to the mine plan will extend the life of the operation, and will require additional dam construction near the end of the mine life. Details of existing structure are provided in Figure 3.4.11.1 and Figure 3.4.11.2.

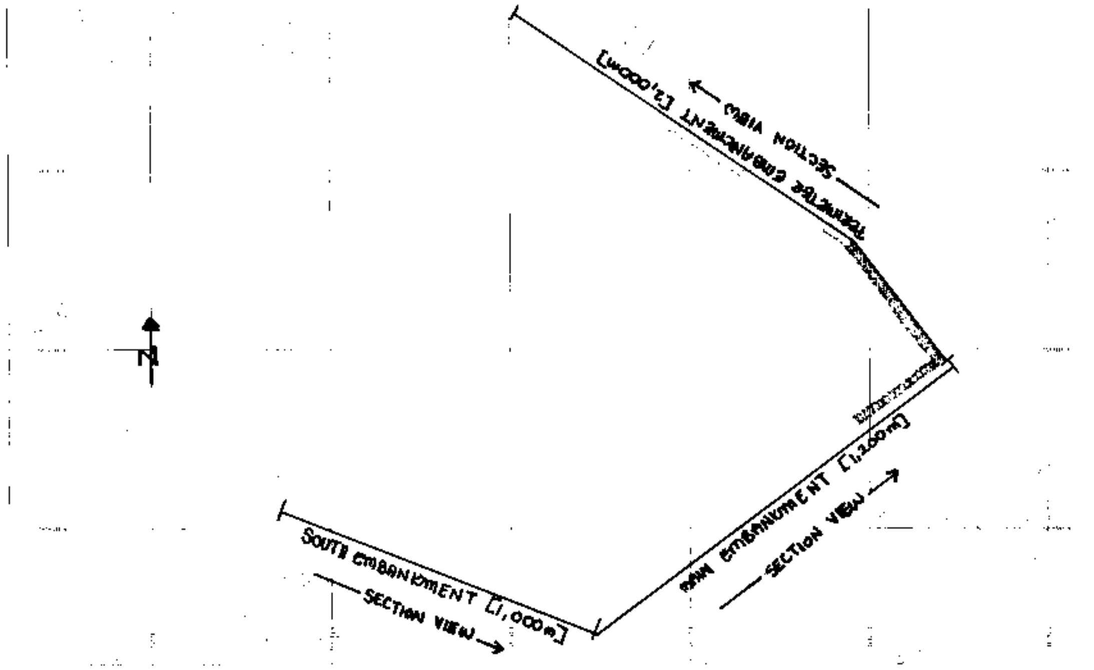

Figure 3.4.11.1 – TSF Overview

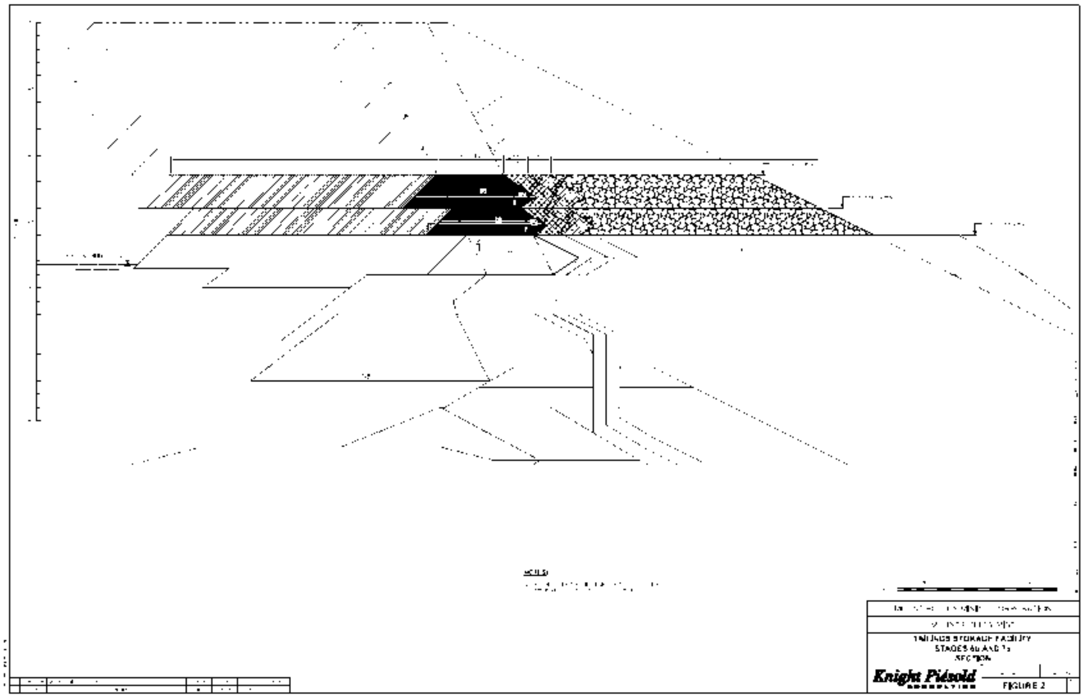

Figure 3.4.11.2 – TSF Typical Section

All existing TSF construction has had detailed designs, construction specifications and waste disposal procedures prepared according to standard geotechnical engineering practice, which has been subsequently submitted and approved - all expansion will continue to do the same.

3.4.12. Waste Rock

Additional PAG and NAG material mined as a result of the development of the Boundary zone and C2 pits will be backfilled into pits during or after the completion of mine life, or stored in dumps. In addition to the existing dumps permitted, the SERDS and the temporary East and West PAG Stockpiles will be required to store waste material.

Dumps will be constructed by end-dumping in 20m lifts from the haulage road at an overall slope of 2:1 (to minimize the need for re-sloping and assist in reclamation work). Quantities of NAG and PAG waste are included in Table 3.4.12.1 and graphical representations of the SERDS, temporary East Stockpile and temporary West Stockpile are included as Figure 3.4.12.1, Figure 3.4.12.2 and Figure 3.4.12.3 respectively.

Table 3.4.12.1 – NAG and PAG Quantities

	Material (Tonnes)	
Pit	**NAG**	**PAG**
Springer 3	29,042,000	4,827,000
Springer 4	29,229,000	10,168,000
C2	3,752,000	0
Boundary	5,573,000	0
SEZ	0	2,860,000
Totals	67,596,000	17,855,000

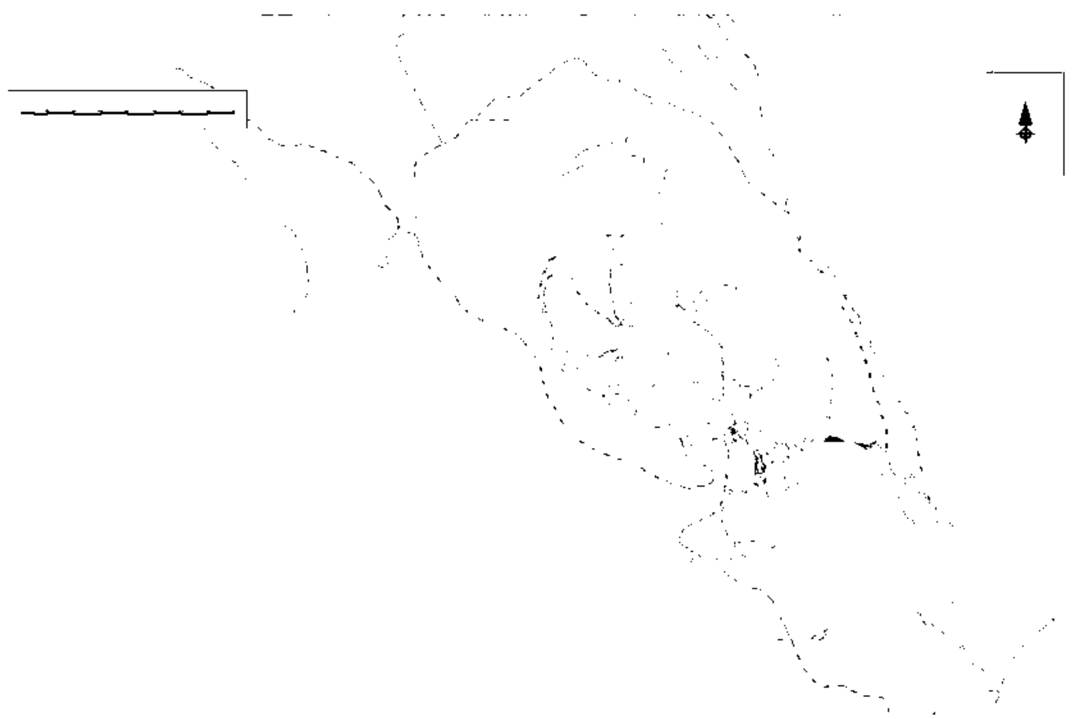

Figure 3.4.12.1 – SERDS Representation

Figure 3.4.12.2 – Temporary East Dump Representation

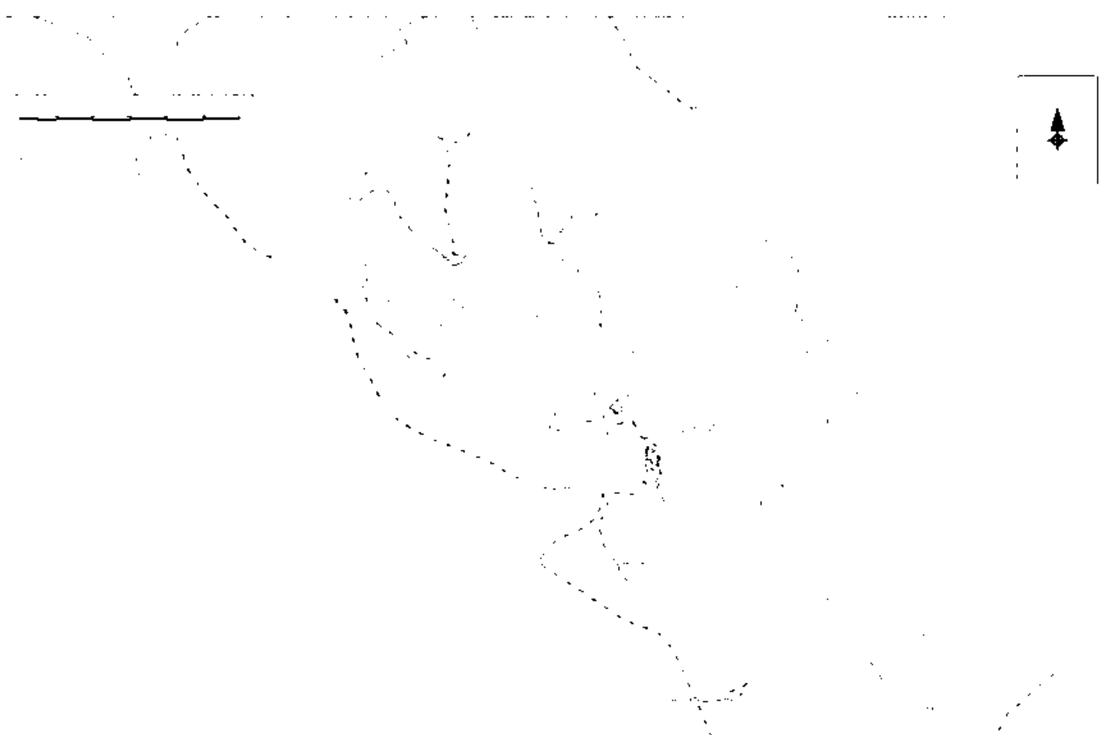

Figure 3.4.12.3 – Temporary West Dump Representation

Storage and material capacities of each of the project components is as outlined in Table 3.4.12.2.

Table 3.4.12.2 Project Component Material Capacities

Component	Material (tonnes)		
	NAG	PAG	Total
SERDS	94,758,000	-	94,758,000
South Road	12,486,000	-	12,486,000
NAG Pad for West PAG Stockpile	1,839,000	-	1,839,000
Temporary West PAG Stockpile	-	12,220,000	12,220,000
Temporary East PAG Stockpile	-	2,887,000	2,887,000
			124,190,000

3.4.13. Watercourse and Water Quality Protection

There are no watercourses that will be impacted by the development of the pit, haul road or waste dumps.

To ensure that the watercourses are not impacted during construction, a Construction Environmental Management Plan (CEMP) along with a Spill Contingency and Emergency Response Plan has been developed by MPMC and is on site.

4. Reclamation Program

In accordance with the Mines Act and the Health, Safety and Reclamation Code for Mines in British Columbia, the primary objective of the Reclamation Plan is, excluding lands that are not to be reclaimed, the average land capability to be achieved on the remaining lands shall not be less than the average that existed prior to mining, unless the land capability is not consistent with the approved end land use.

The current reclamation program for the Mount Polley mine site is directed to the primary end land uses of wildlife habitat and commercial forestry. Reclaimed areas will be capable of supporting secondary uses of the wildlife resource, such as hunting, guide-outfitting, trapping and outdoor recreation; perpetuating, and, if possible, enhancing biodiversity being an important wildlife consideration.

The reclamation program for the C2 and Boundary zone pits, SERD, the South Road and ditches will have the same objectives and goals as the current reclamation program that is in place for the mine site. Pending acceptance of the proposed mine expansion, Mount Polley will prepare an updated five year Reclamation and Closure Plan.

4.1. Soil Handling Plan

Site-specific soil surveys have been undertaken to determine the depth of the soil layers that can be salvaged at each location (see Appendix H). In total 638,105 m^3 of soil has been identified as salvageable. These soils will be stockpiled; the recoverable material will be pushed up by dozers and loaded into trucks for transport to stockpile sites.

4.2. Environmental Monitoring and Surveillance

The current environmental monitoring and surveillance program will be expanded to include disturbed areas associated with the development of the C2 and Boundary zone pits, South Road, SERDS, and the temporary West PAG Stockpile. The main objective of the environmental monitoring program is to evaluate all data collected to identify and mitigate potential mine impacts with a focus on protecting the environment.

4.3. Erosion Prevention and Sediment Control Plan

Refer to Appendix M - Surface Erosion Prevention and Sediment Control Plan.

4.4. Conceptual Final Reclamation Plan

The primary objective of the reclamation plan is to return all areas that have been disturbed by mining operations (except open pit walls) to their pre-mining level of productivity, and to ensure the safety of the public, livestock, and wildlife. To obtain these objectives, the reclamation activities will be directed towards:

- long-term preservation of receiving water quality within and downstream of decommissioned operations;
- long-term stability of engineered structures, including the RDS, haulage roads and the open pits, as well as all exposed erodible materials;
- natural integration of disturbed lands into the surrounding landscape and, to the greatest possible extent, restoration of the natural appearance of the area after mining ceases;
- establishment of a self-sustaining vegetative cover, consistent with the end land uses of wildlife habitat, commercial forestry, and outdoor recreation; and
- removal and proper decommissioning of all secondary access roads, structures and equipment that are not required after mining ceases.

4.4.1. End Land Use Objectives

The end land use objectives for the proposed construction and mining will follow the same objectives as for the entire project. A list of these objectives and the associated details are as follows:

- Commercial Forestry
- Wildlife Habitat
- Cattle Grazing
- Hunting
- Guide-outfitting
- Trapping
- Outdoor Recreation

The reclamation research report entitled, Mount Polley Mining Corporation, Reclamation Research Report, 2006 outlines productivity objectives and the end land use objective of commercial forestry, and is included as Appendix N. The growth target for the reclamation research program at Mount Polley is to obtain 130cm of vertical growth at six years of age. Presently, this target has been achieved on plots that have soil thicknesses of 40cm, 65cm and 15cm that have been mixed with biosolids at a rate of 75 dry t/ha.

Continued monitoring of the reclamation research plots for the next five to seven years will provide an accurate estimate of the forest site productivity. This information will assist in developing the precise reclamation prescription to be used in order to meet the above-stated growth target.

All remaining end land use objectives can be met with the successful establishment of commercial forest. Grasses and legumes will be planted at the same time as the tree seedlings, creating a healthy vegetative cover available for cattle grazing and foraging by other wildlife. The productivity objectives for the human end land uses will simply be the continued and expanded use of the area by the individuals that take part in each of these activities.

4.4.2. Long-term Stability

4.4.2.1. C2 and Boundary Zone Pits

During the excavation of the C2 and Boundary zone pits, stability of the surrounding surfaces and pit walls will be a priority, as this is necessary for the safety of the workers at the mine. Some measures can, however, be taken upon completion to maximize the stability for the future:

- The pit will be excavated using similar techniques used for the excavation of the Cariboo & Bell pits. That is, similar wall angles will be used, but the ideal wall angles will be discussed and agreed to with a qualified geotechnical consultant. The angle of the walls will be chosen to ensure the stability of the pit throughout the excavation phase, as well as for the long-term stability of the pit.

- Prior to the excavation of benches below the top surfaces, all soils and tills will be removed and pulled away from the area immediately surrounding the maximum boundary of the pit. This will prevent the continual sloughing of loose materials down the walls of the pit and into the final lake that will exist upon completed reclamation.

4.4.2.2. SERDS, temporary East and West PAG Stockpiles

The long-term stability of the SERDS and temporary East and West PAG Stockpiles will be ensured through various techniques, from the start of dumping through to the completion of the reclamation work:

- A qualified consultant, Golder Associates, has conducted a footprint stability assessment to determine if any special construction techniques are required to ensure the long-term stability of the sites. See Appendices L and M.
- The soft organic soils within the footprint of the sites will be removed and stockpiled to be used for reclamation.
- The sites will be constructed with 20 metre lifts to improve the stability of the disposal site as well as to minimize costs and efforts for reclamation.
- When the sites are under construction, a qualified consultant will conduct annual visits to determine if the construction technique being utilized will ensure long-term stability as is being stated in this Application.
- When the sites are complete, the slopes will be re-sloped from an angle of 37° to 26.5° (or from the angle-of-repose to a slope ratio of 2:1).

4.4.2.3. South Road

The long-term stability of the South Road will be ensured using similar techniques as those employed for the SERDS:

- The soft organic soils from within the footprint of the haul road will be salvaged and stockpiled to be used for reclamation of the road, once they are no longer required. Through this technique, the stability of the road will be improved, as it will be constructed on more competent materials such as till and bedrock.

- Any steep fills of the road will be re-contoured, as is typical for any fills less than ten metres in height throughout the mine property.

4.5. Reclamation Details

4.5.1. Waste Dump Reclamation

The land use objectives and methodology for reclamation of the waste dump are to:

- ensure public safety;
- increase habitat diversity where possible by distributing coarse woody debris over reclaimed areas (this will depend on ongoing stripping and grubbing and MOFR approval);
- retain and enhance specialized microhabitats such as boulder piles;
- establish a dense and variable cover of willows, Douglas fir, maple, alder, mountain-ash, grasses, and forbs to provide a maximum amount of forage for moose, mule deer, and black bear;
- hand-plant the upper plateau surfaces of the dumps with coniferous tree seedlings, following the stocking standards of the 01 or 05 Site Series for mesic sites, and;
- hand-plant the sloping east and south faces of the waste rock dump with tree seedlings, following the stocking standards of the 02 or 03 Site Series to minimize the rate of infiltration through waste rock piles.

To minimize reclamation costs for re-sloping and soil placement on slopes, an 11.8 m platform will remain at the toe/crest of each lift. Using this technique, soil can be placed on the slopes by simply pushing from the crest of each of the 20m lifts.

The surfaces of the dump will be graded lightly to eliminate large voids or craters, and a soil layer will be applied to support revegetation. A cover crop will be planted in addition to hand-planting of conifer seedlings obtained from the local tree nursery. The level to gently sloping surfaces of the RDS will have a nutrient and moisture regime that approximates the 01 or 05 Site Series.

Wildlife values will be enhanced by plantings of native shrub species that are palatable to moose and deer. These include western mountain-ash, Douglas fir, Scouler willow, Bebbian willow, gray-leaved willow, little-tree willow, Saskatoon-berry, baldhip rose, and red elderberry. Logging slash, especially if it is fresh enough to contain viable root balls or rooted offsets, is a valuable potential source of these native plant materials.

Large rocks and boulder piles will be left in place as long as they are stable and do not pose a safety hazard. These features provide cover for small mammals (such as bushy-tailed woodrat, northwestern chipmunk, and deermouse) and denning areas for small carnivores (such as marten and long-tailed weasel), thus increasing the biodiversity of the area.

4.5.2. TSF Reclamation

The reclamation of the TSF and impoundment area is covered in the 1996 report The Mount Polley Mine Project, Reclamation Plan prepared by Hallam Knight Piesold Ltd. as part of the requirements of the M-200 Mines Act permit (attached as Appendix N).

4.5.3. Pit Reclamation

The land use objectives for reclamation of the open pit are to:

- ensure the safety of the public and livestock, by posting and re-sloping the top overburden bench of the open pit in potentially dangerous locations;
- increase habitat diversity where possible by establishing a lake and distributing coarse woody debris over reclaimed benches (this will depend on ongoing stripping and grubbing and MOFR approval); and
- retain and enhance specialized microhabitats such as boulder piles.

The open pits will flood as the groundwater is re-established to create a lake.

4.5.4. Road Reclamation

The South Road will be maintained as access to the disturbed areas until such time as the reclamation work is completed and access is no longer required. Once the road is no longer required it will be deactivated and revegetated, culverts will be removed, and slopes pulled back to conform to the natural slope. The surface will be seeded with an appropriate grass-legume mixture.

Cross drains will be established along the haulage road. The surface of the road will be scarified, topsoil applied and then seeded with a domestic grass-legume mix, which will provide additional forage for livestock and wild ungulates.

4.5.5. Watercourse Reclamation

The diversion ditches established along the temporary West PAG Stockpile, South Road and the SERDS will be maintained until the water quality reaches acceptable discharge levels, at which time they will be breached to allow the water to flow overland along original or pathways.

4.5.6. Sealing of Underground Workings

Details regarding new underground workings in the Wight pit will be released at a later date.

4.5.7. Trace Element in Soils and Uptake in Vegetation

Site locations will be selected such that they will be below the proposed disturbance and will remain vegetated throughout the life of the mine for long-term monitoring purposes. Monitoring of new sites will follow current programs, and as such, samples will be obtained from wildlife browse species and sent for analysis.

4.5.8. Disposal of Toxic Chemicals

The disposal of toxic chemicals is covered in the 1996 report The Mount Polley Mine Project, Reclamation Plan prepared by Hallam Knight Piesold Ltd. as part of the requirements of the M-200 Mines Act permit, attached as Appendix N.

4.5.9. Operational and Post-Closure Monitoring

Environmental department staff will be on site to monitor the progress and effectiveness of the reclamation work. This information will be included in Annual Reclamation Reports as part of the requirements of M-200. Mining operations will be continuing, and if it is found that additional work is required for reclamation purposes, there will be equipment and materials available on site.

4.6. Detailed Five Year Mine Plan

For more detail on the development of both the C2 and Boundary zone pits, see Table 4.6.1 and Table 4.6.2 respectively.

Table 4.6.1: C2 Pit Mining Schedule

Period	Activities	Ore (Mt)	Waste (Mt)
Pre-production	Clearing and grubbing	-	-
1st Quarter 2011	Pit development and Ph1 Production	0.18	0.4
2nd Quarter 2011	No Planned Activity	0	0
3rd Quarter 2011	Ph2 Production	0.19	0.66
4th Quarter 2011	Ph2 Production	0.28	1.41
2012 Total	Ph2 Production	0.85	0.66
2013 Total	No Planned Activity	0	0
2014 Total	No Planned Activity	0	0
2015 Total	Ph3 Production	1.45	3.08
	Total	**6.19**	**19.78**

Table 4.6.2: Boundary Zone Pit Mining Schedule

Period	Activities	Ore (Mt)	Waste (Mt)
Pre-production	Clearing and grubbing	-	-
1st Quarter 2012	Development and Production	0.38	1.68
2nd Quarter 2012	Production	0.19	2.26
3rd Quarter 2012	Production	0.2	1.45
4th Quarter 2012	Production	0.19	0.19
	Total:	**0.96**	**5.58**

4.7. Detailed Five Year Reclamation Plan

The current Five Year Reclamation Plan for Mount Polley Mines is outlined in detail in the Annual Environmental and Reclamation Report 2010 submitted to MEMPR. The proposed amendments will modify the plan by adding the reclamation of the Boundary zone pit in year three, SERDS and temporary East and West PAG Stockpile in year five, and C2 pit in year six. Reclamation research will be ongoing throughout the next six years. Details are as outlined in Table 4.7.1.

Table 4.7.1: Five Year Reclamation Plan

Year	Mine Activity	Reclamation Work
1	Development of pits and construction of haulage road, stockpile, and RDSs	Areas disturbed during construction will be contoured and seeded Soil stockpiles will be seeded and sediment control structures put in place Stockpiling of soils and overburden
2	C2 pit production ceased	Contouring and placement of soils on inactive dump faces Scarifying and soil deposition of accessible areas of the pit Contouring and placement of soils on road banks which will not be involved in drainage control Revegetation of prepared areas Deactivation of haulage road Scarification of road surface Revegetation of prepared areas Planting of trees and shrubs Application of fertilizer where required
3	Boundary Zone pit production ceased	Scarifying and soil deposition of accessible areas of the pit Contouring and placement of soils on road banks which will not be involved in drainage control Revegetation of prepared areas Deactivation of haulage road Scarification of road surface Planting of trees and shrubs Application of fertilizer where required
4		
5	Southeast Dump decommissioned	Contouring and placement of soils on inactive dump faces Revegetation of prepared areas Planting of trees and shrubs Application of fertilizer where required
	East and West PAG Stockpiles decommissioned	PAG removed Contouring and placement of soils on inactive dump faces Revegetation of prepared areas Planting of trees and shrubs Application of fertilizer where required

5. ACID ROCK DRAINAGE AND METAL LEACHING ASSESSMENT

5.1. Summary

This section of the application provides an overview of the ML/ARD assessment and prediction of mine drainage chemistry completed for the mine expansion. The following subsections combine the requirements for the ML/ARD Prediction and Prevention Plan, the Materials Handling Plan, the Mine Waste Sequencing and Waste Placement Plan, Mitigation Plans; and Water Quantity and Quality Plan. Details from each summary can be found in Appendices B through F.

5.2. Mine Plan

The planned expansion of the Mount Polley considers the main components as included in Table 5.2.1.

Table 5.2.1 – Expansion Components

Item	Description	Size in Ha	Weight in tonnes	Classification
1	South East Rock Dump	124.3	94,758,000	NAG
2	South Road	45.6	12,486,000	NAG
3	West PAG Stockpile	36.3	12,220,000	PAG
4	East PAG Stockpile	9.5	2,887,000	PAG
5	C2 pit	9.7	3,752,000	NAG
6	Boundary pit	6.5	5,573,000	NAG
	Total	**222.4**		

Note: The East PAG Stockpile footprint is contained withing the ultimate SERDS.

5.2.1. Ore Supply

Ore production is planned until 2016 where the main ore supplies will originate from:

- 40.5 million tonnes from the Springer pit,
- 3 million from C2 pit,
- 1.5 million from the SEZ pit, and
- 1 million from the Boundary zone pit.

5.2.2. NAG Waste

Access from the Springer and C2 pits for NAG storage will follow a new South Road running east of Bootjack Lake around the south end of the old East RDS and to the proposed SERDS. Ore from both pits will follow newly constructed ramps to the crusher. Waste from the Boundary zone pit will be stored adjacent to the pit.

5.2.3. PAG Waste

The proposed expansion of mining in the Springer pit, as well as future SEZ pit mining, will result in generation of PAG rock. The best option for management of this rock involves placement in a temporary stockpile prior to re-handling, and permanent subaqueous disposal in the Springer pit following completion of mining. It is important that the PAG waste rock is placed underwater before it becomes acidic so that ARD from the stockpile does not need to be managed, and the Springer pit lake is not affected by acidic salts in the PAG waste rock as it becomes inundated. PAG waste will be temporarily stored in the East or West PAG Stockpiles.

5.2.4. Seepage Control

Both PAG and NAG will be placed in a dump situated where seepage water from the RDS will be collected and directed to the TSF.

5.3. Springer Waste Geochemical Characteristics

SRK was retained to update and interpret results from humidity cell testing on four samples the Springer Zone. Samples were selected by Mount Polley staff with general guidance from SRK. Sample selection methodology has been provided in previous annual reports (SRK 2004, 2005). All results for the following summary can be found in Appendix B.

One Springer Zone test was started on August 11, 2008 (HC9) and three tests were started on October 12, 2009 (HC14, HC15 and HC 16). HC14 was from the central area of the west wall. HC15 and HC16 were from the eastern and western areas of the south wall.

The three newer tests were selected to provide representation of waste rock generated by further development in the Springer Zone:

HC14 – Represents breccia with a median sulphur content and elevated arsenic (33.5mg/kg) and selenium content (4.3 mg/kg) with a TIC/AP ratio of 3.3.

HC15 – This sample has an elevated sulphur (2.5%) content that would allow for refinement of the PAG classification criteria and assessment of Se leaching. Selenium is also elevated at 8.2 mg/kg. The TIC/AP ratio for this sample was measured at 0.3.

HC16 – represents geochemical characteristics typical of intrusive rock types in the Springer pit with a TIC/AP ratio of 6.4.

5.3.1. Discussion

The following sections provide brief discussion with respect to two specific issues:

- Delay to onset of ARD for PAG rock.
- Potential for contaminant leaching under non-acidic conditions.

5.3.1.1. Delay to Onset of ARD

For the Springer zone, samples with TIC/AP less than 2, the estimated delays to ARD onset are:

5 years for HC9 (Springer Zone); and

19 years for HC15 (Springer Zone).

These results are almost the same as the previous estimates (SRK, March 2010). Although results for HC9 indicate a short depletion time, this sample is unlikely to go acidic due to its very low sulphur content (S = 0.04%).

5.3.1.2. Neutral pH Contaminant Leaching

Although Springer Zone rock may generate ARD in the future, all humidity cell samples have remained pH-neutral to alkaline. Therefore, the data provide some indication of the rate of leaching under non-acidic weathering conditions.

Average release rates for all parameters were compared with static characteristics. Rates were compared with sulphur to evaluate correlation of heavy element release with sulphide oxidation, and with the elements themselves to determine if release rates are related to absolute concentrations in the rock.

Arsenic was elevated in the solid phase of sample HC14 relative to the other Springer Zone samples, and samples from other zones at Mt. Polley. Both HC16 and, in recent cycles (cycle 27 to 40), HC14 were an order of magnitude higher than arsenic release rates for HC9 and HC15, between 0.001 and 0.002 mg/kg/wk.

HC14 also exhibited elevated release rates of selenium. Selenium release from HC14 was two orders of magnitude higher than other Springer Zone samples. Although the selenium content in HC15 was elevated at 8.2 mg/kg relative to other samples, the selenium release rate for this sample was very similar to other Mt. Polley HCTs.

As previously reported, there is a lack of correlations between release rates and bulk characteristics of the rock (SRK, 2010). No parameters showed good correlations between release rates and sulphur.

5.3.2. Conclusions

Consistent with previous reports, results obtained from humidity cell test work to date indicate:

- neutral pH weathering conditions consistent with the carbonate content of the rock;

- a site specific criterion for PAG rock of about 1.4 was suggested based on results from HC15. However, the generic TIC/AP ratio of 2.0 is a more conservative criterion;

- time frames to generate ARD of the order of decades but certainly shorter in the Springer Zone where TIC is lower than in other Mt. Polley zones; and

- relatively low contaminant leaching rates, with only arsenic and selenium leaching at neutral pH showing wide differences between samples. For Springer Zone humidity cells, no parameters showed correlation between release rates and bulk characteristics, and no parameters showed correlations of leaching rates with sulphur content.

5.4. Delay to Onset of Acidic Conditions for Springer Zone PAG Waste Rock

The expansion of mining in the Springer pit will result in generation of PAG rock. For the management of this rock, one the best option would involve placement in a temporary stockpile prior to re-handling and permanent subaqueous disposal in the Springer pit following completion of mining. PAG waste rock will need to be placed underwater before it becomes acidic so that ARD from the stockpile does not need to be managed, and the Springer pit lake is not affected by acidic salts in the PAG waste rock as it becomes inundated. SRK's memorandum describes calculation of the delay to onset of acidic conditions for Springer zone PAG waste rock. The memorandum can be found in Appendix C.

The distribution for faster-reacting components indicates that about 2% of the Springer waste rock might become acidic in 20 years, and 10% after 40 years. The majority of the rock with higher NPR might take over 100 years to become acidic. A number of factors complicate the actual estimate for higher NPR materials. Increasing acidification along with heating would result in accelerated oxidation and NP depletion though decreasing oxidation rates due to sulphide depletion and formation of secondary mineral coatings would result in lower oxidation rates and greater time to onset of acidic conditions. In conclusion, the PAG rock placed in stockpiles for a few years is not likely to become significantly acidic due to buffering provided by carbonate minerals.

5.5. Delay to Onset of Acidic Conditions for SEZ PAG Waste Rock

Upon completion of mining in the SEZ pit, PAG material previously stockpiled is to be re-handled, with permanent subaqueous disposal in the SEZ or the Springer pit. It is important that the PAG waste rock is placed underwater before it becomes acidic, so that ARD from the stockpile does not need to be managed, and pit lakes are not affected by acidic salts in the PAG waste rock as it becomes inundated.

According to the report prepared by Stephen Day, P.Geo of SRK Consulting, approximately 10% of the rock might become acidic in 2 years, and 35% after 10 years. The majority of the rock with higher NPR might take over 20 years to become acidic. A number of factors complicate the actual estimate for higher NPR materials. Increasing acidification along with heating would result in accelerated oxidation and NP depletion though decreasing oxidation rates due to sulphide depletion and formation of secondary mineral coatings would result in lower oxidation rates and greater time to onset of acidic conditions.

The existing humidity cells provide partial confirmation of the calculation. One sample has an NP/AP of 0.2 and has a calculated delay to onset at room temperature of eight years. It has operated for two years and has not generated acidic leachate. Two samples with NP/APs of 0.4 and 0.9 have been operating for five years and have also not generated acidic leachate. The full report is attached as Appendix E.

5.6. Estimated Springer PAG Dump Drainage Chemistry

A memorandum by SRK provided estimates of drainage for the Springer PAG Dump (temporary West Stockpile) as a stockpile in the configuration indicated by the Mount Polley Engineering Department email dated August 11, 2010 GN): Details can be found in Appendix D.

- Mass – 12.7 Mt
- Area – 21 ha

The volume of water contacting the waste rock was calculated as average total precipitation (615 mm/year) for measurements made from 2001 to 2009. In the calculation method used, this results in a conservative estimate of load released from the pile though lower flows would result in higher concentrations.

Two estimates of drainage chemistry are needed. The first estimate is for dominantly non-acidic conditions during the normal period of stockpiling, which could be up to a few decades. The second estimate is for acidic conditions which could occur after many decades.

5.6.1. Non-Acidic Conditions

Water chemistry for non-acidic conditions was estimated as follows:

Average release rates (in mg/kg/week) for all measured parameters were calculated for each of four humidity cells containing Springer pit waste rock. The characteristics of these cells vary from non-PAG to PAG and all cells are generating non-acidic drainage. Three non-PAG cells are included because they provide information relevant to understanding weathering under non-acidic conditions.

The data for the four cells were used to calculate P_{50} and P_{95} rates for each parameter. The two sets of rates provide a range of estimates for typical and reasonable worst case conditions. Weathering rates under field conditions (in mg/kg/week) were estimated using generic scaling factors:

- Temperature – 0.3 times lab conditions.
- Particle size – 0.2 times lab sample.

The resulting composite scaling factor is 0.06. That is, weathering rates under field conditions are calculated as 0.06 times the lab rate. The total mass generated was calculated from the mass of rock (mg/year). Weathering products released were assumed to be 50% of the generation rate to account for development of preferential flow paths. Raw concentrations (mg/L) in the water were calculated from the mass released and annual volume of water contacting the pile (129,000 m^3/year).

The raw concentrations were evaluated with respect to the solubility of several minerals including gypsum (calcium, sulphate), calcite (calcium, alkalinity), gibbsite (aluminum), barite (barium), ferric hydroxide (iron), malachite (copper) under atmospheric conditions using Geochemist's Workbench. Any elements for which solubility is expected to be limited by these minerals were adjusted based on model output. Data is included in Table 5.6.2.1.

Leachate pH for both waters was estimated to be near eight. Sulphate concentrations were not constrained by gypsum, but raw copper concentrations between 0.2 and 0.3 mg/L were constrained by malachite to 0.02 to 0.05 mg/L. As indicated, predicted selenium concentrations were elevated at 1 to 5 mg/L due to the lack of a constraining mineral. Gypsum is a candidate to co-precipitate gypsum but the modelling did not indicate gypsum would precipitate.

5.6.2. Acidic Conditions

Acidic drainage has not been observed at Mount Polley due to the presence of carbonate minerals in the PAG rock. Also, no humidity cells containing Springer PAG rock have generated acid. As a result, there is no basis to develop a site-specific estimate of acidic drainage chemistry for Springer PAG rock, and analog data from other BC porphyries (Day and Rees 2006) has been used. In using the analog data, it is noted:

- The rock at Mount Polley appears to contain abundant reactive alumino-silicates as indicated by the difference between neutralization potential and carbonate.
- The PAG rock contains a wide range of carbonate content and NPR. This implies that acidic conditions will occur progressively in the rock over many decades so that at any time, a small proportion of the rock will be severely acidic.

Together, these two factors indicate that it is unlikely the pile as a whole will produce strongly acidic conditions (pH<4). A more likely scenario is that, drainage chemistry will be buffering by aluminum resulting in pHs between 4 and 5. Analog data for this range are provided in Table 5.6.2.1. The resulting water in somewhat acidic (due to dissolved aluminum and copper) but iron concentrations are relatively low.

Table 5.6.2.1 – Springer PAG Drainage Chemistry

Parameter	Units	Neutral Typical	Neutral Extreme	Acidic
pH	su	8.1	7.9	4.1
Sulphate	mg/L	930	2200	2400
Acidity	$mgCaCO_3/L$	0	0	540
Alkalinity	$mgCaCO_3/L$	59	42	2
Al	mg/L	0.0012	0.00088	40
Sb	mg/L	0.017	0.026	0.0001
As	mg/L	0.098	0.21	0.0006
Ba	mg/L	0.0052	0.0044	0.043
Cd	mg/L	0.0036	0.0075	0.04
Ca	mg/L	88	270	790
Co	mg/L	0.014	0.023	1.6
Cu	mg/L	0.023	0.046	340
Fe	mg/L	0.002	0.002	3.4
Pb	mg/L	0.011	0.022	0.018
Mg	mg/L	100	220	180
Mn	mg/L	0.38	0.6	26
Mo	mg/L	1.2	2.4	0.026
Ni	mg/L	0.017	0.024	1.4
Se	mg/L	1.4	4.5	0.085
Ag	mg/L	0.0029	0.0056	0.01
Zn	mg/L	0.081	0.16	4

5.7. Prediction of Pit Lake Formation for the Springer Pit

Golder Associates prepared a model predicting Springer pit lake formation at an early stage (approximately ten years) and at late stage around 50 years. The pit lake model indicates that initially the lake level will increase relatively rapidly, and could reach an elevation of approximately 940m (where all the PAG would be subaqueous) in the seven years in the best estimate scenario. Additionally at latter times, the rise in the lake level elevation was predicted to be slower, with the lake surface reaching the spill elevation of approximately 1060m after 80 years. This report can be found in Appendix F.

5.8. Water Management and Closure Plans for the TSF, SERDS, and Temporary East and West PAG Stockpiles

Currently, the Northeast waste RDS (approximately 155ha in size) is located along the eastern perimeter of the mine site adjacent to Polley Lake. The SERDS will be situated along the southern portion of the waste rock disposal site. The new section will occupy an additional 124 ha or 43% of the total rock disposal site area.

At the base of the existing NEZ rock disposal site, a drainage ditch exists, starting approximately 200m north of the intersection of the Wight pit haul road and the Polley Lake haul road. It runs parallel to the Polley Lake haul road at 0.3-0.5% slope for approximately four km, where it empties into a small detention pond. Runoff is conveyed from the detention pond in a 22" HDPE pipe adjacent to the haul road and crosses Bootjack Creek on the existing bridge. The pipe discharges the runoff into a second ditch, which then flows into the perimeter embankment seepage collection pond (PESCP). Figure 3.4.3.1 shows the alignment of a new cross ditch which will collect drainage from the SERDS and directs seepage to the detention pond.

The temporary West PAG Stockpile will be situated along northwestern ridge of the Springer pit and will occupy 26ha. At the base of the rock disposal site, a drainage ditch will be constructed along with a sump where drainage will be collected and pumped back to the Springer pit.

The temporary East PAG Stockpile will occupy 9.5ha, but will be covered by the SERDS after backfill. Drainage will be captured by the existing Long Ditch, which flows directly into the TSF.

The main components of the TSF and waste dump water management and closure plan are described below.

- TSF and rock dump cover and vegetation;
- wetlands establishment; and
- water treatment.

The amount of clean annual runoff to the TSF on an annual basis is 1,000,000m^3, with the volume of runoff from the SERDS and the temporary West PAG dump projected to be 240,000m^3 and 120,000m^3 respectively. Water quality originating from the ditch systems will be in the neutral range pH 8.0, with similar water quality to current conditions. During operations, the drainage water will be collected in the Perimeter pond and pumped back into the Tailings Pond, while MPMC is actively pursuing a discharge permit to discharge into Hazeltine Creek.

At closure, surplus water in the TSF will be routed to the perimeter embankment seepage collection pond and water from the surge pond will be treated in a treatment pond and discharged first to a wetland pond and then to Hazeltine Creek. The surge pond collects:

- runoff from the NEZ dump, SERDS and surrounding undisturbed area;

- groundwater seeps beneath the NEZ and SERDS;
- runoff from the Perimeter Embankment; and
- seepage from the Perimeter Embankment toe drains.

5.8.1. Water Quality Prediction based on Humidity Testing

As described in Section 5.3 and attached as Appendix B.

5.8.1.1. Major Ions

The pH from leachates from all tests were weakly alkaline to alkaline and stable. Alkalinity release in HC14 and HC16 has remained relatively constant throughout the test and alkalinity release in HC15 showed an initial increase from 8 mg $CaCO_3$/kg/wk to a maximum of 15 mg $CaCO_3$/kg/wk, after which the alkalinity release rate has steadily declined and are current at 9 mg $CaCO_3$/kg/wk.

The initial flush of Springer Zone humidity cells HC14 and HC15 released high rates of several major ions including calcium, magnesium, sulphate and to a lesser extent sodium. After approximately seven weeks, the release rates of these parameters stabilized.

After the initial flush, HC15, which contained a sample with higher sulphur content (Total S = 2.5%), showed a high stabilized sulphate release rate of approximately 18 mg/kg/wk in 2009. Compared to other Mount Polley mine samples, HC14 and HC16 showed low sulphate release rates.

5.8.1.2. Trace Ions

The analyses showed an initial flush of elevated concentrations for several parameters in some cells (Ba, Cd, Mn, Se and Sr). Most of these parameters have since declined or stabilized at near detection limit concentrations. Arsenic release rates were elevated in leachate from HC16, increasing to 0.0035 mg/kg/wk in week 5, after which the release rate decreased to 0.002 mg/kg/wk and continues to decrease.

In April 2010, CANTEST was acquired by Maxxam Analytics, and amongst other changes that were made, ICP equipment was recalibrated. Coinciding with this acquisition (cycle 27 for HC14), the pattern of arsenic release from HC14 changed. Prior to this cycle, the results for arsenic concentration were consistently below the detection limit of 0.0002 mg/L. After this cycle, results were consistently above detection at approximately 0.002 mg/L. At this time, it is impossible to determine the cause of the low concentrations reported prior to the change in laboratory ownership and instrument recalibration. However, arsenic concentration in the HC14 solid phase was elevated compared to other samples, at a concentration of 33.5 ppm, and the release of arsenic at concentrations of 0.002 mg/L observed after the change is not unreasonable.

The selenium release rate for HC14 has been elevated compared to other Springer zone humidity cells. At the time of this report the selenium release rate was 0.021 mg/kg/wk, two to three orders-of-magnitude greater than other cells, and appears to be slowly decreasing.

5.8.2. ARD/ML Prediction and Prevention Plan

5.8.2.1. Waste Rock

The objectives of waste rock monitoring will be to define operational segregation, inventory the geochemical characteristics of the waste rock, confirm the use of TIC/AP=2 to classify waste rock, determine the rate of depletion of alkalinity if required to define underwater disposal requirements, and confirm the metal leaching characteristics of the waste rock.

- **Operational Segregation:** A program for sampling and analysis of blast hole cuttings to effectively define pit dig limits.

- **Geochemical Inventory:** Sampling will be conducted to provide ongoing characterization of the characteristics of different rock and alteration types in the pit.

- **TIC/AP Classification:** Alkalinity Depletion and Metal Leaching will be summarized annual. On- going kinetic tests will be conducted and summarized on an Annual basis.

5.8.2.2. Open Pit

Additional specific monitoring for the open pit will include:

- **Pit Sump Monitoring:** Routine monitoring of pit sump waters to monitor the effect of sulphide mineral oxidation and metal leaching.

- **Bi-Annual Seep Survey**: Sampling of significant inflows to the pit will be conducted.

6. Reclamation Cost Estimates

Mount Polley mine's current closure cost estimate is $4,388,900. The proposed expansion is estimated to increase the reclamation liability by $2,105,268 (as detailed in Table 6.1). In addition to this amount, $500,000 has been added to deal with potential long term water management. This amount has been estimated utilizing MEMPR mines reclamation costing spreadsheet attached as Appendix O.

Table 6.1 Reclamation Liability Summary

Disturbance Components	Area (Ha)
Boundary and C2 Zone Pits	16.2
South Road	45.6
SERDS	124.3
Temporary West PAG Dump	36.3
TOTAL	**222.4**
Cost Components	**Cost ($)**
Site Preparation	456,593
Revegetation	403,631
Material Haulage	1,245,044
TOTAL	**2,105,268**
Water Quality Management	**$ 500,000**

Approximately 15,107,000t of PAG waste will be mined in the mine life. The majority of this material (12,220,000t) will be temporarily stored in the West PAG stockpile until mining of the Springer pit is complete, when this PAG rock will be placed into the Springer pit below its flood line. Seven point five million dollars ($7.5 M dollars) will be set aside to cover this activity (based on a re-handling cost of $0.50 per tonne)

The reclamation liability will be revaluated yearly and included in the Annual Reclamation Report.

Golder Associates

TECHNICAL MEMORANDUM

50 YEARS in 2010

DATE December 1, 2010 **PROJECT No.** 05-1413-027

TO Ron Martel
Mount Polley Mining Corporation

FROM A.V. Chance, P.Eng. **EMAIL** achance@golder.com

FIELD AND LABORATORY INVESTIGATIONS

1.0 INTRODUCTION

Further to your request, this technical memorandum provides a summary of the field and laboratory investigations that were previously carried out in 1999 in the vicinity of the previously proposed West Dumps.

2.0 TEST PIT INVESTIGATIONS

A test pit investigation program was carried out in the area of the proposed West Dumps on October 19 to October 22, 1999. The proposed location of the dumps is shown on Figure 1. The investigation involved the excavation of 17 test pits for the purpose of logging and sampling the foundation soils. Of these test pits, 8 were located within the footprint of the proposed 1,130 metre platform, and the remainder were located within the footprint of the proposed 1,040 metre platform. The test pit locations are shown on Figures 2 and 3, and the test pit coordinates are listed in Table 1. The description of the soils encountered in the test pits are summarized in Table 2.

Localized zones of soft clay and silt rich soils were encountered in flat lying areas. The extent of these zones was delineated by excavating additional shallow test pits.

3.0 LABORATORY TESTING

Laboratory index and shear strength test has been carried out on selected soil samples obtained from the test pits. Grain size distribution curves of selected soil samples are contained in Appendix I, and the results of index properties testing are summarized in Table 3.

Shear strength testing was carried out on soil samples from the clay and silt rich horizons encountered in Test Pit 8 and Test Pit 5, and the results of the strength testing are contained in Appendix II and are summarized in Table 3.

Samples 1-2, 5-2, and 10-1 consists of silty-SAND. These materials were generally firm, and exhibited a low plasticity. Likewise, these soils also exhibited a low to negative liquidity index, meaning their moisture content is less than the plastic limit. Consequently, these materials are relatively dry, and can be expected to exhibit competent behaviour.

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Sample 5-3 is a sandy-SILT that exhibits a low plasticity and liquidity index. This material exhibited the following shear strength parameters: ϕ' = 20 degrees and c' = 15 kPa. These strengths are within the expected range for this material.

Sample 8A-1 exhibits similar index properties as Sample 9-1, and can also be expected to exhibit low shear strengths.

4.0 FOUNDATION CONDITIONS

The results of the field investigations indicate that, in general, the most consistent soil horizon encountered across the site is a well-graded, silty-SAND till, with some gravel and trace clay.

The lower slopes are overlain by a thin veneer of top soil that generally varies in thickness from 5 to 20 cm, but has been identified to be as thick as 1 metre at the south end of the 1,130 metre platform

A number of localized silt clay-rich lenses were encountered in Test Pits 5, 8 and 9 in the 1,130 metre platform area, and Test Pits 14, 15, and 16 in the 1,040 metre platform area. These layers correspond with the localized, low-lying and wet to swampy areas that are located on the flat-lying terrain.

5.0 CLOSURE

We trust this technical memorandum satisfies your current requirements. Should you have any questions, feel free to contact the undersigned.

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED

A. Engbloom
Geotechnical Specialist, Mining Division

ORIGINAL SIGNED AND SEALED

A.V. Chance, P. Eng.
Principal, Mining Division

Attachments: Tables 1 – 3
Figures 1 – 3
Appendix I

AVC/aw

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TABLES 1 – 3

TABLE 1
1080 and 1130 Proposed Waste Dump
Surveyed Excavated Testpit Locations

Testpit#	Northing	Easting	Elevation
TP1	5822539	591844	1053
TP2	5822455	592042	1076
TP3	5822334	592285	1090
TP4	5822134	592390	1064
TP5	5822160	592555	1078
TP5north-claylimit	5822171	592552	1079
TP5east-claylimit	5822159	592640	1082
TP5west-claylimit	5822142	592532	1077
TP6	5822085	592399	1064
TP7	5822130	592538	1076
TP7east-claylimit	5822128	592547	1074
TP8	5822545	592128	1091
TP8east-claylimit	5822573	592144	1092
TP8a & north-claylimit	5822567	592129	1090
TP8west-claylimit1	5822521	592101	1089
TP8west-claylimit2	5822515	592067	1085
TP8west-claylimit3	5822515	592042	1080
TP9	5822632	591999	1086
TP9east-claylimit	5822632	592009	1089
TP9north-claylimit	5822655	592008	1090
TP10	5823178	591344	1053
TP11	5823368	591205	1042
TP12	5823199	591181	1034
TP13	5823504	590994	1023
TP14	5824043	590769	1041
TP15	5823920	590928	1062
TP16	5823853	590784	1035
TP16a	5823927	590766	1040
TP17	5824279	590871	1048

R:\MINING\99\992-1439\99westdump testpits

TABLE 2
RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample Depth (m)	Sample No.
TP99-1		TERRAIN: slight incline.		
		Similar to TP99-2 and TP99-3		
	0-0.1	TOPSOIL - organics, roots, twigs, leaves, etc.		
	0.1-0.4	soft to firm, massive, moist, tan brown, odourless, sandy-SILT, some gravel, trace of clay. TILL. Till does not coarsen with depth.	0.2-0.3	1-1
	0.4-1.7	firm, massive moist, tan brown, odourless, silty SAND, some gravel, trace clay. TILL orgainic fibres, roots.	1.3-1.4	1-2
		Picture - Roll 1 (18,19)		
TP99-2		TERRAIN: 15-20 degree incline		
	0-0.05	TOPSOIL - organics, peaty		
	0.05-0.6	loose, massive dry to moist, tan brown, odourless, gravelly SAND, some silt. gravel and cobbles are angular		
	0.6-2.5	compact, massive, dry to moist, tan brown, odourless, silty SAND, some gravel and cobbles. TILL. Gets coarser with depth		
		Picture - Roll 1 (15)		
TP99-3		TERRAIN: 15-20 degree incline; dry		
	0-0.05	TOPSOIL - organics, roots, fibrous ect		
	0.05-0.5	loose, massive dry to moist, tan brown, odourless, gravelly SAND, some silt. gravel and cobbles are angular	0.3-0.4	3-1
	0.5-2.5	compact, massive, dry to moist, tan brown, odourless, silty SAND, some gravel and cobbles. TILL. Gets coarser with depth	0.9-1.0	3-2
		Pictures - Roll 1 (12,13,14)		
TP99-4		TERRAIN: 5-10 degree incline		
	0-0.05	TOPSOIL - peaty, high organics, decaying organic matter, roots		
	0.05-0.40	soft to firm, massive, moist, tan brown, odourless, clayey SILT, trace sand, some gravel and cobbles. TILL. Drier than TP5 and TP6.	0.2-0.3	4-1
	0.40-2.45	firm to stiff, massive, tan brown, odourless, sandy SILT, with gravel and cobbles. TILL.	0.6-0.7	4-2
		Pictures - Roll 1 (8,9,10,11)		
		drier than TP5 and TP6		
TP99-5		TERRAIN: 5-10 degree incline, soils look disturbed, remnants of forestry activity		
	0-0.90	loose, massive, dry to moist, black, odourless silty-GRAVEL, trace clay, some sand. TOPSOIL. Very high organic content at various stages of decomposition.	0.20-0.30	5-1
	0.90-1.30	firm, massive, moist, dark grey, odourless, silty-CLAY, with some to trace sand and gravel. Contains decomposed organics.	1.0-1.1	5-2
	1.3-2.5	firm, massive, moist to wet, tan brown, odourless, clayey-SILT, some sand, gravel and cobbles.	1.5	5-3
	2.5	Hard layer, angular COBBLES; possibly bedrock		
		Pit Dimensions: 3.6 x 1.0 x 2.5 m		
		A bit of water in southwest corner		
		Pictures - Roll 1 (3,4,5,6)		

TABLE 2
RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample Depth (m)	Sample No.
TP99-6		TERRAIN: Area low lying; swampy (reeds); harder to dig than TP5		
	0-0.20	TOPSOIL - peaty, high organics, decaying organic matter, roots		
	0.2 - 2.5	firm, massive, moist to wet, tan brown, odourless, clayey-SILT, with trace gravel and some cobbles, trace boulders. TILL Some boulders 10" - 12"; moisture increases with depth Water level seepage about 2-5 litres/minute, west side of pit Pictures - Roll 1 (7,8,9)		
TP99-7	0-0.1	TOPSOIL - peat, dark fibrous roots		
	0.1-0.8	firm to stiff, massive, tan brown, odourless, sandy SILT, with gravel and cobbles. TILL.		
	> 0.8	BEDROCK		
TP99-8A		TERRAIN: Rises to the north and east slight decline to SW, swampy		
	0-0.5	Organic, PEAT, loose		
	0.5-0.8	firm, massive, moist, dark brown, odourlesss, CLAY with some silt, highly plastic.	0.6-0.7	8A-1
	1.0-1.45	soft to firm, massive, wet, tan brown, odourless, clayey-SILT, with some sand, gravel and cobbles. TILL.	1.1-1.2	8A-2
	> 1.45	BEDROCK Water seepage at organic/clay contact Picture - Roll 1 (16)		
TP99-8B		TERRAIN: in standing water: south of TP9-8 about 25m (26.4m from);		
	0-0.15	TOPSOIL - peat, organics with roots and fibres		
	0.15-0.45	firm, massive, moist, dark brown, odourlesss, CLAY with some silt, highly plastic.		
	0.45-0.85	soft to firm, massive, wet, tan brown, odourless, clayey-SILT, with some sand, gravel and cobbles. TILL. NOTE: the clay layer thins out to 0m in this TP, the soil log given is the north east corner of the pit. Picture Roll 1 (17)		
TP99-9		TERRAIN: slight 5 degree incline; standing water nearby; no seepage into pit		
	0-0.2	TOPSOIL - peaty, organics, roots, debris ect		
	0.2-0.8	soft to firm, massive, moist, odourless, tan brown, CLAY with some silt, sand and gravel.		
	0.8-1.0	firm, massive, moist, odourless, dark brown, CLAY, with some silt, highly plastic.	0.9-1.0	9-1
	1.0-2.0	soft to firm, massive, moist, odourless, tan brown, CLAY with some silt, sand and gravel. Pictures - Roll 1 (19,20)	1.1-1.2	9-2
TP99-10		broke through an old pipeline of some sort, no gases or water flowing or wires, very rusty, assumed to be decommissioned		
	0-0.2	TOPSOIL - As in previous descriptions		
	0.2-2.5	firm, massive, moist, odourless, tan brown, clayey-SILT, with some sand, gravel and cobbles. TILL. Root fibres Picture - Roll 1 (21)	1.0 - 1.1	10-1

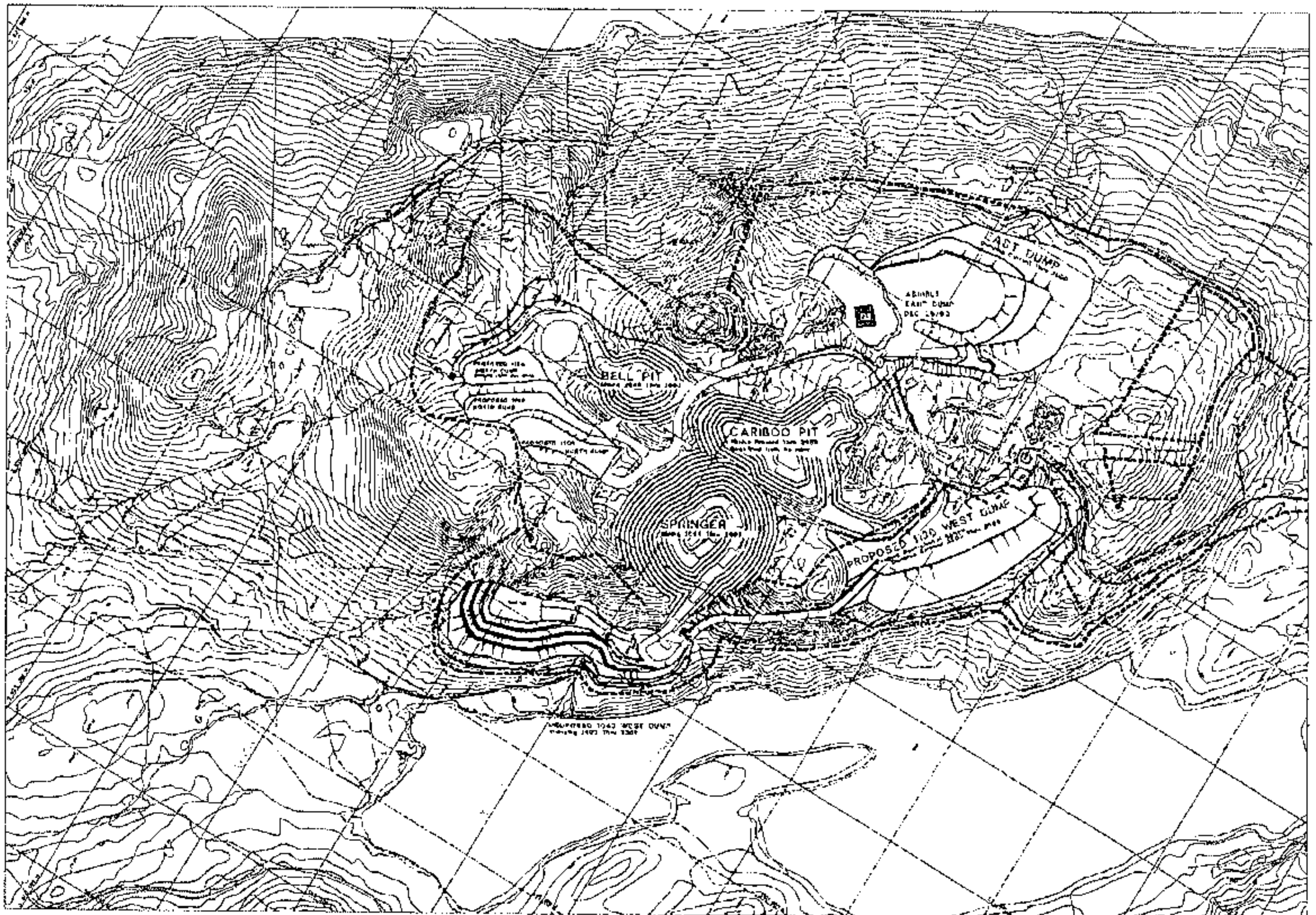
TABLE 2
RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample Depth (m)	Sample No.
TP99-11		TERRAIN - just off main road		
	0-0.15	TOPSOIL - organics		
	0.15-2.4	firm, massive, wet, odourless, tan brown, silty-GRAVEL with some sand and cobbles, trace clay. TILL.		11-1
	> 2.4	BEDROCK		
TP99-12		Terrain - flat northwest side of a clearing		
	0-0.25	TOP SOIL, organics roots, fibres etc.; looks disturbed - evidence of fire soot		
	0.25-3.3	firm, massive, moist, odourless, tan brown, clayey-SILT, with some sand, gravel and cobbles. TILL. Root fibres		
TP99-13		Near road cut through bedrock with overburden less than 1.0 m Test pit was not excavated as the soil profile was evident upon inspection of the road cut. Soil description based on nearby test pits as well as inspection.		
	0 - ~1.0	firm, massive, wet, odourless, tan brown, silty-GRAVEL with some sand and cobbles, trace clay. TILL.		
TP99-14		Lots of water flooding TP; bedrock hit; walls sloughing in		
	0-0.1	TOP SOIL		
	0.1-0.4	soft to firm, massive, moist, odourless, tan brown, CLAY with some silt, sand and gravel.		
	0.4-1.5	firm, massive, moist, odourless, tan brown, clayey-SILT, with some sand, gravel and cobbles. TILL. Root fibres All units very wet Picture - Roll 2 (6)		
TP99-15		TERRAIN - flat; lots of standing water		
	0-0.2	TOPSOIL - peat		
	0.2-0.5	soft to firm, massive, moist, odourless, tan brown, CLAY with some silt, sand and gravel.	0.3-0.4	15-1
	0.5-1.5	firm, massive, dry to moist, odourless, tan brown, clayey-SILT, with some sand and gravel, trace cobbles. TILL. Pictures - Roll 2 (1,2)	1.0-1.1	15-2
TP99-16		Terrain - steep incline		
	0-0.2	TOPSOIL - roots, dark brown		
	0.2-2.5	soft to firm, massive, dry, odourless, tan brown, CLAY with some silt, sand and gravel. Standing water present likely due to road construction impact		
TP99-16a		soft, massive, free water, slight organic odour, grey, clayey-SILT with some sand, gravel and cobbles. TILL.	0.3-0.4	16A-1
TP99-17		TERRAIN - along a road way with wash running down centre of road, reveals a large percentage of rounded cobbles with sand and fines washed away		
	0-0.6	sift to firm, massive, moist, odourless, clayey-SILT, with some sand and gravel. High fibrous organic content.	0.4-0.5	17-1
	0.6-2.5	soft to firm, massive, wet, odourless, tan brown, silty-SAND, with some gravel and cobbles, trace clay. TILL. Grain size increases with depth.	1.0-1.1	17-2
	> 1.6	BEDROCK Picture - Roll 2 (7)		

TABLE 3
Results of Laboratory Testing

Sample Number	Soil Description	Sample Depth (metres)	Liquid Limit (%)	Plasticity Limit (%)	Plasticity Index (%)	Water Content (%)	Liquidity Index	Friction Angle (degrees)
TP1 - 2	Silty-SAND (Till)	1.3 - 1.4	17	16.2	0.8	13.2	-3.77	-
TP5 - 2	Silty-SAND	0.9 - 1.3	31	21.5	9.5	22.8	0.13	-
TP5 - 3	Sandy-SILT	1.5	31.1	20.8	10.3	24.3	0.34	28
TP8A - 1	Clayey-SILT	0.6 - 0.7	49.6	35.7	13.9	48.4	0.91	20
TP9 - 1	Silty- CLAY	0.9 - 1.0	55.7	36.5	19.2	51	0.76	-
TP10 - 1	Silty-SAND (Till)	1.0 - 1.1	25	17.1	7.9	13.3	-0.49	-

FIGURES 1 – 3



CONCEPTUAL DUMP PLAN – NOT FOR CONSTRUCTION

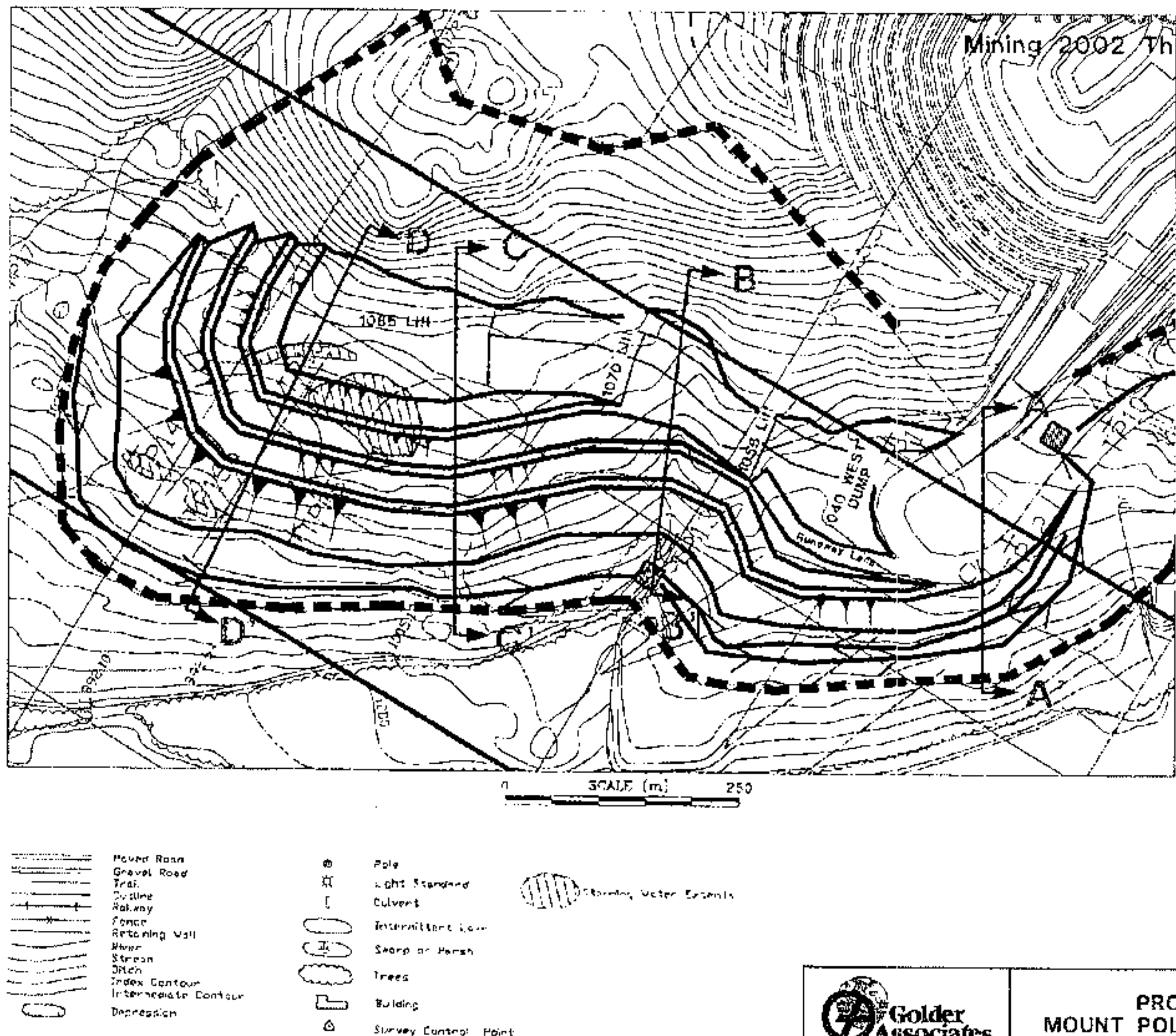
MOUNT POLLEY MINING CORPORATION
BRITISH COLUMBIA

SCALE (m)

Golder Associates

PROPOSED WEST DUMP DEVELOPMENT

Figure 1



Golder Associates

PROPOSED 1040 DUMP
MOUNT POLLEY MINING CORPORATION

Figure **2**

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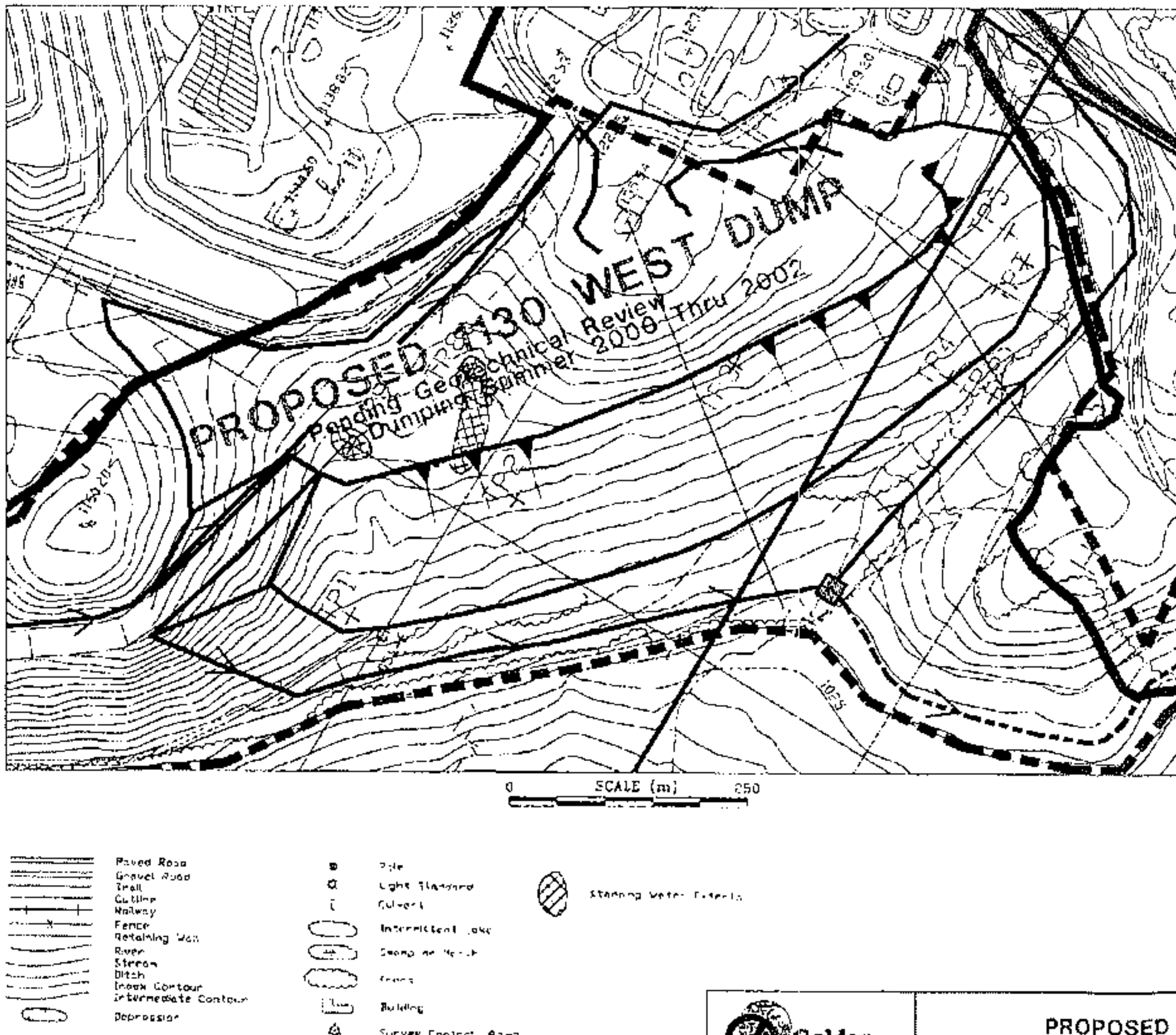

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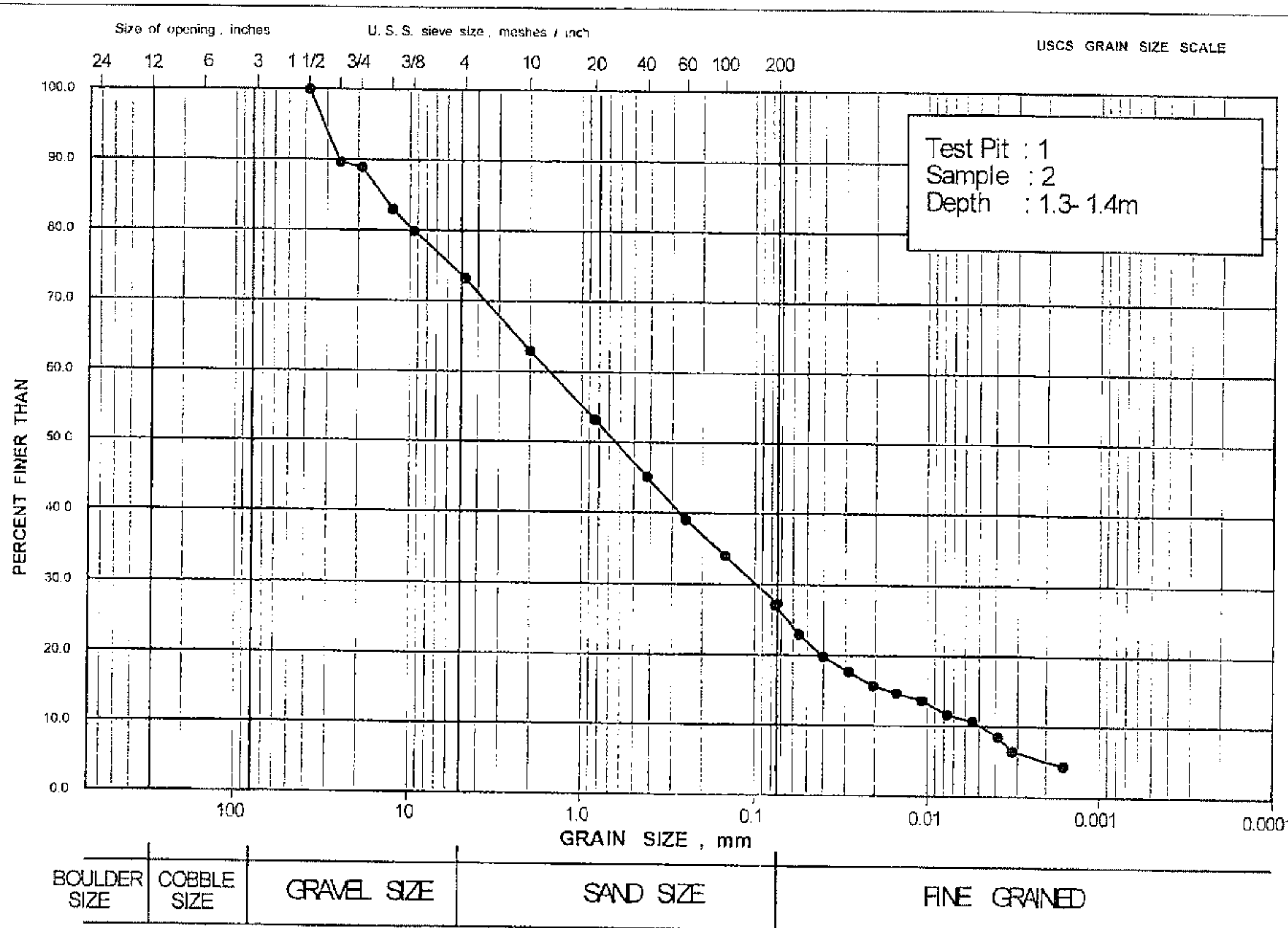
PROPOSED 1130 DUMP
MOUNT POLLEY MINING CORPORATION

Figure 3

APPENDIX I



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GRAIN SIZE DISTRIBUTION

Figure : I- 1

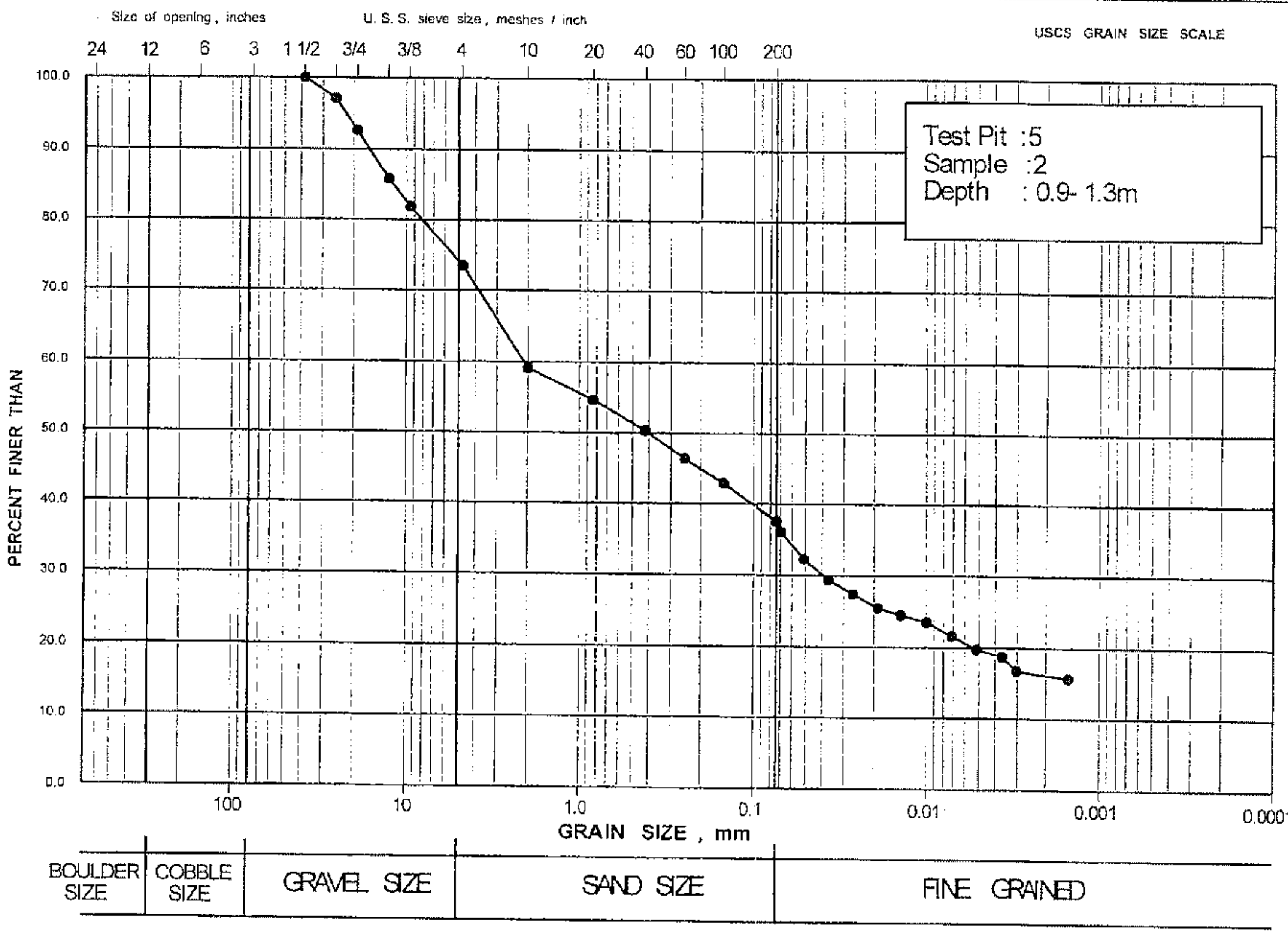

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Figure : I- 2

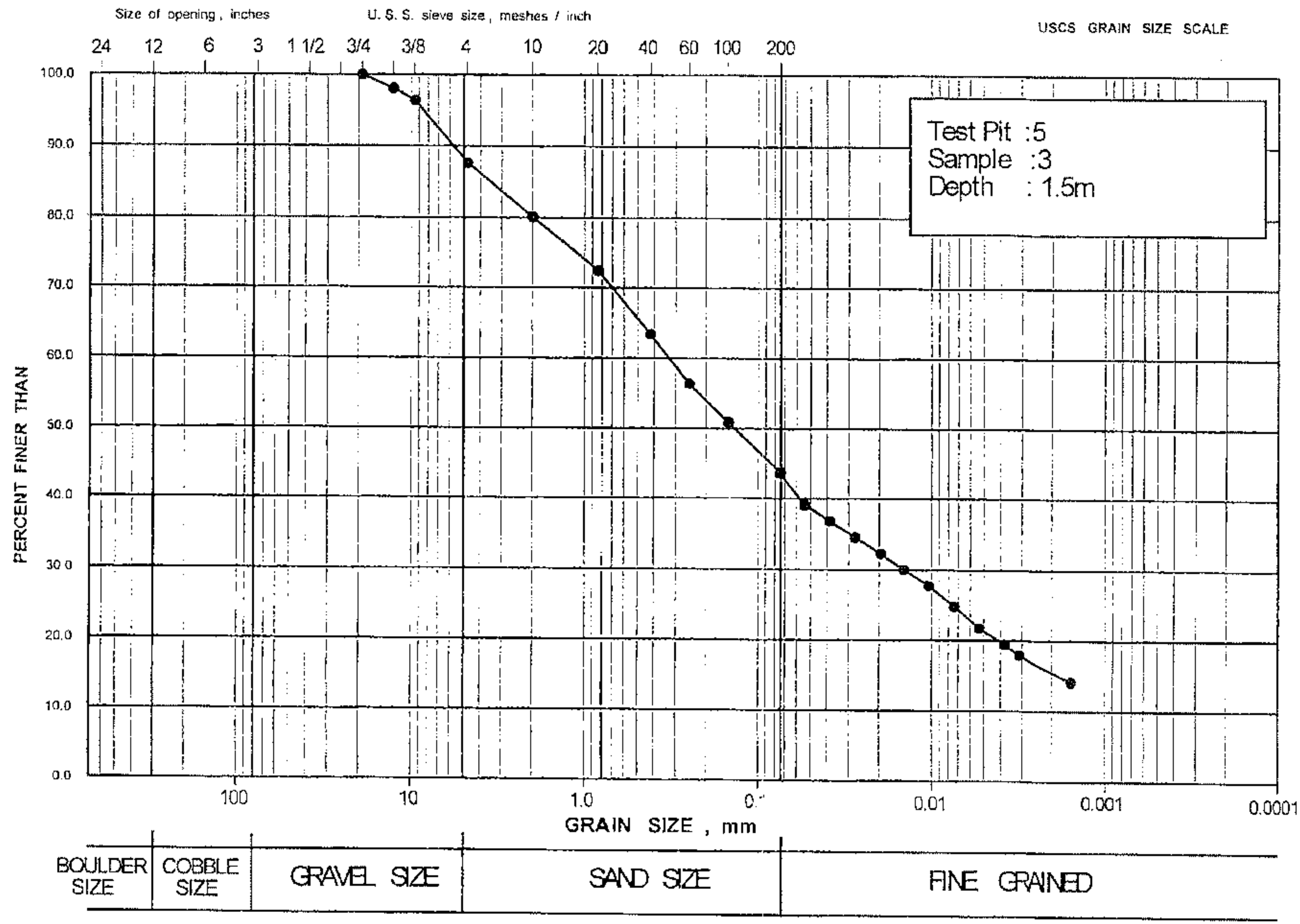

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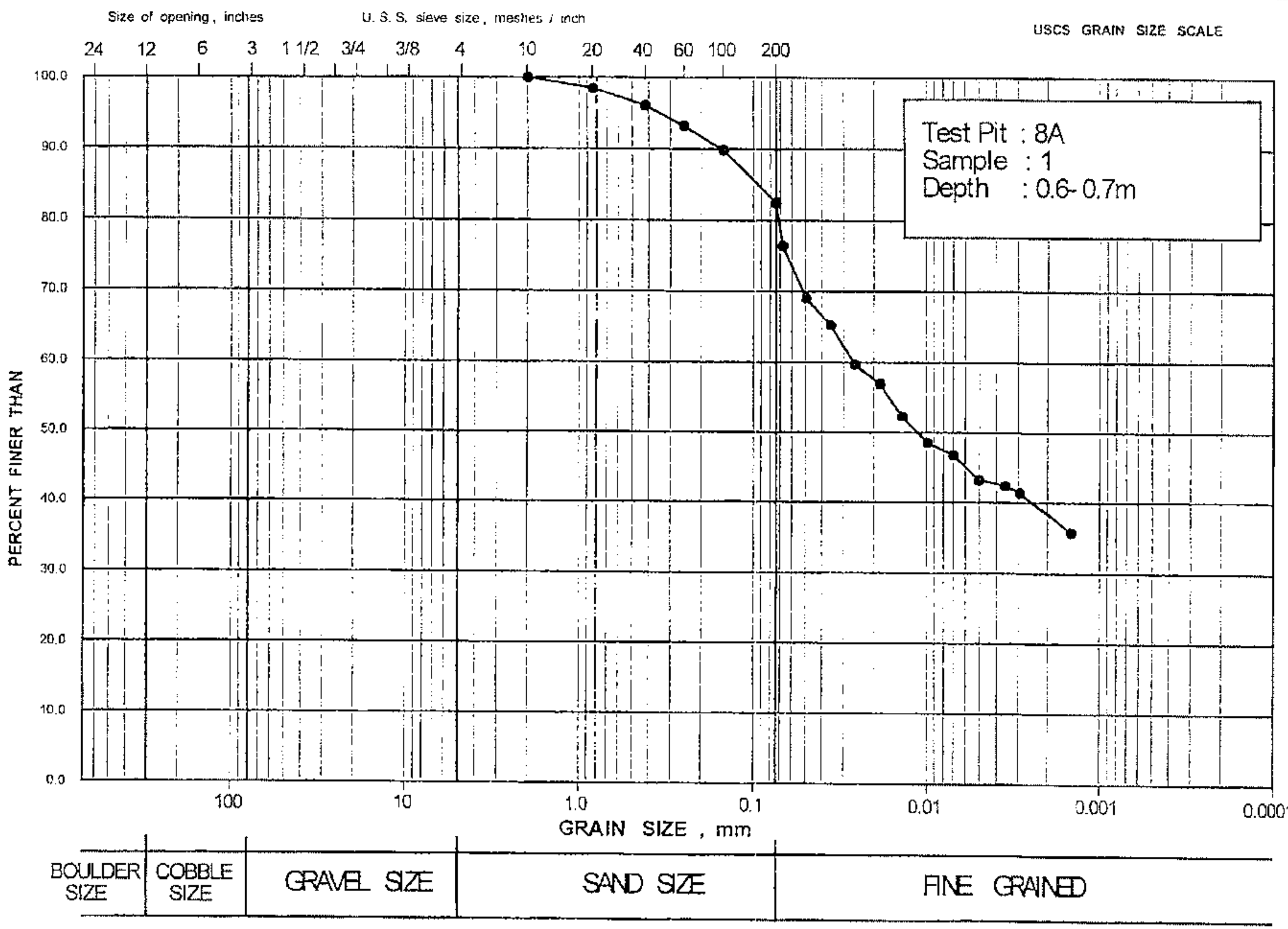
Figure : I- 3



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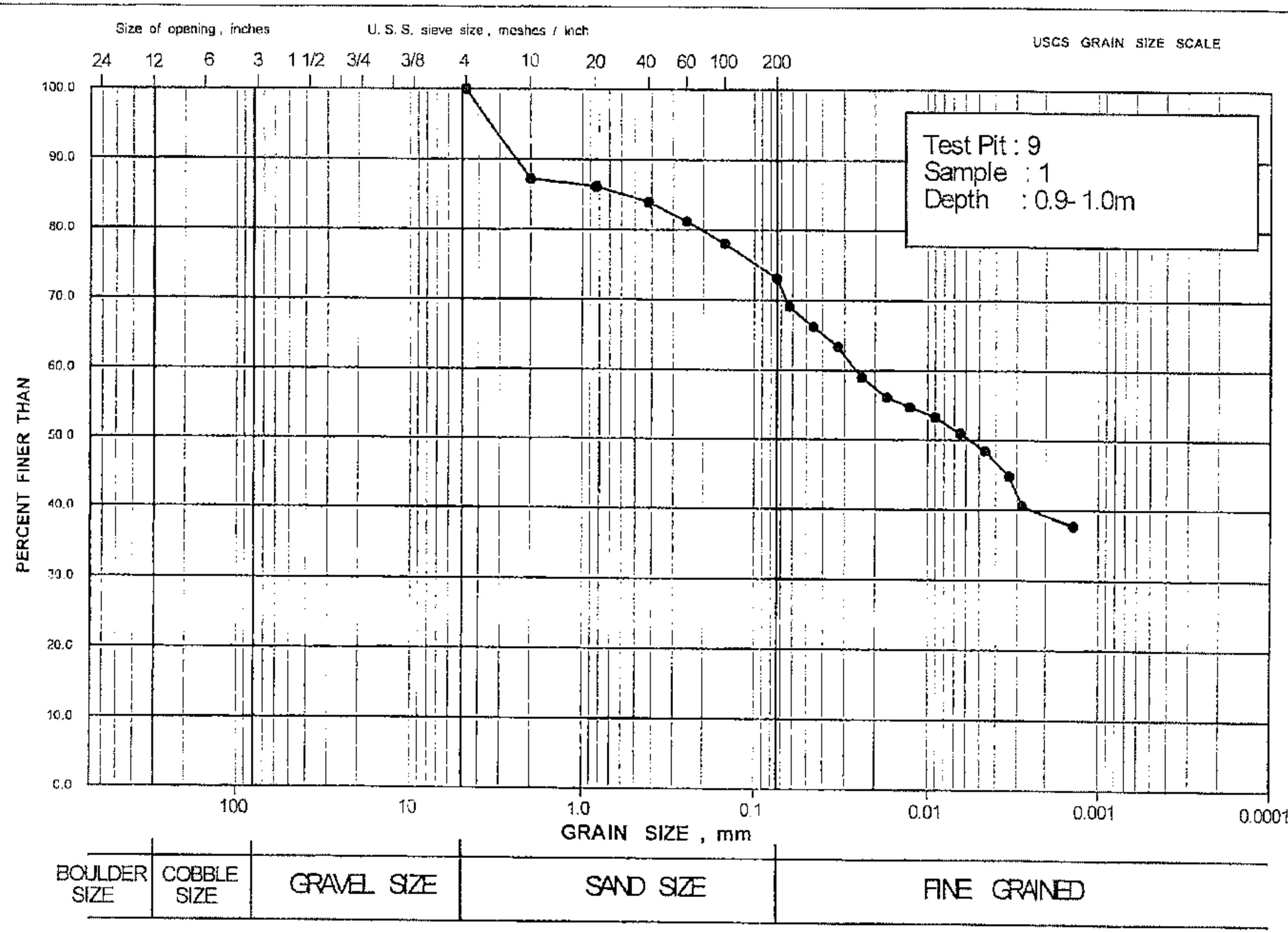
GRAIN SIZE DISTRIBUTION

Figure : I-4



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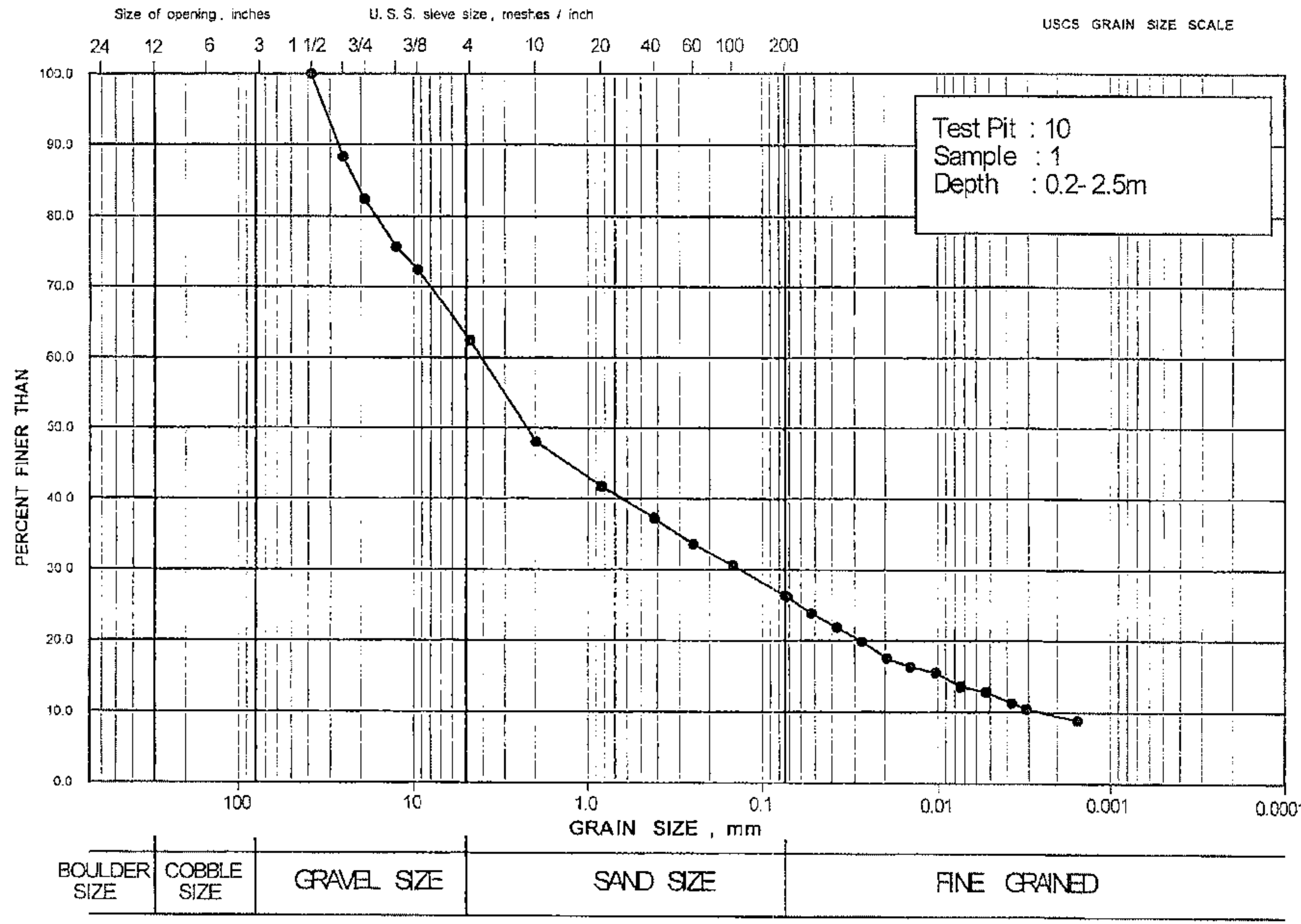
GRAIN SIZE DISTRIBUTION

Figure : I- 5



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GRAIN SIZE DISTRIBUTION

Figure : I- 6

December 23, 2010

50 YEARS in 2010

REPORT ON

A Review of the Stability of the Proposed Southeast Waste Rock Dump, Mount Polley Mining Corporation, Likely, BC

Submitted to:
Mount Polley Mining Corporation
P.O. Box 12
Likely, BC
V0L 1N0

REPORT

Project Number: 05-1413-027

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APPENDICES

1.0 INTRODUCTION

Imperial Metals Corporation's Mount Polley copper/gold open pit mining operation is located approximately 8 km southwest of the town of Likely and 100 km (by road) northeast of Williams Lake, in central British Columbia. Open pit mining is currently being carried out in the Springer, Southeast Zone and the Pond Zone pits. Waste rock generated from the Springer Pit will be consigned to the proposed Southeast Waste Rock Dump. Mount Polley Mining Corporation has retained Golder Associates Ltd. (Golder) to carry out a stability assessment of the proposed Southeast Dump.

This report provides a description of the proposed Southeast Dump development and of the general site conditions. The results of a field test pit investigation programs and laboratory test programs are presented. The engineering geology of the foundation soils at the mine site is described. The results of the stability assessment of the proposed dump development are presented. Finally, recommendations are provided regarding construction and operational procedures, in order to enhance the short and long-term stability of the Southeast Dump.

2.0 PROPOSED SOUTH ROCK DISPOSAL SITE DEVELOPMENT

An overall plan of the Mt. Polley mine site, showing the location of the Springer, Southeast Zone and the Pond Zone Pits, and the current waste rock dump development is shown on Figure 1. The proposed Southeast Dump development is shown on Figure 2.

The Springer Pit is being excavated along the west flank of the northwest/southeast trending ridge of Mount Polley. It is located between mine coordinates 4,030 N and 3,060 N, and 1,290 E and 2,030 E, to the northwest of the inactive Caribou Pit and to the southwest of the inactive Bell Pit. The south wall of the Springer Pit has an approximate maximum crest elevation of 1,140 metres and a maximum wall height of 90 metres. The east wall has a maximum crest elevation of 1,192 metres and an approximate height of 60 metres to the current operating bench. The north wall has an approximate maximum crest elevation of 1,154 metres.

The Southeast Zone Pit is a smaller pit located to the south of the existing East Dumps. This pit extends between 2,320 N and 2,020 N, and 3,520 E and 3,760 E in mine grid coordinates. The pit floor is located at approximately 1,012 metres elevation. The north wall has an approximate maximum crest elevation of 1,074 metres and is 62 metres in height. The east wall has a maximum crest elevation of 1,050 metres, and a maximum wall height of 38 metres. The maximum crest elevation of the west and south walls is 1,080 metres, and the walls are 68 metres in height.

The Pond Zone Pit is located south-southwest of the Southeast Zone Pit, between mine grid coordinates 1,920 N and 1,625 N, and 3,230 E and 3,490 E. The Pond Zone Pit is a semi-circular pit consisting of east, north and west walls. The south side of the pit is currently open to topography and provides access into the pit. The crest of the east and west walls varies from 1,082 metres elevation at the north end, to 1,052 metres elevation at the south end. The crest of the north wall is located at 1,082 metre elevation, and the wall height is 42 metres. The pit floor and the toes of the walls are located at the 1,040 metre elevation.

The proposed Southeast Dump has been designed to accommodate material produced from the Springer Pit. Development of the dump will be along southeast flank of the Mt. Polley Ridge. The dump will be constructed by end-dumping from the proposed crest elevation of approximately 1,100 metres, and will attain a maximum height of approximately 140 metres.

3.0 FIELD AND LABORATORY INVESTIGATIONS

3.1 Test Pit investigations

Test pits investigations for waste dumps and for the tailing disposal facility have previously been carried out at the Mt. Polley Mine. Most recently, a test pit investigation of the dump foundation soils was carried out within the proposed footprint of the previously proposed South WRDS from May 18 to May 20, 2010 by Golder personnel. Eleven test pits were excavated as part of the investigation. The soil stratigraphy was recorded and soil samples were collected for laboratory testing.

This proposed waste dump will not be constructed, and has been replaced with the proposed Southeast Dump. However, the results of the test pit investigations, and of other foundation investigations carried out at the mine, are relevant to the stability assessment of the proposed Southeast Dump. Figure 3 shows the locations of the test pits excavated for previously proposed South WRDS. Photos and a summary of the soil stratigraphy observed in the test pits are included in Appendix A.

Prior to excavating the test pits, a site reconnaissance and an inspection of the proposed test pit locations was carried out by senior Golder personnel accompanied by Mt. Polley personnel. A CAT 320D track excavator was used to excavate the test pits.

3.2 Laboratory Testing

Laboratory tests have been carried out on the selected fine-grained soil samples collected from the South WRDS investigation test pits. Grain size distribution curves and the results of index testing are presented in Appendix B. A summary of the testing results is presented in Table 1 below.

Table 1: Test Pit Soil Sample Test Results

Test Pit Number	Sample Number	Depth (m)		% Clay	% Silt	% Sand	% Gravel	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index
		From	To									
6	2	2	2.5	30.0	53.1	16.9	0	52.9	102	37	65	0.2
9	2&3	3	5.1	21.7	72.3	5.8	0.2	20.3	33	21	12	-0.1

Sample TP6-2 was obtained from just below the ground surface in a topographic low proximal to the swamp located south and east of Bootjack Lake. Sample TP6-2 is clayey-SILT with some sand that exhibits a high plasticity index and a positive liquidity index. This is indicative of a soft, normally-consolidated silt.

Samples TP9-2 and TP9-3 were obtained from a layer of lacustrine silt located to the southeast of Bootjack Lake. Samples TP9-2 and TP9-3 consist of predominantly clayey-SILT, with little sand. The material exhibits a low plasticity index and a negative liquidity index. This is indicative of relatively dense and competent silt.

Direct shear testing was performed on the above samples at normal stresses of 100 kPa, 200 kPa, and 500 kPa. Each sample was tested for peak and residual strength. The results of the direct shear tests are presented in Appendix C, and are discussed further in Section 4.3.

Laboratory tests were conducted on coarse-grained samples collected during the October 1999 West Dump test pit investigations. The results of these tests were used to characterise the coarse-grained soils observed during the May 2010 South WRDS test pit investigations. A summary of the testing results on coarse-grained samples is presented in Table 2.

Table 2: October 1999 West Dump Investigation - Laboratory Results for Coarse-Grained Samples

Sample Number	TP1-2	TP10-1
Sample Description	Silty-SAND (Till)	Silty-SAND (Till)
Depth From (m)	1.3	1
Depth To (m)	1.4	1.1
Gravel Size (%)	27	38
Sand Size (%)	46	34
Fine Grained (%)	27	28
Liquid Limit (%)	17	25
Plasticity Limit (%)	16.2	17.1
Plasticity Index (%)	0.8	7.9
Water Content (%)	13.2	13.3
Liquidity Index	-3.77	-0.49

Grain size distribution curves can be found in the report "A Stability Review of the Proposed West Dumps" (Golder, 2000).

4.0 ENGINEERING GEOLOGY OF PROPOSED SOUTHEAST WASTE ROCK DUMP SITE FOUNDATION

The following discussion of the foundation conditions of the proposed Southeast Dump area is based on the 2010 field investigations, together with over 15 years of experience with the surficial soil conditions the mine.

4.1 Topography and Surface Drainage

The proposed Southeast Dump will be located on the southeast flank of the northwest/southeast trending Mount Polley, and to the west of the shoreline of Polley Lake. A plan that shows the locations of selected cross section through the proposed dump are shown on Figure 4. The cross sections through the proposed dump are shown in Appendix D.

The north portion of the dump will be founded on slopes that are located along the west side of Polley Lake, and that inclined toward the lake at inclinations of 2 to 12 degrees (Figures D1 and D2). The topography is intersected by east-west trending ephemeral drainage channels. The topography also contains some localized flat-lying depressions.

The south portion of the dump will be founded on steeper terrain that slopes down to a broad, east/west trending valley that extends from Boot Jack Lake to Polley Lake. Foundation slope angles vary from 6 to 14 degrees on this slope (Figures D2 and D3).

Two small pits, the Southeast and Pond Zone Pits, are being excavated within the foot print of the proposed dump (Figure 1). These pits will be back filled with waste rock as the dump is developed. The pits have steep rock walls and flat pit floors that have been excavated in strong bedrock.

4.2 Soil and Bedrock Conditions

The following discussion of the anticipated dump foundation conditions is based on the results of the test pit investigations carried out in the vicinity of the previously proposed South WRDS. and the experience gained in other foundation investigations carried out for other waste dumps and the tailings disposal facility that have been constructed on the mine site. The locations of the test pits excavated for the South WRDS site field investigations are shown on Figure 3.

The foundation conditions along Bootjack road, in the vicinity of test pit TP-1, consist of a thin veneer of loose SAND and GRAVEL till overlying bedrock. This veneer has a thickness of 0.75 metres in test pit TP-1. A 0.6 metre veneer of sandy SILT overlying 1.3 metres of till overlying bedrock was encountered in TP-2.

The foundation conditions in the vicinity of test pits TP-3, TP-4 and TP-5, south of the mill site, consist of a layer, of sandy till ranging from 1.3 to 2 metres in thickness overlying weathered bedrock. However, a till layer greater than four metres in thickness was observed in the east/west trending gully located south of the mill site. The till in this area consists mostly of silty SAND till and colluvial deposits. In general, overburden located outside the east/west trending valley varies from loose sub-rounded, poorly sorted silty SAND colluvial deposits to clayey, silty SAND, with some gravel tills.

The foundation conditions in the topographic high in the area southwest of the Pond Zone Pit and in the vicinity of test pits TP-7, TP-8 and TP-11, generally consist of a layer of SAND and GRAVEL till, greater than 3.6 to 5.2 metres in thickness, overlaying bedrock. However, SILT and CLAY lenses were encountered in test pits TP-6, TP-9 and TP-10. The lenses in test pits TP-6 and TP-9 correspond with low-lying and wet to swampy areas that are located on the flat-lying terrain, and are assumed to have been recently deposited at the bottom of the swamps. A thick (3.7-metre) layer of moist to wet SILT was encountered in test pit TP-9. This material is over-consolidated and likely a remnant lacustrine deposit located in the low-lying areas to the east of Boot Jack Lake. The estimated extents of these lenses are shown on Figure 5. Bedrock is very close to surface near local topographic highs in this area, also shown on Figure 5. Numerous bedrock outcrops are exposed in the vicinity of test pits TP-7 and TP-8. Surficial soils consist of a thin layer of SAND and GRAVEL till as encountered in test pits TP-7 and TP-8.

The thickness of the overburden increases to the south of the south flanks of Mt. Polley toward the bottom of the valley to the east of Bootjack Lake.

Foundation investigations have also been carried out in the vicinity of the tailings disposal facility which is located to the south of the east/west trending valley between Boot Jack and Polley Lake. The results of these investigation indicate that the majority of the tailings area is underlain by dense glacial till that overlies bedrock. The exception to this is a localized depression which is spanned by the Main Embankment of the tailings pond. This depression is reportedly underlain by till, and fluvial and lacustrine materials that are up to 20 metres thick.

In summary, the results of the various foundation investigations that have been carried out across the mine site indicate that the following soil stratigraphy can expect to be encountered at the mine site.

- In general, the bedrock is overlain by a dense, well-graded, glacial till that consists of silt, sand, gravel with some clay size particles. The till is thickest in the valley bottoms and becomes thinner with increasing elevation.
- The till is generally overlain by a thin veneer of colluvium that has been derived from bedrock outcrop at the higher elevations or till at the mid to lower elevations.
- Glacio lacustrine deposits have been encountered at the bottom of the valley located to the southeast of Boot Jack Lake, in a localized depression below the Main Embankment of the tailings disposal facility, and along the shoreline of Polley Lake along the east side of the Wight Pit. The locations of these deposits are shown on Figure 5.
- Localized swamp deposits have been encountered in localized depressions throughout the mine site. These sediments were also encountered in the valley to the east of Boot Jack Lake and their anticipated locations are shown on Figure 5.

For the most part, the proposed Southeast Dump is expected to be founded on colluvium that is underlain by dense till. However, it is possible that the toe of the south side of the dump may be advanced over soft swamp bottom clayey silt deposits or dense lacustrine silt deposits located in the bottom of the valley located to the east of Bootjack Lake.

4.3 Overburden Soil Properties

Soils encountered during the 2010 test pit investigations are colluvium, till, swamp bottom clays and lacustrine sediments. Colluvial and till sediments have frequently been encountered and tested in previous foundations studies at the mine. The selection of strength parameters for these materials has been based on these results, together with previous experience at Mount Polley and other mines in BC, design.

Colluvial sediments contain well-graded silts, sands and angular gravels, with little to no clay, and are loosely compacted. Due to the lack of clay content, colluvium in central British Columbia typically exhibits nominal cohesion and a friction angle of approximately 35 degrees. A unit weight of 20 kN/m³ is used to reflect the loose nature of the sediments.

Till sediments contain well-graded, silt, sand and rounded to sub-angular gravel, with little to some clay and are dense. Due to its dense and well-graded nature, the till typically exhibits a friction angle of 35 to 40 degrees, with a variable amount of cohesion. A unit weight of 22 kN/m³ is used to reflect the dense and compact nature of the till. During the 2010 test pit investigations both sediment types were observed to be moist to wet.

Laboratory testing of the swamp bottom clays and lacustrine silts encountered during the 2010 test pit investigations were carried out for the South WRDS studies. Results from the index tests are shown in Appendix B and results from the direct shear tests are shown in Appendix C. Direct Shear results are summarized in Table 3.

Table 3: Direct Shear Results from 2010 Test Pit Investigations

Sample	Depth (m)		Laboratory Description	Peak		Residual
	From	To		Friction Angle (degrees)	Cohesion (kPa)	Friction Angle (degrees)
TP6-2	2.0	2.5	Clayey SILT (Swampy Clay)	22	30	12
TP9-2&3	3.0	5.1	SILT (Lacustrine Silt)	34	26	29

4.4 Waste Rock Dump Properties

The waste rock at Mt. Polley consists of hard competent blasted rock with a grain size that varies from a few centimetres to up to 1 to 2 metres. Research on the strength of rock fill and the testing of large samples of rock fill has shown that rock fill exhibits non-linear shear strength behaviour that is largely dependent upon the gradation of the particles, the angularity of the particles, and the degree of compaction the particles (Reference 1). Figure 6 shows the distribution of friction angle as a function of applied normal stress for various rock fill materials. Figure 7 shows the non-linear strength envelope derived from the low density, poorly-graded weak waste rock particles curve shown on Figure 6. Based on these results, together with experience from other open pit mines in British Columbia, the following non-linear shear distribution for have been used for the waste rock.

$$\tau = 1.446\, \sigma_n^{0.8978}$$

5.0 DUMP STABILITY ASSESSMENT

5.1 Dump Failure Mechanisms

The stability of the proposed Southeast Dump is expected to be governed by the double wedge slope failure mechanisms. The double wedge failure mechanism will most likely occur in steeper terrain, where bedrock outcrops and is overlain by a thin layer of overburden. In this mechanism, the upper portion of the rock fill is in an active state, with the shearing resistance mobilised along the boundaries of the active wedge within the fill. The toe region is in a passive state and provides the lateral support required for the upper part of the slope to remain stable. The Factor of Safety for this mechanism is defined as the ratio of the available foundation shear resistance under the toe wedge to the forces tending to produce translation of the toe.

The stability of the portions of the proposed dumps that are expected to be founded on thin soils has been assessed with respect to the double-wedge failure mechanism. However, slope stability computer programs that allow for a search for a critical double-wedge failure mechanism for a dump configuration do not exist. Therefore, the method of vertical slices, using the computer stability analysis code SLIDE™, has been used to assess the stability of the dump with respect to a bi-linear mechanism that involves sliding along:

- A flat or slightly curved surface that represents failure along the back of the active wedge in the upper portion of the dump;
- A relatively flat failure surface within the foundation materials, along the base of the passive portion of the dump; and
- Possibly, shear through the waste rock at the toe of the platform, if it is located above another platform.

The double wedge method of stability analyses has been used to assess the stability the proposed Southeast dump, and the results of these analyses are discussed in the following sections. The Morgenstern-Price method was used for all analyses, as it is considered to be the most rigorous approach.

5.2 Design Factor of Safety

According to the British Columbia Ministry of Energy and Mines guidelines for the design of waste rock mine dumps (Reference 2), many of the factors that will control the stability of a structure or excavation are site specific. Consequently, it is considered unduly restrictive to establish specific Factor of Safety criteria which must be met in all design cases. Selection of a reasonable design Factor of Safety should be based on sound engineering judgment, with careful consideration given to the ramifications if assumptions prove to be incorrect.

The selection of design Factors of Safety for the proposed Southeast Dump are based in part on:

- The stability performance of large waste dumps previously developed to the north of the proposed Southeast Dump; and
- Guidelines provided in the British Columbia Ministry of Energy and Mines guidelines for the design of waste rock mine dumps (Reference 2). Table 4 provides a summary of the Provincial Mines Ministry Guidelines.

Table 4: Summary of Interim Guidelines for Minimum Design Factors of Safety (Reference 2)

Stability Condition	Factor of Safety	
Stability of Dump Face	**Case A**	**Case B**
Short-term	1.0	1.0
Long-term	1.2	1.1
Overall Stability (Deep-seated Stability)		
Short-term (Static)	1.3 to 1.5	1.1 to 1.3
Long-term (Static)	1.5	1.3
Long-term (Pseudo-static)	1.1 to 1.3	1.0

Case A

- Low level of confidence in critical analysis parameters
- Possibly unconservative interpretation of conditions, assumptions
- Severe consequences of failure
- Simplified stability analyses method (chart, simplified method of slices)
- Stability analyses method poorly simulates physical conditions
- Poor understanding of potential failure mechanisms

Case B

- High level of confidence in critical analyses parameters
- Conservative interpretation of conditions, assumptions
- Minimal consequences of failure
- Rigorous stability analysis method
- Stability analysis method simulates physical conditions well
- High level of confidence in critical failure mechanism(s)

The choice of a design Factor of Safety involves a consideration of level of confidence in the understanding of the factors that will control stability, the in-put parameters, the analysis methods, and the consequences of failure. The provincial guidelines provide a range of suggested Factors of Safety to account for the consideration of these various factors. With respect to the proposed Southeast Dump and the stability analyses presented in this report, the following observations can be made.

- Past experience with pit slope and waste dump construction at Mt. Polley has provided a good understanding of the geologic and hydrogeologic conditions at the mine site, and the probable range of waste rock and foundation material strength parameters. Consequently, there is a reasonable degree of confidence in the design strength parameters used in the analyses. Moreover, the strength parameters are somewhat conservative as they ignore the cohesion that may be exhibited in the foundation soils. In this regard, there is a reasonable to high level of confidence in the input parameters, and the choice of Factor of Safety on the basis of input parameters would appear to satisfy Case B.

- Likewise, past mining and construction experience at the mine and at other porphyry mines in central British Columbia has provided many opportunities to observe and understand the types of instability mechanisms that develop at these mines. Consequently, there is a reasonable to high level of confidence in the understanding of the potential instability mechanisms, and the choice of Factor of Safety on the basis of the understanding of the instability mechanism also appears to satisfy Case B.
- Rigorous limit equilibrium analyses methods have been used in this stability assessment. In this regard, the analyses methods carried out in this assessment and the choice of Factors of Safety based on the stability analyses method likely satisfy Case B.
- There are no public or active mine roads or infrastructure located below the proposed dump. While Polley Lake is located below the dump, the small lake is rarely used by the public. Accordingly, this criterion satisfies Case B when considering the consequences of failure.

In view of the above considerations, the proposed Southeast Dump can be classified as a case B dump.

All angle-of-repose waste dumps will exhibit low Factors of Safety with respect to shallow-seated circular failure of the face of the dump. The stability of the face with respect to shallow-seated failure improves significantly once the dumps have been re-sloped to the planned 26 degree face angle, and shallow-seated stability will not be a long-term consideration for the re-sloped dumps.

However, waste dumps do not fail as a result of shallow-seated circular failure of the dump faces. Rather, waste dump failures of any significance usually occur as the result of failure of the foundations. Therefore, the stability of the proposed dumps has been assessed with respect to deep-seated instability that involves the foundation materials, and the results of the analyses are discussed in the following sections. The case B Factors of Safety in Table 4 have been used as the design Factors of Safety.

5.3 Design Shear Strength Parameters

A summary of the selected strength parameters used in the analyses is shown below in Table 5.

Table 5: Selected Material Strength Parameters

Material	Unit Weight (kN/m^3)	Groundwater Conditions	Friction Angle (degrees)	Cohesion (kPa)
Swamp Bottom Clay	22	Water Table at Surface	22	30
Lacustrine Silt	22	Water Table at Surface	34	26
Colluvium	20	Water Table at Surface	35	0
Till	22	Water Table at Surface	35	10

Material	Unit Weight (kN/m^3)	Groundwater Conditions	Friction Angle (degrees)	Cohesion (kPa)
Bedrock	25	Saturated	45	250
Waste Rock	19	Dry	42	0

The strength parameters used for the swamp clay and lacustrine silt were based on laboratory results from the 2010 field program. The peak friction angle and cohesion were used in the stability analysis, as peak strength will be initially mobilized in these materials before a residual strength condition is attained.

Strength parameters for the colluviums, till and waste rock are based on results from previous experience at Mount Polley and with other mines in British Columbia.

5.4 Stability Analyses

Mount Polley provided Golder Associates Ltd. (Golder) with three-dimensional AutoCAD models of the original foundation area topography and two-dimensional drawings of the crest and toes of the proposed ultimate re-sloped dump configuration. These surfaces were used to cut cross sections through the proposed dump and the original topography. The locations of the cross sections are shown in plan on Figure 4. These sections are included in Appendix D. Cross sections for the pre-closure angle of repose dump face slopes have been created by using a dump face angle of 37 degrees projected through the centre of the proposed re-sloped dump face. Stability analyses have been carried out along Sections 2, 4, 5, and 6, and the analyses cross sections are included in Appendix E.

The coarse-grained waste dumps are expected to be free-draining, and it has been assumed that groundwater levels will not develop in the dumps. It has been assumed that the foundation overburden soils and bedrock will be saturated to surface. These groundwater conditions are considered to be representative of periods of heavy precipitation, as occurs in the spring.

Stability analyses were initially carried out assuming that the proposed dump will be founded on colluvium that is underlain by till or bedrock, which is expected to be the case for the majority of the dump. The results of these analyses are presented in Appendix E and are summarized in the following table.

Table 6: Summary of Stability Analyses along Sections 2, 4, 5 and 6 for Colluvium Foundation Soils

Section	Indicated Factor of Safety for Critical Failure Surface	
	Angle of Repose Slope	Re-Sloped Dump Face
Section 2	1.160 (Fig. E1)	1.718 (Fig. E5)
Section 4	1.235 (Fig. E2)	1.822 (Fig. E6)
Section 5	1.366 (Fig. E3)	2.319 (Fig. E7)
Section 6	1.342 (Fig. E4)	1.693 (Fig. E8)

The results of the stability analyses indicate that, provided that the dumps are founded on colluvium underlain by competent till or bedrock, the proposed angle of repose dump face is expected to exhibit Factors of Safety in excess of approximately 1.1, and is expected to satisfy the short-term and long-term design Factor of Safety criteria with respect to shallow-seated failure of the dump face.

The results of all the stability analyses also indicate that the proposed re-sloped dump is expected to exhibit Factors of Safety in excess of approximately 1.6, and that the reclaimed dump is expected to satisfy the long-term Factor of Safety design criteria of 1.3 with respect to deep-seated stability of the dump.

The results of the stability analyses are consistent with the observed stability performance of the existing East Dump and Sandwich Dump that have been consigned to the slope along the west side of Polley Lake. These angle of repose dumps have exhibited adequate stability performance, with no evidence of dump face or foundations deformation or instability.

6.0 DUMP CONSTRUCTION WITHIN THE SWAMPS AND THE LACUSTRINE SEDIMENT AREA

Based on the distribution of surficial soils shown in Figure 5, there is a possibility that the toe of the southern portion of the proposed dump may be advanced over localized swamps or lacustrine sediments that are located with the bottom of the valley that is located to the east of Bootjack Lake. Additional stability analyses have been carried out for this potential condition. It has initially been assumed that drained conditions will be maintained in the clayey-silt sediments, and that the peak, drained shear strength of the lacustrine sediments and swamp bottom clayey-silts will initially be mobilized. The results of these analyses for Sections 4, 5 and 6 are included in Appendix E, and are summarized in Table 6 and 7 for lacustrine and swamp bottom sediments, respectively.

Table 7: Summary of Stability Analyses along Sections 4, 5 and 6 for Lacustrine Clayey-Silt Foundation Soils

Section	Indicated Factor of Safety for Critical Failure Surface	
	Angle of Repose Slope	Re-Sloped Dump Face
Section 4	1.274 (Fig. E9)	1.875 (Fig. E12)
Section 5	1.437 (Fig. E10)	2.058 (Fig. E13)
Section 6	1.351 (Fig. E11)	1.921 (Fig. E14)

Table 8: Summary of Stability Analyses along Sections 4, 5 and 6 for Swamp Bottom Clayey-Silt Foundation Soils

Section	Indicated Factor of Safety for Critical Failure Surface	
	Angle of Repose Slope	Re-Sloped Dump Face
Section 4	1.180 (Fig. E15)	1.495 (Fig. E18)
Section 5	1.270 (Fig. E16)	1.635 (Fig. E19)
Section 6	1.168 (Fig. E17)	1.473 (Fig. E20)

The results of the stability analyses indicate that the proposed angle of repose and re-sloped dump is expected to satisfy the design Factor of Safety criteria and to exhibit adequate SHORT AND LONG-TERM stability where it is founded on lacustrine or swamp bottom silts that exhibit drained shear strengths. However, the shear strength of soils is dependent upon the groundwater pressures that develop in the soils. As a saturated soil is loaded, the soils matrix compresses, and the load is transferred to the incompressible groundwater in the pores of the soil. The load transfer causes an increase in the pressure in the porewater, which in turn reduces the effective strength of the soil. The increase in porewater pressure can dissipate rapidly in coarse-grained permeable soils, and the rate of dissipation can match the rate of loading, such that the effective strength of the soils remains relative constant. However, in fine-grained, low permeability soils, the pore pressures may not be able to dissipate as rapidly as the load is applied, and pore pressures can increase and result in an attendant reduction in effective strength. Consequently, the rate of loading of fine-grained soils must be controlled in order to minimize the generation of excess porewater pressures and the loss of soil strength.

The lacustrine silts exhibit a negative liquidity index, which indicates that they are reasonably dense materials. The softer and normally consolidated swamp bottom sediments exhibit a positive liquidity index, and will likely be susceptible to the generation of excess pore pressures during rapid loading by the construction of the dump. Rapid loading may occur during initial construction, and possibly during re-sloping of the dump. However, once the dump has been reclaimed, and excess pore pressures within silty sediments have dissipated, the dump is expected to exhibit adequate long-term stability performance.

The following two approaches can be undertaken to guard against the development of excess pore water pressures in the foundation soil along the south side of the dump.

- Firstly, the soils on the valley bottom to the south of the south portion of the dump could be pre-loaded with a 15 metre high lift prior to end-dumping from the ultimate platform elevations. This method has been successfully to pre-load lacustrine silts at other operations; and
- As an alternative, the stability of the dump could be closely monitored as the toe of the dump is advanced over the flatter terrain in the valley bottom where the finer-grained soils are likely to be encountered. Stability monitoring is discussed in further detail in Section 8.0.

7.0 SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

This report has presented the results of an assessment of the stability of the proposed Southeast Waste Rock Dump at the Mt. Polley Mine is central British Columbia.

The majority of the dump will be founded on shallow slopes located along the west side of Polley Lake. This portion of the dump is expected to be founded on competent colluvium and till soils, and this portion of the angle of repose and the re-sloped dump is expected to exhibit adequate stability with respect to both deep and shallow-seated instability. These results are in agreement with the favourable stability performance exhibit by the existing dumps that have already been constructed on the slopes along the west side of Polley Lake.

The south portion of the dump will be founded on steeper slopes located along the southeast flank of the northwest/southeast trending Mount Polley ridge. The results of stability analyses also indicate that this portion of the dump is expected to exhibit adequate stability performance where it is founded on competent colluvium or till soils.

However, the results of previous field investigations indicate that the valley to the east of Boot Jack Lake and to the south of the proposed south end of the Southeast Dump may contain lacustrine silts and/or swamp bottom silts in localized depressions. The results of stability analyses indicate the angle of repose and the re-sloped dump are expected to exhibit adequate stability provided that loading rates are low and drained soil behaviour is maintained in the fine-grained soils. However, there is a possibility that instability could develop if the soils are rapidly loaded and excess porewater pressures are generated in the soils.

The following two approaches can be undertaken to guard against the development of excess pore water pressures in the foundation soil along the south side of the dump.

- Firstly, the soils on the valley bottom to the south of the south portion of the dump could be pre-loaded with a 15 metre high lift prior to end-dumping from the ultimate platform elevations. This method has been successfully to pre-load lacustrine silts at other operations; and
- As an alternative, the stability of the dump could be closely monitored as the toe of the dump is advanced over the flatter terrain in the valley bottom where the finer-grained soils are likely to be encountered. Stability monitoring is discussed in further detail in Section 6.0.

8.0 DUMP STABILITY MONITORING

The portion of the north portion of the dump that will be founded on the slopes located to the west of Polley Lake are expected to be founded on competent colluvium and till, and to exhibit adequate stability performance. Slope stability monitoring of the active dump crest should be carried out visually by the shifters every 3 to 4 hours, and the observations should be recorded in the shift report logs. If excess cracking develops at the crest of the slope or evidence of bulging develops at the toe of the dump or in the foundations soils immediately ahead of the toe of the dump, wireline instrumentation should be used to monitor the stability of the face of the dump. Wireline monitoring is discussed in further detail below.

The south portion of the dump that will be constructed on the steeper slopes above the valley that is located to the east of Boot Jack Lake should also be monitored for stability. Initially, visual monitoring should be used, and the results of the monitoring should be recorded in the shift log. Because this portion of the dump may be advanced over steeper slopes on upper slopes, together with the fine-grained soils at the bottom of the slopes, a higher degree of monitoring vigilance should be used for the south portion of the dump. If cracks develop at the crest or evidence of bulging develops at the toe of the dump or in the foundations soils immediately ahead of the toe of the dump, wireline instrumentation should be used to monitor the stability of the face of the dump.

The wireline monitors should be set up adjacent to the active dumping areas, and along the alignment of any excessive settlement cracks at the crest. The monitors should be read every four hours, and the displacements should be divided by the reading interval time to calculate a velocity for the interval. The results of the monitoring should be recorded in a diary, and used to determine if it remains safe to continue operating the dump as per the Mine's standard waste dump operating procedures.

This report should be read in conjunction with the ***"Study Limitations"*** which is appended at the beginning of the report. The reader's attention is specifically drawn to this information, as it is essential that it be followed for the proper use and interpretation of this report.

We trust this letter report satisfies your current requirements. If you have any questions or require further assistance, please do not hesitate to contact the undersigned.

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED	*ORIGINAL SIGNED AND SEALED*
Ashley Engbloom, EIT (BC) Geotechnical Engineer, Mining Division	A.V. Chance, P.Eng. (BC) Principal, Mining Division

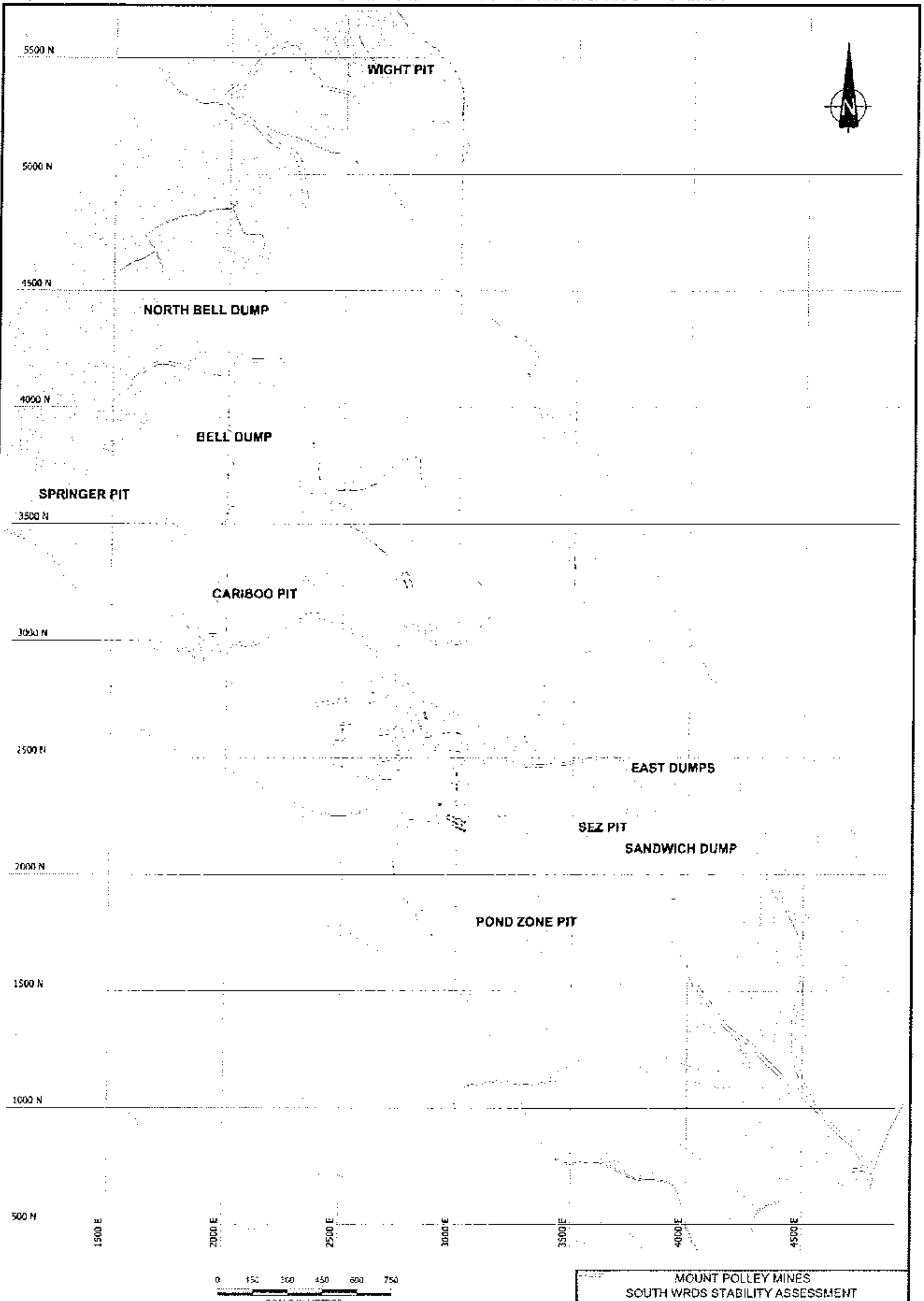
AE/AVC/rs/aw/aks

\\bur1-s-filesrv2\final\2005\1413\05-1413-027\rep 1223_10 stability of se rock dump - final\rep 1223_10 review of stability of proposed southeast waste rock dump-final.docx

REFERENCES

Leps. T.M. (1970) Review of the Shearing Strength of Rockfill. J. of Soil Mech. and Found. Dev., ASCE, Vol.96, No. SM4, Proc. Paper 7394, July 1970, 1159-1170.

"Investigation and Design of Mine Waste Dumps", Ministry of Energy Mines and Petroleum Resources, May 1991.



MOUNT POLLEY MINES
SOUTH WRDS STABILITY ASSESSMENT
LIKELY, B.C.

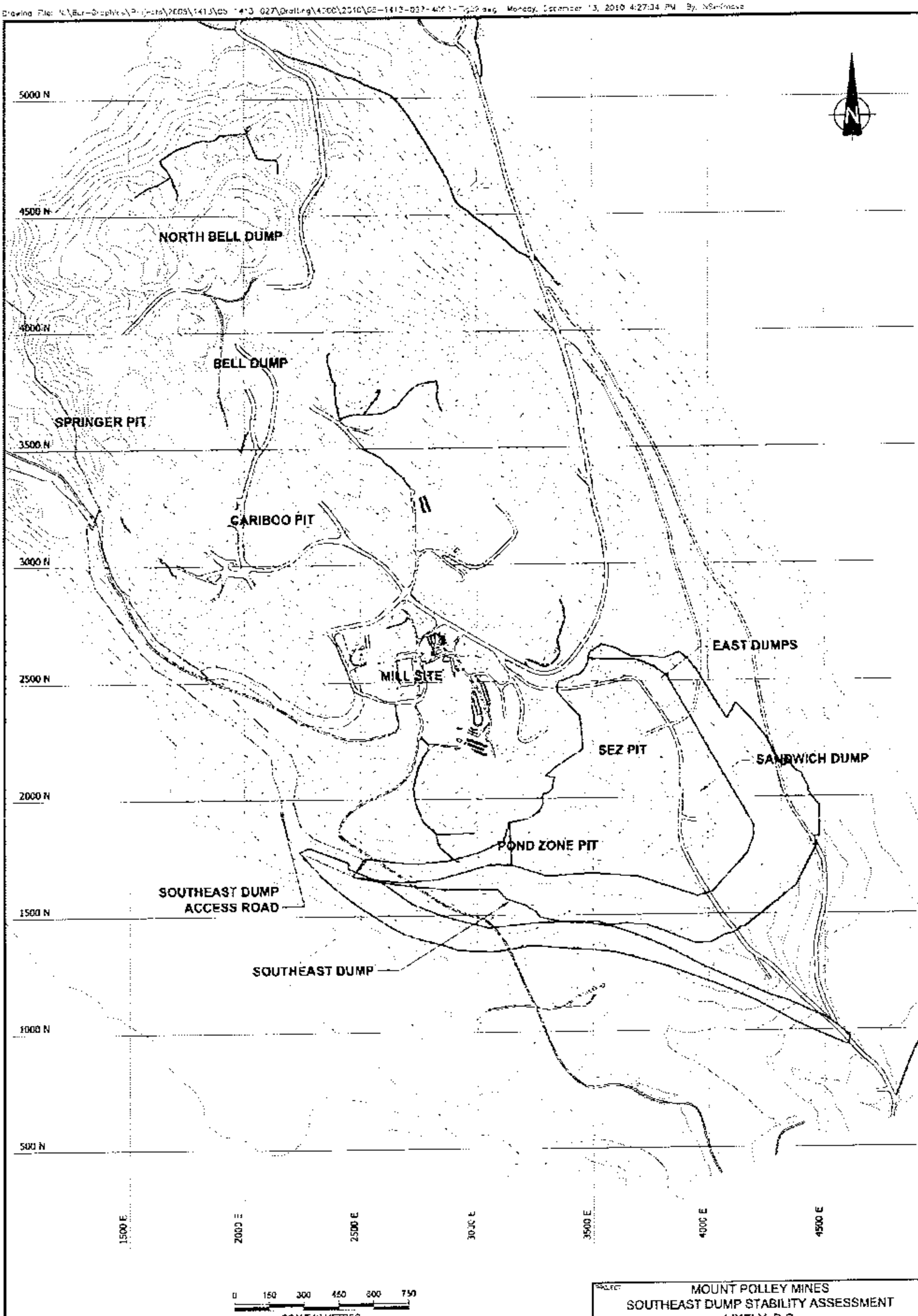
CURRENT MINE LAYOUT

Golder Associates

FIGURE 1

REFERENCES

1. BASE PLAN PROVIDED BY MOUNT POLLEY MINES MAY 2010



MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

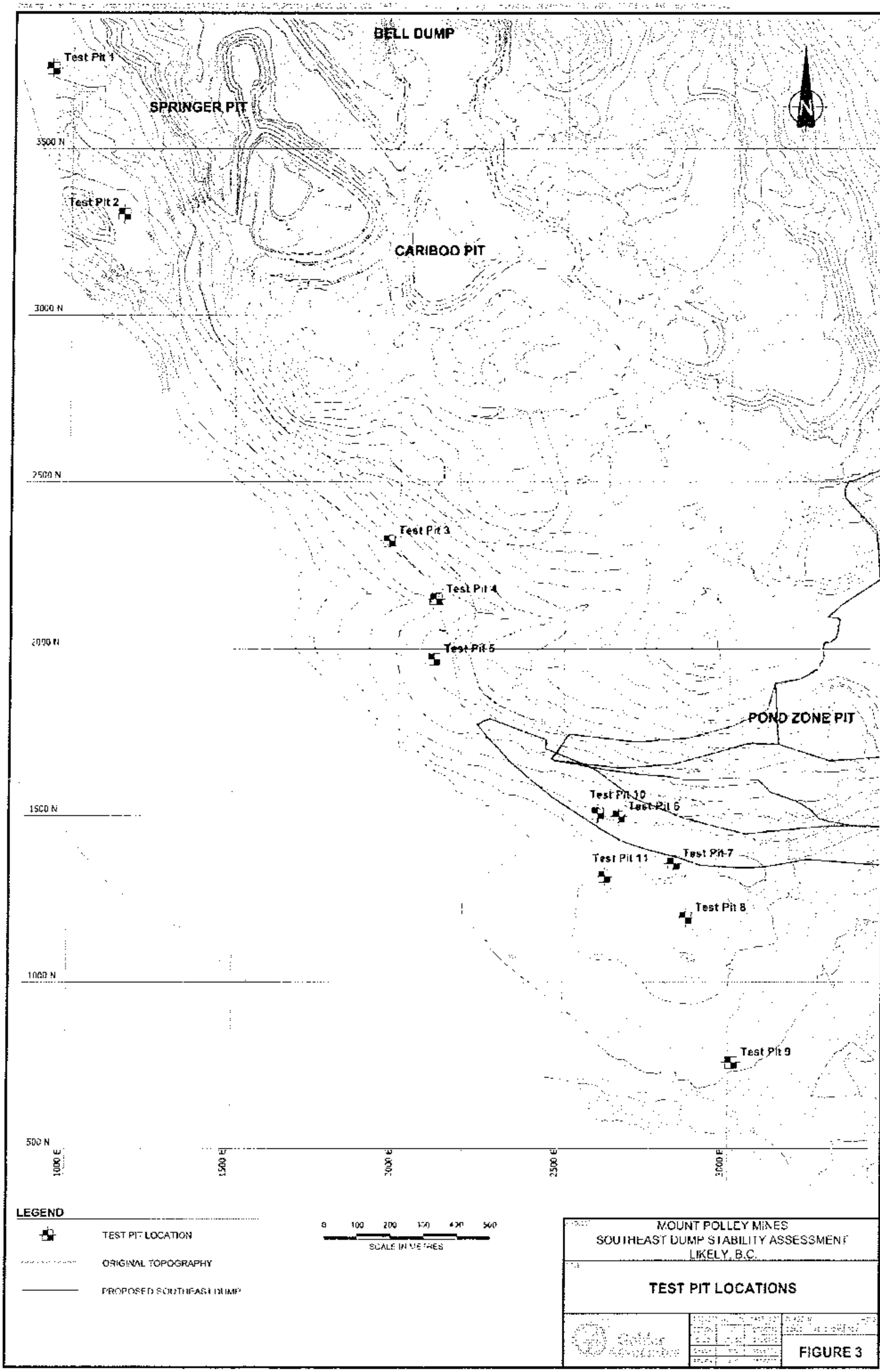
PROPOSED SOUTHEAST DUMP

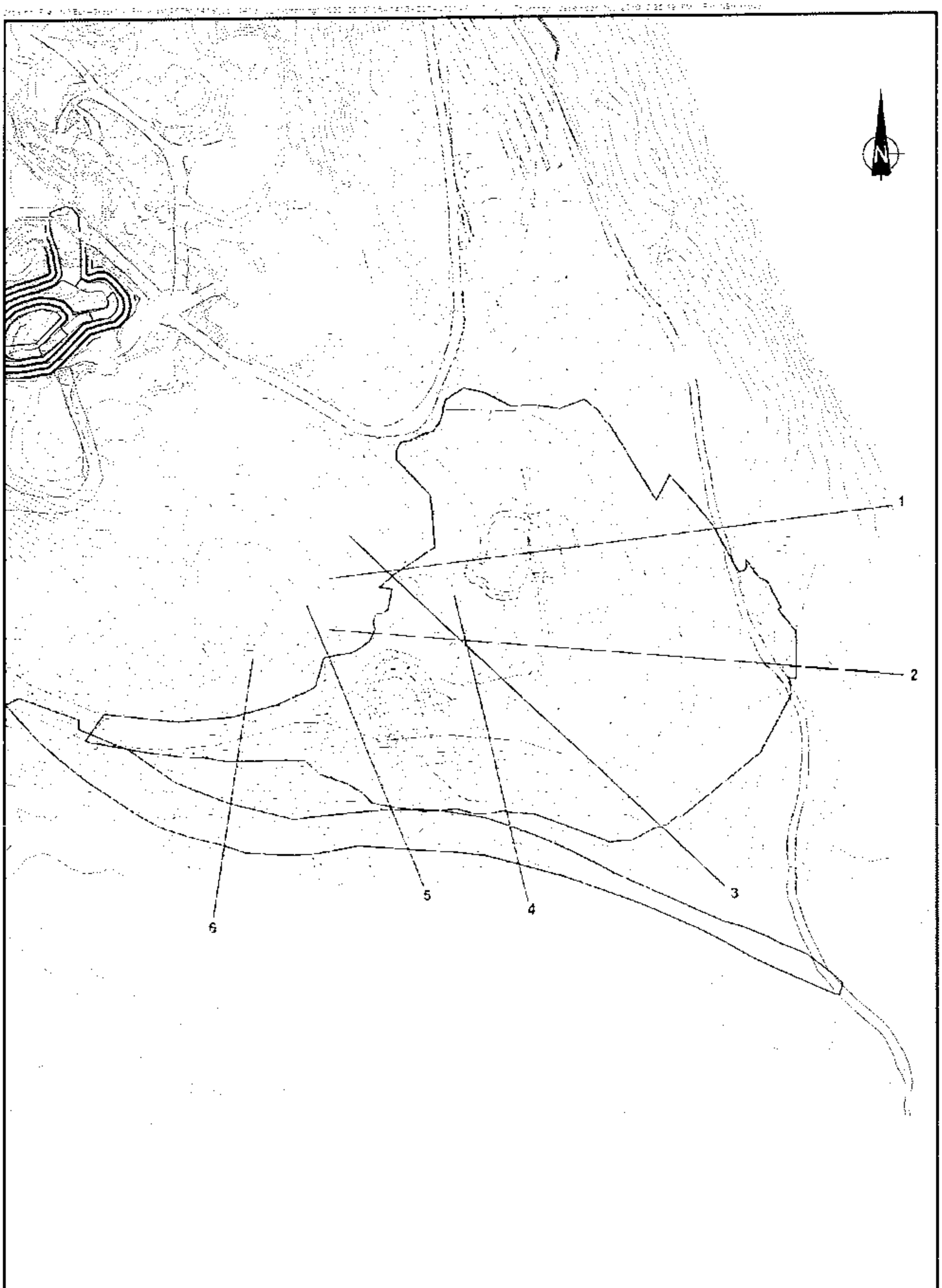
Golder Associates

FIGURE 2

REFERENCES

1. BASE PLAN PROVIDED BY MOUNT POLLEY MINES MAY 2010


BELL DUMP
SPRINGER PIT
CARIBOO PIT
POND ZONE PIT
Test Pit 1
Test Pit 2
Test Pit 3
Test Pit 4
Test Pit 5
Test Pit 6
Test Pit 7
Test Pit 8
Test Pit 9
Test Pit 10
Test Pit 11
N
3500 N
3000 N
2500 N
2000 N
1500 N
1000 N
500 N
1000 E
1500 E
2000 E
2500 E
3000 E
LEGEND
TEST PIT LOCATION
ORIGINAL TOPOGRAPHY
PROPOSED SOUTHEAST DUMP
SCALE IN METRES
MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.
TEST PIT LOCATIONS
FIGURE 3



LEGEND

ORIGINAL TOPOGRAPHY

PROPOSED SOUTHEAST DUMP

6 CROSS-SECTION LOCATION

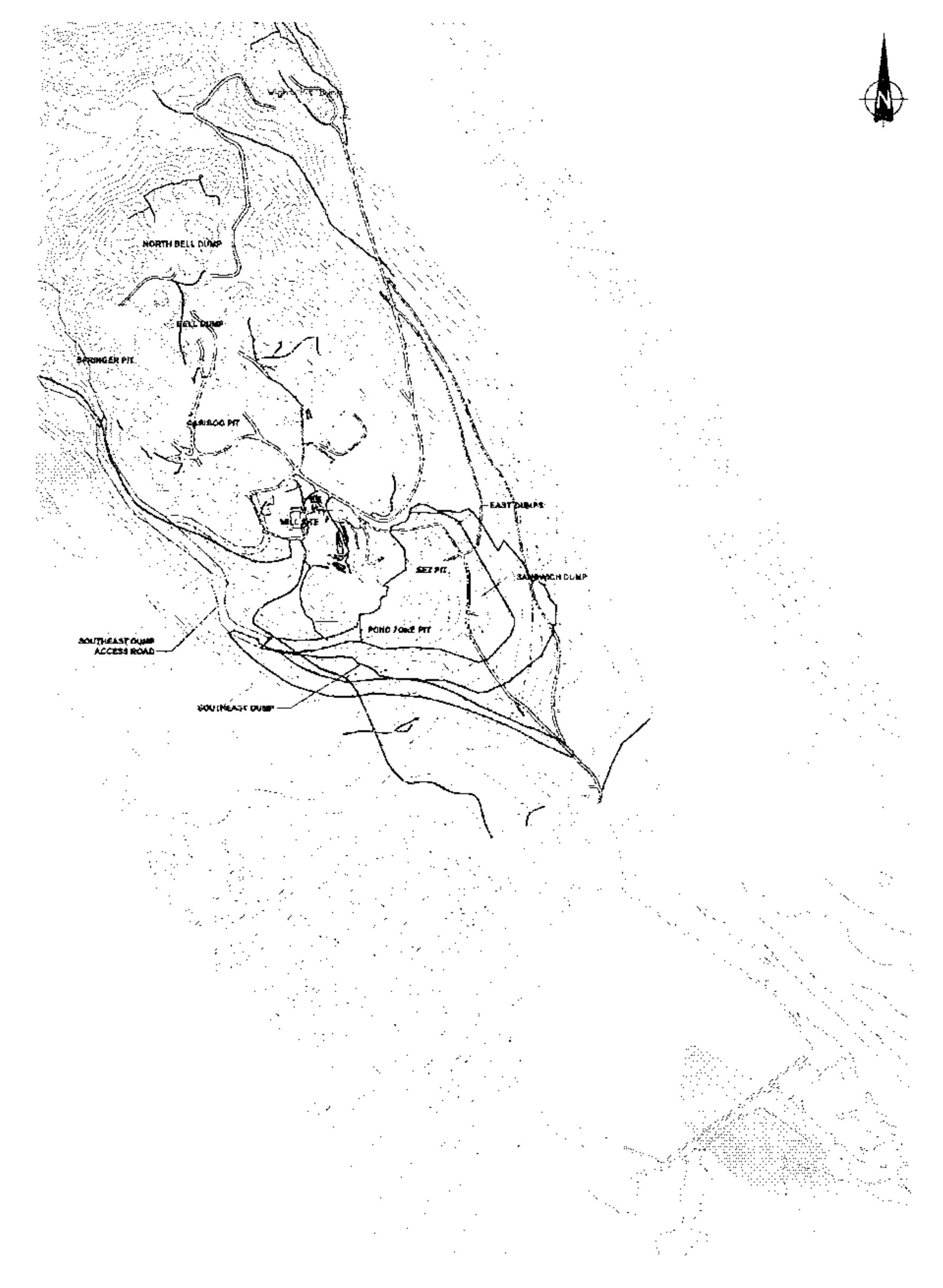
0 100 200 300 400 500

SCALE IN METRES

MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

CROSS SECTION LOCATIONS

FIGURE 4



0 250 500 750 1000 1250

SCALE IN METRES

LEGEND

POSSIBLE EXTENT OF SWAMPY CLAY

POSSIBLE EXTENT OF LACUSTRINE SEDIMENTS

REFERENCES

1. BASE PLAN PROVIDED BY MOUNT POLLEY MINES MAY 2010

MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

ANTICIPATED FOUNDATION CONDITIONS

PROJECT No. 05-1413-027 PHASE No. 4000

FIGURE 5

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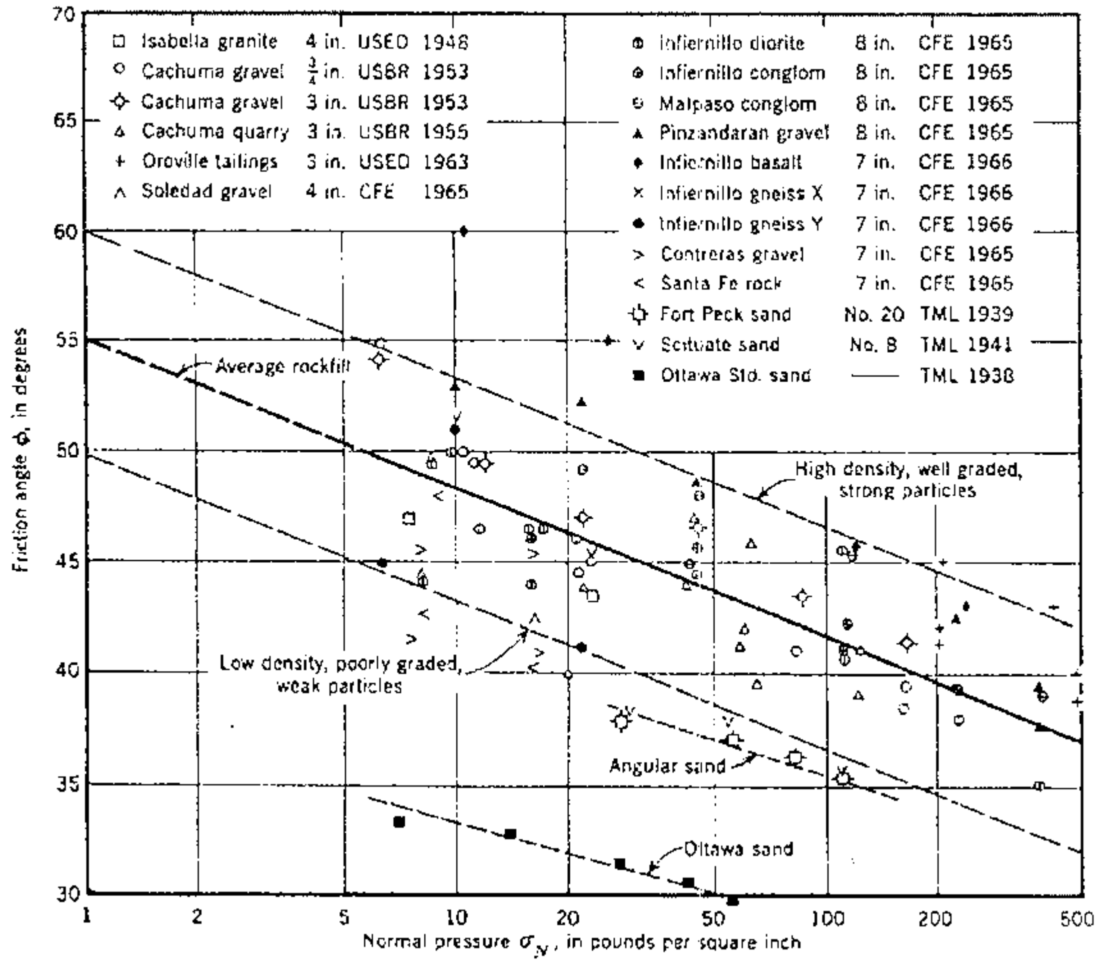


REFERENCE

Leps, T., "Review of Shearing Strength of Rockfill," Journal of Soil Mechanics and Foundation Division, ASCE. Vol. 96, SM4, pp. 1159-1170, 1970.

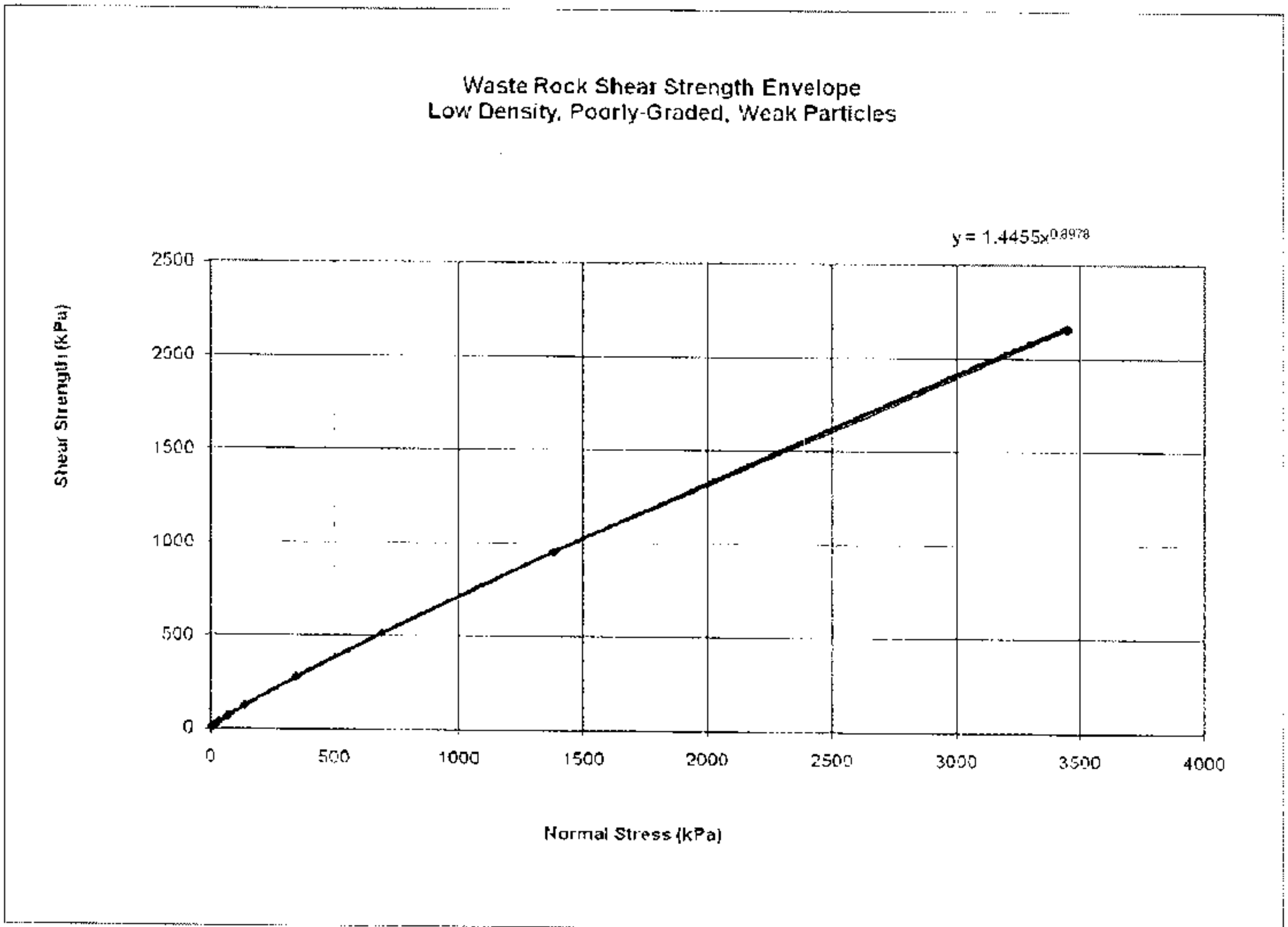
PROJECT
MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

TITLE
LEPS (1970) ROCK FILL STRENGTHS

Golder Associates

PROJECT No.	05-1413-406		PHASE No. 1000
DESIGN	JJR	30NOV09	SCALE NTS / REV
CADD	JJR	30NOV09	
CHECK	AVC	30NOV09	**FIGURE 6**
REVIEW	AVC	30NOV09	

N:\Bur-Graphics\Projects\2005\1413\05-1413-027\Drafting\4000\2010\05-1413-027-4000-Figures 6-7.pptx



PROJECT
MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

TITLE
STRENGTH ENVELOPE FOR LOW DENSITY, POORLY GRADED, WEAK PARTICLES

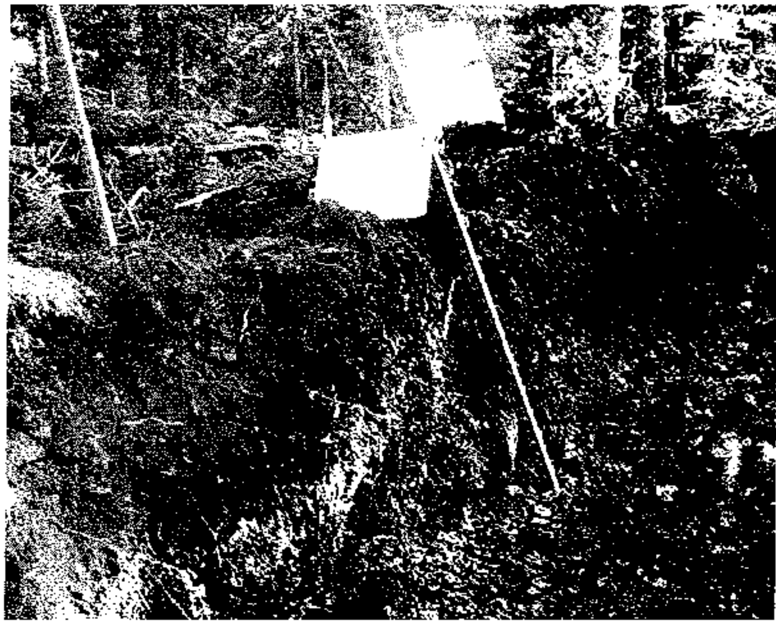
Golder Associates

PROJECT No.	05-1413-406		PHASE No. 1000	
DESIGN	JJR	30NOV09	SCALE	REV.
CADD	JJR	30NOV09	**FIGURE 7**	
CHECK	AVC	30NOV09		
REVIEW	AVC	30NOV09		

APPENDIX A

Test Pit Logs and Photos

TP - 1	TEST PIT LOG	Golder Associates
TEST PIT NO. 1		



PROJECT No. :	05-1413-027
DATE : 19-May-10	REF PT: SE corner
LOCATION : NW slopes of Springer Pit.	
Northing : 5823742	Easting : 590940
ELEVATION (m): 1062 ±17	DIMENSIONS (m): 5.6 x 1
LOGGED BY:	A. Engbloom
EQUIPMENT:	CAT 320D Excavator
OPERATOR:	s.22 (Mt Polley)
WATER LEVEL:	None
SURFACE CONDITIONS: Pit was dug at the end of a drill access road, on a steep embankment. Forested area.	
ROOT DEPTH:	0.75m

DEPTH SCALE (m)	SAMPLE NO.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
0.0 – 0.2			Loose, moist, black, silty sand fibrous PEAT. Decaying organics and roots.									
0.2 – 0.4			Loose, moist, black brown, silty SAND and angular GRAVEL, trace clay, trace roots. TILL.									
0.4 – 0.7			Loose, moist, light brown orange, sub-rounded to subangular SAND and GRAVEL, little silt, trace clay. TILL. Roots present.									
0.7			Dense, moist, light brown silty SAND some clay, little gravel. TILL. Roots present									
0.8 – 1.0			Broken, weathered bedrock. Contact not horizontal, ranges from 0.75m at the south to 1.65m towards the north. Material unravels with push from finger. Orange surface staining									

Notes:
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

TP - 1	TEST PIT LOG	Golder Associates
TEST PIT NO. 1		

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
1.0 1.1 1.2			Broken, weathered bedrock. Contact not horizontal, ranges from 0.75m at the south to 1.85m towards the north. Material will unravel with push from finger. Orange surface staining.									

Notes:

[1] Percent > 75 mm

[2] Sum of gravel, sand, and fines = 100%

[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.

[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense

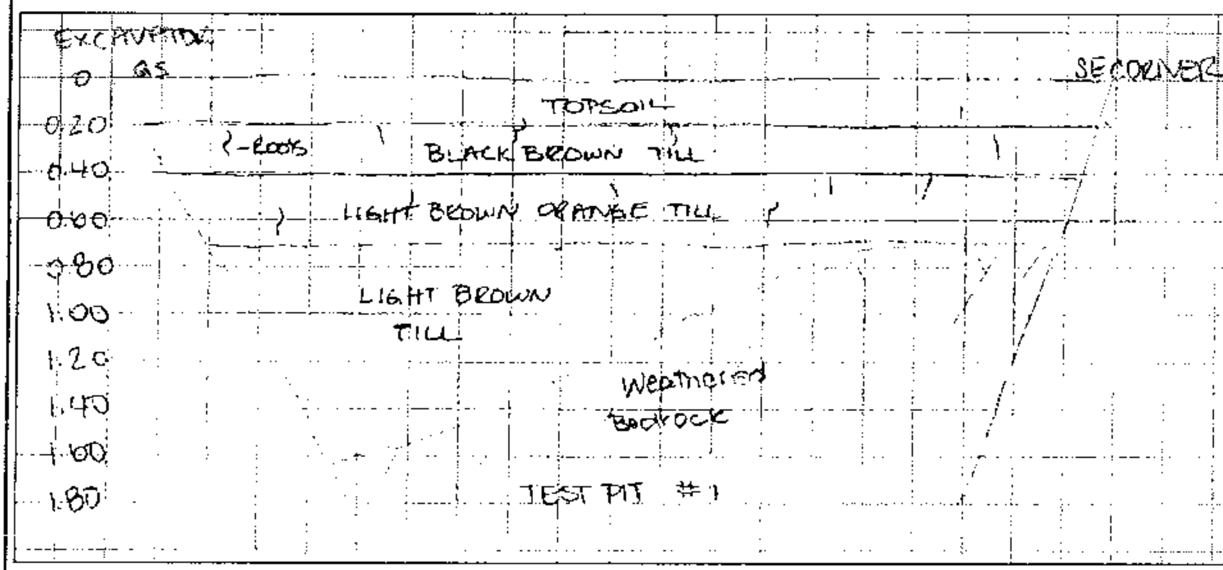
[5] A: Atterberg Limits

P: Permeability

PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

TP-1	TEST PIT LOG	Golder Associates
TEST PIT NO.		



TP - 2	TEST PIT LOG	Golder Associates
TEST PIT NO. 2		

PROJECT No. :	05-1413-027
DATE : 19-May-10	REF PT: SW corner
LOCATION : SW of Springer Pit and Bootjack Road.	
Northing : 5823304	Easting : 591158
ELEVATION (m): 992.2 ± 47	DIMENSIONS (m): 6.5 x 1
LOGGED BY:	A. Engbloom
EQUIPMENT:	CAT 320D Excavator
OPERATOR:	s.22 (Mt Polley)
WATER LEVEL:	None
SURFACE CONDITIONS: Pit was dug off an access road north of the new well and approximately 100 metres south of bootjack road.	
ROOT DEPTH:	0.95m

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
0.0 – 0.1			Topsoil, disturbed by excavator. Not able to be logged									
0.2 – 0.3			Very loose, dry to slightly moist, brown, sandy SILT, some clay, some cobbles, little organic material, including roots. TILL.									
0.4			Loose, dry to slightly moist, brown, sandy SILT, some clay, some cobbles, little organic material, including roots. TILL									
0.5 – 0.6			Dense, slightly moist, brown, sandy SILT, some clay, some cobbles. TILL. Roots present.									
0.7			Dense, moist, grey SILT and GRAVEL, some clay. TILL.									
			Dense, moist, black brown, organic rich SILT and GRAVEL, some clay. TILL. Roots present									
0.8 – 0.9			Dense, moist, black brown, organic rich SILT and sub-rounded to sub-angular GRAVEL, some clay. TILL. Roots present.									
1.0			Dense moist, mottled grey and orange, silty sub-rounded to sub-angular SAND and GRAVEL, some clay, little cobbles. Cobbles up to 15 cm in diameter. Cobbles decrease with depth.									

Notes:
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

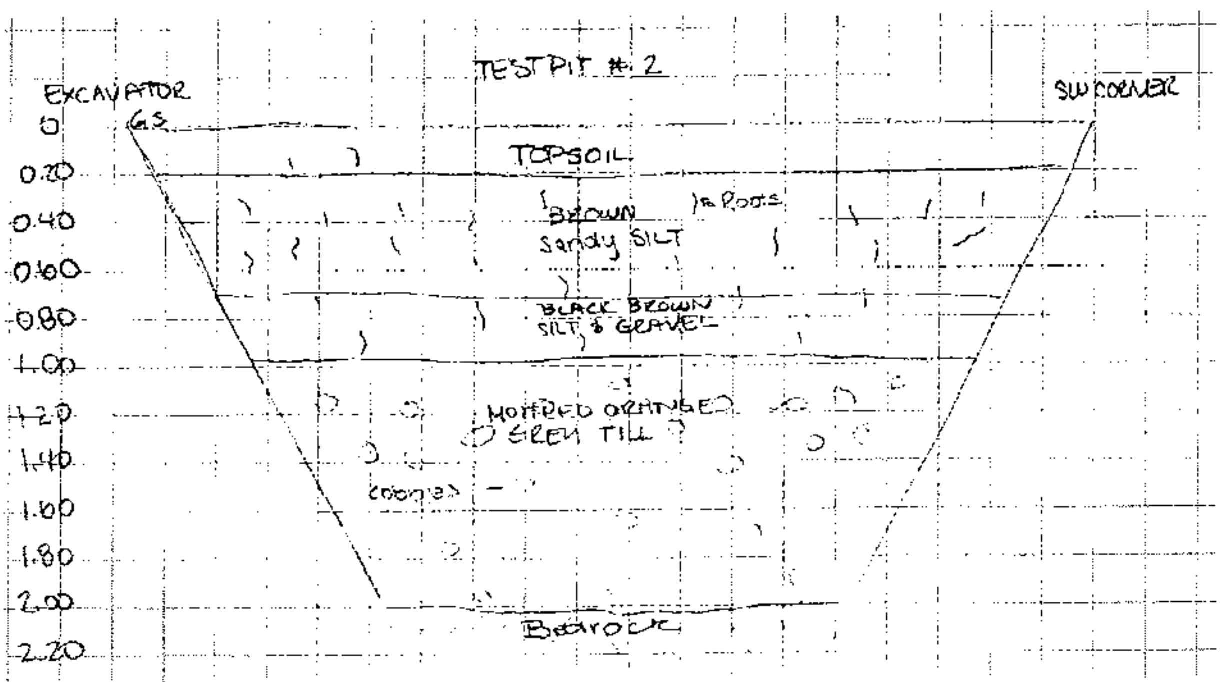
TP - 2	TEST PIT LOG	Golder Associates
TEST PIT NO. 2		

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
1.0 – 2.0			Dense moist, mottled grey and orange, silty, sub-rounded to sub-angular SAND and GRAVEL, some clay, little cobbles. Cobbles up to 15 cm in diameter. Cobbles decrease with depth.									
2.0 – 2.5			BEDROCK dry									

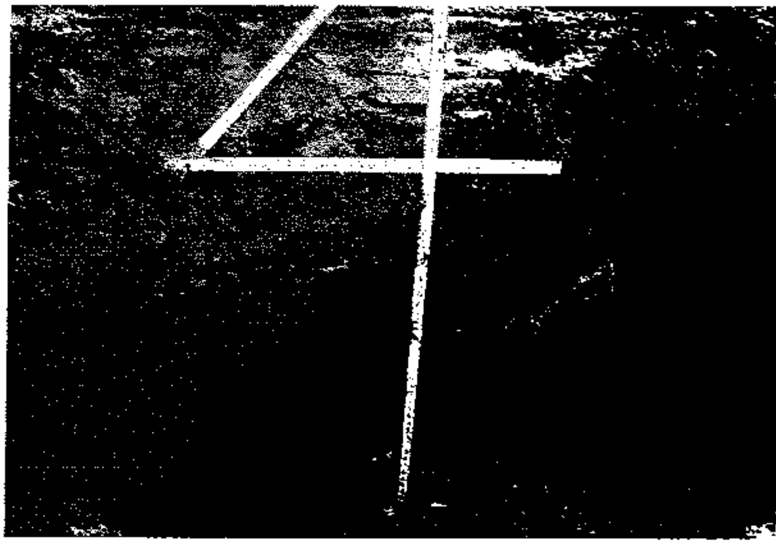
Notes:
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

TP-2	TEST PIT LOG	Golder Associates
TEST PIT NO.		



TP - 3	TEST PIT LOG	Golder Associates
TEST PIT NO. 3		



PROJECT No. :	05-1413-027
DATE : 19-May-10	REF PT: NW corner
LOCATION :	South of Mill & Bootjack Road
Northing : 5822323	Easting : 591967
ELEVATION (m): 1130 + 46	DIMENSIONS (m): 5.6 x 1
LOGGED BY:	A. Engbloom
EQUIPMENT:	CAT 320D Excavator
OPERATOR:	s.22 (Mt Polley)
WATER LEVEL:	None
SURFACE CONDITIONS:	At end of road. Culvert dug on west. Test Pit dug on north side of road.
ROOT DEPTH:	Not applicable, excavated in fill.

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
0.0 – 0.4			Loose to dense, moist, brown, subangular, silty SAND and GRAVEL, trace clay. FILL									
0.4 – 1.0	#1	1.02	Stiff, moist, orange brown mottled with grey, silty CLAY, some GRAVEL. TILL.									

Notes:
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard
[4] For coarse grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

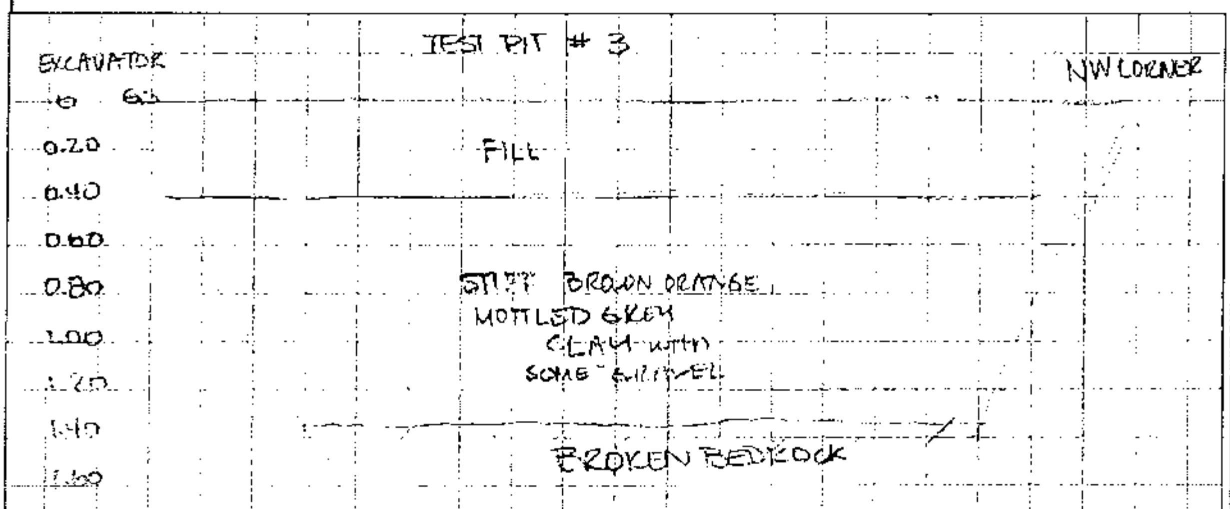
TP - 3	TEST PIT LOG	Golder Associates
TEST PIT NO. 3		

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
1.0 – 1.3			Stiff, moist, orange brown mottled with grey, silty CLAY, some GRAVEL. FILL									
1.4			BEDROCK, broken but fresh									

Notes:
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

TP-3	TEST PIT LOG	Golder Associates
TEST PIT NO.		



TP - 4	TEST PIT LOG	Golder Associates
TEST PIT NO. 4		

PROJECT No. :	05-1413-027
DATE : 18-May-10	REF PT: NE corner
LOCATION : South of Crusher & Road to Tailings	
Northing : 5822148	Easting : 592111
ELEVATION (m): 1041 ± 23	DIMENSIONS (m): 4.8 x 1
LOGGED BY:	A. Engbloom
EQUIPMENT:	CAT 320D Excavator
OPERATOR:	s.22 (Mt Polley)
WATER LEVEL:	5cm & filling
SURFACE CONDITIONS: North of access road, east of small river crossing. Willows and dense bush vegetation.	
ROOT DEPTH:	0.2m

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
0.0 – 0.2			Loose, organics, TOP SOIL.									
0.2 – 0.4			Stiff, moist, grey, organic smell, CLAY, little silt.									
0.4 – 1.0			Dense, moist to wet, brown mottled with orange and grey, well graded, sub-rounded to sub-angular, silty SAND and GRAVEL. TILL.									

Notes:
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AF Checked by: JJR Reviewed by: JJR

TP - 4 TEST PIT NO. 4	TEST PIT LOG	Golder Associates

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
1.0 – 1.7			Dense, moist to wet, brown mottled with orange and grey, well graded, sub-rounded to sub-angular, silty SAND and GRAVEL. TILL									
1.7 – 2.5			Frozen, grey, silty SAND and sub angular to angular GRAVEL, little clay. Trace carbonaceous debris. TILL.									

Notes:
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

TP - 4	TEST PIT LOG	Golder Associates
TEST PIT NO. 4		

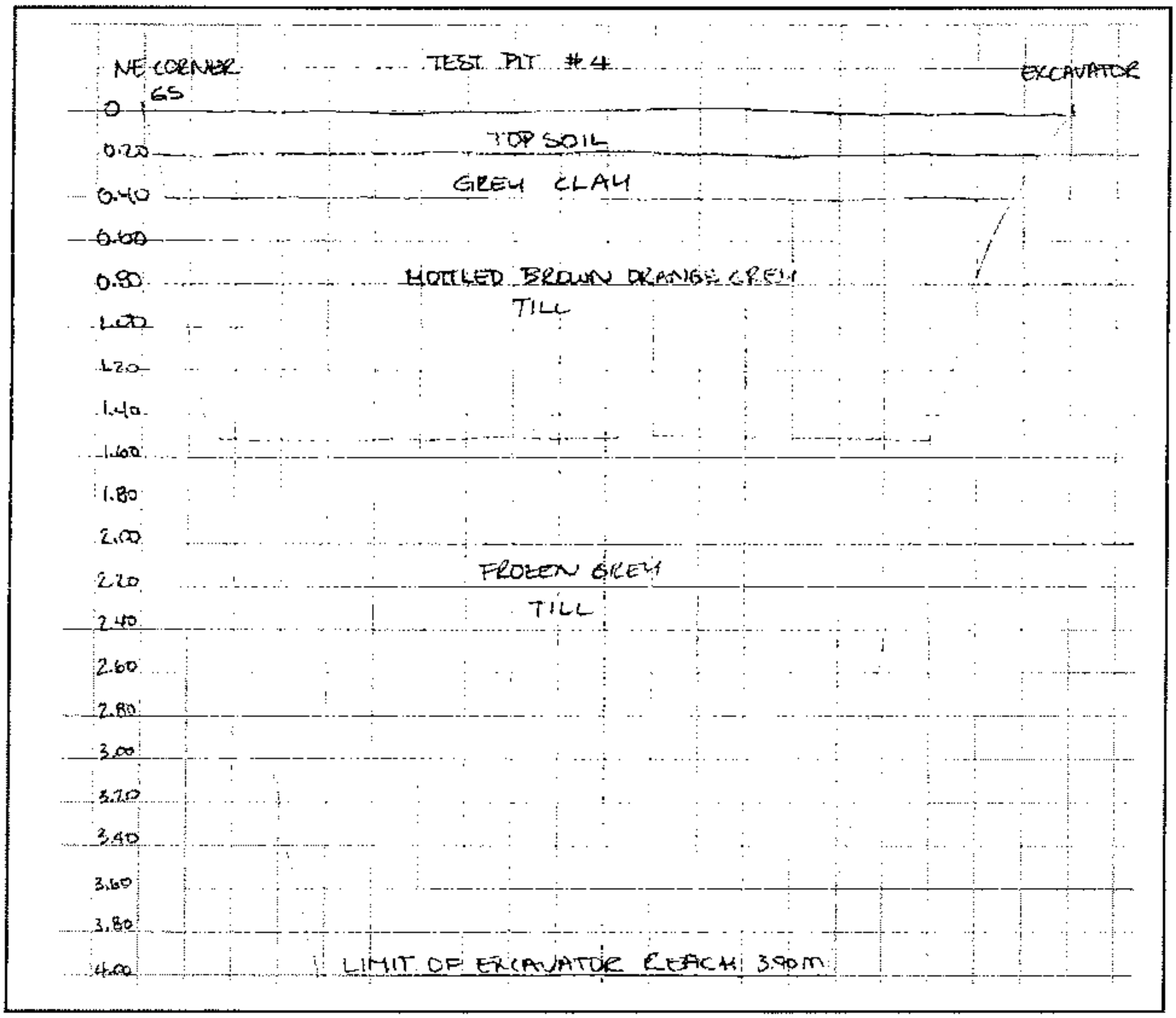
DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
2.5 – 3.9			Frozen, grey, silty SAND and subangular to angular GRAVEL, little clay. Trace carbonaceous debris. TILL.									
3.9 – 4			3.90 – Limit of excavator reach									

Notes:

[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AF Checked by: JJR Reviewed by: JJR

TP-4	TEST PIT LOG	Golder Associates
TEST PIT NO.		



TP - 5	TEST PIT LOG	Golder Associates
TEST PIT NO. 5		

PROJECT No. :	05-1413-027
DATE :	18-May-10 REF PT: NE corner
LOCATION :	NW slopes of Springer Pit.
Northing :	5821970 Easting : 592106
ELEVATION (m):	1013 ± 21 DIMENSIONS (m): 6.3 x 1
LOGGED BY:	A. Engbloom
EQUIPMENT:	CAT 320D Excavator
OPERATOR:	s.22 (Mt Polley)
WATER LEVEL:	None
SURFACE CONDITIONS:	Forest, near muddy areas but ground surface dry. Underbrush present.
ROOT DEPTH:	0.25m

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (e.g. , m, h)	WATER CONTENT %	OTHER TESTS[5]
0.0 0.1 0.2			Organic material, roots and fill. TOPSOIL									
0.3 0.4			Loose, moist, dark brown, sub-rounded to sub-angular, silty SAND, some gravel. TILL									
0.5 0.6 0.7 0.8 0.9 1.0			Frozen, dark brown, sub-rounded to sub-angular, silty SAND, some gravel. TILL [Nbn]									

Notes:
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AF Checked by: JJR Reviewed by: JJR

TP - 5 TEST PIT NO. 5	TEST PIT LOG	Golder Associates

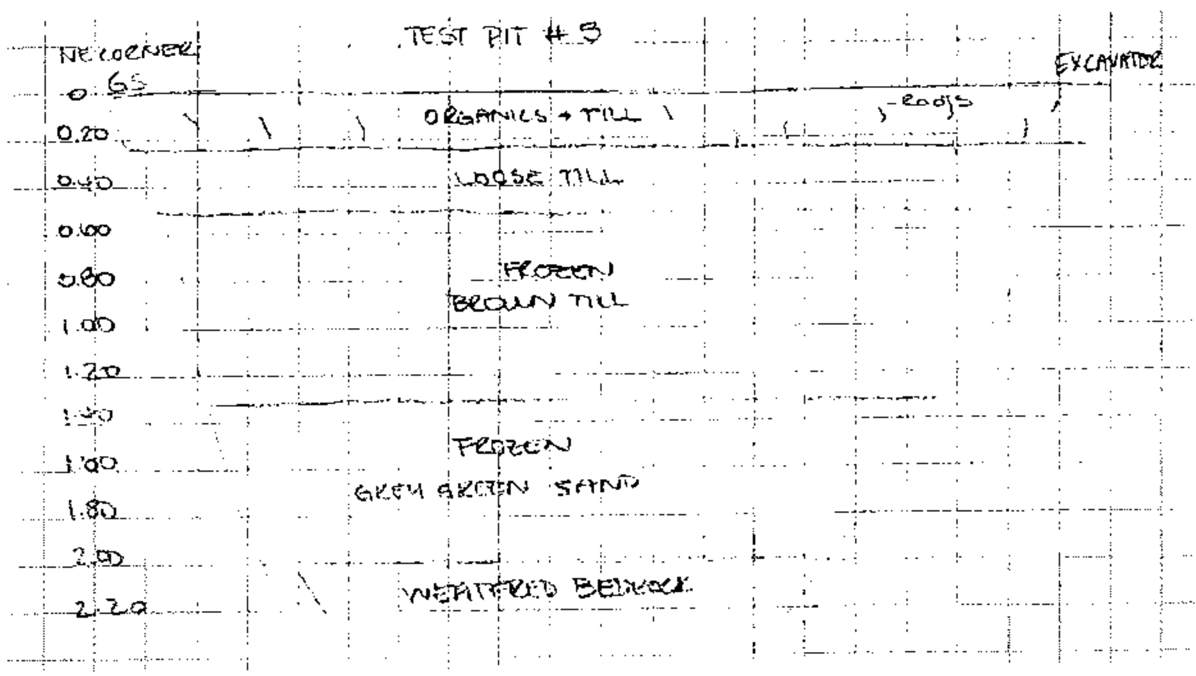
DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
1.0–1.3			Frozen, dark brown, sub-rounded to sub-angular, silty SAND, some gravel. TILL (Nbn)									
1.3–2			Frozen, grey green, fine to coarse SAND. Highly weathered rock present.									
2–2.5			Top of Weathered Bedrock									

Notes:

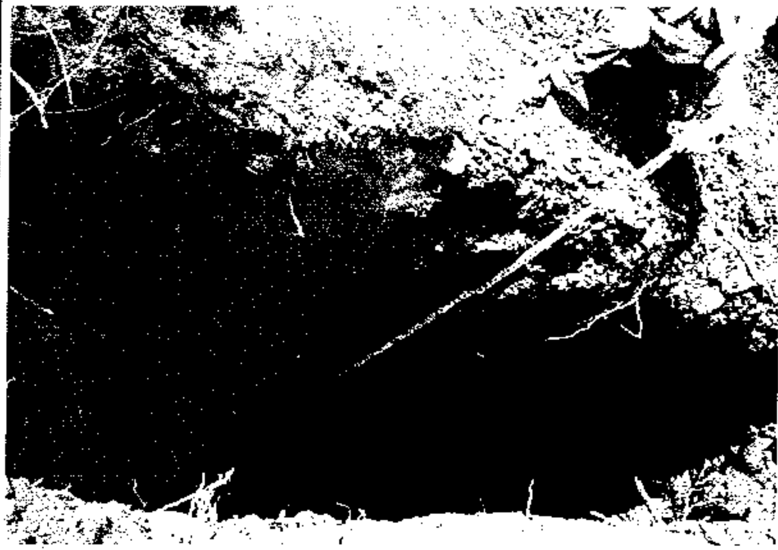
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

TP-5	TEST PIT LOG	Golder Associates
TEST PIT NO.		



TP - 6	TEST PIT LOG	Golder Associates
TEST PIT NO. 6		



PROJECT No. :	05-1413-027
DATE : 18-May-10	REF PT: SE corner
LOCATION : NW slopes of Springer Pit.	
Northing : 5821497	Easting : 592668
ELEVATION (m): 992.1± 10	DIMENSIONS (m): 5.7 x 1
LOGGED BY:	A. Engbloom
EQUIPMENT:	CAT 320D Excavator
OPERATOR:	s.22 (Mt Polley)
WATER LEVEL	None, Seepage Occuring
SURFACE CONDITIONS: Forested area, south of road, evidence of historic land use.	
ROOT DEPTH:	Not applicable, excavated in fill.

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (wp, L, m, h)	WATER CONTENT %	OTHER TESTS[5]
0.0 – 0.35			Loose, moist, brown, rounded to sub angular, SAND, some gravel, some fines. Organics fresh wood pieces in top mater. FILL.									
0.35 – 0.6			Loose, moist, brown, sub-rounded to sub-angular, fine SAND, some gravel, some silt. Roots and decaying plant debris. FILL.									
0.6 – 1.0			Dense, moist, brown, rounded to sub-angular SAND and GRAVEL, some silt, trace clay. FILL.									

Notes:
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

TP - 6 TEST PIT NO. 6	TEST PIT LOG	Golder Associates

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
1.0 – 1.3			Dense, moist, brown, rounded to sub-angular SAND and GRAVEL, some silt, trace clay. FILL.									
1.3 – 1.7			Dense, moist, grey brown, rounded to sub-angular SAND and GRAVEL, some silt, trace clay. FILL									
1.7 – 1.8			Dense, moist to wet, grey brown FILL. Water seepage.									
1.8 – 2			Wet, fibrous, organics. Semi-decayed wood debris									
2 – 2.2			Stiff, moist, black, CLAY, some organic, little silt, little gravel, trace sand.									
2.2 – 2.5			Stiff, moist, grey and orange, clayey SILT, some organics, trace sand, trace gravel									

Notes:
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

TP - 6 TEST PIT NO. 6	TEST PIT LOG											Golder Associates
DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
2.5 – 3.6			Dense, moist, blue, grey and orange, sub-rounded to sub-angular, SAND and GRAVEL, some silt, some clay. TILL									
3.6 – 4.0			Loose, moist, orange brown, sub-rounded to sub-angular, SAND and GRAVEL, trace silt, trace clay. TILL									

Notes:
1 Percent > 75 mm
2 Sum of gravel, sand, and fines = 100%
3 For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
4 For coarse-grained (cohesionless) soil: Loose, Compact, Dense
5 A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

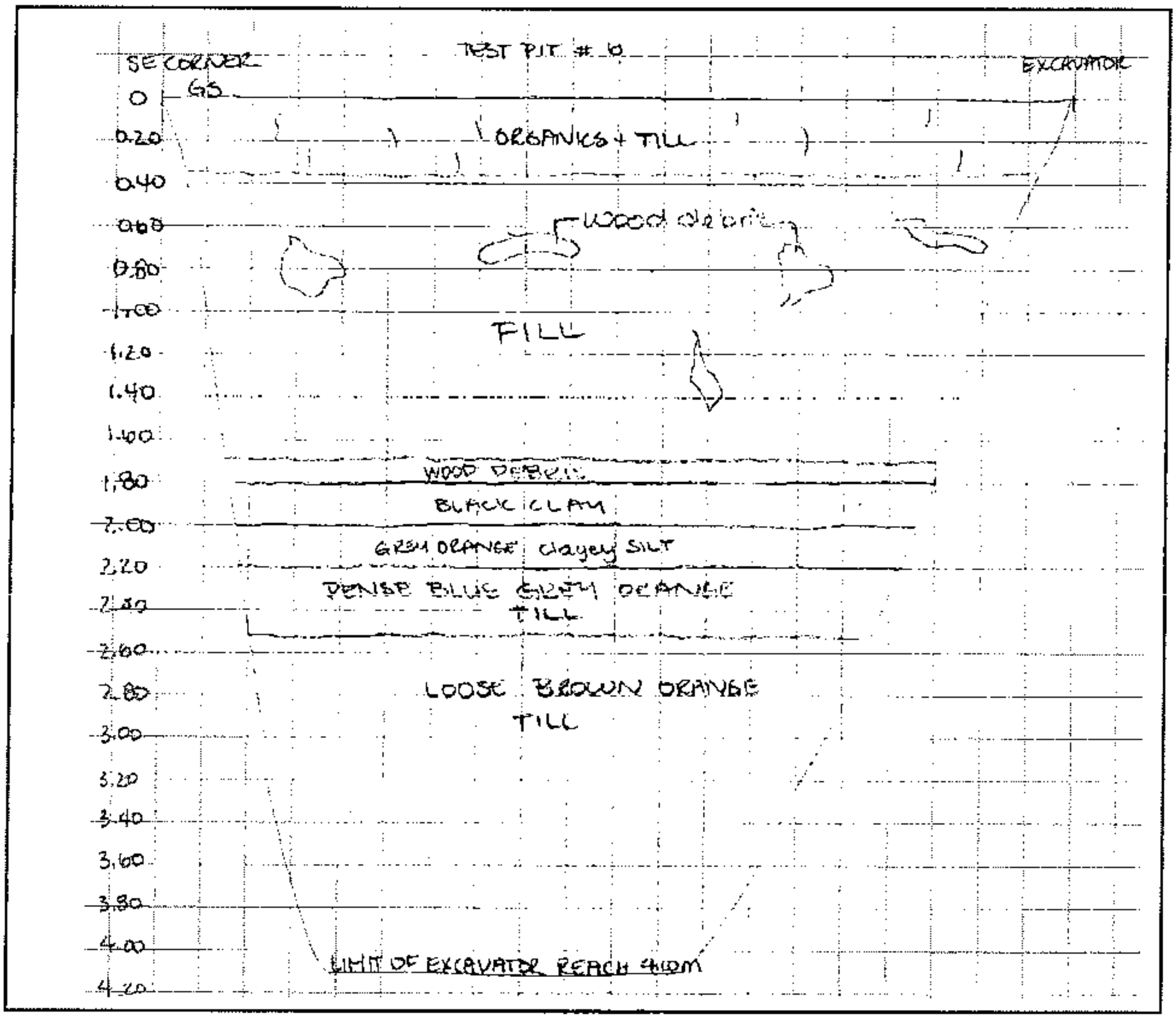
TP - 6	TEST PIT LOG	Golder Associates
TEST PIT NO. 6		

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
4.0 – 4.1			Loose, moist, orange brown, sub-rounded to sub angular, SAND and GRAVEL, trace silt, trace clay. TILL.									
			4.10 m = Limit of excavator reach.									

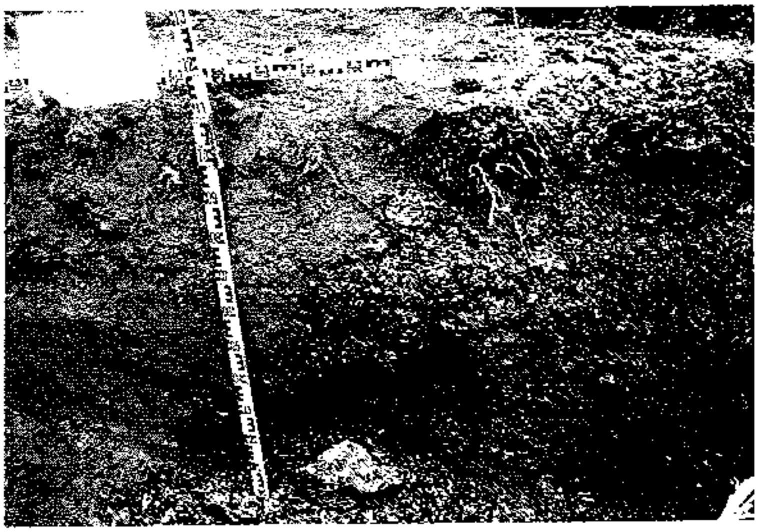
Notes:
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

TP-6	TEST PIT LOG	Golder Associates
TEST PIT NO.		



TP - 7	TEST PIT LOG	Golder Associates
TEST PIT NO. 7		



PROJECT No. :	05-1413-027
DATE :	18-May-10 REF PT: SE corner
LOCATION :	NW slopes of Springer Pit.
Northing :	5821356 Easting : 592833
ELEVATION (m):	1010 ± 10 DIMENSIONS (m): 5 x 1
LOGGED BY:	A. Engbloom
EQUIPMENT:	CAT 320D Excavator
OPERATOR:	s.22 (Mt Polley)
WATER LEVEL:	None
SURFACE CONDITIONS:	North of access road, forested, moderate underbrush.
ROOT DEPTH:	0.2m

DEPTH SCALE (m)	SAMPLE No	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
0.0 – 0.2			Loose, moist, orange brown with some grey, sub rounded to angular, SAND and GRAVEL, some fines. Organics and roots									
0.2 – 0.65			Dense, moist, orange brown with some grey, subrounded to angular, SAND and GRAVEL, some fines.									
0.65 – 1.0			Dense, moist, orange brown, angular SAND and GRAVEL, some fines, some clay. TILL. Top of Weathered Bedrock at 1.0 m.									

Notes:
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

TP - 7	TEST PIT LOG	Golder Associates
TEST PIT NO. 7		

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
1.0 – 1.2			Weathered Bedrock.									

Notes:

[1] Percent > 76 mm

[2] Sum of gravel, sand, and fines = 100%

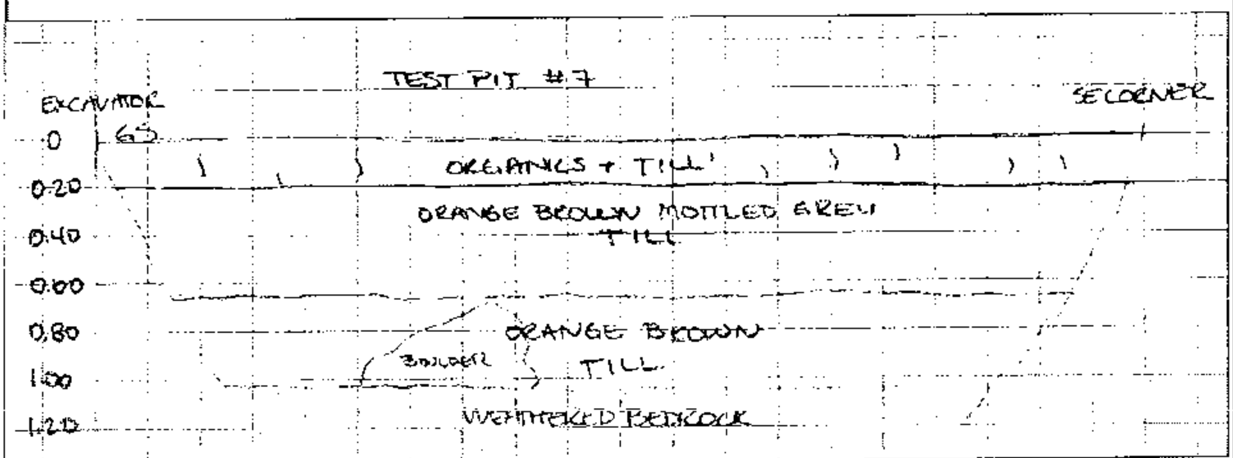
[3] For fine grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.

[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense

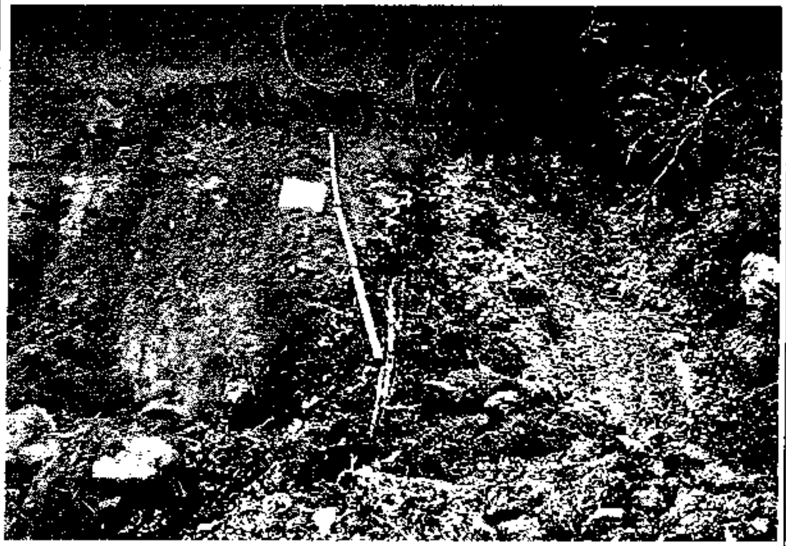
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: Reviewed by:

TP-7	TEST PIT LOG	Golder Associates
TEST PIT NO.		



TP - 8	TEST PIT LOG	Golder Associates
TEST PIT NO. 8		



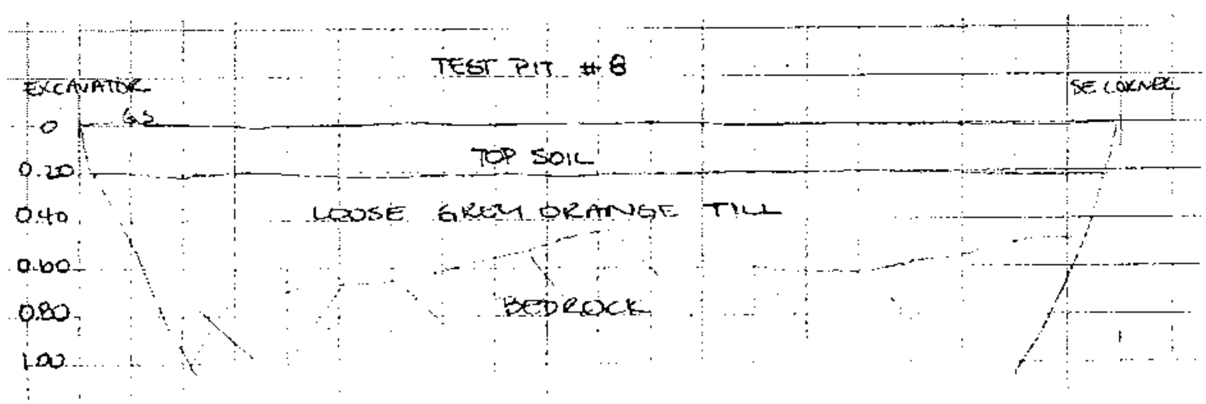
PROJECT No. :	05-1413-027
DATE :	19-May-10 REF PT: SE corner
LOCATION :	NW slopes of Springer Pit.
Northing :	5821194 Easting : 592871
ELEVATION (m):	992.3 ± 8 DIMENSIONS (m): 4.4 (a) and 4.6 (b) x 1m
LOGGED BY:	A. Engbloom
EQUIPMENT:	CAT 320D Excavator
OPERATOR:	s.22 (Mt Polley)
WATER LEVEL	None
SURFACE CONDITIONS:	Between outcrop and marsh lands. South of access road.
ROOT DEPTH:	0.2m

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
0.0 – 0.2			Loose, moist, black, TOP SOIL									
0.2 – 0.4			Loose, moist, grey orange, sub-angular to angular, silty SAND and GRAVEL, some clay									
0.4 – 0.75			Green, angular BEDROCK. Bedrock at 0.4m in pit A, 0.75m in pit B.									
0.75 – 1.0												

Notes:
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

TP-8	TEST PIT LOG	Golder Associates
TEST PIT NO.		



TP - 9	TEST PIT LOG	Golder Associates
TEST PIT NO. 9		

PROJECT No. :	05-1413-027
DATE : 19-May-10	REF PT: SE corner
LOCATION : NW slopes of Springer Pit.	
Northing : 5820760	Easting : 593011
ELEVATION (m): 994.8 ± 9	DIMENSIONS (m): 6.4 x 1
LOGGED BY:	A. Engbloom
EQUIPMENT:	CAT 320D Excavator
OPERATOR:	s.22 (Mt Polley)
WATER LEVEL:	None, Seepage Occuring
SURFACE CONDITIONS: Pasture, near powerlines. Muddy conditions, ground vegetation.	
ROOT DEPTH:	0.4m

DEPTH SCALE (m)	SAMPLE No	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (Lp, Ln, Ip)	WATER CONTENT %	OTHER TESTS[5]
0.0 – 0.2			Loose, moist, black brown TOP SOIL. Decaying organics and roots.									
0.2 – 0.4			Loose, moist, dark brown, sandy SILT and sub-rounded to sub-angular GRAVEL, some clay. TILL. Roots and organic material present.									
0.4 – 0.6			Loose, moist, light brown, sandy SILT and sub-rounded to sub-angular GRAVEL, some clay. TILL.									
0.6 – 1.0			Dense, moist, mottled grey and orange, sandy GRAVEL and SILT, little clay. TILL.									

Notes:
1 Percent > 75 mm
2 Sum of gravel, sand, and fines = 100%
3 For fine grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard
4 For coarse grained (cohesionless) soil: Loose, Compact, Dense
5 A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

TP - 9	TEST PIT LOG	Golder Associates
TEST PIT NO. 9		

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
1.0 – 1.5			Stiff, moist, brown, SILT and CLAY, little sand, little sub-rounded gravel, trace to little weathered angular gravel, trace cobbles and boulders.									
1.5 – 1.7			Frozen, brown, silty SAND and GRAVEL, some clay, little angular boulders and cobbles. FILL									
1.7 – 1.8			Dense, moist, black silver, fissile, shale-like material. Possible organic material. Dipping dense.									
1.8 – 2.5			Grey green, SILT and CLAY, some cobbles, trace boulders. Very stiff.									

Notes:
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

TP - 9	TEST PIT LOG	Golder Associates
TEST PIT NO. 9		

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
2.5												
2.6												
2.7												
2.8												
2.9												
3												
3.1												
3.2			Grey green, SILT and CLAY, some cobbles, trace boulders. Very stiff.									
3.3												
3.4												
3.5												
3.6												
3.7												
3.8												
3.9												
4												

Notes:
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: Reviewed by: JJR

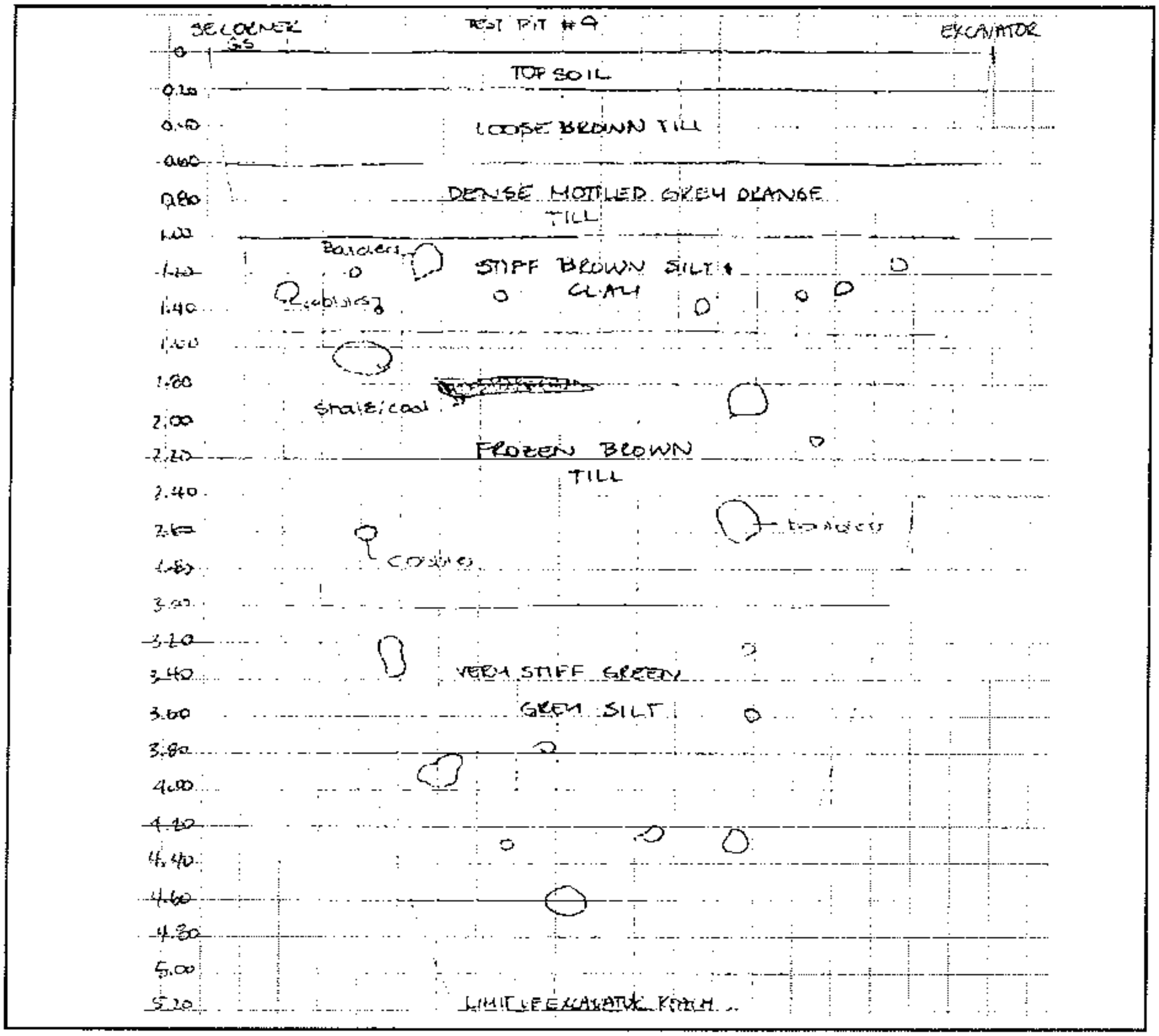
TP - 9 TEST PIT NO. 9	TEST PIT LOG	Golder Associates

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
4.0												
4.1												
4.2												
4.3												
4.4												
4.5												
4.6			Grey green, SILT and CLAY, some cobbles, trace boulders. Very stiff.									
4.7												
4.8												
4.9												
5.0												
5.1												
5.2			5.20 m = Limit of excavator reach.									
5.3												
5.4												
5.5												

Notes:
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

TP-9	TEST PIT LOG	Golder Associates
TEST PIT NO.		



TP - 10	TEST PIT LOG	Golder Associates
TEST PIT NO. 10		

PROJECT No. :	05-1413-027
DATE :	19-May-10 REF PT: SE corner
LOCATION :	
Northing :	5821507 Easting : 592603
ELEVATION (m):	1025 ± 19 DIMENSIONS (m): 5.2 x 1
LOGGED BY:	A. Engbloom
EQUIPMENT:	CAT 320D Excavator
OPERATOR:	s.22 (Mt Polley)
WATER LEVEL:	None, Seepage Occuring
SURFACE CONDITIONS:	On edge of historical laydown area. Trees have been cleared.
ROOT DEPTH.	0.7m

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
0.0 – 0.2			Loose, moist, black brown ORGANICS. TOP SOIL.									
0.2 – 0.7			Loose, dry to moist, brown, rounded to sub-rounded silty SAND and GRAVEL, some clay. Gravel up to 10cm diameter, inclusions of silty clay and decaying organics									
0.7 – 0.9			Dense, moist, mottled grey and orange, rounded to sub-rounded, silty SAND and GRAVEL, some clay. Varying clay content.									
0.9 – 1.0			Loose, moist, black brown decaying ORGANICS, with CLAY, with rounded gravel.									

Notes:
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

TP - 10 TEST PIT NO. 10	TEST PIT LOG	Golder Associates

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
1.0 – 1.2			Dense, moist, dark brown, sub-rounded to sub-angular silty SAND and GRAVEL, trace clay, trace organics. Gravel up to 5cm diameter.									
1.2 – 1.5			Dense, moist, grey and light brown, silty SAND and rounded GRAVEL, some to trace clay. TILL.									
1.5 – 2.5			Dense, moist, grey mottled with orange, sub-angular to angular silty SAND and GRAVEL, little clay. Cobbles at 2m. Cobble and boulder frequency increases with depth									

Notes:

[1] Percent > 75 mm

[2] Sum of gravel, sand, and fines = 100%

[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.

[4] For coarse grained (cohesionless) soil: Loose, Compact, Dense

[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

TP - 10 TEST PIT NO. 10	TEST PIT LOG	Golder Associates

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
2.5												
2.6												
2.7												
2.8												
2.9												
3												
3.1												
3.2			Dense, moist, grey mottled with orange, sub-angular to angular silty SAND and GRAVEL, little clay. Cobbles at 2m Cobble and boulder frequency increases with depth.									
3.3												
3.4												
3.5												
3.6												
3.7												
3.8												
3.9												
4												

Notes:
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

TP - 10 TEST PIT NO. 10	TEST PIT LOG	Golder Associates

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
4.0 – 4.8			Dense, moist, grey mottled with orange, sub angular to angular silty SAND and GRAVEL, little clay. Cobbles at 2m. Cobble and boulder frequency increases with depth.									
4.8 – 5.5			4.74 m = Limit of excavator reach									

Notes:

[1] Percent > 75 mm

[2] Sum of gravel, sand, and fines = 100%

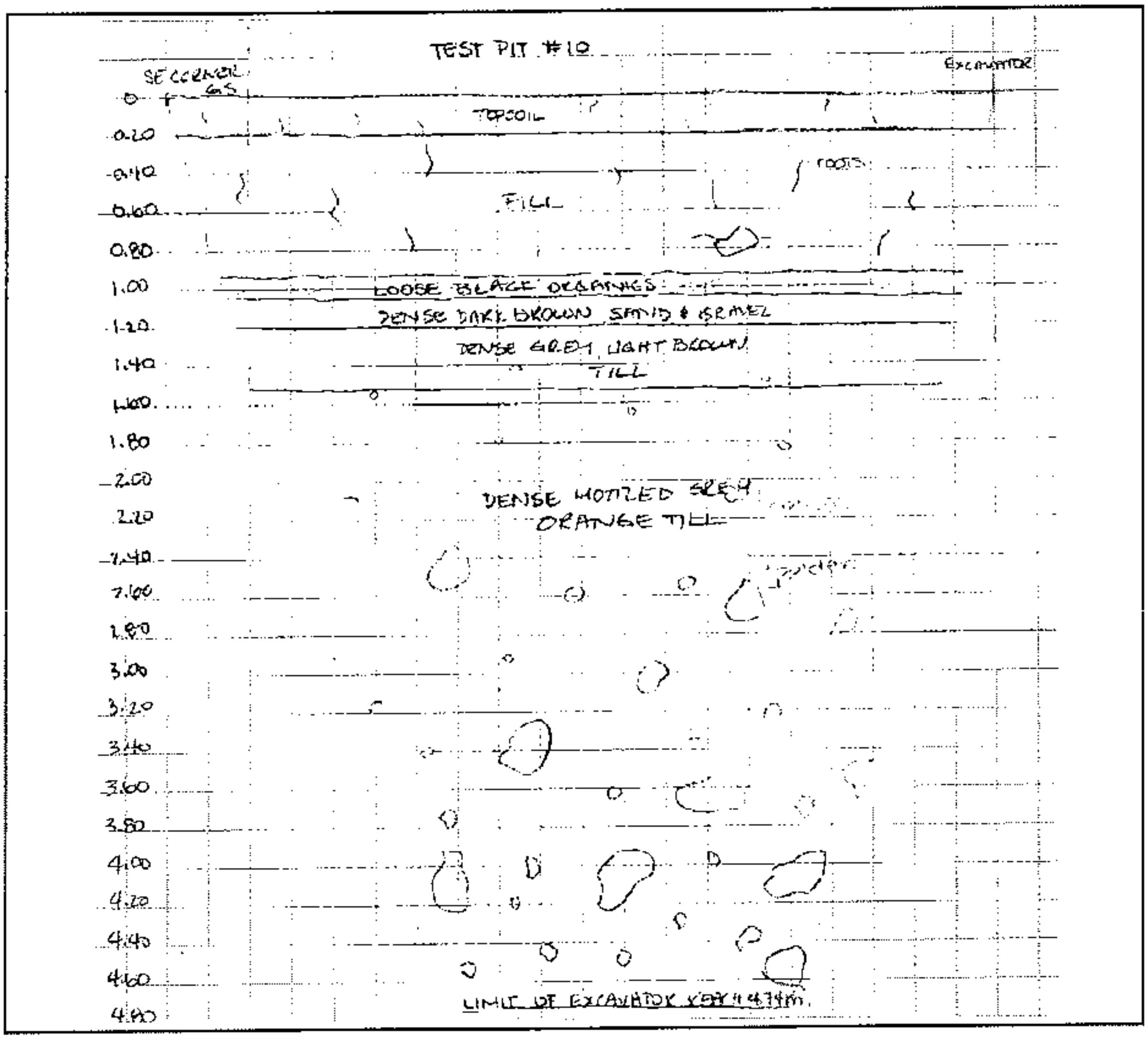
[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.

[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense

[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

TP-10	TEST PIT LOG	Golder Associates
TEST PIT NO.		



TP - 11	TEST PIT LOG	Golder Associates
TEST PIT NO. 11		

PROJECT No. : 05-1413-027

DATE : 19-May-10 REF PT: SE corner

LOCATION : NW slopes of Springer Pit.

Northing : 5821317 Easting : 592625

ELEVATION (m): 1004 ± 8 DIMENSIONS (m): 4.5-5.5 x 1

LOGGED BY: A. Engbloom

EQUIPMENT: CAT 320D Excavator

OPERATOR: s.22 (Mt Polley)

WATER LEVEL: 10cm & rising

SURFACE CONDITIONS: Lightly forested, new growth only. In topographic depression.

ROOT DEPTH: 0.2m

DEPTH SCALE (m)	SAMPLE No	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
0.0 – 0.2			Loose, moist, black, organic rich, TOPSOIL. Roots present.									
0.2 – 0.5			Loose, moist, brown black, sub-rounded to sub-angular silty SAND and GRAVEL, little clay. TILL. Roots to 0.4m									
0.5 – 0.9			Dense, moist, mottled brown and orange, sub-rounded to sub-angular, silty SAND and GRAVEL, little to some clay, little cobbles. TILL.									
0.9 – 1.0			Dense, moist, mottled brown and orange, sub-rounded to sub-angular, silty SAND and GRAVEL, some cobbles, some boulders, trace clay.									

Notes:
1 Percent > 75 mm
2 Sum of gravel, sand, and fines = 100%
3 For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
4 For coarse grained (cohesionless) soil: Loose, Compact, Dense
5 A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

TP - 11	TEST PIT LOG	Golder Associates
TEST PIT NO. 11		

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
1.0 – 1.2			Dense, moist, mottled brown and orange, sub-rounded to sub-angular, silty SAND and GRAVEL, some cobbles, some boulders, trace clay.									
1.2 – 2.5			Loose to dense, moist, sub-rounded to sub angular, sandy graveley COBBLES, little boulders, little fines. Cobble and angular boulder frequency increases with depth.									

Notes:
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

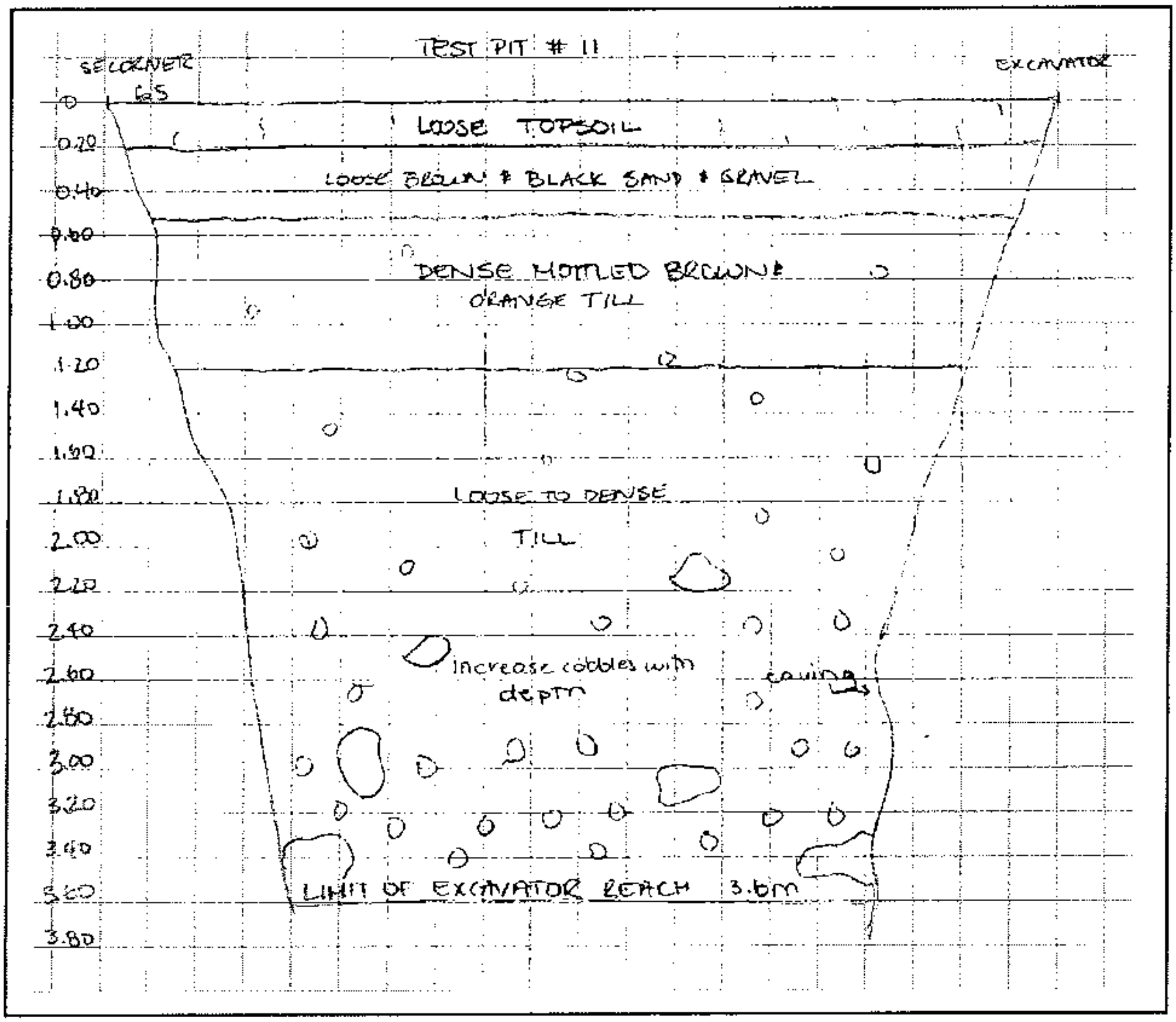
TP - 11 TEST PIT NO. 11	TEST PIT LOG	Golder Associates

DEPTH SCALE (m)	SAMPLE No.	DEPTH (m)	DESCRIPTION	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	FROZEN GROUND DESCRIPTION	CONSISTENCY[3] OR DENSITY[4]	PLASTICITY (np, l, m, h)	WATER CONTENT %	OTHER TESTS[5]
2.5												
2.6												
2.7												
2.8												
2.9												
3			Loose to dense, moist, sub-rounded to sub-angular, sandy graveley COBBLES, little boulders, little fines. Cobble and angular boulder frequency increases with depth									
3.1												
3.2												
3.3												
3.4												
3.5												
3.6			3.6 m = Limit of excavator reach.									
3.7												
3.8												
3.9												
4												

Notes:
[1] Percent > 75 mm
[2] Sum of gravel, sand, and fines = 100%
[3] For fine-grained (cohesive) soil: Very Soft, Soft, Firm, Hard, Very Hard.
[4] For coarse-grained (cohesionless) soil: Loose, Compact, Dense
[5] A: Atterberg Limits
P: Permeability
PS: Standard Proctor

Made by: AE Checked by: JJR Reviewed by: JJR

TP-11	TEST PIT LOG	Golder Associates
TEST PIT NO.		



APPENDIX B

Soil Index Test Results

Golder Associates

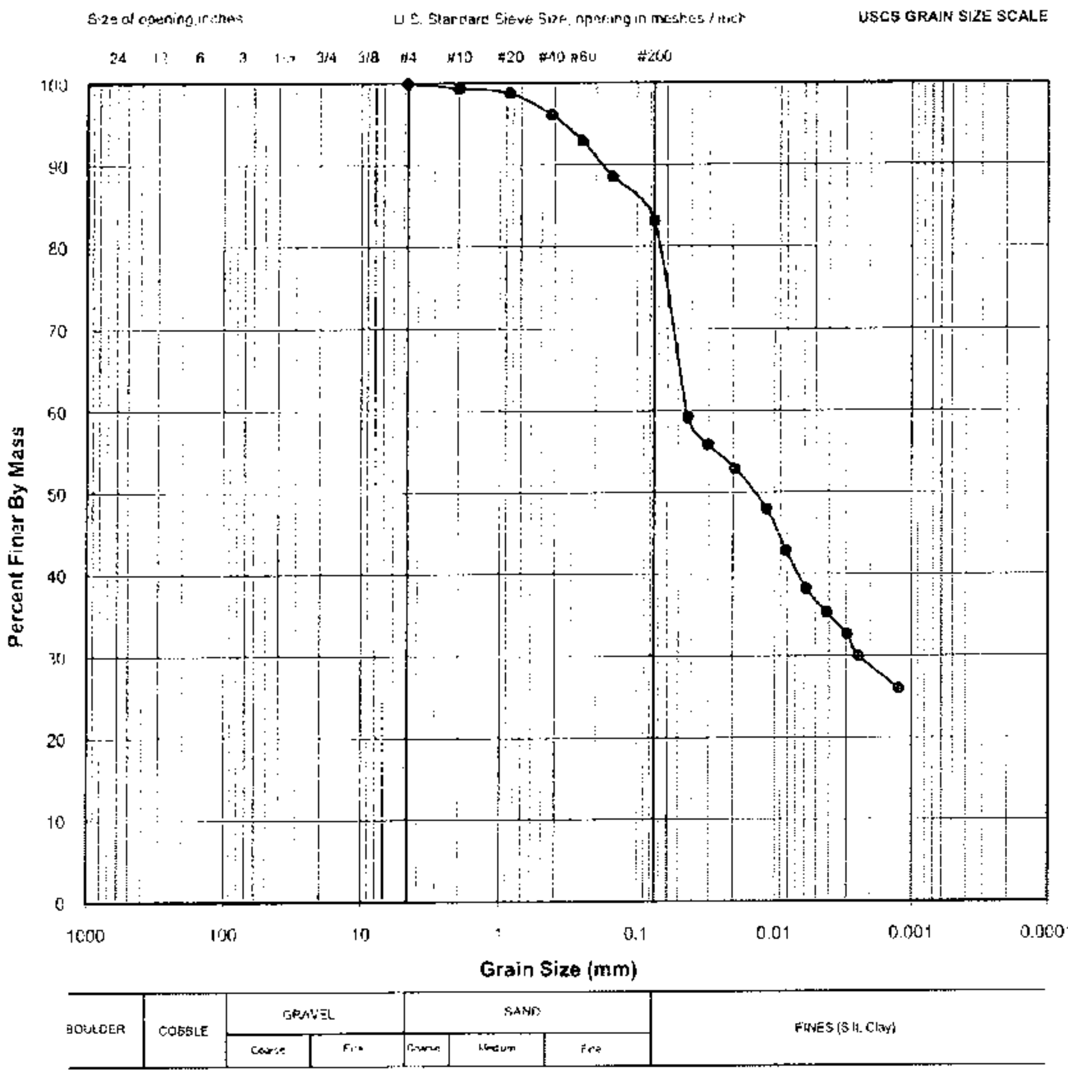
Golder Associates Ltd. - Burnaby Laboratory
4280 Still Creek Drive
Burnaby, B.C. Canada V5C 6C6

PARTICLE SIZE ANALYSIS OF SOILS

Reference: ASTM D 422-63 (2007)

Project No.:	05-1413-0027	**Test Pit:**	6
Client:	Mount Polley	**Sample No.:**	2
Project:	South Dump Investigations	**Depth (m):**	2.00-2.50
Location:	Mt.Polley, Likely, BC	**Lab ID No:**	134
Specific Gravity (assumed):	2.76	**Other Remarks:**	
Dispersion Method:	Air-jet cup		
Dispersion Period (min):			

Sieve Size (USS)	(mm)	% Passing
3.5"	87.50	100.0
3"	75.00	100.0
2"	50.00	100.0
1.5"	37.50	100.0
1"	25.00	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	100.0
#4	4.75	100.0
#10	2.00	99.4
#20	0.850	98.8
#40	0.425	96.2
#60	0.250	92.9
#100	0.150	88.5
#200	0.075	83.1
-	0.0425	59.2
-	0.0304	55.9
-	0.0194	52.9
-	0.0114	48.0
-	0.0082	42.8
-	0.0059	38.2
-	0.0042	35.3
-	0.0030	32.7
-	0.0024	30.0
-	0.0012	26.0



* *The test data given herein pertain to the sample provided only. This report constitutes a testing service only. Interpretation of the data can be provided upon request.*

EB	July 26, 2010	LP	August 17,2010
TESTED BY	DATE	CHECKED BY	DATE

Golder Associates

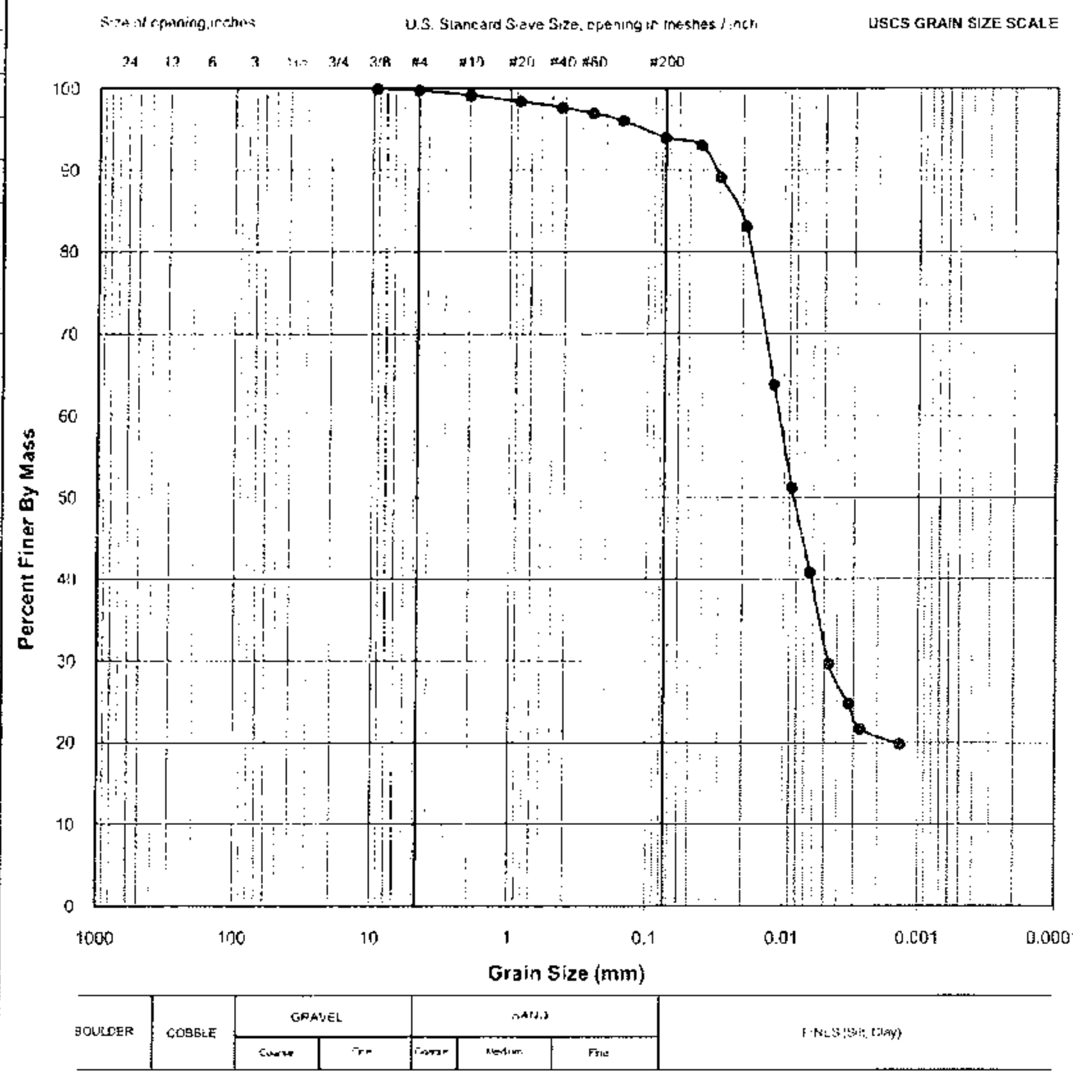
Golder Associates Ltd. - Burnaby Laboratory
4280 Still Creek Drive
Burnaby, B.C. Canada V5C 6C6

PARTICLE SIZE ANALYSIS OF SOILS

Reference: ASTM D 422-63 (2007)

Project No.:	05-1413-0027	**Test Pit:**	9
Client:	Mount Polley	**Sample No.:**	2+3
Project:	South Dump Investigations	**Depth (m):**	3.00-5.10
Location:	Mt.Polley, Likely, BC	**Lab ID No:**	134
Specific Gravity (assumed):	2.76	**Other Remarks:**	
Dispersion Method:	Air-jet cup		
Dispersion Period (min):			

Sieve Size (USS)	Sieve Size (mm)	% Passing
3.5"	87.50	100.0
3"	75.00	100.0
2"	50.00	100.0
1.5"	37.50	100.0
1"	25.00	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	100.0
#4	4.75	99.8
#10	2.00	99.1
#20	0.850	98.4
#40	0.425	97.7
#60	0.250	96.9
#100	0.150	96.0
#200	0.075	94.0
-	0.0411	93.0
-	0.0295	89.1
-	0.0191	83.1
-	0.0119	63.8
-	0.0087	51.1
-	0.0064	40.8
-	0.0046	29.6
-	0.0033	24.8
-	0.0027	21.7
-	0.0014	19.8



** The test data given herein pertain to the sample provided only. This report constitutes a testing service only. Interpretation of the data can be provided upon request.*

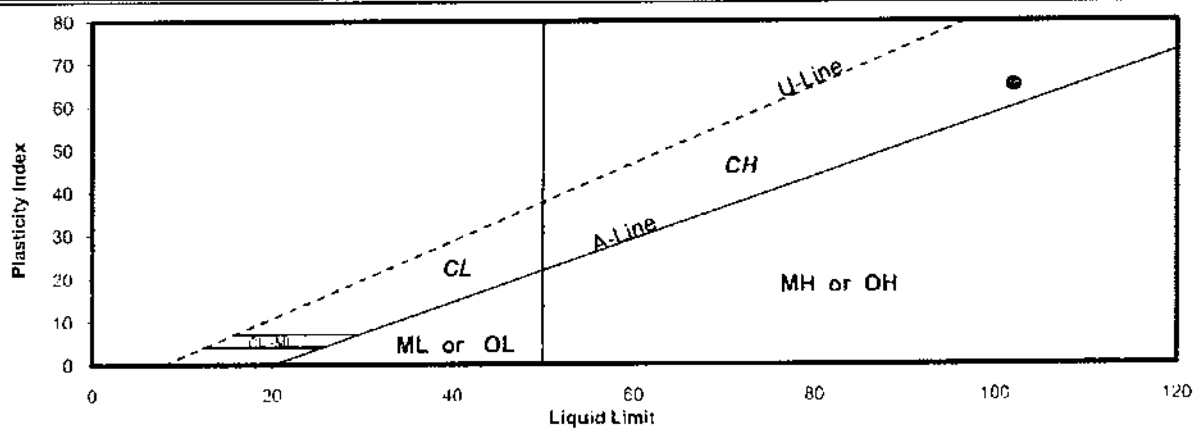
TESTED BY	DATE	CHECKED BY	DATE
EB	July 26, 2010	LP	August 17,2010

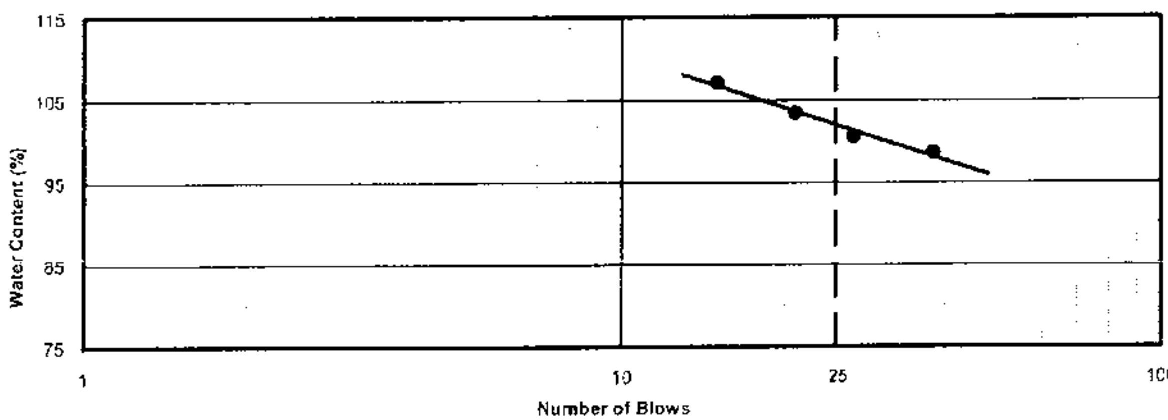
Golder Associates

Golder Associates Ltd. - Burnaby Laboratory
4280 Still Creek Drive
Burnaby, B.C. Canada V5C 6C6

Liquid Limit, Plastic Limit and Plasticity Index of Soils	Reference ASTM D 4318-05

Project No.:	05-1413-0027	**Test Pit:**	6
Client:	Mount Polley	**Sample No.:**	2
Project:	South Dump Investigations	**Depth (m):**	2.00-2.50
Location:	Mt. Polley, Likely, BC	**Lab ID No.:**	134
Method:	A-Multi Point	**Preparation Method:**	Wet
Sample Description:	CH	**Classification Definition**	*Inorganic clays of high plasticity, fat clays*





Test Summary		Remarks
Percent passing #40 Sieve (%)		
Liquid Limit	102	
Plastic Limit	37	
Plasticity Index	65	
Natural water content (%)	53	
Liquidity Index	0.2	

** The test data given herein pertain to the sample provided only. This report constitutes a testing service only.*

EB	July 26, 2010	LP	August 17,2010
TESTED BY	DATE	CHECKED BY	DATE

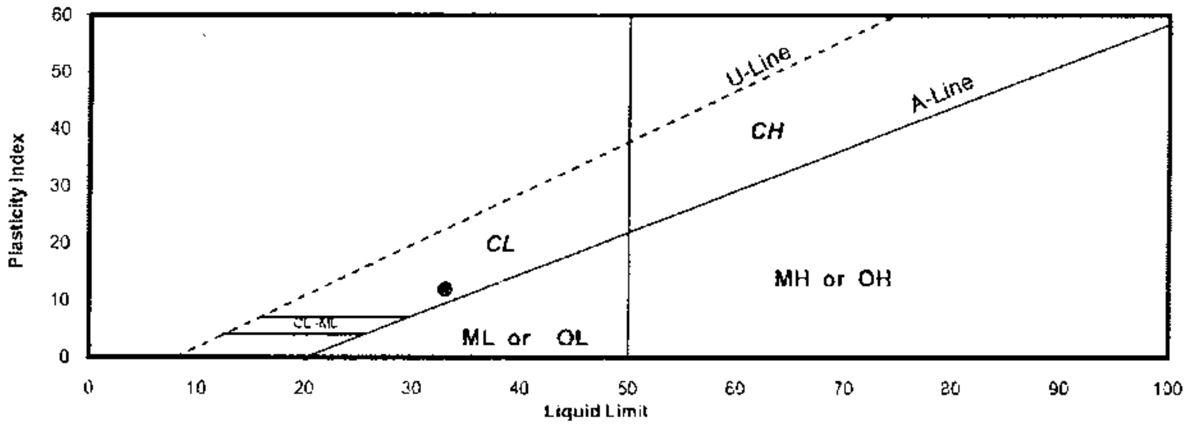
Golder Associates

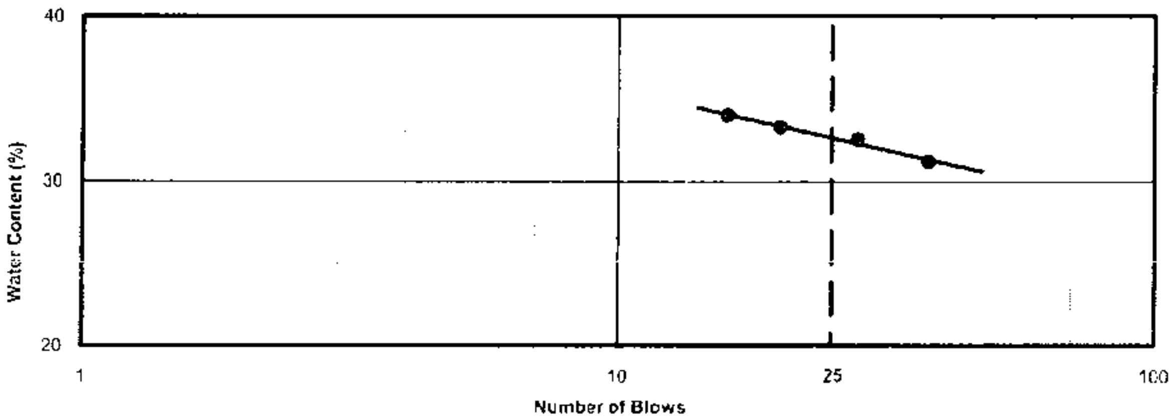
Golder Associates Ltd. - Burnaby Laboratory
4260 Still Creek Drive
Burnaby, B.C. Canada V5C 6C6

Liquid Limit, Plastic Limit and Plasticity Index of Soils

Reference: ASTM D 4318-05

Project No.:	05-1413-0027	**Test Pit:**	9
Client:	Mount Polley	**Sample No.:**	2+3
Project:	South Dump Investigations	**Depth (m):**	3.00-5.10
Location:	Mt. Polley, Likely, BC	**Lab ID No.:**	134
Method:	A-Multi Point	**Preparation Method:**	Wet
Sample Description:	CL	**Classification Definition**	*Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays*





Test Summary		Remarks
Percent passing #40 Sieve (%)		
Liquid Limit	33	
Plastic Limit	21	
Plasticity Index	12	
Natural water content (%)	20	
Liquidity Index	-0.1	

* *The test data given herein pertain to the sample provided only. This report constitutes a testing service only.*

EB	July 26, 2010	LP	August 17,2010
TESTED BY	DATE	CHECKED BY	DATE

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Golder Associates

Laboratory Determination of Water Content of Soil and Rock

ASTM D 2216-05

Project #:	05-1413-0027
Short Title:	South Dump Investigations
Client	Mount Polley
Location	Mt.Polley, Likely, BC
Lab ID	134

Test Pit	6	9				
Sample Number	2	2+3				
Depth (m)	2.00-2.50	3.00-5.10				
Mass of Dry Soil (g)	126.5	252.2				
Water Content W (%)	**52.9**	**20.3**				

Borehole						
Sample Number						
Depth (m)						
Mass of Dry Soil (g)						
Water Content W (%)						

Borehole						
Sample Number						
Depth (m)						
Mass of Dry Soil (g)						
Water Content W (%)						

Borehole						
Sample Number						
Depth (m)						
Mass of Dry Soil (g)						
Water Content W (%)						

Borehole						
Sample Number						
Depth (m)						
Mass of Dry Soil (g)						
Water Content W (%)						

EB	July 21, 2010	LP	August 17,2010
TESTED BY	DATE TESTED	CHECKED BY	DATE CHECKED

Golder Associates Ltd.
500 - 4260 Still Creek Drive Burnaby, British Columbia, Canada V5C 6C6
Tel: +1 (604) 296 4200 Fax: +1 (604) 298 5253 www.golder.com

* The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

APPENDIX C

Direct Shear Test Results

Golder Associates

Golder Associates Ltd. - Burnaby Laboratory
4260 Still Creek Drive
Burnaby, B.C. Canada V5C 6C6

Direct Shear Testing of Soils Under Consolidated Drained Conditions

Reference: ASTM D 3080-04

Client:	Mount Polley	**Test Pit:**	TP-06
Project:	South Dump Investigations	**Sample:**	2
Location:	Mt. Polley, Likely B.C.	**Depth (m):**	2.0-2.5
Project No.:	05-1413-027	**Lab ID No:**	134

Test Condition:	SATURATED	**Equipment Description:**		Stn-1	Stn-2
Visual Description:	Firm moist dark brown CLAY, some silt, some sand, trace fine gravel with trace of organic fibers	**Normal Load Cell:**	Serial No.:	221643	227408
		Shear Load Cell:	Serial No.:	266562	219231
Test parameters:	Peak and residual	**Vertical LPT:**	Serial No.:	LP-621	LP-567

Remarks: Area correction not applied to normal and shear stress calculation
Water added to the shear box

Initial Sample Dimensions

Test No.	1	2	3
Shear box geometry	Circle	Circle	Circle
Diameter (mm)	63.55	63.55	63.55
Height (mm)	25.30	25.30	25.30
Area (cm^2)	31.72	31.72	31.72
Volume (cm^3)	80.25	80.25	80.25

Weight Volume Relationships

Sample Type	Remoulded Sample		
Dry Mass (g)	84.3	82.9	80.8
Initial γ_{wet} (kN/m^3)	15.76	15.80	15.82
Final γ_{wet} (kN/m^3)	16.81	16.58	16.75
Initial γ_{dry} (kN/m^3)	10.31	10.13	9.88
Final γ_{dry} (kN/m^3)	10.66	10.86	10.85
Initial water content (%)	52.9	55.9	60.1
Final water content (%)	57.6	52.7	54.4

Consolidation Results

Normal Stress (kPa)	100	200	500
t_{100} Casagrande Method (min)	295	225	195
t_{50} (min)	19	20	33
Change in height ΔH_c (mm)	0.84	1.69	2.26

Comments: Direct shear test specimens were trimmed from intact chunks

Calibrations:

Test 1	Stn-1	Shear =	266562	Normal =	221643	Vertical =	LP-621
Test-2	Stn-2	Shear =	219231	Normal =	227408	Vertical =	LP-567
Test-3	Stn-1	Shear =	266562	Normal =	221643	Vertical =	LP-621

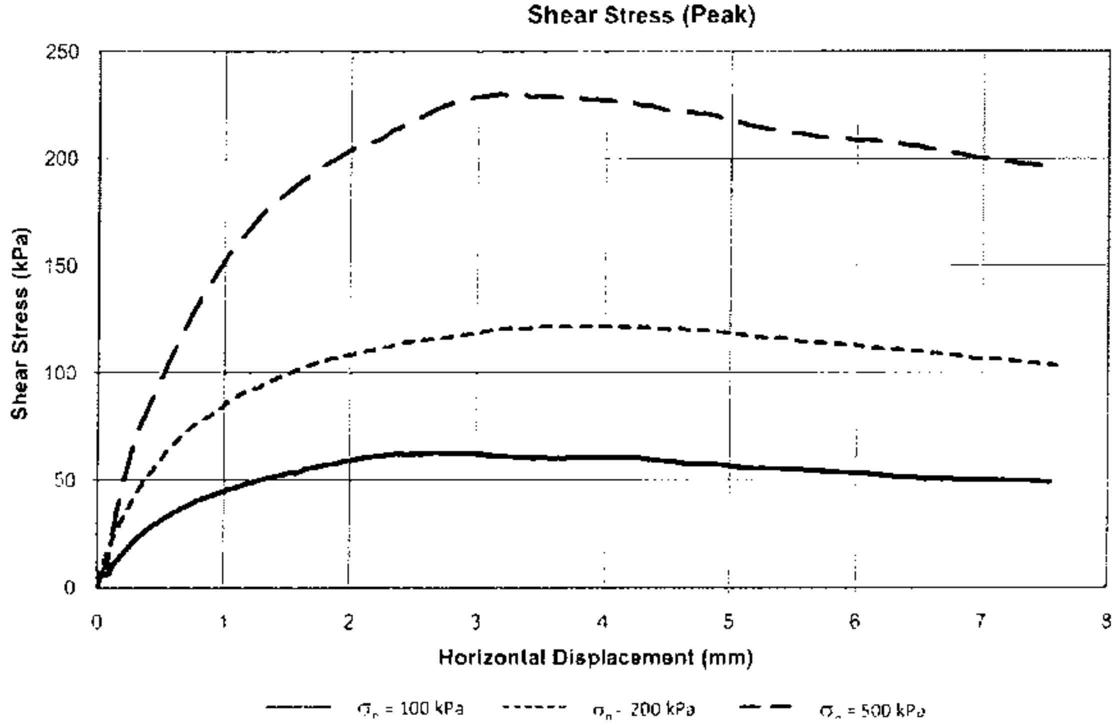
TESTED BY	DATE	CHECKED BY	DATE
TM	July 30, 2010	ROB	August 2, 2010

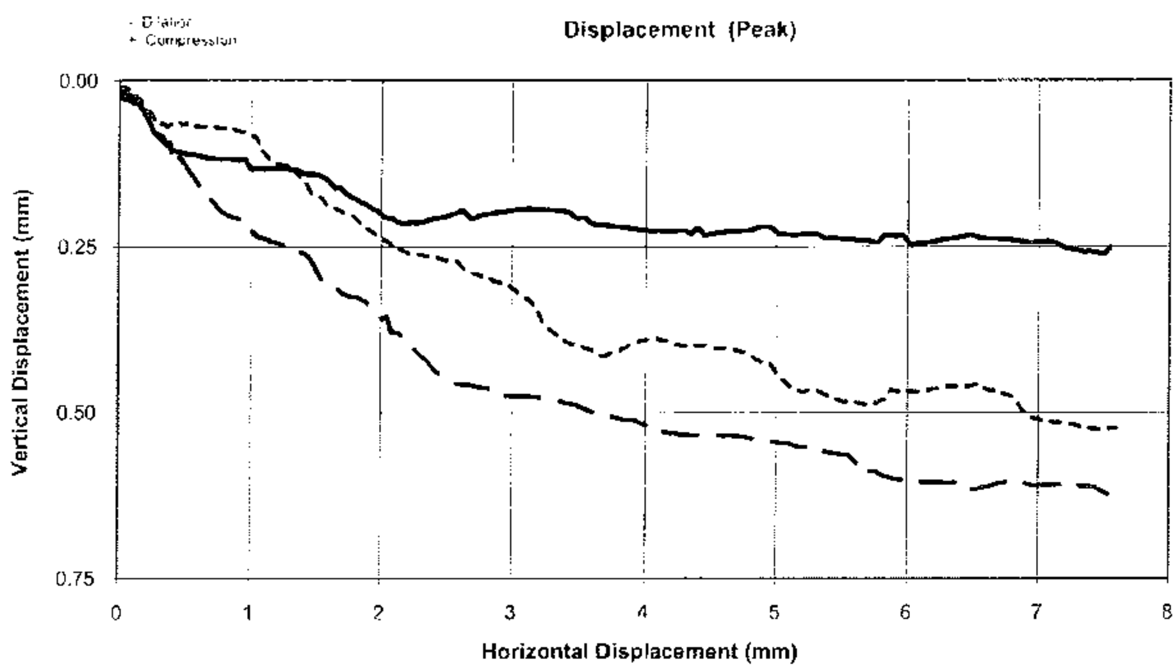
Golder Associates

Golder Associates Ltd. - Burnaby Laboratory
4280 Still Creek Drive
Burnaby, B.C. Canada V5C 6C6

Direct Shear Testing of Soils Under Consolidated Drained Conditions	Reference ASTM D 3080-04

Client:	Mount Polley	**Test Pit:**	TP-06
Project:	South Dump Investigations	**Sample:**	2
Location:	Mt. Polley, Likely B.C.	**Depth (m):**	2.0-2.5
Project No.:	05-1413-027	**Lab ID No:**	134





TM	July 30, 2010	ROB	August 2, 2010
TESTED BY	DATE	CHECKED BY	DATE

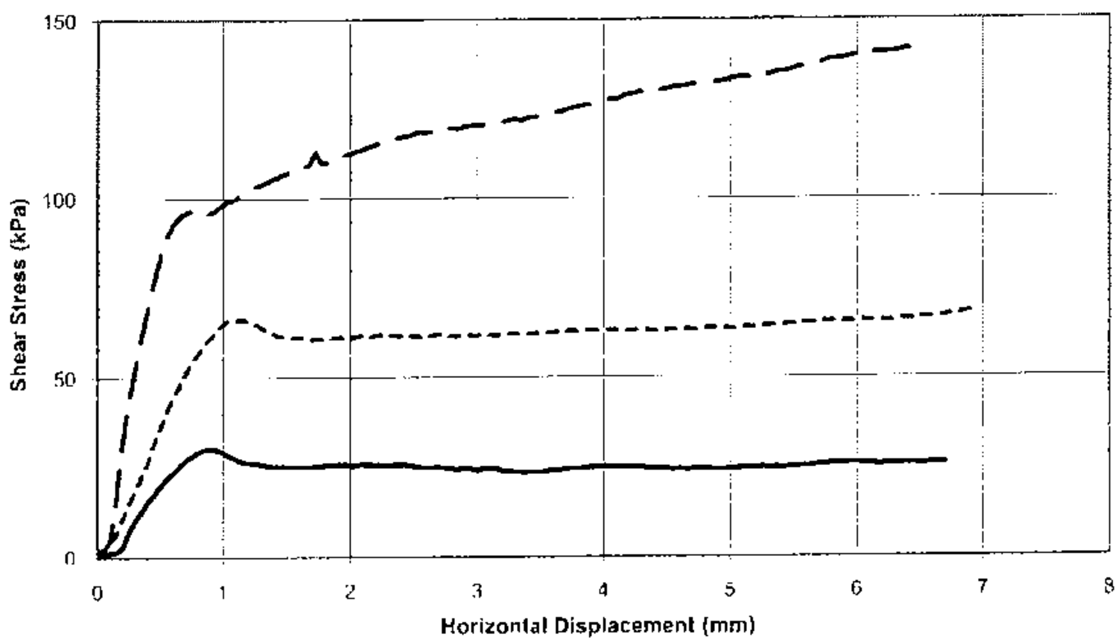
Golder Associates

Golder Associates Ltd. - Burnaby Laboratory
4280 Still Creek Drive
Burnaby, B.C. Canada V5C 6C6

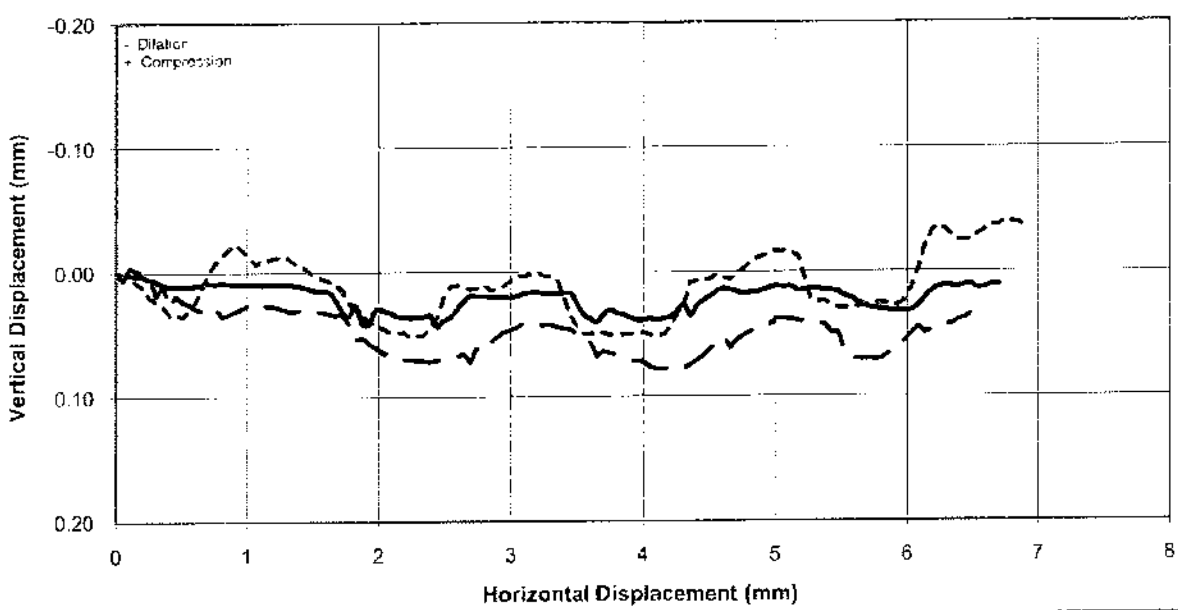
Direct Shear Testing of Soils Under Consolidated Drained Conditions	Reference ASTM D 3080-04

Client:	Mount Polley	**Test Pit:**	TP-06
Project:	South Dump Investigations	**Sample:**	2
Location:	Mt. Polley, Likely B.C.	**Depth (m):**	2.0-2.5
Project No.:	05-1413-027	**Lab ID No:**	134

Shear Stress (Residual)



Displacement (Residual)



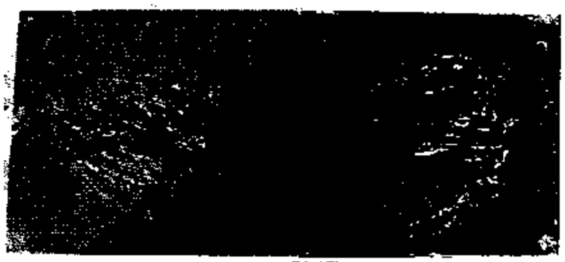
TM	July 30, 2010	ROB	August 2, 2010
TESTED BY	DATE	CHECKED BY	DATE

Golder Associates

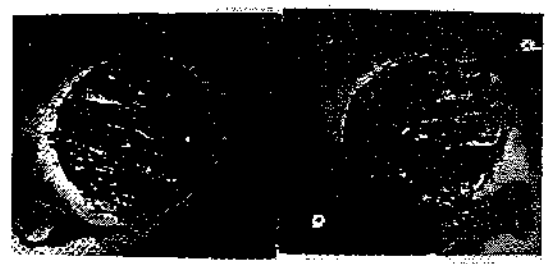
Golder Associates Ltd. - Burnaby Laboratory
4280 Still Creek Drive
Burnaby, B.C. Canada V5C 6C6

Direct Shear Testing of Soils Under Consolidated Drained Conditions	Reference ASTM D 3080-04

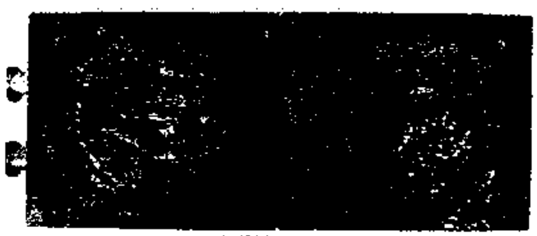
Client:	Mount Polley	**Test Pit:**	TP-06
Project:	South Dump Investigations	**Sample:**	2
Location:	Mt. Polley, Likely B.C.	**Depth (m):**	2.0-2.5
Project No.:	05-1413-027	**Lab ID No:**	134



Test 1 (After Shear)



Test 2 (After Shear)



Test 3 (After Shear)

Remarks:

Peak test was conducted on test specimen trimmed from an intact chunk

Residual test was performed on test specimen after peak run and 5 cycles of pre-shear

TM	July 30, 2010	ROB	August 2, 2010
TESTED BY	DATE	CHECKED BY	DATE

Golder Associates

Golder Associates Ltd. - Burnaby Laboratory
4280 Still Creek Drive
Burnaby, B.C. Canada V5C 6C6

Direct Shear Testing of Soils Under Consolidated Drained Conditions

Reference: ASTM D 3080-04

Client:	Mount Polley	**Test Pit:**	TP-06
Project:	South Dump Investigations	**Sample:**	
Location:	Mt. Polley, Likely B.C.	**Depth (m):**	2.0-2.5
Project No.:	05-1413-027	**Lab ID No:**	134

	Peak 1		Peak 2		Peak 3		
Normal Stress , kPa	100	Normal Stress , kPa	200	Normal Stress , kPa	500	Normal Stress , kPa	
Disp Rate, mm/min	0.001	Disp Rate, mm/min	0.001	Disp Rate, mm/min	0.001	Disp Rate, mm/min	

Horz Disp mm	Shear Stress kPa	Vert Disp mm	Horz Disp mm	Shear Stress kPa	Vert Disp mm	Horz Disp mm	Shear Stress kPa	Vert Disp mm	Horz Disp mm	Shear Stress kPa	Vert Disp mm
0.00	1.1	0.013	0.00	2.4	0.008	0.00	1.1	0.022			
0.01	3.4	0.015	0.01	4.1	0.009	0.01	2.2	0.025			
0.03	4.8	0.018	0.03	6.4	0.009	0.03	4.4	0.027			
0.04	5.9	0.020	0.04	9.2	0.010	0.04	7.1	0.028			
0.05	6.0	0.021	0.05	11.6	0.013	0.05	8.7	0.029			
0.06	6.0	0.021	0.06	14.3	0.013	0.06	9.1	0.030			
0.08	6.1	0.022	0.08	16.6	0.016	0.08	9.2	0.030			
0.09	6.4	0.024	0.09	19.0	0.017	0.09	13.8	0.032			
0.10	7.9	0.024	0.10	20.3	0.019	0.10	18.9	0.033			
0.11	9.6	0.026	0.11	22.5	0.021	0.11	23.7	0.034			
0.13	10.9	0.028	0.13	24.2	0.023	0.13	28.4	0.035			
0.14	11.9	0.032	0.14	25.6	0.026	0.14	32.5	0.037			
0.15	12.9	0.035	0.15	27.4	0.029	0.15	36.3	0.040			
0.16	13.7	0.041	0.16	29.1	0.032	0.16	40.0	0.042			
0.18	14.5	0.045	0.18	30.6	0.037	0.18	43.4	0.043			
0.19	15.4	0.050	0.19	31.9	0.040	0.19	46.5	0.050			
0.20	16.1	0.053	0.20	33.5	0.042	0.20	49.6	0.055			
0.22	17.0	0.058	0.22	34.8	0.045	0.22	52.3	0.065			
0.23	17.9	0.063	0.23	35.8	0.047	0.23	55.1	0.069			
0.24	18.7	0.068	0.24	37.4	0.052	0.24	58.0	0.072			
0.25	19.6	0.075	0.25	38.7	0.054	0.25	61.0	0.074			
0.27	20.4	0.078	0.27	39.8	0.057	0.27	63.6	0.078			
0.28	21.3	0.080	0.28	41.2	0.060	0.28	66.1	0.083			
0.29	22.0	0.080	0.29	42.9	0.063	0.29	68.6	0.085			
0.30	22.7	0.082	0.30	44.2	0.063	0.30	71.0	0.087			
0.32	23.4	0.083	0.32	45.5	0.065	0.32	73.1	0.089			
0.33	24.1	0.086	0.33	46.7	0.066	0.33	75.2	0.091			
0.34	24.7	0.090	0.34	47.8	0.067	0.34	77.2	0.093			
0.36	25.4	0.094	0.36	49.0	0.068	0.36	78.5	0.096			
0.37	26.2	0.096	0.37	49.7	0.068	0.37	80.3	0.098			
0.38	26.7	0.101	0.38	50.7	0.067	0.38	82.0	0.091			
0.39	27.3	0.102	0.39	52.0	0.065	0.39	83.7	0.109			
0.41	27.9	0.104	0.41	53.1	0.064	0.41	85.3	0.113			
0.42	28.4	0.105	0.42	54.0	0.064	0.42	87.1	0.102			
0.43	28.8	0.106	0.43	54.9	0.065	0.43	88.9	0.106			

0.44	29.2	0.107	0.44	56.3	0.065	0.44	90.2	0.112			
0.46	29.7	0.108	0.46	57.0	0.064	0.46	91.8	0.116			
0.47	30.2	0.108	0.47	58.3	0.067	0.47	93.5	0.119			
0.48	30.8	0.109	0.48	58.9	0.066	0.48	95.1	0.123			
0.49	31.2	0.109	0.49	59.7	0.063	0.49	97.2	0.126			
0.51	31.8	0.110	0.51	60.9	0.066	0.51	98.7	0.128			
0.52	32.1	0.110	0.52	61.8	0.068	0.52	100.3	0.133			
0.53	32.5	0.111	0.53	63.0	0.066	0.53	102.0	0.138			
0.55	33.0	0.111	0.55	63.8	0.067	0.55	103.8	0.142			
0.56	33.6	0.111	0.56	64.7	0.069	0.56	105.6	0.145			
0.57	34.0	0.111	0.57	65.7	0.069	0.60	110.4	0.155			
0.61	35.2	0.114	0.58	66.2	0.067	0.63	115.2	0.167			
0.65	36.3	0.115	0.60	67.0	0.069	0.67	119.6	0.177			
0.68	37.5	0.116	0.61	67.8	0.068	0.71	124.0	0.182			
0.72	38.5	0.117	0.62	68.7	0.069	0.75	128.6	0.192			
0.76	39.8	0.118	0.66	70.8	0.070	0.79	132.7	0.199			
0.80	40.8	0.118	0.70	72.9	0.069	0.82	136.6	0.203			
0.84	41.5	0.118	0.74	74.9	0.071	0.86	140.2	0.205			
0.88	42.3	0.119	0.77	76.2	0.072	0.90	143.6	0.208			
0.91	43.1	0.120	0.81	77.6	0.073	0.94	147.4	0.210			
0.95	43.8	0.119	0.85	79.1	0.072	0.98	150.7	0.213			
0.99	44.8	0.132	0.89	80.3	0.075	1.01	154.4	0.230			
1.03	45.5	0.132	0.93	82.1	0.077	1.05	157.5	0.235			
1.07	46.2	0.132	0.96	83.8	0.078	1.09	160.3	0.237			
1.10	46.7	0.133	1.00	85.5	0.081	1.13	163.0	0.240			
1.14	47.6	0.132	1.04	87.0	0.086	1.17	165.6	0.243			
1.18	48.3	0.132	1.08	88.6	0.105	1.20	168.3	0.245			
1.22	48.7	0.132	1.12	89.9	0.114	1.24	171.0	0.247			
1.26	49.6	0.132	1.15	91.1	0.123	1.28	174.0	0.250			
1.29	50.2	0.133	1.19	92.3	0.124	1.32	176.2	0.253			
1.33	50.7	0.134	1.23	92.7	0.127	1.36	177.9	0.256			
1.37	51.1	0.136	1.27	93.3	0.128	1.39	179.8	0.260			
1.41	51.7	0.140	1.31	95.0	0.127	1.43	181.6	0.265			
1.45	52.1	0.140	1.34	96.2	0.140	1.47	183.6	0.275			
1.48	52.9	0.141	1.38	96.7	0.148	1.51	185.4	0.290			
1.52	53.1	0.143	1.42	97.9	0.157	1.55	186.9	0.303			
1.56	53.0	0.147	1.46	98.6	0.171	1.59	189.0	0.308			
1.60	54.0	0.153	1.50	99.7	0.174	1.62	190.5	0.311			
1.64	54.8	0.162	1.53	100.5	0.177	1.66	192.0	0.313			
1.67	55.5	0.161	1.57	101.4	0.187	1.70	193.6	0.321			
1.71	55.9	0.169	1.61	102.4	0.190	1.74	195.5	0.324			
1.75	56.2	0.174	1.65	103.2	0.193	1.78	196.9	0.326			
1.79	56.5	0.177	1.69	103.9	0.197	1.81	198.3	0.327			
1.83	57.1	0.182	1.72	104.5	0.200	1.85	199.3	0.331			
1.86	57.4	0.185	1.76	105.5	0.203	1.89	200.5	0.335			
1.90	58.0	0.190	1.80	105.9	0.209	1.93	201.8	0.344			
1.94	58.5	0.194	1.84	106.5	0.216	1.97	203.4	0.353			
1.98	58.8	0.198	1.88	107.0	0.221	2.00	204.3	0.360			
2.02	59.2	0.205	1.91	107.6	0.227	2.04	205.6	0.355			
2.05	59.7	0.207	1.95	108.1	0.231	2.08	206.5	0.379			
2.09	60.1	0.209	1.99	108.5	0.235	2.12	207.3	0.379			
2.13	60.2	0.214	2.03	109.0	0.241	2.16	207.6	0.385			
2.17	60.7	0.215	2.07	109.6	0.246	2.19	208.5	0.391			

2.21	61.0	0.214	2.11	110.1	0.255	2.23	209.4	0.401			
2.24	61.2	0.214	2.14	110.5	0.255	2.27	211.1	0.409			
2.28	61.5	0.214	2.18	110.9	0.258	2.31	212.7	0.416			
2.32	61.7	0.212	2.22	111.5	0.263	2.35	213.8	0.423			
2.36	61.9	0.210	2.26	111.8	0.262	2.38	214.7	0.432			
2.40	61.9	0.208	2.30	112.4	0.262	2.42	216.0	0.439			
2.43	61.8	0.207	2.33	112.9	0.264	2.46	217.2	0.445			
2.47	61.8	0.205	2.37	113.6	0.265	2.51	218.4	0.452			
2.52	62.0	0.203	2.41	114.0	0.266	2.56	219.9	0.456			
2.57	62.0	0.199	2.45	114.5	0.269	2.61	221.4	0.458			
2.63	62.1	0.197	2.49	114.7	0.270	2.66	222.9	0.458			
2.68	62.5	0.208	2.52	115.0	0.271	2.71	224.3	0.460			
2.73	62.3	0.205	2.57	115.3	0.273	2.76	225.5	0.462			
2.78	62.1	0.202	2.62	115.5	0.283	2.82	226.4	0.463			
2.83	62.2	0.200	2.68	116.2	0.289	2.87	227.5	0.476			
2.88	62.2	0.198	2.73	116.1	0.292	2.92	228.0	0.476			
2.93	62.1	0.197	2.78	116.8	0.295	2.97	228.5	0.475			
2.98	62.1	0.196	2.83	117.1	0.298	3.02	228.9	0.476			
3.03	62.0	0.194	2.88	117.7	0.303	3.07	229.3	0.475			
3.08	61.6	0.193	2.93	118.0	0.307	3.12	229.6	0.476			
3.13	61.4	0.192	2.98	118.5	0.310	3.17	230.0	0.476			
3.18	61.1	0.194	3.03	119.0	0.318	3.22	229.7	0.478			
3.23	60.9	0.194	3.08	119.6	0.326	3.27	230.0	0.480			
3.28	60.7	0.195	3.13	120.3	0.331	3.32	230.0	0.482			
3.34	60.2	0.196	3.18	120.7	0.343	3.37	229.7	0.484			
3.39	60.3	0.197	3.23	120.8	0.367	3.42	228.8	0.487			
3.44	60.1	0.201	3.28	120.9	0.376	3.47	229.5	0.488			
3.49	60.2	0.208	3.34	120.6	0.384	3.53	229.2	0.493			
3.54	60.3	0.206	3.39	120.8	0.391	3.58	229.1	0.497			
3.59	59.8	0.215	3.44	121.1	0.396	3.63	228.8	0.501			
3.64	60.1	0.216	3.49	121.3	0.397	3.68	228.5	0.504			
3.69	60.0	0.217	3.54	121.7	0.402	3.73	228.3	0.506			
3.74	60.2	0.218	3.59	122.2	0.405	3.78	228.3	0.507			
3.79	60.3	0.220	3.64	121.7	0.411	3.83	227.8	0.510			
3.84	60.2	0.221	3.69	121.7	0.416	3.88	227.5	0.511			
3.89	60.3	0.223	3.74	121.5	0.412	3.93	227.7	0.513			
3.94	60.4	0.224	3.79	121.5	0.408	3.98	227.2	0.517			
3.99	60.4	0.226	3.84	121.8	0.403	4.03	227.1	0.522			
4.05	60.4	0.226	3.89	122.1	0.398	4.08	226.8	0.527			
4.10	60.3	0.226	3.94	121.8	0.394	4.13	226.4	0.529			
4.15	60.3	0.226	3.99	121.7	0.392	4.18	225.9	0.531			
4.20	60.2	0.226	4.05	121.9	0.389	4.24	225.8	0.531			
4.25	60.1	0.227	4.10	121.7	0.389	4.29	225.1	0.533			
4.30	60.1	0.226	4.15	121.4	0.392	4.34	225.1	0.533			
4.35	59.6	0.230	4.20	121.4	0.395	4.39	224.2	0.535			
4.40	59.3	0.223	4.25	121.3	0.398	4.44	223.5	0.535			
4.45	59.0	0.233	4.30	121.3	0.400	4.49	222.8	0.535			
4.50	58.6	0.231	4.35	121.2	0.401	4.54	222.7	0.535			
4.55	58.5	0.229	4.40	120.8	0.400	4.59	222.5	0.535			
4.60	57.9	0.228	4.45	120.6	0.399	4.64	222.0	0.535			
4.65	57.5	0.227	4.50	120.4	0.402	4.69	221.7	0.536			
4.70	57.5	0.227	4.55	120.5	0.404	4.74	220.8	0.536			
4.76	57.4	0.226	4.60	120.9	0.404	4.79	221.1	0.538			

4.81	57.4	0.225	4.65	120.2	0.404	4.84	220.3	0.540			
4.86	57.2	0.222	4.70	120.2	0.407	4.89	219.9	0.543			
4.91	57.2	0.220	4.76	119.6	0.409	4.95	218.8	0.544			
4.96	56.7	0.222	4.81	119.9	0.415	5.00	217.9	0.544			
5.01	56.2	0.229	4.86	119.5	0.422	5.05	217.4	0.546			
5.06	55.9	0.231	4.91	119.1	0.426	5.10	216.6	0.547			
5.11	55.8	0.232	4.96	118.9	0.428	5.15	215.6	0.550			
5.16	55.6	0.233	5.01	118.3	0.444	5.20	214.8	0.552			
5.21	55.4	0.231	5.06	118.2	0.453	5.25	214.5	0.553			
5.26	55.5	0.230	5.11	117.5	0.461	5.30	213.8	0.553			
5.31	55.1	0.231	5.16	117.4	0.466	5.35	213.7	0.559			
5.36	55.1	0.237	5.21	116.8	0.469	5.40	212.9	0.561			
5.41	55.0	0.237	5.26	116.7	0.466	5.45	212.4	0.562			
5.47	54.7	0.238	5.31	116.2	0.467	5.50	211.9	0.564			
5.52	54.6	0.239	5.36	116.3	0.472	5.55	211.6	0.565			
5.57	54.6	0.239	5.41	116.7	0.477	5.61	211.1	0.575			
5.62	54.1	0.240	5.47	115.5	0.481	5.66	210.7	0.592			
5.67	54.2	0.241	5.52	115.0	0.485	5.71	209.8	0.588			
5.72	54.0	0.242	5.57	114.7	0.483	5.76	209.8	0.590			
5.77	53.9	0.244	5.62	114.4	0.485	5.81	209.5	0.596			
5.82	53.4	0.233	5.67	114.3	0.488	5.86	209.4	0.598			
5.87	53.4	0.234	5.72	113.8	0.488	5.91	209.4	0.601			
5.92	53.3	0.234	5.77	113.6	0.485	5.96	208.9	0.602			
5.97	52.9	0.235	5.82	113.5	0.481	6.01	208.6	0.604			
6.02	53.2	0.248	5.87	113.4	0.466	6.06	208.7	0.604			
6.07	52.8	0.245	5.92	112.8	0.468	6.11	208.7	0.604			
6.13	52.6	0.245	5.97	113.1	0.469	6.16	208.4	0.605			
6.18	52.3	0.243	6.02	112.4	0.468	6.21	207.9	0.605			
6.23	52.1	0.242	6.07	112.5	0.468	6.26	207.4	0.606			
6.28	51.7	0.239	6.12	111.4	0.468	6.32	207.3	0.606			
6.33	51.7	0.238	6.18	111.7	0.466	6.37	206.8	0.606			
6.38	51.2	0.236	6.23	111.2	0.4636	6.42	205.9	0.605			
6.43	51.1	0.234	6.28	110.9	0.4619	6.47	205.9	0.616			
6.48	50.9	0.233	6.33	111.2	0.4606	6.52	205.4	0.615			
6.53	50.4	0.235	6.38	110.8	0.4616	6.57	204.7	0.614			
6.58	50.4	0.237	6.43	110.3	0.4619	6.62	204.1	0.612			
6.63	50.5	0.238	6.48	110.1	0.4605	6.67	203.6	0.609			
6.68	50.4	0.238	6.53	109.8	0.4571	6.72	202.8	0.606			
6.73	50.4	0.239	6.58	109.2	0.4626	6.77	202.5	0.604			
6.78	50.2	0.240	6.63	109.5	0.4680	6.82	201.9	0.605			
6.84	50.0	0.241	6.68	108.8	0.4659	6.87	201.3	0.605			
6.89	50.0	0.242	6.73	108.6	0.4725	6.92	200.7	0.609			
6.94	49.9	0.244	6.78	108.1	0.4745	6.97	200.2	0.610			
6.99	49.9	0.243	6.84	107.9	0.4849	7.03	200.1	0.610			
7.04	49.8	0.242	6.89	107.5	0.4998	7.08	199.2	0.609			
7.09	49.8	0.243	6.94	106.7	0.5082	7.13	199.2	0.609			
7.14	49.6	0.246	6.99	106.7	0.5097	7.18	198.6	0.609			
7.19	49.6	0.252	7.04	106.6	0.5122	7.23	198.3	0.610			
7.24	49.5	0.253	7.09	106.4	0.5143	7.28	197.6	0.609			
7.29	49.5	0.255	7.14	106.5	0.5152	7.33	197.5	0.611			
7.34	49.4	0.258	7.19	106.0	0.5152	7.38	197.3	0.611			
7.39	49.3	0.258	7.24	105.6	0.5173	7.43	197.1	0.612			
7.44	49.2	0.259	7.29	105.2	0.5197	7.48	195.9	0.618			

7.49	49.1	0.261	7.34	104.9	0.5230	7.53	195.4	0.623			
7.54	48.8	0.251	7.39	104.8	0.5246						
			7.44	104.3	0.5258						
			7.49	104.1	0.5264						
			7.55	103.6	0.5248						
			7.60	103.5	0.5238						

TM	July 30, 2010	ROB	August 2, 2010

Golder Associates

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Direct Shear Testing of Soils Under Consolidated Drained Conditions

Reference: ASTM D 3080-04

Client:	Mount Polley	**Test Pit:**	TP-06
Project:	South Dump Investigations	**Sample:**	
Location:	Mt. Polley, Likely B.C.	**Depth (m):**	2.0-2.5
Project No.:	05-1413-027	**Lab ID No:**	134

Residual 1		Residual 2		Residual 3			
Normal Stress , kPa	100	Normal Stress , kPa	200	Normal Stress , kPa	500	Normal Stress , kPa	
Disp Rate, mm/min	0.001	Disp Rate, mm/min	0.001	Disp Rate, mm/min	0.001	Disp Rate, mm/min	

Horz Disp mm	Shear Stress kPa	Vert Disp mm	Horz Disp mm	Shear Stress kPa	Vert Disp mm	Horz Disp mm	Shear Stress kPa	Vert Disp mm	Horz Disp mm	Shear Stress kPa	Vert Disp mm
0.00	0.6	0.000	0.00	1.7	0.000	0.00	1.5	0.000			
0.05	0.8	0.002	0.05	2.6	0.002	0.05	2.1	0.006			
0.10	1.4	0.002	0.10	4.3	0.004	0.10	4.8	-0.004			
0.15	1.6	0.003	0.15	6.8	0.008	0.15	17.0	-0.002			
0.20	2.8	0.003	0.20	10.9	0.011	0.20	32.5	0.000			
0.25	7.4	0.005	0.25	15.1	0.020	0.25	44.3	0.003			
0.30	10.6	0.007	0.30	19.0	0.024	0.30	53.2	0.019			
0.36	13.0	0.010	0.36	23.0	0.027	0.36	62.1	0.010			
0.41	15.8	0.011	0.41	26.8	0.033	0.41	70.1	0.027			
0.46	17.9	0.011	0.46	32.4	0.033	0.46	77.8	0.019			
0.51	20.2	0.011	0.51	36.8	0.035	0.51	84.8	0.023			
0.56	22.1	0.011	0.56	41.2	0.031	0.56	90.0	0.025			
0.61	23.8	0.010	0.61	44.8	0.023	0.61	93.4	0.029			
0.66	25.6	0.010	0.66	48.6	0.012	0.66	95.3	0.031			
0.71	27.2	0.009	0.71	52.1	0.000	0.71	96.3	0.031			
0.76	28.4	0.009	0.76	55.0	-0.008	0.76	96.7	0.028			
0.81	29.4	0.008	0.81	57.5	-0.014	0.81	95.6	0.036			
0.86	30.1	0.009	0.86	60.0	-0.019	0.86	95.9	0.034			
0.91	29.9	0.010	0.91	61.7	-0.023	0.91	96.2	0.031			
0.96	29.8	0.010	0.96	64.1	-0.018	0.96	97.8	0.029			
1.01	28.8	0.010	1.01	65.6	-0.013	1.01	99.0	0.025			
1.07	27.7	0.009	1.07	65.9	-0.006	1.07	99.5	0.026			
1.12	26.9	0.010	1.12	66.1	-0.010	1.12	100.6	0.026			
1.17	26.1	0.010	1.17	66.2	-0.010	1.17	101.6	0.027			
1.22	26.0	0.010	1.22	65.2	-0.012	1.22	102.7	0.027			
1.27	25.9	0.010	1.27	64.8	-0.011	1.27	103.6	0.030			
1.32	25.5	0.010	1.32	63.5	-0.012	1.32	104.3	0.031			
1.37	25.2	0.011	1.37	62.6	-0.007	1.37	105.2	0.031			
1.42	25.0	0.011	1.42	61.8	-0.005	1.42	105.9	0.030			
1.47	25.1	0.013	1.47	61.4	-0.001	1.47	106.7	0.030			
1.52	25.0	0.015	1.52	61.0	0.003	1.52	107.5	0.030			
1.57	24.9	0.015	1.57	61.2	0.005	1.57	107.7	0.032			
1.62	24.9	0.015	1.62	61.2	0.007	1.62	108.5	0.033			
1.67	24.8	0.021	1.67	60.7	0.010	1.67	109.5	0.034			
1.72	25.2	0.031	1.72	60.8	0.014	1.72	112.9	0.034			

1.78	25.3	0.035	1.78	60.7	0.024	1.78	109.8	0.042			
1.83	25.3	0.027	1.83	60.8	0.030	1.83	110.2	0.055			
1.88	25.5	0.041	1.88	61.0	0.036	1.88	111.3	0.052			
1.93	25.6	0.042	1.93	61.1	0.040	1.93	112.1	0.057			
1.98	25.5	0.030	1.98	61.2	0.043	1.98	112.5	0.061			
2.03	25.3	0.031	2.03	61.2	0.045	2.03	113.1	0.065			
2.08	25.6	0.033	2.08	61.8	0.048	2.08	113.5	0.066			
2.13	25.5	0.035	2.13	61.3	0.049	2.13	114.3	0.069			
2.18	25.5	0.036	2.18	61.6	0.049	2.18	115.0	0.071			
2.23	25.4	0.037	2.23	61.8	0.052	2.23	115.7	0.071			
2.28	25.3	0.036	2.28	62.0	0.052	2.28	116.0	0.071			
2.33	25.4	0.036	2.33	61.6	0.051	2.33	116.8	0.072			
2.38	25.4	0.035	2.38	61.6	0.046	2.38	117.0	0.072			
2.43	25.5	0.044	2.43	61.8	0.037	2.43	117.3	0.071			
2.49	25.2	0.039	2.49	61.6	0.022	2.49	118.0	0.071			
2.54	25.0	0.037	2.54	61.4	0.012	2.54	118.5	0.071			
2.59	24.7	0.031	2.59	61.5	0.011	2.59	118.3	0.069			
2.64	24.6	0.024	2.64	61.5	0.013	2.64	118.7	0.065			
2.69	24.8	0.019	2.69	62.0	0.014	2.69	118.8	0.073			
2.74	24.6	0.020	2.74	61.6	0.013	2.74	119.1	0.062			
2.79	24.3	0.020	2.79	61.6	0.011	2.79	119.6	0.064			
2.84	24.2	0.020	2.84	61.5	0.015	2.84	119.4	0.057			
2.89	24.4	0.020	2.89	61.7	0.014	2.89	120.1	0.052			
2.94	24.3	0.021	2.94	61.8	0.011	2.94	120.2	0.049			
2.99	24.0	0.021	2.99	61.6	0.008	2.99	120.5	0.047			
3.04	24.3	0.019	3.04	62.0	0.003	3.04	120.5	0.045			
3.09	24.4	0.018	3.09	61.7	0.003	3.09	121.2	0.041			
3.14	24.4	0.017	3.14	61.7	0.002	3.14	121.1	0.042			
3.20	23.8	0.016	3.20	61.7	0.001	3.20	121.4	0.043			
3.25	23.8	0.018	3.25	62.0	0.003	3.25	122.0	0.043			
3.30	23.5	0.018	3.30	62.1	0.004	3.30	122.1	0.043			
3.35	23.4	0.018	3.35	61.8	0.007	3.35	121.9	0.044			
3.40	23.4	0.017	3.40	62.0	0.020	3.40	122.5	0.046			
3.45	23.3	0.017	3.45	62.2	0.036	3.45	122.7	0.047			
3.50	23.4	0.026	3.50	62.2	0.044	3.50	123.0	0.049			
3.55	23.6	0.035	3.55	62.3	0.050	3.55	123.3	0.052			
3.60	24.0	0.038	3.60	62.6	0.050	3.60	124.0	0.056			
3.65	24.0	0.041	3.65	62.7	0.049	3.65	124.2	0.068			
3.70	24.3	0.035	3.70	62.8	0.049	3.70	124.7	0.064			
3.75	24.4	0.031	3.75	62.8	0.051	3.75	125.4	0.065			
3.80	24.4	0.033	3.80	62.8	0.051	3.80	125.6	0.068			
3.86	24.7	0.035	3.85	63.1	0.050	3.86	126.0	0.069			
3.91	24.8	0.037	3.91	63.1	0.050	3.91	126.4	0.072			
3.96	24.8	0.039	3.96	63.1	0.050	3.96	126.8	0.071			
4.01	25.0	0.039	4.01	63.1	0.049	4.01	127.7	0.073			
4.06	24.9	0.038	4.06	63.1	0.051	4.06	127.6	0.077			
4.11	24.8	0.039	4.11	63.2	0.052	4.11	127.7	0.078			
4.16	24.9	0.038	4.16	63.3	0.050	4.16	128.7	0.078			
4.21	24.8	0.036	4.21	62.9	0.045	4.21	129.1	0.078			
4.26	24.9	0.032	4.26	63.2	0.034	4.26	129.5	0.077			
4.31	24.8	0.027	4.31	63.4	0.026	4.31	129.9	0.078			
4.36	24.5	0.035	4.36	63.2	0.008	4.36	130.3	0.075			
4.41	24.5	0.027	4.41	62.9	0.008	4.41	130.5	0.071			

4.46	24.3	0.024	4.46	63.0	0.007	4.46	130.3	0.068			
4.51	24.4	0.020	4.51	63.2	0.006	4.51	130.7	0.063			
4.57	24.1	0.016	4.57	63.3	0.002	4.57	131.1	0.058			
4.62	24.4	0.014	4.62	63.2	0.005	4.62	131.1	0.053			
4.67	24.0	0.015	4.67	63.4	0.007	4.67	131.5	0.061			
4.72	24.4	0.016	4.72	63.2	0.002	4.72	131.9	0.055			
4.77	24.3	0.018	4.77	63.2	-0.002	4.77	132.1	0.052			
4.82	24.3	0.017	4.82	63.6	-0.006	4.82	132.2	0.049			
4.87	24.1	0.017	4.87	63.8	-0.011	4.87	132.4	0.047			
4.92	24.1	0.015	4.92	63.4	-0.013	4.92	132.6	0.046			
4.97	24.2	0.013	4.97	63.6	-0.017	4.97	132.9	0.042			
5.02	24.4	0.012	5.02	63.4	-0.016	5.02	133.5	0.037			
5.07	24.4	0.013	5.07	63.6	-0.016	5.07	133.8	0.038			
5.12	24.6	0.012	5.12	64.0	-0.015	5.12	133.7	0.038			
5.17	24.5	0.015	5.17	64.0	-0.013	5.17	133.7	0.039			
5.22	24.6	0.015	5.22	64.3	0.004	5.22	134.6	0.041			
5.28	24.7	0.014	5.28	64.2	0.023	5.28	134.4	0.042			
5.33	24.6	0.014	5.33	64.4	0.024	5.33	134.7	0.042			
5.38	24.6	0.015	5.38	64.5	0.024	5.38	135.3	0.042			
5.43	24.4	0.015	5.43	64.5	0.029	5.43	135.5	0.049			
5.48	24.8	0.016	5.48	64.6	0.029	5.48	135.8	0.049			
5.53	24.7	0.020	5.53	64.9	0.030	5.53	136.4	0.065			
5.58	25.1	0.021	5.58	65.2	0.028	5.58	137.0	0.070			
5.63	24.9	0.025	5.63	65.1	0.028	5.63	137.3	0.070			
5.68	25.3	0.027	5.68	65.2	0.027	5.68	137.8	0.071			
5.73	25.4	0.030	5.73	65.4	0.027	5.73	138.0	0.071			
5.78	25.6	0.030	5.78	65.4	0.026	5.78	138.8	0.071			
5.83	25.8	0.031	5.83	65.5	0.026	5.83	138.9	0.068			
5.88	25.8	0.032	5.88	65.4	0.028	5.88	139.1	0.064			
5.93	25.8	0.031	5.93	65.4	0.027	5.93	139.4	0.059			
5.99	26.0	0.032	5.99	65.5	0.023	5.99	139.8	0.056			
6.04	25.7	0.031	6.04	66.1	0.012	6.04	140.1	0.050			
6.09	25.6	0.027	6.09	65.7	-0.003	6.09	140.5	0.045			
6.14	25.6	0.021	6.14	65.8	-0.022	6.14	140.5	0.050			
6.19	25.3	0.016	6.19	65.7	-0.032	6.19	140.5	0.048			
6.24	25.6	0.013	6.24	65.7	-0.037	6.24	140.6	0.046			
6.29	25.6	0.012	6.29	65.7	-0.034	6.29	140.9	0.043			
6.34	25.7	0.012	6.34	66.2	-0.028	6.34	141.2	0.042			
6.39	25.7	0.013	6.39	66.2	-0.025	6.39	141.6	0.039			
6.44	25.8	0.011	6.44	66.2	-0.025	6.44	141.4	0.037			
6.49	25.6	0.011	6.49	66.6	-0.025	6.48	141.6	0.035			
6.54	25.6	0.014	6.54	66.7	-0.030						
6.59	26.1	0.013	6.59	66.8	-0.033						
6.64	25.9	0.011	6.64	66.8	-0.037						
6.70	26.0	0.012	6.70	67.0	-0.037						
6.70	26.1	0.011	6.75	67.4	-0.040						
			6.80	67.6	-0.039						
			6.85	68.0	-0.038						
			6.90	68.3	-0.037						

TM	July 30, 2010	ROB	August 2, 2010

Golder Associates

Golder Associates Ltd. - Burnaby Laboratory
4280 Still Creek Drive
Burnaby, B.C. Canada V5C 6C6

Direct Shear Testing of Soils Under Consolidated Drained Conditions

Reference: ASTM D 3080-04

Client:	Mount Polley	Test Pit:	TP-09
Project:	South Dump Investigations	Sample:	3
Location:	Mt. Polley, Likely B.C.	Depth (m):	3-5.1
Project No.:	05-1413-027	Lab ID No:	134

Test Condition:	SATURATED	Equipment Description:		
Visual Description:	Stiff moist brown SAND and SILT, trace clay, trace gravel	Normal Load Cell:	Serial No.:	227408
		Shear Load Cell:	Serial No.:	219231
Test parameters:	Peak and residual	Vertical LPT:	Serial No.:	LP-567

Remarks: Area correction not applied to normal and shear stress calculation
Water added to the shear box

Initial Sample Dimensions

Test No.	1	2	3
Shear box geometry	Circle	Circle	Circle
Diameter (mm)	63.55	63.55	63.55
Height (mm)	25.30	25.30	25.30
Area (cm^2)	31.72	31.72	31.72
Volume (cm^3)	80.25	80.25	80.25

Weight Volume Relationships

Sample Type	Remoulded Sample		
Dry Mass (g)	139.4	137.8	137.2
Initial γ_{wet} (kN/m^3)	20.40	20.25	20.38
Final γ_{wet} (kN/m^3)	20.99	20.97	20.74
Initial γ_{dry} (kN/m^3)	17.04	16.84	16.77
Final γ_{dry} (kN/m^3)	17.20	17.22	17.14
Initial water content (%)	19.7	20.2	21.5
Final water content (%)	22.1	21.8	21.0

Consolidation Results

Normal Stress (kPa)	100	200	500
t_{90} (Taylor Method) (min)	0.35	0.44	0.44
Calculated t_{50} (min)	0.08	0.10	0.09
Change in height ΔH_c (mm)	0.23	0.55	0.55

Comments:
Direct shear test specimens were trimmed from intact chunks

TM	July 23, 2010	ROB	August 2, 2010
TESTED BY	DATE	CHECKED BY	DATE

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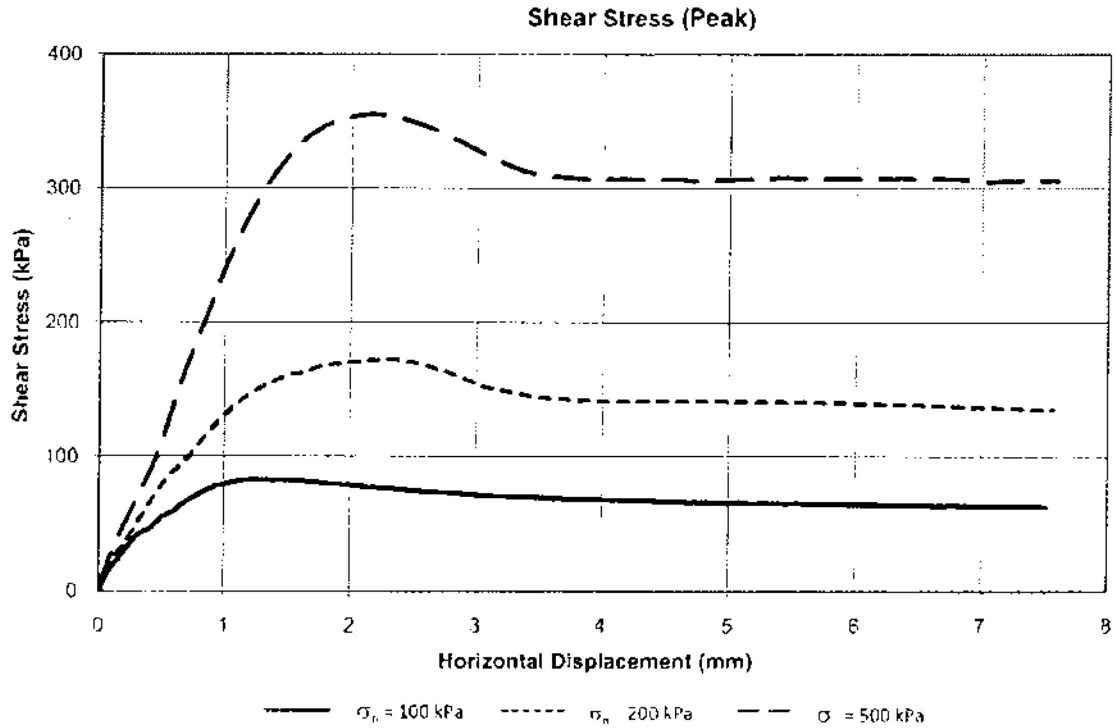
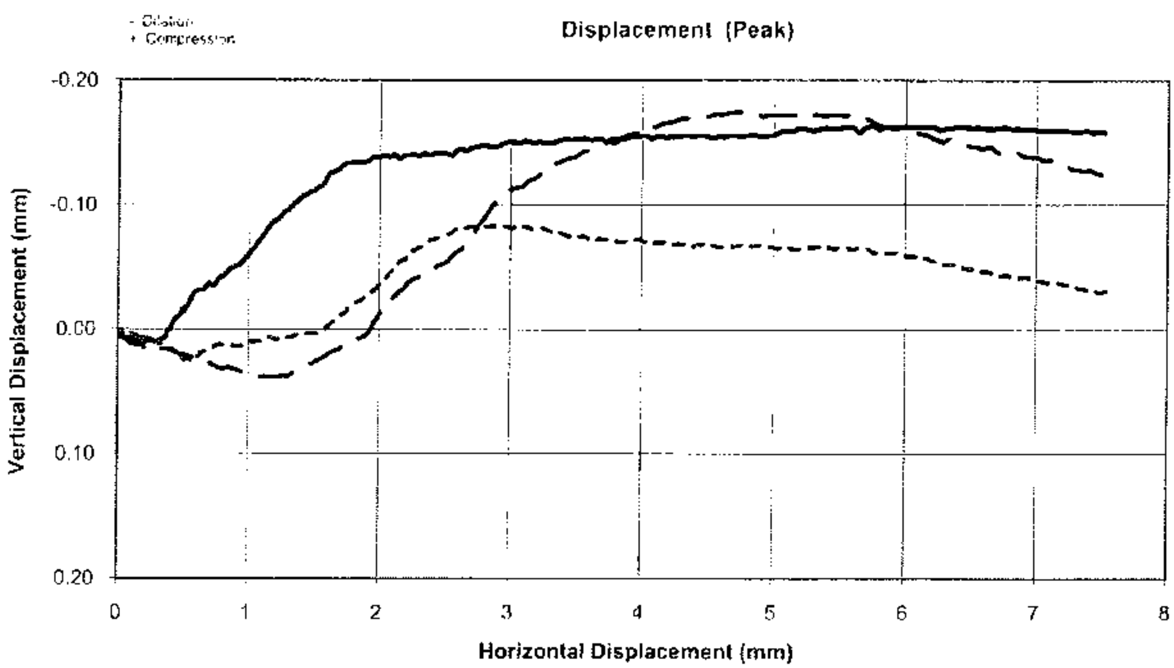
Burnaby, B.C. Canada V5C 6C6

Direct Shear Testing of Soils Under Consolidated Drained Conditions	Reference ASTM D 3080-04

Client:	Mount Polley	**Test Pit:**	TP-09
Project:	South Dump Investigations	**Sample:**	3
Location:	Mt. Polley, Likely B.C.	**Depth (m):**	3-5.1
Project No.:	05-1413-027	**Lab ID No:**	134





TM	July 23, 2010	ROB	August 2, 2010
TESTED BY	DATE	CHECKED BY	DATE

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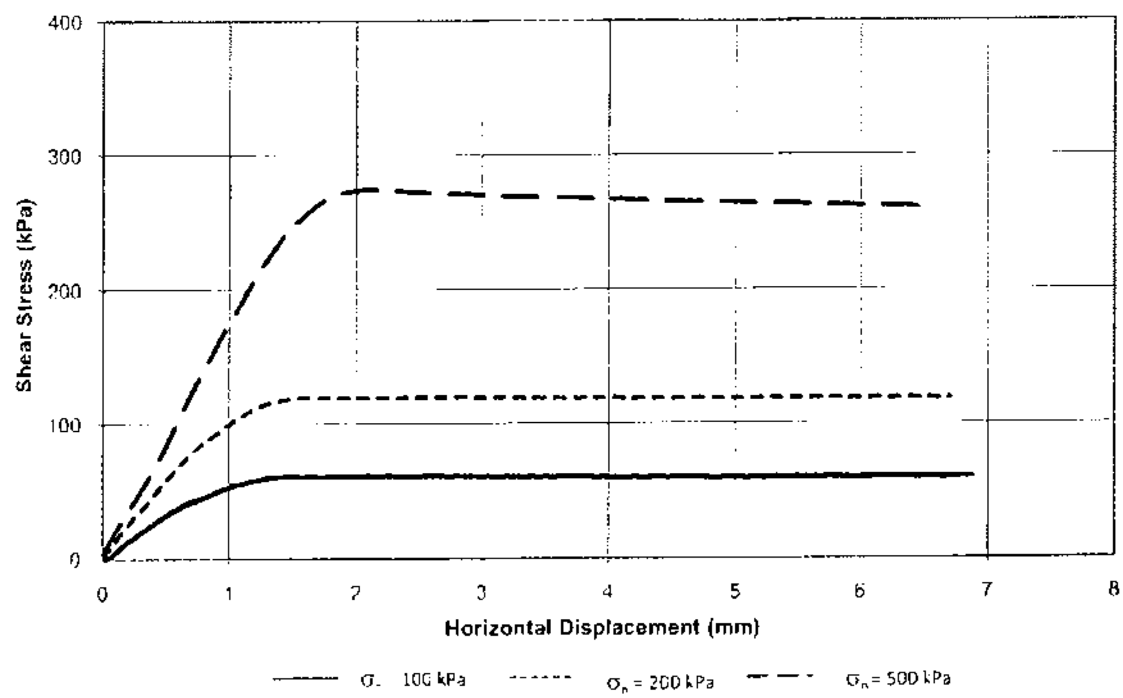
Burnaby, B.C. Canada V5C 6C6

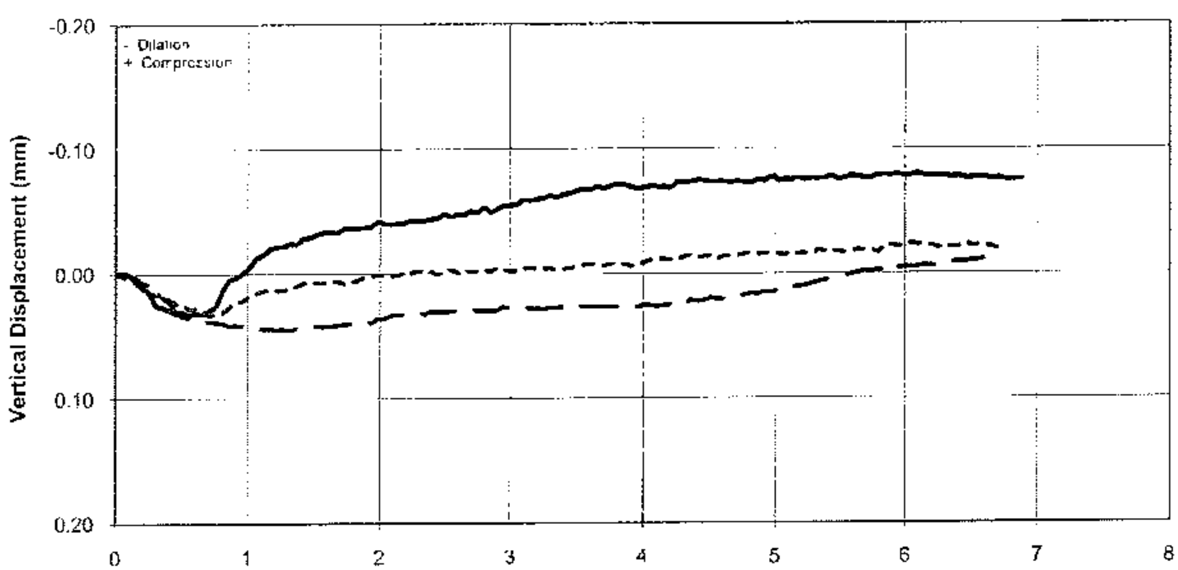
Direct Shear Testing of Soils Under Consolidated Drained Conditions	Reference: ASTM D 3080-04

Client:	Mount Polley	**Test Pit:**	TP-09
Project:	South Dump Investigations	**Sample:**	3
Location:	Mt. Polley, Likely B.C.	**Depth (m):**	3-5.1
Project No.:	05-1413-027	**Lab ID No:**	134

Shear Stress (Residual)



Displacement (Residual)



TM	July 23, 2010	ROB	August 2, 2010
TESTED BY	DATE	CHECKED BY	DATE

Golder Associates

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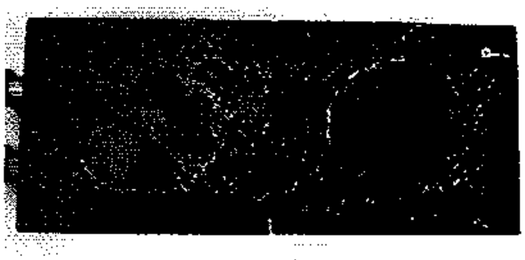
4260 Still Creek Drive
Burnaby, B.C. Canada V5C 6C6

Direct Shear Testing of Soils Under Consolidated Drained Conditions	Reference ASTM D 3080-04

Client:	Mount Polley	**Test Pit:**	TP-09
Project:	South Dump Investigations	**Sample:**	3
Location:	Mt. Polley, Likely B.C.	**Depth (m):**	3-5.1
Project No.:	05-1413-027	**Lab ID No:**	134



Test 1 (After Shear)

Test 2 (After Shear)

Test 3 (After Shear)

Remarks:

Peak tests were conducted on test specimens trimmed from intact chunks

Residual test was performed on test specimen after peak run and 5 cycles of pre-shear

TM	July 23, 2010	ROB	August 2, 2010
TESTED BY	DATE	CHECKED BY	DATE

Golder Associates

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Burnaby, B.C. Canada V5C 6C6

Direct Shear Testing of Soils Under Consolidated Drained Conditions

Reference	ASTM D 3080-04		
Client:	Mount Polley	**Test Pit:**	TP-09
Project:	South Dump Investigations	**Sample:**	3
Location:	Mt. Polley, Likely B.C.	**Depth (m):**	3-5.1
Project No.:	05-1413-027	**Lab ID No:**	134

Peak 1		Peak 2		Peak 3			
Normal Stress , kPa	100	Normal Stress , kPa	200	Normal Stress , kPa	500	Normal Stress , kPa	
Disp Rate, mm/min	0.015	Disp Rate, mm/min	0.015	Disp Rate, mm/min	0.015	Disp Rate, mm/min	

Horz Disp mm	Shear Stress kPa	Vert Disp mm	Horz Disp mm	Shear Stress kPa	Vert Disp mm	Horz Disp mm	Shear Stress kPa	Vert Disp mm	Horz Disp mm	Shear Stress kPa	Vert Disp mm
0.00	0.7	0.005	0.00	0.64	0.002	0.00	3.6	0.003			
0.01	3.0	0.006	0.01	4.33	0.003	0.01	6.4	0.004			
0.03	5.6	0.006	0.03	8.02	0.001	0.03	9.5	0.005			
0.04	8.0	0.005	0.04	11.61	0.004	0.04	12.5	0.007			
0.05	10.7	0.007	0.05	14.97	0.003	0.05	15.5	0.008			
0.06	12.7	0.008	0.06	17.40	0.004	0.06	18.6	0.008			
0.08	14.8	0.007	0.08	19.42	0.003	0.08	22.3	0.010			
0.09	16.2	0.009	0.09	21.17	0.005	0.09	25.9	0.011			
0.10	18.3	0.007	0.10	23.31	0.003	0.10	28.7	0.012			
0.11	20.0	0.008	0.11	24.26	0.004	0.11	31.7	0.012			
0.13	21.5	0.009	0.13	25.96	0.005	0.13	34.4	0.012			
0.14	22.9	0.009	0.14	27.98	0.005	0.14	37.0	0.012			
0.15	23.8	0.009	0.15	29.62	0.005	0.15	39.5	0.013			
0.17	26.0	0.009	0.17	30.96	0.008	0.17	42.6	0.012			
0.18	27.2	0.009	0.18	32.37	0.004	0.18	44.8	0.013			
0.19	28.6	0.008	0.19	34.46	0.008	0.19	47.4	0.013			
0.20	29.9	0.010	0.20	35.86	0.007	0.20	49.8	0.015			
0.22	31.6	0.010	0.22	37.66	0.009	0.22	52.0	0.014			
0.23	33.2	0.008	0.23	39.43	0.007	0.23	54.6	0.014			
0.24	34.8	0.010	0.24	40.73	0.009	0.24	57.1	0.014			
0.25	36.2	0.008	0.25	42.63	0.010	0.25	59.2	0.014			
0.27	37.7	0.009	0.27	44.12	0.009	0.27	61.9	0.015			
0.28	39.0	0.010	0.28	46.42	0.009	0.28	64.1	0.014			
0.29	40.3	0.010	0.29	48.39	0.010	0.29	66.3	0.016			
0.31	41.3	0.010	0.31	50.06	0.009	0.31	69.1	0.015			
0.32	42.2	0.009	0.32	52.51	0.012	0.32	71.5	0.016			
0.33	43.0	0.009	0.33	54.67	0.011	0.33	73.9	0.016			
0.34	43.3	0.008	0.34	56.18	0.014	0.34	77.0	0.016			
0.36	44.2	0.007	0.36	57.99	0.013	0.36	79.1	0.016			
0.37	44.6	0.005	0.37	60.35	0.016	0.37	81.6	0.016			
0.38	44.9	0.001	0.38	62.18	0.016	0.38	84.0	0.016			
0.39	45.3	0.001	0.39	64.41	0.016	0.39	86.4	0.017			
0.41	46.5	-0.001	0.41	66.08	0.016	0.41	89.1	0.017			
0.42	47.4	-0.004	0.42	68.07	0.016	0.42	91.8	0.017			
0.43	48.5	-0.007	0.43	69.52	0.017	0.43	94.6	0.018			

0.44	49.8	-0.009	0.45	71.46	0.018	0.45	97.4	0.018			
0.46	50.9	-0.009	0.46	73.05	0.019	0.46	100.7	0.018			
0.47	52.1	-0.010	0.47	75.21	0.020	0.47	103.9	0.020			
0.48	53.2	-0.012	0.48	76.44	0.021	0.48	107.0	0.021			
0.50	54.6	-0.016	0.50	78.53	0.022	0.50	110.5	0.021			
0.51	55.1	-0.014	0.51	79.96	0.025	0.51	113.6	0.020			
0.52	55.9	-0.018	0.52	81.73	0.025	0.52	117.1	0.021			
0.53	56.7	-0.019	0.53	83.51	0.024	0.53	120.7	0.022			
0.55	56.9	-0.021	0.55	85.02	0.024	0.55	124.7	0.021			
0.58	58.9	-0.029	0.56	86.51	0.025	0.56	128.5	0.022			
0.62	61.8	-0.031	0.57	87.16	0.024	0.57	132.5	0.023			
0.66	64.5	-0.032	0.59	88.65	0.025	0.59	136.5	0.023			
0.70	66.9	-0.037	0.60	89.43	0.025	0.60	139.9	0.023			
0.74	68.9	-0.035	0.64	92.64	0.019	0.61	144.0	0.024			
0.78	71.1	-0.041	0.67	96.22	0.018	0.62	147.9	0.025			
0.81	73.3	-0.043	0.71	100.25	0.016	0.66	158.6	0.025			
0.85	75.1	-0.048	0.75	104.84	0.014	0.70	168.4	0.027			
0.89	76.6	-0.050	0.79	109.21	0.012	0.74	177.6	0.029			
0.93	78.1	-0.052	0.83	113.84	0.014	0.78	187.4	0.031			
0.97	78.5	-0.056	0.86	117.61	0.013	0.81	196.7	0.032			
1.00	79.5	-0.061	0.90	121.92	0.014	0.85	205.2	0.030			
1.04	80.3	-0.065	0.94	125.88	0.014	0.89	214.8	0.032			
1.08	81.0	-0.071	0.98	129.59	0.011	0.93	224.8	0.033			
1.12	81.8	-0.076	1.02	133.15	0.010	0.97	233.6	0.035			
1.16	82.0	-0.082	1.06	136.44	0.010	1.00	242.7	0.036			
1.19	82.5	-0.087	1.09	139.59	0.010	1.04	251.0	0.037			
1.23	82.7	-0.089	1.13	142.47	0.009	1.08	259.4	0.038			
1.27	82.6	-0.094	1.17	145.03	0.006	1.12	267.4	0.038			
1.31	82.5	-0.096	1.21	147.49	0.008	1.16	274.8	0.038			
1.35	82.4	-0.101	1.25	149.47	0.008	1.20	281.3	0.039			
1.39	81.9	-0.104	1.28	151.77	0.006	1.23	288.0	0.038			
1.42	82.0	-0.107	1.32	153.15	0.007	1.27	294.3	0.037			
1.46	82.1	-0.110	1.36	154.92	0.005	1.31	300.6	0.038			
1.50	82.0	-0.111	1.40	156.90	0.004	1.35	306.3	0.034			
1.54	82.1	-0.114	1.44	158.21	0.004	1.39	311.7	0.032			
1.58	81.7	-0.117	1.47	159.89	0.003	1.42	316.5	0.030			
1.61	81.7	-0.125	1.51	160.82	0.003	1.46	321.0	0.029			
1.65	81.2	-0.126	1.55	162.02	0.002	1.50	325.5	0.027			
1.69	80.9	-0.129	1.59	162.45	-0.001	1.54	329.8	0.025			
1.73	80.7	-0.133	1.63	163.13	-0.004	1.58	333.5	0.023			
1.77	80.5	-0.134	1.67	164.53	-0.008	1.61	336.3	0.020			
1.80	80.2	-0.134	1.70	165.74	-0.011	1.65	339.6	0.017			
1.84	79.5	-0.134	1.74	166.82	-0.014	1.69	342.0	0.016			
1.88	79.2	-0.134	1.78	167.93	-0.019	1.73	343.9	0.013			
1.92	79.3	-0.136	1.82	168.24	-0.021	1.77	346.6	0.012			
1.96	78.8	-0.139	1.86	169.13	-0.023	1.81	348.1	0.009			
2.00	78.7	-0.138	1.89	169.02	-0.026	1.84	349.6	0.008			
2.03	77.9	-0.140	1.93	169.61	-0.029	1.88	350.9	0.006			
2.07	77.9	-0.139	1.97	170.50	-0.032	1.92	351.8	0.003			
2.11	77.7	-0.140	2.01	170.43	-0.037	1.96	353.0	-0.005			
2.15	77.0	-0.137	2.05	170.84	-0.040	2.00	353.5	-0.011			
2.19	77.4	-0.140	2.08	171.05	-0.046	2.03	354.3	-0.017			
2.22	76.8	-0.140	2.12	171.55	-0.049	2.07	354.6	-0.020			

2.26	75.9	-0.140	2.16	171.99	-0.055	2.11	355.0	-0.025			
2.30	76.2	-0.139	2.20	171.86	-0.056	2.15	355.2	-0.030			
2.34	75.9	-0.141	2.24	172.44	-0.062	2.19	355.2	-0.033			
2.38	75.3	-0.140	2.28	172.43	-0.064	2.22	354.7	-0.038			
2.41	75.3	-0.141	2.31	172.47	-0.066	2.26	354.7	-0.040			
2.45	74.8	-0.141	2.35	172.25	-0.068	2.30	354.3	-0.042			
2.50	74.5	-0.141	2.39	171.79	-0.072	2.34	353.3	-0.045			
2.55	74.2	-0.140	2.43	171.02	-0.073	2.38	352.3	-0.047			
2.60	73.6	-0.145	2.47	170.61	-0.074	2.41	351.7	-0.048			
2.66	73.2	-0.144	2.50	169.85	-0.075	2.45	350.6	-0.051			
2.71	73.2	-0.146	2.55	168.68	-0.078	2.49	349.3	-0.053			
2.76	73.1	-0.147	2.61	167.63	-0.082	2.53	348.3	-0.055			
2.81	72.6	-0.148	2.66	166.19	-0.081	2.58	346.3	-0.061			
2.86	72.2	-0.146	2.71	164.35	-0.082	2.63	344.4	-0.065			
2.91	71.9	-0.148	2.76	163.47	-0.082	2.68	342.4	-0.071			
2.96	71.7	-0.150	2.81	161.42	-0.082	2.73	339.9	-0.079			
3.01	71.4	-0.151	2.86	159.59	-0.083	2.78	337.9	-0.087			
3.06	70.9	-0.150	2.91	157.53	-0.083	2.83	336.0	-0.095			
3.11	70.8	-0.151	2.96	155.59	-0.082	2.88	333.7	-0.102			
3.16	70.5	-0.150	3.01	153.68	-0.081	2.94	331.0	-0.107			
3.21	70.3	-0.151	3.06	152.08	-0.084	2.99	328.5	-0.112			
3.27	70.1	-0.150	3.11	151.13	-0.082	3.04	326.1	-0.114			
3.32	70.0	-0.150	3.16	150.07	-0.081	3.09	324.2	-0.115			
3.37	69.7	-0.152	3.22	149.00	-0.082	3.14	322.0	-0.119			
3.42	69.4	-0.153	3.27	148.27	-0.080	3.19	319.5	-0.122			
3.47	69.5	-0.153	3.32	146.68	-0.078	3.24	317.3	-0.126			
3.52	69.3	-0.154	3.37	146.25	-0.078	3.29	315.7	-0.131			
3.57	69.2	-0.154	3.42	145.43	-0.076	3.34	313.7	-0.133			
3.62	68.6	-0.152	3.47	144.19	-0.074	3.39	312.3	-0.135			
3.67	68.8	-0.154	3.52	143.85	-0.075	3.44	311.1	-0.138			
3.72	68.2	-0.151	3.57	143.45	-0.075	3.49	310.2	-0.139			
3.77	68.4	-0.153	3.62	142.65	-0.070	3.55	309.5	-0.142			
3.82	68.3	-0.153	3.67	142.98	-0.072	3.60	308.6	-0.144			
3.87	68.0	-0.153	3.72	142.86	-0.072	3.65	308.6	-0.146			
3.93	67.8	-0.155	3.77	142.19	-0.071	3.70	307.9	-0.148			
3.98	67.6	-0.155	3.82	141.78	-0.071	3.75	308.0	-0.151			
4.03	67.6	-0.156	3.88	142.20	-0.070	3.80	307.4	-0.150			
4.08	67.3	-0.153	3.93	141.75	-0.072	3.85	307.1	-0.154			
4.13	67.5	-0.156	3.98	141.74	-0.072	3.90	306.8	-0.157			
4.18	67.3	-0.154	4.03	141.40	-0.070	3.95	306.6	-0.158			
4.23	67.3	-0.155	4.08	141.39	-0.069	4.00	307.0	-0.161			
4.28	66.7	-0.155	4.13	141.70	-0.070	4.05	307.0	-0.161			
4.33	66.9	-0.156	4.18	141.09	-0.070	4.10	306.8	-0.163			
4.38	67.0	-0.155	4.23	141.50	-0.068	4.16	307.1	-0.165			
4.43	66.4	-0.156	4.28	141.26	-0.069	4.21	306.8	-0.166			
4.48	66.5	-0.156	4.33	141.38	-0.068	4.26	306.7	-0.167			
4.54	66.1	-0.154	4.38	141.46	-0.066	4.31	306.9	-0.170			
4.59	66.1	-0.155	4.43	141.77	-0.069	4.36	306.4	-0.170			
4.64	66.0	-0.155	4.49	141.16	-0.068	4.41	306.7	-0.169			
4.69	65.7	-0.156	4.54	141.43	-0.068	4.46	306.6	-0.170			
4.74	66.1	-0.155	4.59	141.10	-0.066	4.51	306.6	-0.171			
4.79	65.9	-0.156	4.64	141.23	-0.066	4.56	306.5	-0.173			
4.84	65.9	-0.157	4.69	140.85	-0.066	4.61	306.5	-0.173			

4.89	65.2	-0.156	4.74	141.25	-0.068	4.66	305.9	-0.174			
4.94	65.9	-0.155	4.79	141.07	-0.068	4.71	305.6	-0.175			
4.99	65.6	-0.156	4.84	141.06	-0.067	4.76	306.0	-0.174			
5.04	65.7	-0.158	4.89	141.06	-0.068	4.82	305.9	-0.174			
5.09	65.8	-0.160	4.94	141.49	-0.066	4.87	306.1	-0.174			
5.15	65.2	-0.160	4.99	140.78	-0.066	4.92	306.1	-0.171			
5.20	64.9	-0.162	5.04	140.76	-0.065	4.97	306.3	-0.173			
5.25	65.3	-0.161	5.10	140.79	-0.067	5.02	306.3	-0.172			
5.30	65.0	-0.160	5.15	140.97	-0.065	5.07	306.5	-0.173			
5.35	65.0	-0.161	5.20	140.54	-0.065	5.12	306.8	-0.172			
5.40	65.0	-0.162	5.25	141.00	-0.066	5.17	307.3	-0.172			
5.45	64.6	-0.161	5.30	140.63	-0.066	5.22	307.2	-0.172			
5.50	64.8	-0.161	5.35	140.96	-0.067	5.27	307.4	-0.171			
5.55	65.0	-0.163	5.40	140.70	-0.067	5.32	307.4	-0.173			
5.60	64.7	-0.163	5.45	140.52	-0.065	5.37	307.9	-0.172			
5.65	64.5	-0.158	5.50	140.44	-0.065	5.43	307.8	-0.172			
5.70	64.5	-0.162	5.55	140.15	-0.066	5.48	307.9	-0.172			
5.75	64.6	-0.164	5.60	140.71	-0.064	5.53	307.5	-0.172			
5.81	64.1	-0.161	5.65	140.56	-0.065	5.58	307.6	-0.172			
5.86	64.1	-0.163	5.71	140.53	-0.065	5.63	307.6	-0.170			
5.91	64.5	-0.161	5.76	140.35	-0.062	5.68	307.1	-0.170			
5.96	64.0	-0.162	5.81	139.82	-0.061	5.73	307.0	-0.168			
6.01	64.1	-0.163	5.86	140.27	-0.061	5.78	307.6	-0.165			
6.06	64.1	-0.162	5.91	140.17	-0.062	5.83	307.3	-0.163			
6.11	64.0	-0.163	5.96	139.99	-0.060	5.88	307.4	-0.163			
6.16	64.0	-0.162	6.01	139.59	-0.059	5.93	307.5	-0.164			
6.21	63.9	-0.163	6.06	139.62	-0.059	5.98	307.5	-0.162			
6.26	63.7	-0.160	6.11	139.49	-0.058	6.04	307.3	-0.157			
6.31	63.8	-0.162	6.16	139.43	-0.057	6.09	307.6	-0.158			
6.36	63.7	-0.162	6.21	139.04	-0.055	6.14	307.5	-0.157			
6.42	63.7	-0.163	6.26	138.86	-0.054	6.19	307.3	-0.155			
6.47	63.5	-0.162	6.31	138.80	-0.0519	6.24	307.9	-0.1522			
6.52	63.5	-0.162	6.37	138.78	-0.0522	6.29	307.2	-0.1509			
6.57	63.4	-0.162	6.42	138.57	-0.0500	6.34	307.83	-0.1538			
6.62	63.2	-0.161	6.47	138.48	-0.0492	6.39	307.72	-0.1513			
6.67	63.2	-0.161	6.52	138.13	-0.0486	6.44	307.38	-0.1496			
6.72	63.2	-0.162	6.57	137.97	-0.0462	6.49	307.23	-0.1475			
6.77	63.4	-0.162	6.62	137.84	-0.0469	6.54	307.11	-0.1466			
6.82	63.3	-0.161	6.67	137.55	-0.0455	6.59	307.47	-0.1451			
6.87	63.3	-0.161	6.72	137.88	-0.0429	6.65	307.46	-0.1471			
6.92	62.9	-0.161	6.77	137.31	-0.0440	6.70	307.36	-0.1428			
6.97	62.7	-0.161	6.82	137.26	-0.0420	6.75	306.60	-0.1405			
7.03	63.1	-0.160	6.87	137.15	-0.0415	6.80	306.66	-0.1413			
7.08	63.0	-0.160	6.92	136.48	-0.0418	6.85	306.23	-0.1427			
7.13	63.1	-0.160	6.98	137.11	-0.0412	6.90	306.47	-0.1394			
7.18	62.8	-0.160	7.03	136.70	-0.0392	6.95	305.76	-0.1389			
7.23	62.7	-0.160	7.08	136.74	-0.0375	7.00	305.57	-0.1387			
7.28	62.8	-0.159	7.13	136.39	-0.0380	7.05	304.74	-0.1359			
7.33	62.9	-0.159	7.18	135.84	-0.0368	7.10	305.08	-0.1361			
7.38	62.6	-0.160	7.23	135.87	-0.0363	7.15	305.24	-0.1354			
7.43	62.7	-0.158	7.28	135.57	-0.0349	7.20	305.69	-0.1319			
7.48	62.6	-0.159	7.33	135.24	-0.0329	7.25	305.42	-0.1293			
7.52	62.5	-0.158	7.38	135.11	-0.0318	7.31	305.68	-0.1285			

			7.43	135.02	-0.0311	7.36	305.65	-0.1270			
			7.48	134.68	-0.0299	7.41	305.67	-0.1279			
			7.53	134.54	-0.0306	7.46	305.75	-0.1258			
			7.57	134.84	-0.0302	7.51	305.28	-0.1240			
			7.57	134.84	-0.0302	7.56	305.92	-0.1233			
						7.60	305.38	-0.1232			

TM	July 23, 2010	ROB	August 2, 2010

Golder Associates

Golder Associates Ltd. - Burnaby Laboratory
4280 Still Creek Drive
Burnaby, B.C. Canada V5C 6C6

Direct Shear Testing of Soils Under Consolidated Drained Conditions

Reference: ASTM D 3080-04

Client:	Mount Polley	Test Pit:	TP-09
Project:	South Dump Investigations	Sample:	3
Location:	Mt. Polley, Likely B.C.	Depth (m):	3-5.1
Project No.:	05-1413-027	Lab ID No:	134

	Residual 1	Residual 2	Residual 3	
Normal Stress , kPa	100	200	500	
Disp Rate, mm/min	0.015	0.015	0.015	

Residual 1 Horz Disp mm	Shear Stress kPa	Vert Disp mm	Residual 2 Horz Disp mm	Shear Stress kPa	Vert Disp mm	Residual 3 Horz Disp mm	Shear Stress kPa	Vert Disp mm	Horz Disp mm	Shear Stress kPa	Vert Disp mm
0.00	0.3	0.000	0.00	2.70	0.000	0.00	4.6	0.000			
0.05	0.7	-0.001	0.05	6.13	0.002	0.05	12.0	0.000			
0.10	4.9	0.000	0.10	13.14	0.003	0.10	20.1	0.001			
0.15	9.0	0.007	0.15	19.38	0.007	0.15	27.4	0.002			
0.20	12.9	0.011	0.20	25.33	0.011	0.20	35.1	0.007			
0.25	16.3	0.015	0.25	31.16	0.014	0.25	42.8	0.008			
0.30	19.9	0.025	0.30	36.36	0.016	0.30	51.2	0.014			
0.36	23.2	0.027	0.36	41.51	0.016	0.36	58.7	0.018			
0.41	26.2	0.029	0.41	47.29	0.021	0.41	66.5	0.022			
0.46	29.7	0.031	0.46	53.27	0.023	0.46	75.3	0.030			
0.51	32.8	0.030	0.51	59.12	0.025	0.51	85.4	0.033			
0.56	35.4	0.033	0.56	64.61	0.028	0.56	95.9	0.035			
0.61	38.2	0.031	0.61	69.99	0.027	0.61	105.5	0.035			
0.66	40.9	0.032	0.66	74.98	0.029	0.66	115.4	0.037			
0.71	42.4	0.029	0.71	79.65	0.033	0.71	125.1	0.038			
0.76	44.0	0.025	0.76	83.97	0.032	0.76	134.4	0.039			
0.81	45.7	0.013	0.81	87.43	0.031	0.81	143.4	0.039			
0.86	47.9	0.005	0.86	90.60	0.027	0.86	152.4	0.041			
0.91	49.9	0.003	0.91	93.90	0.023	0.91	161.6	0.041			
0.97	51.5	-0.001	0.97	97.55	0.021	0.97	170.2	0.042			
1.02	53.5	-0.005	1.02	101.52	0.018	1.02	178.4	0.043			
1.07	54.5	-0.013	1.07	104.31	0.015	1.07	186.5	0.043			
1.12	55.8	-0.015	1.12	107.39	0.014	1.12	195.0	0.044			
1.17	57.0	-0.020	1.17	110.04	0.013	1.17	203.7	0.044			
1.22	57.8	-0.021	1.22	112.54	0.013	1.22	211.9	0.045			
1.27	59.0	-0.022	1.27	114.29	0.014	1.27	219.4	0.044			
1.32	59.3	-0.024	1.32	115.68	0.011	1.32	226.5	0.045			
1.37	59.9	-0.024	1.37	116.81	0.010	1.37	233.5	0.044			
1.42	60.3	-0.028	1.42	117.65	0.007	1.42	240.0	0.044			
1.47	60.7	-0.029	1.47	118.25	0.008	1.47	245.3	0.043			
1.52	60.5	-0.032	1.52	118.82	0.007	1.52	250.1	0.042			
1.58	60.1	-0.033	1.58	118.97	0.007	1.58	254.4	0.043			
1.63	60.6	-0.033	1.63	118.90	0.006	1.63	258.7	0.042			
1.68	60.6	-0.033	1.68	118.98	0.006	1.68	262.5	0.041			
1.73	59.8	-0.036	1.73	119.26	0.008	1.73	265.6	0.041			

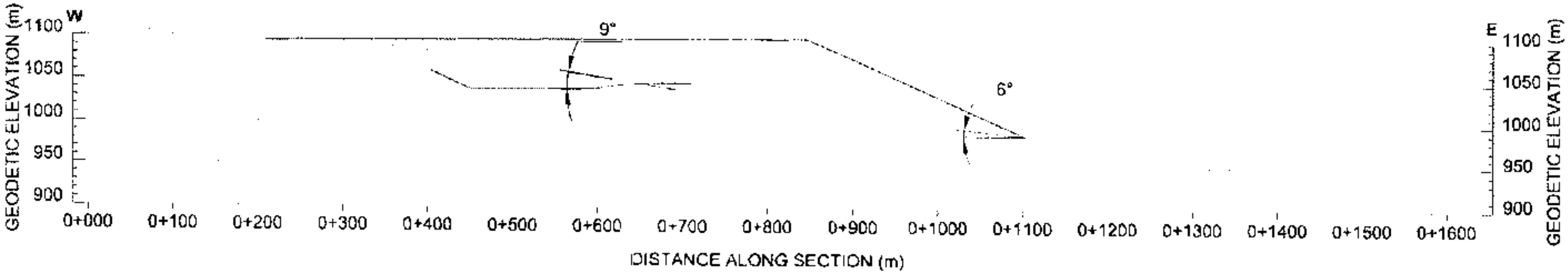
1.78	60.7	-0.036	1.78	119.24	0.007	1.78	268.1	0.040			
1.83	60.7	-0.037	1.83	119.28	0.005	1.83	270.2	0.038			
1.88	60.3	-0.037	1.88	119.30	0.003	1.88	272.0	0.039			
1.93	60.7	-0.038	1.93	118.86	0.002	1.93	272.8	0.040			
1.98	60.1	-0.041	1.98	119.32	0.001	1.98	273.4	0.036			
2.03	60.7	-0.040	2.03	119.44	0.001	2.03	273.9	0.036			
2.08	60.8	-0.040	2.08	118.89	0.002	2.08	274.1	0.034			
2.13	60.7	-0.041	2.13	119.38	0.001	2.13	274.0	0.033			
2.18	60.2	-0.041	2.18	119.24	0.000	2.19	274.0	0.033			
2.24	60.8	-0.042	2.24	119.24	0.000	2.24	273.9	0.031			
2.29	60.5	-0.042	2.29	119.28	-0.002	2.29	273.7	0.030			
2.34	60.5	-0.042	2.34	119.09	-0.003	2.34	273.5	0.032			
2.39	60.5	-0.044	2.39	119.45	-0.001	2.39	272.8	0.030			
2.44	60.6	-0.044	2.44	119.21	0.001	2.44	272.8	0.031			
2.49	60.3	-0.048	2.49	119.52	-0.002	2.49	272.4	0.031			
2.54	60.5	-0.046	2.54	119.42	-0.003	2.54	272.3	0.031			
2.59	60.8	-0.048	2.59	119.57	-0.001	2.59	272.0	0.030			
2.64	60.7	-0.047	2.64	119.60	-0.001	2.64	271.6	0.029			
2.69	60.5	-0.050	2.69	119.28	-0.002	2.69	271.4	0.029			
2.74	60.3	-0.049	2.74	119.41	-0.001	2.74	271.1	0.029			
2.79	60.5	-0.053	2.79	119.63	-0.003	2.79	271.0	0.030			
2.85	60.4	-0.049	2.85	119.84	-0.002	2.85	270.7	0.030			
2.90	60.4	-0.052	2.90	119.81	-0.004	2.90	270.8	0.029			
2.95	60.5	-0.054	2.95	119.38	-0.003	2.95	270.3	0.027			
3.00	60.2	-0.054	3.00	119.25	-0.002	3.00	270.1	0.028			
3.05	60.3	-0.056	3.05	119.32	-0.002	3.05	270.0	0.028			
3.10	60.1	-0.059	3.10	119.53	-0.004	3.10	270.0	0.027			
3.15	59.7	-0.059	3.15	119.21	-0.005	3.15	269.8	0.028			
3.20	60.4	-0.060	3.20	119.49	-0.004	3.20	269.4	0.028			
3.25	60.1	-0.060	3.25	119.06	-0.004	3.25	269.1	0.029			
3.30	60.1	-0.062	3.30	119.27	-0.004	3.30	269.1	0.028			
3.35	59.9	-0.061	3.35	119.17	-0.002	3.35	269.0	0.028			
3.40	60.3	-0.063	3.40	119.20	-0.003	3.40	268.9	0.027			
3.46	59.6	-0.064	3.46	119.20	-0.004	3.46	269.0	0.027			
3.51	60.3	-0.066	3.51	118.82	-0.006	3.51	268.3	0.026			
3.56	60.0	-0.067	3.56	118.62	-0.007	3.56	268.3	0.027			
3.61	60.2	-0.067	3.61	119.04	-0.008	3.61	268.5	0.027			
3.66	60.4	-0.069	3.66	118.75	-0.006	3.66	268.1	0.027			
3.71	60.1	-0.068	3.71	119.24	-0.006	3.71	267.8	0.027			
3.76	60.1	-0.070	3.76	118.68	-0.007	3.76	267.9	0.027			
3.81	60.1	-0.072	3.81	119.11	-0.008	3.81	267.5	0.027			
3.86	60.0	-0.071	3.86	118.82	-0.007	3.86	267.3	0.026			
3.91	59.7	-0.069	3.91	118.84	-0.005	3.91	267.5	0.027			
3.96	59.8	-0.068	3.96	118.89	-0.007	3.96	267.4	0.027			
4.01	59.7	-0.069	4.01	119.70	-0.008	4.01	267.1	0.026			
4.06	59.7	-0.070	4.07	119.16	-0.010	4.07	267.0	0.026			
4.12	59.6	-0.069	4.12	118.61	-0.011	4.12	267.0	0.026			
4.17	59.5	-0.069	4.17	118.37	-0.012	4.17	266.8	0.026			
4.22	59.8	-0.069	4.22	118.62	-0.011	4.22	266.2	0.025			
4.27	59.6	-0.073	4.27	118.96	-0.011	4.27	266.2	0.024			
4.32	59.4	-0.073	4.32	118.46	-0.013	4.32	266.2	0.025			
4.37	60.0	-0.073	4.37	118.70	-0.014	4.37	265.8	0.022			
4.42	60.1	-0.075	4.42	118.92	-0.013	4.42	266.0	0.022			

4.47	59.5	-0.074	4.47	119.01	-0.013	4.47	265.9	0.022			
4.52	59.9	-0.073	4.52	118.68	-0.014	4.52	265.6	0.020			
4.57	59.7	-0.074	4.57	118.58	-0.012	4.57	265.4	0.021			
4.62	59.7	-0.073	4.62	118.69	-0.013	4.62	265.3	0.021			
4.67	59.8	-0.073	4.67	118.58	-0.015	4.67	265.2	0.019			
4.73	59.5	-0.074	4.73	118.96	-0.014	4.73	265.4	0.019			
4.78	59.5	-0.072	4.78	118.66	-0.015	4.78	264.9	0.017			
4.83	59.0	-0.072	4.83	118.60	-0.015	4.83	264.9	0.016			
4.88	59.2	-0.075	4.88	118.61	-0.015	4.88	264.7	0.017			
4.93	59.6	-0.074	4.93	118.58	-0.015	4.93	264.4	0.015			
4.98	59.5	-0.077	4.98	118.55	-0.016	4.98	264.6	0.016			
5.03	59.6	-0.074	5.03	118.61	-0.015	5.03	264.3	0.014			
5.08	59.2	-0.075	5.08	118.76	-0.015	5.08	264.2	0.013			
5.13	59.2	-0.075	5.13	118.62	-0.016	5.13	263.9	0.011			
5.18	59.7	-0.076	5.18	118.39	-0.015	5.18	263.9	0.011			
5.23	59.3	-0.075	5.23	118.83	-0.016	5.23	263.9	0.010			
5.28	59.8	-0.076	5.28	118.85	-0.015	5.28	263.9	0.008			
5.34	59.6	-0.076	5.34	118.73	-0.018	5.34	263.5	0.007			
5.39	59.5	-0.076	5.39	118.60	-0.018	5.39	263.7	0.005			
5.44	59.4	-0.078	5.44	118.88	-0.017	5.44	263.6	0.006			
5.49	59.7	-0.075	5.49	118.48	-0.017	5.49	263.6	0.003			
5.54	59.5	-0.076	5.54	118.39	-0.016	5.54	263.3	0.002			
5.59	59.4	-0.078	5.59	118.51	-0.017	5.59	263.3	0.001			
5.64	59.6	-0.077	5.64	118.77	-0.018	5.64	262.9	0.000			
5.69	59.3	-0.077	5.69	118.75	-0.018	5.69	262.9	-0.002			
5.74	59.6	-0.076	5.74	118.61	-0.018	5.74	263.1	-0.001			
5.79	59.5	-0.078	5.79	118.64	-0.017	5.79	262.7	-0.003			
5.84	59.4	-0.079	5.84	118.78	-0.021	5.84	262.4	-0.003			
5.89	59.2	-0.078	5.89	118.17	-0.022	5.89	262.7	-0.005			
5.95	59.3	-0.079	5.95	118.58	-0.021	5.95	262.3	-0.004			
6.00	59.3	-0.077	6.00	118.49	-0.021	6.00	262.2	-0.005			
6.05	59.3	-0.078	6.05	118.25	-0.024	6.05	262.1	-0.005			
6.10	59.5	-0.080	6.10	118.48	-0.023	6.10	262.1	-0.005			
6.15	59.4	-0.078	6.15	118.61	-0.022	6.15	261.8	-0.006			
6.20	59.6	-0.078	6.20	118.56	-0.022	6.20	261.8	-0.006			
6.25	59.7	-0.078	6.25	118.31	-0.020	6.25	261.8	-0.006			
6.30	59.4	-0.078	6.30	118.65	-0.022	6.30	261.6	-0.007			
6.35	59.4	-0.077	6.35	118.54	-0.021	6.35	261.9	-0.008			
6.40	59.5	-0.077	6.40	118.60	-0.021	6.40	261.4	-0.009			
6.45	59.3	-0.076	6.45	118.55	-0.023	6.45	260.7	-0.009			
6.50	59.5	-0.076	6.50	118.32	-0.022	6.50	261.0	-0.010			
6.55	59.7	-0.077	6.56	118.56	-0.022	6.56	260.9	-0.010			
6.61	59.5	-0.077	6.61	118.03	-0.021	6.59	261.0	-0.011			
6.66	59.1	-0.075	6.66	118.57	-0.021						
6.71	59.3	-0.076	6.71	118.77	-0.019						
6.76	59.5	-0.075	6.71	118.52	-0.021						
6.81	59.8	-0.075									
6.86	59.8	-0.075									
6.88	59.6	-0.075									

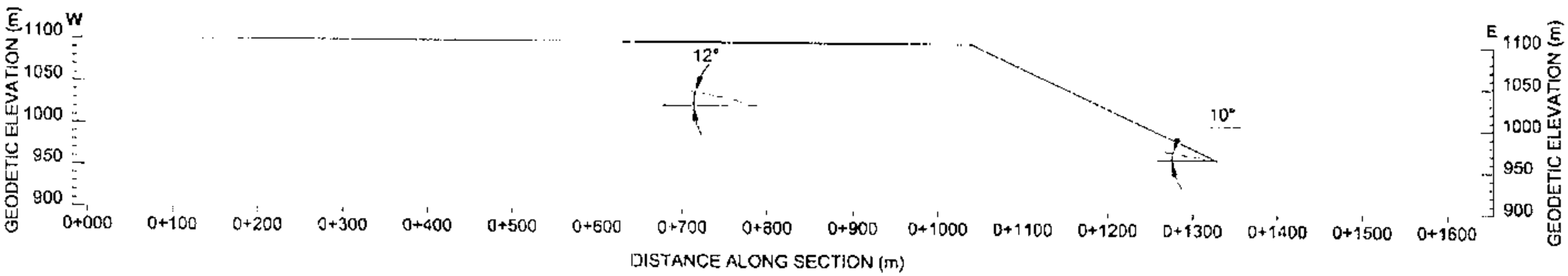
TM	July 23, 2010	ROB	August 2, 2010

APPENDIX D

Cross-sections



1 SECTION



2 SECTION

LEGEND

- PROPOSED SOUTHEAST DUMP
- ORIGINAL GROUND SURFACE
- SEZ PIT

REFERENCES

1. BASE PLAN PROVIDED BY MOUNT POLLEY MINES

0 75 150 225 300 375
SCALE IN METRES

PROJECT
MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

TITLE
SECTIONS 1 AND 2

Golder Associates
Greater Vancouver Office, BC

PROJECT No.	05-1413-027		PHASE No.	4000
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CHECK				
REVIEW				

FIGURE D1

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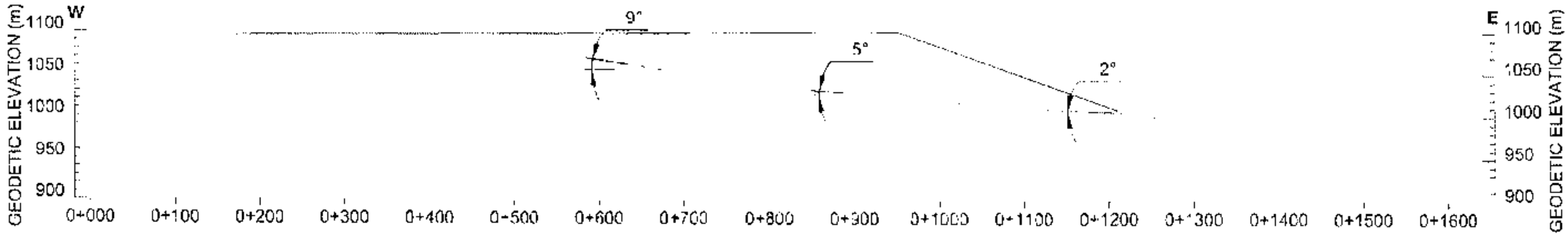
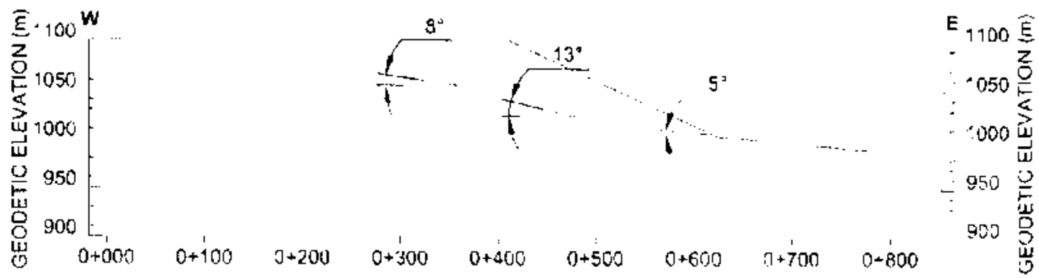


3 SECTION



4 SECTION

LEGEND

PROPOSED SOUTHEAST DUMP

ORIGINAL GROUND SURFACE

REFERENCES

1. BASE PLAN PROVIDED BY MOUNT POLLEY MINES

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SCALE IN METRES

PROJECT

MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

TITLE

SECTIONS 3 AND 4

Golder Associates
Greater Vancouver Office, BC

PROJECT No.	05-1413-027		PHASE No.	4000
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CHECK				
REVIEW				

FIGURE D2

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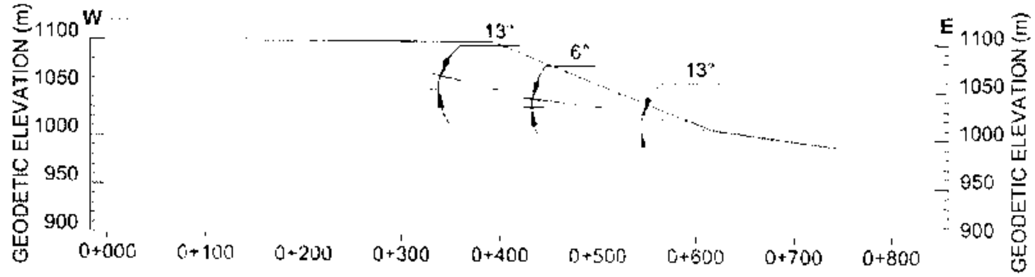
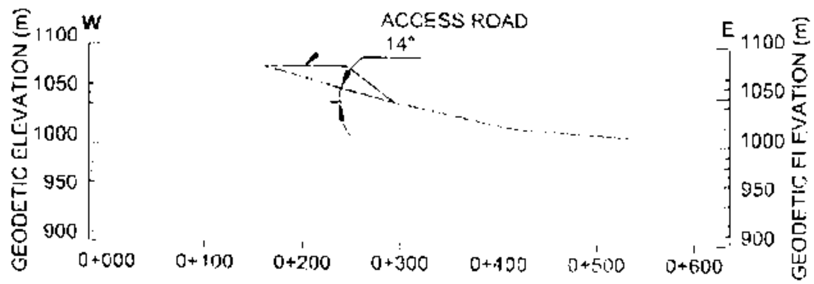


5 SECTION



6 SECTION

LEGEND

PROPOSED SOUTHEAST DUMP

ORIGINAL GROUND SURFACE

REFERENCES

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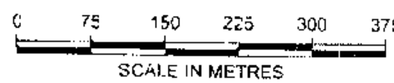

PROJECT

MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

TITLE

SECTIONS 5 AND 6

Golder Associates
Greater Vancouver Office, BC

PROJECT No.	05-1413-027		PHASE No. 4000
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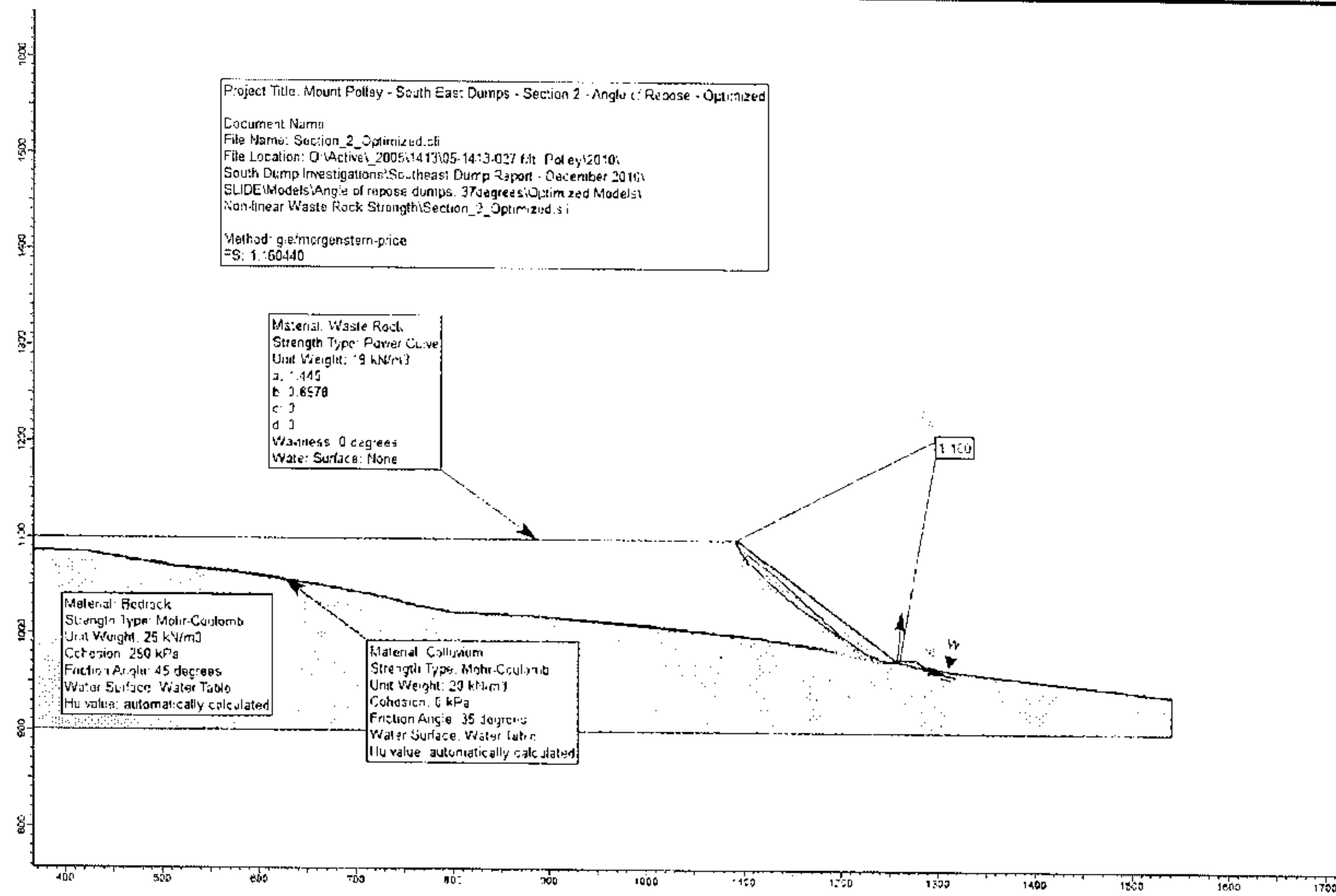
CADD	NS	CHECKED 10	
CHECK			
REVIEW			

FIGURE D3

APPENDIX E

Results of Stability Analyses



PROJECT

MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

TITLE

Angle of Repose Dump Face, Section 2

Golder Associates

PROJECT No.	05-1413-027		PHASE No. 4000
DESIGN	RP	16DEC10	SCALE As Shown / REV.
CADD	RP	16DEC10	
CHECK			**FIGURE E1**
REVIEW			

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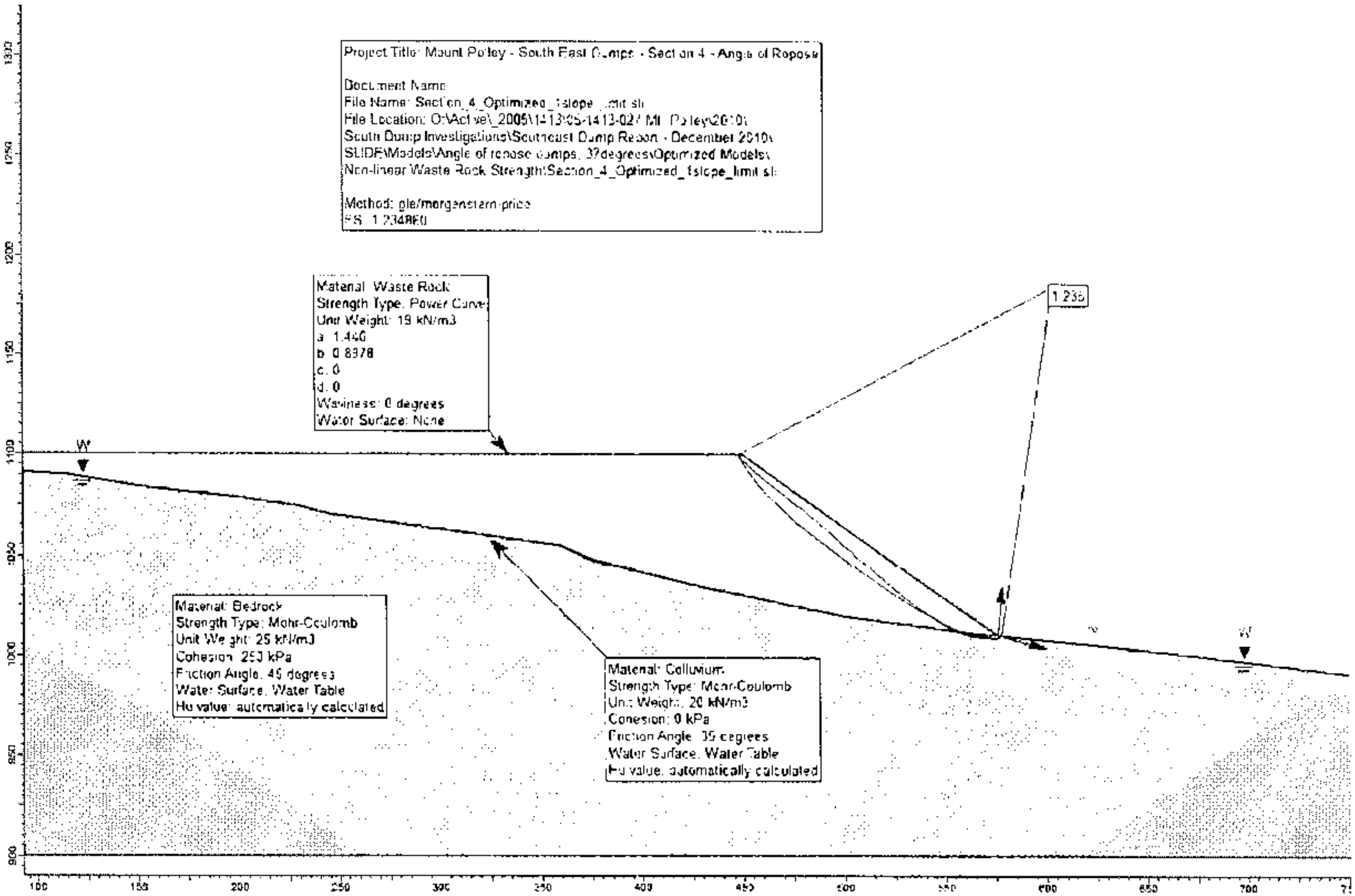

PROJECT

MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

TITLE

Angle of Repose Dump Face, Section 4

Golder Associates

PROJECT No.	05-1413-027		PHASE No. 4000
DESIGN	RP	16DEC10	SCALE As Shown REV.
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CHECK			
REVIEW			

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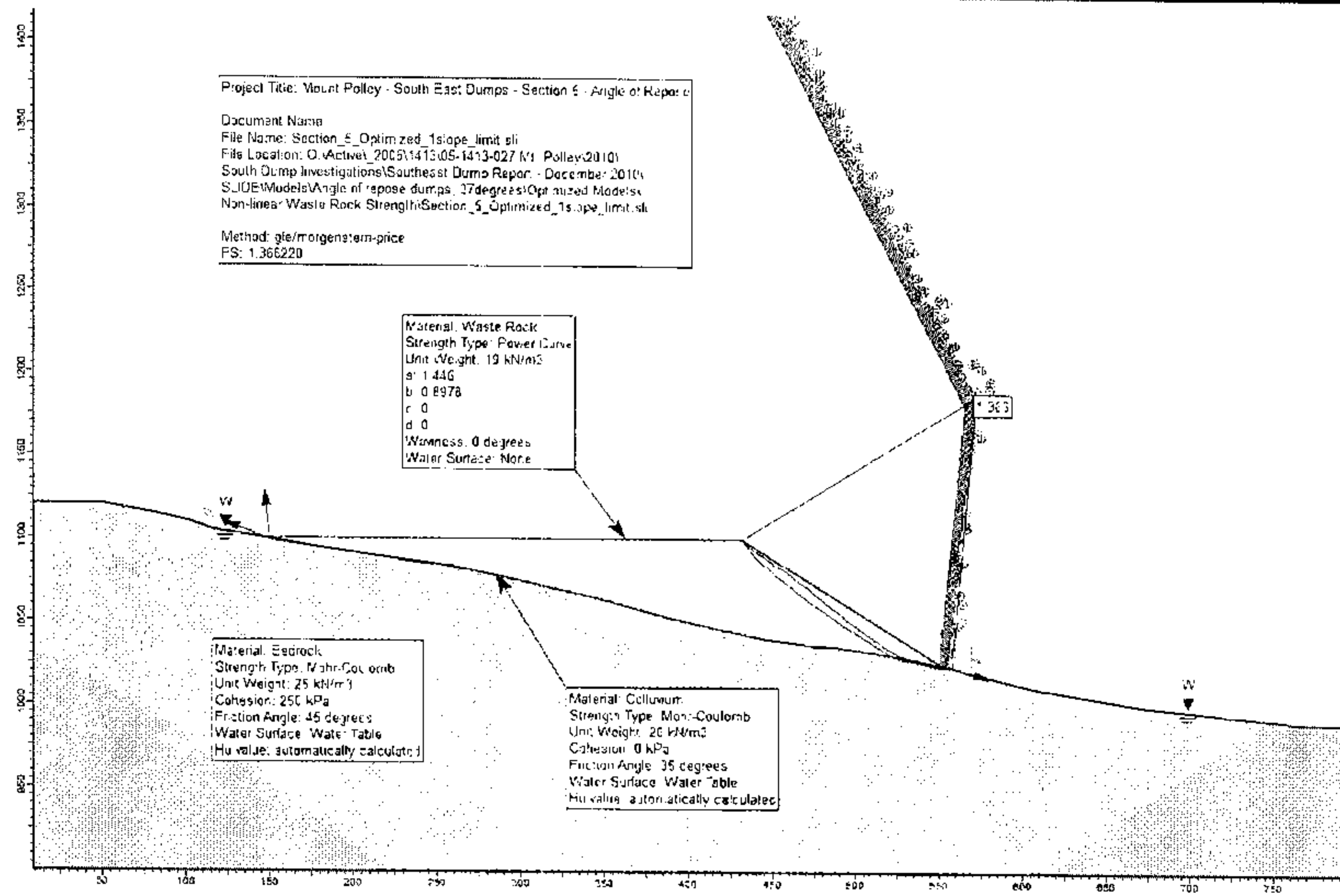

PROJECT

MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

TITLE

Angle of Repose Dump Face, Section 5

Golder Associates

PROJECT No.	05-1413-027		PHASE No. 4000	
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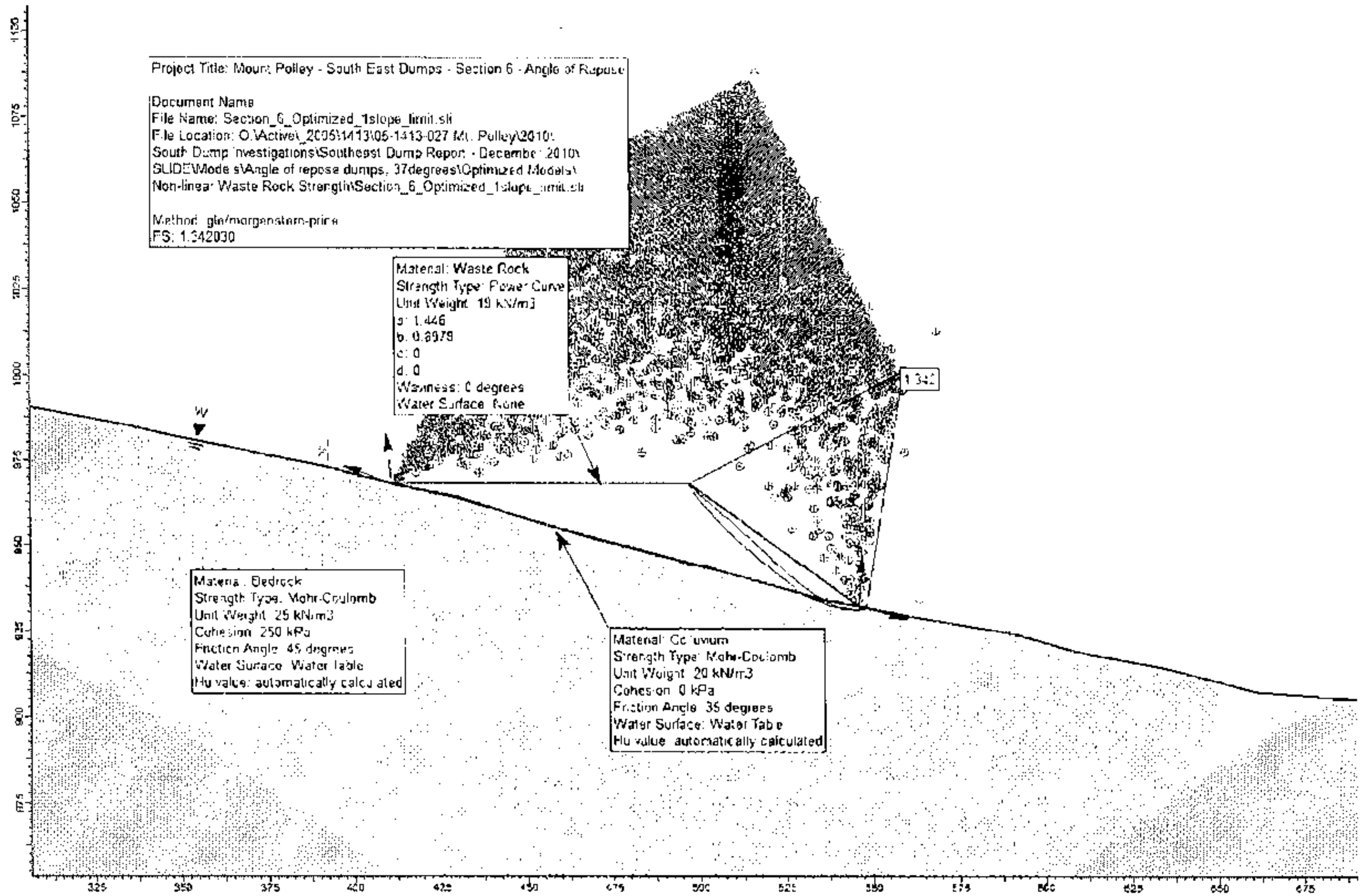
CADD	RP	16DEC10		
CHECK				
REVIEW				

FIGURE E3



PROJECT
MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

TITLE
Angle of Repose Dump Face, Section 6

Golder Associates

PROJECT No.	05-1413-027		PHASE No. 4000	
DESIGN	RP	16DEC10	SCALE As Shown	REV.
CADD	RP	16DEC10	FIGURE E4	
CHECK				
REVIEW				

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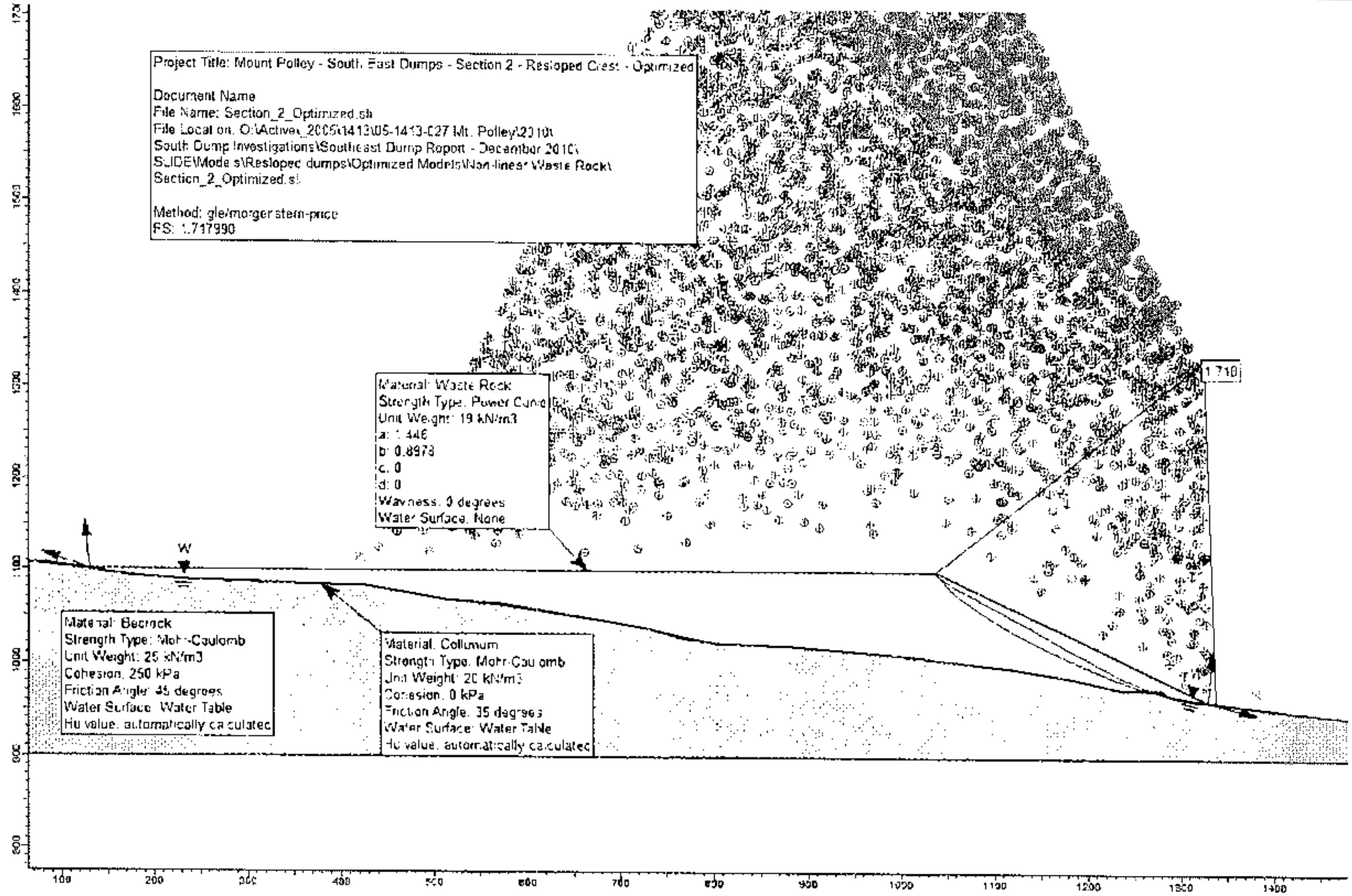


PROJECT

MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

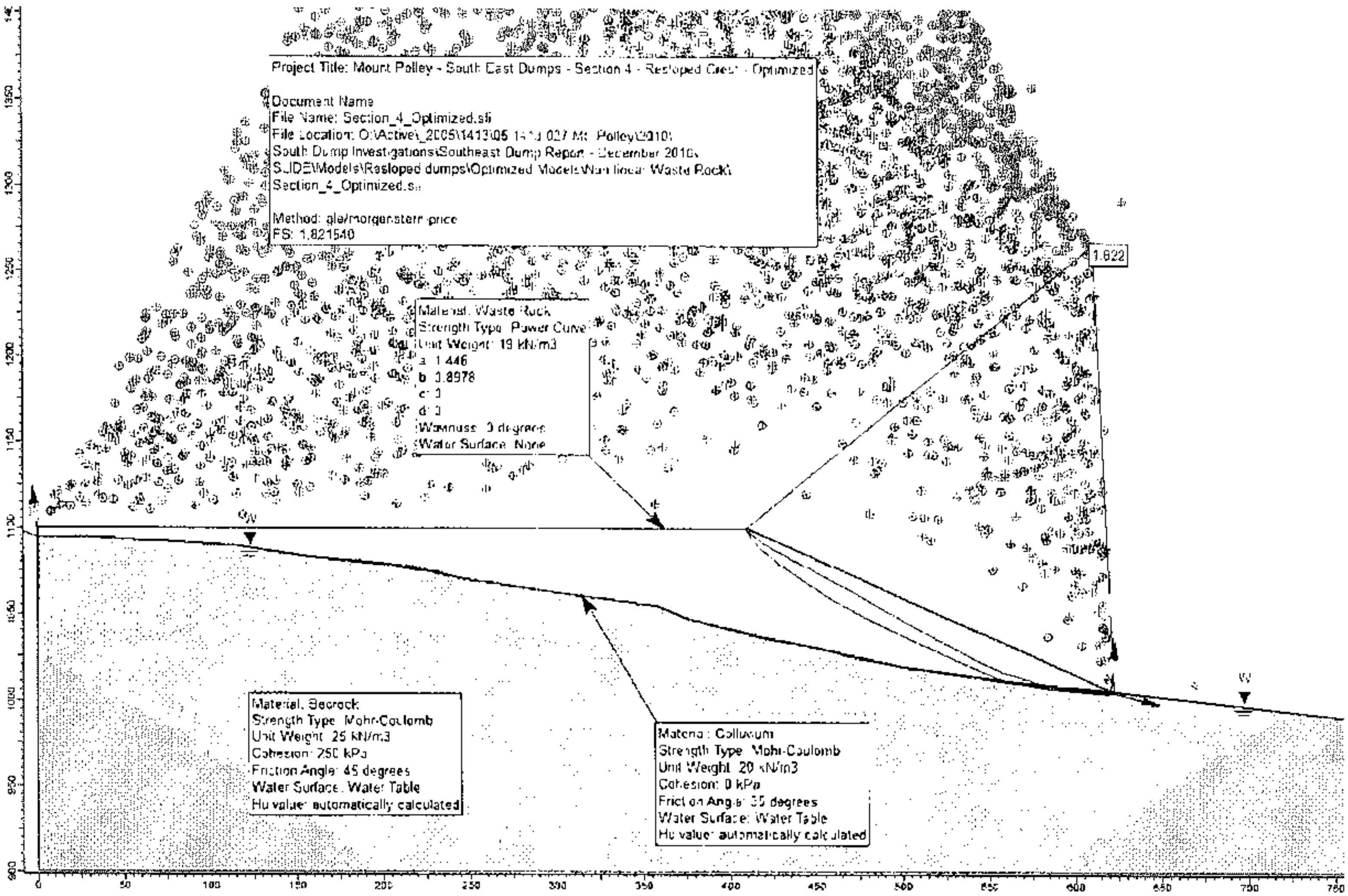
TITLE

Re-Sloped Dump Face, Section 2

Golder Associates

PROJECT No.	05-1413-027		PHASE No. 4000
DESIGN	RP	16DEC10	SCALE As Shown REV.
CADD	RP	16DEC10	
CHECK			**FIGURE E5**
REVIEW			

FILE: O:\Active_2005\1413\05-1413-027 Mt. Polley\2010\South Dump Investigations\Southeast Dump Report - December 2010\Appendix E\Appendix E Figures.pptx



PROJECT

MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

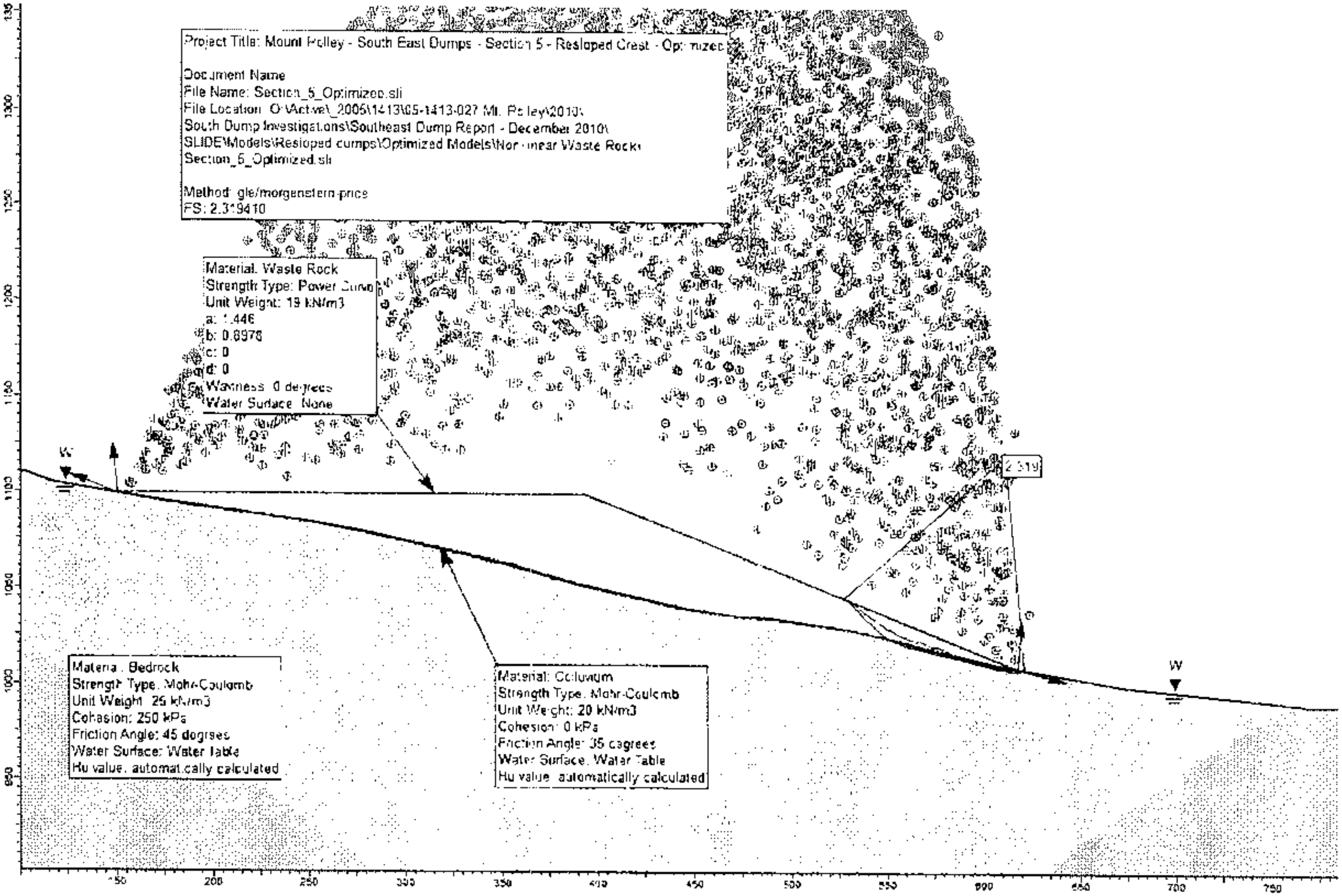
TITLE

Re-Sloped Dump Face, Section 4

Golder Associates

PROJECT No. 05-1413-027			PHASE No. 4000
DES GN	RP	16DEC10	SCALE As Shown REV.
CADD	RP	16DEC10	**FIGURE E6**
CHECK			
REVIEW			

FILE: O:\Active_2005\1413\05-1413-027 Mt. Polley\2010\South Dump Investigations\Southeast Dump Report - December 2010\Appendix E\Appendix E Figures.pptx



PROJECT

MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

TITLE

Re-Sloped Dump Face, Section 5

Golder Associates

PROJECT No.	05-1413-027		PHASE No. 4000
DES.GN	RP	16DEC10	SCALE As Shown REV.
CADD	RP	16DEC10	**FIGURE E7**
CHECK			
REVIEW			

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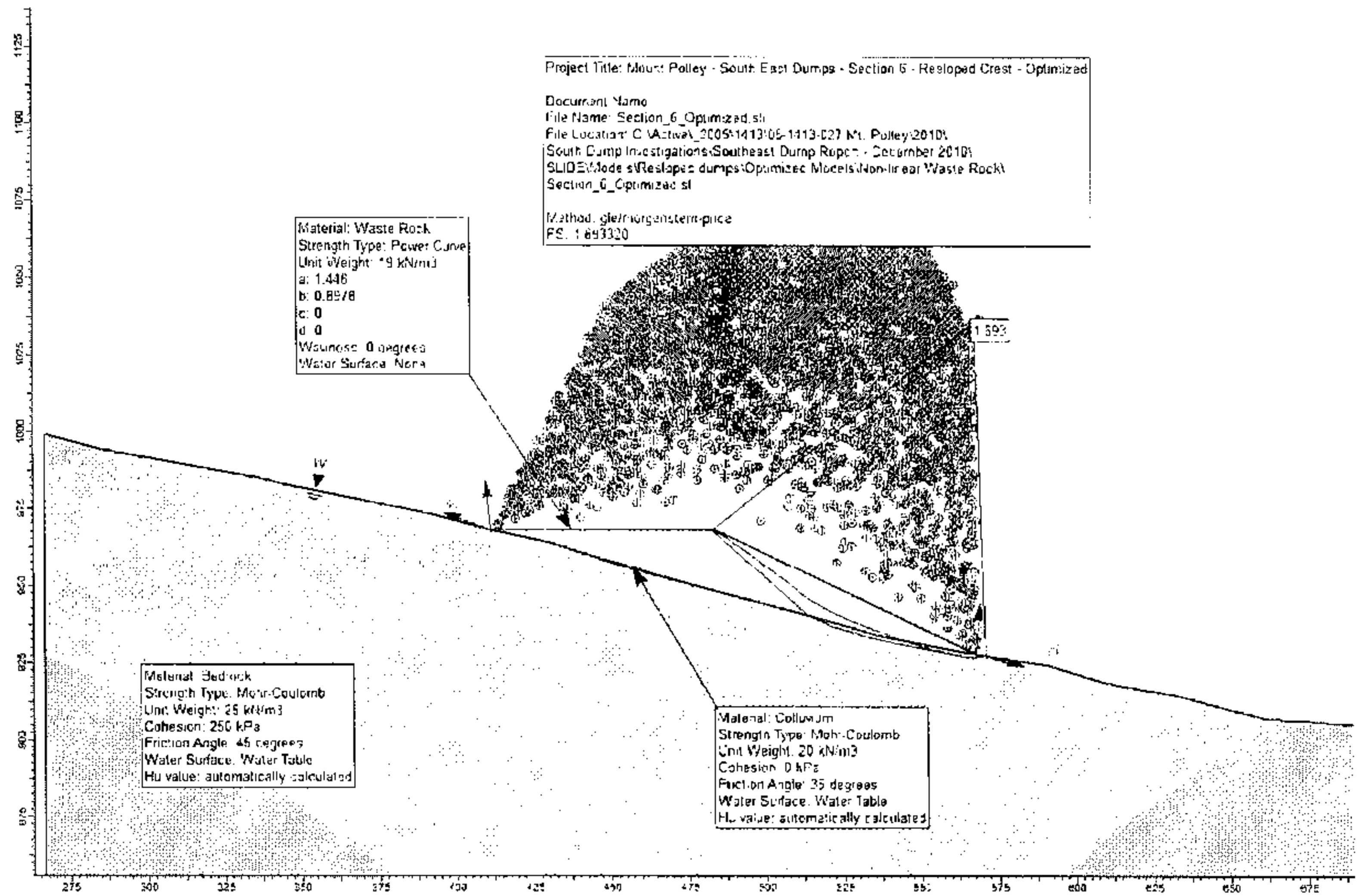

PROJECT

MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

TITLE

Re-Sloped Dump Face, Section 6

Golder Associates

PROJECT No.	05-1413-027		PHASE No. 4000
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CADD	RP	16DEC10	
CHECK			
REVIEW			

FIGURE E8

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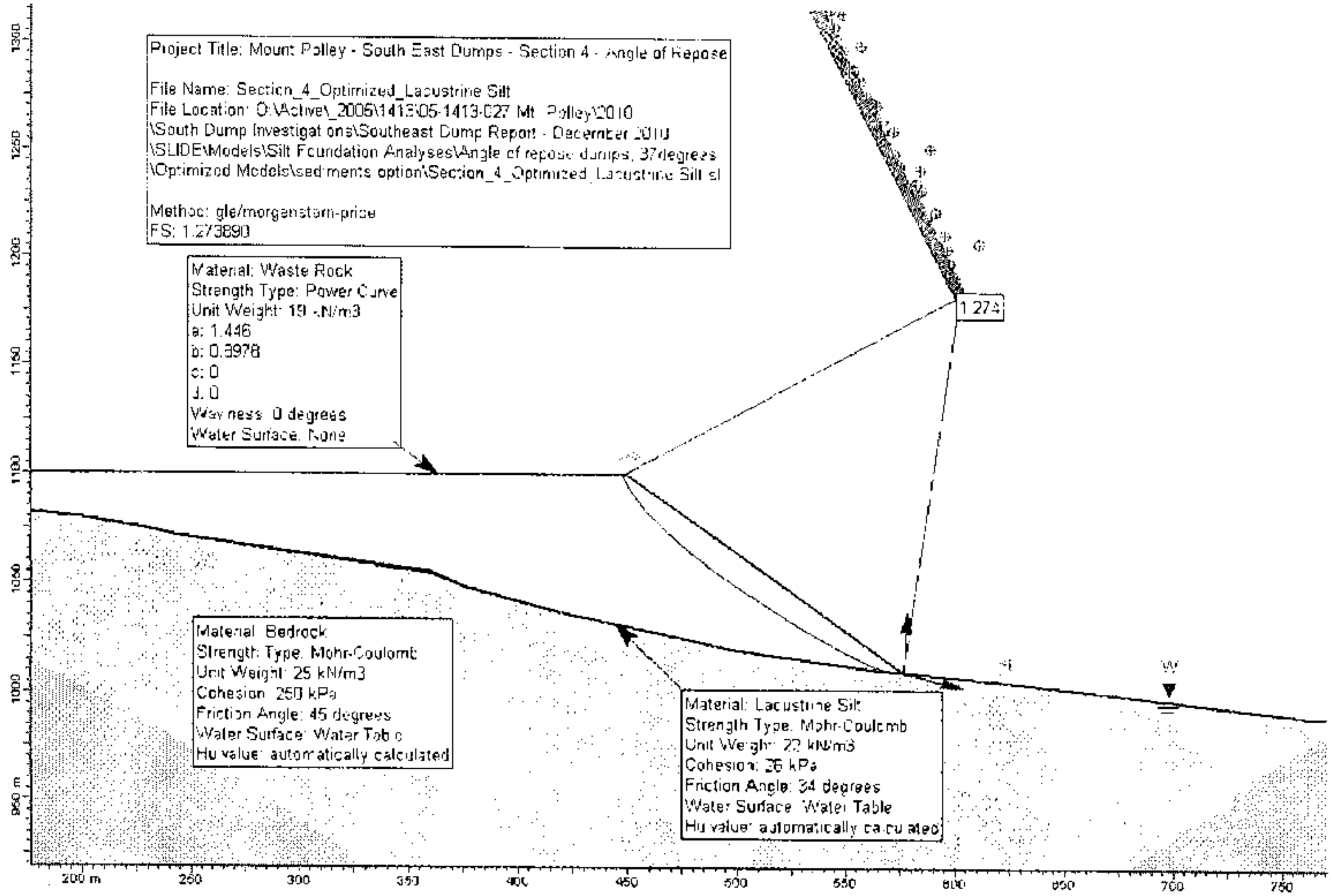


PROJECT

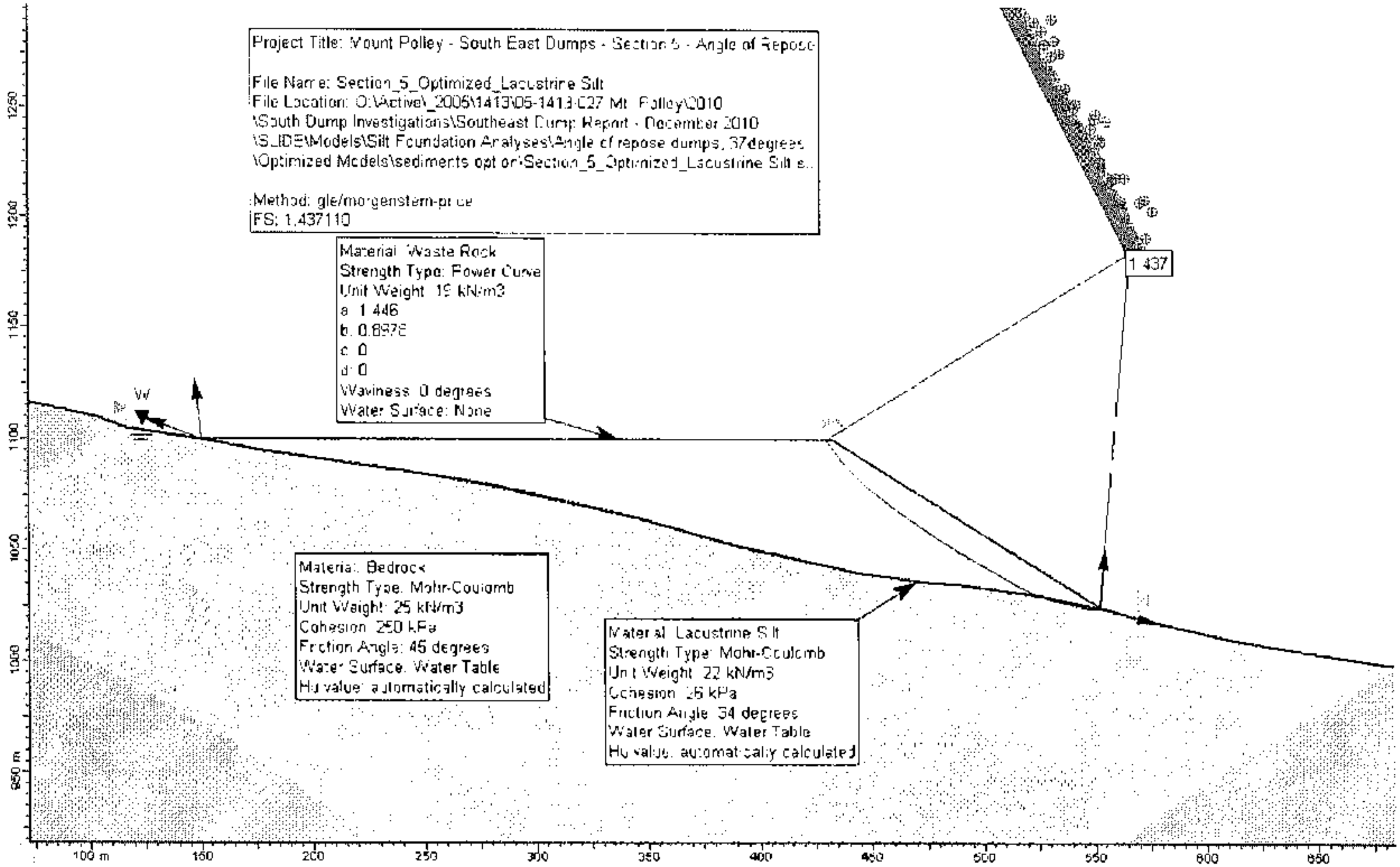
MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

TITLE

Angle of Repose Dump Face, Lacustrine Sediments Foundation, Section 4

Golder Associates

PROJECT No.	05-1413-027		PHASE No. 4000	
DESIGN	RP	16DEC10	SCALE As Shown	REV.
CADD	RP	16DEC10	**FIGURE E9**	
CHECK				
REVIEW				



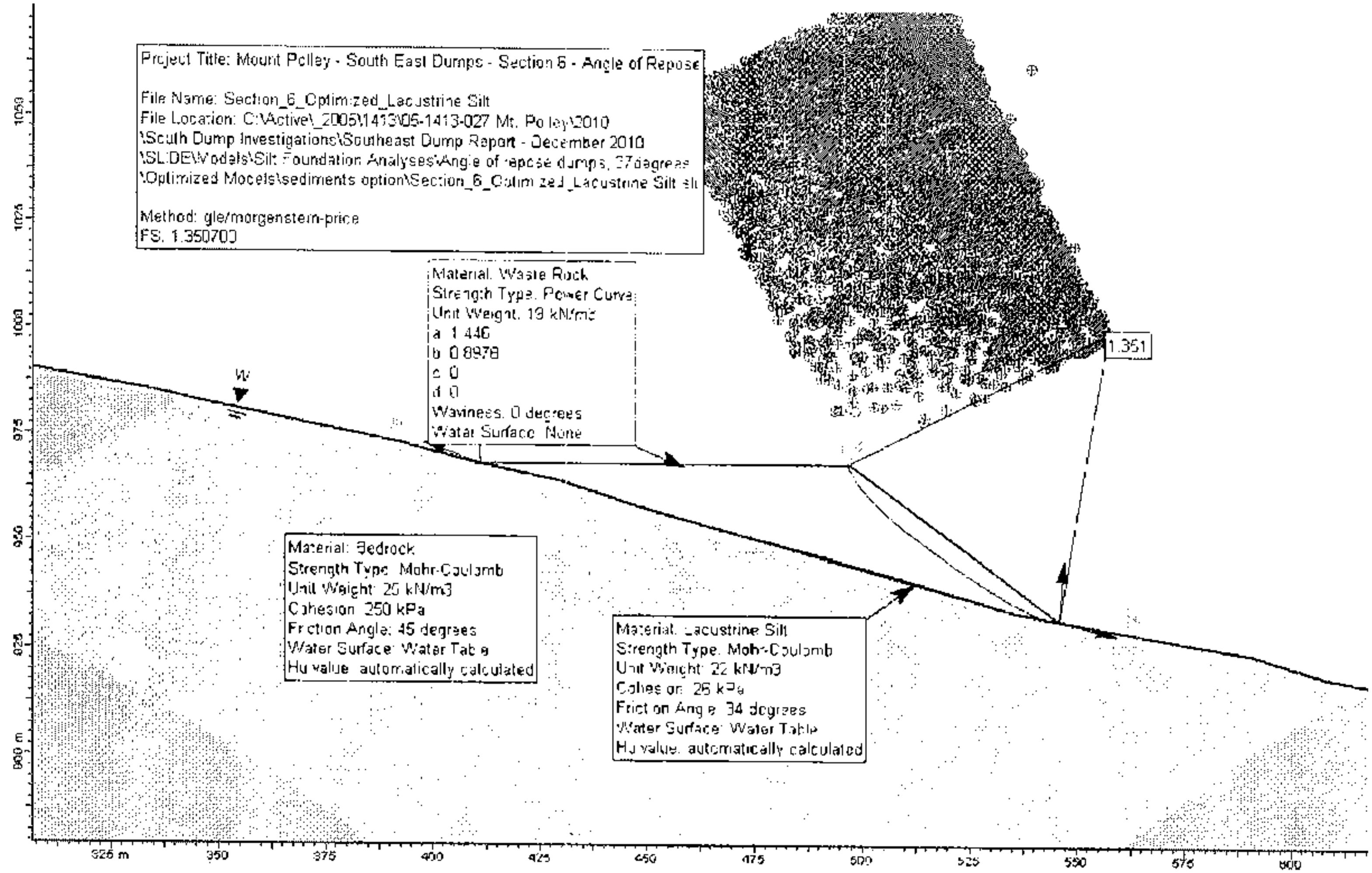
PROJECT
MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

TITLE
Angle of Repose Dump Face, Lacustrine Sediments Foundation, Section 5

Golder Associates

PROJECT No.	05-1413-027		PHASE No. 4000
DESIGN	RP	16DEC10	SCALE As Shown REV.
CADD	RP	16DEC10	
CHECK			
REVIEW			

FIGURE E10



PROJECT

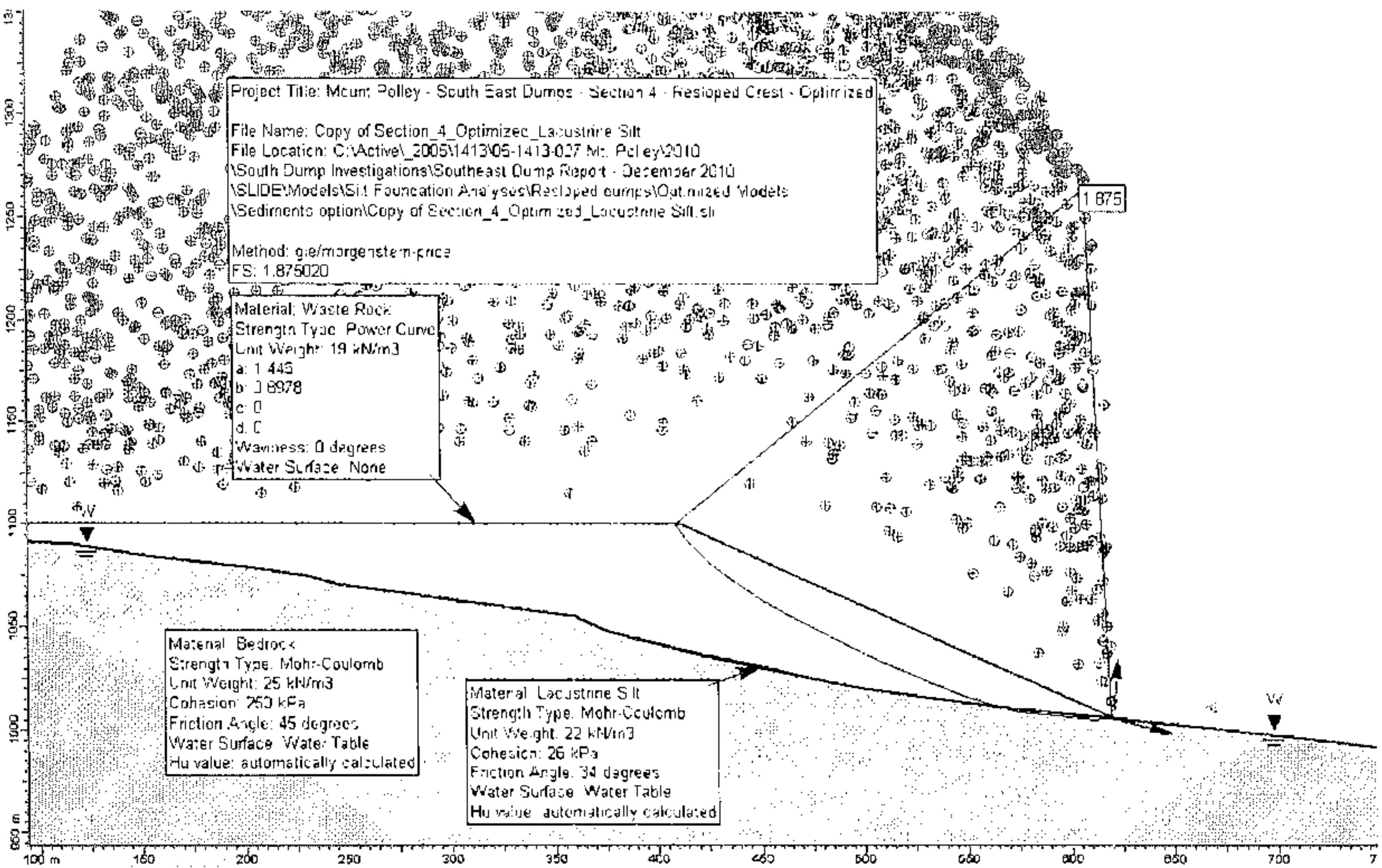
MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

TITLE

Angle of Repose Dump Face, Lacustrine Sediments Foundation, Section 6

Golder Associates

PROJECT No.	05-1413-027		PHASE No. 4000	
DESIGN	RP	16DEC10	SCALE As Shown	REV.
CADD	RP	16DEC10		
CHECK			**FIGURE E11**	
REVIEW				



PROJECT

MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

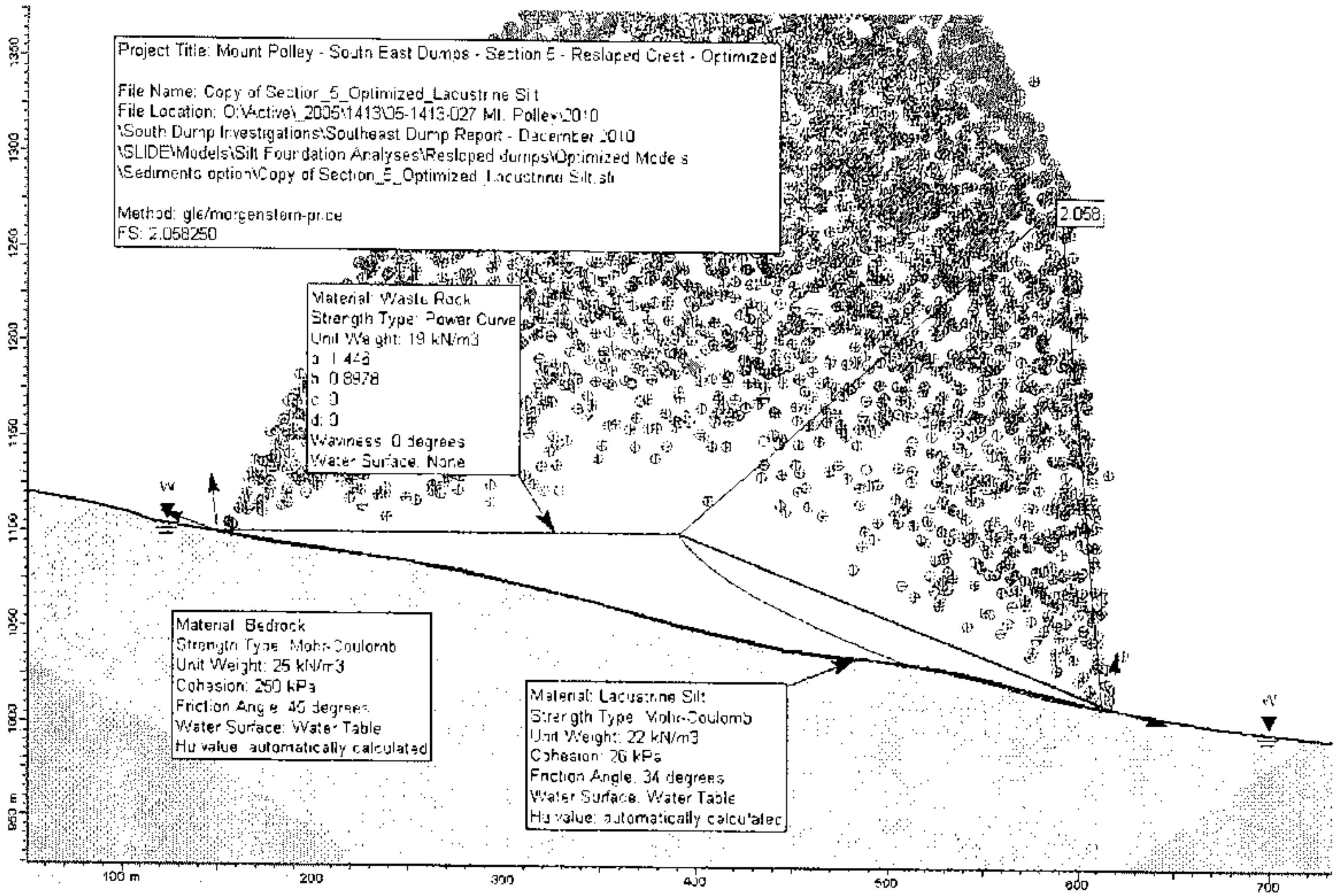
TITLE

Re-Sloped Dump Face, Lacustrine Sediments Foundation, Section 4

Golder Associates

PROJECT No.	05-1413-027		PHASE No. 4000
DESIGN	RP	16DEC10	SCALE As Shown / REV.
CADD	RP	16DEC10	**FIGURE E12**
CHECK			
REVIEW			

FILE: O:\Active_2005\1413\05-1413-027 Mt. Polley\2010\South Dump Investigations\Southeast Dump Report - December 2010\Appendix E\Appendix E Figures.pptx



PROJECT

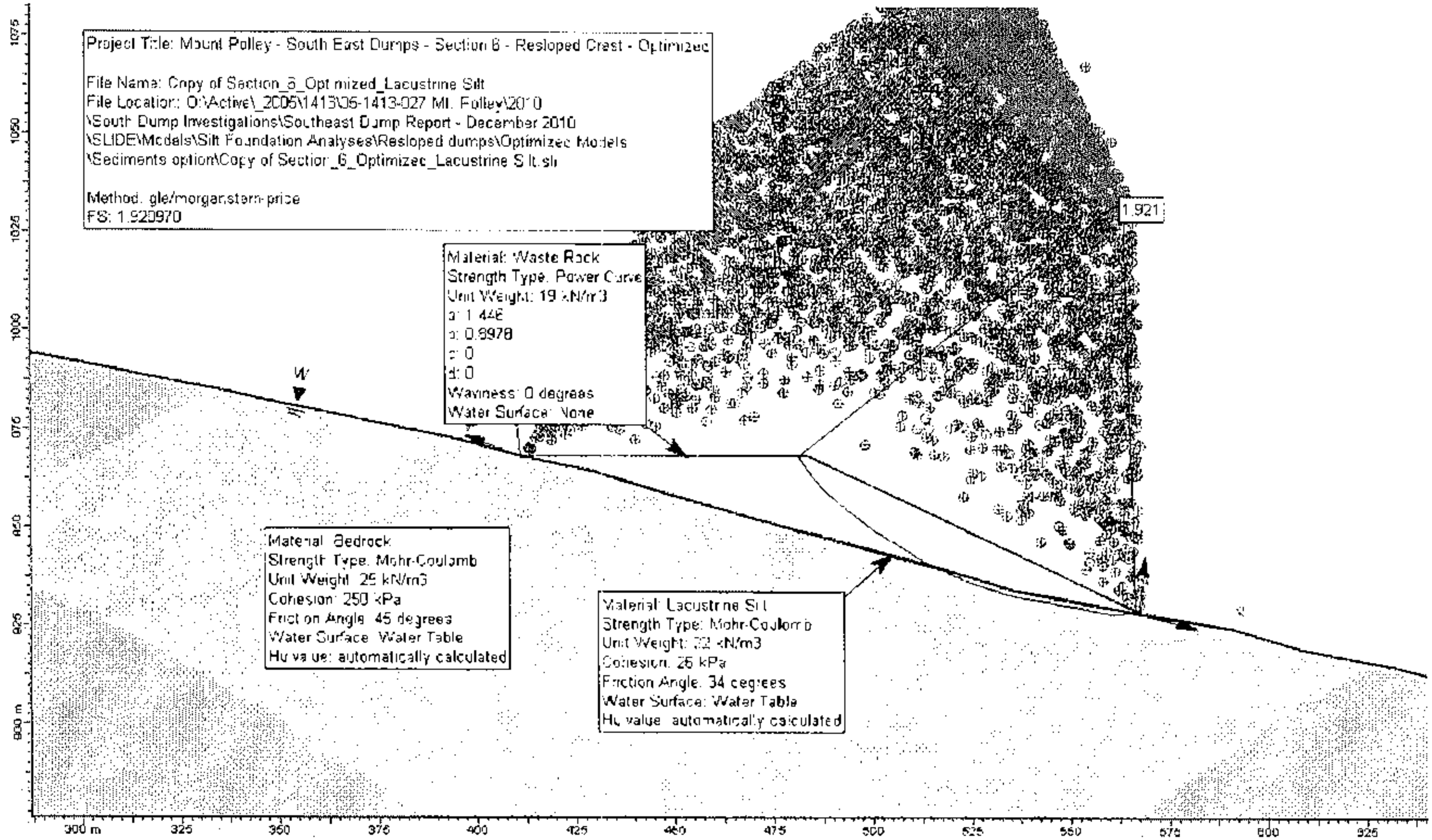
MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

TITLE

Re-Sloped Dump Face, Lacustrine Sediments Foundation, Section 5

Golder Associates

PROJECT No.	05-1413-027		PHASE No. 4000
DESIGN	RP	16DEC10	SCALE As Shown / REV.
CADD	RP	16DEC10	
CHECK			**FIGURE E13**
REVIEW			



PROJECT
MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

TITLE
Re-Sloped Dump Face, Lacustrine Sediments Foundation, Section 6

Golder Associates

PROJECT No.	05-1413-027		PHASE No. 4000
DESIGN	RP	16DEC10	SCALE As Shown REV.
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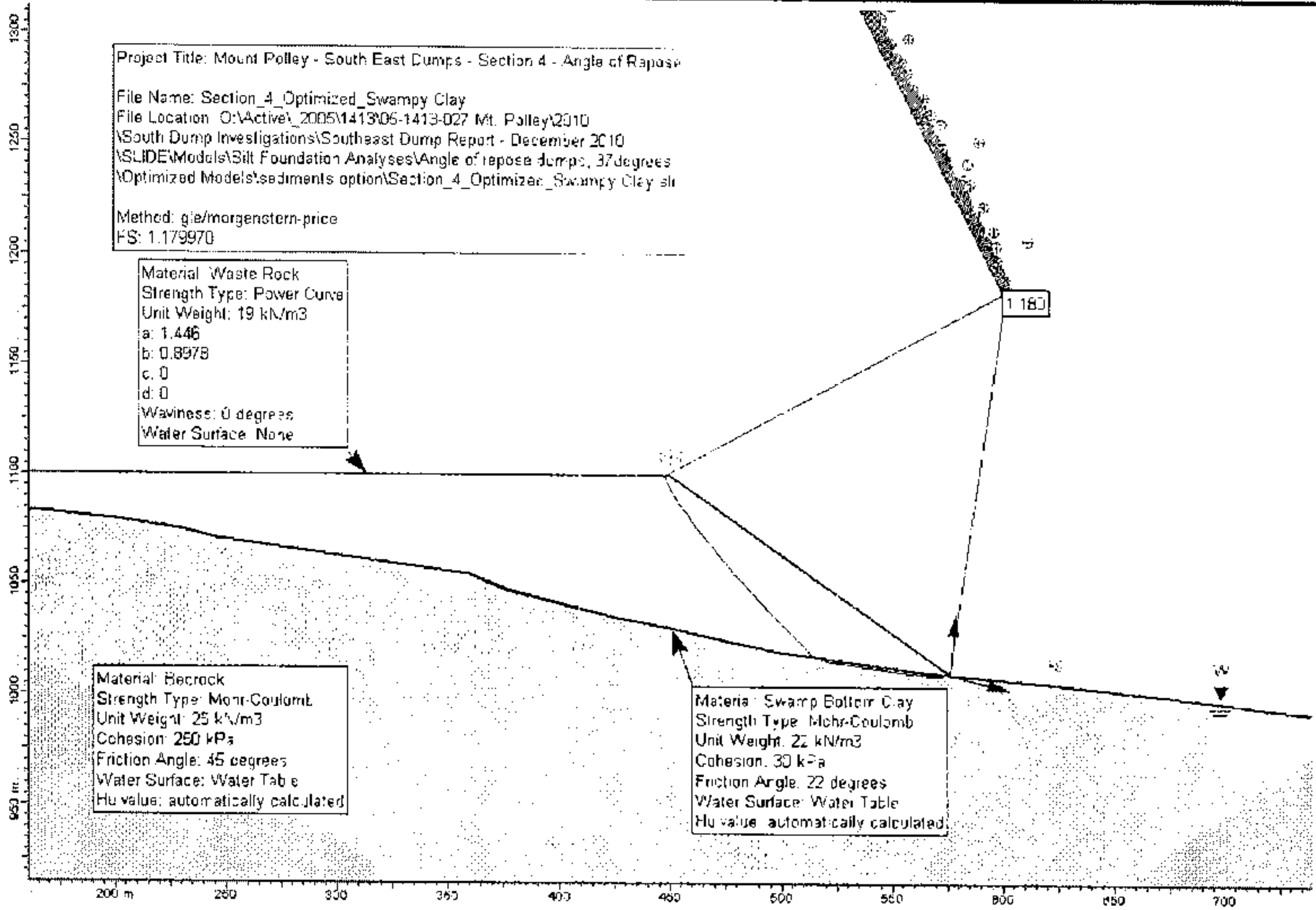
CHECK			**FIGURE E14**
REVIEW			



PROJECT

MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

TITLE

Angle of Repose Dump Face, Swamp Bottom Sediments Foundation, Section 4

Golder Associates

PROJECT No.	05-1413-027		PHASE No. 4000
DESIGN	RP	16DEC10	SCALE As Shown REV.
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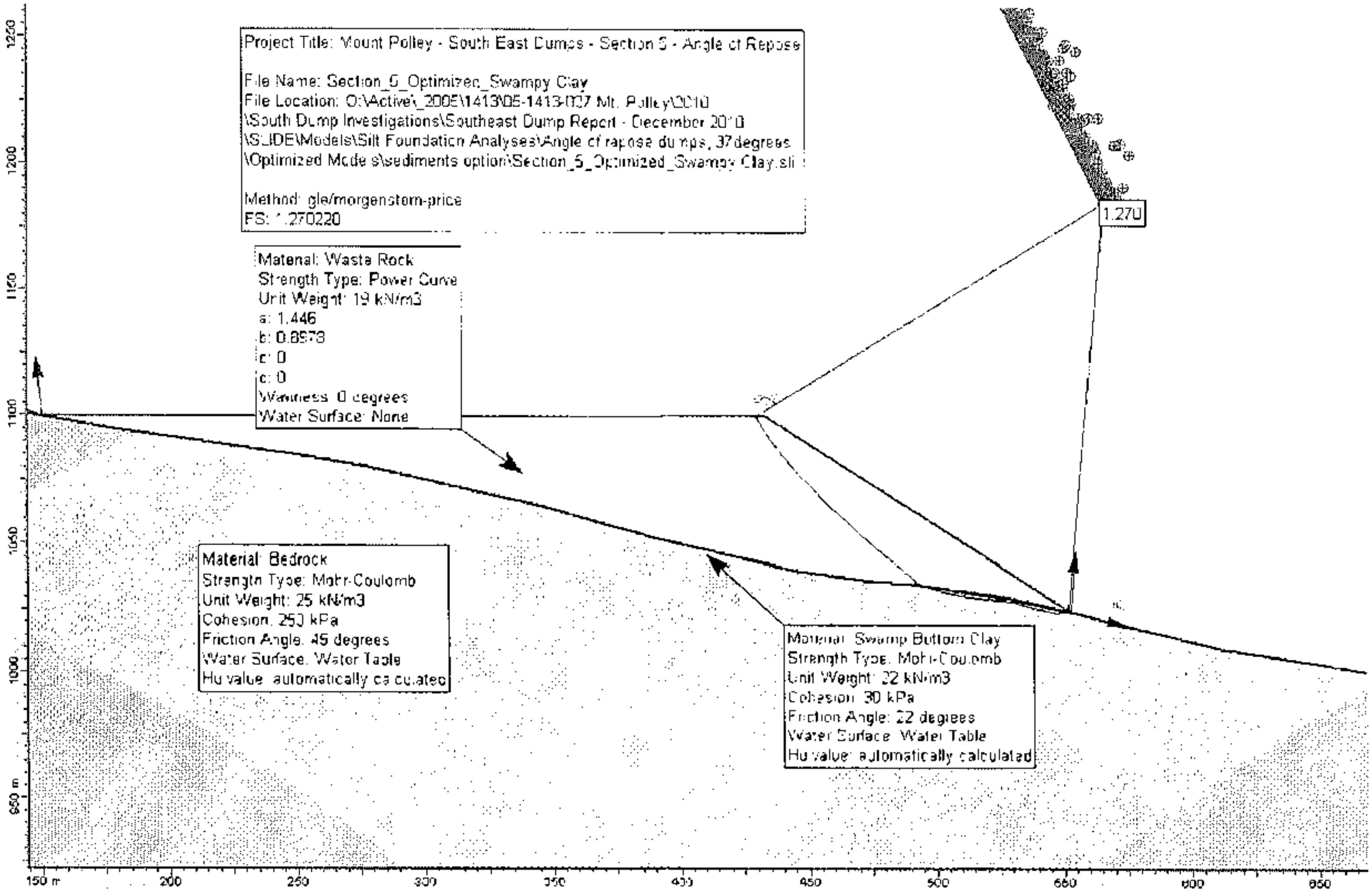
CHECK			**FIGURE E15**
REVIEW			



PROJECT

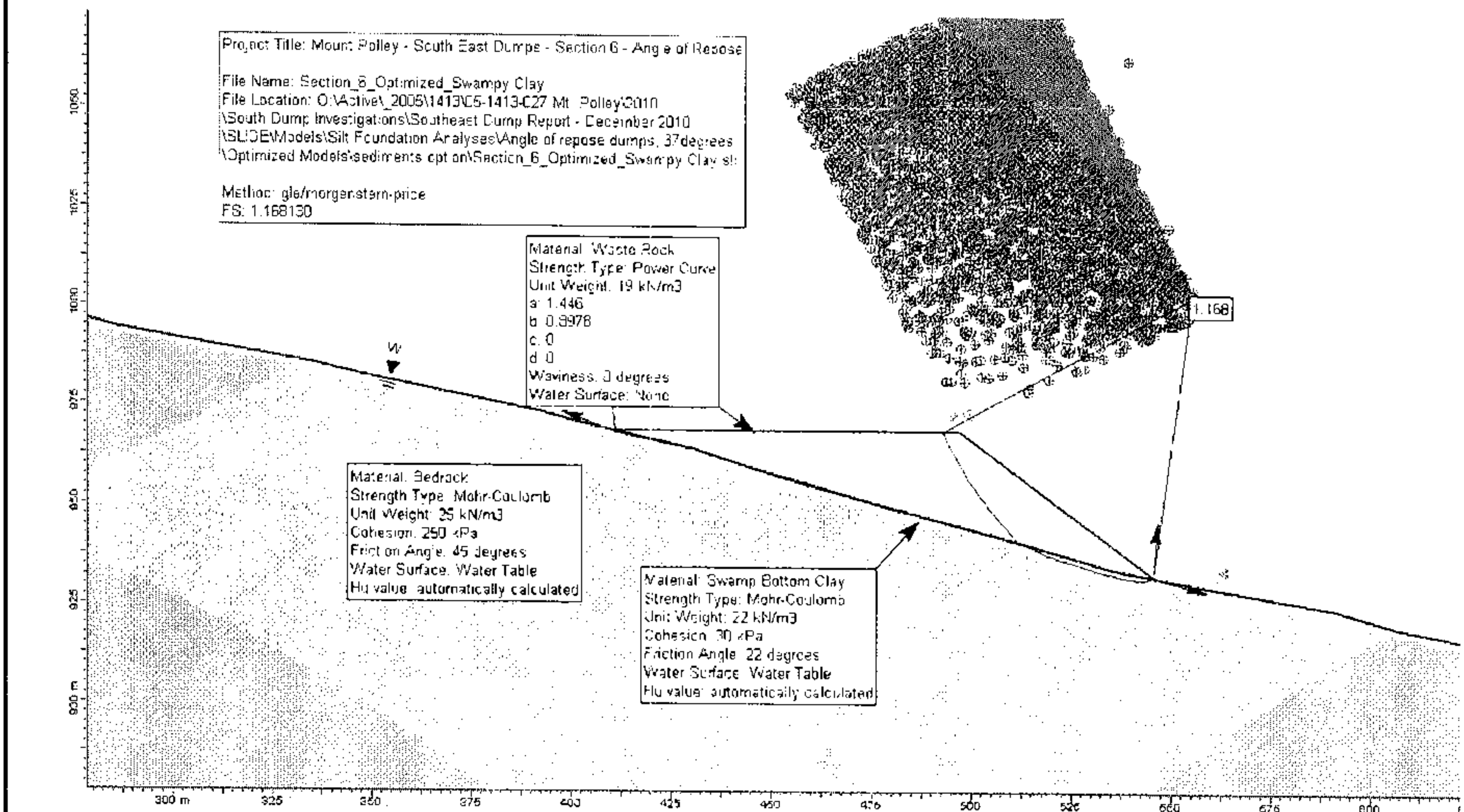
MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

TITLE

Angle of Repose Dump Face, Swamp Bottom Sediments Foundation, Section 5

Golder Associates

PROJECT No.	05-1413-027		PHASE No. 4000
DES GN	RP	16DEC10	SCALE As Shown REV.
CADD	RP	16DEC10	**FIGURE E16**
CHECK			
REVIEW			

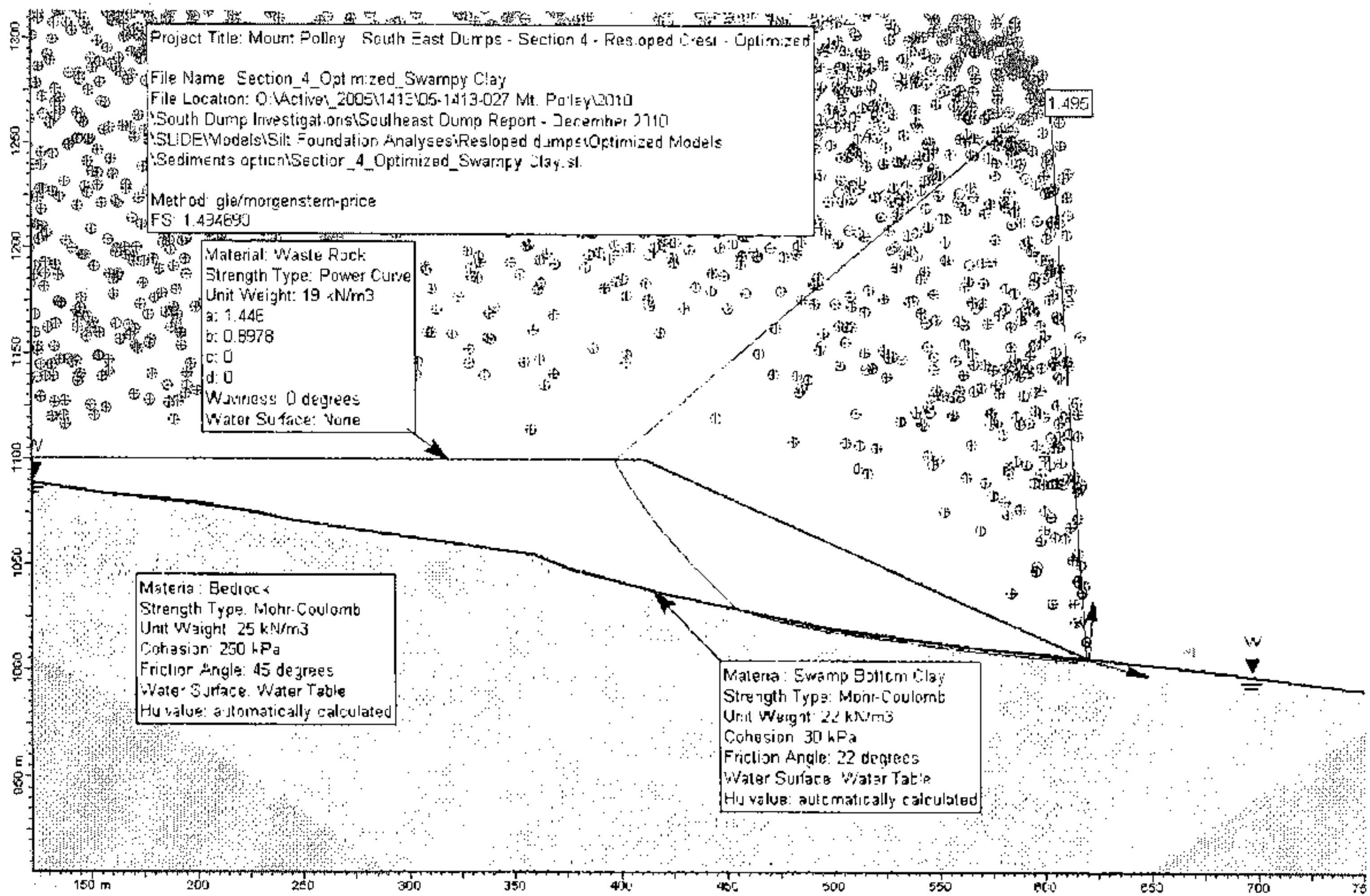


PROJECT	MOUNT POLLEY MINES SOUTHEAST DUMP STABILITY ASSESSMENT LIKELY, B.C.
TITLE	**Angle of Repose Dump Face, Swamp Bottom Sediments Foundation, Section 6**

Golder Associates

PROJECT No.	05-1413-027		PHASE No. 4000	
DESIGN	RP	16DEC10	SCALE As Shown	REV.
CADD	RP	16DEC10	**FIGURE E17**	
CHECK				
REVIEW				

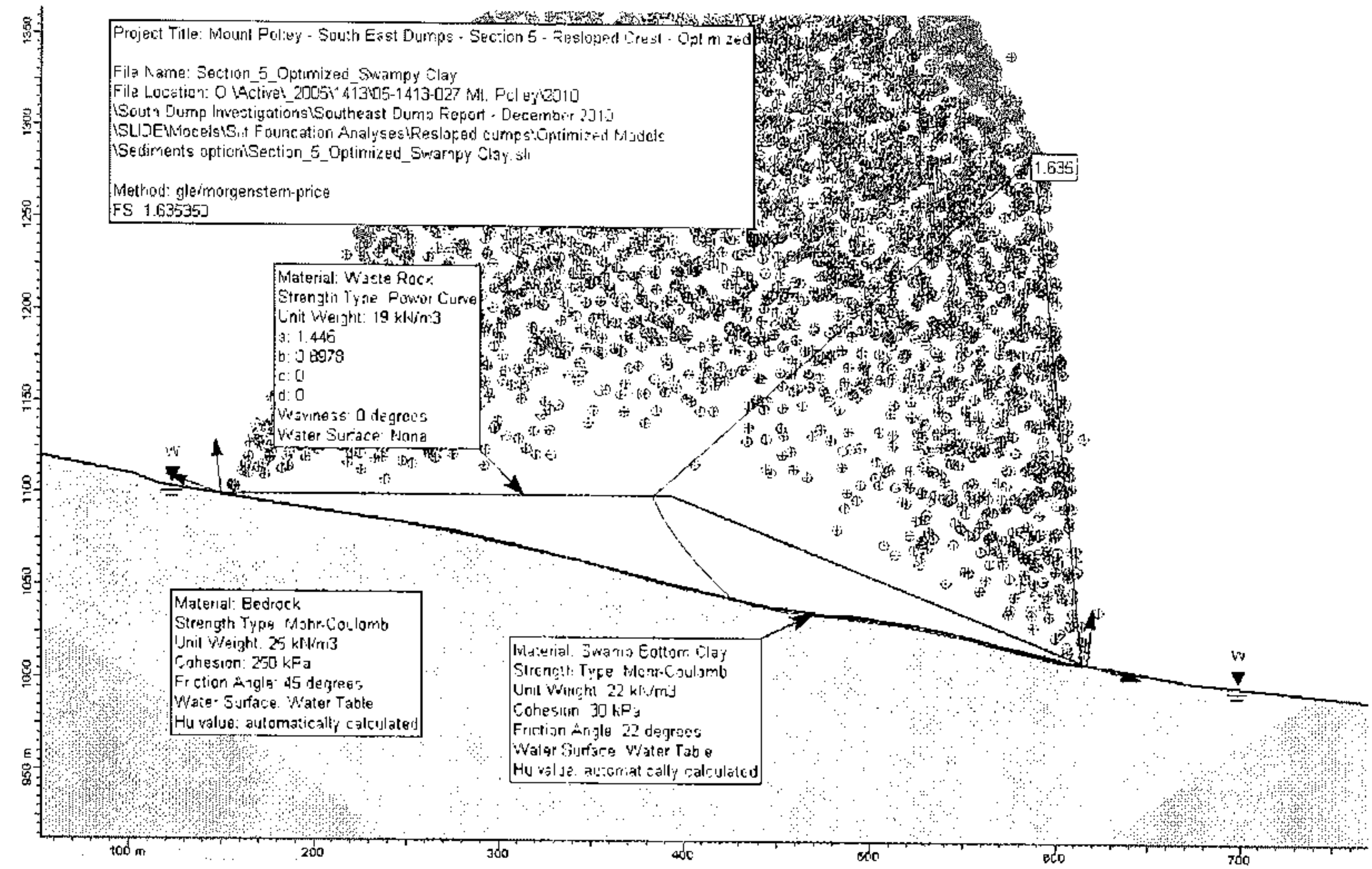
FILE: O:\Active_2005\1413\05-1413-027 Mt. Polley\2010\South Dump Investigations\Southeast Dump Report - December 2010\Appendix E\Appendix E Figures.pptx



PROJECT	MOUNT POLLEY MINES SOUTHEAST DUMP STABILITY ASSESSMENT LIKELY, B.C.
TITLE	**Re-Sloped Dump Face, Swamp Bottom Sediments Foundation, Section 4**

Golder Associates

PROJECT No.	05-1413-027		PHASE No. 4000
DESIGN	RP	16DEC10	SCALE As Shown REV.
CADD	RP	16DEC10	**FIGURE E18**
CHECK			
REVIEW			



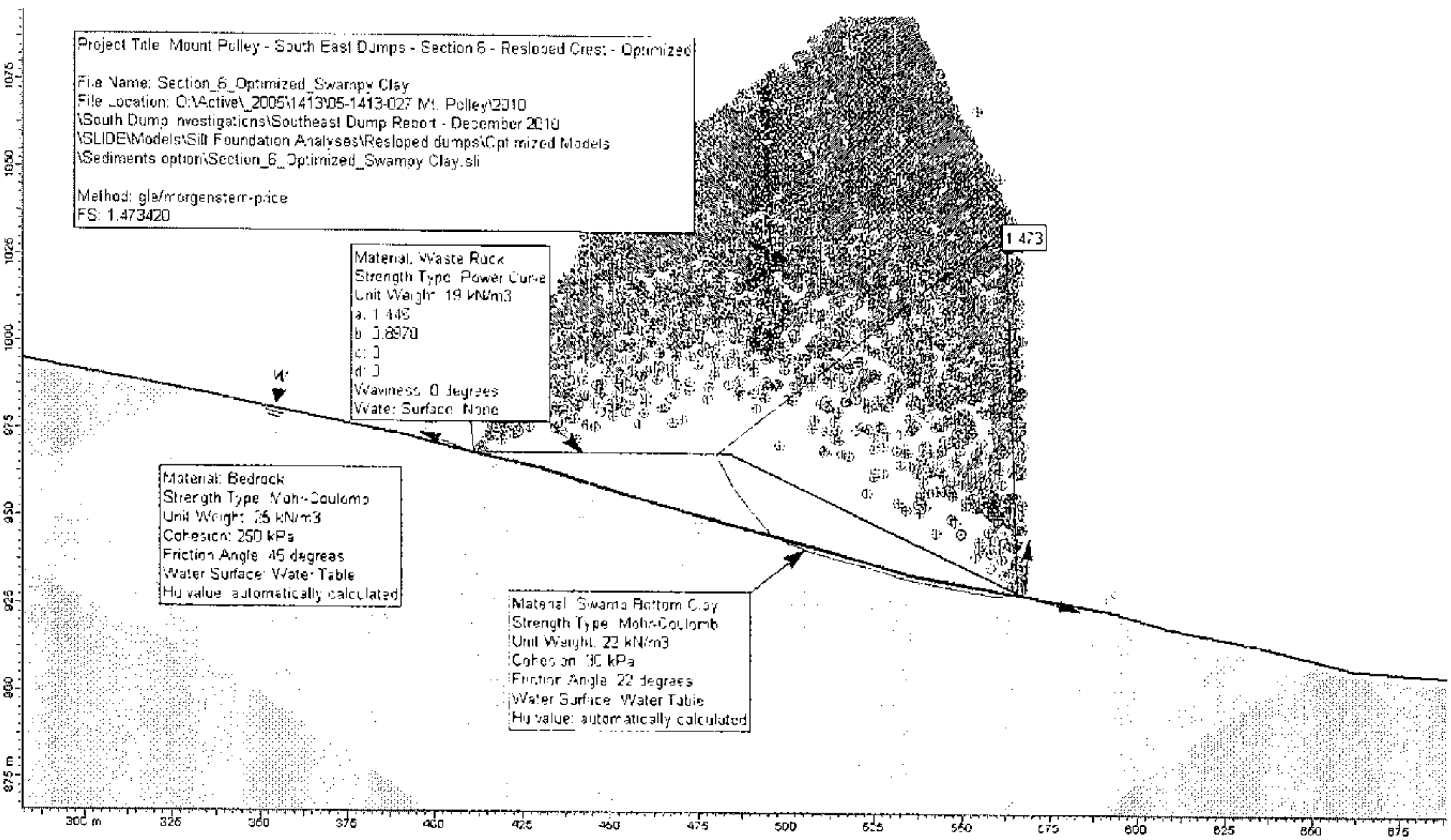
PROJECT
MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

TITLE
Re-Sloped Dump Face, Swamp Bottom Sediments Foundation, Section 5

Golder Associates

PROJECT No.	05-1413-027		PHASE No. 4000
DESIGN	RP	16DEC10	SCALE As Shown REV.
CADD	RP	16DEC10	
CHECK			**FIGURE E19**
REVIEW			

FILE: O:\Active_2005\1413\05-1413-027 Mt. Polley\2010\South Dump Investigations\Southeast Dump Report - December 2010\Appendix E\Appendix E Figures.pptx



PROJECT

MOUNT POLLEY MINES
SOUTHEAST DUMP STABILITY ASSESSMENT
LIKELY, B.C.

TITLE

Re-Sloped Dump Face,
Swamp Bottom Sediments Foundation, Section 6

Golder Associates

PROJECT No.	05-1413-027		PHASE No. 4000	
DESIGN	RP	16DEC10	SCALE As Shown	REV.
CADD	RP	16DEC10		
CHECK			**FIGURE E20**	
REVIEW				

At Golder Associates we strive to be the most respected global group of companies specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees now operating from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

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Golder Associates

Metcalfe, Megan MEM:EX

From:	Ron Martel <rmartel@mountpolley.com>
Sent:	Thursday, May 5, 2011 7:51 PM
To:	Demchuk, Tania MEM:EX
Cc:	Tim Fisch; Art Frye; Howe, Diane J MEM:EX
Subject:	RE: Permit amendment application - geochem questions
Attachments:	Summary of Mines Material.xlsx; Reclamation Cost Estimatesbk.docx; ABA Metals 13 Mt Polley (Valley High) Samples Oct08 (30).xls; Boundary Zone ARD Samples.xls

Hi Tania, nice talking to you today, great conversation, I have provided you four (4) files which should address your comments.

- Summary of mines material...this file highlights NAG and PAG amount over time (i.e. 7,003,000 PAG)
- Cost document sent to Diane illustrating suggested bonding cost expended over time which will be reviewed each year which should provide contingency against for temporary or early suspension of mine operations
- First file reflecting ABA of selected Boundary Zone ABA, results show sample are considered mostly NAG using leco method determination and a site criteria of 1.4 NPR per suggested Steve Day, or 2 samples of 10 PAG using NPR of 2
- More ABA samples with analysis using leco method, 2 sample slightly PAG from 16 taken,

Note that the Boundary NAG will be sent to a approved NAG dump, will the PAG waste will be placed in a vacant pit below anticipated flood line at closure.

I trust this information meets your request

Ron Martel

From: Demchuk, Tania MEM:EX [mailto:Tania.Demchuk@gov.bc.ca]
Sent: Thursday, May 05, 2011 11:27 AM
To: Ron Martel
Subject: Permit amendment application - questions

Hi Ron,

I apologize that it has taken me so long to follow-up with you. Are you around this afternoon for a quick phone call (any time after 2:30)? I have not quite finished my review but have a few preliminary questions for you. I am also available tomorrow afternoon if that is better for you.

Let me know a time and I will call you.
Thank-you,
Tania

Tania Demchuk, MSc
Environmental Geoscientist,
BC Ministry of Energy and Mines
P.O. Box 9320, Stn Prov Gov't, Victoria BC V8W 9N3
Phone: (250) 952-0417 Fax: (250) 952-0481

Table 3: Ultra Trace Metals Using Aqua Regia Digestion with ICP-MS Finish for 13 Mt. Polley Samples - October 2008

S. No.	Sample ID	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ag ppb	Ni ppm	Co ppm	Mn ppm	Fe %	As ppm	U ppm	Au ppb	Th ppm	Sr ppm	Cd ppm	Sb ppm
1	63001 (Boundary 1)	5.90	230.01	81.79	110.3	282	1.4	14.5	1419	3.47	26.9	1.1	14.8	1.5	89.8	1.12	1.65
2	63002 (Boundary 2)	5.83	220.35	11.18	81.1	141	7.8	18.4	1699	4.02	11.8	0.5	6.6	1.0	166.5	0.35	0.40
3	63003 (Boundary 3)	2.55	156.08	15.70	75.7	132	1.2	7.7	1419	2.06	8.2	0.8	3.9	1.8	141.9	0.22	0.40
4	63004 (Boundary 4)	3.44	404.33	22.71	121.0	316	2.3	11.0	1756	3.17	13.7	0.8	9.3	1.5	128.9	0.43	0.64
5	63005 (Boundary 5)	5.20	209.23	43.44	91.4	205	1.2	8.3	1320	2.41	13.0	0.4	6.6	1.2	148.8	0.77	0.45
6	63006 (Boundary 6)	4.83	142.57	25.21	102.1	163	14.4	12.5	1517	3.19	20.5	0.5	2.1	1.1	170.8	0.31	0.69
7	63007 (Boundary 7)	5.97	304.82	40.59	124.6	340	3.1	14.1	1655	3.69	20.9	0.7	4.5	1.7	158.9	0.87	1.43
8	63008 (Boundary 8)	1.21	569.59	20.27	153.2	471	3.3	15.4	2211	3.65	14.4	1.2	14.0	1.1	126.4	0.31	0.42
9	63009 (Boundary 9)	1.77	200.50	19.21	121.6	201	1.2	8.8	1460	2.69	14.4	0.8	6.6	1.4	210.8	0.29	0.38
10	63010 (Boundary 10)	1.47	346.58	19.75	102.3	291	1.5	10.9	1599	2.60	12.0	0.7	6.5	1.3	344.6	0.43	0.32
11	080504d 8732 33 E Cor Monthly Comp April 08	83.49	>10000.0	199.55	246.0	>100000.0	10.2	82.6	418	21.43	578.2	0.7	15207.2	0.5	33.6	15.74	56.21
12	M9694 95 Head Monthly Comp April 08	8.50	5711.91	11.75	81.7	3041	7.1	17.5	894	4.07	32.1	0.8	209.2	1.0	107.9	0.59	1.86
13	080504a M9664 85 Tails Monthly Comp April 08	5.83	1023.84	6.70	81.6	839	7.2	16.8	936	4.17	15.4	0.8	64.4	1.0	110.9	0.21	0.55
QA/QC (Duplicates)																	
5	63005 (Boundary 5)																
6	63006 (Boundary 6)	4.59	139.77	24.60	96.6	160	13.9	12.1	1520	3.17	17.5	0.5	2.4	1.1	177.4	0.27	0.68
Reference Material																	
STD DS7 (1)		21.09	135.58	74.34	435.1	890	57.5	10.1	629	2.43	57.3	5.1	75.9	4.6	70.4	7.36	5.36
STD DS7 STD CPZO-1-SPER (2)		20.57	117.82	70.07	418.6	900	54.9	10.0	630	2.39	60.4	5.3	90.5	4.7	67.3	7.00	6.22
True Value STD DS7		20.9	109.0	70.6	411.0	890.0	56.0	9.7	627.0	2.4	48.2	4.9	70.0	4.4	68.7	6.4	5.9
Percent Difference (1)		0.6	24.4	5.3	5.9	0.0	2.7	4.1	0.3	1.7	18.9	4.1	8.4	4.5	2.5	15.4	-8.5
Percent Difference (2)		1.7	7.9	0.8	1.8	1.1	2.0	3.1	0.5	0.0	4.9	8.2	29.3	6.8	2.0	8.7	10.9
Detection Limits		0.01	0.01	0.01	0.1	2	0.1	0.1	1	0.01	0.1	0.1	0.2	0.1	0.5	0.01	0.02
Method		1F MS	1F MS	1F MS	1F MS	1F MS	1F MS	1F MS	1F MS	1F MS	1F VS	1F VS	1F MS	1F VS	1F VS	1F VS	1F VS

S. No.	Sample ID	Bi ppm	V ppm	Ca %	P %	La ppm	Cr ppm	Mg %	Ba ppm	Ti %	B ppm	Al %	Na %	K %	W ppm	Sc ppm	Tl ppm	Hg ppb	Se ppm	Te ppm	Ga ppm	Cu/Ox %
1	63001 (Boundary 1)	0.34	108	3.23	0.140	23.8	8.4	0.75	72.7	0.008	24	1.16	0.027	0.29	<0.1	2.7	<0.02	21	0.9	0.02	5.8	0.003
2	63002 (Boundary 2)	0.05	125	4.10	0.116	12.0	32.5	1.28	97.6	0.058	<20	1.34	0.054	0.33	<0.1	5.8	<0.02	37	0.2	<0.02	6.0	0.052
3	63003 (Boundary 3)	0.14	93	2.62	0.079	16.4	15.1	0.52	377.4	0.022	<20	0.77	0.044	0.23	<0.1	1.7	<0.02	31	0.3	0.02	4.7	<0.001
4	63004 (Boundary 4)	0.10	122	3.62	0.128	23.6	13.4	0.84	286.2	0.057	21	1.11	0.029	0.21	<0.1	3.3	<0.02	75	0.5	<0.02	5.7	0.052
5	63005 (Boundary 5)	0.11	64	2.84	0.082	10.8	12.8	0.56	214.3	0.052	<20	0.95	0.025	0.24	<0.1	1.2	<0.02	13	0.6	0.05	3.9	<0.001
6	63006 (Boundary 6)	0.23	95	3.63	0.134	18.7	17.6	0.89	195.9	0.008	<20	1.29	0.026	0.30	<0.1	2.4	<0.02	13	1.1	0.04	5.0	<0.001
7	63007 (Boundary 7)	0.27	112	3.88	0.143	23.6	14.6	0.94	114.6	0.005	27	1.19	0.030	0.28	<0.1	3.1	<0.02	42	0.9	0.02	5.2	0.001
8	63008 (Boundary 8)	0.11	125	6.37	0.172	22.6	14.5	1.07	247.7	0.030	40	1.32	0.030	0.23	<0.1	4.4	<0.02	<5	0.6	<0.02	6.3	0.054
9	63009 (Boundary 9)	0.09	62	3.26	0.103	21.1	7.5	0.66	217.2	0.005	20	0.96	0.025	0.23	<0.1	1.5	<0.02	20	0.6	<0.02	4.2	<0.001
10	63010 (Boundary 10)	0.11	75	4.35	0.122	10.4	9.8	0.68	288.2	0.006	<20	1.02	0.024	0.27	<0.1	2.7	<0.02	13	0.9	<0.02	3.6	0.052
11	080504d 8732 33 E Cor Monthly Comp April 08	7.89	111	0.83	0.050	5.5	3.8	0.36	17.2	0.048	<20	0.38	0.008	0.03	0.5	2.3	0.12	4582	>100	4.99	3.3	0.425
12	M9694 95 Head Monthly Comp April 08	0.24	101	3.17	0.150	11.7	14.3	0.98	160.7	0.127	<20	1.22	0.054	0.15	0.4	5.2	<0.02	286	3.7	0.18	7.8	0.071
13	080504a M9664 85 Tails Monthly Comp April 08	0.09	169	3.13	0.150	11.8	15.6	0.97	162.6	0.110	<20	1.26	0.057	0.16	0.4	5.2	<0.02	217	1.1	0.08	8.2	0.03
QA/QC (Duplicates)																						
5	63005 (Boundary 5)																					<0.001
6	63006 (Boundary 6)	0.23	95	3.50	0.127	17.4	17.8	0.89	181.7	0.008	22	1.32	0.027	0.31	<0.1	2.3	<0.02	12	1.0	<0.02	5.0	
Reference Material																						
STD DS7 (1)		4.92	84	0.99	0.082	13.7	182.9	1.08	413.4	0.124	45	1.02	0.081	0.46	3.5	2.8	4.43	230	3.6	1.28	4.9	
STD DS7 STD CPZO-1-SPER (2)		4.77	75	0.94	0.078	12.5	183.0	1.06	396.9	0.116	50	0.97	0.083	0.45	3.4	2.7	4.23	213	3.5	1.18	4.8	0.259
True Value STD DS7		4.5	86.0	0.9	0.1	12.7	163.0	1.1	370.3	0.1	38.6	1.0	0.1	0.4	3.8	2.5	4.2	200.0	3.5	1.1	4.6	0.260
Percent Difference (1)		9.1	-2.3	6.5	2.5	7.9	12.2	2.9	11.6	0.0	16.6	6.4	24.7	4.5	-7.9	16.0	5.7	15.0	2.9	19.4	6.5	
Percent Difference (2)		5.9	11.6	1.1	2.5	1.6	12.3	1.0	7.2	8.5	29.5	1.1	13.7	2.3	10.5	8.0	1.0	6.5	0.0	7.4	4.3	0.4
Detection Limits		0.02	2	0.01	0.001	0.5	0.5	0.01	0.5	0.001	20	0.01	0.001	0.01	0.1	0.1	0.02	5	0.1	0.02	0.1	0.001
Method		1F VS	1F VS	1F VS	1F VS	1F VS	1F VS	1F VS	1F VS	1F VS	1F MS	1F MS	1F MS	1F MS	1F MS	1F VS	1F MS	1F MS	1F MS	1F MS	1F MS	G6 Cu Ox

Note:
Analysis done at Acme Labs.

CANTEST
CANTEST Ltd 4606 Canada Way, Burnaby BC Canada V5G 1K5 Tel. 604 734 7276 Fax 604 731 2386 www.cantest.com

Mt. Polley Mining Corporation, Mt. Polley, 29-Aug-08
Page 1 of 5

Table 1: ABA Test Results for 13 Mt. Polley Samples - October 2008

S. No:	Sample ID	Paste pH	CO2 (Wt.%)	CaCO3 Equiv. (Kg CaCO3/Tonne)	Total Sulphur (Wt.%)	Sulphate Sulphur (Wt.%)	Sulphide Sulphur* (Wt.%)	Maximum Potential Acidity** (Kg CaCO3/tonne)	Std. Sobek NP Neutralization Potential (Kg CaCO3/tonne)	Net Neutralization Potential (Kg CaCO3/tonne)	Fizz Rating	npr
1	83001 (Boundary 1)	8.2	3.16	71.82	1.57	0.01	1.56	48.8	108.7	59.9	Strong	1.47319
2	83002 (Boundary 2)	8.5	4.6	105.00	0.21	<0.01	0.21	6.6	169.2	162.6	Strong	16
3	83003 (Boundary 3)	8.8	3.1	69.77	0.30	0.01	0.29	9.1	89.8	80.8	Strong	7.69906
4	83004 (Boundary 4)	8.6	4.0	90.91	0.60	0.01	0.59	18.4	134.1	115.6	Strong	4.93066
5	83005 (Boundary 5)	8.4	3.0	67.05	1.00	0.01	0.99	30.9	94.2	63.3	Strong	2.16713
6	83006 (Boundary 6)	8.4	3.9	89.09	1.14	0.01	1.13	35.3	122.8	87.5	Strong	2.52293
7	83007 (Boundary 7)	8.4	4.0	90.00	2.12	0.01	2.11	65.9	135.1	69.1	Strong	1.36493
8	83008 (Boundary 8)	8.5	5.3	120.00	0.62	0.01	0.61	19.1	182.8	163.7	Strong	6.29508
9	83009 (Boundary 9)	8.4	3.5	80.45	0.97	0.01	0.96	30.0	104.3	74.3	Strong	2.68182
10	83010 (Boundary 10)	8.5	5.2	117.50	0.55	0.01	0.54	16.9	146.4	129.5	Strong	6.96296
11	080504d 9732-33 F. Con Monthly Comp April 08	6.4	0.6	13.86	25.67	0.06	25.61	800.3	32.7	-767.6	Moderate	
12	M9694/95 Head Monthly Comp April 08	8.2	2.9	66.14	0.69	0.01	0.68	21.3	109.3	88.0	Strong	
13	080504a M9684/85 Tails Monthly Comp April 08	8.5	2.9	65.68	0.31	0.01	0.30	9.4	104.3	94.9	Strong	
Detection Limits		*0.1*	*0.02*	*0.45*	*0.02*	*0.01*	*0.02*	*0.6*				
CANTEST SOP Number		7160	LECO	Calculation	LECO	7410	Calculation	Calculation	7110	Calculation	7110	

*Based on difference between total sulphur and sulphate-sulphur.
**Based on sulphide-sulphur.
Total Sulphur and Carbonate Carbon (CO2 HCl method) by LECO furnace at Acme Labs.

Reference (Cantest SOP Number 7110): Standard Sobek NP Method (EPA 600 Method - described in Sobek et al. 1978).

CANTEST
CANTEST Ltd. 4606 Canada Way, Burnaby, BC Canada V5G 1K5 Tel: 604 734 7276 Fax: 604 731 2386 www.cantest.com

Table 2a: QA/QC for Paste pH & NP Determination - October 2008
(for of 13 Mt. Polley Samples)

Sample ID	Paste pH (pH Units)	
Duplicates - Paste pH		
83010 (Boundary 10)	8.5	8.5
Sample ID	**Neutralization Potential (KgCaCO3/Tonne)**	
Duplicates - Standard ABA NP		
83010 (Boundary 10)	146.4	144.5
KZK-1 Reference (NP = 64.8)	67.8	

Table 2b: QA/QC for Sulphur Speciation

Sample ID	Sulphur (Wt.%)	
QAQC - Total Sulphur		
Cantest Ref. (0.11% S)	0.10	
STD CSC (4.19% S)	4.12	
STD OREAS76A (18.00% S)	16.50	
Sample ID	**Sulphate Sulphur (Wt.%)**	
Duplicates - Sulphate Sulphur		
83010 (Boundary 10)	0.01	0.01
CANTEST Ref. (0.27% SO4-S)	0.29	

Table 2c: QA/QC for CO2 Determination

Sample ID	CO2 (Wt.%)	
QAQC - CO2		
STD CSC (1.50% CO2)	1.54	

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Sample Summary:	Mt. Polley Mining Corporation, Mt. Polley, 29-Aug-08
	Page 5 of 5
Date Samples Rec'd:	29-Aug-08
Date Instructions Rec'd:	25-Aug-08 from Ron Martel
Number of Samples:	13 Samples
Sample Type:	Pulp samples
Client Project Name/No:	Mt. Polley (PO No. 509144)
Sample Prep:	None. Rec'd Samples as pulps.
Date of Analysis:	ABA: 3-Sep-08; SO4-S: 4-Sep-08.

Name of Customer:	Mount Polley Mining Corporation
Contact Person:	Ron Martel *CCEP, CET* (Environmental Superintendent)
E-mail Adress:	rmartel@mountpolley.com
Address:	P.O. Box 12, Likely, BC V01 1N0
Contact No:	250 790 2215 x409
Fax No:	250 790 2268

	Sign:
Report Released by:	Ivy Rajan
Position:	Lab Manager, ARD Division, CANTEST Ltd.
Report Verified by:	Kavita Ahluwalia
Position:	Data Processor
Report Validated by:	Tim O'Hearn
Position:	Director, ARD Division, CANTEST Ltd.
CANTEST Project No:	2-21-910
Contact No:	604-734-7276 x5029; Direct: 604-638-5029 (Ivy Rajan)
Contact No:	604-734-7276 x2208 (Kavita Ahluwalia)
Contact No:	604-734-7276 x5031 ; Direct: 604-638-5031 (Tim O'Hearn)

Sample list as received from client

S. No:	Sample ID	Sample Type/ Condition	Dry Sample Wt. (g)
1	83001 (Boundary 1)	Pulp Samples	~200
2	83002 (Boundary 2)	Pulp Samples	~200
3	83003 (Boundary 3)	Pulp Samples	~200
4	83004 (Boundary 4)	Pulp Samples	~200
5	83005 (Boundary 5)	Pulp Samples	~200
6	83006 (Boundary 6)	Pulp Samples	~200
7	83007 (Boundary 7)	Pulp Samples	~200
8	83008 (Boundary 8)	Pulp Samples	~200
10	83010 (Boundary 10)	Pulp Samples	~200
11	080504d 9732-33 F. Con Monthly Comp April 08	Pulp Samples	~200
12	M9694/95 Head Monthly Comp April 08	Pulp Samples	~200
13	080504a M9684/85 Tails Monthly Comp April 08	Pulp Samples	~200

CANTEST

CANTEST Ltd. 3650 Wesbrook Mall, Vancouver, BC Canada V6S 2L2 Tel: 604 224 4331 Fax: 604 224 0540 www.cantest.com

Mt. Polley Mining Corporation, Mt. Polley, 29-Aug-08

S. No.	Sample ID	File Name	Sample Reference	Ref Total Sulphur	Ref Total Carbon	Ref Non-Carbonate Carbon	Sample Fraction	Total Sulphur	AP	Total Carbon	NP	NPR
1	83001	080819a	Boundary 1	0.28	0.78	0.00		1.78	55.63	0.88	73.00	1.31
2	83002		Boundary 2					0.25	7.88	1.23	102.50	13.02
3	83003		Boundary 3					0.36	11.16	0.82	68.42	6.13
4	83004		Boundary 4					0.71	22.03	1.05	87.50	3.97
5	83005		Boundary 5					1.17	36.56	0.80	66.67	1.82
6	83006		Boundary 6					1.28	40.00	1.04	86.67	2.17
7	83007		Boundary 7					0.24	7.34	1.06	88.33	12.03
8	83008		Boundary 8					0.69	21.56	1.41	117.50	5.45
9	83009		Boundary 9					1.04	32.50	0.94	78.25	2.41
10	83010		Boundary 10					0.61	19.16	1.40	116.67	6.09
11			Mill Head									
12			Mill Final Conc									
13			Mill Tails									

Sample #	Hole ID	From	To	Length	Type	Sample #	Cu %	Ag g/t	Au g/t	rocktype	Sample Number	Total Sulphu	AP	TotalCarbo	NP	NPR	ref TotalSu	ref TotalCar
1	ND-06-05	6.1	7.5	1.4	CORE	320198	0.01		0.00	MZ	469951	1.14	35.63	0.74	61.50	1.73	0.27	0.77
	ND-06-05	7.5	10.0	2.5	CORE	320199	0.01		0.00	MZ								
	ND-06-05	10.0	12.5	2.5	CORE	320200	0.02		0.00	MZ								
	ND-06-05	12.5	15.0	2.5	CORE	320201	0.05		0.00	MZ								
	ND-06-05	15.0	17.5	2.5	CORE	320202	0.04		0.00	MZ								
2	ND-06-06	17.5	20.0	2.5	CORE	320302	0.02		0.02	MZ	469952	0.20	6.16	1.25	104.17	16.92	0.27	0.77
	ND-06-06	20.0	20.8	0.8	CORE	320303	0.02		0.02	MZ								
	ND-06-06	20.8	22.5	1.7	CORE	320305	0.03		0.03	MZ								
	ND-06-06	22.5	25.0	2.5	CORE	320306	0.04		0.03	MZ								
	ND-06-06	25.0	27.5	2.5	CORE	320307	0.05		0.02	MZ								
	ND-06-06	27.5	30.0	2.5	CORE	320308	0.05		0.02	MZ								
3	ND-06-07	30.0	32.5	2.5	CORE	320380	0.04		0.02	MZ	469953	0.69	21.41	1.26	105.00	4.91	0.27	0.77
	ND-06-07	32.5	35.0	2.5	CORE	320381	0.04		0.02	MZ								
	ND-06-07	35.0	37.5	2.5	CORE	320382	0.04		0.02	MZ								
	ND-06-07	37.5	40.0	2.5	CORE	320384	0.04		0.00	MZ								
	ND-06-07	40.0	42.5	2.5	CORE	320385	0.04		0.00	MZ								
4	ND-06-08	22.5	25.0	2.5	CORE	320447	0.01		0.00	MZ	469954	1.21	37.81	0.86	72.00	1.90	0.27	0.77
	ND-06-08	25.0	27.5	2.5	CORE	320448	0.01		0.00	MZ								
	ND-06-08	27.5	30.0	2.5	CORE	320449	0.01		0.00	MZ								
	ND-06-08	30.0	32.5	2.5	CORE	320450	0.01		0.00	MZ								
	ND-06-08	32.5	35.0	2.5	CORE	320451	0.00		0.00	MZ								
5	ND-06-09	4.6	5.0	0.4	CORE	320534	0.02		0.00	MZ	469955	0.41	12.81	0.77	63.83	4.98	0.27	0.77
	ND-06-09	5.0	7.5	2.5	CORE	320535	0.03		0.00	MZ								
	ND-06-09	7.5	10.0	2.5	CORE	320536	0.01		0.00	MZ								
	ND-06-09	10.0	12.5	2.5	CORE	320537	0.01		0.00	MZ								
	ND-06-09	12.5	15.0	2.5	CORE	320538	0.01		0.00	MZ								
	ND-06-09	15.0	16.1	1.1	CORE	320540	0.01		0.00	MZ								
6	ND-06-10	5.0	7.5	2.5	CORE	320735	0.01		0.02	MZ	469956	0.51	15.97	0.97	80.42	5.04	0.27	0.77
	ND-06-10	7.5	10.0	2.5	CORE	320736	0.01		0.02	MZ								
	ND-06-10	10.0	12.5	2.5	CORE	320737	0.01		0.02	MZ								
	ND-06-10	12.5	15.0	2.5	CORE	320739	0.01		0.05	MZ								
	ND-06-10	15.0	17.5	2.5	CORE	320740	0.01		0.04	MZ								
7	ND-06-11	18.8	20.0	1.3	CORE	320855	0.01		0.01	AP	469957	0.03	0.78	0.60	50.17	64.21	0.27	0.77
	ND-06-11	20.0	22.5	2.5	CORE	320856	0.02		0.01	AP	469985	1.08	33.75	1.14	95.00	2.81	0.28	0.78
	ND-06-11	22.5	25.0	2.5	CORE	320857	0.02		0.00	AP								
8	ND-06-11	67.5	70.0	2.5	CORE	320880	0.05		0.03	MZ	469985	1.08	33.75	1.14	95.00	2.81	0.28	0.78
	ND-06-11	70.0	72.5	2.5	CORE	320881	0.06		0.03	MZ	469957	0.03	0.78	0.60	50.17	64.21	0.27	0.77
	ND-06-11	72.5	75.0	2.5	CORE	320882	0.05		0.03	MZ								
	ND-06-11	75.0	77.5	2.5	CORE	320883	0.05		0.03	MZ								
	ND-06-11	77.5	80.0	2.5	CORE	320885	0.04		0.04	MZ								
9	ND-06-14	45.0	47.5	2.5	CORE	215305	0.02		0.00	MZ	469958	0.30	9.31	0.82	67.92	7.29	0.27	0.77
	ND-06-14	47.5	50.0	2.5	CORE	215306	0.01		0.00	MZ								
	ND-06-14	50.0	52.5	2.5	CORE	215308	0.01		0.00	MZ								
	ND-06-14	52.5	54.5	2.0	CORE	215309	0.02		0.00	MZ								
	ND-06-14	54.5	55.0	0.5	CORE	215310	0.01		0.00	MZ								
10	ND-06-15	15.0	15.2	0.2	CORE	215401	0.02		0.02	MZ	469959	0.66	20.59	0.71	59.50	2.89	0.27	0.77
	ND-06-15	15.2	17.5	2.3	CORE	215402	0.02		0.01	MZ								
	ND-06-15	17.5	20.0	2.5	CORE	215403	0.01		0.01	MZ								
	ND-06-15	20.0	22.5	2.5	CORE	215405	0.01		0.01	MZ								
11	ND-06-16	45.0	47.5	2.5	CORE	265862	0.01		0.00	MZ	469960	0.05	1.44	0.75	62.83	43.71	0.27	0.77
	ND-06-16	47.5	50.0	2.5	CORE	265863	0.01		0.00	MZ								
	ND-06-16	50.0	52.5	2.5	CORE	265864	0.01		0.00	MZ								
	ND-06-16	52.5	55.0	2.5	CORE	265866	0.01		0.00	MZ								
	ND-06-16	55.0	57.5	2.5	CORE	265867	0.01		0.00	MZ								
12	ND-06-17	12.5	15.0	2.5	CORE	265988	0.02		0.00	MZ	469961	0.73	22.78	1.04	86.67	3.80	0.27	0.77
	ND-06-17	15.0	17.5	2.5	CORE	265989	0.03		0.01	MZ								
	ND-06-17	17.5	20.0	2.5	CORE	265990	0.03		0.00	MZ								
	ND-06-17	20.0	22.5	2.5	CORE	265991	0.03		0.02	MZ								
	ND-06-17	22.5	25.0	2.5	CORE	265993	0.03		0.02	MZ								
13	ND-06-18	15.0	17.5	2.5	CORE	400129	0.01		0.00	MZ	469962	0.19	5.88	0.97	80.92	13.77	0.27	0.77
	ND-06-18	17.5	20.0	2.5	CORE	400130	0.01		0.00	MZ								
	ND-06-18	20.0	22.5	2.5	CORE	400132	0.01		0.00	MZ								
	ND-06-18	22.5	25.0	2.5	CORE	400133	0.01		0.00	MZ								
	ND-06-18	25.0	27.5	2.5	CORE	400134	0.01		0.00	MZ								
14	ND-06-19	7.5	10.0	2.5	CORE	400251	0.01		0.01	MZ	469963	0.19	5.81	0.66	55.33	9.52	0.27	0.77
	ND-06-19	10.0	12.5	2.5	CORE	400252	0.01		0.01	MZ								
	ND-06-19	12.5	15.0	2.5	CORE	400254	0.01		0.00	MZ								
	ND-06-19	15.0	17.5	2.5	CORE	400255	0.00		0.00	MZ								
	ND-06-19	17.5	20.0	2.5	CORE	400256	0.00		0.00	MZ								

14 composite ABA waste samples, all within the preliminary BZ Zone Pit

'oan

Summary of Mining

Period	Period	Target Ore	Ore Mined	Marginal	NAG	PAG
1	2010Q3	2008	0	0	0	0
2	2010Q4	1825	0	0	0	0
3	2011Q1	1862	1974	81	4829	2
4	2011Q2	2002	2212	125	4492	0
5	2011Q3	2024	2302	115	3909	602
6	2011Q4	1902	2176	88	3483	999
7	2012Q1	1862	1937	122	3416	958
8	2012Q2	2002	2160	56	2650	1116
9	2012Q3	2024	2131	69	2078	728
10	2012Q4	1902	2095	61	1224	202
11	2013Q1	1862	2084	39	1386	102
12	2013Q2	2002	2181	79	1357	21
13	2013Q3	2024	2188	89	1207	97
14	2013Q4	1902	2018	13	1629	1
15	2014Q1	1862	1864	34	1719	0
16	2014Q2	2002	1381	82	1542	179
17	2014Q3	2024	1174	121	1954	249
18	2014Q4	1902	1318	121	892	1166
19	2015Q1	1862	845	42	290	580
20	2015Q2	2002	0	0	0	0
21	2015Q3	2024	0	0	0	0
22	2015Q4	1902	0	0	0	0
23	2016Q1	1862	0	0	0	0
24	2016Q2	2002	0	0	0	0
25	2016Q3	2024	0	0	0	0
Totals			32041	1336	38057	7003

1. Reclamation Cost Estimates

Mount Polley mine's current closure cost estimate is $4,388,900. The proposed expansion is estimated to increase the reclamation liability by $1,077,566 (as detailed in Table 6.1). In addition to this amount, a lump sum of $500,000 has been added to deal with potential long term water management, bringing the total amount of additional bonding to $1,577,566. This amounts for Site Preparation, Revegetation, and Material Haulage have been estimated utilizing MEMPR mines reclamation costing spreadsheet attached as Appendix O.

Table 6.1 Reclamation Liability Summary

Disturbance Components	Area (Ha)
Boundary and C2 Zone Pits	16.2
South Road	45.6
SERDS	124.3
Temporary West PAG Dump	36.3
Ditch	15
Total	**237.43**

Cost Components	Cost ($)
Site Preparation	256,539
Revegetation	403,631
Material Haulage	417,396
Water Quality Management	$500,000
Total	**1,577,566**

Approximately, 7,000,000 tonnes of PAG waste will be mined in the balance of our current mine life. This material will be temporarily stored in the West PAG stockpile until mining of the Springer pit is complete, thereafter, this PAG rock will be placed into the Springer pit below its flood line. Reclamation liability will be revaluated yearly and included in the Annual Reclamation Report. Costing will be based on the area disturbed from the previous year including the amount of PAG mined and temporarily stored in the West PAG Dump. For example if the site disturbed is the full **237.43** hectares in one given year, then bond amount would increase by $1,077,566 dollars, and assuming that only a quarter of the 7 million tonnes of PAG was mined and stored on surface, then the bond would increase by say $0.875 million based on based on a re-handling cost of $0.50 per tonne. *(0.25 x 7,000,000t = 1,750,000t of PAG x $0.50/t for re-handling = $875,000)*

Metcalfe, Megan MEM:EX

From: Ron Martel <rmartel@mountpolley.com>
Sent: Thursday, May 12, 2011 3:11 PM
To: Demchuk, Tania MEM:EX
Cc: Art Frye; Tim Fisch
Subject: FW: Permit Amendment: 5 questions

Hi Tania...nice work **my comments in RED**

I have come up with a couple of more questions/clarifications for the permit amendment application. If you send a response or give me a shout so we can discuss these that would be appreciated.

- In reviewing the volumes of waste rock I see that the predicted volume of PAG (from page 43) is approximately 7 Mt from the C2 and Springer pits combined (page 43). The capacity of the temporary PAG stockpile is 9.7 Mt (page 59). I have 2 questions:
  a. Does the storage capacity of 9.7 Mt exclude the 2 Mt of non-PAG required for the base of the dump? **YES**
  b. On page 59 I see that the PAG dump is estimated to be 12.7 Mt. Can you please clarify the volume of PAG waste rock and size of the temporary PAG stockpile?
     The 12.7 Mt estimate was given to SRK for the purposes of predicting water quality, we elected to be on the conservative side.

- My understanding is that any PAG waste rock that is found in the Boundary pit will be moved to the Wight pit for permanent subaqueous storage. Has the Wight pit already started to flood? If so, can PAG be safely deposited into the Pit? If the pit is not currently flooded, how long until it floods(i.e. how long would any PAG waste rock be exposed in the pit)? As discussed, I have reviewed the ABA data that was sent for the Boundary pit area. It appears that at least some PAG waste rock may be encountered during mining of this area so it will be important to maintain the procedures outlined for ABA sampling and ML/ARD material monitoring, characterization and management.

  I concur, when mining the Boundary zone pit and if monitoring shows that PAG is encountered, the material will be safely disposed in a permanent manner below an approved open pit below the anticipated flood elevation after closure or in the anticipated permitted temporary PAG stockpile. As of right now, the Wight Pit is not flooded as water from this pit is being transferred out, and so material can be safely deposited here; the same flooding timeline as already approved for the Wight Pit PAG storage remains.

- At the bottom of page 54 in section 5.2.2 (NAG Waste) is the statement "Waste from the Boundary zone pit will be stored adjacent to the pit". My understanding is that there will be approximately 6 Mt of waste rock from this pit. If there is PAG from the Boundary zone (it appears there may be some based on the data you sent me), it will go into the Wight pit. Where will the NAG waste rock be stored?

  The Boundary NAG will be used to buttress the west high wall of the Wight Pit and to shape the local topography.

- I have noticed that the ABA sampling procedure introduces a change in how PAG rock will be identified in the pits. Why is this change being introduced? And, how will this change to procedures be communicated to the operators to avoid any confusion about where waste rock is to be deposited?

The change from the traditional composite sampling program (irrespective of the total tonnage) to a more defined individual sampling allows for a more accurate classification of the mined material. NAG and PAG classifications are now based on single samples, rather than on composite (i.e. four 10,000t defined areas rather than one 40,000 "blended" classification). As with all of our procedures, once instituted, operators to which the procedure applies are trained accordingly.

- Is there a low grade ore stockpile on site?

  Yes, confined in a strategic location near crusher.

I look forward to hearing from you.

Ron Martel CCEP. CET
Mount Polley Mining Corporation
Environmental Superintendent
P.O. Box 12
Likely BC
V0L 1N0
rmartel@mountpolley.com
250 790 2215 X 409

From: Demchuk, Tania MEM:EX [mailto:Tania.Demchuk@gov.bc.ca]
Sent: Thursday, May 12, 2011 11:54 AM
To: Ron Martel
Cc: Howe, Diane J MEM:EX
Subject: Permit Amendment: 5 questions

Hi Ron,

I have come up with a couple of more questions/clarifications for the permit amendment application. If you send a response or give me a shout so we can discuss these that would be appreciated.

- In reviewing the volumes of waste rock I see that the predicted volume of PAG (from page 43) is approximately 7 Mt from the C2 and Springer pits combined (page 43). The capacity of the temporary PAG stockpile is 9.7 Mt (page 59). I have 2 questions:
  a. Does the storage capacity of 9.7 Mt exclude the 2 Mt of non-PAG required for the base of the dump?
  b. On page 59 I see that the PAG dump is estimated to be 12.7 Mt. Can you please clarify the volume of PAG waste rock and size of the temporary PAG stockpile?

- My understanding is that any PAG waste rock that is found in the Boundary pit will be moved to the Wight pit for permanent subaqueous storage. Has the Wight pit already started to flood? If so, can PAG be safely deposited into the Pit? If the pit is not currently flooded, how long until it floods(i.e. how long would any PAG waste rock be exposed in the pit)? As discussed, I have reviewed the ABA data that was sent for the Boundary pit area. It appears that at least some PAG waste rock may be encountered during mining of this area so it will be important to maintain the procedures outlined for ABA sampling and ML/ARD material monitoring, characterization and management.

- At the bottom of page 54 in section 5.2.2 (NAG Waste) is the statement "Waste from the Boundary zone pit will be stored adjacent to the pit". My understanding is that there will be approximately 6 Mt of waste rock from this pit. If there is PAG from the Boundary zone (it appears there may be some based on the data you sent me), it will go into the Wight pit. Where will the NAG waste rock be stored?

- I have noticed that the ABA sampling procedure introduces a change in how PAG rock will be identified in the pits. Why is this change being introduced? And, how will this change to procedures be communicated to the operators to avoid any confusion about where waste rock is to be deposited?

- Is there a low grade ore stockpile on site?

I look forward to hearing from you.

Tania

Tania Demchuk, MSc
Environmental Geoscientist,
BC Ministry of Energy and Mines
P.O. Box 9320, Stn Prov Gov't, Victoria BC V8W 9N3
Phone: (250) 952-0417 Fax: (250) 952-0481

March 28, 2013

REPORT ON

A Review of the Proposed Northwest Dump and the Tailings Road, Mount Polley Mine, Likely, BC

Submitted to:
Mount Polley Mine
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V0L 1N0

Attention: Ryan Brown

REPORT

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