IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT

REPORT ON GEOTECHNICAL INVESTIGATIONS AND DESIGN OF OPEN PITS AND WASTE DUMPS
(REF. NO. 1628/1)

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Suite 1400
750 West Pender Street
Vancouver, British Columbia
Canada V6C 2T8
Telephone (604) 685-0543
Telefax (604) 685-0147
CIS: 72360,477

Knight Piésold Ltd.
CONSULTING ENGINEERS

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IMPERIAL METALS CORPORATION

MT. POLLEY PROJECT

REPORT ON GEOTECHNICAL INVESTIGATIONS AND DESIGN OF OPEN PITS AND WASTE DUMPS

TABLE OF CONTENTS

TABLES

FIGURES

DRAWINGS

1628.100	Overall Site Plan Geotechnical Investigations Programs
1628.101	Geologic Plan of Open Pit Area
1625.230	Drainage Plan - Mine Site

APPENDICES

Appendix A	Review of Open Pit design by C.O. Brawner, P.Eng.
Appendix B	Drill hole data and point load test results
Appendix C	Test pit logs - 1995

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT

REPORT ON GEOTECHNICAL INVESTIGATIONS AND DESIGN OF OPEN PIT AND WASTE DUMPS

SECTION 1.0 - INTRODUCTION

1.1 GENERAL OVERVIEW

The Mt. Polley Project is located in central British Columbia approximately 56 kilometres north-east of Williams Lake, as shown on Figure 1.1. The nearest settlement is the community of Likely, which is located on the northern tip of Quesnel Lake.

The project derives its name from Mt. Polley, a low mountain with a peak elevation of 1260 metres, approximately 300 metres above the surrounding terrain. Mt. Polley is situated between Polley Lake to the east, and Bootjack Lake to the south-west. The site is accessible by paved road from Williams Lake to Morehead Lake, near Likely, and then by gravel forestry road for the final 10 kilometres to the site.

The project involves open pit mining of an estimated 82.3 million tonnes of copper and gold ore contained in three adjacent orebodies, at a nominal rate of 17,800 tonnes per day. Approximately 92.6 million tonnes of waste rock will be stored in waste rock dumps adjacent to the open pit.

After processing of the ore to produce a copper/gold concentrate, the tailings will be discharged as a slurry into a tailings storage facility designed to provide environmentally secure storage of the solids waste, with collection and recycling of all process solutions. No discharge of process solutions from the site is required.

This report is an updated version of the 1990 Knight Piésold report "Geotechnical Investigations and Design of Open Pit, Waste Dumps and Tailings Storage Facility" prepared for Imperial Metals Corporation. Details related to the tailings storage facility have been omitted. New information concerning modified waste rock dump sites, geotechnical investigations throughout the site, project water management plans, proposed reclamation program, pit bench design, and proposed pit dewatering plans have been incorporated in this report. All new or revised information has been derived from the following documents by Knight Piésold Ltd:

- March 1995 "Report on Geotechnical Investigations for Mill Site and Tailings Storage Facility" (Ref. No. 1623/1).
- February 1995 "Report on Project Water Management" (Ref. No. 1624/1).
- March 1996 "Hallam Knight Piésold Reclamation Plan Report"
- June 1996 "Groundwater Monitoring Program" (Ref. No. 1624/2).

1.2 SCOPE OF REPORT AND ACKNOWLEDGEMENTS

This report summarizes the design for the open pit and waste dumps with a brief discussion on the project water management plans. It is based on the results of field investigations and laboratory testwork. Specific design items which are addressed in the report are:

- Site characteristics including hydrometeorology, regional geology and seismicity.
- The results of geotechnical investigations carried out in the open pit and waste dump areas.
- Assessment of open pit geology, rock mass characteristics, hydrogeology, and dewatering requirements.

- New layout of the waste rock dumps and an assessment of the hydrogeologic impacts.

- Water management plans.

These items are discussed in the following sections of the report and are intended to provide input towards a Work Systems Approval.

All field geotechnical work was carried out under the direction of Knight Piésold Ltd. personnel with active involvement of Imperial Metals Corporation field personnel.

A comprehensive review of geotechnical data pertaining to the open pit design was carried out by Mr. C.O. Brawner, P. Eng. Results of this review with recommendations for open pit slope design are summarized in Section 4.0 of the 1990 Knight Piésold "Report on Geotechnical Investigations and Design of Open Pit, Waste Dumps and Tailings Storage Facility, Ref. No. 1621/1", and are included in this report as Appendix A.

SECTION 2.0 - SITE CHARACTERISTICS

2.1 HYDROMETEOROLOGY

Long and short term climate records are available for a number of locations in the area, as shown on Figure 2.1. Two recently established stations (Likely with 12 years of record and Horsefly with 17 years) are located within 40 km of the site in similar terrain. The project area is subjected to a relatively temperate climate with warm summers and cool winters. The precipitation is well distributed throughout the year.

Detailed climatological summaries from 1984 to 1990 for weather stations from within the project area are included in Appendix A of the 1990 Knight Piésold report, Ref. No. 1621/1. Site specific data collected from July 1995 to January 1996 is available in the 1996 Hallam Knight Piésold "Reclamation Plan" report.

The mean annual temperature at Likely, the nearest station to the site, is 4.0°C with an extreme maximum of 33.9°C and an extreme minimum of -37°C. At Quesnel, with approximately 76 years of record, extremes are 40.6°C and -46.7°C. Frost free days in the area range from 199 at Horsefly Lake (elevation 788 m) to 244 at Barkerville (elevation 1244 m).

A preliminary estimate of the total annual and monthly distribution of precipitation for the site has been made using data from a number of stations in the area. The mean annual precipitation at Likely is 699.7 mm and at Barkerville (with over 76 years of record) is 1043.9 mm. Precipitation for the site can be expected to fall within this range. The 1996 Knight Piésold "Groundwater Monitoring Program" report gives a mean annual site precipitation of 755mm. Data for Likely, Barkerville and the site are presented in Table 2.1.

Short term storm intensity, duration, and return period curves have been plotted using data obtained from the rainfall frequency atlas for Canada, and are shown on Figure 2.2. Probable maximum precipitation for the site has also been calculated from data contained in this atlas and is shown on Table 2.2.

Evaporation data and estimated evaporation for the site have been computed using potential evapotranspiration by AES using the Thornwaite model and available data for Quesnel and Williams Lake. This data is shown in Table 2.3. Canadian Climate Normals, Volume 9 contains lake evaporation data for Mica Creek and Blue River which are at similar latitude to the mine site but are judged to be too distant to be relevant.

2.2 REGIONAL GEOLOGY

The Mt. Polley site is located in an alkalic intrusive complex in the Quesnel Trough, a 35 km wide north-west trending volcanic sedimentary belt.

The rock units are segmented into blocks by several faults, including an inferred north-westerly trending normal fault which extends along Polley Lake. The predominant structural orientation of the region is north-west trending and dipping steeply to the north-east. Localized geology in the vicinity of the open pit is shown on Drawing 1628.101.

The topography is generally subdued and has been glaciated. Surficial deposits of well graded, dense glacial till material are common throughout the region and are typically present in greater thicknesses in topographic lows. Bedrock exposures are common at high elevations.

2.3 SEISMICITY

The Mt. Polley site is situated within an area of very low seismic activity. A seismic risk calculation based on a Cornell type probabilistic model has been developed by the Pacific Geoscience Centre. The results for the Mt. Polley site are included as Table 2.4 and are summarized as follows:

Return Period (yrs)	Probability of Exceedence in 50 years (%)	Peak Ground Acceleration (g)	Peak Ground Velocity (m/s)
100	40	.021	.043
475	10	.037	.077
1000	5	.046	.094

The project is located in a NBCC Acceleration Zone 0, and Velocity Zone 1 for structural design requirements.

SECTION 3.0 - GEOTECHNICAL INVESTIGATIONS AND TESTING

3.1 GENERAL

Geotechnical investigations have been carried out to provide design criteria for the proposed open pit and waste dumps facilities. Investigative work consisted of field mapping, test pit excavations, installation of ground water monitoring wells, and diamond drilling with permeability testing. The following provides a summary of the investigation work:

- 1989 - A diamond drilling program and hydrogeologic investigation was conducted by Imperial Metals Corporation, in conjunction with exploration drilling. A total of thirty-nine geotechnical drill holes, including three holes with oriented drill core, were completed in the open pit areas, as shown on Figure 3.1. Details from the oriented drill holes are included as Appendix B. Nine groundwater monitoring wells were also completed, as shown on Figure 3.1.

- 1995 - A geotechnical investigation program consisting of thirty-nine test pits was completed by Knight Piésold throughout the project area. Test pit logs are included as Appendix C. Seven groundwater monitoring wells were completed in the vicinity of the open pits and mill site.

Evaluation of site conditions and geotechnical design criteria were based on the following:

(i) Open Pit

- Detailed logging of rock mass discontinuity data in oriented drill core from angled drill holes, and non-oriented drill core from vertical exploration holes (1989).

- Selected laboratory testing of fault gouge material (1990).

- Permeability testing in vertical drill holes (1989)
- Installation of three pneumatic and standpipe piezometers (1989), and installation of groundwater wells monitoring flow from the pit to Bootjack Lake (1995).

(ii) Waste Dumps

- Laboratory studies on the acid generation potential of waste rock (1990).
- Condemnation drilling in the vicinity of the proposed waste dumps (1989).
- Groundwater well monitoring flow from the south-east dump to Polley Lake (1995).

3.2 OPEN PIT

3.2.1 General Description

The open pit will consist of three interconnecting pits, namely the Central, North and West Pits as shown on Drawing 1625.230. The Central and North Pits will extend approximately 1,100m in a north-south direction and the Central and West pits approximately 1,100m in an east-west direction. The total area of the open pits at the conclusion of the operation will be approximately 70 ha. Mining is scheduled to commence in the Central Pit. Development of the North and West Pits will follow.

3.2.2 Geotechnical Drilling

The exploration program conducted by Imperial Metals Corporation in 1989 was expanded to provide additional information on the rock structure within the proposed open pit areas. Geotechnical drill logs were developed in addition to the geologic logs for 39 drill holes. The drill hole locations are shown on Figure 3.1. The following parameters were routinely recorded:

- RQD (rock quality designation)
- Discontinuity spacing and description of surface conditions
- Discontinuity orientation with respect to the core axis
- Discontinuity infilling materials
- Point load test results

Three inclined geotechnical drill holes, MP89-152, MP89-153 and MP89-154 were drilled in 1989 to provide true orientation of the rock discontinuities.

Stereonet plots of the joint and fracture orientations measured in each of the three inclined holes have been developed by the Schmidt contouring method and are presented in Figures 3.2, 3.3 and 3.4. A combined plot of all discontinuity data is included in Figure 3.5. A summary of rock types, RQD, fracture index and unconfined compressive strength data for the three inclined geotechnical drill holes is included as Appendix B.

The predominant rock types encountered were intrusion breccia, syenodiorite and monzonite, with minor occurrence of mafic dykes. Several fracture zones were identified and occasional clayey to sandy zones of fault gouge were encountered in the drill core. Two samples of fault gouge were analyzed in the laboratory as follows:

Drill Hole	MP89-143	MP89-152
Depth	38 m (125 ft)	90 m (245 ft)
Gradation		
Gravel	6 percent	7 percent
Sand	28 percent	16 percent
Silt	46 percent	23 percent
Clay	20 percent	54 percent
Atterberg Limits		
L.L.	57 percent	86 percent
P.L.	26 percent	36 percent
P.I.	31 percent	50 percent
Pocket Penetrometer	disturbed	4.5 tons/ft^2
Natural Moisture Content	23.5 percent	26.5 percent

In general, the rock mass quality comprising the proposed open pit walls was found to have variable conditions, ranging from strong and fresh to weak and altered rock. The uniaxial compressive strength of intact core samples ranged from very high (>200 MPa) to very low (<5 Mpa). Zones of very weak and highly altered rock were identified at localized intervals in most drill holes. Highly fractured zones up to 100 metres in thickness were encountered in several drill holes. Zones of increased fracturing, more intense alteration and lower rock mass quality are recognized to be generally associated with large scale structural features such as faults and contacts between the intrusive geologic units.

Discontinuities in the rock mass generally reflect the regional structural trend, as the dominant joint set was observed to strike 170 degrees and dip 75 degrees to the north-east. A secondary joint set was found to be approximately orthogonal to the main set, striking 30 degrees and dipping 20 degrees to the north-west. Discontinuities observed in the core were generally rough, and contained calcite and chlorite cementation. However, smooth, polished and slickensided joints were also identified. It should be noted that these orientations are based on the results of oriented core from three drill holes. Information on rock mass structure from the other cored drill holes supports these general orientations, however a more comprehensive model of the rock mass structure will be established with the initial development of the open pit.

3.2.3 Permeability Testing

Permeability testing was completed in five vertical exploration holes in 1989 as shown on Figure 3.1. The test apparatus consisted of an NQ double packer wireline system with a flow meter and pressure gauge for accurate monitoring of test conditions.

The test results are included in Table 3.1. In general, the measured rock formation permeabilities were less than about 1 x 10^{-5} cm/s, but occasional higher permeability zones (approximately 10^{-4} cm/s to 10^{-3} cm/s) were encountered, often associated with zones of intensely fractured bedrock. The geometric mean of all the permeability tests is 8.4 x 10^{-6} cm/s.

3.2.4 Groundwater Monitoring

Groundwater instrumentation installed in 1989 in the open pit area included three 40 mm diameter standpipe piezometers for water level measurement and groundwater sampling. These wells are still operational. Two multiple port pneumatic piezometers were installed for measurement of water levels and hydraulic gradients, but their status is unknown. Water level measurements were also obtained in open drill holes at the site. In August 1995, three groundwater monitoring wells were installed in the vicinity of Bootjack Lake to monitor the groundwater flow from the open pit and the mill site. An additional monitoring well was installed to monitor the groundwater flow from the east waste dump to Polley Lake. These are discussed in the 1996 Knight Piésold groundwater monitoring report, Ref.

No. 1624/2. This report reviews past well monitoring programs and presents the results of the 1995 wells. It serves as a compilation of the current understanding of the site's hydrogeological conditions and the anticipated impacts that will result from the project development.

In general, groundwater levels around the project area were measured at depths in the order of 30 metres at higher elevations, and 3 to 10 metres at lower elevations, as summarised in Table 3.2. Hydraulic gradients measured in the multiple port installations appeared to be approximately hydrostatic, however, temporary artesian flows were encountered in a few holes during drilling.

3.2.5 Pit Dewatering

Water inflow into the open pits results from groundwater seepage and surface runoff. While groundwater seepage is assumed to be relatively constant over the life of the mine, surface water inflows can be more variable depending on open pit area, precipitation levels and surface water diversions surrounding the pit perimeters. Groundwater flow is difficult to predict accurately, but experience at other mines suggests that the inflow will be in the order of 0.005 m^3/s to 0.025 m^3/s. These rates may be temporarily higher if permeable fracture systems are intersected, but short term dewatering of these fracture zones should occur.

Surface water inflow due to direct precipitation will vary according to rainfall intensity, and is expected to average about 0.01 m^3/s to 0.02 m^3/s on an average annual basis depending on the undiverted catchment area of the pit(s). These values are based on an average annual precipitation of 755 mm/yr (as discussed in Section 2.1), a runoff coefficient of 75% and initial and final pit areas of 41 ha and 90 ha respectively.

Water accumulating in the pit bottom will be transferred to an in-pit sump located on the East side of the Central Pit, about 60 metres above the ultimate base. From there, it will be pumped to the mill for use as process water or discharged into the tailings basin. However, during storm events considerable water will accumulate in the pit bottom where it will be temporarily stored in a bottom sump until it is transferred to the higher sump. Pumping requirements will be determined during initial operations and the pumping capacity will be selected to accommodate increased pumping requirements during and after storm events.

If additional water storage capacity is required, a separate external pit sump may be installed during later mine operations.

Perimeter dewatering wells, and/or horizontal drains may be installed in and around the pits to draw down groundwater levels should it be necessary to control seepage and enhance pit slope stability. These requirements will be progressively determined during mine development.

In the later years of mine operation, the Central Pit may be used for waste rock disposal while the West Pit is mined. Groundwater and surface runoff could then accumulate in the Central Pit and may result in increased lateral seepage rates into the West and North Pits. The West Pit is about 50 metres deeper than the Central Pit and seepage would occur through a bench approximately 150 m high which separates the two pits. The permeability of the bedrock throughout the pit area has been determined to be less than approximately 1 x 10^{-5} cm/s, but may range from 1 x 10^{-4} cm/s to 1 x 10^{-3} cm/s in zones of fractured bedrock (natural geologic fracture zones and/or blast damaged zones). There are three geologic contacts in the vicinity of the bench which have been identified as zones of weak and highly altered rock. These discontinuities could serve as relatively high permeability seepage paths into the West Pit and will be evaluated during initial and ongoing pit development.

The North and Central Pits are separated by a larger bench, approximately 100 m high. Both pits are of the same depth. A north-south trending fault has been found which cuts the west side of the bench and could be a zone of high permeability which will be evaluated during future pit development. It is unlikely that seepage from the Central to North Pits will be a significant consideration due to long seepage path lengths and low seepage gradients.

3.3 WASTE DUMPS

3.3.1 Waste Characterisation

A detailed program of acid/base accounting was completed in 1989 and 1990 on potential waste rock materials from the open pit. This program involved the collection of random samples of drill core and subsequent analyses for:

- total sulphur
- neutralization potential
- total acid generation potential (calculated on the basis of total sulphur)

These tests were carried out by Envirochem Services Ltd. and Coastech Research, both of North Vancouver, B.C. The results of the waste characterization tests for the 94 samples tested are included in Appendix C of the 1990 Knight Piésold report, Ref. No. 1621/1. The testwork indicates that the waste rock will not be acid generating. ARD tests are discussed extensively in the 1996 Hallam Knight Piésold "Reclamation Plan Report".

3.3.2 Surficial Materials

The revised waste dump sites are shown on Drawing No. 1625.230. In general, the sites are characterized by gently undulating topography. The Central pit may be used for waste rock disposal when development of the west pit proceeds during the later stages of operation.

The North dump is situated on a relatively flat area with bedrock knobs and ridges. Colluvium, glacial till and forest litter were encountered along the flat area to a maximum thickness of approximately 20 metres. The North dump has a capacity for 16 million tonnes and will likely be used during the mining of the North Pit later on in the mine life.

The South-East dump is situated along the crest of a broad ridge. The topography is relatively flat and undulating. A veneer of colluvium, glacial till and forest litter is present over most of the area. Bedrock was encountered in drill holes at depths ranging from approximately 3 to 7.6 metres.

Groundwater in the vicinity of the waste dumps is generally shallow with flow directions governed by the surface topography.

SECTION 4.0 - OPEN PIT SLOPE DESIGN

4.1 GENERAL

This section provides a revised summary of Section 4.0 of the 1990 Knight Piésold "Report on Geotechnical Investigations and Design of Open Pit, Waste Dumps and Tailings Storage Facility" authored by Mr. C.O. Brawner. A proposed blasting program and details of anticipated groundwater inflow and pumping requirements can be found in the original report, which is included as Appendix A.

4.2 FACTORS WHICH INFLUENCE PIT SLOPE STABILITY AND SLOPE ANGLE

Factors which influence rock slope stability of open pit mines include geologic structure, groundwater conditions and dynamic acceleration forces generated during blasting.

The potential for pit slope instability is generally related to the presence of adversely oriented geologic discontinuities in the pit slopes. Typical slope failure mechanisms include circular, planar, block, wedge, and toppling modes as shown in Figure 4.1.

The presence of groundwater in the pit slopes influences stability by reducing rock mass shear strength due to reduced effective stress, creating seepage forces towards the pit slopes, creating hydrostatic forces in tension cracks, and increasing hydrodynamic shock due to blasting below the water table. Consequently, it is important that low water levels and groundwater pressures be maintained in the pit slopes. The most effective way to develop this control is with the installation of horizontal drains. Drainage requirements can most effectively be determined during initial development of the open pit by inspection of bench faces for seepage, and through the drilling of exploratory drain holes.

Dynamic acceleration forces due to blasting must be reduced at the final pit face to allow the steepest practical slopes to be developed, thereby minimizing the waste to ore ratio. This requires controlled blasting techniques to maintain the design pit slope angles.

Slope movements, reflecting instability of the pit slopes, are typically indicated by the development of tension cracks along the pit or bench crests. Periodic inspections along the pit crest and bench locations will identify areas which may require further scaling and/or monitoring.

4.3 STRUCTURAL GEOLOGY

Three inclined boreholes, MP89-152 to MP89-154 were drilled using the clay imprint procedure to orient the rock mass structure. Stereographic plots are shown in Figures 3.2 to 3.5. The overall plots indicate a predominant joint set with an average strike of 170 degrees and an average dip of 75 degrees east. A secondary joint set was revealed striking on average 30 degrees and dipping 20 degrees north west. These geologic structures are the features which will influence slope stability throughout the pit walls, and potentially lead to certain types of instability in each pit face depending on the face orientation. The pit slope design must accommodate these potential failure mechanisms.

Generally, the rock strength is moderate to high so that stability will be controlled by the geologic structures. In addition to the joint sets described above, several localized zones featuring very closely spaced fractures, development of clayey gouge material and low compressive strength were noted. These localized zones may require additional design requirements, such as reduction of bench face angles, or installation of steel mesh and/or shotcrete to control bench face stability, which will be evaluated during development of the pit.

Details of the rock mass discontinuity data (R.Q.D. and joint frequency), together with unconfined compressive strength data, are provided in Appendix B.

4.4 EVALUATION AND CONTROL OF GROUNDWATER

The groundwater table is generally close to the ground surface, ranging from 30 metres depth in topographically higher areas, to 3 metres depth in lower elevations around the project area. In some cases, artesian conditions were encountered in exploration drill holes. Drainage measures will be developed in the pit allowing for pit walls to be excavated at the steepest slopes possible and to prevent potential bottom heaving of the pit floor. Drainage measures to control seepage into the pit and improve stability of the pit walls will include the installation of horizontal drain holes, as determined from observed conditions in the initial pit development.

4.5 PIT SLOPE AND BENCH DESIGN

Design of initial pit slopes is based on a relatively steep bench face of 70 degrees, with inter-ramp slope angles of 52 degrees, shown as Design I in Figure 4.2. This design is based on the available structural information, and assumes drained conditions in the pit slopes. Where favourable interaction of rock mass structure and pit wall geometry are revealed during initial pit development, Design II will be utilized to optimize pit slope angles. These two pit slope designs are included to accommodate the different combinations of geologic conditions and pit slope orientations. A summary of the proposed design geometry for pit slopes is presented in Table 4.1. It should be highlighted that pit slope design will be modified based on updated geology and on additional geotechnical information obtained during early pit development.

For final pit design, controlled blasting will be used to develop the relatively steep bench face angles. Bench faces will be scaled to reduce ravelling and reduce width requirements for catch berms. The most recent pit design was completed using Mintec's MEDSYSTEM software.

SECTION 5.0 - WASTE DUMP LAYOUTS

5.1 WASTE DUMP LOCATIONS AND CONSTRUCTION

Waste dump sites are shown on Drawing No. 1625.230. Selection of waste dump sites has included consideration of environmental and economic factors, in addition to optimization of waste rock haulage.

The waste dumps are generally situated on relatively flat topography and will be underlain by glacial till and bedrock. Sufficient quantities of suitable topsoil and glacial till will be stripped and stockpiled for reclamation of the dumps. The ultimate waste dumps, as shown on Drawing No. 1625.230 include final reclaimed slopes of 2h:1v. During operations, the waste rock will be placed in individual benches as required to control surface erosion.

Drainage ditches will be used to control surface runoff from the North and South-East waste dumps. The dumps will be graded to direct runoff from the tops of the dumps into the open pit areas. The ditches will collect runoff from the dump slopes and will transfer the water to sediment control ponds as shown on Drawing No. 1625.230. The water will then be discharged into the tailings basin. There will be three main perimeter drainage ditches, as follows:

- The first drainage ditch will run north to south along the eastern end of the South East waste dump.

- The second drainage ditch will run west to east along the southern end of the final limit of the South-East dump.

- The third drainage ditch will run south between the South-East waste dump and the mill site. It is then directed east and will connect to the first drainage ditch. This ditch will cut across the southern end of the South-East waste dump, to be used later in the mine life. As the dump advances, the ditch will be converted to a rock drain so that drainage can continue as the dump is developed. It is anticipated that natural segregation of coarser material will occur during waste rock placement. The coarser material will fall to the base of the advancing dump and the ditch will be filled with durable, coarse material. In the event that coarse, durable material is not available to fill the ditch, suitable material will be selected and placed in the ditch prior to covering it with the waste dump. This requirement will be evaluated as the waste dump develops.

Existing groundwater levels at the waste dump sites have been observed to be within a few metres of the ground surface, with a phreatic surface similar to the general topographical features. Due to the segregation of waste rock during placement, coarser particles will collect along the base of the dump providing free draining conditions within the waste dump materials.

5.2 STABILITY ANALYSES

Stability analyses of the waste dump have been carried out for a range of natural ground conditions and maximum dump height. A typical stability analysis is shown on Figure 5.1.

Strength parameters for the rockfill have been assumed from published information on the shear strength of rockfill by Leps (1970), and recommended values from the US Forest Service Intermountaine Region, Dump Stability Performance Objectives and Evaluation Criteria. These are summarized in Figure 5.2. Strength parameters for the foundation material are based on an in-situ layer of till, as stripping of topsoil and organic debris will be implemented.

The stability analyses were carried out for base translational failure along the waste rock/foundation contact using a non-circular analysis. The analyses were completed for the final reclaimed slopes of 2h:1v, using a maximum dump elevation of 1170 metres, as shown in Figure 5.1. The calculations take into account the maximum natural slope of the terrain in the waste dump area which does not exceed 38°. Previous stability analyses, outlined in the 1990 "Report on Geotechnical Investigations and Design of Open Pit, Waste Dumps and Tailings Storage Facility" (ref 1621/1) indicated that for the final reclaimed dump slopes, a minimum factor of safety of 1.3 can be achieved for all terrain on site, regardless if topsoil is stripped.

However, topsoil stripping will be implemented in the waste dump locations, creating a factor of safety against failure greater than 1.5 on all terrain, as indicated in Figure 5.3. The topsoil will be used for reclamation, as discussed below.

5.3 RECLAMATION

Areas designated for waste rock storage will be logged, grubbed and cleared prior to mining. Topsoil, overburden and coarse woody debris will be removed and stockpiled. These materials will be removed in a staged manner so that material removed from each succeeding raise is replaced on the previously completed raise. This leapfrog pattern will reduce the need for large soil stockpiles, will minimize haul costs, and will accelerate the recolonization of reclaimed areas by native materials from soil seed banks, bud banks, and rooted offsets. Most importantly, reclamation of completed raises of the waste dumps will commence almost immediately instead of being deferred until the end of mining.

Waste rock dumps will be constructed by end dumping, re-contoured to an ultimate slope of 2h:1v, covered with a layer of overburden/topsoil and re-vegetated. Individual dumps will not exceed 50 m in height. The top surfaces of the stockpiles will drain toward the open pits, but will be designed to have ridges and depressions, to blend in with the surrounding topography and to create habitat diversity. The final surfaces will be covered with a layer of overburden and topsoil, then re-vegetated. Final reclamation of the waste dumps will involve spreading of topsoil and glacial till and seeding or planting as required.

For further discussion on proposed reclamation plans, refer to the 1996 Hallam Knight Piésold "Reclamation Plan Report".

SECTION 6.0 - WATER MANAGEMENT PLAN

An overview of all water associated with the Mt. Polley Project is provided in the 1995 Knight Piésold "Report on Project Water Management". An overall project water balance was completed by integrating the water balances for the mine site, including the open pits, waste dumps and mill site with the tailings facility and the undisturbed catchment areas immediately upgradient from it. The @RISK Analysis and Modelling program was used to describe the effects of the statistical nature of precipitation over the entire life of the project.

The report demonstrated that the tailings facility and open pit can and will be operated so that no surface discharge of excess water will be required and that make-up water requirements from Polley Lake will be minimized by addition and use of surface runoff from waste dumps and undisturbed catchment areas. Included in the report is the most recent hydrometeorological information obtained, including precipitation, snowmelt, evaporation and runoff. The report discusses assumptions made and presents conclusions and recommendations concerning make-up water supply and the project water management plan.

SECTION 7.0 - REFERENCES

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TABLE 2.1

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT

MEAN MONTHLY AND ANNUAL PRECIPITATION

Location:	Likely, B.C.		Mine Site		Barkerville	
Elevation:	724 m		1000 m		1265	
Location:	52° 36'N 121° 32'W		52° 30'N 121° 35'W		53° 4'N 121° 31'W	
	Mean (mm)	Std. Dev. (mm)	Mean (mm)	Std. Dev. (mm)	Mean (mm)	Std. Dev. (mm)
Jan	74.2	27.0	75.5	27.0	103.0	44.4
Feb	60.2	27.7	58.1	27.7	85.6	42.5
Mar	37.8	13.5	44.5	13.5	85.3	29.1
Apr	42.2	20.9	43.1	20.9	61.8	24.5
May	36.6	15.4	50.6	15.4	65.9	28.9
June	66.3	29.7	81.5	29.7	89.2	28.8
July	47.0	27.4	65.7	27.4	81.7	31.0
Aug	82.0	35.7	83.1	35.7	102.3	53.0
Sept	50.4	27.1	60.4	27.1	85.4	39.9
Oct	61.6	42.3	60.4	42.3	88.4	37.4
Nov	58.4	18.8	57.3	18.8	86.6	28.2
Dec	83.0	36.9	74.8	36.9	108.7	42.5
Annual	699.7	116.4	755	116.4	1043.9	112.7

Source :

Canadian Climate Normals, 1951-1980, Temperature and Precipitation Atmospheric Environment Service, Environment Canada.

TABLE 2.2

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT

PROBABLE MAXIMUM PRECIPITATION

1 hour PMP = 78 mm = 78 mm/hour
6 hour PMP = 88 mm = 14.6 mm/hour
24 hour PMP = 163.3 mm = 6.8 mm/hour

Source :

Rainfall Frequency Atlas for Canada, W.D. Hogg, D.A. Carr, Supply and Services Canada 1985.

TABLE 2.3

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT

ESTIMATED PAN EVAPORATION AT SITE

	Quesnel	Williams Lake	Site
May	98	88	93
June	130	124	127
July	151	144	148
August	131	129	130
September	81	77	79
October	39	38	38
Total	630	600	615

Source:

Based on computed potential evapotranspiration data by AES using Thornthwaite model, increased by an empirical factor of 1.25 to bring into line with pan evaporation data.

TABLE 2.4

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT

SEISMIC RISK CALCULATION

ENERGY, MINES AND RESOURCES CANADA GEOLOGICAL SURVEY OF CANADA	ENERGIE, MINES ET RESSOURCES CANADA COMMISSION GEOLOGIQUE DU CANADA
SEISMIC RISK CALCULATION *	CALCUL DE RISQUE SEISMIQUE *

REQUESTED BY/ DEMANDE PAR Jeremy Haile / Knight & Piesold Ltd. mJ

SITE Mt. Polley, B.C.

LOCATED AT/ SITUE AU 52.55 NORTH/NORD 121.63 WEST/OUEST

PROBABILITY OF EXCEEDENCE PER ANNUM/ PROBABILITE DE DEPASSEMENT PAR ANNEE	0.010	0.005	0.0021	0.001
PROBABILITY OF EXCEEDENCE IN 50 YEARS/ PROBABILITE DE DEPASSEMENT EN 50 ANS	40 %	22 %	10 %	5 %
PEAK HORIZONTAL GROUND ACCELERATION (G) ACCELERATION HORIZONTALE MAXIMALE DU SOL (G)	0.021	0.028	0.037	0.046
PEAK HORIZONTAL GROUND VELOCITY (M/SEC) VITESSE HORIZONTALE MAXIMALE DU SOL (M/SEC)	0.043	0.056	0.077	0.094

* REFERENCES

1. NEW PROBABILISTIC STRONG SEISMIC GROUND MOTION MAPS OF CANADA: A COMPILATION OF EARTHQUAKE SOURCE ZONES, METHODS AND RESULTS.
   P.W. BASHAM, D.H. WEICHERT, F.M. ANGLIN, AND M.J. BERRY
   EARTH PHYSICS BRANCH OPEN FILE NUMBER 82-33, OTTAWA, CANADA 1982.

2. ENGINEERING APPLICATIONS OF NEW PROBABILISTIC SEISMIC GROUND-MOTION MAPS OF CANADA.
   A.C. HEIDEBRECHT, P.W. BASHAM, J.H. RAINER, AND M.J. BERRY
   CANADIAN JOURNAL OF CIVIL ENGINEERING, VOL. 10, NO. 4, P. 670-680, 1983.

3. NEW PROBABILISTIC STRONG GROUND MOTION MAPS OF CANADA.
   P.W. BASHAM, D.H. WEICHERT, F.M. ANGLIN, AND M.J. BERRY, BULLETIN OF THE SEISMOLOGICAL SOCIETY OF AMERICA, VOL. 75, NO. 2, P. 563-595, 1985.

4A. SUPPLEMENT TO THE NATIONAL BUILDING CODE OF CANADA 1985, NRCC NO. 23178.
CHAPTER 1: CLIMATIC INFORMATION FOR BUILDING DESIGN IN CANADA.
CHAPTER 4: COMMENTARY J: EFFECTS OF EARTHQUAKES.

4B. SUPPLEMENT DU CODE NATIONAL DU BATIMENT DU CANADA 1985, CNRC NO 23178F.
CHAPITRE 1: DONNEES CLIMATIQUES POUR LE CALCUL DES BATIMENTS AU CANADA.
CHAPITRE 4: COMMENTAIRE J: EFFETS DES SEISMES.

TABLE 2.4 (Continued)

SEISMIC RISK CALCULATION

```
SITE                                                    Mt. Polley, B.C.

     ZONING FOR ABOVE SITE/ ZONAGE DU SITE CI-DESSUS

     1985 NBCC/CNBC:   ZA = 0;   ZV = 1;   V = 0.05 M/S

 ACCELERATION ZONE/ ZONE D'ACCELERATION     ZA=0
 ZONAL ACCELERATION/ ACCELERATION ZONALE  0.00 G

 VELOCITY ZONE/ ZONE DE VITESSE             ZV=1
 ZONAL VELOCITY/ VITESSE ZONALE            0.05 M/S


                 1985 NBCC/CNBC **
  SEISMIC ZONING MAPS/ CARTES DU ZONAGE SEISMIQUE

           PROBABILITY LEVEL: 10% IN 50 YEARS
       NIVEAU DE PROBABILITE: 10% EN 50 ANNEES

        ------------------------------------
         G OR M/S    ZONE      ZONAL VALUE/
                               VALEUR ZONALE
        ------------------------------------
          0.00
                      0          0.00
          0.04
                      1          0.05
          0.08
                      2          0.10
          0.11
                      3          0.15
          0.16
                      4          0.20
          0.23
                      5          0.30
          0.32
                      6*         0.40
        ------------------------------------

  * ZONE 6:  NOMINAL VALUE/ VALEUR NOMINALE  0.40;
     SITE-SPECIFIC STUDIES SUGGESTED FOR IMPORTANT PROJECTS/
     ETUDES COMPLEMENTAIRES SUGGEREES POUR DES PROJETS D'IMPORTANCE.


 ** FOR NBCC APPLICATIONS, CALCULATED ZONE VALUES AT A SITE SHOULD BE
     REPLACED BY EFFECTIVE ZONE VALUES [ZA(EFF) OR ZV(EFF)] AS SHOWN BELOW/
    POUR APPLICATIONS SELON LE CNBC, ON DOIT REMPLACER LES VALEURS ZONALES
     CALCULEES POUR UN SITE PAR LES VALEURS EFFECTIVES [ZA(EFF) OU ZV(EFF)]
     COMME MONTRE CI-DESSOUS:

      1.   IF/SI (ZA - ZV) > 1,          ===>  ZA(EFF) = ZV + 1.
 OR/OU
      2.   IF/SI (ZA - ZV) < 1,          ===>  ZA(EFF) = ZV - 1.
 OR/OU
      3.   IF/SI  ZV=0 AND/ET ZA > 0,  ===>  ZV(EFF) = 1.

       (SEE REFERENCE 2 CITED ABOVE, PAGE 677)
       (VOIR PAGE 677 DE LA REFERENCE 2 CI-DESSUS)
```

TABLE 3.1

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT

SUMMARY OF PERMEABILITY TESTING IN OPEN PIT

Hole No.	Depth Interval (ft)	Measured Permeability (cm/s)
MP89-145	40-60	1.0 x 10^{-6}
	70-90	4.6 x 10^{-6}
	100-120	5.0 x 10^{-7}
	130-150	3.5 x 10^{-6}
	160-180	1.3 x 10^{-5}
	190-210	< 3.0 x 10^{-6}
	220-240	8.7 x 10^{-7}
MP89-146	60-80	8.8 x 10^{-6}
	90-110	5.0 x 10-^{7}
	120-140	6.9 x 10^{-7}
	150-170	3.1 x 10^{-6}
	180-200	1.5 x 10^{-5}
	210-230	5.7 x 10^{-6}
	240-260	2.2 x 10^{-6}
	270-290	3.7 x 10^{-6}
	300-320	1.1 x 10^{-5}
	330-350	1.6 x 10^{-4}
	360-380	1.5 x 10^{-6}
	390-410	< 1.5 x 10^{-6}
	420-440	6.9 x 10^{-7}

TABLE 3.1 (Continued)

Hole No.	Depth Interval (ft)	Measured Permeability (cm/s)
MP89-146 (Con't)	460-480	9.8 x 10^{-7}
	480-520	1.0 x 10^{-6}
	520-560	2.5 x 10^{-6}
	600-640	4.8 x 10^{-6}
	640-700	2.0 x 10^{-6}
MP89-147	20-50	3.2 x 10^{-4}
	50-80	6.8 x 10^{-6}
	80-120	2.6 x 10^{-6}
	120-160	4.0 x 10^{-5}
	160-200	1.4 x 10^{-4}
	200-240	1.8 x 10^{-5}
	240-280	6.2 x 10^{-6}
	280-320	1.8 x 10^{-5}
	320-360	7.5 x 10^{-7}
	360-400	7.5 x 10^{-7}
MP89-148	20-60	1.0 x 10^{-4}
	60-100	6.6 x 10^{-4}
	100-140	3.0 x 10^{-3}
	140-180	4.2 x 10^{-4}
	180-220	4.8 x 10^{-5}
	220-260	3.0 x 10^{-5}
	260-300	7.2 x 10^{-6}
	300-340	4.9 x 10^{-4}

TABLE 3.1 (Continued)

Hole No.	Depth Interval (ft)	Measured Permeability (cm/s)
MP89-155	20-50	2.8×10^{-5}
	50-90	1.6×10^{-5}
	90-130	3.4×10^{-4}
	130-170	4.7×10^{-6}
	170-210	$< 1.0 \times 10^{-7}$
	210-250	$< 1.0 \times 10^{-7}$
	250-290	1.0×10^{-7}
	290-330	1.7×10^{-6}
	330-370	9.4×10^{-7}
	370-410	4.5×10^{-6}
	410-450	1.5×10^{-7}
	450-490	6.8×10^{-3}
	490-530	1.4×10^{-4}
	530-570	3.6×10^{-5}
	570-610	2.7×10^{-4}
	610-650	$< 1.0 \times 10^{-7}$
	650-700	$< 1.0 \times 10^{-7}$
Geometric Mean of all tests:		8.4×10^{-6} cm/s

TABLE 3.2

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
GROUNDWATER LEVELS IN PROPOSED OPEN PIT AREA

DEPTH TO GROUNDWATER TABLE (m) IN MONITORING WELLS

Date	MP89-107	MP89-146	MP89-151
August 16, 1989	28.0	14.7	35.5
November 8, 1989	10.0	10.5	31.0

DEPTH TO PHREATIC SURFACE (m) IN MULTIPLE PNEUMATIC PIEZOMETERS

	MP89-147A	-147B	-147C	MP89-155A	-155B
Tip Depth (m)	27.6	59.0	88.8	7.8	157.7
Date					
August 2, 1989	3.2	2.6	4.5	-	-
August 15, 1989	3.5	2.4	4.6	-	-
November 12, 1989	2.2	1.6	9.2	2.7	*

* Reading beyond capacity of read-out box.

TABLE 4.1

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT

PRELIMINARY SLOPE DESIGN

DESIGN SECTOR	PIT SLOPE ORIENTATION	BENCH FACE ANGLE	BENCH HEIGHT (m)	BENCH WIDTH (m)	INTER-SLOPE ANGLE
I	All slopes	70°	20	8.5	52°
II	Favourable conditions	75°	20	8.5	55°

Notes: 1. Pit slope design based on fully drained slope conditions.

2. Pit slope design to be reviewed during initial development of pit, as actual conditions are encountered.

1628.A3

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
PROJECT LOCATION PLAN

CAD FILE: \1628\FIG\A3 Plot 1=1

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FIGURE 1.1

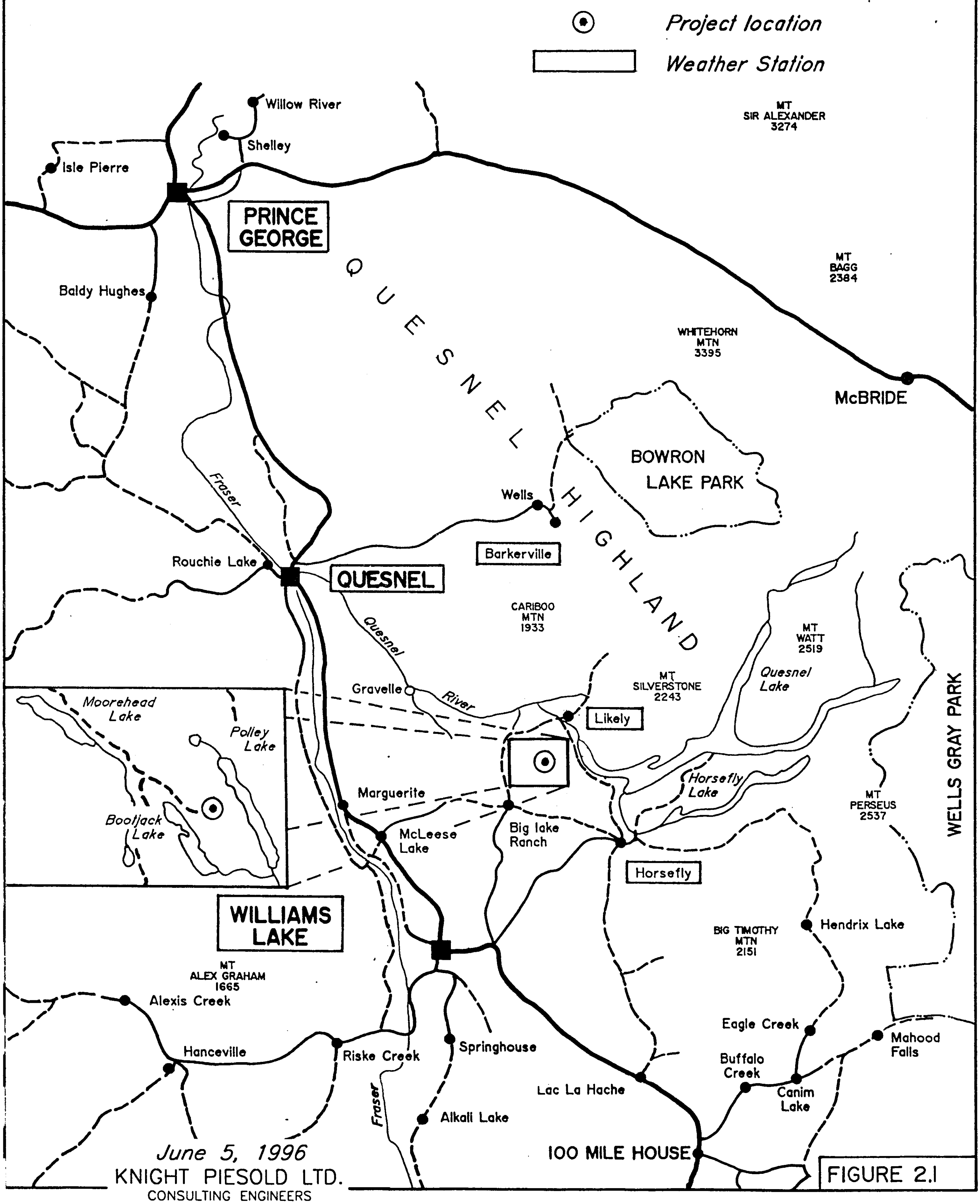
NC

1625.A16

IMPERIAL METALS CORPORATION

MT. POLLEY PROJECT

LOCATION OF WEATHER STATIONS



June 5, 1996

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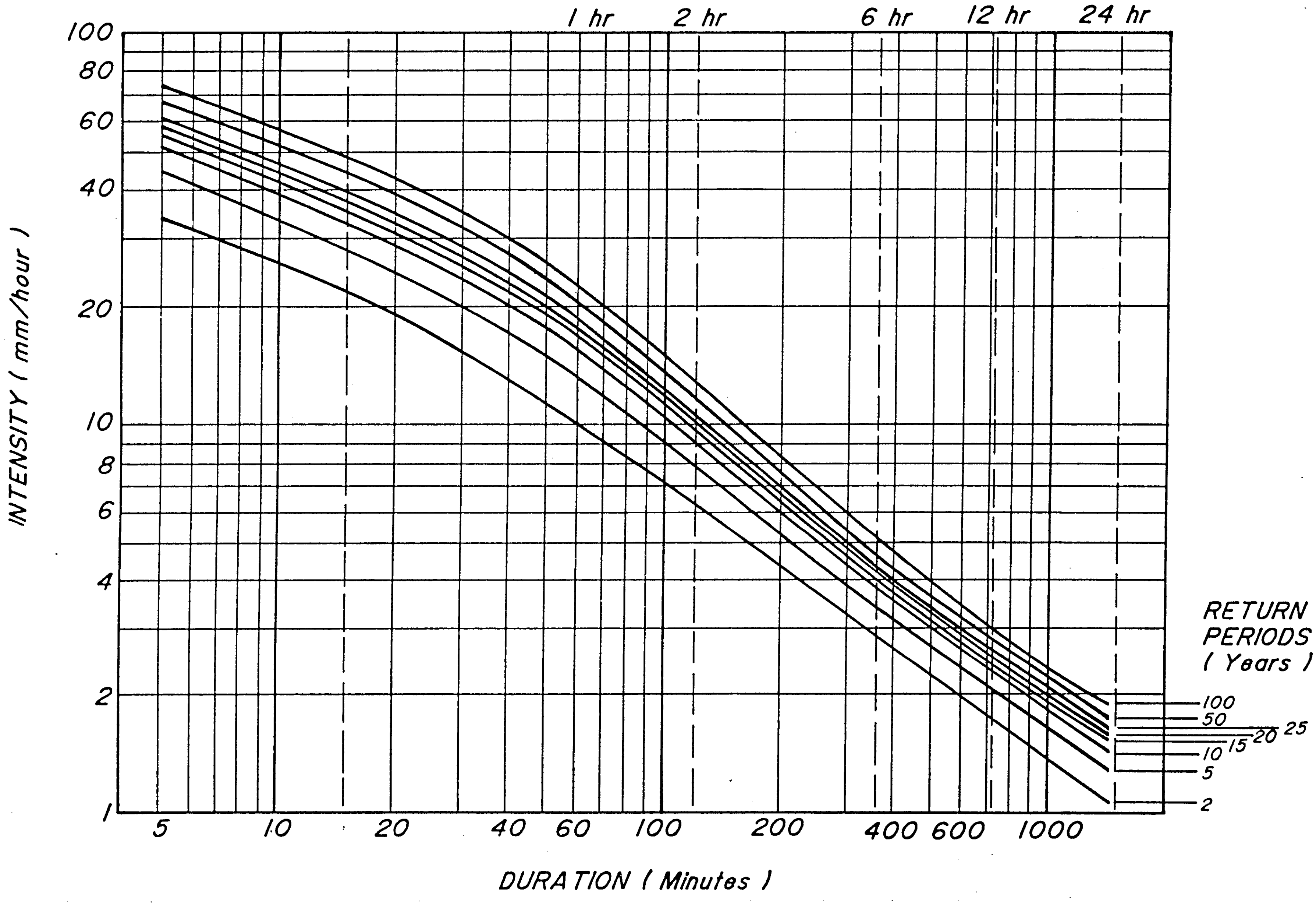
FIGURE 2.1

IMPERIAL METALS CORPORATION

MT. POLLEY PROJECT

SHORT DURATION RAINFALL INTENSITY – DURATION – FREQUENCY DATA FOR MINE SITE



June 6, 1996

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FIGURE 2.2

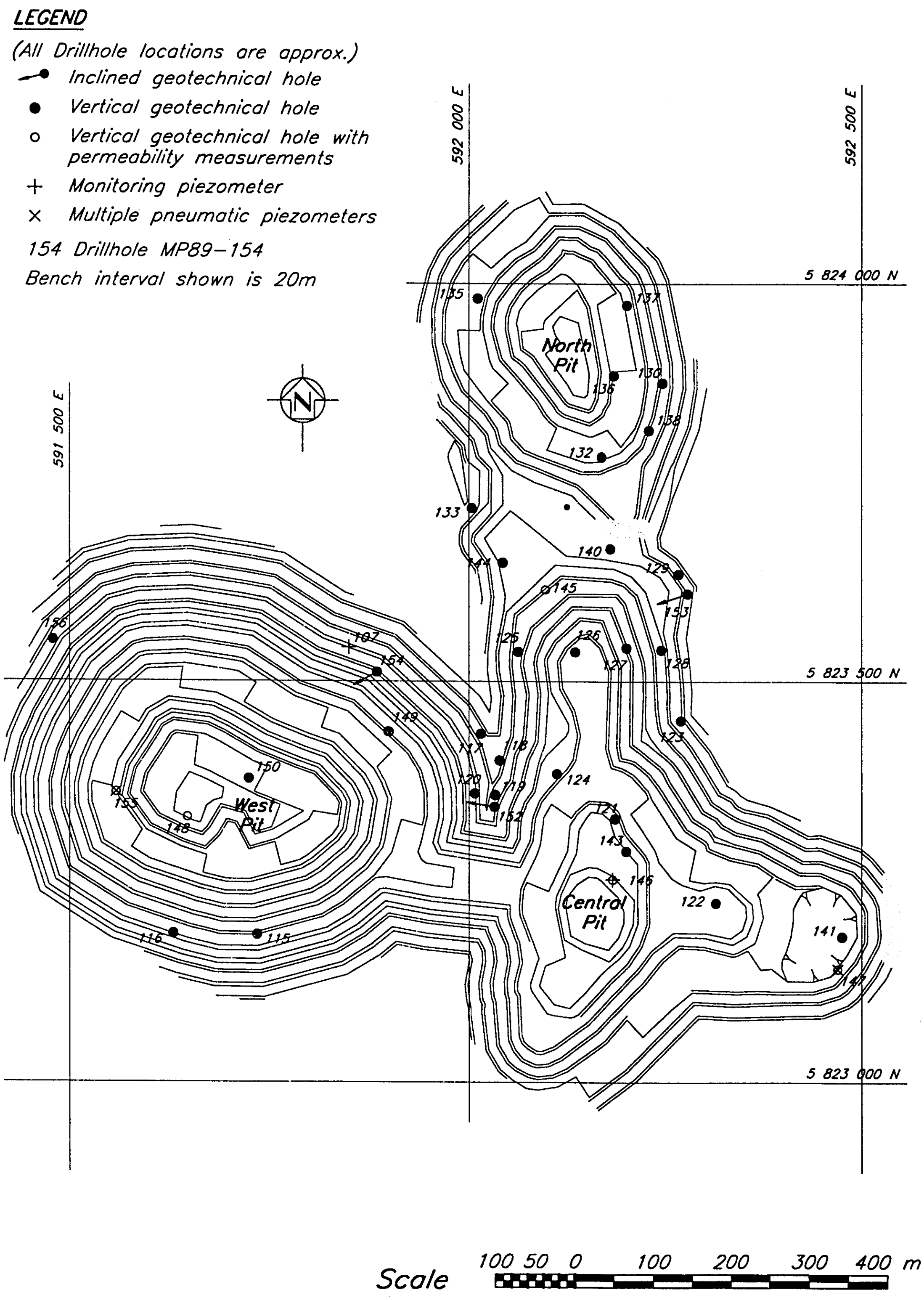
1625.A1

1628.A1

IMPERIAL METALS CORPORATION

MT. POLLEY PROJECT

OPEN PIT LAYOUT AND
GEOTECHNICAL DRILL HOLE LOCATIONS



CAD FILE: \1628\FIG\A1 1:6000 Plot 1=8

July 8, 1996

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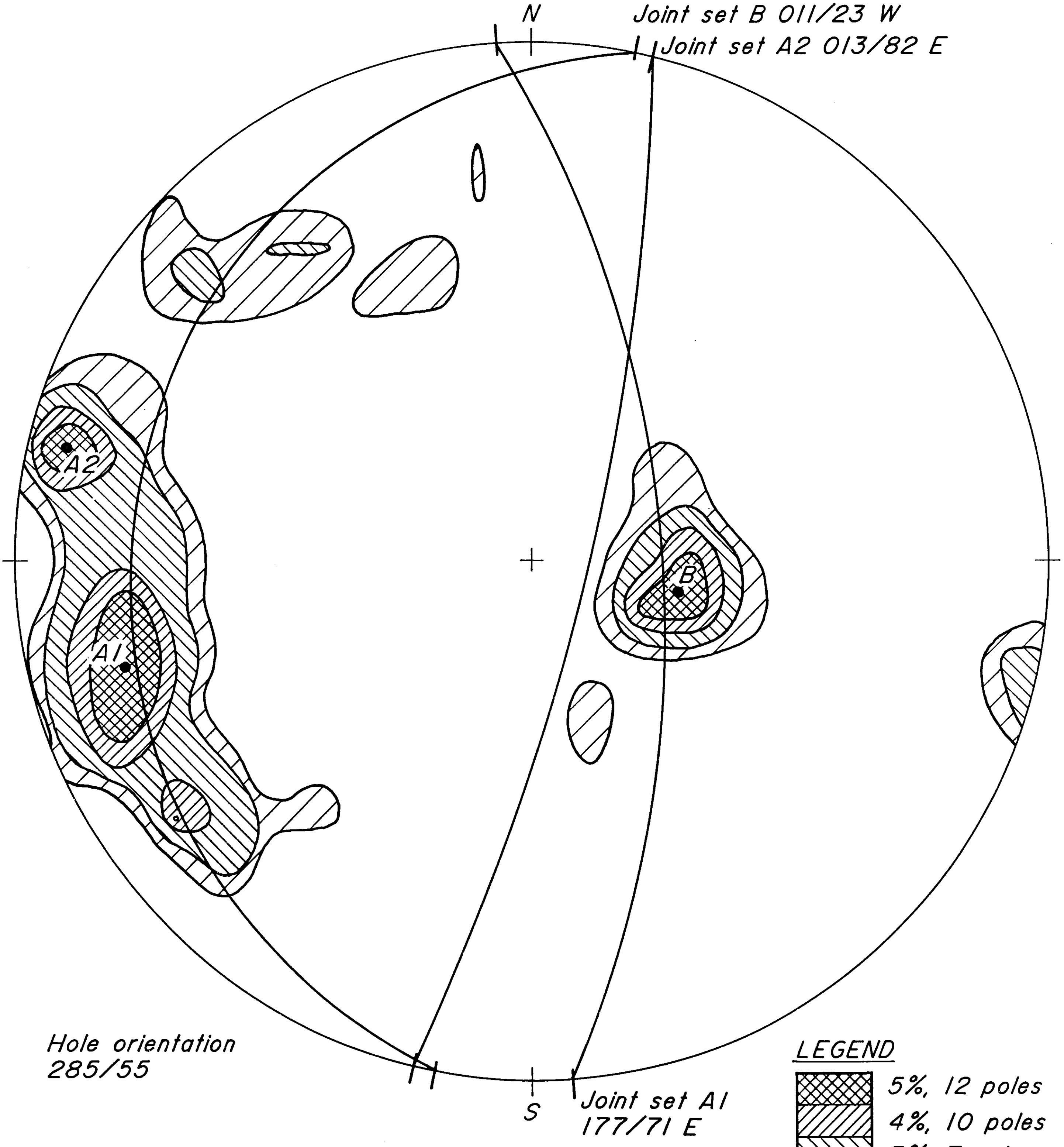
FIGURE 3.1

IMPERIAL METALS CORPORATION

MT. POLLEY PROJECT

SUMMARY OF JOINT DATA FOR MP89-152

244 observations



Hole orientation
285/55

LEGEND

▦ 5%, 12 poles
▨ 4%, 10 poles
▧ 3%, 7 poles
▨ 2%, 5 poles

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FIGURE 3.2

NCI-763

1628.A7

IMPERIAL METALS CORPORATION

MT. POLLEY PROJECT

SUMMARY OF JOINT DATA FOR MP89-153

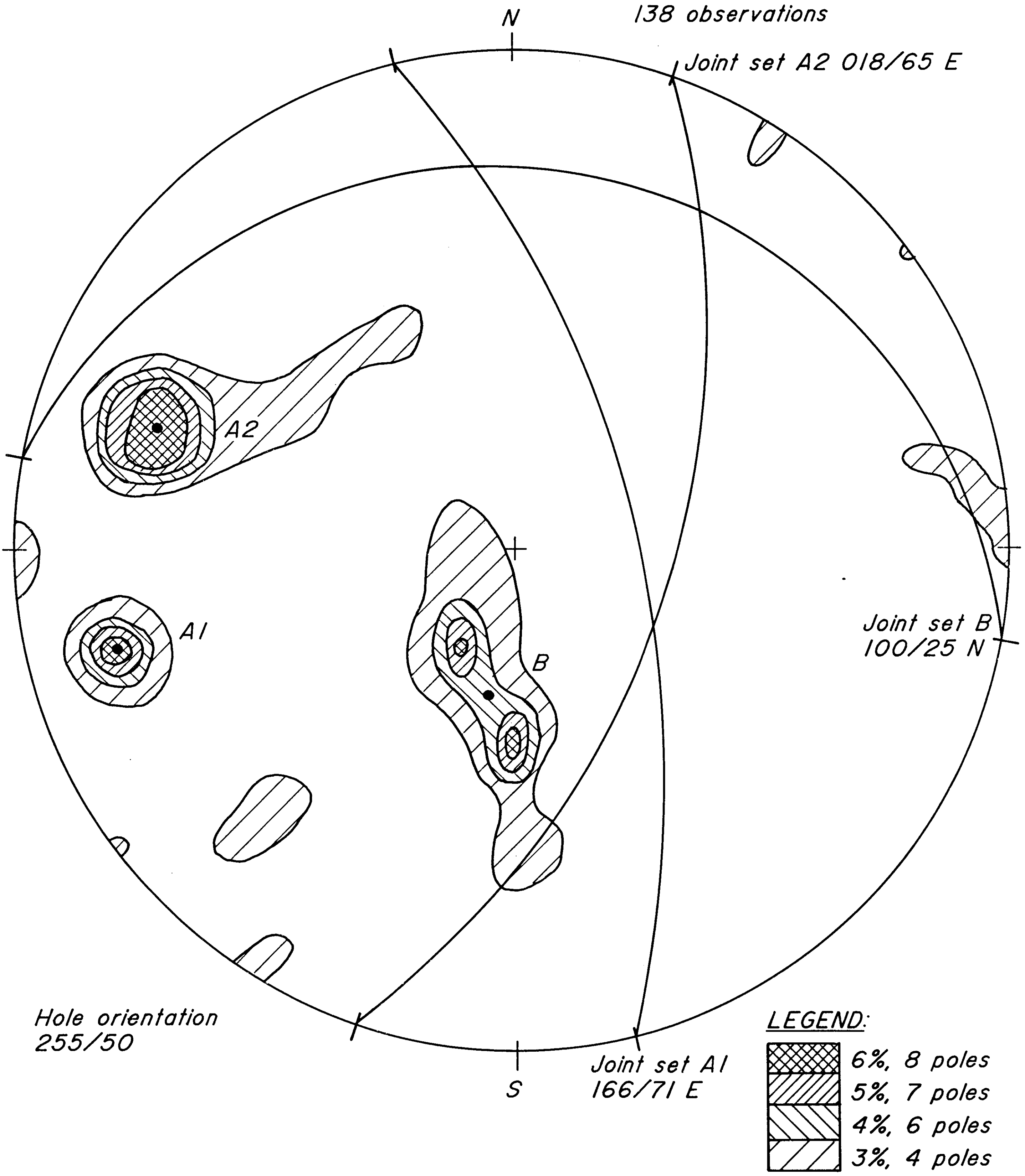

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FIGURE 3.3

NCI-763

1628.A8

IMPERIAL METALS CORPORATION

MT. POLLEY PROJECT

SUMMARY OF JOINT DATA FOR MP89-154

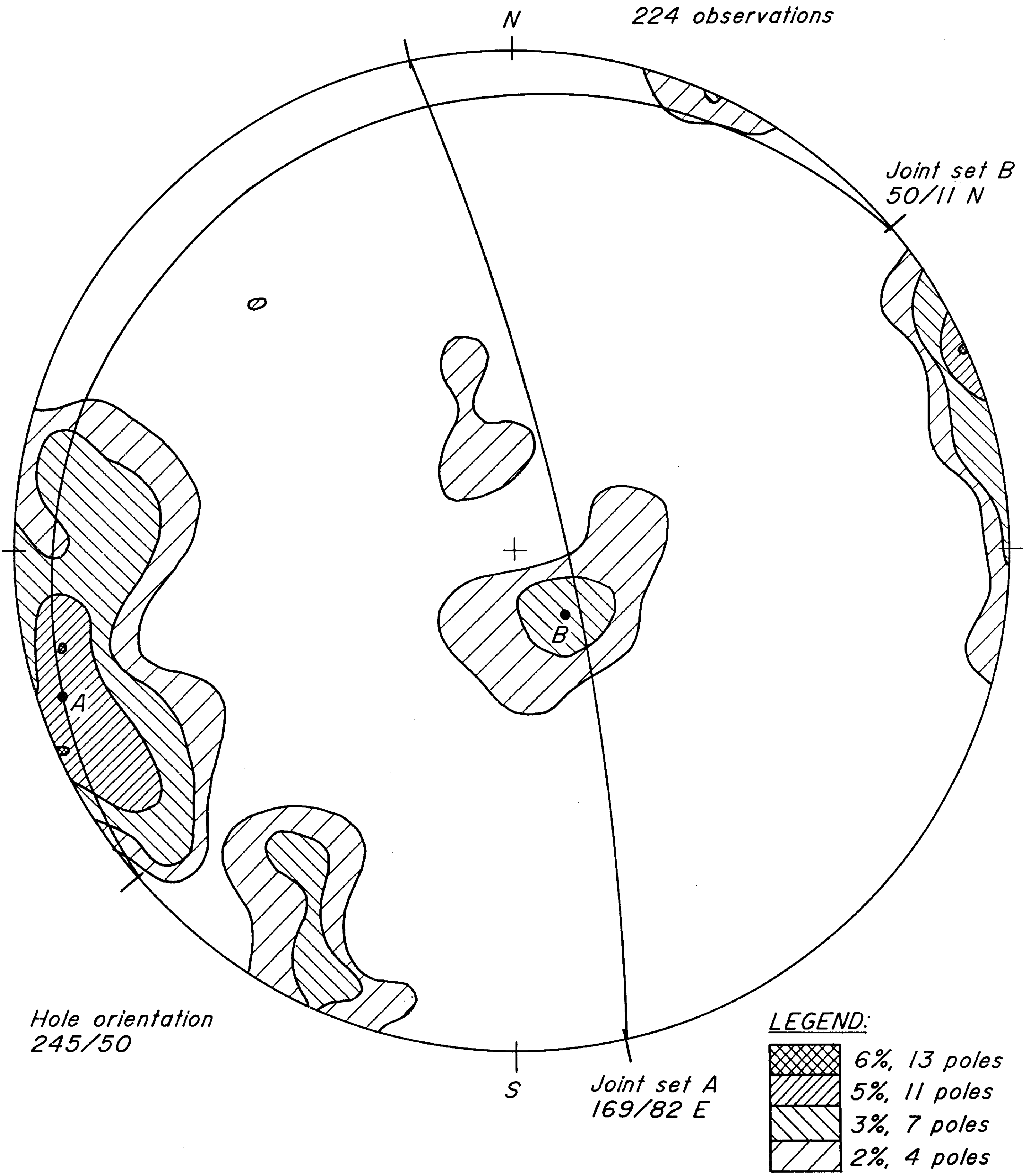

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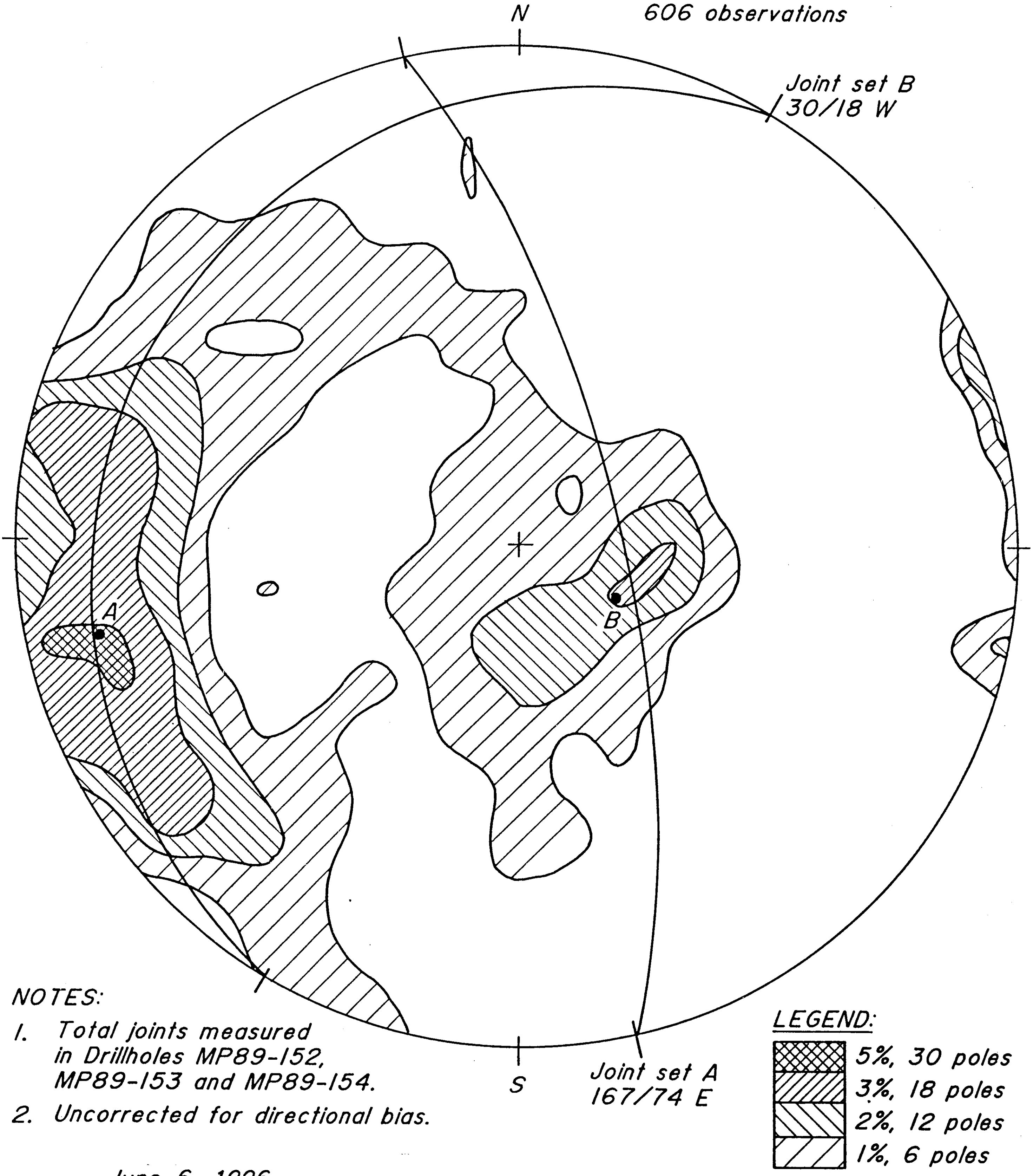
FIGURE 3.4

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
SUMMARY OF JOINT DATA



LEGEND:

- ▩ 5%, 30 poles
- ▨ 3%, 18 poles
- ▧ 2%, 12 poles
- ▨ 1%, 6 poles

NOTES:

1. Total joints measured in Drillholes MP89-152, MP89-153 and MP89-154.
2. Uncorrected for directional bias.

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FIGURE 3.5

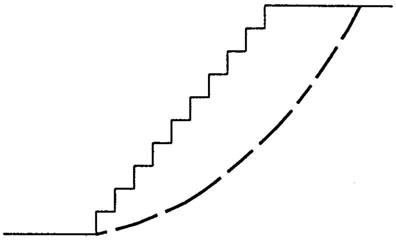
1628.A5

IMPERIAL METALS CORPORATION

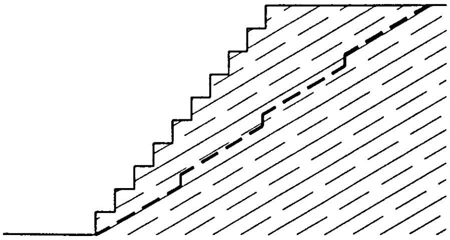
MT. POLLEY PROJECT

OPEN PIT

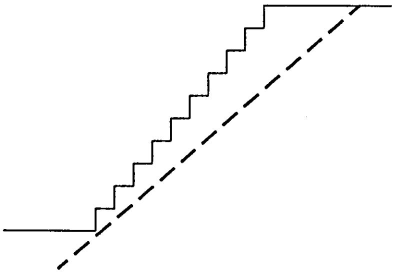
TYPICAL FAILURE MODES



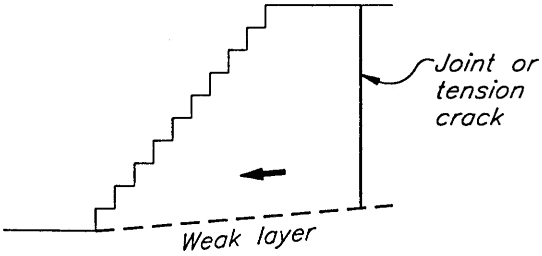
(a) Failure geometry in homogeneous rock or rock with random localized jointing



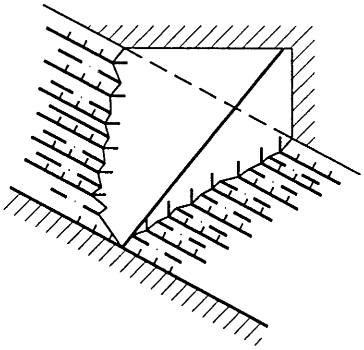
(b) Failure combining movement along discontinuous joints and through intact rock



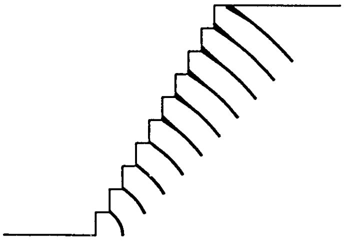
(c) Failure on the plane of a continuous fault, shear zone or joint



(d) Failure as a block on a weak layer bounded at the back by a joint or tension crack



(e) Failure as a wedge on two or more intersecting discontinuities



(f) Failure by toppling. Most frequent where major structure dips steeply

CAD FILE: \1628\FIG\A5 Plot 1=1

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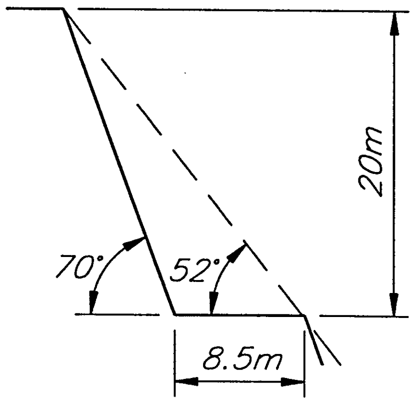
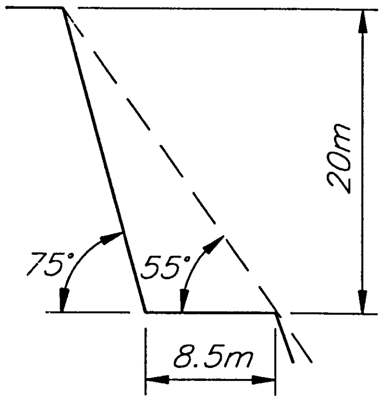
FIGURE 4.1

1628.A4

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
OPEN PIT – PRELIMINARY DESIGN
SLOPE ANGLES AND BENCH DESIGN



DESIGN I – ALL INITIAL PIT SLOPES



DESIGN II – FAVOURABLE CONDITIONS ENCOUNTERED DURING PIT EXCAVATION

CAD FILE: \1628\FIG\A4 Plot 1=1

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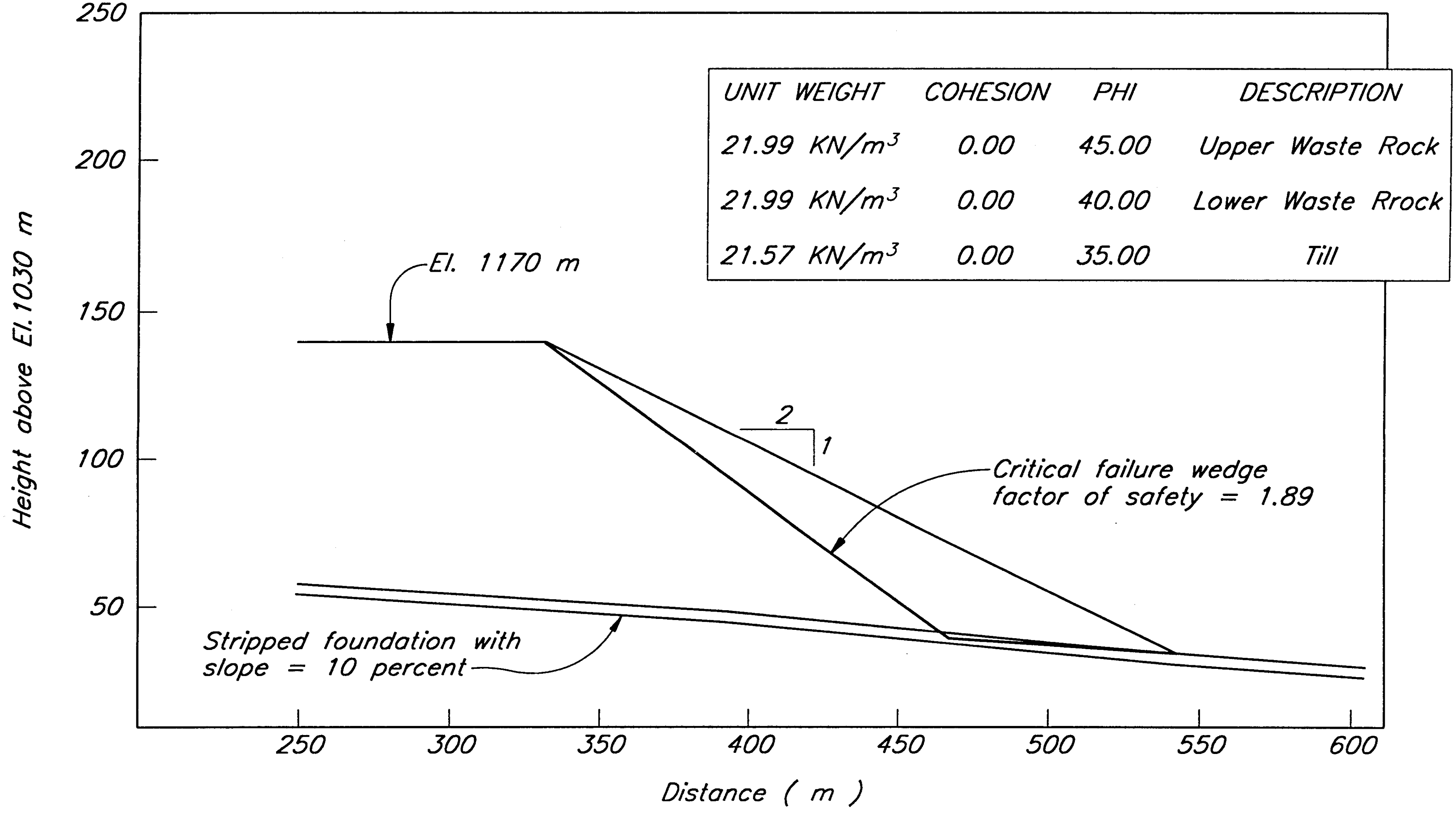
FIGURE 4.2

CAD FILE: \1625\FIG\A38 Plot 1=1

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
TYPICAL STATIC WEDGE FAILURE ANALYSIS



UNIT WEIGHT	COHESION	PHI	DESCRIPTION
21.99 KN/m^3	0.00	45.00	Upper Waste Rock
21.99 KN/m^3	0.00	40.00	Lower Waste Rrock
21.57 KN/m^3	0.00	35.00	Till

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FIGURE 5.1

1625.A38

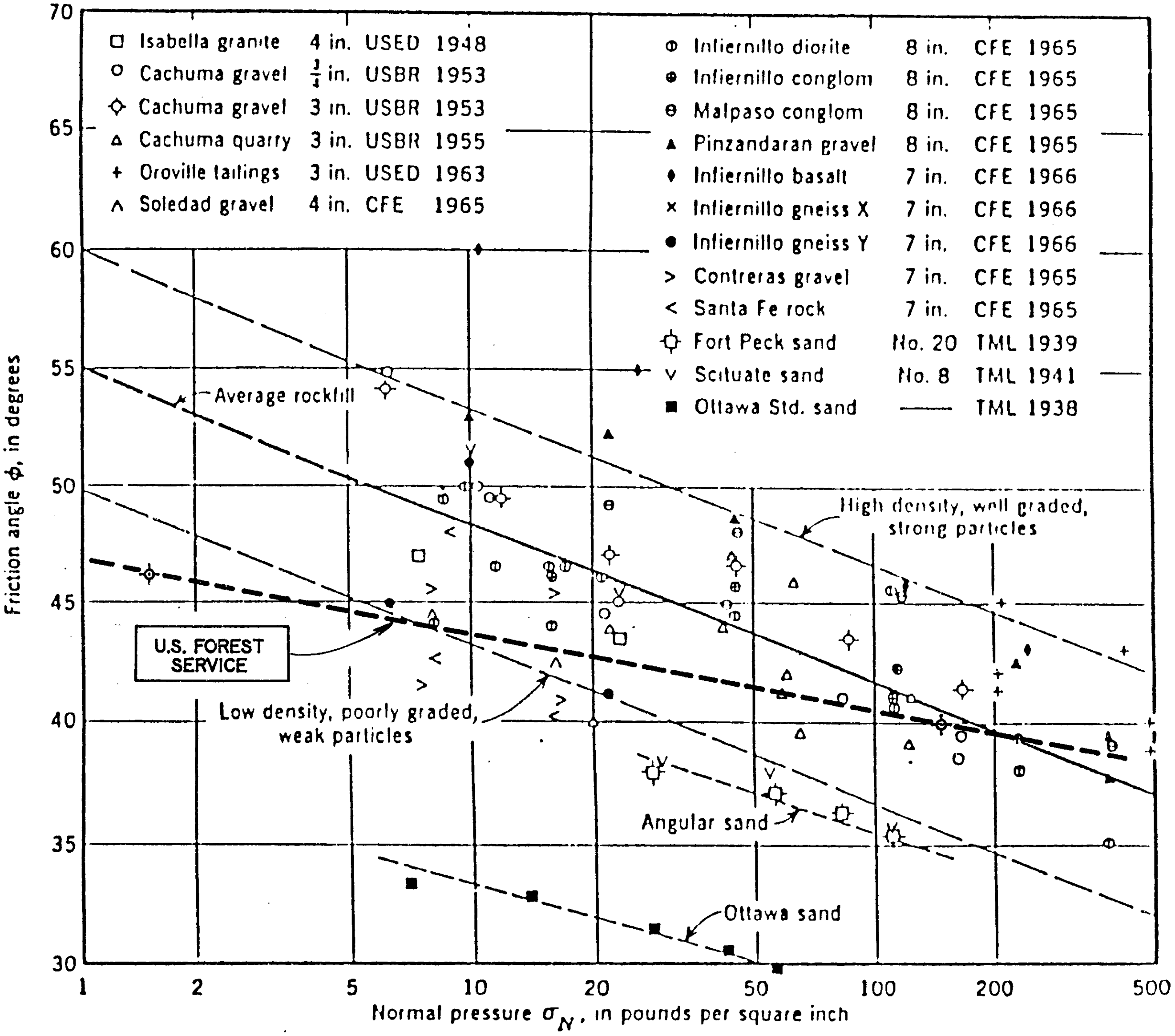
1628.A9

IMPERIAL METALS CORPORATION

MT. POLLEY PROJECT

WASTE DUMPS

SHEAR STRENGTH OF ROCKFILL



Information taken from :

REVIEW OF SHEARING STRENGTH OF ROCKFILL
By Thomas M. Leps, F. ASCE
July , 1970

June 6, 1996
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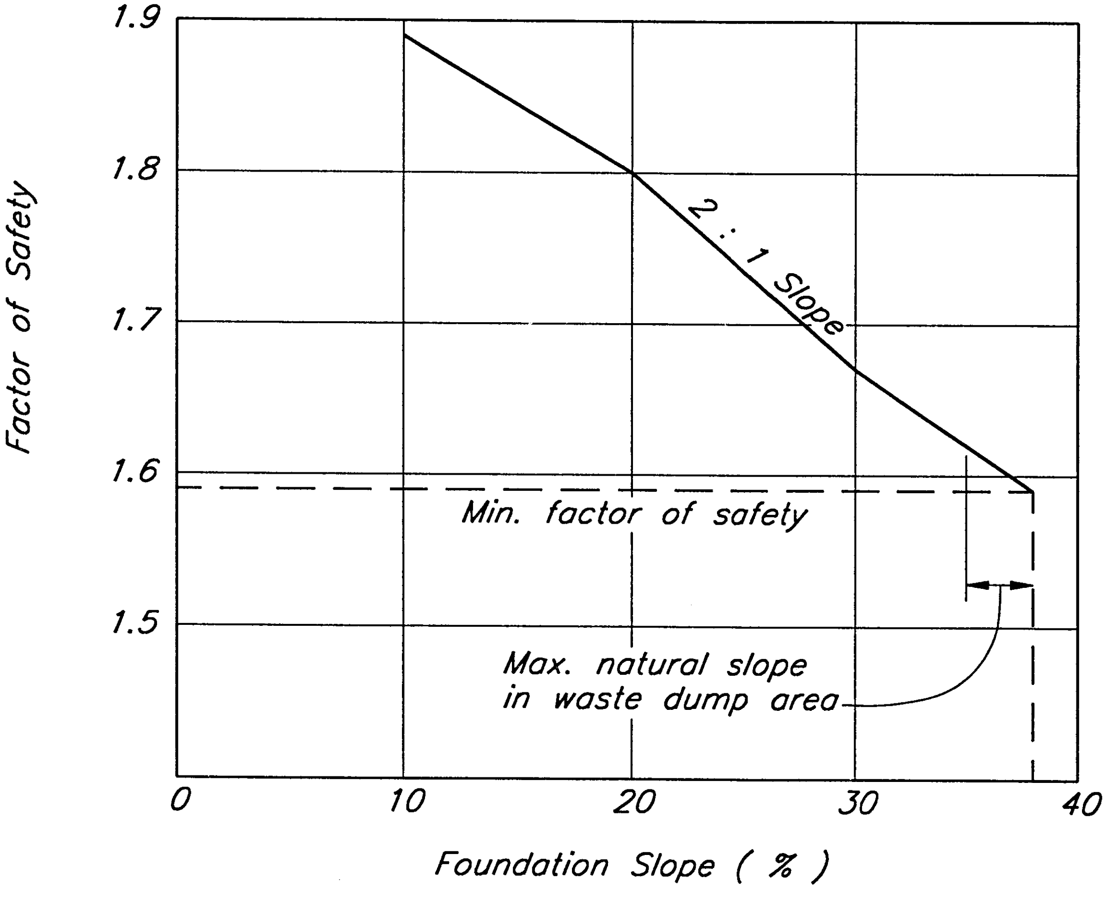
FIGURE 5.2

BCIL 7733 KP

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
WASTE DUMPS – STABILITY CHART



NOTE: Foundation will be stripped with $\varphi' = 35°$.

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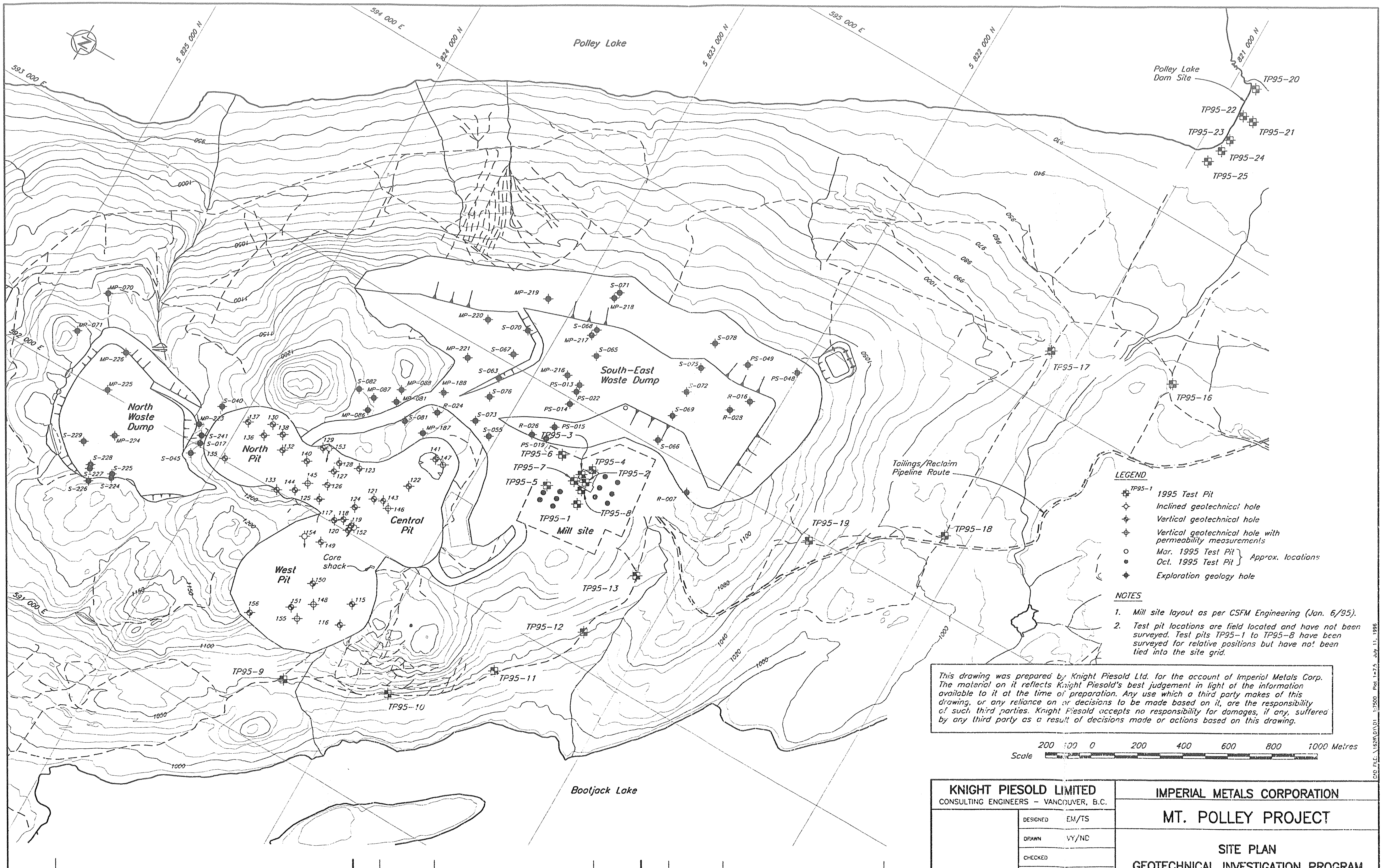
FIGURE 5.3



LEGEND

- ⊞ TP95-1 1995 Test Pit
- ⌖ Inclined geotechnical hole
- ⊕ Vertical geotechnical hole
- ⌖ Vertical geotechnical hole with permeability measurements
- ○ Mar. 1995 Test Pit } Approx. locations
- ● Oct. 1995 Test Pit } Approx. locations
- ◆ Exploration geology hole

NOTES

1. Mill site layout as per CSFM Engineering (Jan. 6/95).
2. Test pit locations are field located and have not been surveyed. Test pits TP95-1 to TP95-8 have been surveyed for relative positions but have not been tied into the site grid.

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CAD FILE: \1628\D1\D1 1:7500 Plot 1=7.5 July 11, 1996

DRG. NO.	DESCRIPTION

REFERENCE DRAWINGS

REV.	DATE	DESCRIPTION	APPROVED

REVISIONS

REV.	DATE	DESCRIPTION	APPROVED

REVISIONS

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

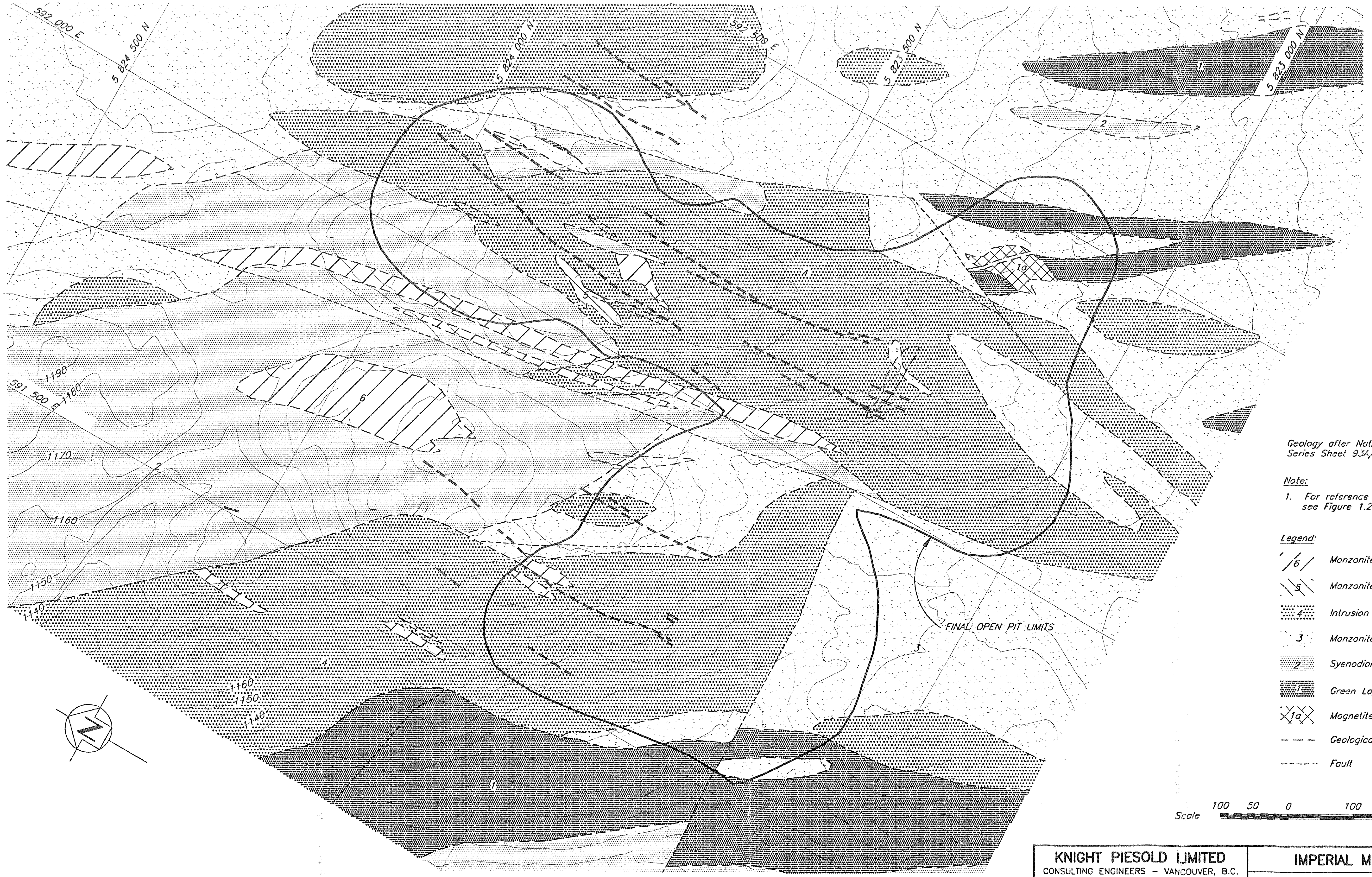
DESIGNED EM/TS
DRAWN VY/ND
CHECKED
APPROVED

IMPERIAL METALS CORPORATION

MT. POLLEY PROJECT

SITE PLAN
GEOTECHNICAL INVESTIGATION PROGRAM

DATE JULY 11, 1996 | SCALE AS SHOWN | DRG. NO. 1628.100 | REV. A



Geology after National Topographic
Series Sheet 93A/12

Note:

1. For reference information see Figure 1.2, Note 1.

Legend:

6	Monzonite Porphyrl - 3
5	Monzonite Porphyrl - 2
4	Intrusion Breccia
3	Monzonite Porphyry - 1
2	Syenodiorite
1	Green Lapili & Crystal-green Tuff
1a	Magnetite Skarn
— — —	Geological Contact
- - - - -	Fault

Scale 100 50 0 100 200 300 Metres

CAD FILE:\1628\D2\D2 1:3000 Plot 1=3 JUN 12, 1996

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CONSULTING ENGINEERS - VANCOUVER, B.C.

DESIGNED EM
DRAWN AW/VY
CHECKED
APPROVED

IMPERIAL METALS CORPORATION

MT. POLLEY PROJECT

GEOLOGICAL PLAN OF OPEN PIT AREA

DATE JUNE 12, 1996 SCALE AS SHOWN DRG. NO. 1628.101 REV. A

DRG. NO.	DESCRIPTION

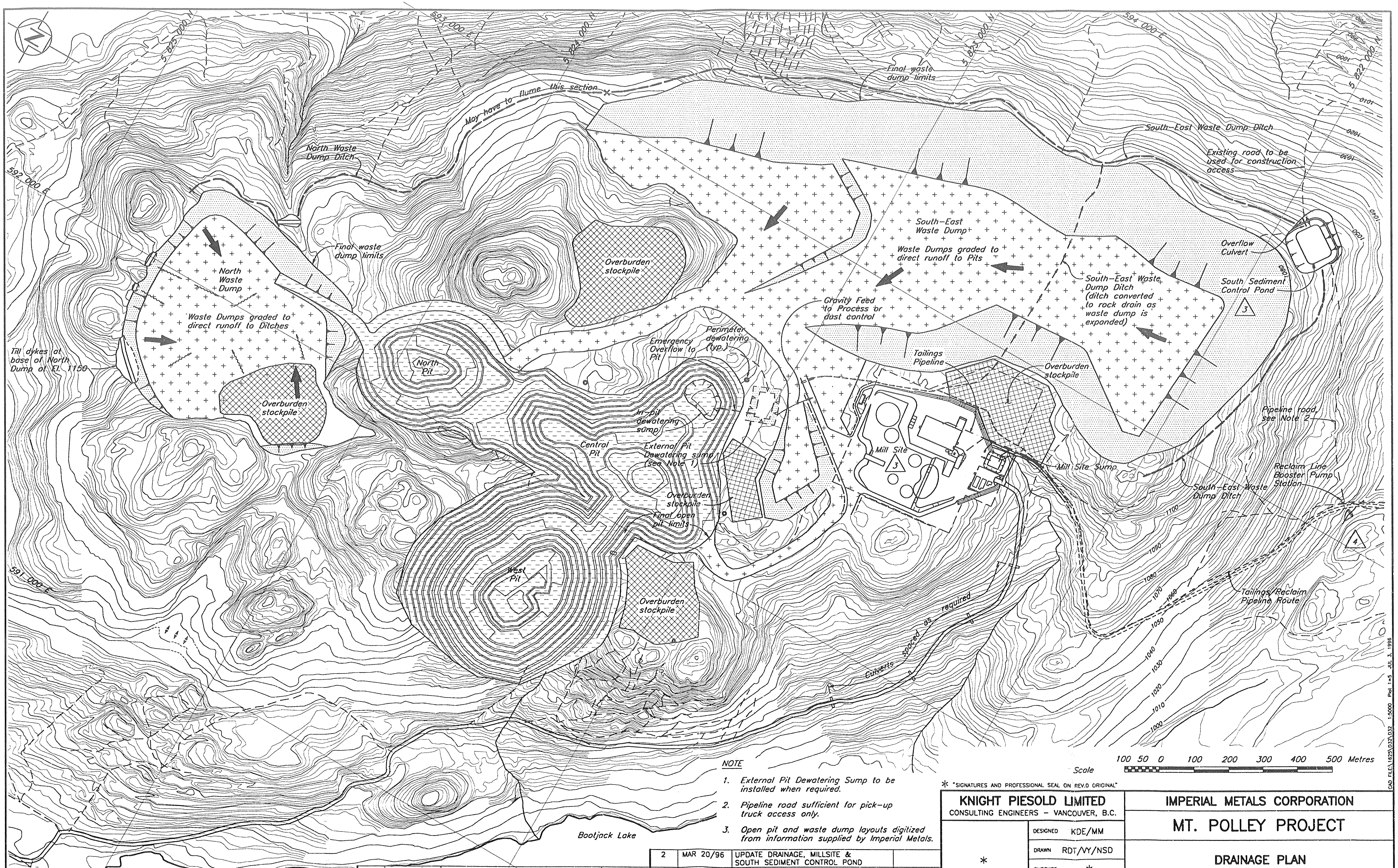
REFERENCE DRAWINGS

REV.	DATE	DESCRIPTION	APPROVED

REVISIONS

REV.	DATE	DESCRIPTION	APPROVED

REVISIONS



NOTE

1. External Pit Dewatering Sump to be installed when required.
2. Pipeline road sufficient for pick-up truck access only.
3. Open pit and waste dump layouts digitized from information supplied by Imperial Metals.

CAD FILE:\1625\D32\D32 1:5000 Plot 1=5 JUL 3, 1996

* "SIGNATURES AND PROFESSIONAL SEAL ON REV.0 ORIGINAL"

1625.232	DRAINAGE PLAN - SECTIONS AND DETAILS
DRG. NO.	DESCRIPTION
REFERENCE DRAWINGS	

REV.	DATE	DESCRIPTION	APPROVED
4	JULY 3/96	RELOCATE BOOSTER PUMP STATION	
3	APRIL 1/96	MILLSITE AND CONTROL POND REVISED	
REVISIONS			

REV.	DATE	DESCRIPTION	APPROVED
2	MAR 20/96	UPDATE DRAINAGE, MILLSITE & SOUTH SEDIMENT CONTROL POND	
1	MAR 14/96	UPDATED OPEN PITS,WASTEDUMPS,SITE DRAINAGE	
0	AUG 24/95	ISSUED FOR CONSTRUCTION	
REVISIONS			

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

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DESIGNED KDE/MM
DRAWN RDT/VY/NSD
CHECKED *
APPROVED *

IMPERIAL METALS CORPORATION

MT. POLLEY PROJECT

DRAINAGE PLAN
MINE SITE

DATE AUGUST 24, 1995 SCALE AS SHOWN DRG. NO. 1625.230 REV. 4

APPENDIX A

REVIEW OF OPEN PIT DESIGN
BY
C.O.BRAWNER, P.ENG.

1628/1

July 5, 1996

SECTION 4.0 - OPEN PIT SLOPE DESIGN

4.1 FACTORS WHICH INFLUENCE PIT SLOPE STABILITY AND SLOPE ANGLE

The most important factors which influence rock slope stability of open pit mines are geologic structure, groundwater conditions and seismic acceleration forces due to blasting.

Where geologic discontinuities, (joints, bedding planes, foliation, shears, faults, etc.) singly or in combination dip out of the slope at angles near or in excess of the angle of friction of the discontinuities, a potential for failure exists. It is essential that the geologic model of discontinuities around the pit be determined and the kinematic potential for failure evaluated. Typical failure models are shown in Figure 4.1. They include circular, planar, wedge, block and toppling modes.

Where multiple bench failures can occur along discontinuities, it is normally necessary to obtain samples to perform direct shear tests along these discontinuities. The surface roughness and waviness along the discontinuity must be evaluated in the direction of sliding. This may increase the effective angle of friction by ten degrees or more. Both conditions require assessment in order to evaluate the safety factor for that portion of the slope.

The presence of groundwater in the slopes may influence stability in a number of ways:

a. Reduction in the frictional shear strength due to buoyancy.

b. Reduction in cohesion of clay gouge or clayey rock with increasing moisture content.

c. Development of seepage forces during drainage towards the pit slope.

d. Creation of hydrostatic forces in tension cracks during heavy rainfall or snow melt (this pressure increases as the square of the depth).

e. An increase in hydrodynamic shock due to blasting below the water table.

As a result, it is important that the water table and groundwater pressures be maintained low in the pit slopes. The most effective way to develop this control is with the installation of horizontal drains. Any tension cracks that develop should be monitored and filled in to prevent the build up of water pressures.

Seismic acceleration forces due to blasting must be reduced at the final pit face to allow the steepest practical slopes to be used to minimize the waste to ore ratio. This will usually comprise using controlled blasting for the line holes, angled line holes, buffer holes adjacent to the line holes, numerous delays and blasting to a free face. Photographs of representative conditions are enclosed in Figure 4.2. The relationship between distance from the blast, pounds per delay and particle velocity (related to damage) is given in Figure 4.3.

4.2 STRUCTURAL GEOLOGY

Three boreholes, MP89-152 to MP89-154 were drilled on an inclination and the core was oriented using the clay imprint procedure as discussed in Section 3. Stereographic plots are shown in Figures 3.2 to 3.5. The overall plots indicate the major joint set has an average strike of 167 degrees and an average dip of 75 degrees E. The strike variation is about ± 20 degrees and the dip variation about ± 10 degrees. A second set of joints strikes 30 degrees ± 20 degrees and dips 18 degrees W ± 10 degrees. These geological structures are the major features which will influence pit slope stability for all walls.

This structure will lead to certain types of potential instability in each pit face depending on the face direction. The pit slope design must accommodate this potential.

East facing slopes - planar failure along shears, faults and contacts
North facing slopes - shallow wedges along joint intersections or fault contacts
South facing slopes - local wedges adjacent to fault contacts
West facing slopes - toppling

Rock joint continuity data (R.Q.D. and Joint Frequency) is shown in Appendix B, together with unconfined compressive strength data. Generally the rock strength is moderate to high so that stability will be controlled by the geologic structure. Several local zones of high fracturing and low strength were noted, i.e. - hole MP89-152, depth 180-350 feet. When the preliminary pit design has been developed, it will be necessary to evaluate rock strength data where drill holes intersect the pit walls to determine if any special design modification would be required. The west facing slopes must be evaluated in particular. If weak zones dip into these slopes, stress relief and high stress could cause subsidence and over stress the overlying rock to initiate toppling movement.

4.3 EVALUATION AND CONTROL OF GROUNDWATER

Groundwater is generally reasonably shallow below the ground surface. In some drill holes it was artesian. Consideration must be given to developing drainage of the pit walls to allow steep slopes and drainage in the pit floor to prevent pit bottom heaving. Wet blast holes will also require the use of more expensive explosives than the standard ANFO.

The projected open pit dewatering requirements have been estimated from the permeability test results and by a general water balance incorporating climatic data and hydrogeologic information. The volume of recoverable groundwater stored in the bedrock fractures and fissures has been estimated by assuming a specific yield of 0.005. Open pit dewatering systems will be required to remove this water from storage. Additional open pit inflows will include direct precipitation and groundwater recharge from the area of influence. The hydrometeorologic data presented in Section 2.1 has been adjusted for runoff and transpiration losses to enable a prediction of annual recharge to the groundwater system.

The rate of groundwater inflow is controlled by the permeability of the bedrock. The bedrock permeability is expected to be anisotropic due to structural features. Rock structure provides a barrier to groundwater movement across relatively intact formations and low permeability clay gouge but also results in preferential flow parallel to fractured rock zones. The site investigation program outlined in Section 3.2 identified zones with a broad range of permeabilities.

It is anticipated that the principal directions of groundwater inflow will be parallel to the dominant structural features which trend roughly north and south. This groundwater flow trend is advantageous in the later years of operation, when the ultimate depth of the west pit is below the surface elevation for Bootjack Lake. In general, the rock structure provides a natural barrier to flow from Bootjack Lake into the bottom of the ultimate pit. However the approximately east-west trending fault structure in the west zone, as shown on Figure 2.3, may provide a high permeability conduit for groundwater flow. On-going evaluation of pit geology during operations will enable accurate predictions to be made prior to final development.

It is estimated that the average, steady state pumping requirements for open pit groundwater control over the life of the project will be approximately 15 L/s (200

Igpm). This estimate does not include for removal of direct precipitation which will average approximately 13 L/s (175 Igpm) annually. The actual pit dewatering rate will be higher in the early stages of the operation when groundwater is removed from storage, and during periods of high rainfall.

Generally the most effective ways of controlling seepage into the pit is to install horizontal drain holes. They should be 20 to 30 metres (60 to 100 ft) long, drilled at a +2 to +3 degree slope and spaced about 12 metres (40 ft) apart at the toe of each double bench where seepage is encountered. In order to locate seepage zones, all blast holes which have water in them along the line holes and buffer holes should be plotted on blasting plans. The horizontal drain holes are only installed in areas where seepage is indicated.

If wet holes become a problem, a program to drill every tenth to twelfth blast hole an additional 6 to 9 metres (20 to 30 ft) deep and blast to that lower depth will provide a groundwater sink and help to lower the water table in the blast area. If this procedure is not successful, pumping wells at a number of locations around the pit may be required.

In order to continue to monitor the groundwater level conditions, a percentage of future drill holes should have piezometers installed to monitor the water table.

4.4 BLASTING CONTROL NEAR THE FINAL WALLS

Where the pit slope design angle will not be controlled by the structural geology the use of controlled blasting at the final face will normally allow an increase of 5 to 7 degrees in the slope angle. This involves the use of controlled blasting, with reasonably small diameter blast holes detonated as a pre-shear line in the harder massive rock or as a cushion or post shear line in weak or heavily fractured rock. The line holes should not be larger than 15 cm (6 inches) in diameter and spaced

1.5 to 2 m (5 to 6 ft) apart. It is preferable if this pre-shear line is drilled at an angle of 70-75 degrees below the horizontal rather than vertical. It is also desirable to drill the line holes double bench depth to do away with a small bench lip which could develop half way up a double benched slope. To minimize wall damage it is preferable that the explosive in the line holes be decoupled laterally and/or air decked to spread the explosive more throughout the length of the hole. Rock excavation should be to the line holes and not beyond.

Two or three lines of buffer holes are recommended, drilled in front of the line holes with the spacing equal to about one-half that between the production holes. The first line of buffer holes should be angled. The others may be vertical. They should use the same diameter as the line holes. In order to drill the angle holes, it will be necessary to purchase or lease a drill which drills this size of hole and can be angled at angles up to about 25 degrees. Tamrock have drills with angled capacity. The amount of explosives per buffer hole will be approximately one-quarter that in the production holes. All buffer holes should be delayed.

Production holes may use larger diameter drills. Every hole of a production blast within one hundred feet of the final wall must be delayed singly.

Blasting should be developed towards a free face with that free face perpendicular to the wall. A typical trial blast pattern is shown in Figure 4.4. Figure 4.2 shows an excellent blast control program at Gortrum Mines in Ireland. Figure 4.3 is a plot of damage to rock, related to the weight of charge per delay, and the blast distance to the final wall. This graph emphasizes the utmost importance of using delays to reduce seismic acceleration forces to minimize wall damage.

The best blast design will result from trial test blast patterns in the field. The most beneficial program will develop where the open pit will be developed initially as a small pit and a subsequent set back will be developed. This initial pit can be

Revised: February 15, 1990

developed with variable test slopes and test blast patterns to develop the best blast design for the final wall. Test trial blasts will be required wherever the rock conditions change substantially.

It is recommended that double benching be used at the final wall. In order for this procedure to be successful, the upper bench face must be scaled prior to drilling the buffer holes on the next lower bench elevation. It is also important that blast holes be staggered so the bottom of the hole does not intercept the crest of the bench below. Otherwise, very fragmented bench crests will develop leading to considerable ravelling and a greater berm width.

It is recommended that the operators of front-end loaders or shovel loaders who excavate this final face be given a seminar on structural geology, particularly the identification of small planar blocks and small wedges which could fail. By recognizing these in advance, they can dig them out so that ravelling at a later date will be reduced. By minimizing this ravelling the bench width can be narrowed to increase the overall slope angle.

Do not place piles of loose rock at the outer side of berms to catch ravelling rock. This requires an excessive bench width and results in overall flatter slope angles. Berms are to catch ravelled rock. They are not intended for later access.

4.5 MONITORING

The development of slope movement will be indicated by the development of a tension crack or cracks. It is most important that periodic inspections along the crest and bench locations be performed periodically to locate such cracks.

When tension cracks are observed the initial monitoring program requires the installation of surface movement hubs or gages which will allow measurement of both vertical and horizontal displacement. This is required to evaluate the type of movement that is occurring - circular, planar, toppling etc.

If larger scale movements appear to be developing, an electronic distance measuring (EDM) prism monitoring system should be developed. Three or four prisms should be installed on a line down the center of the slide with readings taken daily from a fixed station across the pit. Movement records should be plotted daily to determine if there is an acceleration of the movement. Plots should be made of a total movement vs time. At this point in time a decision as to whether the slide will be stabilized or whether it will simply be monitored and allowed to fail will then be made. If it is to be allowed to fail, continued monitoring of the acceleration will allow the date of failure to be predicted several days in advance. Mining would be discontinued at this time.

From a practical standpoint, where failure volumes involve 500,000 cubic yards or more, experience is that a failure will not occur within the next 24 hours if the amount of daily movement is less than about three inches.

Any failures involving one or more benches should be back analyzed. The location, structural geology, face failure geometry, failure surface roughness, seepage and blasting details etc. should be recorded. This allows the most accurate evaluation of the shear strength along the failure surface to be determined, to be used in re-design. Photographs should be taken and described.

4.6 BENCH DESIGN

For final pit wall bench design it is proposed that controlled blasting be used to develop a relatively steep bench face (70 to 75 degrees) which should be scaled with excavating equipment and a drag chain or equivalent from the top. Double benching is recommended. The scaling will reduce subsequent ravelling and reduce the catch width required for berms. Where the rock face stands up well, a 6 metre (20 foot) wide bench is suggested. If the rock is very fractured and considerable ravelling occurs the bench will have to be widened to about 8 metres (25 feet).

If areas of heavily fractured rock or faulted rock are encountered in the final slopes, more stable bench faces can frequently be developed using bulldozers and rippers rather than blasting along the final line holes. By utilizing this procedure the slope angles at Bougainville, in Papua New Guinea, for example, were steepened some 8 degrees.

4.7 PRELIMINARY PIT SLOPE DESIGN

East Facing Slope - A revised geological interpretation provided by Imperial Metals Corporation indicates the geologic structure is reasonably uniform over all three pits. Planar failures will occur locally where the structure dip is flatter than the bench face angle.

The slope angle can be developed with bench face angles of 70 degrees. The overall angle will depend on berm width, bench height and whether single or double benching will be used. See Table 4.1 and Figures 4.5 and 4.6.

West Facing Slopes - Based on existing structural geologic data the structure dips into the west facing slopes at about 45 to 75 degrees. Where the structure dip is less than about 60 degrees and does not cross major faults the bench faces can be developed at 75 degrees. The overall angle will depend on berm width, bench height and single or double benching. Where the dip angle is steeper than about 60 degrees the potential for toppling failure exists. The bench faces should be flattened to 70 degrees and berm widths should be increased by 2.0 metres.

The overall slope angles for various conditions are shown in Table 4.1 and Figures 4.5 and 4.6.

It is very important that these slopes be drained.

South Facing Walls - The fault structures generally dip N-S and will not materially influence slope stability. The joints dip into the slope which is a stable condition. Accordingly bench faces can be developed at 75 degrees with minimum berms widths. The overall slope angle will depend on the use of single or double benches. See Table 4.1 and Figures 4.5 and 4.6.

North Facing Walls - The fault structures will have similar influence as in the south facing walls. The two joint sets prevalent at the site will intersect to form shallow wedges. Some local bench size failures can be expected. Bench faces should be developed at 70 degrees with wider catch berms. The overall slope angles for various conditions are given in Table 4.1 and Figures 4.5 and 4.6.

Note that the slope angles recommended do not include haul roads.

Pit Noses - The preliminary design of the west pit and central pit has created a north and a south nose. Such noses usually suffer from excessive ravelling and instability. It is recommended the overall slopes in any such area be flattened 10 degrees by using wider catch benches.

Ramps - It is desirable to locate haul roads on the most stable pit wall - in this instance along the west facing slopes.

Fault Intersections - Where faults intersect the walls at shallow angles (<30 degrees) local wedge failures will occur. Extra scaling will be required.

Knight Piésold Ltd.
CONSULTING ENGINEERS

APPENDIX B

DISCONTINUITY DATA AND POINT LOAD TEST RESULTS

APPENDIX B

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT

DISCONTINUITY DATA AND POINT LOAD TEST RESULTS

DRILLHOLE MP89-152 (285/55)

DEPTH		ROCK TYPE	R.Q.D.	FRACTURE INDEX (jt/ft)	GAUGE (psi)	COMP.STRENGTH	
from	to					(psi)	(MPa)
10	20	DIORITE	60	2.0	3200	36188	250
20	30		82	2.0	3200	36188	250
30	40		83	1.0	3500	39581	273
					2900	32796	226
40	50		68	1.5	3500	39581	273
					2800	31665	218
50	60		95	1.2			
60	70		80	2.0	1000	11309	78
70	80		88	1.0	2000	22618	156
					4000	45235	312
80	90		93	1.5	2900	32796	226
90	100		68	3.0	2000	22618	156
100	110		93	1.0	1000	11309	78
110	120		100	1.2	2200	24879	172
120	130		65	2.7			
130	140		80	1.0	2800	31665	218
140	150		80	1.2	3000	33926	234
150	160		75	1.3	3000	33926	234
160	170		97	1.7	1900	21487	148
170	180		75	1.7	2600	29403	203
180	190		80	High	400	4524	31
190	200		20	High			
200	210		40	High	1800	20356	140
220	230		20	V.High			
220	230	SYENO	40	High	400	4524	31
230	240		60	2.5	1500	16963	117
240	250		35	3.0	1000	11309	78
250	260		18	High			
260	270		35	High	200	2262	16
270	280		25	High	200	2262	16
280	290		10	High	900	10178	70
290	300		7		100	1131	8
300	310		5	High			
310	320		3	High	700	7916	55

APPENDIX B (Continued)

DRILLHOLE MP89-152 (285/55)

DEPTH		ROCK	R.Q.D.	FRACTURE INDEX (jt/ft)	GAUGE (psi)	COMP.STRENGTH	
from	to	TYPE				(psi)	(MPa)
320	330		0	High			
330	340		15	High	700	7916	55
340	350		-	1.5	600	6785	47
					800	9047	62
350	360		85	1.8	1700	19225	133
					2200	24879	172
360	370		99	0.7	1100	12440	86
370	380		95	1.5	2700	30534	211
380	390		95	1.2	2600	29403	203
390	400		80	4.0	1200	13571	94
					2000	22618	156
400	410		80	1.0	2100	23748	164
410	420		80	3.3	1800	20356	140
					2600	29403	203
420	430		65	3.3	1200	13571	94
430	440		70	3.0	700	7916	55
440	450		15	High	1200	13571	94
450	460		83	1.7	1200	13571	94
					1000	11309	78
460	470		94	1.4	1600	18094	125
470	480		90	1.0			
480	490		85	1.1	2800	31665	218
					400	4524	31
490	500		80	2.0			
500	510		65	1.0	700	7916	55
510	520		40	3.0	900	10178	70
520	530		70	1.6	1800	20356	140
530	540		75	0.8			
540	550		85	0.8	700	7916	55
					1200	13571	94
550	560		45	High	900	10178	70
560	570		45	High	600	6785	47
570	580		35	High	400	4524	31
			35	High	600	6785	47
580	590		30	High	2800	31665	218
590	600		15	High	700	7916	55
					1500	16963	117
600	610		92	0.4	2100	23748	164
610	620		98	0.5	1900	21487	148
620	630		73	1.6			

APPENDIX B (Continued)

DRILLHOLE MP89-152 (285/55)

DEPTH from	DEPTH to	ROCK TYPE	R.Q.D.	FRACTURE INDEX (jt/ft)	GAUGE (psi)	COMP.STRENGTH (psi)	COMP.STRENGTH (MPa)
630	640		92	1.0	2000	22618	156
640	650		92	0.8	800	904	762 7
650	660		35	1.2	300	3393	23
660	670		98	0.5	200	2262	16
					900	10178	70
670	680	IB	95	0.8	1700	19225	133
					1600	18094	125
680	690		95	0.7	400	4524	31
					1000	11309	78
690	700		87	1.3	3000	33926	234
					2000	22618	156
					1700	1922	133
700	710	DYKE	95	1.2	1200	13571	94
		IB			1000	11309	78
710	720		100	0.6	2800	31665	218
720	730		85	1.1	600	6785	47
730	740		90	1.0	1900	21487	148
740	750		50	1.0	300	3393	23
					100	1131	8
750	760		100	0.4	1300	14701	101
					1200	13571	94
760	770		90	0.6	300	3393	23
					700	7916	55
770	780		40	High	50	565	4
780	790		35	1.5	1900	21487	148
790	800		25	High	1500	16963	117
800	810		-	0.9	3200	36188	250
810	820		92	0.9	1100	12440	86
					3200	36188	250
820	830		87	1.1	2500	28272	195
830	840		80	1.1	900	10178	70
					2100	23748	164
840	850		50	High	600	6785	47
					1600	18094	125
850	860		90	1.1	2300	26010	179
					1500	16963	117
860	870		95	1.1	1100	12440	86
870	880		25	1.2	800	9047	62
880	890		96	0.5	200	2262	16
					500	5654	39

APPENDIX B (Continued)

DRILLHOLE MP89-152 (285/55)

DEPTH from	DEPTH to	ROCK TYPE	R.Q.D.	FRACTURE INDEX (jt/ft)	GAUGE (psi)	COMP.STRENGTH (psi)	COMP.STRENGTH (MPa)
890	900		94	0.7	300	3393	23
900	910		90	1.7	800	9047	62
910	920		55	3.0	300	3393	23
920	930		45	2.0	200	2262	16
					400	4524	31
930	940		30	High	100	1131	8
940	950		87	1.4	3500	39581	273
950	960		70	2.0	1200	13571	94
960	970		90	1.5	1500	16963	117
970	980		93	1.4	2500	28272	195
					200	2262	16
980	990		85	1.3	1500	16963	117
990	1000			1.5	2300	26010	179

DRILLHOLE MP89-153 (253/50)

30	40		25	High	1000	11309	78
40	50		15	High			
50	60		35	High	500	5654	39
60	70		70	High	1000	11309	78
70	80	DYKE	35	High	2500	28272	195
		IB			600	6785	47
80	90		15	High	100	1131	8
90	100		35	High	100	1131	8
100	110		18	3.0	800	9047	62
110	120		50	2.2	2300	26010	179
120	130		15	3.0	1700	19225	133
130	140		12	4.0	1200	13571	94
140	150		95	1.1	400	4524	31
150	160		95	0.9	1300	14701	101
160	170		91	1.0	2000	22618	156
170	180		35	2.6	1200	13571	94
180	190		65	2.4	100	1131	8
					300	3393	23
190	200		87	1.3	2700	30534	211
200	210		99	0.8	3600	40712	281
210	220		94	1.2	1800	20356	140
					2500	28272	195
220	230		97	0.7	3800	42973	296
230	240		92	1.1	2900	32796	226

APPENDIX B (Continued)

DRILLHOLE MP89-153 (253/50)

DEPTH		ROCK TYPE	R.Q.D.	FRACTURE INDEX (jt/ft)	GAUGE (psi)	COMP.STRENGTH	
from	to					(psi)	(MPa)
240	250		100	0.6	2500	28272	195
250	260		80	1.4	1100	12440	86
260	270		100	0.4	1000	11309	78
			100	0.4	1400	15832	109
270	280		100	0.4	3000	33926	234
			100	0.4	1500	16963	117
280	290		80	1.2	2600	29403	203
290	300		96	0.7	1700	19225	133
300	310		89	1.1	1400	15832	109
310	320		96	0.9	2400	27141	187
320	330		50	2.7	1300	14701	101
330	340	DYKE	80	1.2	600	6785	47
		IB			400	4524	31
340	355		83	1.0	2200	24879	172
350	360		98	0.6	1500	16963	117
360	370		100	0.6	1400	15832	109
370	380		80	1.6	1000	11309	78
380	390		100	0.4	1600	18094	125
390	400		98	0.9	2200	24879	172
400	410		100	0.3	2000	22618	156
410	420		100	0.5			
420	430		100	1.0	1300	14701	101
430	440		100	0.5	2000	22618	156
					1200	13571	94
440	450		91	0.4	1900	21487	148
450	460		96	0.6	1800	20356	140
460	470		100	0.5			
470	480		100	0.7	1200	13571	94
480	490		100	0.3	1200	13571	94
490	500		100	0.0	1200	13571	94
					1000	11309	78
					4000	45235	312
500	510		100	0.4	2500	28272	195
510	520		98	0.7	1500	16963	117
520	530		97	0.7	3000	33926	234
530	540		90	0.8	2200	24879	172
540	550		100	0.3	2200	24879	172
550	560		100	0.7	2300	26010	179
560	570		65	1.8	800	9047	62
570	580		50	2.6	300	3393	23

APPENDIX B (Continued)

DRILLHOLE MP89-153 (253/50)

DEPTH		ROCK TYPE	R.Q.D.	FRACTURE INDEX (jt/ft)	GAUGE (psi)	COMP.STRENGTH	
from	to					(psi)	(MPa)
					700	7916	55
580	590		20	2.0	500	5654	39
					2800	31665	218
590	600		75	1.5	1100	12440	86
600	610		40	3.0	50	565	4
					100	1131	8
610	620		82	1.3	800	9047	62
620	630		97	0.6	1000	11309	78
630	640		95	0.3	2400	27141	187
640	650		80	1.2	2000	22618	156
650	660		100	0.3	2800	31665	218
660	670		100	0.1	500	5654	39
					1000	11309	78
670	680		98	0.4	2700	30534	211
					700	7916	55
680	690		95	1.1	100	1131	8
				1.1	700	7916	55
690	700		96	0.8	1000	11309	78
700	710		89	0.9	2200	24879	172
710	720		92	0.7	900	10178	70
720	730	DYKE	70	1.4	1000	11309	78
730	740		75	0.8	1500	16963	117

DRILLHOLE MP89-154 (245/50)

10	20	IB	20	2.5	2000	22618	156
					2800	31665	218
20	30		30	2.5	1400	15832	109
30	40		50	1.8	400	4524	31
40	50		30	1.8			
50	60	DYKE	70	1.7	100	1131	8
		IB			300	3393	23
60	70		25	3.0	1100	12440	86
70	80		95	High	400	4524	31
80	90		45	High	400	4524	31
90	100		7	High	1100	12440	86
100	110		45	1.9	600	6785	47
110	120		55	1.9	2600	29403	203
120	130	DYKE	55	2.1	600	6785	47
130	140	IB	30	High	350	3958	27

APPENDIX B (Continued)

DRILLHOLE MP89-154 (245/50)

DEPTH from	DEPTH to	ROCK TYPE	R.Q.D.	FRACTURE INDEX (jt/ft)	GAUGE (psi)	COMP.STRENGTH (psi)	COMP.STRENGTH (MPa)
140	150		25	3.0	350	3958	27
150	160		55	1.7	150	1696	12
160	170		55	1.0	300	3393	23
170	180		35	High			
180	190		30	High	300	3393	23
190	200		60	High			
200	210	DYKE	12	High	300	3393	23
210	220	IB	3	High	250	2827	19
220	230		3	High	50	565	4
230	240		15	High			
240	250		40	High	1100	12440	86
250	260		30	High			
260	270		45	High			
270	280		14	High			
280	290			High			
290	300	DYKE	18	High	500	5654	39
300	310	IB	5	High			
310	320		18	High	300	3393	23
320	330		45	7.5	700	7916	55
					900	10178	70
330	340		75	1.5	4100	46366	320
340	350		95	1.2	5000	56544	390
350	360		85	1.6			
360	370		94	0.9	3000	33926	234
370	380		91	1.1	2600	29403	203
380	390		40	2.2	3400	38450	265
390	400		97	1.2	4100	46366	320
					3600	40712	281
400	410		93	1.3	3000	33926	234
410	420		93	1.2	1400	15832	109
420	430		92	1.4	3500	39581	273
430	440		83	2.3			
440	450	SYENO	85	1.6	2900	32796	226
450	460		90	1.1	2800	31665	218
460	470		95	0.8			
470	480		87	1.0			
480	490		95	1.1			
490	500		94	1.2			
500	510		96	1.2			
510	520		91	1.0			

APPENDIX B (Continued)

DRILLHOLE MP89-154 (245/50)

DEPTH		ROCK TYPE	R.Q.D.	FRACTURE INDEX (jt/ft)	GAUGE (psi)	COMP.STRENGTH	
from	to					(psi)	(MPa)
520	530		92	1.4			
530	540		100	0.4			
540	550		98	0.7			
550	560		92	0.9			
560	570	IB	87	1.3	2400	27141	187
570	580		95	1.1	2000	22618	156
580	590	DYKE	82	0.8	3400	38450	265
				25	High		
600	610	SYENO	100	0.1	3600	40712	281
610	620	IB	97	1.2	1400	15832	109
620	630	DYKE	95	0.7	1600	18094	125
630	640	SYENO	90	0.9	900	10178	70
640	650		92	1.3	3700	41843	289
650	660		85	1.4	1600	18094	125
660	670		90	1.3	1700	19225	133
670	680		96	0.7			
680	690		99	1.0	1400	15832	109
690	700		95	1.0	3500	39581	273
700	710	IB	87	1.0	500	5654	39
710	720		80	1.3	100	1131	8
					1500	16963	117
720	730		30	2.0	900	10178	70
730	740		40	2.0	500	5654	39
740	750		30	High	500	5654	39
750	760		20	High	0	0	0
760	770		25	V.High			
770	780		10	V.High	0	0	0
780	790		18	V.High	50	565	4
790	800		15	V.High			
800	810		34	High	50	565	4
810	820		23	High	300	3393	23
					0	0	0
820	830		6	V.High	150	1696	12
830	840		40	High			
840	850	IB	68	1.4	600	6785	47
850	860		53	1.4	1300	14701	101
860	870		50	1.2			
870	880		85	1.1	150	1696	12
880	890		70	1.3	800	9047	62
890	900		100	1.0	300	3393	23

APPENDIX B (Continued)

DRILLHOLE MP89-154 (245/50)

DEPTH from	DEPTH to	ROCK TYPE	R.Q.D.	FRACTURE INDEX (jt/ft)	GAUGE (psi)	COMP.STRENGTH (psi)	COMP.STRENGTH (MPa)
900	910		100	0.4	800	9047	62
910	920		97	0.7	400	4524	31
920	930		65	1.0	1200	13571	94
930	940		100	0.6	800	9047	62
940	950		89	0.8	500	5654	39
950	960		98	0.7	1400	15832	109
960	970		90	1.4	200	2262	16
970	980		18	1.5	400	4524	31
980	990		70	1.2	2000	22618	156
990	1000		93	1.6	300	3393	23
1000	1010		15	High	100	1131	8
1010	1020		15	High			
1020	1030		85	1.5	1100	12440	86
1030	1040		85	1.5	1500	16963	117

APPENDIX C

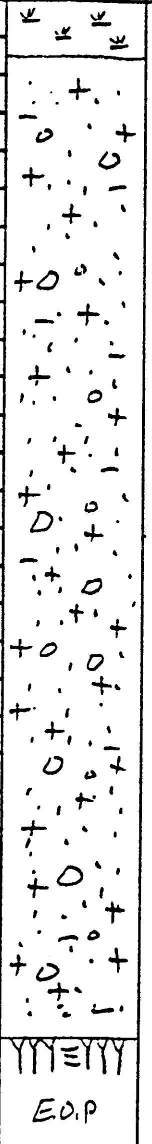
TEST PIT LOGS

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

TEST PIT LOG

TEST PIT No. TP95-1
SHEET 1 of 1

PROJECT Mt Polley
LOCATION OF TEST PIT Approx 5,822,550N, 592,610E
Fine Ore Stockpile
DATE Jan 11/95
PROJECT No. 1623
GROUND ELEVATION ~1112 m
LOGGED BY KGB



NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe.	0	Dark brown / black ORGANICS
Moderate digging conditions.	1	Brown, dense, slightly moist, fine-grained sandy SILT with some fine-grained gravel and clay. Well graded, poorly sorted. Becomes denser at depth (dense, cohesive chunks are ripped from in-situ material). → Sandy Silt Glacial Till
	2	
	3	
Sample TP95-1 from 4 to 5.5m depth ←	4	
Seep encountered at 5.2m depth.	5 ▽	saturated till below 5.2m.
	6	Bedrock encountered at 5.5m. Too deep to excavate any further.
	7	
	8	

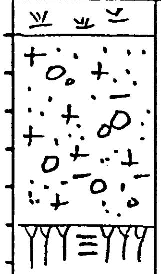
KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

TEST PIT LOG

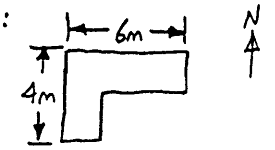
TEST PIT No. TP95-2
SHEET 1 of 1

PROJECT Mt Polley
LOCATION OF TEST PIT Approx 5,822,560 N, 592,730 E
DATE Jan 11/95 Concentrator

PROJECT No. 1623
GROUND ELEVATION ~1110 m
LOGGED BY KGB

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe	0		Dark brown/black, saturated, ORGANICS.
			Orange brown/brown, dense, moist to very moist, fine-grained sandy SILT with some gravel and clay. Organics sometimes encountered to 1m depth. Sandy SILT Glacial Till
Water table encountered at 1.2m No samples taken.	1 ▽ 2	E.O.P.	Bedrock encountered at 1.2m depth. Angular fragments, typically 10cm dia. Wet due to water table.

Note: This trench was excavated approx. 10m long:



- The north-south portion typically had 1m of organics, a thin layer of till overlying bedrock.
- The east-west portion is described above.
- Both limbs encountered bedrock at shallow depths.

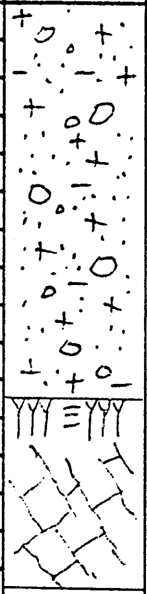
KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

TEST PIT LOG

TEST PIT No. TP95-3
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5,822,560 N, 592,765 E
DATE Jan 11/95 Concentrator

PROJECT No. 1623
GROUND ELEVATION ~1110 m
LOGGED BY KGB

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe Moderate digging conditions No samples taken!	0 1		Brown, dense, fine-grained sandy SILT with some gravel and clay. Slightly moist to moist. Similar to material encountered in TP95-1 Sandy Silt Glacial Till
Water table encountered. at 2.1 m Water ponded in pit to 2m depth after 18hrs.	▽ 2 3 4	E.O.P.	Bedrock encountered at 2.1 m. Angular fragments 10 to 20 cm dia. typically. Very broken at surface, and becomes more competant with depth. Backhoe rips through 1m of bedrock, and could continue, indicating the contact is very fractured.

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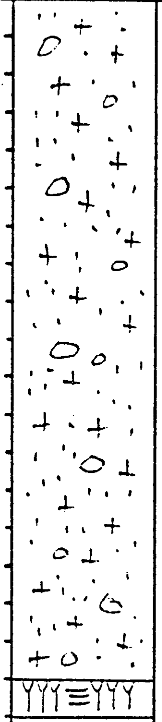
CONSULTING ENGINEERS

TEST PIT LOG

TEST PIT No. TP95-4
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5,822,510N, 592,765E
South end of Concentrator
DATE Jan 11/95

PROJECT No. 1623
GROUND ELEVATION ~ 1109 m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe	0		Orange-brown (near surface) to brown, dense fine-grained sandy SILT with some gravel and Clay (similar to TP95-1). slightly moist. Cohesive in-situ, especially at depth where chunks of material is ripped from pit. Fine to moderate-grained gravel.
Moderate digging conditions	1		
Sample TP95-4 taken 2 to 3.6m	2 ∇		Sandy Silt Glacial Till
	3		↓ Basal till
Water table encountered at 3.6m. water ponded to approx 2 to 2.5m depth after 18hrs	∇		Bedrock encountered at 3.6m depth. Angular fragments encountered.
	4	E.O.P.	

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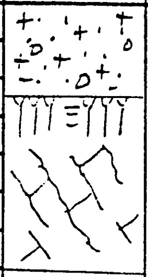
CONSULTING ENGINEERS

TEST PIT LOG

TEST PIT No. TP95-5
SHEET 1 of 1

PROJECT Mt Polley
LOCATION OF TEST PIT Approx 5,822,720 N, 592,600E
" Crusher
DATE Jan 12/95

PROJECT No. 1623
GROUND ELEVATION ~1120 m
LOGGED BY KGB

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe.	0		Oxidized silty SAND with some gravel, trace clay. Coarser grained than tills in TP95-1, 3 and 4. Lots of roots throughout. Silty Sand Glacial Till
No seeps encountered. No samples taken.	1 2	E.O.P.	Bedrock encountered at 0.5m. Lapilli Tuff (volcanics). Oxidized (iron stained) on exposed outcrop. Fractured. Note: Test pit is 10 m long, and varies in depth up to 1.4m.

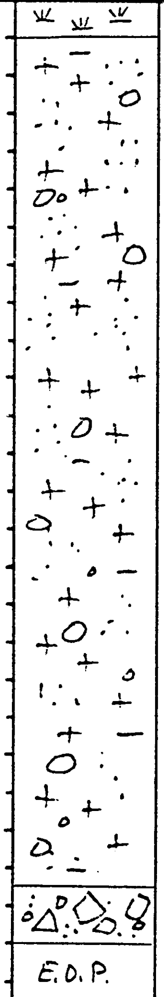
KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

TEST PIT LOG

TEST PIT No. TP95-6
SHEET 1 of 1

PROJECT Mt Polley
LOCATION OF TEST PIT Approx 5,822,720 N; 592,740 E
" Coarse ore Stockpile.
DATE Jan 12/95

PROJECT No. 1623
GROUND ELEVATION ~1117 m.
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe.	0		ORGANICS
Moderate digging conditions	1		Brown, dense, fine-grained sandy SILT with some fine-grained gravel, trace to some clay. Slightly moist. Becomes very dense (hard) near bottom of pit as backhoe rips chunks of till (very cohesive, looks like gravelly clay with some sand and silt. Probably a basal till layer).
Sample TP95-6 from 0 to 4m ←	2		Sandy Silt Glacial Till
Digging becomes more difficult.	3		
	4		Till becomes oxidized at 4m.
No seeps encountered.	5	E.O.P.	Oxidized coarse-grained sand and angular rock fragments encountered. No large rock fragments or visible outcrop encountered.
	6		

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

TEST PIT LOG

TEST PIT No. TP95-7
SHEET 1 of 1

PROJECT Mt Polley
LOCATION OF TEST PIT Approx 5,822,610 N; 592,730 E. Concentrator
DATE Jan 12/95

PROJECT No. 1623
GROUND ELEVATION ~1112 m
LOGGED BY KGB

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL

NOTES

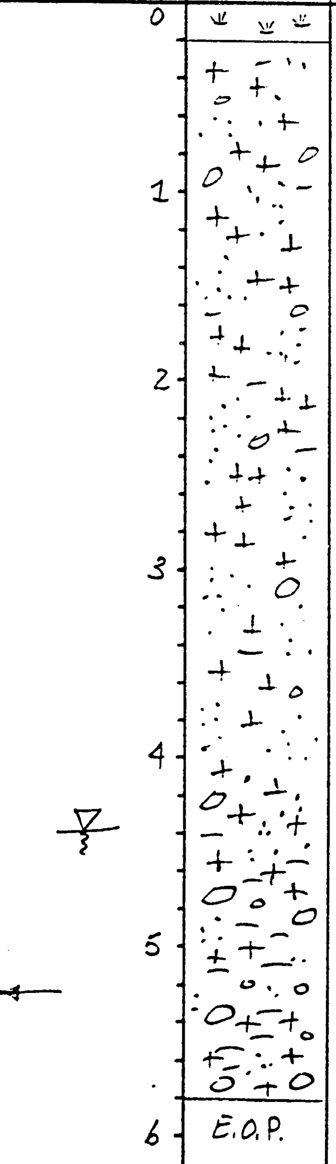
Hitachi 200 hoe.

Moderate digging conditions.

Seep encountered at 4.4m.

Sample TP95-7 (4.4 to 5.8m)

Difficult digging conditions



DESCRIPTION AND CLASSIFICATION OF MATERIAL

Organics

Brown, dense, slightly moist, fine-grained sandy SILT with some gravel, clay. Similar to material encountered in surrounding test pits. Hard, gray coloured till encountered at depth (~4.4m). Rips in extremely cohesive, dense chunks from pit. Gravel is round and fine to medium sized. Typically, this more dense till is encountered near the till/bedrock contact in previous test pits.

Sandy Silt Glacial Till

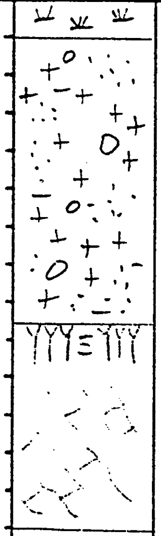
KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

TEST PIT LOG

TEST PIT No. TP95-8
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5,822,560 N ; 592,690 E.
" Concentrator
DATE Jan 12/95

PROJECT No. 1623
GROUND ELEVATION ~1110 m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe.	0		Organics, black + brown colour.
Moderate digging conditions.	1		Dense, brown, fine-grained sandy SILT with some fine-grained gravel and clay. Loose once excavated. Similar till as majority of millsite pits. No hard basal till encountered. Sandy Silt Glacial Till
Water quickly ponding at bottom of hole. No samples taken.	∇ ? 2		Bedrock encountered at 1.7m. Lapilli Tuff (volcanics). Angular fragments up to 30cm dia. Backhoe tears through approx 1.1m with difficulty. Becomes extremely difficult to excavate at 2.8m depth.
	3	E.O.P	

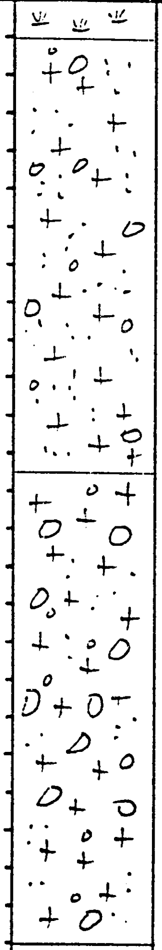
KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

TEST PIT LOG

TEST PIT No. TP95-9
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5,823,280 N; 591,300 E
'' East side Bootjack Lake
DATE Jan 12/95

PROJECT No. 1623
GROUND ELEVATION ~1052m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe.	0		Organics.
Moderate digging conditions Sample TP95-9A ← (0.2 to 2.5m)	1 2		Brown, dense, moist, sandy gravelly SILT with trace to some clay. Medium sized gravel. Poorly sorted, well graded. Coarser than till at mill site. Sandy Gravelly Silt Glacial Till
Sample TP95-9B ← (2.5 to 5.0m) Seep @ 4m.	3 ▽ 4		Grey, slight to moderately dense (firm), very moist → sat'd, (sticky and cohesive) sandy SILT with some clay trace to some gravel, trace cobbles. Gravel is fine to coarse grained. Moderate resistance when indented with finger Very plastic. Backhoe creates suction when excavating material. This is very wet material! Sandy Silt Glacial Till
	5	E.O.P.	

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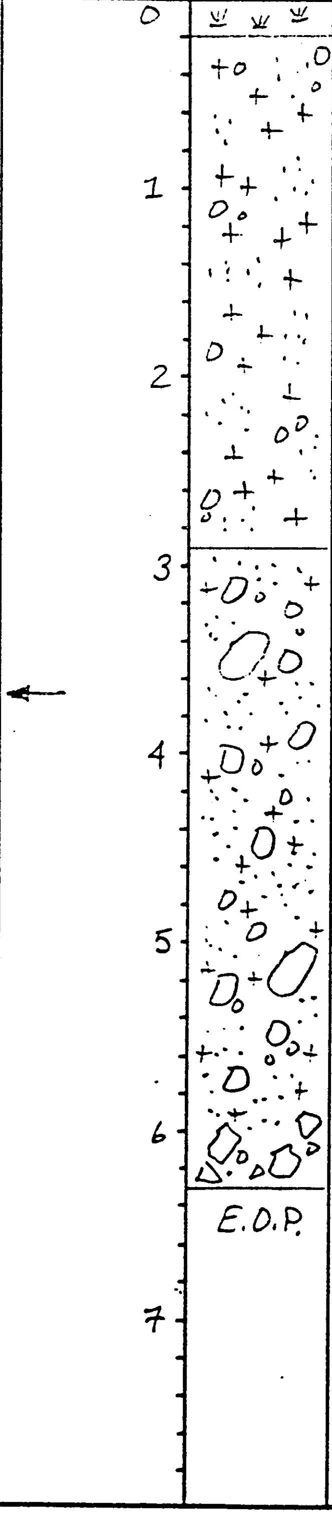
TEST PIT LOG

TEST PIT No. TP95-10
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Appr 5,822,850N : 551 480E
" (East side Bootjack Lake)
DATE Jan 12/95

PROJECT No. 1623
GROUND ELEVATION ~1048m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe. Moderate digging conditions. Sample TP95-10 ← More difficult digging (due to coarse rocks) No seeps encountered.			Organics. Oxidized, dense sandy SILT with some gravel and clay. Slightly moist. Same material as encountered at mill site. Loose once excavated. Sandy Silt Glacial Till Brown, dense, moist, silty gravelly SAND with trace cobbles and clay. Non-plastic. Loose once excavated. Moderate to coarse gravel. Denser material at bottom of pit. Coarser than till encountered in TP95-9. Silty Gravelly Sand Glacial Till Rock fragments encounted (up to 20cm dia.) at base of pit -- possible bedrock ?

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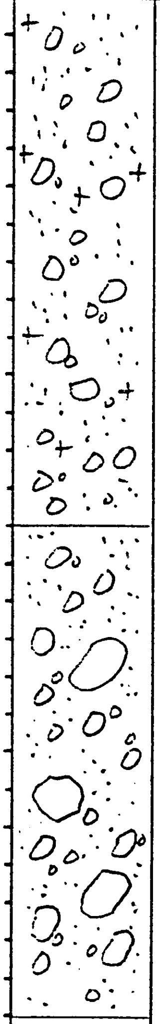
CONSULTING ENGINEERS

TEST PIT LOG

TEST PIT No. TP95-11
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5,822,500 N; 591,800 E (East side of Bootjack Lake)
DATE Jan 12/95

PROJECT No. 1623
GROUND ELEVATION ~1040 m
LOGGED BY KGB.

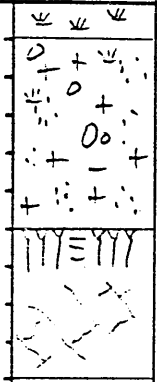
NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe.	0		Brown, dense, slightly moist (near surface) to very moist (to 2.8m depth), gravelly SAND with some silt. Non-plastic. Poorly sorted, moderately graded. Slightly oxidized near surface. Gravelly Sand Glacial Till
Moderate digging conditions	1		
Sample TP95-11	←		
	2		
Seep encountered @ 2.8m.	▽		
	3		Saturated sandy GRAVEL with some cobbles, trace to some silt. Moderately dense. Angular cobbles and gravel. Very coarse material. Noticable water in material when excavated. Sandy Gravel Glacial Till
Difficult digging due to coarse material.	4		
	5		
		E.O.P.	
	6		

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

TEST PIT LOG

TEST PIT No. TP95-12
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5 822 250 N ; 592 140 E
DATE Jan 13/95 (East side of Bootjack Lake)
PROJECT No. 1623
GROUND ELEVATION ~1050 m
LOGGED BY KGB.



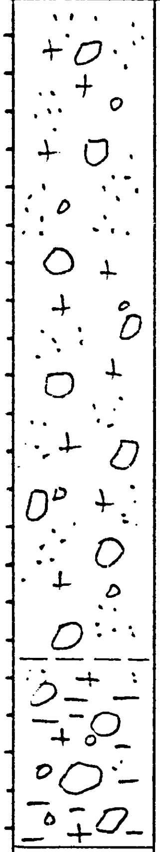
NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe.	0		Organics
Sample TP95-12	←		Brown, moderately oxidized, moist to very moist, moderately dense, fine-grained sandy SILT with some fine-grained gravel and clay, trace organics. Poorly sorted, moderately graded. Slightly plastic.
Moderate digging to 2m.	1		Sandy Silt Glacial Till
	2	E.O.P.	Bedrock encountered at ~2m depth. Fractured, typically 20 cm dia sizes. Slightly wet at contact.
	3		

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

TEST PIT LOG

TEST PIT No. TP95-13
SHEET 1 of 1

PROJECT Mt Polley
LOCATION OF TEST PIT Approx 5822170 N; 592 470 E
DATE Jan 13/95 (East side of Bootjack Lake)
PROJECT No. 1623
GROUND ELEVATION ~1076 m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe. Moderate digging conditions Sample TP95-13 (0 to 3.5m) ←	0 1 2 3		Brown, dense, moist, silty SAND with some gravel, trace to some clay. Gravel is typically medium sized. Well graded, poorly sorted. Slightly plastic. Coarser than material encountered at mill site. Good construction material. Silty Sand Glacial Till
Difficult digging conditions No seeps.	4 5 6	E.O.P.	Till becomes denser and more difficult to excavate. Grey-brown, hard, slightly moist sandy SILT with some gravel and clay. Rounded gravel; variable sizes. Extremely cohesive (rips in chunks from pit). Looks like a basal till. Sandy Silt Basal Till

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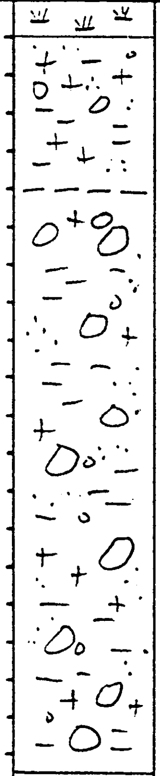
CONSULTING ENGINEERS

TEST PIT LOG

TEST PIT No. TP95-14
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5 825 000 N; 589 230 E
DATE Jan 13/95 (7.1 km along Main Access Road)
PROJECT No. 1623
GROUND ELEVATION ~ 975 m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe	0		Organics
	1		Oxidized-brown near surface (becoming grey-brown coloured with depth), dense, slightly moist, sandy SILT and CLAY with some gravel and trace cobbles. Gravel and cobbles are rounded. Material becomes denser below 1m:
Moderate digging conditions			
Sample TP95-14. ←	2		Hard, slightly moist, sandy SILT with some gravel and clay. Moderate to well graded, poorly sorted. Plastic when wet. Good construction material.
No seeps.	3		Sandy Silt Glacial Till
Difficult digging with depth.			
	4	E.O.P.	
	5		

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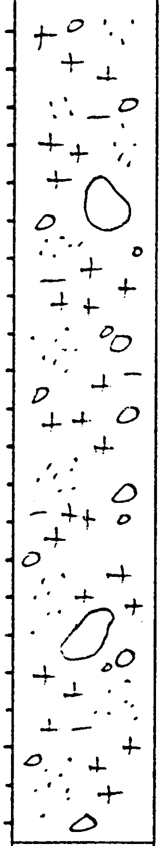
CONSULTING ENGINEERS

TEST PIT LOG

TEST PIT No. TP95-15
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5826 300 N; 587 500 E
DATE Jan 13/95 (4.35 km along Main Access Road)

PROJECT No. 1623
GROUND ELEVATION ~930 m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe	0		No organics (on top of clear-cut hill).
Moderate digging conditions.	1		Brown, dense, slightly moist, sandy gravelly SILT with trace to some clay, trace cobbles. Poorly sorted, well graded. Rounded cobbles and gravel. Dense basal-till like appearance when excavated in hard chunks, although majority of material is loose once excavated. Good construction material. (Similar till as TP95-14, only coarser.) Sandy Gravelly Silt Glacial Till
Sample TP95-15 ←	2		
No seeps.	3		
	4	E.O.P.	
	5		

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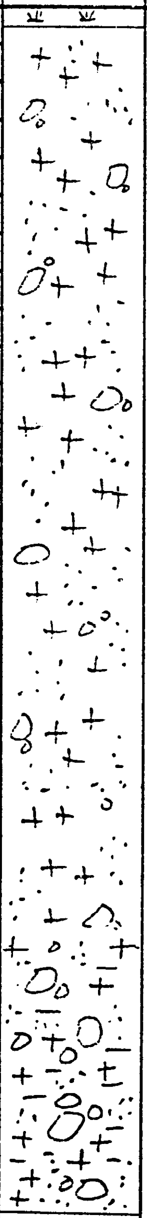
CONSULTING ENGINEERS

TEST PIT LOG

TEST PIT No. TP95-16
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5 820 580N; 594 370 E
DATE Jan 13/95 (TSF Access Road)

PROJECT No. 1623
GROUND ELEVATION ~980m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe.	0		Organics
Easy to moderate digging conditions.	1		Brown, dense, slightly moist, sandy SILT with trace to some gravel and clay. Occasional rounded cobble or boulder. Moderately graded, poorly sorted. Plastic. No oxidation evident. In-situ material is 'very stiff'.
Sample TP95-16 ← (0 to 5m)	2		Sandy Silt Glacial Till
	3		
	4		
Seep at 5.0m.	▽ 5		Grey, hard, slightly moist sandy SILT with some gravel and clay, trace cobbles. Material is ripped from ground in extremely cohesive chunks. Slightly moist.
Very difficult digging conditions.	6	E.O.P.	Note: Some local coarse areas of gravel and sand exist and water seeps through.
	7		

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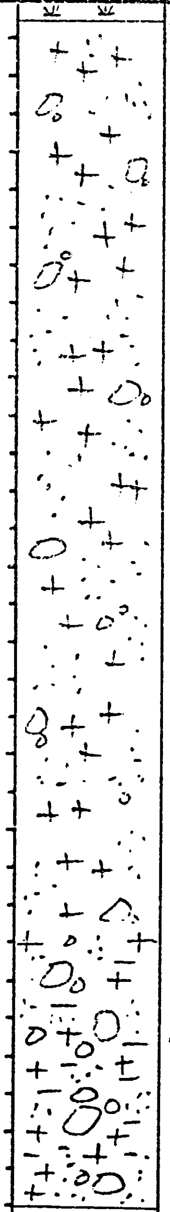
TEST PIT LOG

TEST PIT No. TP95-16
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5820580N; 594370E
DATE Jan 13/95 (TSF Access Road)

PROJECT No. 1623
GROUND ELEVATION ~980m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe.	0		Organics
Easy to moderate digging conditions.	1		Brown, dense, slightly moist, sandy SILT with trace to some gravel and clay. Occasional rounded cobble or boulder. Moderately graded, poorly sorted. Plastic. No oxidation evident. In-situ material is 'very stiff'. Sandy Silt Glacial Till
Sample TP95-16 (0 to 5m) ←	2		
	3		
	4		
Seep at 5.0m.	▽ 5		Grey, hard, slightly moist sandy SILT with some gravel and clay, trace cobbles. Material is ripped from ground in extremely cohesive chunks. Slightly moist. Note: Some local coarse areas of gravel and sand exist and water seeps through.
Very difficult digging conditions.	6		
		E.O.P.	
	7		

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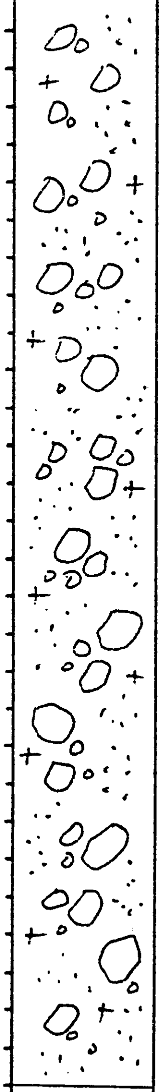
TEST PIT LOG

TEST PIT No. TP95-17
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5 821 110 N; 594 230 E (TSF Access Road).
DATE Jan 13/95
PROJECT No. 1623
GROUND ELEVATION ~980 m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (Metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe.	0		
	1		Brown, moderately dense, moist, GRAVEL and SAND with some fine cobbles and silt. Poorly sorted, moderately graded. Non-plastic. Sub-angular gravel and cobbles.
Moderate digging conditions.	2		Gravel and Sand Glacial Till
Sample TP95-17			
Water level rises to 3m depth after 15 hrs.	3		
	4		
Water table encountered at 4.3m.			Material is saturated below 4.3m.
	5		
	6	E.O.P.	

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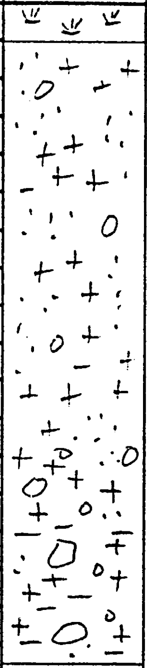
TEST PIT LOG

TEST PIT No. TP95-18
SHEET 1 of 1

PROJECT Mt Polley
LOCATION OF TEST PIT Approx 5821100 N; 593 295 E
DATE Jan 14/95 (Along tailings/reclaim pipeline route)

PROJECT No. 1623
GROUND ELEVATION ~ 992m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe.	0		Organics
Moderate digging conditions.	1		Brown, dense, slightly moist sandy SILT with some gravel and trace clay. Occasional rounded cobble. Plastic. Poorly sorted, moderately graded. Approx. top 20cm is oxidized; the remainder is fresh. Sandy Silt Glacial Till
Sample TP95-18	←		
	2		
Difficult digging conditions. No seeps encountered.	3		Gray-brown, hard, slightly moist sandy SILT with some gravel and clay and trace cobbles. Very dense and cohesive (rips out of pit in chunks). Poorly sorted, well graded. Gravel and cobbles are round to sub-rounded.
	4	E.D.P.	

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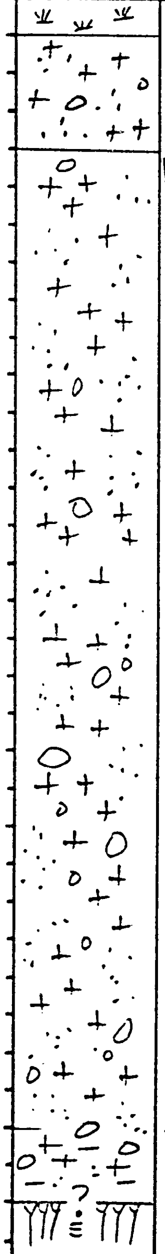
TEST PIT LOG

TEST PIT No. TP95-19
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5821600N; 592980E (Along tailings/reclaim pipeline route)
DATE Jan 14/95
PROJECT No. 1623
GROUND ELEVATION ~1042m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe. *Seepage from 0.2 to 0.8m only.	▽* 0 1 2		Organics. Brown, dense, moist gravelly SAND and SILT with trace cobbles and clay. Oxidized near surface. Plastic. Very well graded, poorly sorted. Sub-angular to sub-rounded particles. Visible seepage. Gravelly Sand and Silt Till (Note: This may be a layer of material developed from road construction.)
Moderate digging conditions Sample TP95-19 (0.8 to 6.0m)	← 3 4 5		Brown, dense, slightly moist, silty fine-grained SAND with some gravel, trace cobbles (with depth). Plastic. Poorly sorted, moderately graded. Becomes moister with depth. Material becomes sandy SILT with some gravel and clay, trace cobbles. All gravel is sub-round to sub-angular. Silty Sand/Sandy Silt Glacial Till
Difficult digging conditions.	6		approximate depth. Becomes grey and hard. Rounded gravel and cobbles.
	7	E.O.P.	Note: Angular rock fragments encountered at bottom of hole. Fine-grained, mafic with white (>1mm) flecs. (Possible bedrock contact?)

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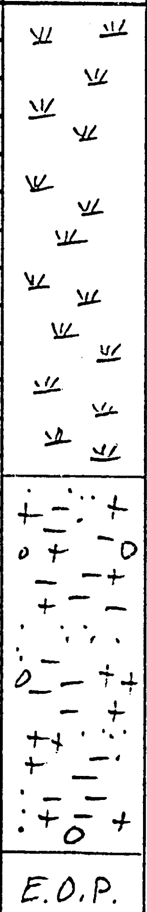
TEST PIT LOG

TEST PIT No. TP95-20
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5 820 900 N; 595 670 E (South-east corner of Polley Lake)
DATE Jan 14/95
PROJECT No. 1623
GROUND ELEVATION ~922 m
LOGGED BY KGB.



NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres) ▽*	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe.	0		Black/brown ORGANICS. Completely saturated. Side walls continuously slough into pit. Very smelly! Very soft. Water continuously seeps into pit.
*Perched water table above dense till. Very easy digging (0-2.5m)	1		
	2		
More difficult digging conditions.	3		Grey, very stiff → hard, slightly moist → moist, sandy SILT with some gravel and clay. Plastic. Poorly sorted, moderately graded. Very cohesive. Looks like basal till encountered in local pits, only more in-situ moisture.
Sample TP95-20 ←			Sandy Silt Basal Till
	4		
		E.O.P.	← Approximate depth. Difficult to measure due to pit constantly collapsing and filling with water.
	5		

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CONSULTING ENGINEERS

TEST PIT LOG

TEST PIT No. TP95-21
SHEET 1 of 1

PROJECT Mt Polley
LOCATION OF TEST PIT Approx 5 820 840N; 595 540E
DATE Jan 14/95 (60m south of Polley Lake)

PROJECT No. 1623
GROUND ELEVATION ~922m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.

Hitachi 200 hoe.

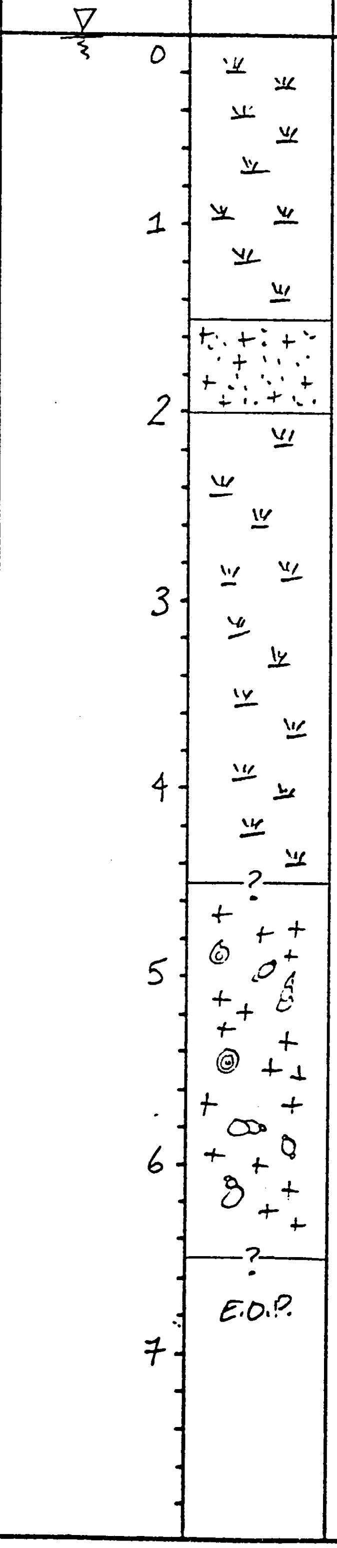
Visible seeps from peat from 0 to 1m depth. Pit is saturated.

Very soft digging throughout.

No samples taken.

DEPTH (metres)

GRAPHIC LOG



DESCRIPTION AND CLASSIFICATION OF MATERIAL

Black/brown, saturated, very soft ORGANICS. Very strong odour. Minimal strength.

Layer of gray, saturated, very soft, silty fine-grained SAND. Varves of grey and brown colours. Easily indented with finger.

Tan and grey, saturated, very soft SILT and ORGANICS. Varved silt layers. Tan layers contain yellow grass and small (up to 1cm; ave 0.5cm long) white fresh water shells. Well sorted, poorly graded. Very plastic and cohesive. Strong odour.

SILT and ORGANICS

Note: Depths are approximate only, due to pit constantly collapsing and filling with water.

KNIGHT AND PIESOLD LTD. CONSULTING ENGINEERS	TEST PIT LOG	TEST PIT No. TP95-22 SHEET 1 of 1

PROJECT Mt Polley

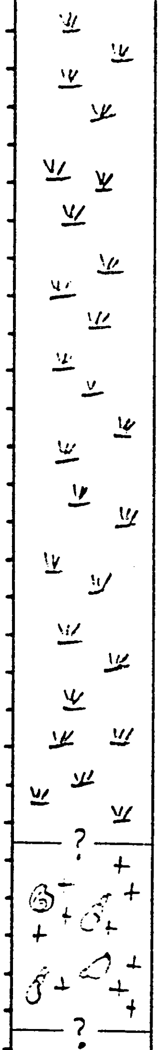
LOCATION OF TEST PIT Approx 5820 890 N; 595 540 E

DATE Jan 14/95 (South end of Polley Lake)

PROJECT No. 1623

GROUND ELEVATION ~922m

LOGGED BY KGB

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe Visible seeps from peat layer. Pit is saturated Very easy digging throughout test pit. No samples taken.	▽ 0 1 2 3 4		Black/brown, saturated, very soft ORGANICS. Side walls continuously collapse into pit. Very strong odour. Minimal strength.
	5		Tan/grey, saturated, very soft SILT and ORGANICS. Varved layers. Some material as encountered in TP95-21. SILT and ORGANICS
	6	E.O.P.	

Note: Depths are approximate only due to pit walls continuously collapsing and pit filling with water.

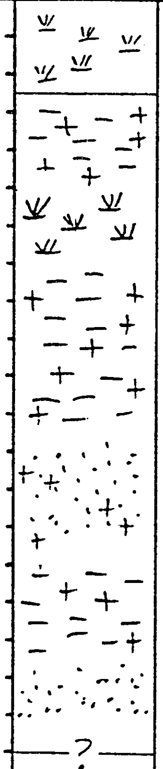
KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

TEST PIT LOG

TEST PIT No. TP95-23
SHEET 1 of 1

PROJECT Mt Polley
LOCATION OF TEST PIT Approx 5820 890 N; 595 420 E (South west corner of Polley Lake)
DATE Jan 14/95
PROJECT No. 1623
GROUND ELEVATION ~922m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe.	∇ 3 0		Black/brown, saturated, very soft ORGANICS.
Soft digging conditions.	1		Grey, saturated, very soft CLAY and SILT. Well sorted, poorly graded. Varved. Very plastic. Strong odour. Very cohesive.
Pit is saturated.	2		
No samples taken.	3		Layers of dark-grey/black, saturated, very soft fine-grained SAND and SILT. Some sand is coarse grained and of quartz composition. Cohesive. LACUSTRINE LAYERS
	4	?	
		E.O.P.	



Note: Depths are approximate only due to pit walls continuously collapsing and the pit filling with water.

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CONSULTING ENGINEERS

TEST PIT LOG

TEST PIT No. TP95-24
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5 820 900 N; 595 360 E
DATE Jan 14/95 (south-west corner of Polley Lake)

PROJECT No. 1623
GROUND ELEVATION ~922 m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.

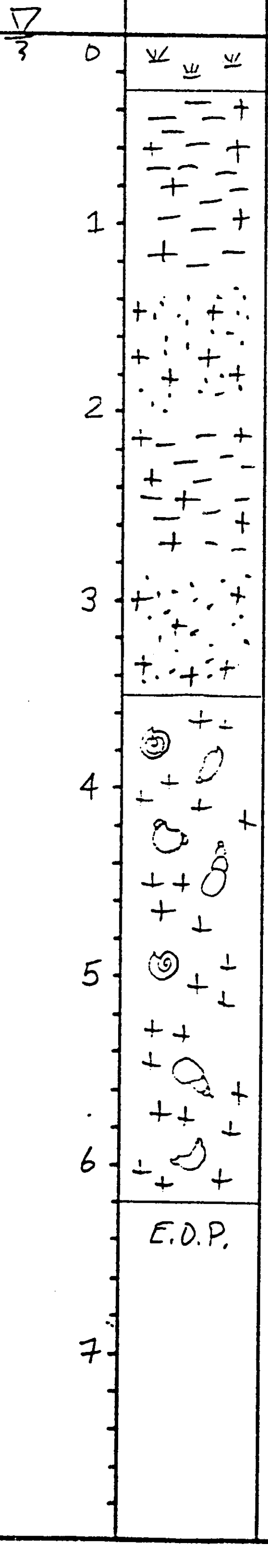
Hitachi 200 hoe.

Very soft digging conditions.

Pit walls are more competent than in earlier test pits (TP95-20 to 23)

No samples taken.

DEPTH (metres) — **GRAPHIC LOG**



DESCRIPTION AND CLASSIFICATION OF MATERIAL

Black-brown, saturated, very soft ORGANICS.

Lacustrine sequences of the following:

- Dark grey, very soft, saturated CLAY and SILT with some organics. Varved. Well sorted, poorly graded.
- Dark grey, very soft, saturated silty fine-grained SAND.

Both are plastic due to high silt/clay content. Strong odour.

LACUSTRINE LAYERS

Tan/grey, saturated, very soft SILT and ORGANICS. Varved layers containing white fresh-water shells and yellow grass. Well sorted, poorly graded. Very plastic and cohesive. Strong odour.

SILT and ORGANICS

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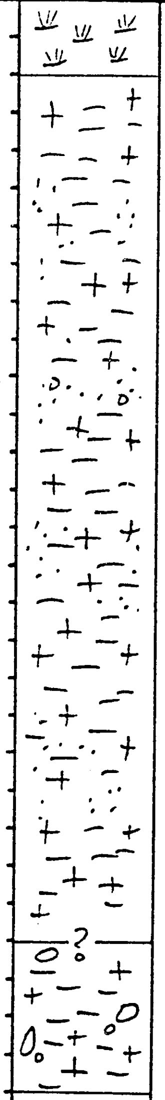
CONSULTING ENGINEERS

TEST PIT LOG

TEST PIT No. TP95-25
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5 820 930 N; 595 250 E
DATE Jan 14/95 (On access road to Polley Lake)

PROJECT No. 1623
GROUND ELEVATION ~922
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe	∇ 0		Black/brown, saturated, very soft ORGANICS.
Very soft digging conditions. Sample TP95-25 ← (0.4 to 5m)	1 2 3 4		Dark grey, saturated, very soft (and sticky) CLAY and SILT with some sand, coarsening with depth to sandy CLAY and SILT with trace gravel. Very plastic. Strong odour. Moderate to well sorted, poorly graded. Layers of sand and gravel at local intervals. LACUSTRINE LAYERS
Difficult digging conditions at 5 to 5.8m	5	?	Brown, hard, slightly moist, sandy SILT with some gravel and clay, trace cobbles. Very dense chunks are ripped from pit. Poorly sorted, well graded. Plastic (when wet). Looks similar to basal till encountered locally, only brown in colour. Sandy Silt Basal Till
	6	E.O.P.	

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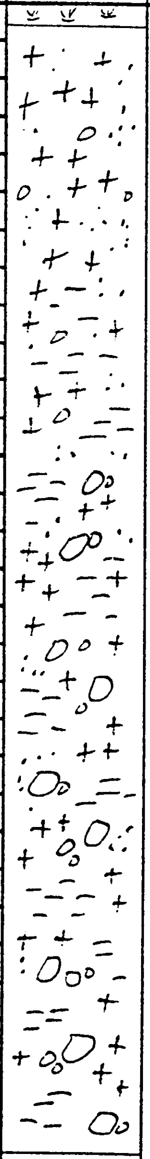
TEST PIT LOG

TEST PIT No. TP95-26
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5819 180 N; 594 645 E (Tailings Basin)
DATE Jan 15/95
PROJECT No. 1623
GROUND ELEVATION ~938m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe.	0		ORGANICS
	1		Brown, dense, slightly most → moist, sandy SILT with some fine gravel and clay, trace cobbles. Very plastic. Poorly sorted, well graded. With depth, material becomes grey coloured and increases in gravel content. Looks very much like a typical basal till.
Moderate digging conditions	2		Very cohesive, hard chunks of material is ripped out of pit. This material is more moist than usually encountered.
No seeps encountered.	3		Sandy Silt Glacial Till
Sample TP95-26 ←			
	4		
	5		Material at approx 5.5m becomes very plastic due to higher moisture content (behaves like plastecene when remoulded). Material remains the same well graded nature, only more moist.
	6	E.O.P.	
	7		

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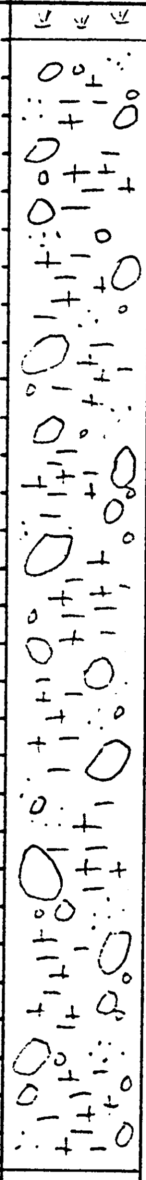
TEST PIT LOG

TEST PIT No. TP95-27
SHEET 1 of 1

PROJECT Mt Polley
LOCATION OF TEST PIT Approx 5 819 740 N; 595 350E
DATE Jan 15/95 (North embankment alignment)

PROJECT No. 1623
GROUND ELEVATION ~530 m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe	0		ORGANICS
	1		Brown (grey at depth), hard, slightly moist sandy SILT with some gravel and clay, trace cobbles. Poorly sorted, well graded. Very cohesive (rips in dense chunks from pit). Gravel and cobbles are sub-rounded. Cobble content increases with depth to "some cobbles." Top 0.5m of material is oxidized. Plastic when wetted.
*Local seeps at 2.7m and 4m only. The remainder of the pit is dry.	2		
	∇*		
	3		Sandy Silt Basal Till
Sample TP95-27 ←	∇* 4		
Moderate to difficult digging conditions.	5		
	6		
		E.O.P.	
	7		

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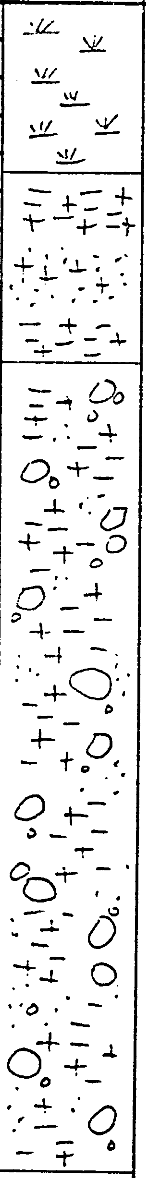
TEST PIT LOG

TEST PIT No. TP95-28
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5 819 360 N ; 595 285 E
(Tailings Basin)
DATE Jan 15/95

PROJECT No. 1623
GROUND ELEVATION ~ 923.4m
LOGGED BY KGB.



NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe	▽ 0		Brown, soft, saturated ORGANICS.
Ponded water at surface. Easy digging conditions (0 to 1.5m)	1		Grey-green, soft, very moist layers of CLAY and SILT and silty SAND. Well sorted, poorly graded layers. Clay and silt are very plastic due to high moisture. Sand layer is visibly wet on pit walls.
	2		Brown-grey, hard, slightly moist, sandy SILT with some gravel and clay, trace cobbles. Very cohesive, dense chunks of material. Plastic when wet. Poorly sorted, well graded. Sandy Silt Glacial Till
Moderate to difficult digging conditions (1.5 to 6.2m).	3		
Sample TP95-28 ← (1.5 to 6.2m)	4		
	5		Material becomes moist at 5m depth. Clay and silt matrix materials become sticky and are easily remoulded (like plasticene). Bedrock and possible water table nearby.
	6	E.O.P.	
	7		

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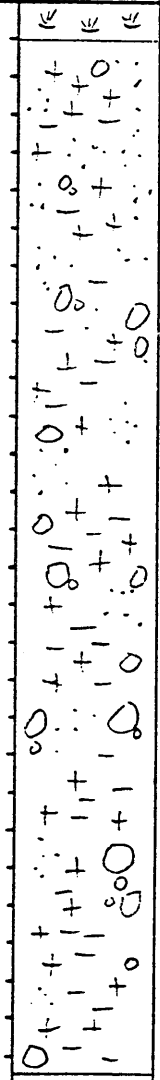
TEST PIT LOG

TEST PIT No. TP95-29
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Apprx 5 818 745 N; 596 270E
DATE Jan 15/95 (Potential East Ridge Borrow Area)

PROJECT No. 1623
GROUND ELEVATION ~ 936m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe.	0		ORGANICS.
Dry soil to 1m depth!	1		Brown, dense (firm to hard), dry to slightly moist, sandy SILT with some gravel, trace clay and cobbles. Material is drier than usually encountered. Poorly sorted, well graded. Plastic when wet, otherwise at plastic limit with natural moisture content. Becomes very hard with depth, and excavates in dense, cohesive chunks. Good construction material.
Modeate digging conditions			Sandy Silt Glacial Till
No seeps.	2		
Sample TP95-29 ←	3		
	4		
	5		
	6	E.O.P.	

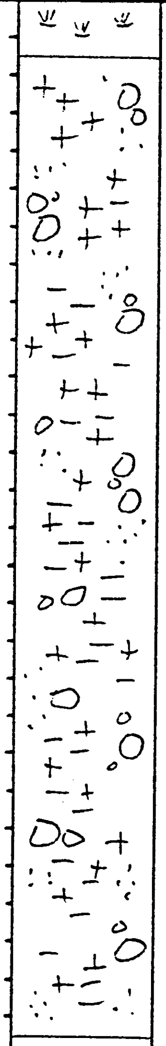
KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

TEST PIT LOG

TEST PIT No. TP95-30
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5818 495 N; 596 560 E
DATE Jan 15/95 (Potential East Ridge Borrow Area)

PROJECT No. 1623
GROUND ELEVATION ~938m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe.	0		Bright orange ORGANICS (rotten wood).
No seeps encountered.			
Moderate digging conditions	1		Brown, dense (firm to hard), slightly moist, sandy SILT with some gravel, trace clay and cobbles. Poorly sorted, well graded. Becomes more cohesive, grey coloured and hard with depth as material is ripped out of pit in chunks. Gravel and cobbles are sub-rounded to round. Good construction material (similar to TP95-29). Sandy Silt Glacial Till
	2		
	3		
Sample TP95-30 ←			
	4		
	5		
		E.O.P.	
	6		

KNIGHT AND PIESOLD LTD.
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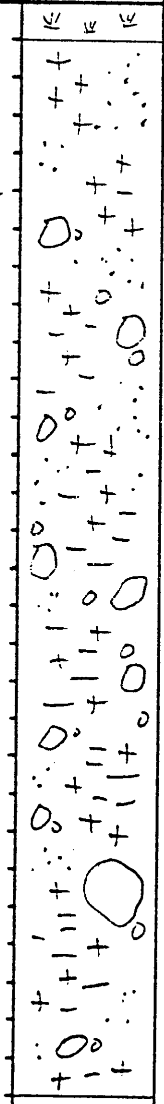
TEST PIT LOG

TEST PIT No. TP95-31
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5 816 955 N; 596 470 E
DATE Jan 15/95 " (Potential East Ridge Borrow Area)

PROJECT No. 1623
GROUND ELEVATION ~ 939 m.
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe No seeps encountered. Moderate digging conditions Sample TP95-31 ←	0 1 2 3 4 5 6	 E.O.P.	ORGANICS. Brown, dense (firm to hard), slightly moist, sandy SILT with some gravel, trace clay and cobbles. Occasional boulder at depth. Poorly sorted, well graded. Same material as encountered in TP95-29 and 30 (same natural moisture content as TP95-30). Good construction material. Sandy Silt Glacial Till

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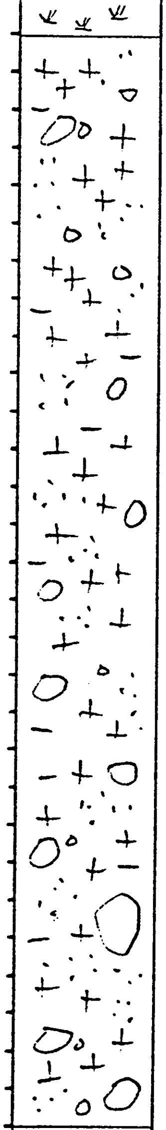
TEST PIT LOG

TEST PIT No. TP95-32
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5 819 140 N; 595 780E
DATE Jan 16/95 (East Tailings Basin)

PROJECT No. 1623
GROUND ELEVATION ~932m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe	0		ORGANICS, black/brown/orange
Moderate to difficult digging. No seeps encountered	1 2		Brown, dense (very stiff), slightly moist, sandy SILT with some gravel and clay, trace cobbles. Becomes grey in colour and increases in density to 'hard' with depth. Poorly sorted, well graded. No oxidized zone near surface. Gravel and cobbles are sub-round to round. Becomes very basal-like with depth. Very low permeability. Sandy Silt Glacial Till
Sample TP95-32 ←	3 4 5 6	E.O.P.	

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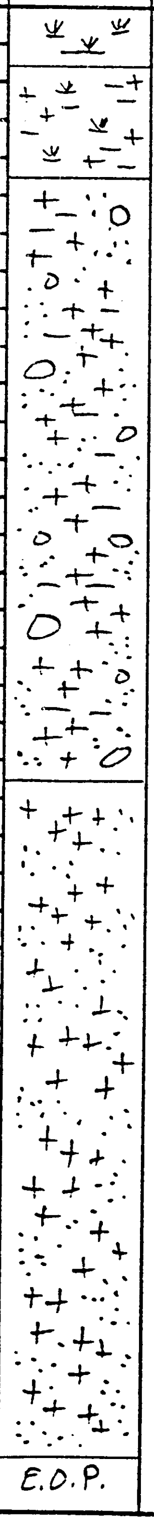
TEST PIT LOG

TEST PIT No. TP95-33
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5 818 750 N; 594 820 E (SW Tailings Basin)
DATE Jan 16/95
PROJECT No. 1673
GROUND ELEVATION ~932m
LOGGED BY KGB.



NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	DESCRIPTION AND CLASSIFICATION OF MATERIAL
litachi 200 hoe	0	Black, soft, saturated ORGANICS. Swamp. Willows + swamp spruce.
onded water at surface (perched water table).		Grey-black, oxidized, stiff, moist SILT and CLAY with some organics (grass and roots). Very plastic. Well sorted, poorly graded. Low permeability SILT and CLAY
mooth, easy digging (0 to 0.9m) erate digging (0.9 to 4.1m)	1 – 4	Brown, dense (v. stiff), slightly moist sandy SILT with some gravel and clay, trace cobbles. Poorly sorted, well graded. Oxidized at contact with overlying silt + clay. Slightly plastic. Low permeability Sandy Silt Glacial Till
mooth, easy digging (4.1 to 7.7m) ample TP95-33 (4.1 to 7.7m) ←	4 – 8	Grey, stiff to very stiff, moist, SILT and fine-grained SAND. Very thin laminated layers (<<1mm) which can be carefully peeled apart by hand. Plastic. Well sorted, poorly graded. No varves evident. Low permeability. Cohesive. SILT and SAND
	8	E.O.P.

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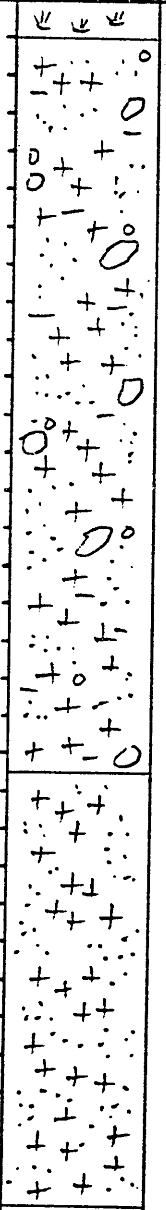
TEST PIT LOG

TEST PIT No. TP95-34
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5818730N; 595250E
DATE Jan 16/95 (South Basin)

PROJECT No. 1623
GROUND ELEVATION ~824 m.
LOGGED BY KGB

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe	0		Black, soft ORGANICS.
Moderate digging conditions.	1		Brown, dense (hard), slightly moist, sandy SILT with some gravel and clay, trace cobbles. Top 30cm is oxidized. Rounded gravel and cobbles. Material is just below plastic limit. Poorly sorted, well graded. Similar material as encountered in TP95-33. Low permeability. Sandy Silt Glacial Till.
Sample TP95-34A ← (0.2 to 4.1m)	2		
* Only local, low flow seeps visible at contact.	3		
	▽* 4		
Smooth, easy digging (4.1 to 6.4m)	5		Dark grey / black, stiff → very stiff, slightly moist, SILT and fine-grained SAND. Well sorted, poorly graded. Does not have layering like TP95-33 did. At plastic limit. Cohesive. Low permeability. Drier than TP95-33 Silt and sand layers. SILT and SAND
Sample TP95-34B ← (4.1 to 6.4m)	6		
		E.O.P.	
	7		

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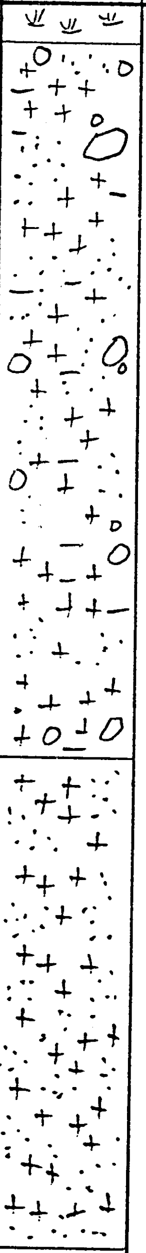
TEST PIT LOG

TEST PIT No. TP95-35
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5818 690 N; 595 535 E. (South Basin).
DATE Jan 16/95
PROJECT No. 1623
GROUND ELEVATION ~917m
LOGGED BY KGB



NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe	0	ORGANICS, black/orange.
Moderate digging conditions. (0.2 to 4.0m). * Seep at contact. ery localized and low flow rate.	1 2 3	Brown, dense (v. stiff → hard), slightly moist sandy SILT with some gravel and clay, trace cobbles. Poorly sorted, well graded. Slightly plastic (at P.L.) Rounded gravel + cobbles. Dense, very cohesive chunks of material encountered with depth when ripped out of pit. Becomes grey-colour with depth. Very low permeability. Sandy Silt Glacial Till
mooth, easy digging (4.0 to 6.6m) mple TP95-35 .0 to 6.6m) ←	∇* 4 5 6	Dark grey, slightly moist, stiff, SILT and fine-grained SAND. Sand is visible as white qtz. flecks in silt. Well sorted, poorly graded. Below plastic limit. Cohesive chunks when excavated, and cohesive overall. Low permeability. Same material as encountered in TP95-34 pit. Silt and Sand.
	7	E.O.P.

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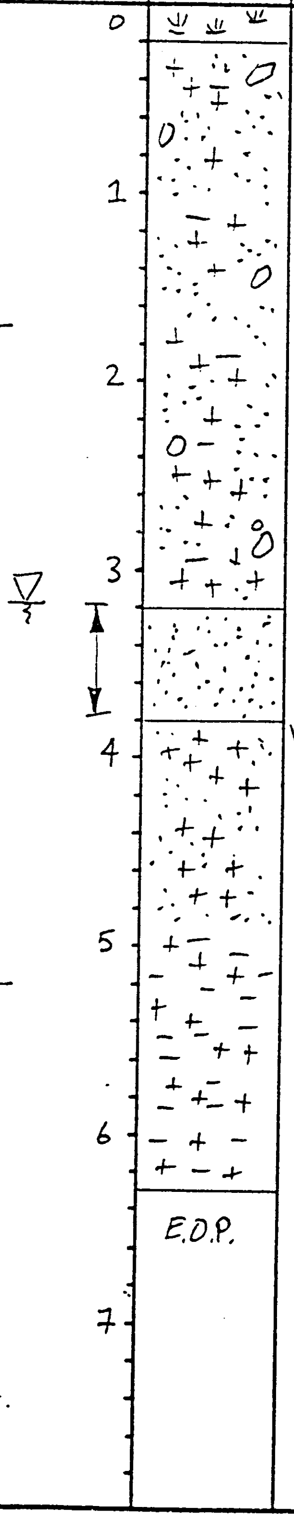
TEST PIT LOG

TEST PIT No. TP95-36
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5 818 520 N; 595 275 E (South Basin)
DATE Jan 16/95
PROJECT No. 1623
GROUND ELEVATION ~924 m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe.			ORGANICS.
Moderate digging. Sides slough into pit. Sample TP95-36A ← (0.2 to 3.2m)			Brown to grey, very stiff → hard, moist, silty SAND with trace to some gravel and clay. No coarse gravel or cobbles in this material. Poorly sorted, moderately graded. Moister than most tills. Rounded gravel. Cohesive. Coarser than most tills, also. Silty Sand Glacial Till
Moderate flow from sand ayer.			Black, medium to coarse-grained SAND with trace (to none) of silt. Not cohesive. Well sorted, poorly graded. Saturated. Approx 60 cm thick. SAND
smooth digging (3.2 → 6.3m) Sample TP95-36B ← 3.8 to 6.3m)			Creamy brown, very stiff → hard, slightly moist SILT and CLAY. No coarse material. Layered. Well sorted, poorly graded. Very cohesive. Low permeability. SILT and CLAY
			Brown, soft, moist to very moist SILT and fine-grained SAND. Well sorted, poorly graded. Slightly cohesive (probably due to high moisture content). Sides of pit continuously cave-in. Difficult to tell where this layer exists due to instability of test pit walls. SILT and SAND

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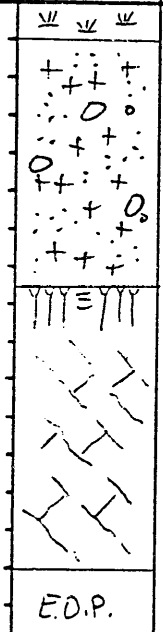
TEST PIT LOG

TEST PIT No. TP95-37
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5 818 345 N; 595 260 E
DATE Jan 16/95 (SW Tailings Basin).

PROJECT No. 1623
GROUND ELEVATION ~938m
LOGGED BY KGB.



NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe	0		ORGANICS.
Moderate digging (0 to 1.5m) Sample TP95-37 ←	1		Brown, very stiff, moist sandy SILT with some gravel and clay. Poorly sorted, well graded. Plastic. Contains more moisture than usual (probably due to close proximity to surface and bedrock). Sandy Silt Glacial Till
Seep below till/bedrock contact. Difficult digging rock.	2 ▽		Bedrock encountered at 1.5m depth. Very fractured, purple volcanic conglomerate (friable). Fragments are typically 30cm size. and very angular.
	3	E.O.P.	

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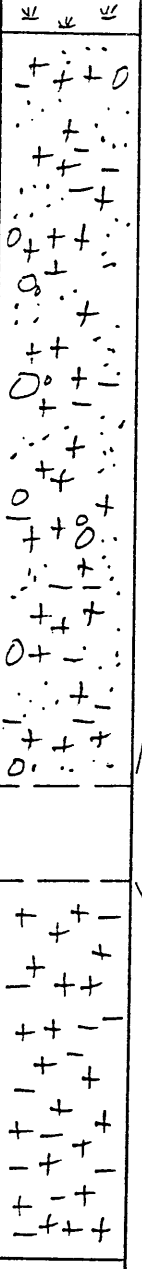
TEST PIT LOG

TEST PIT No. TP95-38
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5 818 460 N; 585 495E
DATE Jan 16/95

PROJECT No. 1623
GROUND ELEVATION ~915m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe.	0		ORGANICS.
Moderate digging (0 to 4.7m) No seepage encountered.	1 2 3 4		Brown to grey, hard, slightly moist sandy SILT with some gravel and clay. Poorly sorted, well graded. Rounded gravel. Very dense, cohesive chunks ripped out of pit. Plastic. Grey colour on face of some chunks (along cracks in till?). Occasional cobble near surface and becoming "trace cobbles" with depth. Low permeability. Sandy Silt Glacial Till
			Dark grey, stiff to very stiff, moist SILT with some clay, trace to some sand, trace gravel. Very plastic. Looks like above till, although some material is layered (and peels apart on layers). (Probable transition where till has been mixed with underlying layers)
Moderate, yet smooth digging (~4.5 to 6.7m) ample TP95-38 ←	5 6		Creamy brown to grey, very stiff → hard, slightly moist SILT with some clay. Very cohesive and dense. Well sorted, poorly graded. Obvious layers in grey silt. Till-like feel for density of this material. Similar to silt/clay encountered in TP95-36. Low permeability. SILT and CLAY
	7	E.O.P.	

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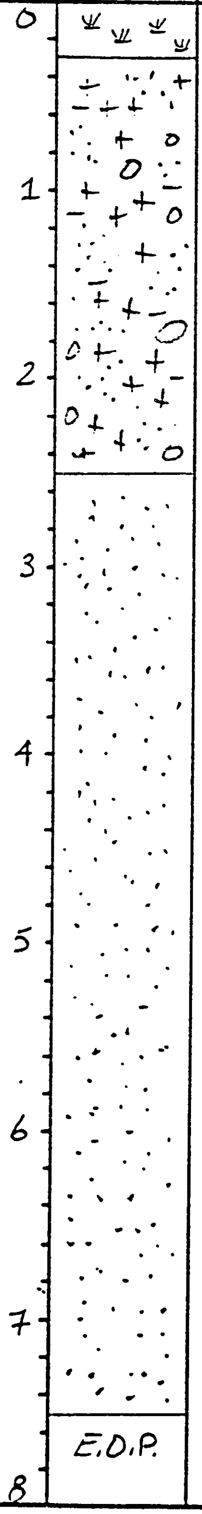
TEST PIT LOG

TEST PIT No. TP95-39
SHEET 1 of 1

PROJECT Mt. Polley
LOCATION OF TEST PIT Approx 5 818 405 N; 595 405 E
DATE Jan 16/95 (south tailings basin)

PROJECT No. 1623
GROUND ELEVATION ~918 m
LOGGED BY KGB.

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH (metres)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Hitachi 200 hoe.			Black, saturated, soft ORGANICS.
Moderate digging (0 to 2.5m)			Brown to grey, hard, slightly moist → moist, sandy SILT with some gravel and clay. Poorly sorted, well graded. More moist on surface of dense, cohesive chunks of till (from surface inflow?). Typical till. Sandy Silt Glacial Till
Water table at act.	▽ 3		
Easy digging 2.5 to 7.5m)			Brown, soft, saturated, fine-grained SAND and SILT. No cohesion (pit walls continuously cave-in). Very well sorted, poorly graded. Becomes more dense with depth. Sand and Silt
ides of pit ontinuously lough.			
ple TP95-39 at bottom of pit).	←		Note: Bottom of pit is estimated only as continuous sloughing of side walls made accurate measurements impossible.