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Mount Polley Mine Project: Tailings Storage Facility 2011 Geotechnical Site Investigation: Draft Report

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IMPORTANT NOTICE

This report was prepared exclusively for Mount Polley Mining Corporation by AMEC Environment & Infrastructure Limited, a wholly owned subsidiary of AMEC Americas Ltd. The quality of information, conclusions and estimates contained herein is consistent with the level of effort involved in AMEC services and based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions and qualifications set forth in this report. This report is intended to be used by Mount Polley Mining Corporation only, subject to the terms and conditions of its contract with AMEC. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

1.0 INTRODUCTION

Mount Polley is a copper and gold mine owned by Imperial Metals Corporation and operated by the Mount Polley Mining Corporation (MPMC). The design and construction monitoring of the Tailings Storage Facility (TSF) embankment from mine start up to early 2011 had been completed under the direction of Knight Piesold Limited (KP). AMEC Environment and Infrastructure, a division of AMEC Americas (AMEC), assumed the role of engineer-of-record for the TSF embankment as of 28 January 2011.

A geotechnical investigation was undertaken in October 2011, based on the review of existing site instrumentation and as required to conform to TSF monitoring recommendations. The investigation comprised geotechnical drilling, installation of three slope indicators, eleven vibrating wire piezometers and was followed up by laboratory testing on selected samples. In conjunction with the investigation, the installation of four monitoring wells was also completed, at the request of MPMC.

2.0 BACKGROUND

The Mount Polley mine is located 56 km northeast of Williams Lake, British Columbia. Operations began in 1997 and have continued to the present, with the exception of a temporary shutdown for economic reasons occurring between 2001 and 2005. The mine currently processes ore at a mill throughput rate of 20,000 tonnes per day. Tailings are deposited as slurry into a TSF comprised of a 4.2 km long earth and rockfill embankment, as shown in Drawing 2011.01. The embankment is formed of three sections of consistent modified centerline design but varying heights (Main, 45 m high; Perimeter, 27 m high; and South, 17 m high). The Stage 7 embankment raise, constructed in the summer of 2011, uniformly increased the TSF embankment crest elevation to approximately 960.1 m, a height increase of 2.0 m.

Historical data indicates that, as of June 2011, 93 piezometers have been installed along nine monitoring planes. Of the 93 piezometers, approximately forty percent currently function. Piezometers have been installed in the TSF embankment fills, foundations, and tailings deposits. Five slope inclinometers were installed near the downstream toe of the Main embankment, of which four currently function. Replacement of non-functioning instrumentation was initially recommended in the 2006 dam safety review (AMEC, 2006) and subsequently in the 2011 TSF review and recommendations memorandum (AMEC, 2011).

2.1 Basis for Investigation

Based on AMEC's review of the existing Mount Polley TSF information, and instrumentation coverage (AMEC, 2011), there was a lack of full characterization of foundation soil conditions, pore pressures and potential movements within glaciolacustrine soils. The investigation was undertaken with efforts focussed on enhancing the understanding of these issues and in particular, the following three geotechnical issues:

1. *Glaciolacustrine foundation soils*: The 2006 Dam Safety Review (AMEC, 2006) and 2010 Dam Safety Inspection (KP, 2011) both highlighted the significance of any potential of pre-sheared (i.e. low strength) planes within the glaciolacustrine soils present within the Mount

Polley TSF foundation soils and recommended additional testing be undertaken to improve characterisation of these soils. Specifically, the concern would be associated with any laterally continuous, high plastic clay varves within the glaciolacustrine soils that, if pre-sheared to a low residual shear strength, would represent a weak planar feature within the foundation that would largely govern stability. Further, even if not pre-sheared, such clay varves could be driven to a low shear strength as a result of movements induced by the ongoing raising of the dam, thus making it important to monitor displacement patterns within these soils. It was movement (about 4 mm) within this foundation soil type noted by KP (2011) to have occurred in inclinometer SI01-02.

2. *Perimeter embankment crack:* The 2010 Dam Safety Inspection (KP, 2011) observed a crack at the eastern portion of the Perimeter embankment (at station 3+400 m) within the downstream rockfill shell. It is currently uncertain whether this crack is indicative of embankment slope movement (possibly related to till borrow excavation operations to the downstream, and/or foundation glaciolacustrine soils), or merely reflects localized rockfill settlement.

3. *South embankment foundation conditions*: AMEC's recent review of foundation conditions has revealed that very little information exists within the ultimate South embankment downstream toe area.

3.0 SITE INVESTIGATION PROGRAM

3.1 General

The investigation was carried out from September 29 to October 11, 2011 in support of the TSF review and recommendations completed by AMEC.

3.2 Scope of Investigation Program

A geotechnical site investigation for the three tailings dam embankments (perimeter, main, south) was carried out using a sonic drill rig and included completion and installation of 11 vibrating wire piezometers, and 3 slope inclinometers.

Each of the piezometer and inclinometer holes were drilled to depth with retrieval of continuous overburden core samples. The sample retrieval allowed characterisation of foundation soils (in particular, examination of the glaciolacustrine unit) and identification of appropriate piezometer tip installation locations. The method of grouted-in piezometers was used, allowing for rapid installation of multiple piezometers in a single borehole. Slope inclinometers were grouted into completed sonic drill holes.

The drill holes were advanced in the following locations based on the three geotechnical conditions mentioned in Section 2.1:

1. *Glaciolacustrine foundation soils*: Six piezometers and two inclinometers were advanced in the downstream toe area of the Main embankment, using the existing rockfill buttress as a platform. Two piezometers were advanced in the downstream toe area of the Perimeter embankment.

2. *Perimeter embankment crack:* Drill holes were advanced both on the embankment crest and adjacent to the downstream embankment toe at chainage 3+400. One inclinometer was installed at the crest while one piezometer was installed at the toe.

3. *South embankment foundation conditions:* Two piezometers were installed adjacent to the downstream toe area of the South embankment.

Locations of the drill holes are shown on Drawing 2011.01. Instrumentation sections are presented on Drawings 2011.02 through 2011.09.

A summary of the completed site investigation program is presented in Table 3.1. A summary of installed instrumentation details is presented in Table 3.2.

Laboratory tests including Atterberg Limits, moisture content determinations and grain size distributions for samples of overburden soil were carried out in AMEC's Prince George Materials Lab and are presented in Appendix A. Detailed visual inspection was also performed in the lab on selected samples. Drill hole logs from the program are provided in Appendix B.

Table 3.1: Summary of Site Investigation Drill Holes

Hole ID	Coordinates		Instrumentation	Surface Elevation (m)	Total Drillhole Depth (m)	Location
	Northing	Easting				
VW11-01	5818480	594463	Piezometer	941.0	11.1	South Embankment
VW11-02	5818343	594786	Piezometer	945.1	17.4	
VW11-03	5818272	595467	Piezometer	927.0	23.2	Main Embankment
VW11-04	5818309	595533	Piezometer	921.6	29.3	
VW11-05	5818410	595605	Piezometer	920.6	32.3	
VW11-06	5818423	595686	Piezometer	916.3	35.4	
VW11-07	5818554	595850	Piezometer	919.8	43.3	
VW11-08	5818697	596027	Piezometer	927.7	47.5	
VW11-09	5819415	595928	Piezometer	936.6	41.7	Perimeter Embankment
VW11-10	5819783	595410	Piezometer	931.8	42.4	
VW11-11	5820031	594892	Piezometer	940.9	23.5	
SI11-01	5818353	595527	Inclinometer	921.1	44.8	Main Embankment
SI11-02	5818716	595998	Inclinometer	928.3	49.4	Main Embankment
SI11-04	5819780	595408	Inclinometer	931.9	43.3	Perimeter Embankment

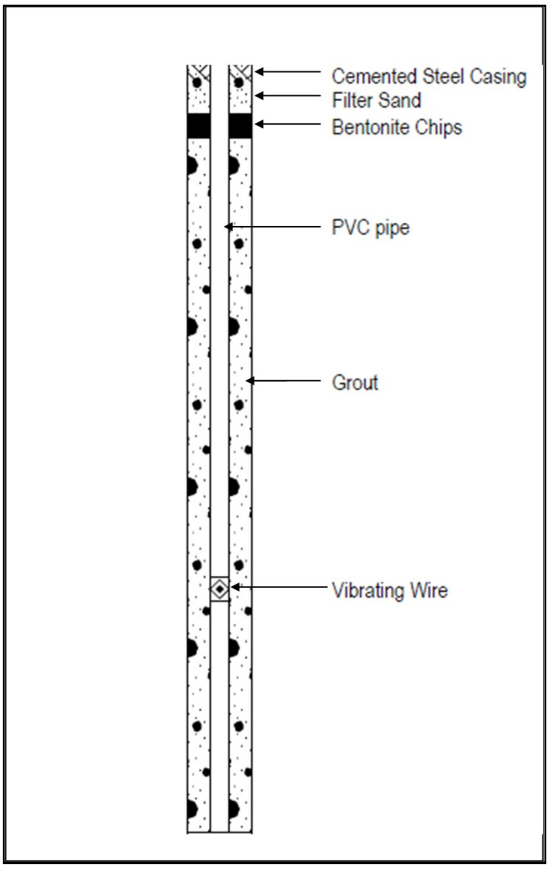
Table 3.2: Summary of Instrumentation Details

Hole ID	Instrumentation ID	Instrumentation Serial No.	Installation Depth (m)	Tip Location (Soil Unit)
VW11-01 (FX3)	F5	1119797	7.0	Foundation Till
VW11-02 (IX3)	I5	1119796	7.6	Foundation Till
	I6	1119792	10.4	Glaciolacustrine
VW11-03 (EX4)	E6	1119794	15.2	Glaciolacustrine
	E7	1119801	18.9	Glaciofluvial
VW11-04 (CX4)	C11	1119798	12.5	Glaciolacustrine
	C12	1119795	21.0	Foundation Till
VW11-05 (AX5)	A16	1119799	12.2	Glaciolacustrine
	A17	09-2810	16.8	Glaciolacustrine
	A18	09-2808	24.4	Foundation Till
VW11-06 (AX6)	A19	09-2811	10.7	Glaciolacustrine
	A20	09-2809	15.2	Glaciolacustrine
	A21	1119786	22.9	Foundation Till
VW11-07 (BX4)	B11	1119793	13.7	Glaciolacustrine
	B12	1119791	25.9	Foundation Till
	B13	1119785	31.1	Glaciolacustrine
VW11-08 (KX2)	K1	1119788	15.2	Glaciofluvial
	K2	1119784	33.8	Glaciofluvial
VW11-09 (JX1)	J1	1119800	19.4	Foundation Till
VW11-10 (DX4)	D6	1119790	18.4	Glaciolacustrine
	D7	1119802	24.4	Glaciofluvial
VW11-11 (GX2)	G4	1119789	6.1	Foundation Till
	G5	1119787	10.7	Glaciofluvial

Note: ID in brackets (eg. (FX3)) corresponds with existing Mount Polley instrumentation identification.

Drill hole depths ranged from 11.1 to 49.4 m below ground surface. Holes with vibrating wire piezometer installations were backfilled with bentonite chips, sand, grout, and drill cuttings. Holes with slope inclinometer installations were backfilled with bentonite chips and pellets, sand, and grout. Typical piezometer installation details are shown on Figure 3.1.

Figure 3.1: Typical Piezometer Installation Details



3.3 Index Property Testing – Overburden Samples

3.3.1 General

Index property testing conducted on collected samples included moisture content tests, grain size analyses (including hydrometer analysis on selected samples), and Atterberg limits testing on samples with apparent plasticity.

A summary of laboratory testing from each drill hole is presented below in Table 3.3.

Table 3.3: Summary of Laboratory Testing – Vibrating Wires and Slope Inclinometers

Hole ID	Total Drillhole Depth (m)	No. of Samples Tested		
		Grain size Determination	Moisture Content	Atterberg Limit
VW11-01	11.1	1	4	0
VW11-02	17.4	0	5	1
VW11-03	23.2	0	5	1
VW11-04	29.3	1	10	2
VW11-05	32.3	0	9	2
VW11-06	35.4	0	19	0
VW11-07	43.3	0	17	3
VW11-08	47.5	4	31	1
VW11-09	41.7	3	18	0
VW11-10	42.4	2	25	4
VW11-11	23.5	1	18	0
SI11-01	44.8	3	8	1
SI11-02	49.4	2	26	5
SI11-04	43.3	1	4	0

Note: 23 samples were tested from collected boxed core at VW11-06, VW11-08 and SI11-04. All other samples were grab samples.

Calibration reports for each of the installed vibrating wire's are provided in Appendix C. Readings of new instrumentation are presented in Appendix D. A summary of piezometer readings from February 4, 2012 are shown in Figure 3.1.

Figure 3.1: Summary of Piezometer Data (February 4, 2012)

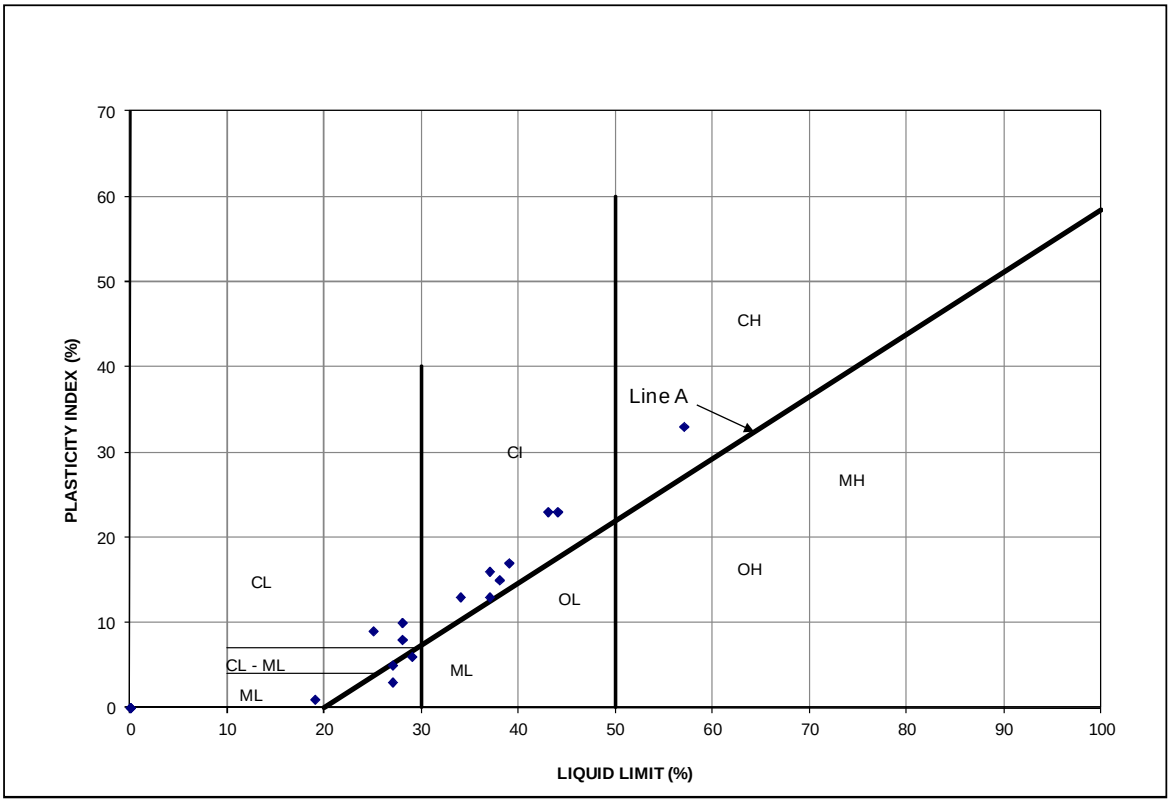
Location	Instrumentation ID	Tip Material	Fill Elevation (m)	Elevation Head (m)
7+52	F5	Foundation Till	941	942.3
11+00	I5	Foundation Till	945.1	946.6
	I6	Glaciolacustrine		946.6
17+60	E6	Glaciolacustrine	927	917.7
	E7	Glaciofluvial		918.1
18+45	C11	Glaciolacustrine	921.6	914.8
	C12	Foundation Till		906.2
19+60	A16	Glaciolacustrine	920.6	913.7
	A17	Glaciolacustrine		913.5
	A18	Foundation Till		915.4
20+30	A19	Glaciolacustrine	916.3	910.2
	A20	Glaciolacustrine		911.7
	A21	Foundation Till		914.5
22+40	B11	Glaciolacustrine	919.8	916.7
	B12	Foundation Till		918.1
	B13	Glaciolacustrine		917.8
24+70	K1	Glaciofluvial	927.7	934.7
	K2	Glaciofluvial		937.3
32+80	J1	Foundation Till	936.6	921.6*
39+15	D6	Glaciolacustrine	931.8	916.1
	D7	Glaciofluvial		915.6
44+60	G4	Foundation Till	940.9	941.8
	G5	Glaciofluvial		938.4

*Piezometer inaccessible, last reading from November 27, 2011

Atterberg limits testing of selected samples yielded plasticity indexes between, 0 and 33%, as shown on Figure 3.2. Samples tested from within the glaciolacustrine unit yielded results of 3% and 33%, the fines generally classifying as clay of low to intermediate plasticity (CL-CI). The highest plasticity index of 33%, fines classifying as a clay of high plasticity (CH), occurred in a sample from drill hole SI11-02 (Main Embankment) at a depth of approximately elevation 900.6m.

Within the glaciolacustrine unit, grain size analyses indicated clay contents (% by dry weight finer than 2 microns) in the range of 8.1% to 33.7% with total fines contents (% by dry weight finer than 74 microns) typically in the range of 72.9% to 99.5%, based on the 75-mm minus sample fraction. Within the till unit, grain size analyses indicated clay contents in the range of 4.7% to 21.6% with total fines contents in the range of 40.7% to 88.1%.

Figure 3.2: Atterberg Limits Tests



3.4 Key Results and Interpretation

Key information obtained from the investigation is summarized below.

1. Main Embankment

    a. Glaciolacustrine and glaciofluvial units exist between an upper and lower till unit, with thickness's ranging from approximately 5 to 33m.

2. Perimeter Embankment

    a. Glaciolacustrine and glaciofluvial units exist within the glacial till units. At Stn 4+000 the thicknesses are approximately 3 to 4m, while at Stn 3+300 the thickness of the unit is approximately 4m. Glacial till was the only soil unit encountered in the drill hole at Stn 4+500.

3. South Embankment

    a. Only a thin unit of glaciolacustrine soil, approximately 0.6m, was encountered within till foundation soils near Stn 1+100.

4.0 MONITORING WELLS

The installation of four monitoring wells was completed during the site investigation, at the request of MPMC. In general, one deep and one shallow monitoring well were installed at each of the two drill sites, designated G1 and G2. Site G1 is located along the Bootjack Access road while G2 is located along the old Polley Lake pump road. The well locations are presented in Drawing 2011.11.

Drill hole logs describing the encountered soil stratigraphy and well installations are presented in Appendix E.

5.0 LIMITATIONS AND CLOSURE

This report has been prepared for the exclusive use of Mount Polley Mining Corporation for specific application to the area within this report.

Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. AMEC accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. It has been prepared in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

Respectfully submitted,

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DRAWINGS

APPENDIX A

2011 Laboratory Testing Data

APPENDIX B

2011 Borehole Site Investigation Logs

APPENDIX C

Vibrating Wire Calibration Reports

APPENDIX D

Instrumentation Readings

APPENDIX E

Monitoring Well Drill Hole Logs