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**MOUNT POLLEY MINES**

**TAILINGS STORAGE FACILITY – STAGE 8**  
**2012 CONSTRUCTION MONITORING MANUAL**

Submitted to:

**Mt. Polley Mining Corporation**  
Vancouver, British Columbia

Submitted by:

**AMEC Environment & Infrastructure,**  
**a Division of AMEC Americas Limited**  
Prince George & Burnaby, British Columbia

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## TABLE OF CONTENTS

	Page
<b>1.0 INTRODUCTION.....</b>	<b>1</b>
1.1 Project Overview .....	1
1.2 Construction Schedule.....	1
1.3 Construction Monitoring.....	2
1.4 Purpose of Manual.....	2
<b>2.0 CONSTRUCTION MONITORING AND TESTING REQUIREMENTS .....</b>	<b>3</b>
2.1 Construction Activities .....	3
2.2 Monitoring and Testing .....	3
2.3 Organization and Responsibilities .....	4
2.3.1 MPMC Field Inspector.....	5
2.3.2 AMEC Support Engineer .....	5
2.3.3 AMEC Project Manager.....	7
2.3.4 Senior Geotechnical Engineer.....	7
2.3.5 AMEC Soils Laboratory – Prince George .....	7
2.3.6 Soils Testing – Mount Polley Site .....	8
2.3.7 MPMC Project Manager .....	8
2.3.8 MPMC Mine Operations Manager .....	8
2.3.9 MPMC Field Inspector and Mine Technicians .....	9
<b>3.0 MATERIALS TESTING AND CONSTRUCTION INSPECTION .....</b>	<b>9</b>
3.1 General.....	9
3.2 Estimated Fill Volumes .....	9
3.3 Foundation Preparation, Inspection, and Approval.....	10
3.3.1 General .....	10
3.3.2 Tie-In to Existing Till Core .....	11
3.3.3 Foundation Preparation.....	11
3.3.4 Special Considerations for Bedrock Exposed in Till Cutoff Trench .....	12
3.4 Borrow Materials Site Development and Operation.....	14
3.5 Material Specifications, Material Testing, Inspection, and Approval .....	14
3.5.1 Zone S (Core) – Glacial Till .....	14
3.5.2 Zone F (Filter) – Manufactured Sand and Gravel .....	15
3.5.3 Zone T (Transition) – Fine NAG Rock Transition.....	16
3.5.4 Zone C (General Rockfill) – Coarse NAG Rock Shell .....	17
3.5.5 Zone U (Selected Upstream Fill) – Tailings/NAG.....	17
3.6 Criteria for Suspension of Work .....	17
<b>4.0 TEST PROCEDURES.....</b>	<b>18</b>
4.1 Scheduled Tests .....	18
4.2 Additional/Supplemental Tests.....	19
4.3 Sample Collection Procedures.....	19
<b>5.0 REPORTING.....</b>	<b>20</b>
5.1 Construction Documentation.....	20



## TABLE OF CONTENTS

	Page
5.2 Daily Construction Reports .....	20
5.3 Monthly Progress Reports .....	21
5.4 As-Built Report/Annual Review .....	21
<b>6.0 INSTRUMENTATION &amp; MONITORING .....</b>	<b>22</b>
6.1 General.....	22
6.2 Inclinometers .....	22
6.3 Vibrating Wire Piezometers .....	22
<b>7.0 CLOSURE.....</b>	<b>23</b>

## LIST OF FIGURES

Figure 2.1: 2012 Construction Organization Chart .....	4
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## LIST OF TABLES

Table 2.1: Construction Monitoring Tasks.....	6
Table 3.1: Stage 8 Expansion (El. 963.5 m) Estimated Fill Volumes.....	9
Table 3.2: Inclinometer Trigger Levels .....	18

## LIST OF DRAWINGS

Drawing 2012.01	Stage 8 Tailings Embankment General Site Plan
Drawing 2012.02	Stage 8 Tailings Embankment Plan View
Drawing 2013.03	Stage 8 Fill Material Specifications
Drawing 2013.04	Stage 8 Main Embankment 2012 Planned Raise
Drawing 2012.05	Stage 8 Perimeter Embankment 2012 Planned Raise
Drawing 2012.06	Stage 8 South Embankment 2021 Planned Raise
Drawing 2012.07	Stage 8 Abutment Foundation Preparation

## LIST OF APPENDICES

APPENDIX A Stability Analysis
APPENDIX B Sample Daily Construction Report



#### **IMPORTANT NOTICE**

This report was prepared exclusively for Mt. Polley Mining Corporation by AMEC Environment & Infrastructure, a wholly owned subsidiary of AMEC Americas Limited. 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 Mt. 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

### 1.1 Project Overview

Mount Polley copper and gold mine is owned by Imperial Metals Corporation and operated by Mount Polley Mining Corporation (MPMC). The site is located 56 km northeast of Williams Lake, British Columbia. The Mount Polley mine began production in 1997 and operated until October 2001, when operations were suspended for economic reasons. In March 2005, the mine restarted production and has been in continuous operation since. Currently, mill throughput is approximately 20,000 tpd. Tailings are deposited as slurry into the tailings storage facility (TSF). The TSF is comprised of one overall embankment that is approximately 4.2 km in length. The embankment, based upon original separate embankments, is subdivided into three (3) sections; referred to as the Main Embankment, Perimeter Embankment and South Embankment. Heights vary along the embankment and are approximately 48 m, 30 m, and 20 m respectively (based upon the Main, Perimeter and South nomenclature). The design and construction monitoring of the TSF embankments through 2010 was completed under the direction of Knight Piésold Limited (KP). AMEC Earth and Environmental, now known as AMEC Environment & Infrastructure, a division AMEC Americas Limited (AMEC), assumed the role of engineer of record for the TSF embankment as of 28 January 2011. The overall embankment has incorporated a staged expansion design utilizing a modified centerline construction methodology. The latest expansion was completed in September 2011, which entailed an approximate 2.1 m embankment raise to a crest elevation of 960.1 m.

The next expansion, to an elevation of 963.5 m, is planned for 2012 construction season. AMEC understands that a new permit will be required for the planned 2012 raise. To check the stability of the proposed 2012 raise, slope stability analysis of the embankment was carried out. The results of the stability analyses are presented in Appendix A.

### 1.2 Construction Schedule

The optimal construction season for placement of moisture-sensitive till core material at the Mount Polley Project site typically falls between May and September. The 2012 Stage 8 Embankment raise (3.4 m to crest El. 963.5 m) is targeted for completion by the end of September 2012.

For the 2012 construction season, as per the 2011 construction season, MPMC will use a contractor to carry out the majority of earthworks associated with the annual raise. Haulage of waste rock and cell construction using tailings will be performed by MPMC.

In addition, MPMC or the contractor will prepare abutment foundations to the full extent of the current ultimate embankment (970.0 m) and place the specified blanket materials.

### **1.3 Construction Monitoring**

The level of construction monitoring and QA/QC performed in previous years is to be continued. In 2011, MPMC undertook a greater role and responsibility in this regard. Specifically, MPMC engaged its own engineers, technicians, and summer students to provide full-time construction monitoring and field inspection during the construction of the embankment. AMEC provided support as required, which include regular site visits, particularly during key phases of the construction. Overall, this arrangement was deemed to be successful; however, minor modifications to the 2011 construction monitoring program will be implemented for 2012. AMEC understands that for the 2012 construction similar field inspections will be applied. Mr. Luke Moger of MPMC will oversee the overall construction monitoring. The day-to-day monitoring, reporting and instrumentation reading tasks will be the responsibility of the MPMC Field Inspectors and mine technicians.

At the commencement of construction, AMEC will provide full-time supervision for approximately ten (10) days, to kick-off construction and to verify that proper construction methods are employed, material specifications are met and testing requirements and frequencies are understood and followed by MPMC personnel.

Once AMEC is satisfied that the design objectives are being met, and that MPMC Field Inspectors are fully trained and prepared to undertake the construction monitoring and reporting role with primarily remote support required by AMEC, AMEC will reduce monitoring presence to monthly visits (though actual timing will vary somewhat with visits timed for key construction activities such as foundation preparation and approval, and till core trench approval). To be successful, this arrangement will require MPMC Field Inspector, devoted full-time to the dam construction project, to have good support and co-operation from senior Mt. Polley personnel, and from the Mt. Polley construction team, along with regular technical support as needed from AMEC project personnel.

Todd Martin, Senior Geotechnical Engineer or Daryl Dufault, Project Manager, will visit the site during construction activities. The objective of this senior personnel visit will be to conduct an annual site-visit, and get a “look-ahead” so that any future upcoming issues can be proactively identified and resolved. This visit will also be used to ensure that a good working relationship is being maintained between AMEC and MPMC project personnel, which will be critical to AMEC having the requisite confidence to provide as-built report sign off following the end of each stage of the embankment raise.

### **1.4 Purpose of Manual**

AMEC has prepared this manual for use by MPMC’s on-site personnel and for AMEC’s engineering support personnel, who will maintain close communication with the site throughout the construction season and carry out periodic site visits as required.

The objectives of this manual are as follows:

- Summarize the annual construction plans.
- Detail the technical specifications for the dam construction as presented in the design drawings.
- Outline the requirements for monitoring and reporting of the dam construction.
- Present the proposed performance monitoring procedures and design criteria.
- Clearly define the roles and responsibilities of both MPMC and AMEC personnel associated with the 2012 embankment construction activities.

## **2.0 CONSTRUCTION MONITORING AND TESTING REQUIREMENTS**

### **2.1 Construction Activities**

The 2012 construction of the TSF embankment will include the following activities:

- Foundation preparation of the abutments to an elevation of 970.0 m, including excavation of the cut-off trench.
- Development of glacial till borrow areas.
- Development of non-acid-generating (NAG) rock borrow areas (mine rock).
- Development of the sand and gravel borrow area or production of sand and gravel from mine waste rock via processing.
- Excavating, hauling, placing, and compacting acceptable structural fills and waste zones to raise the dam core and shell in accordance with design specifications.

The guidelines for quality control testing procedures outlined in this manual are to be observed during construction to satisfy and document that the dam is constructed in accordance with the design intent.

### **2.2 Monitoring and Testing**

The general monitoring and testing requirements for construction of the 2012 construction of the TSF embankment correspond to the construction activities outlined in Section 2.1; these general requirements are:

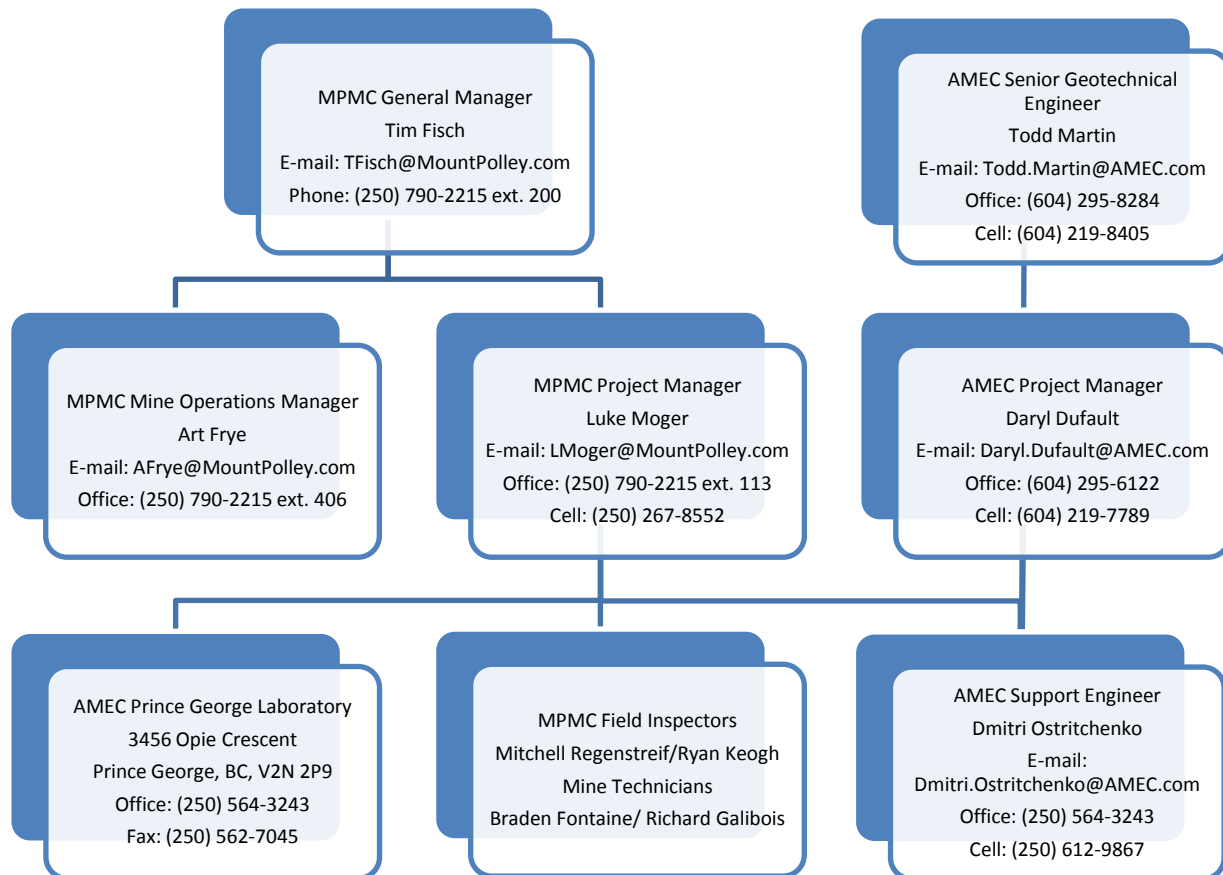
- Review and confirm that the prepared foundation areas are acceptable for support of structural fills.
- Review and confirm that the borrow materials are acceptable for use as structural fill.
- Monitor and test (where required) the placement and compaction of accepted structural fill.
- Monitor dam performance by reading and recording instruments in the dam(s) and preparing cumulative change and time plots of the results.
- Monitor drain performance by measuring flow and inspecting water quality.

Construction monitoring of activities such as placement of structural fills and foundation preparation will proceed on a continuous basis. Schedules based on minimum test frequencies per unit volume of compacted structural fill will be followed for the various field and laboratory tests, with additional tests to be performed as required to reassess out-of-compliance results or at the discretion of AMEC.

The results of the monitoring and testing program will be reported to the appropriate parties (MPMC, AMEC) as they are obtained.

### 2.3 Organization and Responsibilities

Overall Figure 2.1 below outlines the overall organizational structure for Stage 8 TSF embankment construction, while the responsibilities are summarized in Table 2.1.



**Figure 2.1: 2012 Construction Organization Chart**



### **2.3.1 MPMC Field Inspector**

MPMC is to provide a full-time field inspector to monitor daily embankment expansion construction. The MPMC Field Inspector is to have support and co-operation from the senior MPMC personnel and construction team.

The responsibilities of MPMC's Field Inspector will be as follows:

- Monitor and photograph daily construction activities related to TSF embankment.
- Set out construction limits, and verify lift thicknesses and zone widths.
- Prepare daily technical/activity reports. (See Appendix B).
- Conduct instrumentation readings on a regular basis and promptly report them to AMEC.
- Document and conduct compaction testing and visual and laboratory material testing as specified in this document.
- Report any non-compliance issues observed to AMEC and MPMC.

### **2.3.2 AMEC Support Engineer**

The AMEC Support Engineer will provide full-time construction monitoring at the commencement of Stage 8 construction. After the MPMC Field Inspector has achieved sufficient confidence and commensurate approval, the AMEC Support Engineer will provide primarily remote assistance by reviewing daily reports and instrumentation data as required. The AMEC Support Engineer will also conduct monthly site visits (actual frequency to be determined by site performance) to verify construction methods and specifications are being followed.

The responsibilities of the AMEC Support Engineer are as follows:

- Provide remote assistance to MPMC Field Inspector.
- Provide on-site assistance with inspection and approval of abutment preparation.
- Review daily construction reports, communicate and document any concerns arising from the review to AMEC's Project Manager and/or Senior Geotechnical Engineer.
- Review instrumentation reading plots provided by MPMC, and communicate any concerns to AMEC's Project Manager and/or Senior Geotechnical Engineer.
- Carry out monthly site visits to monitor construction progress and perform quality assurance testing.
- Prepare monthly progress reports summarizing construction activities, test results, and milestone achievements.
- Prepare site As-built/Annual Review Report.

**Table 2.1: Construction Monitoring Tasks**

No.	Tasks Description	Responsibility
<b>1.0</b>	<b>Foundation Preparation</b>	
1.1	<u>Abutment Extensions</u> : Review of exposed soil and or rock conditions and confirmation that suitable dense, undisturbed, native soil, or sound bedrock conditions are exposed for dam construction.	AMEC
1.2	<u>Core Trench Construction</u> : Review of exposed soil and/or rock conditions, perform test pits as required to confirm the thickness of glacial till over bedrock along the core trench alignment. Review of core trench excavation and confirmation of proper excavation slopes. Direct rock excavation and cleaning work as deemed necessary.	AMEC
1.3	<u>Approval</u> : Review the provided photos of the foundation preparation and provide approval.	AMEC
<b>2.0</b>	<b>Review of Borrow Areas and Materials</b>	
2.1	<u>Glacial Till Borrow Pit</u> : <ul style="list-style-type: none"> <li>Review cut slopes.</li> <li>Collect samples of borrow material for testing to assess both suitability of materials and to evaluate the Standard Proctor maximum dry density and optimum moisture content of the material.</li> <li>Report test results to AMEC and MPMC's Project Manager as they are obtained.</li> </ul>	MPMC
2.2	<u>NAG Rock Source (Zone C)</u> : <ul style="list-style-type: none"> <li>Review the selective borrowing/classification of material for the coarse NAG rockfill.</li> <li>Visual verification of the material for conformance to the gradation specifications.</li> <li>Report observation to AMEC and MPMC's Project Manager as they are obtained.</li> </ul>	MPMC
2.3	<u>NAG Rock Source (Zone T)</u> : <ul style="list-style-type: none"> <li>Monitoring the selective borrowing/classification/processing of material for the fine NAG rock transition zone.</li> <li>Collect periodic samples for conformance to the gradation specifications.</li> <li>Report observation to AMEC and MPMC's Project Manager as they are obtained.</li> </ul>	MPMC
2.4	<u>NAG Crushing Operation (Zone F)</u> : <ul style="list-style-type: none"> <li>Monitoring the filter sand and gravel crushing and decking operation.</li> <li>Collect periodic samples for conformance to the gradation specifications.</li> <li>Report observation to AMEC and MPMC's Project Manager as they are obtained.</li> </ul>	MPMC
2.5	<u>Materials Approval</u> : <ul style="list-style-type: none"> <li>Conduct Tests on collected samples.</li> <li>Approve the materials to be used during construction of the embankment.</li> </ul>	AMEC
<b>3.0</b>	<b>Review of Structural Fill Placement</b>	
3.1	<u>Zone S</u> : <ul style="list-style-type: none"> <li>Review and confirm that the locations of zone interfaces are in their correct locations.</li> <li>Confirm the width of the core zone is sufficient.</li> <li>Test the placed and compacted Zone S structural fill for in-place density.</li> <li>Collect samples for moisture content determinations and density (rock content) corrections.</li> <li>Collect samples of fill for confirmation index testing.</li> <li>Report observations and test results to AMEC and MPMC's Project Manager as they are obtained.</li> </ul>	MPMC
3.2	<u>Zone C</u> : <ul style="list-style-type: none"> <li>Review and confirm that the NAG rock is in conformance to the gradation specifications.</li> <li>Observe and confirm the compaction specification is followed.</li> </ul>	MPMC
3.3	<u>Zone T</u> : <ul style="list-style-type: none"> <li>Review and confirm that the NAG transition zone rock is in conformance to the gradation specifications.</li> <li>Observe and confirm the compaction specification is followed.</li> <li>Collect samples for gradation analysis.</li> <li>Report observations and test results to AMEC and MPMC's Project Manager as they are obtained.</li> </ul>	MPMC
3.4	<u>Zone F</u> : <ul style="list-style-type: none"> <li>Review and confirm that the zone interfaces are in their correct locations.</li> <li>Confirm the width of the filter zone is sufficient.</li> <li>Collect samples for gradation analysis.</li> <li>Review and confirm that the crushed fine filter material is in conformance to the gradation specifications.</li> <li>Confirm via hand-excavated test pits that segregation of filter sand and gravel is not occurring.</li> <li>Report observations and test results to AMEC and MPMC's Project Manager as they are obtained.</li> </ul>	MPMC
3.5	<u>Zone U</u> : <ul style="list-style-type: none"> <li>Review and confirm that the zone interface is in the correct location.</li> <li>Monitor material reworking to ensure proper distribution within the cell.</li> <li>Report observations and test results to AMEC and MPMC's Project Manager as they are obtained.</li> </ul>	MPMC
<b>4.0</b>	<b>Dam Performance Monitoring</b>	
4.1	Coordinate biweekly readings of vibrating wire piezometers and slope inclinometers during the construction. Submit the raw data collected to AMEC for review.	MPMC
4.2	Review submitted weekly readings, prepare associated graphs and analyze the collected data. Report monitoring results to AMEC and MPMC's Project Manager as they are obtained.	AMEC
<b>5.0</b>	<b>Construction Monitoring</b>	
5.1	Daily meetings between MPMC's Field Inspectors and Contractor to establish and review daily construction plan, identify concerns, and discuss other relevant issues.	MPMC
5.2	Monthly meeting between MPMC's Field Inspector, Project Manager, AMEC Support Engineer and Contractor.	MPMC/AMEC
5.3	Establish and confirm construction boundaries between various zones.	MPMC
5.4	Addressing any concerns or out-of-compliance situations observed and recorded during construction.	MPMC/AMEC
<b>6.0</b>	<b>Record Keeping</b>	
6.1	Maintain daily construction site photographic record of construction activities.	MPMC
6.2	Completing daily construction reports, and delivering a copy to MPMC's Project Manager and by email to AMEC's Support Engineer.	MPMC
6.3	Completing monthly construction reports, with copies to MPMC's Project Manager and AMEC's Project Manager and Senior Geotechnical Engineer.	AMEC

### **2.3.3 AMEC Project Manager**

AMEC's Project Manager will have overall responsibility for AMEC's role with upcoming and future dam raising projects. He will review all monthly construction progress reports and liaise with the AMEC Senior Geotechnical Engineer and MPMC's Project Manager to review any problems that may arise.

The AMEC Project Manager will also liaise with the AMEC Support Engineer and the MPMC's Project Manager (and through him MPMC's Field Inspector), and will make site visits as deemed necessary during construction. The exact timing and duration of the site visits will be determined in consultation with the MPMC Project Manager so that critical aspects of the construction can be viewed during these visits.

The responsibilities of AMEC's Project Manager will be as follows:

- Review instrumentation interpretations and communicate of any concerns to MPMC's Project Manager and AMEC's Senior Geotechnical Engineer.
- Review monthly progress reports prepared by the AMEC Support Engineer and communicate any concerns arising from these reviews to MPMC's Project Manager and AMEC's Senior Geotechnical Engineer.
- Carry out periodic site visits as appropriate during the construction season, timed to coincide with critical aspects of the construction.
- Identification, review, and approval of any design changes determined to be required by AMEC and/or MPMC.

### **2.3.4 Senior Geotechnical Engineer**

AMEC's Senior Geotechnical Engineer will serve as the Engineer of Record for the Mount Polley TSF embankment. He will review monthly construction and instrumentation reports as required and review the As-built/Annual Review reports. AMEC's Senior Geotechnical Engineer is familiar with the site and will make site visits only if deemed necessary by the AMEC Project Manager or MPMC Project Manager.

### **2.3.5 AMEC Soils Laboratory – Prince George**

All off-site material testing will be carried out at the AMEC Prince George Laboratory. MPMC will be responsible for collection and shipment of samples as required. AMEC's laboratory technician will be responsible for carrying out the required testing and reporting of results to the AMEC Support Engineer who in turn will convey the results to MPMC's Project Manager.

### **2.3.6 Soils Testing – Mount Polley Site**

For the 2012 construction period, AMEC will conduct the majority of material testing required to support the construction. The following tests are required to be carried out by Mount Polley personnel at the Mount Polley on-site lab:

- gradation analysis (3 tests per run) for Zone T and Zone F during production (D422-07);
- daily moisture content confirmatory testing (D2216-10) of Zone S.

All test results will be compiled by the MPMC Field Inspector or the MPMC laboratory staff, and are to be submitted to AMEC's Support Engineer along with the daily construction reports for review and approval.

### **2.3.7 MPMC Project Manager**

MPMC's Project Manager shall assume overall responsibility for MPMC construction management and MPMC supervision, monitoring, and quality control testing activities when AMEC is not on site. This person shall ensure that the design specifications and the QA/QC requirements as outlined in this manual are followed. In the absence of the MPMC Project Manager, the MPMC Mine Technicians dedicated to the TSF embankment will take responsibility, under the supervision of the Mine Operations Manager.

MPMC's Project Manager shall liaise with AMEC's Support Engineer and AMEC's Project Manager to discuss construction progress, any problems encountered and their resolution, and the timing of site visits by AMEC personnel to view the construction.

The MPMC Project Manager will address any concerns raised by the MPMC Field Inspector/AMEC Support Engineer, including, but not limited to, the following:

- Placement of material unacceptable as dam fill.
- Unacceptable construction procedures (excessive lift thickness, inadequate compaction, inadequate foundation preparation, inadequate material testing etc.).
- Non-compliance issues identified by the AMEC Support Engineer and MPMC Field Inspector that are not immediately rectified by the construction forces, be they those of the contractors or MPMC.

### **2.3.8 MPMC Mine Operations Manager**

The MPMC Mine Operations Manager will address any concerns raised by the Field Inspector/Support Engineer as related to any potential environmental issues or concerns.

### 2.3.9 MPMC Field Inspector and Mine Technicians

Survey control for the dam construction will be provided by MPMC. The MPMC Field Inspectors, with support from Mine Technicians, will be responsible for the following tasks:

- Locating the centerline and cutoff trenches for the Dam as identified on the appropriate AMEC construction drawings.
- Establishing and maintaining upstream and downstream slope stakes as required during dam construction.
- Locating the upstream and downstream toes of the slopes in the field, based on the identified centerline locations.
- Providing location and elevation data as required by field staff.
- Collecting data required for the as-built drawings, including a complete survey of the cutoff trench, dam crest, and dam toe as constructed.

The Field Inspector will record survey data as provided for compacted density test locations, etc. in the daily construction reports.

## 3.0 MATERIALS TESTING AND CONSTRUCTION INSPECTION

### 3.1 General

The detailed technical requirements for the 2012 raise of the TSF Embankment are shown in attached drawing 2012.01 through 2012.07. The technical requirements for the construction are indicated on attached drawing and are restated in Sections 3.3 through 3.6.

### 3.2 Estimated Fill Volumes

Table 3.1 below summarizes the estimated material quantities for Stage 8 expansion to be constructed in 2012.

**Table 3.1: Stage 8 Expansion (El. 963.5 m) Estimated Fill Volumes**

SECTION	ESTIMATED FILL VOLUMES (m <sup>3</sup> )			
	Zone C	Zone T	Zone F	Zone S
Main Embankment	57,900	7,400	7,400	20,600
Perimeter Embankment	70,100	11,900	11,900	33,200
South Embankment	32,400	6,400	6,400	17,900
<b>Total</b>	<b>160,400</b>	<b>25,700</b>	<b>25,700</b>	<b>71,700</b>

Notes:

1. Volumes are estimated from drawings 2012.02 through 2012.06, and are rounded up to the nearest 100 m<sup>3</sup>.
2. No settlement allowance has been considered.
3. Quantities are based on neat construction lines; with no contingency or allowance for overbuild or waste factors.

### 3.3 Foundation Preparation, Inspection, and Approval

#### 3.3.1 General

Foundation preparation for the 2012 dam construction along the abutment extensions are to be completed to the following specifications:

- All topsoil, organic material, soft or loose soils, and other deleterious materials are to be removed from the foundation area.
- The exposed abutment foundation subgrade is to consist of dense to very dense glacial till, or bedrock.
- The abutment subgrade shall be proof-rolled with a smooth drum compactor.

Foundation preparation for the abutment cutoff trench extensions will be completed to the following specifications and in accordance with Detail 1 on drawing 2012.07:

- The cutoff trench shall extend a minimum of 0.5 m into the undisturbed glacial till, where the glacial till is in excess of 1 m thick.
- Where less than 1m thickness of glacial till exists, the cutoff trench shall extend to sound bedrock with removal of weathered or fractured bedrock completed to the approval of the AMEC Support Engineer. Additional specifications related to bedrock encountered in the cutoff trench are provided in Section 3.3.4 below.
- The thickness of glacial till at the cutoff trench is to be confirmed by performing test pits at locations along the cutoff trench alignment selected by the AMEC Support Engineer.
- The cutoff trench shall be constructed with a minimum 2 m width at its base. Where bedrock is encountered, the AMEC Support Engineer may direct that overburden be removed for the full 5 m width of the Zone S core.
- The cutoff trench shall have side slopes of 1H:1V or flatter. Steeper slopes may be accepted in bedrock at the discretion of the AMEC Support Engineer.
- Surface runoff water or groundwater shall not be permitted to collect in the cutoff trench.

Prior to placement and compaction of structural fill in the cutoff trench excavation, the Field Inspector will send photos to the AMEC Support Engineer for review and, as appropriate, approval. The Field Inspector will verify that the cutoff trench is founded in the minimum specified depth of glacial till (and will conduct or oversee soil probing as required), or that the cutoff trench is founded on sound bedrock. Cutoff trench excavation inspections will be performed as required, and inspection dates and results will be tracked by the Field Inspector on copies of the construction drawings or by station number. MPMC Field Inspectors, with support from the mine technicians, will provide a survey pick-up of the cutoff trenches and maintain a project database for use in the as-built documentation.



### 3.3.2 Tie-In to Existing Till Core

The 2012 raise of the core zones of the embankment will involve placement of structural fill on the existing dam crests. On the existing dam crests, removal of the crest running surface (by grading it off the upstream edge of the dam crest) may be required, followed by removal and/or drying and re-compaction of any loose, over-wet zones within the till fill. As the final lift of 2011 construction season was not tested, the material will be tested and if necessary re-compacted as specified in Section 3.5.1 of this document.

### 3.3.3 Foundation Preparation

Foundation preparation is to be conducted when AMEC's Support Engineer is on site. The foundation preparation for 2012 construction will consist of foundation preparation to the current ultimate design (El. 970.0 m). The foundation will be drained (where required) and will be stripped of all organic material, loose or soft soils, and all other deleterious materials under the foot print of the embankment with an additional 2 m buffer zone for tie-in capabilities and material placement inaccuracies. These unacceptable materials will be wasted in an approved manner, in an approved location as designated by MPMC personnel. Salvageable topsoil and organic material that could be used for reclamation will be stockpiled in appropriate locations for future use, as directed by MPMC's Project Manager.

Suitable dense subgrade for the embankment will be exposed, then proof-rolled and scarified (if deemed necessary by the AMEC Support Engineer). Prior to placement of structural fill as specified on drawing 2012.07, AMEC's Support Engineer will approve the subgrade. The exposed subgrade is to be protected from moisture softening due to surface water runoff or excessive precipitation.

The cutoff trench location will be identified in the field with a survey (to be completed by MPMC Field Inspectors and mine technicians), and the design vertical (depth) extent of the cutoff in native soil or weathered bedrock verified by test pits or soil probes that extend below the minimum specified trench depth (see Detail 1, drawing 2012.07). The cutoff trench excavation will be protected from moisture softening due to surface water inflow or excessive precipitation. Water seeping into the cutoff trench excavation will be removed by pumping, and will not be permitted to collect and remain in the excavation.

Prior to placement and compaction of structural fill in the cutoff trench excavation, AMEC's Support Engineer will approve the preparation of the trench. Inspections will occur as foundation areas are prepared and the approval will be documented as described in the monthly report. Photographic records will be maintained to identify foundation areas that have been inspected and approved, clearly indicating their date of inspection. Areas not approved for placement of structural fill by the AMEC Support Engineer are not to be covered with fill under any circumstances to avoid having to remove/replace materials.

### 3.3.4 Special Considerations for Bedrock Exposed in Till Cutoff Trench

If bedrock is encountered in the dam foundation cutoff trench, special considerations exist and special bedrock treatment measures may be required. Guidelines and procedures for dealing with bedrock exposed in the cutoff trenches are as follows:

Weathered or fractured bedrock is defined as bedrock that can be readily excavated by a dozer or a hoe excavator equipped with a digging bucket and that, based on visual assessment, is highly pervious to groundwater flow due to the presence of fractures/joints/faults. Sound (competent) bedrock, is defined as bedrock that can be excavated only with significant difficulty (or not at all) by a hoe excavator equipped with a digging bucket. When excavating in bedrock, frequent communication with AMEC's Senior Geotechnical Engineer and transmission of photographs is to be carried out.

If shear/fault zones are encountered within the bedrock exposed in the core to abutment contacts, the following information should be collected and passed on to AMEC's Senior Geotechnical Engineer:

- Photographs of the shear zone from a variety of vantage points (both close-ups and photos giving an overall perspective).
- Orientation (strike & dip) of the feature and its orientation relative to that of the core zone (i.e. does it provide a potential upstream-downstream seepage pathway?).
- Thickness and continuity.
- Infilling (clayey gouge, granular material). The infilling material should be sampled and sent to the AMEC Prince George soils laboratory for grain size and Atterberg limits testing.

AMEC's Senior Geotechnical Engineer, upon analysis of the information provided, will determine what (if any) special treatment is required for the shear/fault zone. Such treatment may include hand excavation a few centimeters into the shear zone, followed by placement of bentonite powder in advance of till placement.

Once sound bedrock is encountered, the surface should be cleaned of loose materials using a hoe excavator equipped with a narrow cleaning bucket, followed by pressure washing using either air or water. Where the slope of the cleaned and approved sound bedrock surface, along the axis of the dam (i.e. up the abutment), is flatter than 1H:1V, then Zone S structural fill placement may proceed. Good compaction of the Zone S fill against the bedrock surface is required. If the undulations in the bedrock surface along the bottom of the trench are such that this cannot be achieved using dozers and the compactor, then such undulations (i.e. rock protrusions) should be removed if possible. If this is not possible, then compaction of thin till lifts with a walk-behind or plate-tamping compactor, or with tamping with a hoe bucket, will be required, to fill in the undulations. Once this is done, then normal spreading and compaction procedures can be undertaken.



Where the slope of the sound bedrock surface is steeper (overall) than 1H:1V, but flatter than 0.5H:1V, then the AMEC design office should be consulted for a decision on the need for any further treatment measures. Photographs of the bedrock surface should be sent to the design office. If the roughness of the rock surface is such that it is judged that effective compaction of till fill against the bedrock on the base of the trench cannot be achieved, then additional (small scale) bedrock excavation (removal of protrusions) should be attempted to attain a surface against which it is judged till fill can be effectively compacted. If this measure is unsuccessful, then one of the following additional measures will be required:

- (a) Additional (large scale) bedrock excavation should be undertaken to achieve a maximum 1H:1V overall slope for the bedrock surface. This can be achieved by mechanical means (dozers, hoe excavators), or by small scale, controlled drilling and blasting.
- (b) Dental concrete or shotcrete application will be required to fill in the undulations in the bedrock surface, and yield a maximum slope of 0.5H:1V, against which till fill can be effectively compacted.

Where the bedrock surface is steeper than 0.5H:1V, the same two measures outlined above will apply.

Where dental concrete is required against steep bedrock faces, it will likely be necessary to use formwork. Dental concrete, if used, will conform to the following specifications:

- 28 day strength – minimum 25 MPa if flyash included in mix, otherwise minimum 30 MPa.
- Water to cement ratio: 0.45:1 by mass.
- Air entrainment: to provide for 5% to 7% air entrainment.
- Cement to flyash ratio (if flyash used): 4:1 by mass, which would allow overall water:cement:flyash ratio of 0.45:0.8:0.2.

The dental concrete need not be of high strength. It does need to be sufficiently fluid that it will fill in irregularities in the bedrock surface to a reasonable extent. Addition of flyash to the mix would achieve that objective, as well as save on cement costs.

Should shotcrete be selected, then MPMC will prepare a mix design for review and approval by AMEC.

Prior to placement and compaction of structural fill in the cutoff trench excavation, the Field Inspector will send photos to the AMEC Support Engineer for approval. Core trench excavation inspections will be performed as required, and the Field Inspector will track inspection dates and results on copies of the construction drawings or by station number. MPMC Field Inspectors will provide a survey pick-up of the core trench excavations and maintain a project database for use in the as-built documentation.

### **3.4 Borrow Materials Site Development and Operation**

The proposed borrow pit will be subjected to sampling, laboratory testing, and approval by AMEC's Support Engineer. During the TSF embankment construction, detailed documentation will be maintained to ensure the source of the material being placed is known and material testing requirements are satisfied.

Topsoil and other overburden judged to be unsuitable as structural fill will be stripped from the borrow pit and hauled to an acceptable waste dump.

The borrow material site shall be developed such that groundwater inflow and precipitation runoff are directed in a controlled manner to designated sump area(s) of the site, and then removed as required. External surface water runoff shall be prevented from flowing into the borrow materials area by construction of diversion ditches as required.

The performance of the cut slopes in borrow areas will be inspected and recorded as required by the MPMC Field Inspector for documentation within the construction reports. AMEC's Support Engineer may request modifications to the excavation plan, including flattening of the slopes and water control measures, based on the observed performance of the cut slopes.

### **3.5 Material Specifications, Material Testing, Inspection, and Approval**

The approved structural fill to be used for embankment construction is to meet the specifications shown on drawing 2012.03. Additional comments pertaining to each of the zones are provided below.

#### **3.5.1 Zone S (Core) – Glacial Till**

The glacial till borrow materials approved for construction are to be well graded, organic-free, mineral soils, having moisture contents near their optimum for compaction and conforming to the specified gradation envelope provided on drawing 2012.03. The optimum moisture content range of the borrow soils is to be determined by Standard Proctor moisture-density relationship testing. A general guideline for allowable moisture contents for the Zone S structural fill is  $\pm 1\%$  of the optimum moisture content as determined by the Standard Proctor test.

The proposed till borrow soils are to be visually inspected for consistency on a daily basis by MPMC Field Inspectors. Any material not meeting specification shall not be placed within the embankment. The till borrow pits are to be sampled bi-weekly or every 10,000 m<sup>3</sup> removed, whichever is less, and shipped to the AMEC Prince George Laboratory for testing. Samples are to be collected and shipped according to ASTM standard: Standard Practices for Preserving and Transporting Soil Samples (D4220-07); and shall consist of two (2) three-quarter (3/4) full 5-gallon buckets, void of any oversized rocks (>75 mm in diameter). If the representative sample contains oversized rocks, they are to be collected, weighed, and noted as being removed from the collected sample.

Prior to placement of glacial till, the previous lift or prepared abutment is to be scarified to promote bonding between successive lifts. Scarification should only be carried out for the areas that will be immediately covered (during the work day). Moisture conditioning may be required for areas of the scarified surface that have dried out.

A sample of glacial till is to be collected from the embankment bi-weekly (offset from the borrow pit sample) or every 6,500 linear meters, whichever is less, and shipped to the AMEC Prince George Laboratory for laboratory testing. The samples are to be collected and shipped as described above.

The approved Zone S glacial fill is to be spread in loose 0.3 m thick lifts and compacted by a 10-ton vibratory smooth drum compactor. A minimum of 95% compaction of the Standard Proctor maximum dry density is to be achieved.

Placed and compacted glacial till is to be tested for compaction at least once (1) per 100 linear meters per lift per day to confirm that specified compaction of 95% has been achieved. Compaction testing will be carried out with a nuclear densometer (ND) with the Moisture and Density Indicator (MDI) as a back-up testing device. The compaction testing should be conducted in accordance with ASTM standards D6938-10 and D6780-05. The compaction test locations are to be surveyed and identified by three dimensions: elevation, northing and easting in sequential order, and submitted to AMEC Support Engineer on a daily basis.

In addition to the density tests, a confirmatory in-situ moisture content sample is to be collected once (1) per 1,000 linear meters per lift or once (1) per day per lift, whichever is less. The moisture content testing should be conducted in accordance with ASTM standards: Water (Moisture) Content of Soil and Rock (D2216-10) and Correction of Unit Weight and Water Content for Soils Containing Oversize Particles (D4718-07). The confirmatory moisture test will identify the accuracy of ND and MDI density testing. If there is a greater than 10% difference between the ND/MDI and laboratory sample a secondary test is to be conducted, and if the issue persists AMEC's Support Engineer is to be informed immediately.

Upon receiving collected samples, AMEC's Prince George Laboratory will perform the following tests utilizing ASTM standards: Particle Size Analysis of Soils (D422-07), Laboratory Compaction Characteristics of Soil Using Standard Effort (D698-07), Liquid Limit, Plastic Limit, and Plasticity Index of Soils (D4318-10).

### **3.5.2 Zone F (Filter) – Manufactured Sand and Gravel**

The sand and gravel filter material is to be well graded, organic-free, mineral soil, falling within the specified gradation envelope shown on drawing 2012.03. Routine testing of produced material is to be carried out to ensure the material is within specification. The test program should determine if the manufacturing process is consistent, and if the produced material is within the gradational specification. During transportation of the aggregate to the TSF, regular representative samples of the stock piles are to be collected. On-site testing of the collected

samples will consist of at a minimum of one (1) sample per 5,000 m<sup>3</sup> per stockpile or as deemed to be representative of the stock pile. Off-site testing of the collected samples will consist of at a minimum of one (1) sample per stock pile.

Zone F material is to be placed in maximum 0.6 m thick lifts prior to compaction. Care will be taken during handling and placement of the material to minimize segregation and to avoid cross contamination of the zones. If cross contamination of the zones occurs the contaminated material is to be removed. MPMC's Field Inspector is to visually inspect placed Zone F material to ensure the material is well graded and the specified width of the zone is established and maintained. Zone F is to be compacted with a minimum of four (4) passes with a 10-ton vibratory smooth drum. Visual inspection after compaction will be carried out and approved by the MPMC Field Inspector.

On-site testing of Zone F during placement will include visual determination of upper and lower bound grain sizes, suitability of rock hardness, and a gradational test once (1) per placement event or once (1) per 2,500 linear meter of placed material. Off-site testing of this material during placement will consist of a gradational test once (1) per 5,000 linear meters of placed material.

The samples are to be collected and shipped according to ASTM standard D4220-07; each sample consist of one (1) three-quarter (3/4) full 5-gal buckets, void of any oversized rocks (<75 mm in diameter). If the representative sample is to contain oversized rocks, they are to be collected, weighed, and noted as being removed from the collected sample.

### **3.5.3 Zone T (Transition) – Fine NAG Rock Transition**

Fine NAG rock transition material shall be confirmed to be NAG by MPMC, and shall fall within the gradation limits indicated on Drawing 2012.03. On site testing of this material includes visual determination of upper and lower bound grain sizes, suitability of rock hardness, and a gradational test once (1) per 5,000 m<sup>3</sup>. Off site testing of this material, will consist of a gradational test once (1) per 10,000 m<sup>3</sup>. Special care shall be taken during sampling to ensure that representative samples are obtained. Photographs of this material when exposed in the excavated filter trenches are to be taken frequently, as the best means of assessing the ability of Zone T to serve as a filter for Zone F is through visual means. The samples are to be collected and shipped according to ASTM D4220-07; each sample consist is to consist of three (3) three-quarter (3/4) full 5-gal buckets.

The fine NAG rock transition zone serves as filter protection for the adjacent Zone F filter sand and gravel which in turn serves as filter protection for the Zone S core. The importance of conformance with gradation specifications for both of these filter zones cannot be over-emphasized. Photographs of this material are to be taken frequently during placement.

Prior to placement of Zone T material adjacent to the Zone C Rock Shell, the Zone C/Zone T interface is to be inspected for openwork areas created by concentrations of larger size rocks. Removal of openwork areas will be carried out prior to placement of Zone T.

Zone T material is to be placed in maximum lift thicknesses of 0.6 m. Care will be taken during handling and placement of the material to minimize segregation. Zone T lifts will be compacted by uniform routing of haul trucks and spreading equipment. Visual inspection after compaction will be carried out and approved by the MPMC Field Inspector.

### **3.5.4 Zone C (General Rockfill) – Coarse NAG Rock Shell**

Coarse NAG rockfill shall be confirmed to be NAG by MPMC prior to being used as fill on the dam. QA/QC personnel are to visually confirm that particles no larger than 1 m are used as structural fill. Larger sizes are to be dozed away from the contact with Zone T.

The rockfill shell (Zone C) will be constructed using approved coarse NAG rockfill, placed in lift thicknesses of 2 m or less. The Zone C lifts will be compacted by uniform routing of haul trucks and spreading equipment. Some degree of compaction of Zone C is required nearer Zone T as excessive settlement of the rockfill could disrupt the continuity of the overlying transition and fine filter materials (Zones T and F respectively). If Zone C material contains appreciable quantities of fines, and the compacted lift surfaces assume a 'pavement' type appearance that might impede vertical drainage, then these lift surfaces may require scarification prior to placement of a subsequent lift.

### **3.5.5 Zone U (Selected Upstream Fill) – Tailings/NAG**

The selected upstream fill (Zone U) will be constructed using cells of total tailings. The cells are constructed by confining the discharged tailings with berms. The confining berms are to have a culvert to allow for the water and fine materials to escape into the TSF. The coarse tailings sand that settles out into the cells is to be reworked with the help of a dozer to achieve proper distribution within the cells, provide compaction and to expedite the excess water drainage. This construction method has been used and proved effective in previous TSF embankment raises.

In areas of the dam (along the Main Embankment) where there is not sufficient tailings line pressure to deposit with the cell method, NAG mine waste rock will be substituted for Zone U Material. Care will be taken to taken during construction of the berm to ensure the NAG is well graded and free of boulders larger than 0.5 m in diameter.

## **3.6 Criteria for Suspension of Work**

The till borrow material is highly sensitive to moisture in terms of its compaction characteristics and workability. Consequently, during periods of wet weather, construction of the core zone will be suspended. Adequate slopes will be maintained on till fill surfaces, and they will be sealed

with a smooth drum vibratory roller, to promote surface water runoff and prevent excessive softening of compacted fill. Moisture-softened lifts must be removed or scarified, dried to acceptable moisture content and re-compacted.

Embankment construction will be suspended if the inclinometers or piezometers fall under the yellow or red condition as described in Table 3.2, or if the piezometers indicate increasing trend in the foundation piezometers.

**Table 3.2: Inclinometer Trigger Levels**

Condition	Inclinometer Movement Rate		Main Embankment Foundation Piezometer	
	(mm/day)	(bi-weekly)	Elevation (m)	Above original ground (m)
RED	> 1 mm/day	>14mm	> 925 m	>13 m
YELLOW	0.5 mm/day to 1.0 mm/day	7 mm to 14 mm	921 m to 925 m	9 m to 13 m
GREEN	< 0.5 mm/day	7 mm	< 921 m	< 9 m

Embankment construction work will stop for the season when freezing weather prevents acceptable fill placement and compaction.

#### 4.0 TEST PROCEDURES

##### 4.1 Scheduled Tests

The following tests, as described by the American Society for Testing and Materials (ASTM), will be used for quality control of materials and earthworks during the 2012 construction.

ASTM STANDARD PRACTICE	DESIGNATION
Sieve in Mineral Aggregates by Washing	C117-04
Sieve Analysis of Fine and Coarse Aggregates	C136-06
Dry Preparation of Soil Samples	D421-07
Particle Size Analysis of Soils (Hydrometer test)	D422-07
Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft <sup>3</sup> (600 kN-m/m <sup>3</sup> ))	D698-07
Water (Moisture) Content of Soil and Rock	D2216-10
Standard Practices for Preserving and Transporting Soil Samples	D4220-07
Liquid Limit, Plastic Limit, and Plasticity Index of Soils	D4318-10
Correction of Unit Weight and Water Content for Soils Containing Oversize Particles	D4718-07
Water Content and Density of Soil in Place by Time Domain Reflectometry	D6780-05
Particle-Size Distribution (Gradation) of Soils	D6913-04
In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)	D6938-10



Laboratory and field procedures for each test are provided in the corresponding ASTM Standard Practice document. Moistures and density tests will be conducted by the Field Inspectors and laboratory personnel on site. Replicate samples of those tests carried out on site will be forwarded to the AMEC Prince George laboratory for confirmation testing, typically at a rate of one confirmation test per fifteen field tests. Atterberg limits and proctor tests will be carried out in the AMEC Prince George soils laboratory.

The tests outlined above will be carried out initially at the minimum frequencies indicated on drawing 2012.03. As trends and consistency in the test results develop, AMEC's Support Engineer may reduce testing frequencies where deemed appropriate.

#### **4.2 Additional/Supplemental Tests**

Determinations of specific gravity (ASTM D854-10) for the approved glacial till and borrow soils may be required if significant material changes are observed. These tests will be conducted at the AMEC Prince George laboratory, following the Sample Collection Procedures contained herein. Typically, two or three specific gravity determinations would be required for each soil type.

#### **4.3 Sample Collection Procedures**

Samples to be transported to the AMEC Prince George laboratory for field laboratory verification testing will be sealed to minimize soil moisture losses, and shipped in an expedient manner. The shipping address is as follows:

Attn: Dmitri Ostritchenko (Mt. Polley)  
AMEC Environment and Infrastructure  
3456 Opie Crescent  
Prince George, BC  
V2N 2P9

The MPMC Field Inspector shall include transmittals with the samples outlining the tests to be carried out for each respective sample. These transmittals are to be emailed to AMEC's Support Engineer in advance of the shipment and are to be included in the daily construction report. The Prince George laboratory will check that the label information attached to each sample is incorporated onto the corresponding test sheets, and that copies of the test sheets and results are forwarded to AMEC's Support Engineer as the tests are completed. AMEC's Support Engineer will review the test results and submit them in the monthly report, or sooner if immediate actions are needed.

Samples collected by the Field Inspectors for the scheduled tests during the 2012 construction will be identified by a detailed labeling scheme, the following is an example:

SAMPLE LABEL	
Project name :	Mt. Polley Mines Project
Construction :	Stage 8 Raise – 2012
Material :	<i>Glacial Till (Zone S)</i>
Source :	<i>Main Embankment</i>
Location :	<i>Elev. 960.0, 1.0 m d/s of CL, station 21+00</i>
Date :	<i>June 20, 2012</i>
Sample Number :	<i>ZS1-Jun6,2012</i>
Sample Destination:	AMEC Prince George Laboratory
Test Type(s):	<i>Standard Proctor, Gradation</i>

Sample locations, material descriptions, and other relevant notes will be recorded by the MPMC Field Inspectors. The sample label information, accompanying field notes, and test results will be included in the construction reports as part of the permanent record of the 2012 construction program.

Samples will be collected and preserved in a manner consistent with their scheduled tests, such as the placing and sealing of samples for natural moisture content determinations in plastic bags.

## 5.0 REPORTING

### 5.1 Construction Documentation

MPMC's Field Inspectors will document the monitoring and testing program for Stage 8 embankment raise construction by means of daily construction reports, field and laboratory test sheets, survey reports as provided, and notes from relevant on-site meetings, discussions, and decisions. Other documents, such as borrow area excavation diagrams or dam construction progress maps, may be included with the construction records. A photographic record will also be maintained on site. Select photographs will be captioned, dated, and included in the daily construction report and final as-built report.

### 5.2 Daily Construction Reports

MPMC Field Inspectors will be responsible for submitting a daily construction report. A sample of a daily construction report and associated spread sheets are attached in Appendix B and a digital copy of the reports will be submitted to MPMC Project Manager. The information to be provided in these reports includes but is not limited to the following:

- Construction Activities – What preparation work was conducted prior to placement of material? What material was placed where and how was the material placed, compacted, etc?
- Material Testing – What samples were collected? Where was the sample collected?



- Compaction Testing – At what station and offset was the test conducted? (Northing, Easting) Was a comparative laboratory moisture content sample taken? If so, at what elevation was the sample collected?
- Instrumentation Readings – What instrumentation data was collected?
- Non-compliance Issues and Mitigating Actions to be taken.
- Daily Activities Photographs – Photographs depicting various activities performed in relation to TSF embankment construction. A minimum of six (6) high quality photographs are generally appropriate per daily report.

Daily reports are to be signed and submitted via email by 10:00 am of the following day to AMEC's Support Engineer and MPMC's Project Manager for review.

### **5.3 Monthly Progress Reports**

Monthly progress reports will be prepared by the AMEC Support Engineer for those periods when active construction is ongoing; documenting the construction activities, material testing results, instrumentation readings and compliance with the design specifications. These reports will be issued to the MPMC Project Manager, AMEC's Project Manager and AMEC's Senior Geotechnical Engineer.

In addition to the monthly reports, a formal monthly meeting during active construction is to be conducted between AMEC Support Engineer, MPMC Project Manager and MPMC Field Inspector\Mine Technicians. The purpose of this meeting is to address any concerns, and determine if the specifications and standards for construction and testing are followed.

### **5.4 As-Built Report/Annual Review**

AMEC will prepare a report summarizing the construction methodology followed and documenting the as-built dam conditions for the 2012 construction season. This as-built report for 2012 will be combined with the 2012 annual review report. The report will be confirmation that the dam was raised in conformance with design intent, and will serve as a guide for construction of TSF embankment in subsequent years.

The as-built report will also outline any modifications made in the field to the initial methods of foundation preparation; borrow soils excavation, hauling, placement, and compaction; or other relevant work. Documentation of any such refinements made during construction will be of benefit for subsequent embankment raises. The as-built report will also include recommendations pertinent to the construction and QA/QC monitoring of future construction.

MPMC will mark-up the construction drawings based on as-built surveys of the raised dam. These marked-up drawings will be used by AMEC to produce CADD as-built drawings for the report.

## **6.0 INSTRUMENTATION & MONITORING**

### **6.1 General**

In 2011, additional instrumentation was installed to replace defective and damaged instruments. No new instrumentation is planned to be installed during the 2012 construction program.

### **6.2 Inclinometers**

Overall, eight (8) inclinometers have been installed in around the TSF embankment; seven (7) along the main embankment and one (1) along the perimeter embankment. Slope inclinometers are installed to measure the displacement of the embankment.

One (1) of the inclinometers has sustained damage (SI01-01) and is no longer functional. During the 2012 construction program the AMEC Support Engineer, with the aid of a MPMC operated excavator; will attempt to fix the damaged (SI01-01) inclinometer.

During active construction, the slope inclinometers are to be read, and the data downloaded and submitted to AMEC Support Engineer, bi-weekly. During non-active construction the data should be read, downloaded and submitted monthly. The AMEC Support Engineer shall be responsible for interpreting and analyzing data collected. Based on dam performance, the reading frequency may be increased or decreased at the sole discretion of the AMEC Senior Geotechnical Engineer.

### **6.3 Vibrating Wire Piezometers**

The vibrating wire piezometers monitor pore pressures in the embankment and embankment foundation materials. The data collected provides the pore pressure parameters that are used for limit equilibrium stability analyses. This information will continue to be required for monitoring the short and long term performance of the structure and for design optimization of future raises.

During active construction, piezometers are to be read, recorded, and submitted to the AMEC Support Engineer bi-weekly. The MPMC Field Inspector shall indicate on these plots when construction activities have taken place within 100 m of S.O.L chainage from the piezometers. This is required so that changes in piezometric pressures and measured displacements can be correlated with construction activities. During non-active construction the data should be read, recorded, and submitted monthly. The AMEC Support Engineer shall be responsible for interpreting and analyzing data collected. Based on dam performance, the reading frequency may be increased or decreased at the sole discretion of the AMEC Senior Geotechnical Engineer.

## 7.0 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 engineering geology and geotechnical engineering practices. No other warranty, expressed or implied, is made.

If you have any questions about the content of this manual, please do not hesitate to call.

Respectfully submitted,

**AMEC Environment & Infrastructure,  
a Division of AMEC Americas Limited**

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AMEC (2011). *"Construction Manual 2011"*, 20 April.

AMEC (2011). *"Tailings Storage Facility Instrumentation Review and Recommendations"*,  
14 June.

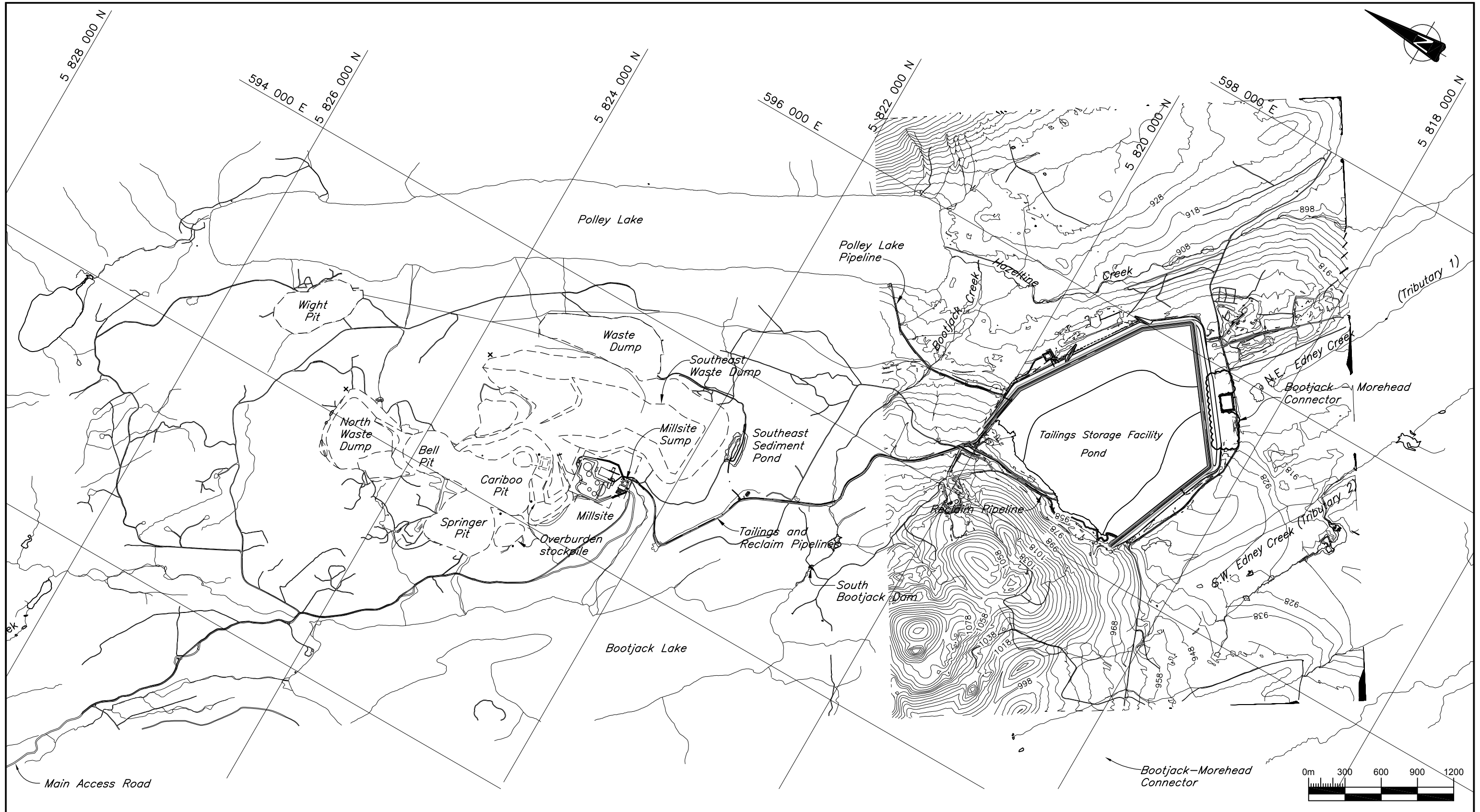
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KP (2011). *"Mount Polley Mine – Tailings Storage Facility Report on Stage 6B Construction"*,  
25 January.

KP (2011). *"Mount Polley Mine – Tailings Storage Facility Report on 2010 Annual Inspection"*,  
25 January.

**DRAWINGS**



NOTE:  
 1. BASE DRAWING FROM KNIGHT PIÉSOLD LTD.,  
 '100\_r0.dwg' AND 'dam-clip.dwg'.



CLIENT:  
**IMPERIAL METALS**  
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 Burnaby, BC V5C 0E4  
 Tel. 604-294-3811 Fax 604-294-4664

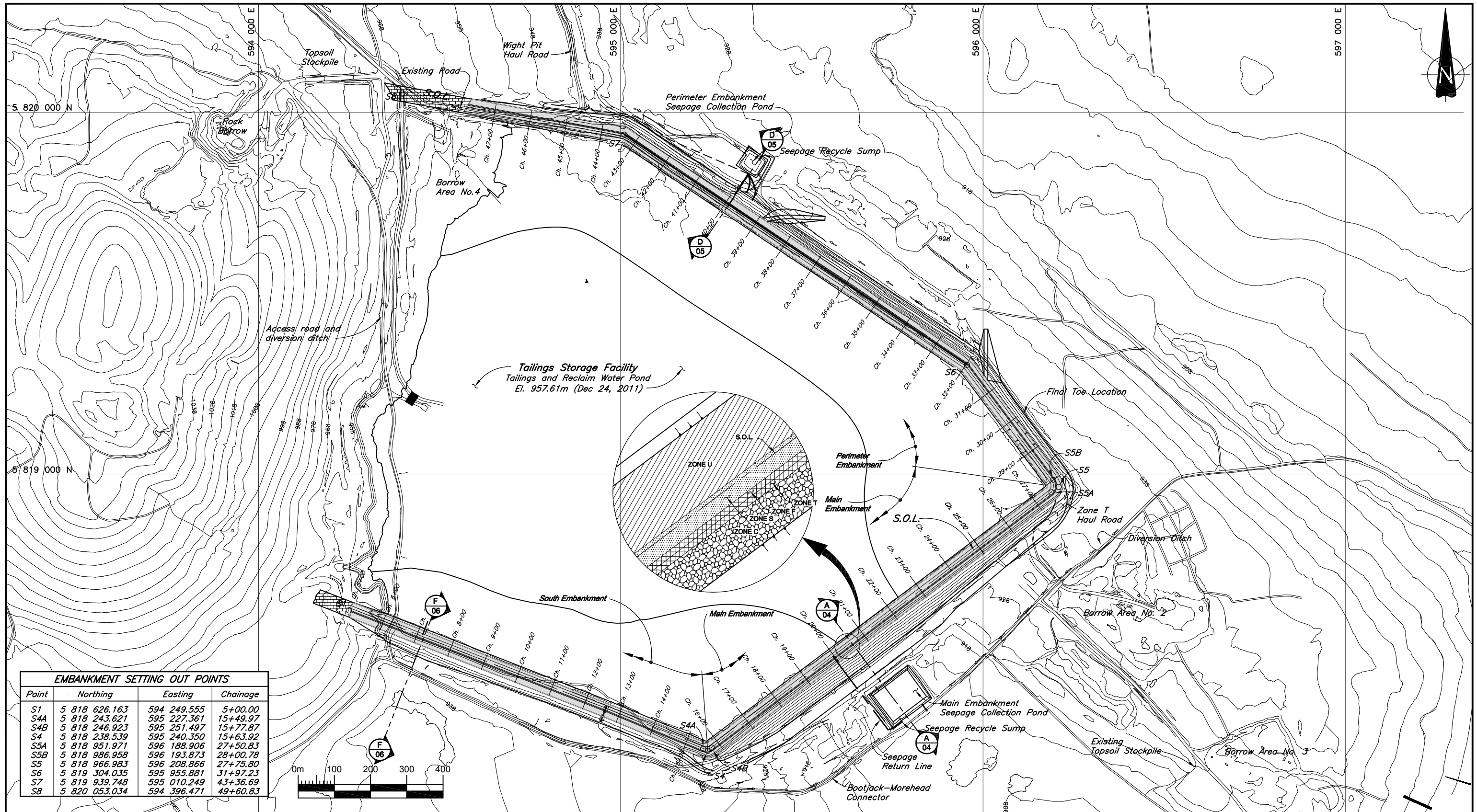


DWN BY: BB  
 CHK'D BY: DO  
 DATUM: NAD83  
 PROJECTION: UTM Zone 10  
 SCALE: AS SHOWN

PROJECT:  
**MOUNT POLLEY MINE  
 TAILING STORAGE FACILITY**  
 TITLE:  
**STAGE 8 TAILINGS EMBANKMENT  
 GENERAL SITE PLAN**

DATE:  
 FEBRUARY 2012  
 PROJECT NO:  
 VM00560  
 REV. NO:  
 A  
 FIGURE NO:  
 2012.01





EMBANKMENT SETTING OUT POINTS			
Point	Northing	Easting	Chainage
S1	5 818 626.163	594 249.555	5+00.00
S4A	5 818 243.621	595 227.361	15+49.97
S4B	5 818 246.923	595 251.497	15+77.87
S4	5 818 238.539	595 240.350	15+63.92
S5A	5 818 951.971	596 188.906	27+50.83
S5B	5 818 966.958	596 193.873	28+00.78
S5	5 818 966.983	596 208.866	27+75.80
S6	5 819 304.035	595 955.881	31+97.23
S7	5 819 939.748	595 010.249	43+36.69
S8	5 820 053.034	594 396.471	49+60.83

**LEGEND:**

	Upstream Fill		Transition
	Till Core		Rock Fill
	Filter		Abutment Preparation

**NOTES:**

- BASE DRAWING FROM KP DRAWINGS 102\_R0.dwg' AND 'dam-clip.dwg'.
- FOR MATERIAL SPECIFICATIONS SEE 2012.03
- S.O.L. - SETTING OUT LINE



CLIENT:

**IMPERIAL METALS**

**AMEC Environment & Infrastructure**

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Tel. 604-294-3811 Fax 604-294-4664

DWN BY: BB

CHK'D BY: DO

DATUM: NAD83

PROJECTION: UTM Zone 10

SCALE: AS SHOWN

PROJECT:

**MOUNT POLLEY MINE  
TAILING STORAGE FACILITY**

TITLE:

**STAGE 8 TAILINGS EMBANKMENT  
PLAN VIEW**

DATE: FEBRUARY 2012

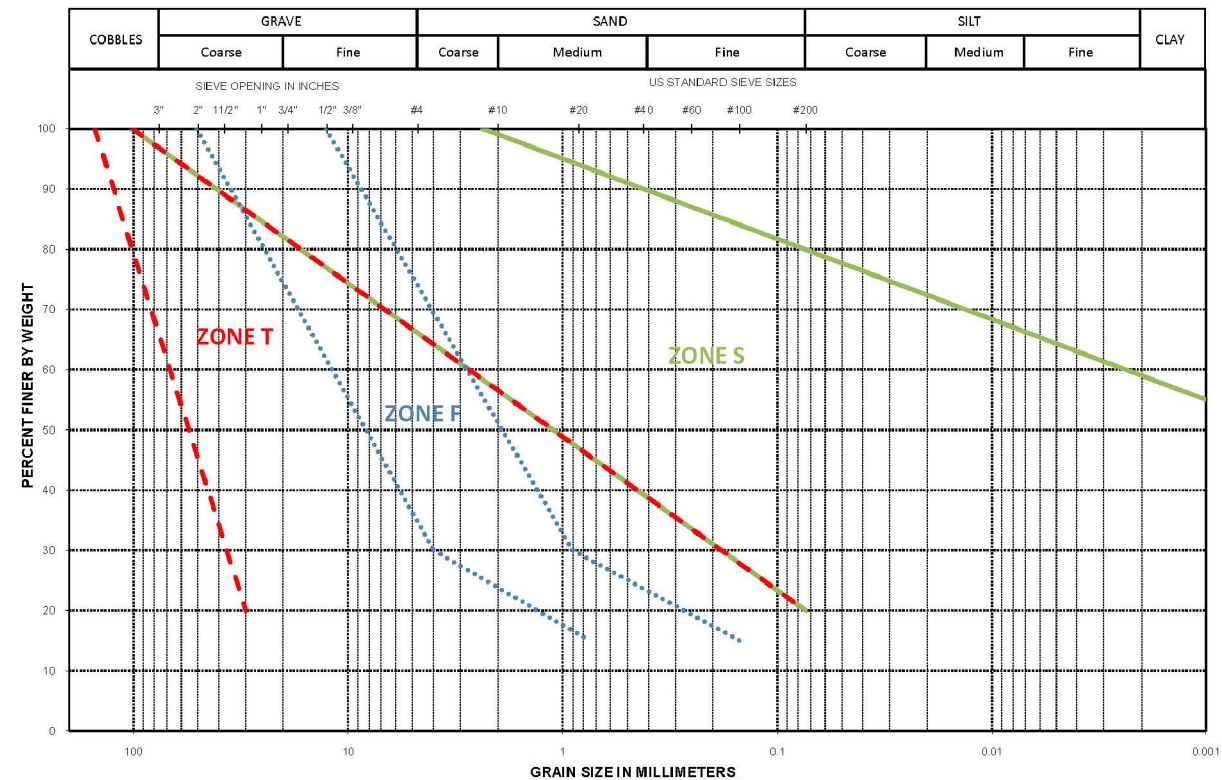
PROJECT NO: VM00560

REV. NO: A

FIGURE NO: 2012.02

EMBANKMENT ZONE	DESCRIPTION	MATERIAL TYPE	SPECIFICATIONS	SUBGRADE BASE PREPARATION	PLACEMENT AND COMPACTION	ON-SITE TESTING	OFF-SITE TESTING	SAMPLE COLLECTION SCHEDULE	SAMPLE SIZE
S	TILL CORE	GLACIAL TILL	Well graded till moisture content at ±1% of optimum. (See Gradator Envelope below)	Strip all topsoil and organic material. Excavate cutoff trench as per detail. (see VM0560.2012.07) Strip all frost softened and weakened soils, proof roll then scarify base soils.	Place, moisture condition and spread in maximum 300mm loose lifts. Vibratory compaction to 95% of standard proctor maximum density. Density tested once (1) per 100 linear m per lift per day.	<u>Source Classification:</u> Visual inspection of borrow material. <u>In-Place Testing:</u> Visual inspection of zone dimension, and material. ND Density Testing (D6938-10) MDI Density Testing (D680-05) Moisture Content (D4318-10)	<u>Source Classification and In-Place Testing:</u> Proctor (D698-07 / D4718-07) Atterberg (D421-07 / D4318-10) Hydrometer Gradation (D421-07 / D422-07) Sieve Gradation (D6913-09)	<u>Source Classification:</u> One (1) per biweekly per source or one (1) per 10,000 m <sup>3</sup> per source <u>In-Place Testing:</u> One (1) per offset biweekly per source or one (1) per 6,500 linear meters per source <u>Moisture Content:</u> One (1) per 1000 linear meters per lift per day	<u>Source Classification:</u> Two (2) three-quarter (3/4) full five (5) gallon bucket, void of oversized rocks <u>In-Place Testing:</u> Two (2) three-quarter (3/4) full five (5) gallon bucket, void of oversized rocks <u>Moisture Content:</u> Minimum sample 700g
F	FILTER	SAND AND GRAVEL	Sand and gravel sized material. (See Gradator Envelope below)	Strip all frost softened and weakened soils. Expose previously placed material.	Place, and spread in maximum 600mm loose lifts. Vibratory compaction minimum of 4 passes utilizing a 10 ton smooth drum compactor.	<u>During Production/Transportation:</u> Wash Sieve Gradation (C117-04 / C136-06) <u>During Placement:</u> Visual inspection of material size, compaction, preparation, and zone dimension. <u>Wash Sieve Gradation (C117-04 / C136-06)</u>	<u>During Production/Transportation:</u> Wash Sieve Gradation (C117-04 / C136-06) <u>In-Place Testing:</u> Wash Sieve Gradation (C117-04 / C136-06)	<u>During Production/Transportation:</u> One (1) per 5,000 m <sup>3</sup> per stockpile A duplicate sample for off-site testing one (1) per stockpile <u>In-Place Testing:</u> One (1) per placement event or one (1) per 2,500 linear meters A duplicate sample for off-site testing one (1) per 4,500 linear meters	<u>During Production/Transportation:</u> One (1) three-quarter (3/4) full five (5) gallon bucket, void of oversized rocks <u>In-Place Testing:</u> One (1) three-quarter (3/4) full five (5) gallon bucket, void of oversized rocks
T	TRANSITION	FINE ROCKFILL (NAG)	Cobble and gravel sized material. (See Gradator Envelope below)	Strip all frost softened and weakened soils. Expose previously placed material.	Place, and spread in maximum 600mm loose lifts. Vibratory compaction minimum of 4 passes utilizing a 10 ton smooth drum compactor.	<u>In-Place Testing:</u> Wash Sieve Gradation (C117-04 / C136-06) 1 per 5000 m <sup>3</sup> material placed Confirmation of waste rock inertness, as required. Visual inspection of material size, compaction, preparation, and zone dimension.	<u>In-Place Testing:</u> Wash Sieve Gradation (C117-04 / C136-06)	<u>In-Place Testing:</u> one (1) per 5,000 m <sup>3</sup> material placed. A duplicate sample for off-site testing one (1) per 10,000 m <sup>3</sup>	<u>In-Place Testing:</u> Three (3) three-quarter (3/4) full five (5) gallon bucket
C	ROCKFILL	GENERAL ROCKFILL (NAG)	Nominal 1m maximum particle size.	Strip all frost softened and weakened soils. Scarify previously placed material.	Placed and spread in maximum 2000mm loose lifts. Boulder-rich rockfill not to be placed adjacent to fine rock transition zone.	Confirmation of waste rock inertness, as required. Visual in-place inspection of material size, preparation, and placement.	Not Applicable	Not Applicable	Not Applicable
U	UPSTREAM FILL	SELECT FILL	Cell construction is to be utilized. Constant reworking of the tailings is needed to ensure proper distribution within the cell.	Not Applicable	Placement and compaction requirements to be determined based on material selection.	Not Applicable	Not Applicable	Not Applicable	Not Applicable

MATERIAL GRADATION LIMITS



NOTE:  
1. ASTM STANDARDS ARE ATTACHED IN APPENDIX C.

CLIENT LOGO:



CLIENT:

IMPERIAL METALS

AMEC Environment & Infrastructure

Suite 600 - 4445 Loughheed Highway  
Burnaby, BC V5C 0E4  
Tel. 604-294-3811 Fax 604-294-4664



DWN BY:

BB

CHK'D BY:

DO

DATUM:

N/A

PROJECTION:

N/A

SCALE:

NTS

PROJECT:

MOUNT POLLEY MINE  
TAILING STORAGE FACILITY

TITLE:

STAGE 8 FILL MATERIAL  
SPECIFICATIONS

DATE:

MARCH 2012

PROJECT NO:

VM00560

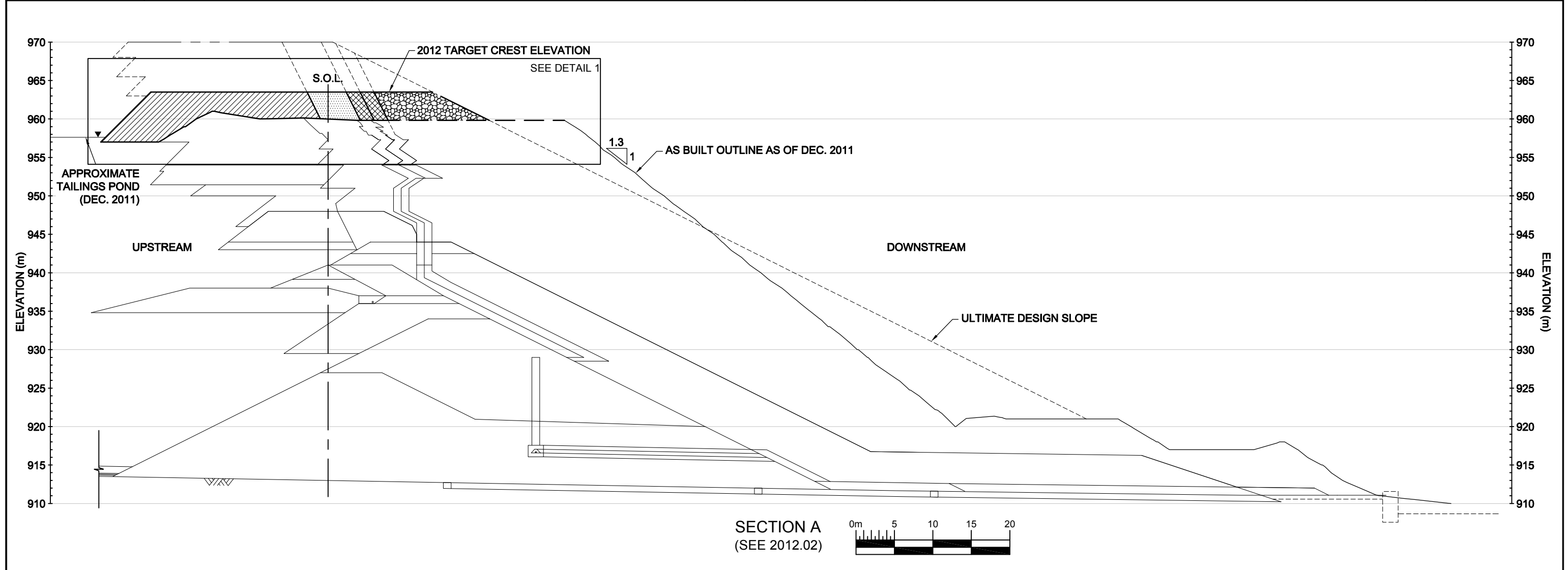
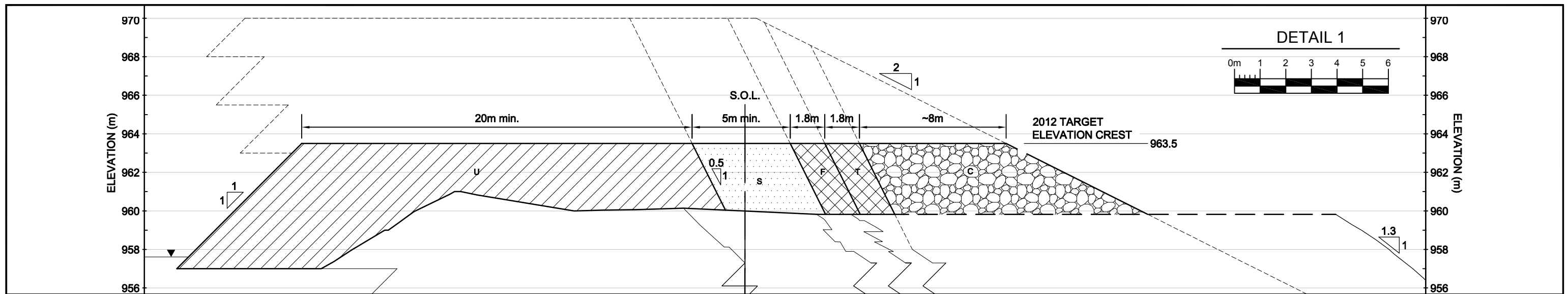
REV. NO:

A

FIGURE NO:

2012.03





**LEGEND:**

— Stage 8 Expansion	▨ Till Core
- - - Approximate	▨ Filter
- - - Planned Expansions	▨ Transition
▨ Upstream Fill	▨ Rock Fill

**NOTES:**

- PREVIOUS RAISES FROM 2011.04.
- FOR MATERIAL SPECIFICATIONS SEE 2012.03
- S.O.L. - SETTING OUT LINE



CLIENT:

**IMPERIAL METALS**

AMEC Environment & Infrastructure  
Suite 600 - 4445 Lougheed Highway  
Burnaby, BC V5C 0E4  
Tel. 604-294-3811 Fax 604-294-4664

DWN BY: BB

CHK'D BY: DO

DATUM: N/A

PROJECTION: N/A

SCALE: AS SHOWN

PROJECT:

**MOUNT POLLEY MINE  
TAILING STORAGE FACILITY**

TITLE:

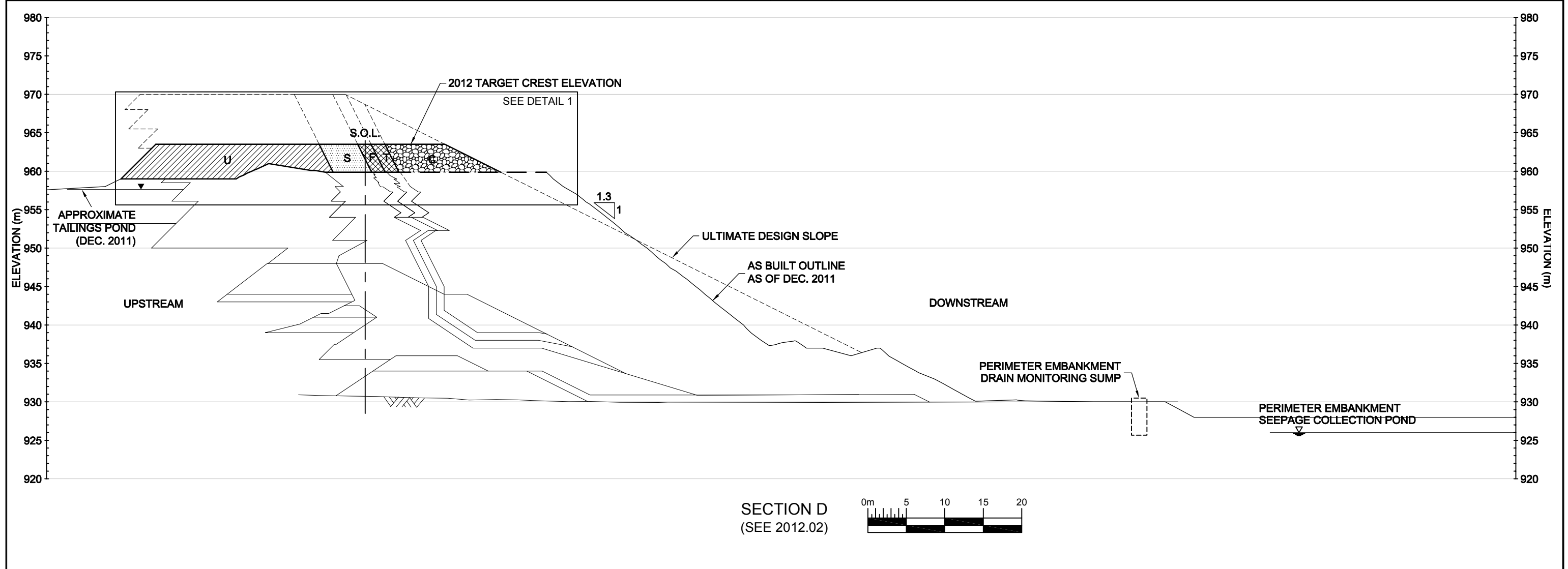
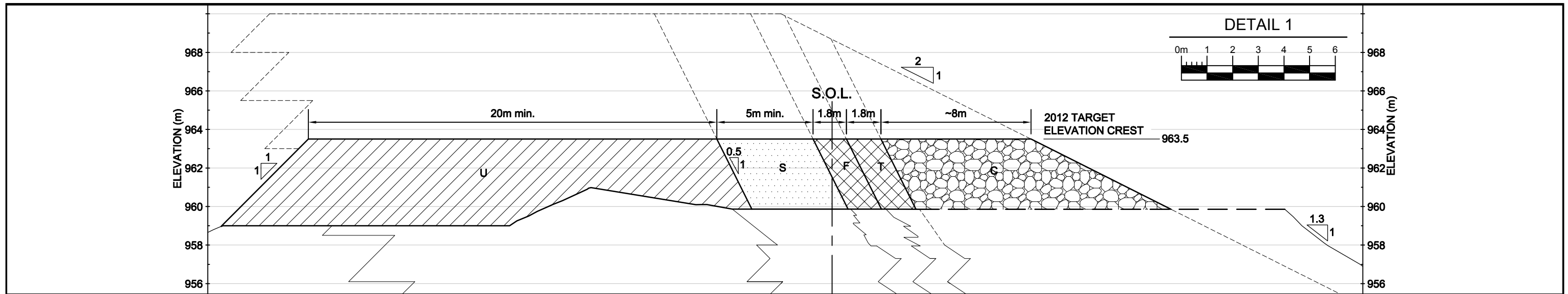
**STAGE 8 MAIN EMBANKMENT  
2012 PLANNED RAISE  
SECTION A (20+60)**

DATE: FEBRUARY 2012

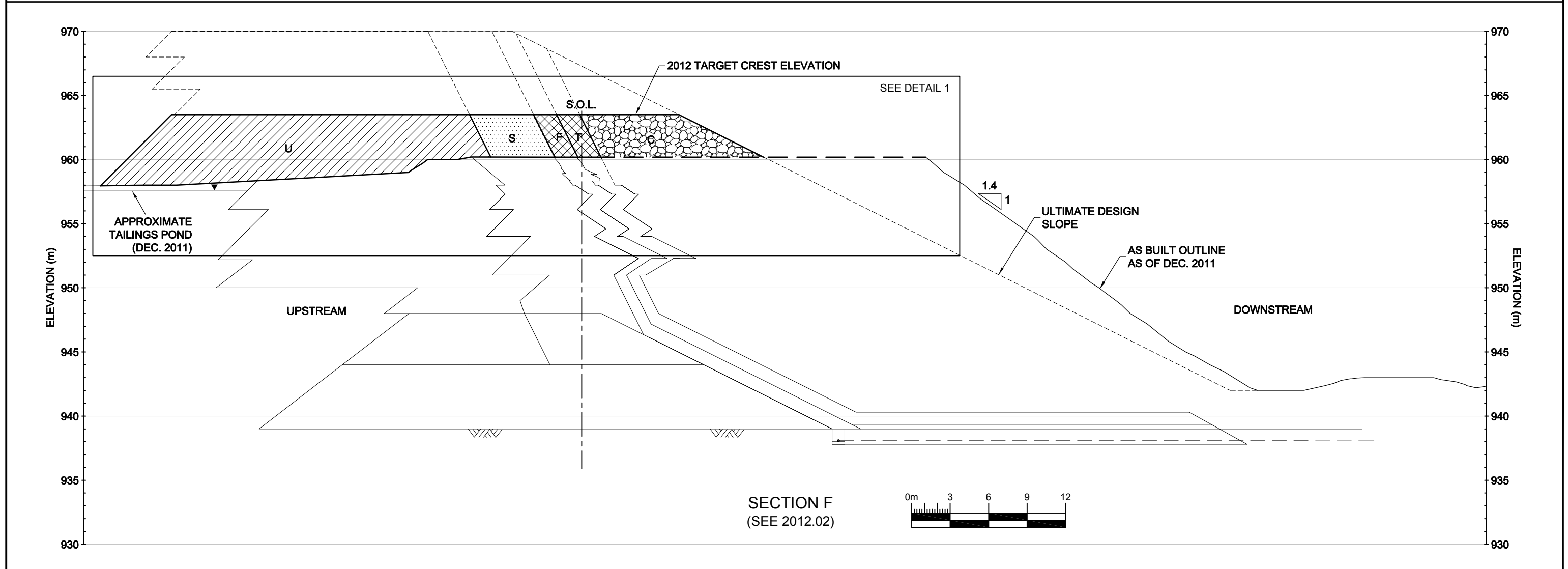
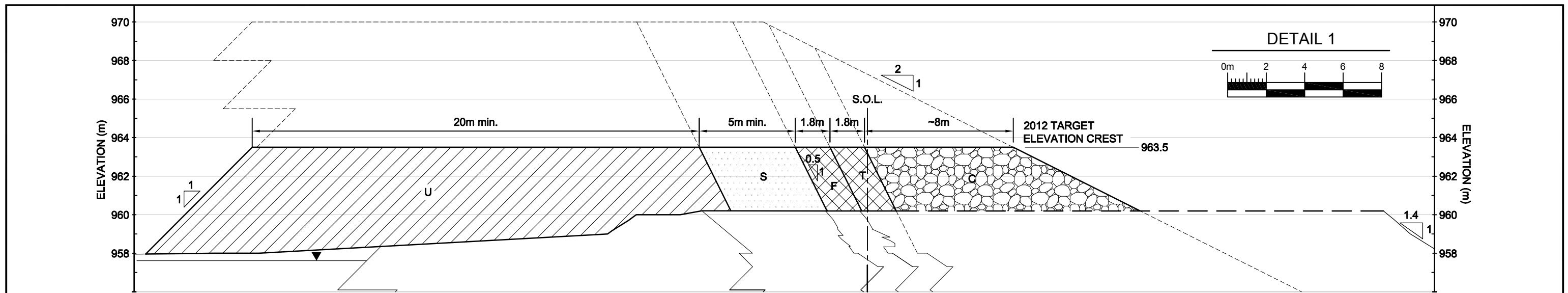
PROJECT NO: VM00560

REV. NO: A

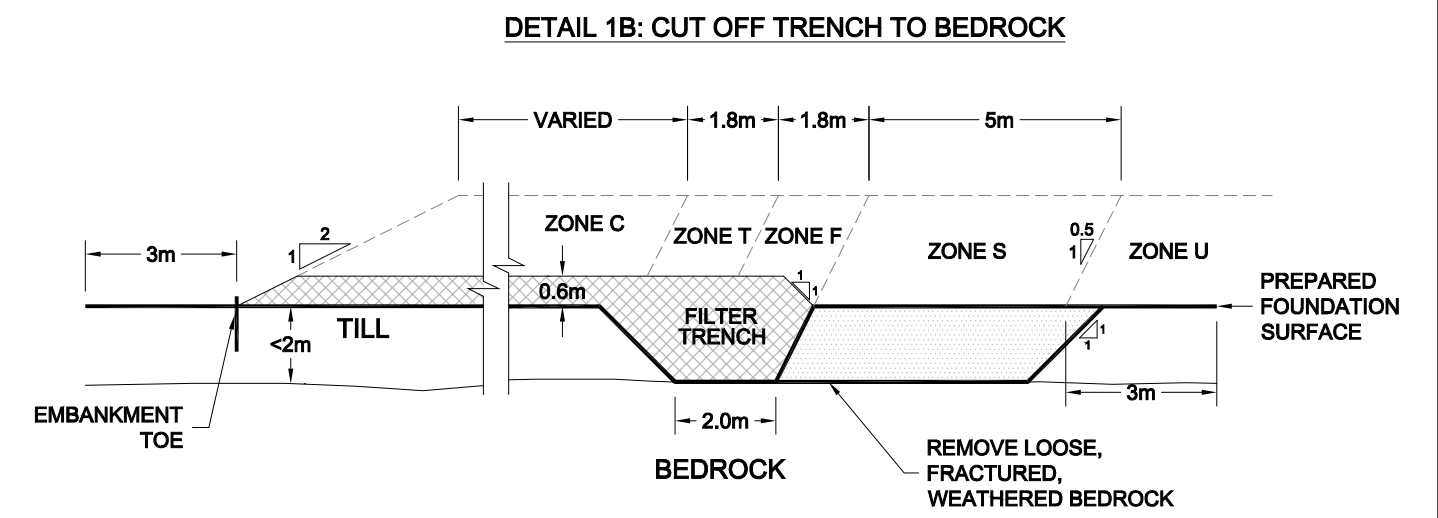
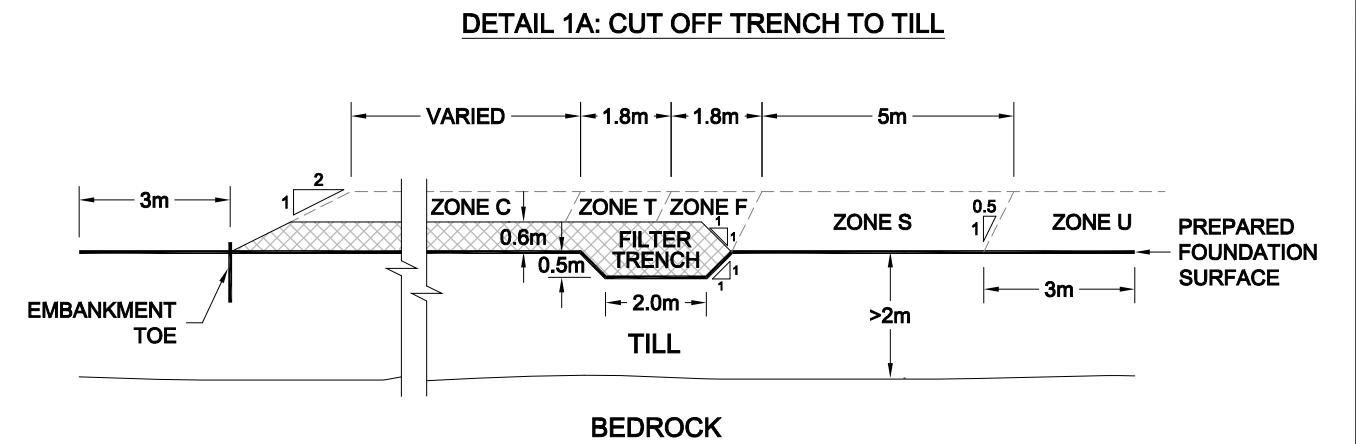
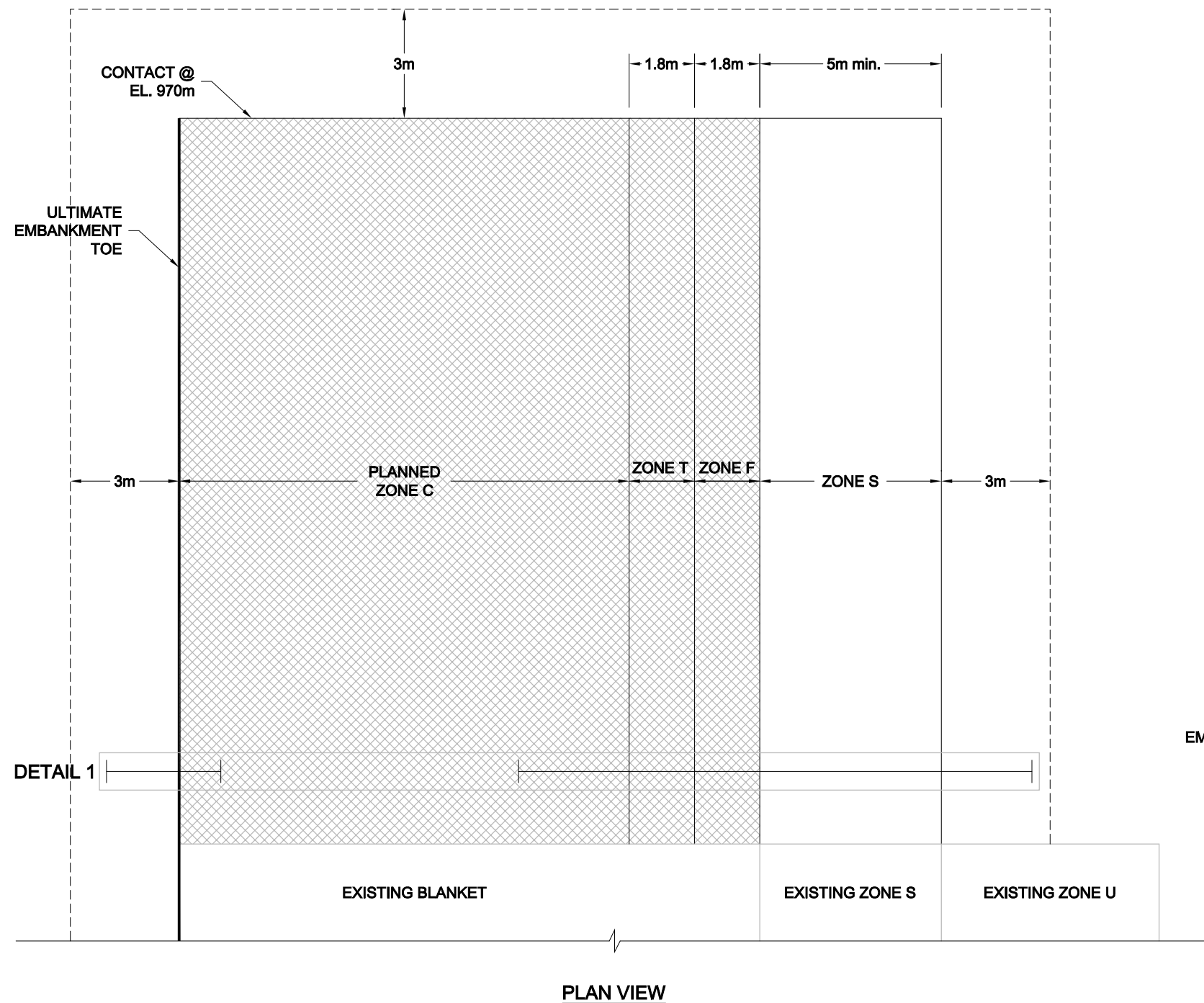
FIGURE NO: 2012.04



<b>LEGEND:</b> — Stage 8 Expansion - - - Approximate - - - - Planned Expansions Upstream Fill Till Core Filter Transition Rock Fill	<b>CLIENT LOGO:</b> 	<b>CLIENT:</b> <b>IMPERIAL METALS</b> AMEC Environment & Infrastructure Suite 600 - 4445 Lougheed Highway Burnaby, BC V5C 0E4 Tel. 604-294-3811 Fax 604-294-4664	<b>DWN BY:</b> BB <b>CHK'D BY:</b> DO <b>DATUM:</b> N/A <b>PROJECTION:</b> N/A <b>SCALE:</b> AS SHOWN	<b>PROJECT:</b> <b>MOUNT POLLEY MINE TAILING STORAGE FACILITY</b> <b>TITLE:</b> <b>STAGE 8 PERIMETER EMBANKMENT 2012 PLANNED RAISE SECTION D (39+90)</b>	<b>DATE:</b> FEBRUARY 2012 <b>PROJECT NO:</b> VM00560 <b>REV. NO:</b> A <b>FIGURE NO:</b> 2012.05
			<b>NOTES:</b> 1. PREVIOUS RAISES FROM KP DRAWING 225_R0.DWG 2. FOR MATERIAL SPECIFICATIONS SEE 2012.03 3. S.O.L. - SETTING OUT LINE		



<b>LEGEND:</b> - - - Stage 8 Expansion - - - Approximate - - - Planned Expansions Upstream Fill Till Core Filter Transition Rock Fill	<b>CLIENT LOGO:</b> 	<b>CLIENT:</b> <b>IMPERIAL METALS</b> AMEC Environment & Infrastructure Suite 600 - 4445 Lougheed Highway Burnaby, BC V5C 0E4 Tel. 604-294-3811 Fax 604-294-4664	<b>DWN BY:</b> BB <b>CHK'D BY:</b> DO <b>DATUM:</b> N/A <b>PROJECTION:</b> N/A <b>SCALE:</b> AS SHOWN	<b>PROJECT:</b> <b>MOUNT POLLEY MINE TAILING STORAGE FACILITY</b> <b>STAGE 8 SOUTH EMBANKMENT 2012 PLANNED RAISE SECTION F (7+20)</b>	<b>DATE:</b> FEBRUARY 2012 <b>PROJECT NO:</b> VM00560 <b>REV. NO:</b> A <b>FIGURE NO:</b> 2012.06
			<b>NOTE:</b> 1. PREVIOUS RAISES BASED FROM KP DRAWING 235_r0.dwg 2. FOR MATERIAL SPECIFICATIONS SEE 2012.03 3. S.O.L. - SETTING OUT LINE		



<b>LEGEND:</b> - - - Clearing Extents - - - Planned Raises Filter Till Core	<b>CLIENT LOGO:</b> 	<b>CLIENT:</b> <b>IMPERIAL METALS</b>	DWN BY: BB	<b>PROJECT:</b> <b>MOUNT POLLEY MINE TAILING STORAGE FACILITY</b>	DATE: FEBRUARY 2012
			CHK'D BY: DO		PROJECT NO: VM00560
		<b>AMEC Environment &amp; Infrastructure</b> Suite 600 - 4445 Lougheed Highway Burnaby, BC V5C 0E4 Tel. 604-294-3811 Fax 604-294-4664	DATUM: N/A	<b>TITLE:</b> <b>TYPICAL ABUTMENT DETAIL</b>	REV. NO: A
			PROJECTION: N/A		FIGURE NO: 2012.07
			SCALE: NTS		

**APPENDIX A**  
**Stability Analysis**

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## **APPENDIX A**

### **MOUNT POLLEY MINES**

#### **Tailing Storage Facility 2012 Stage 8 Expansion - Stability Analyses**

Submitted to:

**Mt. Polley Mining Corporation**  
Vancouver, British Columbia

Submitted by:

**AMEC Environment & Infrastructure,  
a Division of AMEC Americas Limited**  
Prince George & Burnaby, British Columbia

February 14, 2012

AMEC File: VM00560A.A



## TABLE OF CONTENTS

	<b>Page</b>
1.0 ANALYSIS PARAMETERS AND METHODOLOGY .....	1
1.1 General.....	1
1.2 Material Parameters .....	1
1.3 Pore Pressure Assumptions.....	3
1.4 Minimum Factor of Safety Criteria.....	3
2.0 STABILITY ANALYSES RESULTS.....	4
2.1 Pore Pressure Trigger Levels.....	5
REFERENCES .....	12

## LIST OF FIGURES

Figure 1.1:	Shear Strength Relationship Used for Rockfill .....	2
Figure 2.1:	Main Embankment Stability Analysis.....	7
Figure 2.2:	Perimeter Embankment Stability Analysis.....	8
Figure 2.3:	South Embankment Stability Analysis .....	9
Figure 2.4:	Glaciolacustrine Sensitivity Analysis (Main Embankment) .....	10
Figure 2.5:	Pore Pressure Trigger Levels Stability Analysis.....	11

## LIST OF TABLES

Table 1.1:	Material Strength Parameters.....	3
Table 2.1:	Factor of Safety Summary.....	4
Table 2.2:	Foundation Piezometer Trigger Levels.....	6



## 1.0 ANALYSIS PARAMETERS AND METHODOLOGY

### 1.1 General

Two-dimensional limit equilibrium stability analyses were carried out using the computer code SLOPE/W (GeoStudio, 2007). The analyses utilized the Morgenstern-Price method of slices solution. There are seven main materials incorporated into the analyzed sections, Zone S (compacted till fill), Zone C (rockfill), tailings, foundation tills (ablation, basal), glaciolacustrine and glaciofluvial sediments, and bedrock. The material properties used for the analyses are based on previously established parameters assumed by KP (2007) with minor modifications deemed appropriate by AMEC. The parameters used in the stability analyses presented herein are summarized in Table 1.1.

The stability of the three dam sections is dependent on the strength of the downstream rockfill shell and foundation materials. The compacted till core is supported by the downstream rockfill shell and does not significantly contribute to the stability of the embankment from a slope stability perspective.

### 1.2 Material Parameters

In the fall of 2011, AMEC conducted a field investigation, involving sonic drilling, to replace broken instrumentation and to gather additional information around the base of the embankment, with specific focus on the extent and geotechnical characteristics of glaciolacustrine and glaciofluvial sediments within the glacial till units that predominate within the dam foundations. The following is the summary of the findings as presented in the AMEC Site Investigation Report:

#### Main Embankment

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

#### Perimeter Embankment

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.

#### South Embankment

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

The glaciolacustrine/glaciofluvial unit generally was found to be varved with predominantly silt and clayey silt of low plasticity, interbedded with more granular glaciofluvial deposits. There is



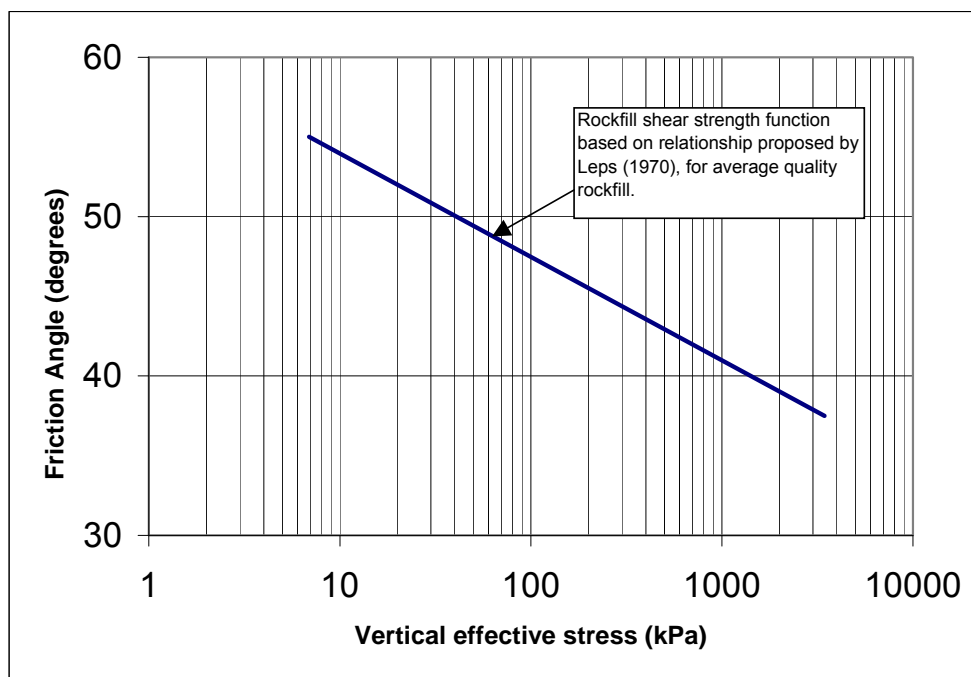
no indication of pre-shearing within the glaciolacustrine (each unit was checked by peeling the cores apart for close visual examination, specifically looking for slickensided surfaces). Therefore a shear strength of  $c' = 0$ , and  $\phi' = 28^\circ$  is judged reasonable for the glaciolacustrine unit, although sensitivity analyses were carried out within the range given in Table 1.1.

The till unit was generally observed as silty sand and gravel with occasional interbedded sand seams at depth.

The rockfill shear strength is taken as stress-level dependent as per Leps (1970), as illustrated in Figure 1.1. It is anticipated that the rockfill used for construction of the 2012 expansion will be comparable to that used for the past dam raises. As such, the trend for average rockfill was used because the rockfill is anticipated to be:

- strong and durable with high compressive strength;
- well-graded, and comprised of highly angular rock; and
- will receive moderate compactive effort.

**Figure 1.1: Shear Strength Relationship Used for Rockfill**



During the 2011 construction season, AMEC observed that on average the bulk unit weight of the till on average is  $20.5 \text{ kN/m}^3$ , so this is now adopted for the purposes of stability analyses. The material strength parameters used in the stability analyses are as summarized in Table 1.1

**Table 1.1: Material Strength Parameters**

Material	$\gamma_b$ (Bulk Unit Weight) (kN/m <sup>3</sup> )	$\phi'$ (Friction Angle) (degrees)	c' (Cohesion) (kPa)
Rockfill (Zone C)	22	Defined by Lep's (1970) shear normal function for average quality rockfill (Note 1)	0
Compacted Till Fill (Zone S)	20.5	35	0
Glaciolacustrine/Glaciofluvial	20	28 Sensitivity analysis (24 through 33)	0
Basal Till	21	33	0
Tailings	18	30 (drained) $S_u/\sigma_v' = 0.1$ (undrained)	0

Note 1: The shear normal function used for the rockfill accounts for the stress-level dependency of the normalized shear strength as expressed by the effective friction angle ( $\phi'$ ) – see Figure 1.1.

### 1.3 Pore Pressure Assumptions

Where possible, the current phreatic surfaces were derived from vibrating wire piezometer readings installed in the embankments or into the embankment foundation. Where no piezometric pressure data was available, the phreatic surface was estimated based on trends on monitored sections, interpolation of piezometer data, observed piezometric trends over the years at this facility, and experience from other tailings dams of similar design with similar foundation conditions.

The phreatic surface for the 2012 expansion was estimated by increasing current phreatic surface on the upstream side of the core by 3.4 m, equivalent to the Stage 8 raise, while maintaining the phreatic surface downstream of the core indicated by interpolation of piezometric data.

The rockfill was assigned zero pore pressure except where located below the phreatic surface, below which pore pressures at any given point were taken as hydrostatic.

The phreatic surface modeled in the analyses reflects the pore pressures observed in the glaciolacustrine/glaciofluvial unit.

### 1.4 Minimum Factor of Safety Criteria

The minimum factor of safety (FoS) criteria for design is 1.3 for short-term (during construction) and 1.5 for long-term (closure) steady state conditions.

## 2.0 STABILITY ANALYSES RESULTS

The stability analyses of the TSF 2012 expansion were carried out for three cross sections of the embankment (Perimeter, Main, and South). These sections are near the previously analyzed sections. Slight modifications to the analyzed cross sections were made to eliminate confusion between the planes and sections references in previous reports. The stability results are presented in Figure 2.1 through Figure 2.3 and are summarized below in Table 2.1.

To analyze stability of the embankment two cases were considered for each cross section. Case one considers drained shear strength within the tailings, while the second case considers the undrained tailings shear strength scenario.

**Table 2.1: Factor of Safety Summary**

Section Embankment	Current Conditions	2012 Stage 8 Expansion	Approximate FoS Reduction
Tailings shear strength: drained ( $c' = 0$ , $\phi' = 30^\circ$ )			
Main (Ch. 20+60)	1.37	1.32	3.6%
Perimeter (Ch. 39+90)	2.01	1.89	6.0%
South (Ch. 7+20)	2.25	2.07	8.0%
Tailings shear strength: post-liquefaction, undrained ( $S_u/\sigma_v' = 0.1$ )			
Main (Ch. 20+60)	1.33	1.27	4.5%
Perimeter (Ch. 39+90)	1.98	1.82	8.1%
South (Ch. 7+20)	2.23	2.03	9.0%

Sensitivity analyses were undertaken for the main embankment (the one with the lowest FoS) considering a range of shear strengths within the glaciolacustrine/glaciofluvial unit, for peak (drained) and post-liquefaction residual (undrained) shear strength conditions within the tailings. The results of these analyses are summarized on Figure 2.4. For the 2012 raise configuration, an acceptable factor of safety ( $\geq 1.3$ ) is obtained for a glaciolacustrine/glaciofluvial unit  $\phi'$  value of  $27^\circ$ .

To analyze the 2012 expansion impact on the overall stability of the embankment, analyses comparing the 2011 as-built condition and 2012 expansion were performed. Similar to the 2011 expansion the stability analyses identified that the main embankment was the critical section for the 2012 expansion (i.e. the section yielding the lowest FoS). A FoS reduction of about 3.6% was observed in the main embankment for the case of peak (drained) strength within the tailings, while a 4.5% reduction was observed for the post-liquefaction residual (undrained) strength within the tailings. Similarly, due to the negligible reduction in FoS under static loading conditions, it is reasonable to infer that the seismic stability situation would remain essentially unchanged relative to KP's 2007 analyses, which predicted earthquake-induced deformations,

under the design earthquake loading, to be well within tolerable limits. Thus, the stability requirement is satisfied for the 2012 expansion.

A stability analyses for the ultimate embankment configuration will be undertaken in 2012. This analysis will review the embankment to an elevation of 970 m or as specified. In addition, during the ultimate design stability analysis the timing of fluttering/extending of the overall downstream slope will be assessed to maintain a FoS during construction above 1.3 and ultimately achieve the minimum closure requirement of 1.5 once the embankment is completed to its final configuration.

## **2.1 Pore Pressure Trigger Levels**

Pore pressure trigger levels are a useful means of relating monitored piezometer data to the stability analyses and the achieved factors of safety. In this way, piezometric alert levels can be quantified, with pre-set actions to be taken if defined trigger levels are approached or exceeded.

To determine the pore pressure trigger levels in the foundation piezometers additional stability analyses were performed. As the main embankment cross sections was determined to be the critical section, as stated above; thus, this cross section and the pore pressures associated with this section were utilized to assess and assign trigger levels. A red, yellow, green stoplight approach was utilized and the conditions are depicted as follows:

**Red (factor of safety at or below 1.1)** – If the foundation piezometers indicate a red condition, crest raising is to cease. AMEC's Senior Technical Engineer is to be informed immediately, and a corrective course of action will be implemented as per direction of the AMEC's Senior Technical Engineer, including intensified monitoring, and placement of a stabilization buttress to flatten the overall slope in the embankment area of concern.

**Yellow (factor of safety above 1.1 and below 1.3)** – If the foundation piezometers indicate a yellow condition, work should be temporarily suspended in around the embankment, AMEC's Senior Technical Engineer is to be informed, and a corrective action will be implemented as per direction of the AMEC's Senior Technical Engineer. Access to the embankment should be limited to essential personnel.

**Green (factor of safety above 1.3)** – If the foundation piezometers indicate a green condition, work in and around the embankment is to continue as needed.

It should be noted that a yellow or red condition is not triggered by a single piezometer on a given instrumentation section yielding a reading of concern. Such conditions will only be triggered if most or all foundation piezometers reach the requisite trigger levels. If individual piezometers on a section approach or reach threshold levels while the remainder do not, additional and/or intensified monitoring may be specified, but the threshold levels described above will not be deemed as having been triggered.



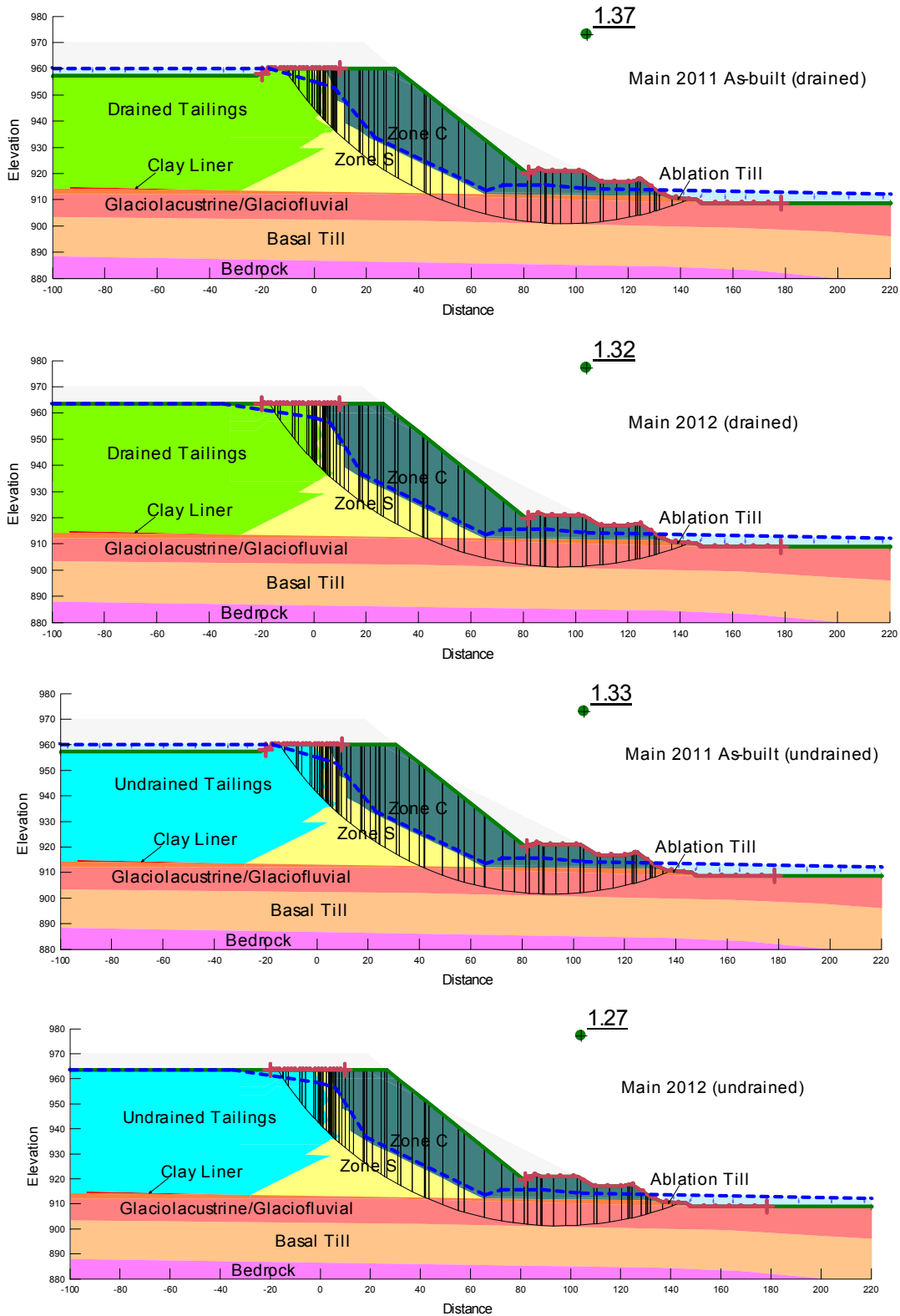
Besides the specified trigger levels, piezometric trends are to be closely monitored in the foundation piezometers. Small variations in the piezometric readings are expected, however if a spike occurs in any of the foundation piezometers, and/or an unexpected a consistent trend of increasing pore pressure is noted, AMEC's Support Engineer is to be informed immediately to assess the situation.

The results of the pore pressure trigger level stability analyses are presented in Figure 2.5 and are summarized in the Table 2.2 below, which applies only for the main embankment piezometers. Factor of safety values for the perimeter and south embankments are sufficiently high that monitoring of piezometric trends, without defined trigger levels, is deemed sufficient.

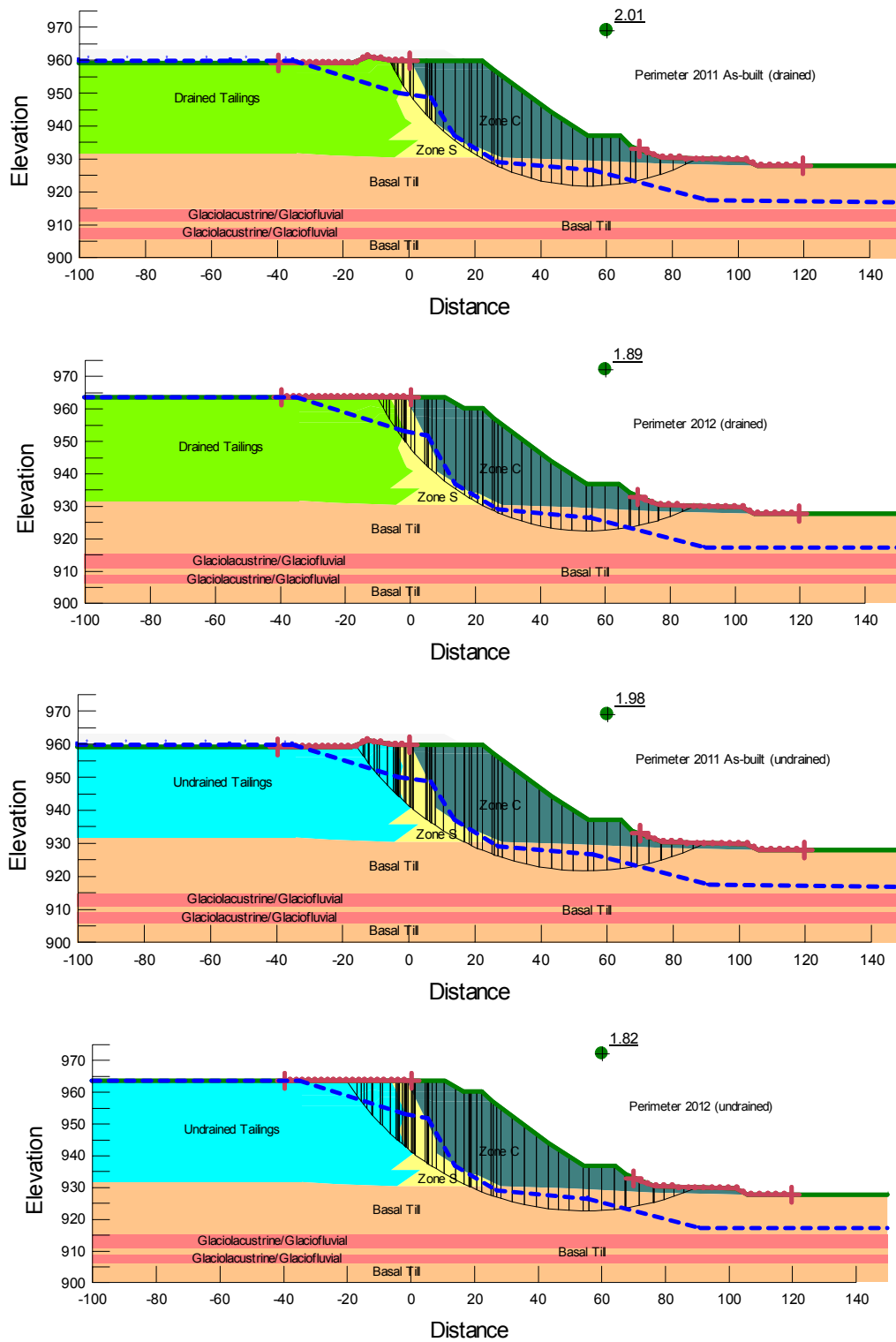
**Table 2.2: Foundation Piezometer Trigger Levels**

Condition	Modeled Elevation (m)	Above Original Ground Elevation (912m) (m)
RED	Above 925	>13
YELLOW	Between 921 and 925	9 to 13
GREEN	Less than 921	<9

**Figure 2.1: Main Embankment Stability Analysis**

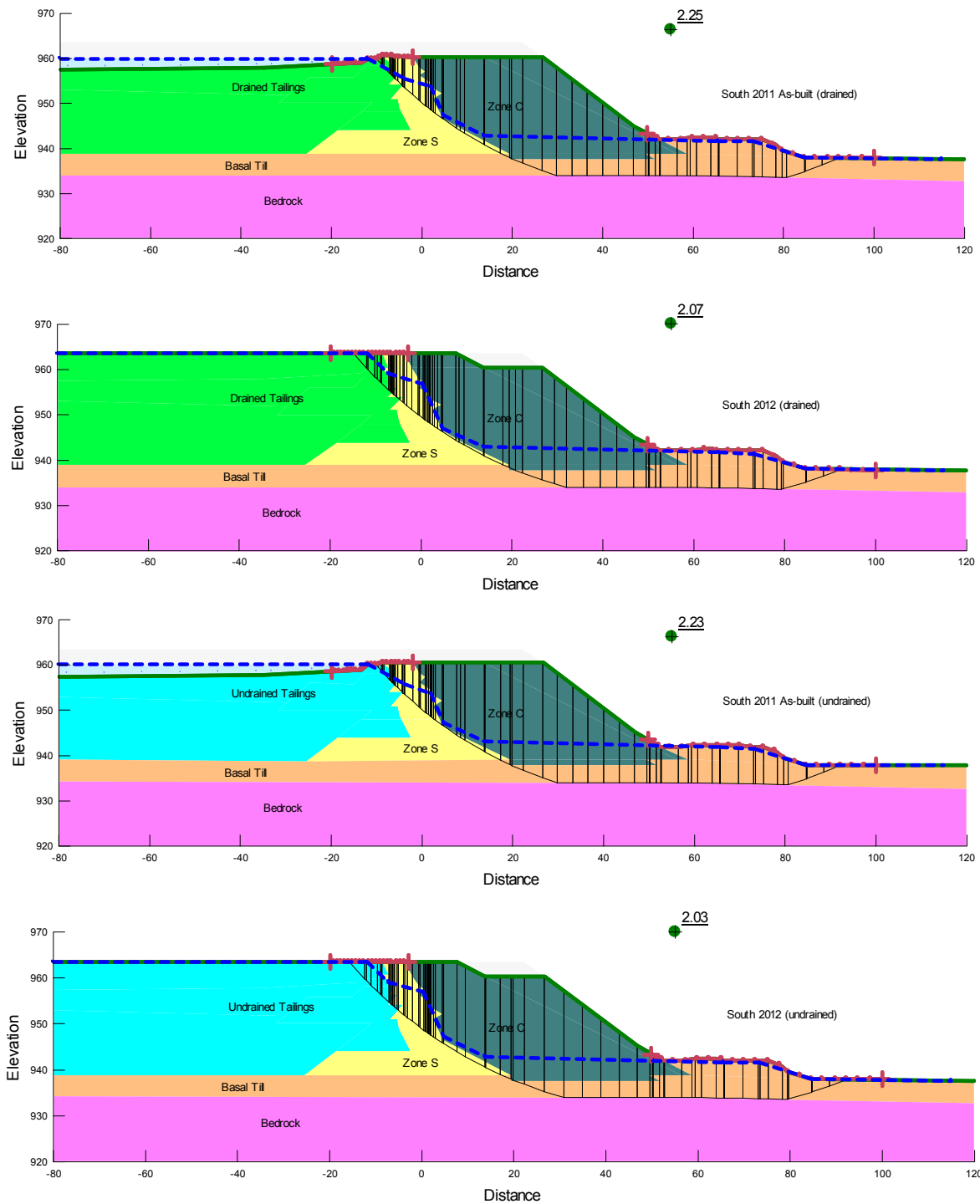


**Figure 2.2: Perimeter Embankment Stability Analysis**

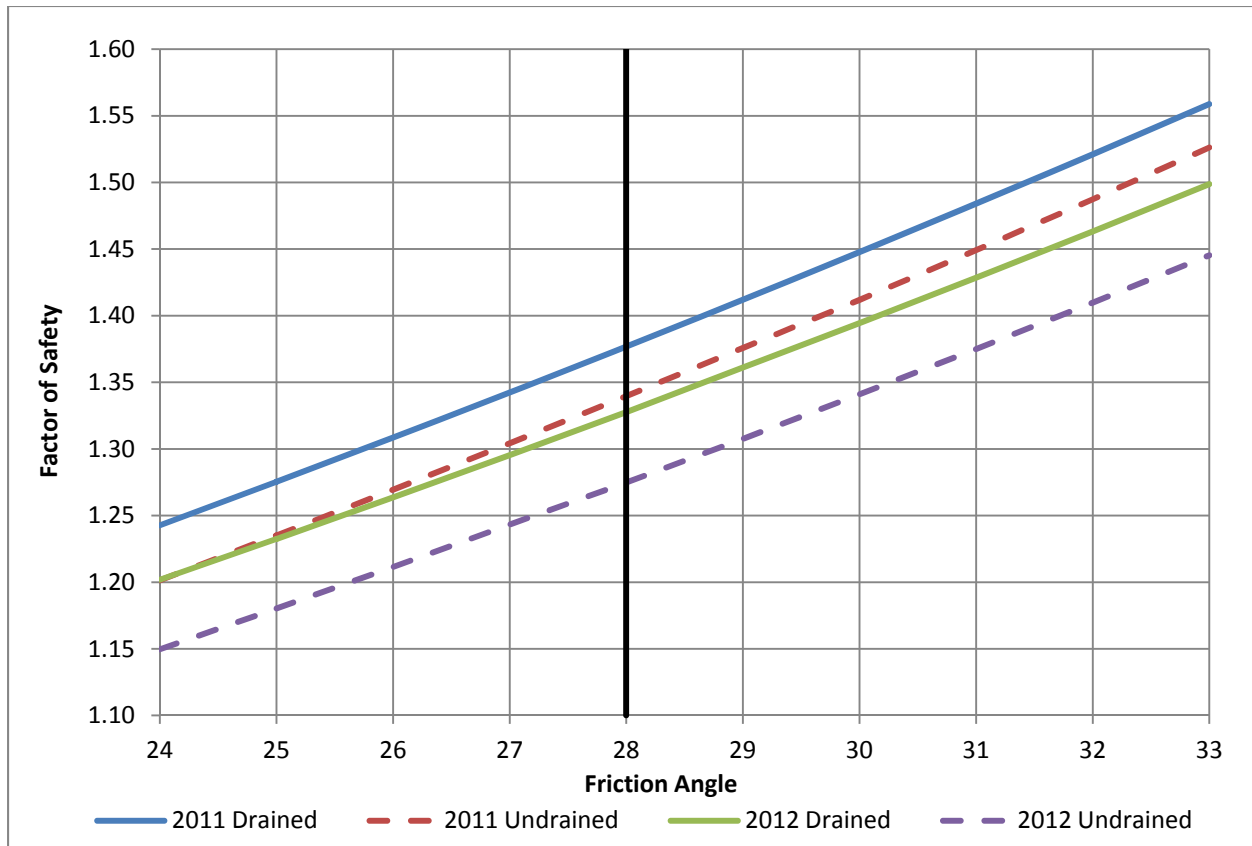




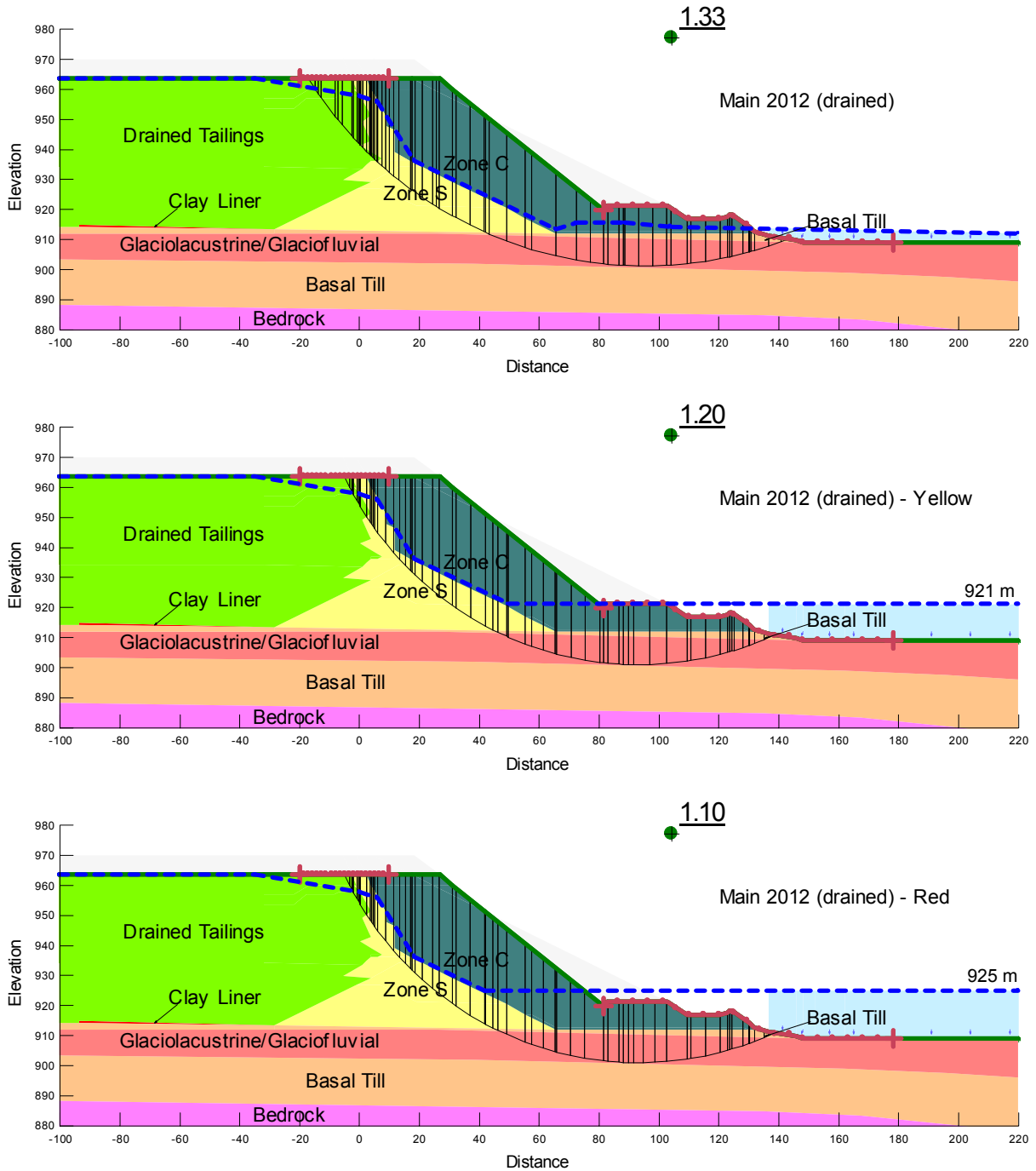
**Figure 2.3: South Embankment Stability Analysis**



**Figure 2.4: Glaciolacustrine Sensitivity Analysis (Main Embankment)**



**Figure 2.5: Pore Pressure Trigger Levels Stability Analysis**



## REFERENCES

- AMEC (2011). "Construction Manual 2011", 20 April.*
- CDA (Canadian Dam Association), 2007. Dam Safety Guidelines.*
- GeoStudio, 2007 (Version 7.17, Build 4921). Geo-Slope International, Ltd. Calgary, Alberta, Canada.*
- Knight Piésold Limited, 2011. Tailing Storage Facility Report of Stage 6B Construction. January 25, 2011.*
- Knight Piésold Limited, 2007. Stage 6 Design of the Tailings Storage Facility. June 18, 2007.*
- Knight Piésold Limited, 2005. Design of the Tailings Storage Facility to Ultimate Elevation. March 14, 2005.*
- Leps, T.M., 1970. Review of Shearing Strength of Rockfill. ASCE Journal of the Soil Mech. and Found. Eng. Div., SM4. July 1970. pp. 1159-1170.*

**APPENDIX B**

**Sample Daily Construction Report**



HOURS WORKED: 8am to 4:30pm (8.5 hours)

WEATHER: 25° C Sunny, Clear

**DESCRIPTION OF WORK PERFORMED TODAY**

**Construction Activities**

Zone S - South:

- Material **placed** between **Stn. 6+50 to 15+80** using 4 scrapers and 1 grader to compacted elevation of **958.4m (lift 2)**.
- Material **compacted** between **Stn. 6+50 to 15+80** using vibratory smooth drum *10 ton* (to be confirmed) compactor.
- Material **tested** and **approved** between **Stn. 9+00 to 15+80** using nuclear densometer at an elevation of **958.4m**.
- Prior to material placement the grade was scarified (June 21) and sprayed with water.
- Downstream toe slope stakes were established between Stn. 10+00 to 15+70 to elevation of 958.65m (lift 3).

**Compaction Testing**

2 side by side MDI tests completed, 5 Nuclear Densometer (ND11to ND15) tests completed (see Stage 8 Compaction.xlsx)

**Material Testing**

None

**Instrumentation Monitoring**

None

**REMARKS** (Delays, interruptions, extra work activities, unusual occurrences, etc. relevant to today's work)

- Peterson Contracting's water truck did not show up until 12pm causing delays
- 1 scraper broke down at about 2 pm
- Dmitri Ostritchenko (AMEC) on-site
- M+DI software difficulties, only Nuclear Densometer testing was completed

**CRITICAL INFORMATION**

None

**Field Inspector Arthur Collier**

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Signature

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Date

**AMEC Rep. Dmitri Ostritchenko**

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Signature

\_\_\_\_\_

Date

**MPMC Rep. Luke Moger**

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Signature

\_\_\_\_\_

Date





**DAILY REPORT NO.: TSF12-06-22**

**AMEC PROJECT NO.: VM00560**

**DAILY PHOTOGRAPHS**