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## BGC Project Memorandum

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<b>To:</b>	Mount Polley Mining Corporation	<b>Doc. No.:</b>	1197007.14.001
<b>Attention:</b>	MPMC – Mr. Luke Moger	<b>cc:</b>	D. Dufault, T. Harper – BGC
<b>From:</b>	Todd Martin, Stephanie Hunter	<b>Date:</b>	June 9, 2014
<b>Subject:</b>	Mount Polley Tailings Storage Facility Updated Storage Design Criteria and Stage 10 Crest Elevation		
<b>Project No.:</b>	1197001.04		

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### 1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) owns and operates the Mount Polley open pit copper mine near Likely, B.C. The Mount Polley Mine tailings storage facility (TSF) embankment is currently permitted, under B.C. Ministry of Energy and Mines (MEM) Permit No. M-200, to be raised to a crest elevation of El. 970 m. The raise to that elevation, from about El. 967 m, is currently underway, and is anticipated to be completed approximately mid-summer 2014. BGC Engineering Inc. (BGC) has been retained to provide design for ongoing crest raising above El. 970 m to meet continuing tailings storage capacity requirements. The first such raise will be undertaken in the second half of the 2014 construction season, immediately upon completion of the El. 970 m crest raise. The extent of the additional raising required in 2014 is driven by ongoing tailings production rates, water storage requirements, and flood storage and freeboard criteria. This memorandum presents storage capacity scenarios, reviews flood storage and freeboard criteria, and provides a recommended target crest elevation for the second half of the 2014 construction season.

Given the current TSF condition and the trend of accumulating surplus water stored within the TSF, it is recommended that a more conservative set of TSF water management design criteria be applied than has been prior practice in setting annual stage raise target crest elevations. The updated storage design criteria and dam crest target elevation are presented herein.

## 2.0 BACKGROUND INFORMATION

The Mount Polley Mine has been operating since 1996, with operations suspended from 2001 to 2005 owing to low copper prices. The mine has typically operated with a pond volume sufficiently small as to allow development and maintenance of above-water tailings beaches along significant portions of the dam perimeter. However, expansion of the mine footprint has increased the amount of mine-impacted water which must be stored in the TSF. In recent years the TSF has been operating with a significant annual water balance surplus, with the result that the volume of water stored within the TSF has increased on a year over year basis. MPMC has a permit to discharge up to 1.4 Mm<sup>3</sup> of water per year to Hazeltine Creek, but has generally been unable to discharge more than about 10% of this amount owing to water quality issues. As of the end of May 2014, following what is understood to have been an abnormally high snowpack runoff and a significant multi-day rainfall event, the pond volume was estimated to be between 8 and 9 Mm<sup>3</sup>. This is significantly more water than is required to maintain a viable process water reclaim pond – in 2010, for example, the estimated volume of water in the TSF was only about 900,000 m<sup>3</sup>.

The ongoing accumulation of a water surplus within the TSF causes the following problems:

- For a given dam crest elevation, tailings storage capacity is displaced by water storage.
- Wide, above-water tailings beaches that separate the dam from the reclaim water pond, a fundamental component of the dam design, can neither be established nor maintained.
- The conceptual closure configuration for the TSF incorporates reclaimed (covered and vegetated), wide above-water beaches against the dam from abutment to abutment, and a minimal water pond with an overflow spillway for pond level control. TSF pond volume that increases year over year is incompatible with operating to achieve the closure configuration.
- The dam crest raising schedule has to be accelerated.

The volume of water stored in the TSF is controlled by hydrologic conditions beyond MPMC's control, and the ability of MPMC to store water in open pits, a previous practice at odds with current mine plans and pit development scheduling. This increases the potential for flood storage and freeboard requirements to be infringed upon as a result of larger than anticipated water accumulation within the TSF. To resolve this and the issues noted above, MPMC is advancing the permitting and design for the construction of a reverse osmosis water treatment plant (WTP), capable of treating and discharging up to 3 Mm<sup>3</sup> per year to Polley Lake, on a year-round basis. MPMC anticipates commissioning of the WTP, and initiation of discharge to Polley Lake, in October 2014.

MPMC has developed a site-wide water balance model that can be used to predict the site wide surplus or deficit for average, wet, and dry year scenarios. The model accounts for the expanded mine footprint of recent years and for the flows captured by recently constructed

runoff and seepage collection ditches. The model also allows MPMC to project TSF pond volume changes for various water treatment and discharge scenarios. MPMC has used that model to project various water management scenarios for the coming year, prior to the 2015 dam crest raise, in order to determine the appropriate target crest elevation for the TSF dams for the 2014 construction season, as presented in Section 3.2. The target crest elevation is also driven by the Inflow Design Flood (IDF) and freeboard criteria, which are reviewed in Section 3.1.

### **3.0 STORAGE DESIGN CRITERIA & TARGET CREST ELEVATION**

#### **3.1. Tailings and Flood Storage**

##### **3.1.1. Timing Basis for Target Crest Elevations for Annual Stage Raising**

Previous dam crest raise elevations have generally been designed to accommodate tailings and water storage through April of the following year, based on the assumption of minimal pond rise through the remaining fall and spring months, and the ability to raise the dam crest, prior to IDF and freeboard criteria being compromised. However, construction of the till core is seasonally dependent and only feasible typically from May to October, resulting in a threat if wet spring conditions are encountered.

More common practice for annual stage raising of tailings dams is to construct to crest elevations that are projected to provide sufficient tailings storage, operating pond water storage, and flood storage and freeboard requirements, to the end of the construction season for the year following. This more conservative approach is particularly prudent for TSFs operated as zero-discharge facilities, or where discharge capacity is limited relative to potential inflows in wetter than average years. Should the target crest elevation not be reached at the end of a construction season, this allows for the dam to be raised to the target elevation during the following construction season and minimizes the risk of running afoul of flood and freeboard compliance which could, in the extreme, necessitate a shut-down of the mine. Violation of compliance with these dam safety criteria would result in zero tailings storage capacity and could require shutting down operations until crest raising restores compliance. The proposed Stage 10 crest elevation, representing the final target crest elevation for the 2014 construction season, is therefore based on the expected tailings production and operating pond volume as of the end of September, 2015.

##### **3.1.2. IDF and Freeboard Criteria**

Apart from storage capacity for tailings and the volume of water impounded within the TSF, there must also be sufficient capacity to accommodate the IDF, with freeboard above the pond level that would result from the IDF to account for wave run-up and wind set up. Minimum IDF requirements are stipulated in the Canadian Dam Association (CDA) 2007 guidelines. The minimum IDF that should be adopted as the design basis is based upon the consequence classification provided within the guidelines.

The IDF adopted since the original design of the Mount Polley TSF has been the Probable Maximum Flood (PMF). The duration and magnitude (storm depth and inflow volume) of the PMF, and the freeboard allowance, have been modified at various stages over the life of the TSF. Those changes, and the currently recommended criteria for establishing the 2014 target crest elevation, are outlined in Table 3-1.

**Table 3-1. IDF and Freeboard Criteria**

Reference	PMF Duration (days)	PMF Storm Depth (mm)	PMF Inflow Volume to TSF (Mm <sup>3</sup> )	Freeboard Above PMF Pond Level (m)
Knight Piesold (1995)	1	203	0.68	1
Knight Piesold (2007)	3	319	1.07	0.7
Recommended herein	10	406	1.36	1

The original flood freeboard requirements considered a 24-hr PMP event, subsequently updated in 2007 to a 72-hour PMP event. As the TSF is operated without an emergency overflow spillway, less intense but longer duration PMF events are judged appropriate as the IDF to protect the dam from overtopping. The appropriate duration should match with realistic site contingency plans so that, once a certain triggering pond level is reached, water is discharged, via the reclaim system or other means, from the impoundment. The rate of discharge must be sufficient to at least keep pace with ongoing inflows from longer duration PMF events, so that overtopping is prevented and freeboard is maintained.

For the time being, a 10-day duration PMF is judged suitable as the basis for establishing the target 2014 crest raise elevation. The 1 m of freeboard to account for wave run-up and wind set-up is judged conservative, which is appropriate until the PMF and freeboard criteria can be fully reviewed and updated as part of the next phase of design.

### 3.2. Operating Pond Scenarios

The pond elevation was El. 966.4 m as of June 3, 2014. Three scenarios were considered with this baseline in developing the storage design criteria for the TMF:

1. Run-off from average hydrologic conditions with no water treatment and discharge (required 2014 crest El. 972.5 m);
2. Run-off from the 1 in 200-year wet hydrologic conditions with water treatment and discharge beginning in January 2015 (required 2014 crest El. 972.5 m), three months later than currently anticipated by MPMC; and
3. Run-off from the 1 in 200-year wet hydrologic conditions with water treatment and discharge beginning in July 2015 (required 2014 crest El. 973.5 m), nine months later than currently anticipated.

Scenario 1 represents the most probable hydrologic conditions (an average year) but the most conservative assumption in terms of water treatment and discharge (none). Scenarios 2 and 3 represent conservative hydrologic conditions combined with varying WTP and discharge start dates, both of which are later than the currently anticipated start date in October 2014.

It is recommended that the 2014 target crest elevation be set at 972.5 m. Scenario 3, combining a wet year with a substantial delay in WTP commissioning and water discharge, is judged overly conservative. It is noted that, should Scenario 3 occur, the dam at crest El. 972.5 m would be out of compliance in May 2015. This could be tolerated on a short term basis as dam raising could begin shortly thereafter. Moreover, monitoring of snowpack conditions could give some prior warning of an unusually large spring 2015 snowmelt runoff, and contingencies provided to divert runoff into open pits to avoid or at least reduce compliance issues within the TSF.

#### **4.0 DELIVERABLES**

The Mount Polley Mine TSF is expected to be constructed to its currently permitted crest El. 970 m by mid-summer 2014. Based on the updated storage design criteria presented herein, construction of the dam to crest El. 972.5 m will need to be completed by the end of the 2014 construction season (typically October). BGC is currently evaluating stability of the Perimeter, Main and South embankments for the Stage 10 dam raise. To facilitate permitting and construction of the Stage 10 raise to El. 972.5 m, BGC will submit a design report including a summary of the stability analyses as well as technical specifications and IFC drawings to MPMC and the Ministry of Mining by early July 2014. Design for additional raising, to accommodate the next five or so years of required tailings storage, will commence thereafter, with an updated design report produced by January 2015.

## 5.0 CLOSURE

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Yours sincerely,

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