



Stantec Consulting Ltd.
905 Waverley Street, Winnipeg, MB R3T 5P4

December 12, 2014
File: 123310527

Attention: Mr. Brent Hamblin, Manager

First Quantum Minerals Ltd.
Samatosum Minesite
P.O. Box 1499
Barriere, BC V0N 1E0

Dear Mr. Hamblin,

Reference: Independent Third Party Review of the 2014 Tailings Dam and Impoundments Dam Safety Inspection (DSI), Samatosum Mine, Barriere, BC

1.0 INTRODUCTION

First Quantum Minerals Ltd. retained Stantec Consulting Limited (Stantec) to conduct an independent third party review of the 2014 Dam Safety Inspection (DSI) conducted by Piteau Associates for the Tailings Dam and Impoundment of Samatosum Mine, Barriere, BC.

The Dam Safety Inspection of the Samatosum Mine at Barriere, BC was completed by Piteau Associates Engineering Ltd. (Piteau) with the results outlined in report dated October 30, 2014. This letter outlines the results of Stantec's third-party review of the DSI carried out by Piteau.

2.0 THIRD PARTY REVIEW REQUIREMENTS BY CHIEF INSPECTOR

Following the Mount Polley breach and the subsequent order of the Chief Inspector of Mines, dated August 18, 2014, a dam safety inspection for every storage facility at a permitted mine was mandated to be conducted by December 1, 2014. Under the same order, an independent, qualified, third-party, professional engineer from a firm not associated with the tailing facility, must review these inspections. The order also includes a requirement for a third-party review of the dam consequence classification.

3.0 AVAILABLE DOCUMENTATION AND REFERENCES

The following documents were received and reviewed by Stantec in order to complete this independent third party review of the DSI:

- Piteau Associates, "Re: 2014 Tailings Dam and Impoundments Dam Safety Inspection, Samatosum Mine, Barriere, BC", File 1071(1071-14-L001), October 30, 2014;
- Piteau Associates, Drawing 88-0343 (fig. 3) – "Site Plan & Surficial Geology", May 1988;
- Piteau Associates, Drawing 946C-4 (fig. 2) – "Tailing Impoundment Site Plan & General Arrangement", Rev. 2, August 1988;



December 12, 2014
Mr. Brent Hamblin, Manager
Page 2 of 6

Reference: Independent Third Party Review of the 2014 Tailings Dam and Impoundments Dam Safety Inspection (DSI), Samatosum Mine, Barriere, BC

- Piteau Associates, Drawing 946C-5 (fig. 3) – "Section Through Tailing Impoundment Area", Rev. 2, August 1988;
- Piteau Associates, Drawings 946C-6 (fig. 11) – "Sections Through Tailings and Emergency Spillway", Rev. 1, August 1988 and Rev.2, February 1989
- Piteau Associates, Drawings 946C-7 (fig. 10) – "Plan View of Tailings Dam and Related Earthworks", Rev. 1 and Rev.2, August 1988.

For our review, Stantec used the following references:

- BC Ministry of Energy and Mines, "Guidelines for Annual Dam Safety Inspection Reports", August 2013.
- BC Ministry of Energy and Mines, "Notification of Chief Inspector's Orders – *Tailings Dams – Independent Review of Dam Safety and Consequences Classification*", August 18, 2014.
- BC Ministry of Energy and Mines, NEWS RELEASE "Independent Expert Engineering Review Launched Following Mount Polley Dam Breach", (2014MEM0022-001207), August 18, 2014.
- BC Ministry of Energy and Mines, BACKGROUNDER "Inspections and Independent Reviews of Tailings Ponds at Permitted Mines", (2014MEM0022-001207), August 18, 2014;
- Canadian Dam Association (CDA), "Dam Safety Guidelines 2007" (Revised 2013);
- Water Act, "British Columbia Dam Safety Regulation", B.C. Reg. 44/2000, and amendments up to B.C. Reg. 163/2011, November 30, 2011.

4.0 SITE BACKGROUND

The Samatosum Mine is located 60 kilometers north of Kamloops near the town of Barriere, BC. Samatosum Mine operated for 4 years between 1989 and 1992. Mining operations have been permanently stopped as of September 1992, following issuance of a pollution abatement order connected to production of acid rock drainage.¹ Samatosum was an open pit massive sulphide mine that produced silver, gold, zinc, lead, copper and antimony. Disturbance at the site includes a small open pit, a 32 hectare waste rock dump, a flooded tailings impoundment, several borrow

¹ Mining and Mineral Division, Annual Report of the Chief Inspector of Mines, 2008, Ministry of Energy, Mines and Petroleum Resources



December 12, 2014
Mr. Brent Hamblin, Manager
Page 3 of 6

Reference: Independent Third Party Review of the 2014 Tailings Dam and Impoundments Dam Safety Inspection (DSI), Samatosum Mine, Barriere, BC

pits and a plant-site area. Following the shutdown of the mine and facilities, it went through a decommissioning phase in accordance with a closure, reclamation and abandonment plan.

In accordance with the original operating permit and relevant provisions of the B.C. Mines Act, Samatosum is required to submit annual reports to the B.C. Ministry of Energy and Mines (MEM), and the B.C. Ministry of Environment (MOE) regarding the condition of the tailing disposal facility. We understand that Piteau was originally retained to provide geotechnical investigations and dam and facility construction recommendations prior to the mine development, and has also provided all required reports pertaining to the conditions of the tailing disposal facility.

According to the received documentation, the following structures within the Samatosum Mine site are relevant to the annual Dam Safety Inspections:

1. Main Dam;
2. Rediversion;
3. Abandonment spillway structure;
4. Diversion channel;
5. Plant site sedimentation ponds;
6. Seepage collection system;
7. Water quality pond.

5.0 DAM HAZARD CLASSIFICATION

Based on the Piteau Associates documentation listed above, this tailing dam and impoundments have been classified by Piteau as a "low" consequence of failure dam in accordance with the 2007 CDA Dam Safety Guidelines.

Stantec has performed a desktop **conceptual** level review of the consequence of dam failure and dam classification in accordance with the 2007 CDA Guidelines and B.C. Reg. 44/2000. Our general assumptions and rationale behind this review is as follows:

1. **Population at risk and possibility of loss of life:** A review of aerial photographs and terrain mapping of the area of the dam and of the potential dam-breach inundation zone indicates that there is no "permanent population at risk". Under a hypothetical dam breach scenario, there is likely a low possibility of loss of life beyond temporary people within the inundation



December 12, 2014
Mr. Brent Hamblin, Manager
Page 4 of 6

Reference: Independent Third Party Review of the 2014 Tailings Dam and Impoundments Dam Safety Inspection (DSI), Samatosum Mine, Barriere, BC

zone. Temporary people within a hypothetical inundation zone may include mine staff and other workers, or people passing through on river transportation routes. For this case, the dam is classified as "Low to Significant".

2. **Cultural loss:** A review of aerial photographs and considerations of the remoteness of the dam and of the potential dam-breach inundation zone suggests that there are no unique landscapes or sites of cultural significance at risk. For this case, the dam is classified as "Low".
3. **Economic loss:** A review of aerial photographs of the dam and of a potential dam-breach inundation zone suggests that the area contains limited infrastructure. Economic losses would be minimal and mainly limited to infrastructure owned by the Mine. For this case, the dam is classified as "Low".
4. **Environmental loss:** A review of aerial photographs suggests that in the event of a hypothetical dam failure, the water released from the breach would eventually reach the nearby Johnson Creek (located approximately 500 m north of the main dam). Under this circumstance, the presence of pollutants in the impounded water could have negative effects on the downstream aquatic environment. Surface water samples collected from the discharge of the tailings pond spillway and the discharge of the water quality pond (from Appendix C of the 2014 Piteau DSI) indicates compliance with the British Columbia Water Quality Guidelines. There is additional background information (supplied by the mine), that groundwater chemistry may exceed some of the acute and chronic levels as compared to the British Columbia Water Quality Guidelines. There is a potential of a tailings run-out from a hypothetical dam breach reaching Johnson Creek, and therefore the potential for tailings and groundwater release into the environment. For this case, the dam is classified as "Low to Significant".

From our conceptual level review of the dam classification, Stantec would classify this tailings impoundment as having a "Significant" consequence of failure in accordance with the 2007 CDA Dam Safety Guidelines.

6.0 SUMMARY OF RESULTS OF DSI REVIEW AND RECOMMENDATIONS

From our review of the Dam Safety Inspection report (DSI) issued by Piteau for the Samatosum Mine site, dated October 30, 2014, Stantec considers that, in general, the DSI fulfills the requirements indicated in the B.C. Ministry of Energy & Mines "Guidelines for Annual Dam Safety



December 12, 2014
Mr. Brent Hamblin, Manager
Page 5 of 6

Reference: Independent Third Party Review of the 2014 Tailings Dam and Impoundments Dam Safety Inspection (DSI), Samatsum Mine, Barriere, BC

Inspection Reports." Moreover, Stantec considers the DSI sound and consistent with the standard of care required for this type of assessment.

Stantec has noted several items within the Piteau DSI that should be addressed to provide a clearer understanding of the results of the DSI related to the ongoing monitoring of the dam safety. These items are as follows:

1. Stantec acknowledges that the latest instrumentation data (piezometer monitoring data) were not available at the time of writing the assessment and therefore not included in the report. However, the available historical data, as indicated in drawings 7A, B, and C fails to provide the context and the general meaning of the piezometer readings with regards to the stability of the tailing impoundment embankment dam. In particular, no timeline references are given to the actual reporting periods or to the historical data (i.e. start and finish of the reporting period and dates related to the readings of the historical data). More importantly, the piezometer levels are not related to the factor of safety against the instability of the main embankment dam. Therefore, it is difficult to assess whether or not the recorded total head values (piezometer readings) are approaching the critical level for the stability of the embankment dam. Correlations between the piezometer readings and stability of the embankment dam should be reviewed and addressed (if not already available) and included in the DSI. It would be helpful if all piezometer data was plotted with time to get an overall feel of the data significance.
2. The DSI (Section 7) refers to the freeboard and storage availability. It is indicated that the "Freeboard **usually** remains constant as incoming water flows discharge naturally over spillway as designed." It appears that there is a degree of uncertainty with regards to the assessment of the freeboard position over time. A more exhaustive explanation should be given in Section 7 outlining the freeboard requirements for the dam and if these requirements are met.
3. The DSI (Section 11 and Drawing 9, in the 2014 DSI Appendix B) refers to the review of piezometers, settlements and lateral movements. The last survey of the main embankment dam was completed during the 1998 Confirmation Survey, which is 16 years ago. This data should be updated and include vertical and lateral marker positions. In addition, it would be advantageous to have one or two slope inclinometers installed through the main embankment to monitor potential lateral movement of the embankment. This would help to better address/understand the safety of the main embankment dam during the life of the dam.



December 12, 2014
Mr. Brent Hamblin, Manager
Page 6 of 6

Reference: Independent Third Party Review of the 2014 Tailings Dam and Impoundments Dam Safety Inspection (DSI), Samatsum Mine, Barriere, BC

4. For an external reader who is not familiar with the original design and history behind the impoundment, it is not easy to understand how the facility is organized and functions, especially related to the redirection and abandonment spillway. A brief summary and a sketch clearly indicating all the facilities in the inspection and the interfaces/functional connections between them, will address the completeness and consistency of the DSI. The summary should explain how the water arrives, enters, and exits the impoundment and what has changed since the redirection works were completed.

Stantec understands that the Chief Inspector requires that any recommendations made in the Independent Third Party Review of the DSI be summarized in an accompanying letter from the Mine Manager to the Chief Inspector outlining the commitments for completing the recommended work along with a schedule for implementing the recommended work. We recommend that our recommendations be forwarded to the Chief Inspector as requested in the Chief Inspector Order.

7.0 CLOSURE

We trust this information meets your present requirements. Should you have any questions, or require additional information please contact the undersigned.

Regards,

STANTEC CONSULTING LTD.

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