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c:		Memo No.:	001
From:	Justin Pigage, P.Eng.	File:	ENG.WARC03039-01.003

Subject: Preliminary Dam Classification – Mine Waste Structures
Clinton Creek Mine Site, YT

1.0 INTRODUCTION

Government of Yukon, Assessment and Abandoned Mines (AAM) has retained Tetra Tech EBA Inc. (Tetra Tech EBA) to assist with the summary and evaluation of available geotechnical information related to closure of the Clinton Creek asbestos mine near Dawson City, YT. We have prepared this memo at the request of AAM to provide some background information regarding dam classification to project parties.

1.1 Background

As part of Tetra Tech EBA's scope of work, we are required to complete a seismic analysis for the Clinton Creek waste rock pile and Wolverine tailings pile. An important part of a seismic analysis is selecting the return period of the design seismic event. There are guidelines available with recommendations and advice regarding design return periods for different types of structures (dams, mine waste piles, etc.). The return periods for design events differ for structures depending on their type and use. Generally, dams are designed to more stringent standards than mine waste piles. Before completing the seismic analysis, it is necessary to choose the appropriate guidelines to provide recommendations for design return periods.

2.0 CANADIAN DAM ASSOCIATION GUIDELINES

2.1 Clinton Creek Waste Rock Pile

It is our opinion that the 2013 Canadian Dam Association (CDA) Guidelines should be applied to the Clinton Creek waste rock pile at the site. The CDA Guidelines define a dam as:

A barrier constructed for the retention of water, water containing any substance, fluid waste, or tailings, provided the barrier is capable of impounding at least 30,000 m³ of liquid and is at least 2.5 m high.¹

While the failed waste rock pile was not constructed as a dam, it does meet the two requirements above. It is our opinion that since catastrophic failure of the pile, or specifically the outlet structure, would result in a relatively quick release of a large volume of water, the recommendations in the CDA Guidelines should be applied in evaluating the stability for closure of the site.

Further, the CDA published a technical bulletin titled, *Application of Dam Safety Guidelines to Mining Dams*,² in 2014 which should be used in determining the design return periods for design and analysis of closure options for

¹ Canadian Dam Association, 2013. Dam Safety Guidelines. ISBN: 978-0-7726-5802-9

² Canadian Dam Association, 2014. Technical Bulletin: Application of Dam Safety Guidelines to Mining Dams. ISBN: 978-0-9936319-2-4

the Clinton Creek waste rock pile as failure could release asbestos-containing materials. This will result in a more conservative design or analysis as the technical bulletin recommends more conservative return periods for design events in mining closure applications.

2.2 Wolverine Tailings Pile

Determining if the CDA Guidelines are applicable to the Wolverine tailings pile is beyond Tetra Tech EBA’s current scope. The project parties should review the proposed closure options for the Wolverine tailings pile with specific focus on whether or not the structure will meet the above definition of a dam per the CDA Guidelines.

3.0 DAM CLASIFICATION

Dam classification is generally completed with input from all project parties and is typically a collaborative process. The following is our opinion of the dam classification for the failed waste rock pile for the purpose of completing the current seismic analysis only.

Dam classification is generally driven by consequences of failure. Table 2.1 from the Dam Safety Guidelines presents dam classifications and corresponding consequences.

Dam Classification

Source: Table 2-1 of CDA 2013 as reproduced in CDA 2014 Bulletin for Mining Dams

Dam class	Population at risk [note 1]	Incremental losses		
		Loss of life [note 2]	Environmental and cultural values	Infrastructure and economics
Low	None	0	Minimal short-term loss No long-term loss	Low economic losses; area contains limited infrastructure or services
Significant	Temporary only	Unspecified	No significant loss or deterioration of fish or wildlife habitat Loss of marginal habitat only Restoration or compensation in kind highly possible	Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes
High	Permanent	10 or fewer	Significant loss or deterioration of <i>important</i> fish or wildlife habitat Restoration or compensation in kind highly possible	High economic losses affecting infrastructure, public transportation, and commercial facilities
Very high	Permanent	100 or fewer	Significant loss or deterioration of <i>critical</i> fish or wildlife habitat Restoration or compensation in kind possible but impractical	Very high economic losses affecting important infrastructure or services (e.g., highway, industrial facility, storage facilities for dangerous substances)
Extreme	Permanent	More than 100	Major loss of <i>critical</i> fish or wildlife habitat Restoration or compensation in kind impossible	Extreme losses affecting critical infrastructure or services (e.g., hospital, major industrial complex, major storage facilities for dangerous substances)
<p>Note 1. Definitions for population at risk: None— There is no identifiable population at risk, so there is no possibility of loss of life other than through unforeseeable misadventure.</p>				

Temporary—People are only temporarily in the dam-breach inundation zone (e.g., seasonal cottage use, passing through on transportation routes, participating in recreational activities).

Permanent—The population at risk is ordinarily located in the dam-breach inundation zone (e.g., as permanent residents); three consequence classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life (to assist in decision-making if the appropriate analysis is carried out).

Note 2. Implications for loss of life:

Unspecified—The appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

3.1 Clinton Creek Waste Rock Pile

It is our opinion that the dam classification of the failed waste rock pile is **Significant** because:

- There is no permanent population at risk;
- It is our opinion that the habitat at risk is marginal and could be restored; and
- Only recreational facilities, seasonal workplaces, and infrequently used transportation routes are at risk.

3.2 Wolverine Tailings Pile

For the purposes of our current analysis, Tetra Tech EBA will apply the design return periods resulting from the dam classification established herein for the Clinton Creek waste rock pile to the Wolverine tailings pile. This approach is considered conservative as it is unlikely that classification of the Wolverine tailings pile will result in design return periods higher than those established for the Clinton Creek waste rock pile.

4.0 CLOSURE

A formal dam classification should be determined for the Clinton Creek waste rock pile and which guidelines apply to the Wolverine tailings pile should be established prior to or as part of future work related to the structures.

We trust this technical memo meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech EBA Inc.



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