Via Email

February 11, 2015

Ms. Julie Houle
Yukon Government
A/Mine Licensing Officer
Energy Mines and Resources

SLR Project No.: 200.01005.00000

Dear Ms. Houle:

RE: CAPSTONE MINTO MINE, MAIN PIT DAM
REVIEW OF PRELIMINARY DESIGN

1.0 INTRODUCTION

The Yukon Government, Mineral Resources – Energy Mines & Resources, has retained the services of SLR Consulting (Canada) Ltd. (SLR) to carry out a review of the Preliminary Design of the Main Dam for the proposed Tailings Management Facility (TMF) expansion, prepared by SRK Consulting (Canada) Inc. (SRK) for the Capstone Mining Corporation (Capstone) Minto Mine (operated by Minto Explorations Ltd.) (Minto) as well as the Tailings Management Plan prepared by Capstone.

The documents provided and reviewed include the following:

- *Tailings Management Plan* dated June 2014 and prepared by Capstone Mining Corp., Section related to the Main Pit tailings management facilities only; and
- *Main Dam Preliminary Design Report* dated July 2014 and prepared by SRK Consulting (Canada) Inc.

Additional documents were also made available for information purposes and included the following:

- *Minto Main Dam Conceptual Design Review* dated January 30, 2014 and prepared by Norwest Corporation; and
- *Minto Main Dam Conceptual Design Review* dated May 22, 2014 and prepared by Norwest Corporation.

The focus of the review is the Main Pit TMF including the design of the Main Dam with particular attention on identifying areas that might require further design attention. The TMF, including the dam, is required to follow the *Canadian Dam Association - Dam Safety Guidelines* (CDA Guidelines) and the *Mining Association of Canada - Guide to the Management of Tailings Facilities*.

2.0 BACKGROUND

The Minto Mine is located 240 kilometres north of Whitehorse in central Yukon. Mine development began in 2007 with tailings being prepared as a filtered product deposited in a dry stack on the east side of the mine site and south of the Mill complex. Tailings deposition transitioned to a thickened product (50% to 60% solids by weight) and was deposited hydraulically into the Main Pit. Additional capacity beyond that of the Main Pit was determined to be required for storage of tailings and potentially acid generating waste rock. In 2013 SRK determined that an additional 1.7 million cubic metres (Mm^3) of storage capacity was required beyond what was available in mined out open pits. A dam along the east side of the Main open pit was determined to be the best option to provide the required additional storage (could provide up to 2.2 Mm^3).

The overall plan is to discharge tailings as a thickened slurry into the Main Pit, Area 2 Pit (both Stage 2 and Stage 3), and Ridgetop North Pit. The tailings is also to be considered for use as underground backfill in selected areas depending on the outcome of future underground mine engineering evaluations. Water stored in the pits will be reclaimed for use as process water, and will be transferred between pits to satisfy operational and storage requirements for water.

As described in Capstone's Phase V/VI waste rock and overburden management plan (WROMP), the great majority of waste rock generated in Phase V/VI will be released from the open pits, which are scheduled to be completed in 2017 (Minto 2014b). Waste rock with NP:AP<3 which is considered potentially acid generating (PAG) will be co-disposed with tailings in the Phase V/VI TMF, in locations that will be saturated post-closure. Table 1 summarizes the total storage requirements for the Phase V/VI Tailings Management Plan.

Table 1: Volume Requirements for the Phase V/VI Tailings Management Plan

Material	Mass (Mt)	Dry Density (t/m^3)	Volume (Mm^3)
Phase IV + V/VI Tailings	13.3	1.1	12.1
NP:AP<3 Waste Rock			2.3
Accumulated Water			1.1
Surge Capacity			0.97
Total Storage Volume Required			**16.4**

The total storage capacity of the Main Pit to its natural spill elevation is 4.7 Mm^3. An additional storage capacity of 9.6 Mm^3 is available in the Area 2 Pit and the Ridgetop North Pit (7.7 Mm^3 and 1.9 Mm^3 respectively) for a total capacity of 14.3 Mm^3. As part of Phase V/VI, Minto plans to construct a dam across the low point of the east wall of the Main Pit to increase its storage capacity to roughly 8 Mm^3 (additional 3.3 Mm^3). As indicated in the Capstone Tailings Management Plan Report, this will provide the storage capacity required for Phase V/VI tailings, NP:AP<3 waste rock and water (based on the figures in Table 1), as well as contingency for storage volume lost to ice entrainment. The total available capacity with the construction of the proposed Main Pit Dam to a crest elevation of 812 metres (m) will be 17.6 Mm^3 (14.3 + 3.3 = 17.6 Mm^3).

3.0 SITE CONDITIONS

To evaluate the Main Pit Dam design and Tailings Management Plan it is important to understand the specific site conditions that can affect the design and operation of the TMF. The specific site conditions are summarized as follows:

- Bedrock condition includes deep erosional features or paleochannels, one of which extends below the south side of the Main Pit (location of previous south wall overburden failure) and the upper 5 m to 15 m of bedrock is moderately to heavily weathered with high fracture frequency;
- Three significant fault structures intersect the Main Pit:
    - The DEF fault is at the northern end of the Main Pit and strikes nearly east-west and dips north-northeast. This fault has been characterized with high gouge content that, based on water pressures measured across the fault, acts as a barrier to groundwater flow (SRK 2010);
    - The Minto Creek fault (or Fault 2) strikes almost perfectly east-west where it bisects the Main Pit and is believed to be north dipping (SRK 2008). Horizontal and lateral displacements have been observed, but are not clearly defined. Although surface expression of this fault exists for horizontal and vertical displacement, the magnitude of movement is not well characterized; and
    - The third fault lies to the south of the previous two and strikes south-east to north-west, and possibly intersects the other two faults towards the western edge of the pit. This fault is believed to dip north-northeast.
- The mine is located in a discontinuous permafrost region (north facing slopes contain permafrost) and is generally warm (-0.5 ^{o} C) with ice lenses ranging from non-visible to >4 m thick in the paleochannel. The active layer is between 1 m and 3 m thick;
- Groundwater flow is generally to the east towards the Minto Creek Valley;
- Ground instability has been identified in three locations (creep displacement of the Dry Stack Tailings Storage Facility; Main Pit south wall failure; and foundation movement at the Southwest Waste Dump); and
- Weather and Precipitation data was not provided but this will clearly affect the overall site water balance and operations during the different seasons.

4.0 MAIN DAM DESIGN CRITERIA

The Main Dam is required to contain tailings and water in a manner that provides stability and minimizes seepage losses throughout operations (about 10 years, conservatively assumed to be 20 years in the design) and closure. Establishment of design criteria is primarily based on the CDA Guidelines which specify selection of a “Hazard Classification” for every dam, based on the potential consequences of a failure. SRK has carried out a preliminary Hazard Classification for the proposed Main Dam and has determined that the dam is categorized as “Very High”. As such, the following design criteria are required:

- 1/5,000 year earthquake event;
- Design precipitation based on the Probable Maximum Flood (PMF) event;
- Inflow Design Flood (IDF) determined to be the 1 hour PMF (55 m^3/s);
- Design Freeboard provides core at 1 m above the IDF. This allows for 1 m of flow in the spillway and dam crest at 3 m above the Spillway invert or Full Supply Level (FSL);
- FS static (1.3 short-term, 1.5 long-term, 1.2-1.3 rapid drawdown), seismic (1.2-1.3 post-liquefaction, and 1.0 pseudostatic);
- Seepage (upper bound of 83 m^3/day);
- Consider Settlement Tolerance (resulting from consolidation, thaw);
- Construction quality assurance/quality control ;and
- Closure (apply long-term criteria to above).

5.0 MAIN DAM DESIGN

The proposed Main Pit Dam will be constructed to EL. 812 m and provide 3 m of freeboard above the FSL at EL. 807 m. The dam has a crest width of 14.5 m, a 2.5H:1V upstream slope and a 3H:1V downstream slope. The maximum dam height is expected to be approximately 28 m with crest length of approximately 430 m based on an 812 m crest elevation. The dam is a rockfill structure with an internal sloping geomembrane liner and a fine-grained (low permeability) core system (6 m wide) on the upstream side that is keyed into fine-grained overburden and/or bedrock. The key-trench has a typical 10.5 m base width and variable depths up to approximately 10 m. The upstream face of the dam will include a 1 m thick rip-rap layer for erosion protection.

The issues related to the dam design are as follows:

- The sloping core is susceptible to settlement cracking as a result of thawing of underlying ice rich overburden. In addition, the specification calling for 100% standard proctor for the core material may produce a more brital material. A central core dam may be more amenable to settlement and can provide a wider base where hydraulic pressures are greatest;
- Movement along the paleochannel will require extensive monitoring during construction and operation of the dam to ensure that the movement is within tolerable limits or has stopped completely. Additional loading resulting from the dam construction can trigger further or accelerated movement along the fault which can also affect the dam and liner integrity;
- Consideration could be given to a bituminous liner which is known to be more forgiving and can be applied during colder temperatures, if necessary;
- The extensive weathered bedrock may prove to be difficult to provide a suitable seepage barrier at the abutments. Additional effort may be required to investigate and provide seepage cutoffs;
- The fine core material sourced from the reclaim overburden pile requires further investigation to identify possible frozen soil that cannot be placed in the dam; and
- Consideration could be given to a staged construction of the Main Dam but this would have to be tied into the overall filling and water management plans.

6.0 FILLING PLAN

Tailings will be end discharged from the southeast side of the TMF until a sufficient beach has developed (100 m wide) on the upstream side of the dam to minimize seepage. Tailings will then be discharged around the facility maintaining the upstream beach and optimizing filling of the pond and eventually forming the closure surface.

The issues related to filling the Main Pit are as follows:

- Although PAG rock will also be placed within the TMF, there are no details on where or when this will occur. The PAG rock can be consider for use in providing internal access or water control dykes, but a plan is required;
- Thickened tailings discharged into a water pond may lead to segregation and the potential for increased consolidation settlement in the centre of the pond. This could lead to difficulties in preparing a final closure surface;
- Discharge of tailings into the pond requires additional planning in consideration of pump locations and pumping requirements for overall water management; and
- Although excess capacity has been provided within the Main Pit, a detailed operation plan is required to detail procedures during the winter to limit ice/snow and frozen tailings entrapment within the pond since these can result in prolonged settlement after closure.

7.0 WATER MANAGEMENT PLAN

Water management has only briefly been discussed within the reports and is generally focused on the time just prior to closure. The reports indicate that there is ample space to manage water throughout the life of the facility and that the water within the Main Pit TMF at closure will be reduced to a level where the Main Dam can be declassified as a dam.

The issues related to water management within the Main Pit are as follows:

- Although substantial space is available for water within the Main Pit, a detailed water management plan is required that describes specific operating conditions throughout the life of the facility; and
- Criteria including the minimum above water beach length adjacent to the Main Pit Dam, pump locations, winter operations, flood event operation, overall site water balance, etc. are required to prevent issues from developing. A tailings facility is often used to store excess water but this must be planned for.

8.0 CLOSURE

Closure of the Main Pit TMF involves: filling the facility with tailings to promote runoff towards the spillway and into Area 2 Pit; providing a composite cover composed of waste rock (to provide a trafficable surface) and then fine-grained overburden; followed by revegetation. The plan indicates that the Main Pit Dam can be declassified as a dam after pond removal and suitable monitoring indicates favourable long-term conditions.

The issues related to closure of the Main Pit TMF and the Main Pit Dam are as follows:

- Although the report suggests the possibility of declassifying the Main Pit Dam, this may not be possible for a very long time. Continued settlement within the TMF will result in ponding and the need to re-contour. In addition, seepage control may govern depending on the quantity and quality of seepage water from the saturated tailings pond;
- Access to the surface of the tailings pond will likely be difficult for some time after milling is stopped. Equipment will likely need to be remobilized to the site to carry out this work. Some additional planning details are required to close out the facility; and
- Spillway requirements at closure will likely be different than during operations. The spillway may be lowered to reduce the potential for water ponding near the dam and will require long-term inspection to ensure that it remains clear.

9.0 OTHER OPERATIONAL CONSIDERATIONS

Some basic operational information was provided within the reports reviewed along with an estimate of instrumentation requirements.

At the next stage of design, it will be important to prepare an Operations, Maintenance and Surveillance (OMS) manual that will contain procedures and identify both the positions and personnel responsible for the care and safe operation of the facility. The OMS manual should also contain an Emergency Preparedness Plan (EPP) and an Emergency Response Plan (ERP) based on a dam-break analysis carried out for potential failure modes of the Main Pit Dam. A tailings facility must have a clear OMS program with committed and trained personnel. Routine inspections by the designer and third party review are also very important to include.

Tailings and water management are important aspects of operating a successful mining business. It is therefore important for the mining company to have an established policy that realizes the importance and commitment of the company with respect to safe operation of these systems.

Please feel free to call or write at any time if you would like to discuss the contents of this memo further.

Yours sincerely,
SLR Consulting (Canada) Ltd.

Irwin Wislesky, P.Eng.
Technical Director, Tailings & Mine Waste