December 17, 2021

Canadian Environmental Assessment Agency

Re: Comments on EIS Reports Proposed Beaver Dam Gold Mine, NS

Herein are my comments and concerns regarding the EIS reports. My focus is on Acid Rock Drainage (ARD) and groundwater:

1. I don't see any discussion on fractures created around the Open Pit from blasting. My research at the Halifax Airport revealed that ARD began a few months following bedrock blasting and accelerated quickly, stemming from mineral exposure along the newly created fractures extending outward from the blast source. I refer to this as a "blast halo" around the pit which could extend many tens of metres outward from the open pit. I anticipate this situation will occur at the Open Pit at Beaver Dam, resulting in ARD inflow during pit operations and following closure as the pit fills over an estimated 13 year time frame.
2. I read that ARD is estimated to begin after 20 years in the PAG stockpile. I am curious as to the assumptions used to determine this. In my experience, again at Halifax Airport, is that the waste rock can begin generating ARD in a relatively short period of time due to exposure to relatively low pH precipitation and oxygen. GHD indicated they applied "predicted COC concentrations" in their modeling to assess whether Cameron Flowage would become impacted over the long term. I would like to see these "predicted COC concentrations" that were used in the modeling to determine if ARD was considered and to what levels of pH and metals concentrations are anticipated within the PAG stockpile over time.
3. With an impermeable membrane placed over the PAG and NAG stockpiles, it is anticipated that infiltration would be reduced to 3%, which would still provide low pH moisture and likely oxygen to stimulate microorganisms to begin generating ARD. As the pH drops within the PAG stockpile, ARD generation will accelerate under anaerobic conditions. I like the recommended approach suggested by Lorax Environmental whereby the NPAG waste rock should be mixed with PAG waste rock in sequential layers, in order to increase buffering capacity. The key to preventing ARD is to not have any infiltrating water and oxygen reaching the exposed mineralized waste rock. Consideration should be given to importing calcareous crushed bedrock as a supplemental cover, such as gypsum and/or limestone, in order to increase buffering capacity and maintain higher pH to prevent ARD.
4. It appears that the final elevation of the PAG stockpile will be approximately 15m in height above existing grade and the NAG stockpile will be approximately 38-45m in height above existing grade. Please confirm whether this is correct.
5. The GHD modeling indicates that Cameron Flowage will not be adversely affected by metals over the long term. It would be helpful to illustrate anticipated shallow groundwater flow directions more close up. I anticipate that shallow groundwater beneath the PAG stockpile will flow northerly and discharge to the Open Pit via the relatively permeable silty sand gravelly till which is approximately 6-11m thick below the PAG stockpile, particularly as the water table rises within the PAG stockpile over time. It is predicted that the water level in the Open Pit will stabilize in about 13 years after mine closure, with an anticipated water level elevation of 127m AMSL, compared to the water level elevation in Cameron Flowage of 130m AMSL. These anticipated water levels indicate that water within Cameron Flowage would continue to flow towards the Open Pit over the long term. It would be helpful therefore, to confirm the predicted water levels in the PAG stockpile, Open Pit and

Cameron Flowage to verify long term predictions of shallow groundwater flow and contaminant movement.

6. I note that GHD also says that "current water quality predictions suggest that when the Open Pit becomes flooded in 13 years, the Open Pit water will be suitable for release to Cameron Flowage". I question how this could be, considering groundwater flow into the open pit will be from groundwater discharge along exposed mineralized fractures created from blasting (ie through the blast halo) and shallow groundwater discharge from the PAG stockpile continuing over the long term.

7. To add to my queries, the reports indicate that the groundwater level adjacent to Cameron Flowage will only drop by one metre during pit operation. This seems a bit surprising, considering the Open Pit is situated only 50-80 metres west of Cameron Flowage and the water level in the pit will be about 160m below the water level in Cameron Flowage. There was no accounting for increased fracture flow resulting from blasting around the Open Pit, ie within the blast halo I referred to earlier, which would lower the water table at increased distances beyond the pit walls.

8. It appears based on predictions provided in the reports that the steady state water level in the Open Pit will be approximately 127m AMSL after 13 years, compared to the land surface around the pit of approximately 140m AMSL. This suggests that the water level in the Open Pit will be about 13 metres below the shoreline and yet another report indicates that there will be a shoreline likely suitable for habitat around the Open Pit after it fills with water. Please confirm what will be the anticipated status long term. I also question whether the proposed two metre high constructed berm to be placed around the perimeter of the Open Pit will suffice to prevent animals from falling into the pit as it fills with water after mine closure. I am also concerned with the infilling water into the Open Pit will be metal laiden and acidic over the long term, which will not be appealing to wildlife and fish.

9. The GHD reports indicate that based on modeling, zinc and cobalt will be the only metal parameters with CCME Freshwater Aquatic Guideline exceedences post mine closure. I point out that aluminum will increase in concentration in concentration as pH of the groundwater lowers due to exposure of disturbed overburden to low pH rainfall, coupled with ARD. Aluminum is already above applicable guidelines in waterways along the Eastern Shore of Nova Scotia, coupled with relatively low pH, making these waterways extremely sensitive. Aluminum is toxic to fish and therefore needs to be paid attention to.

10. It appears that surface water monitoring / sampling will continue semi-annually for at least 5 years after the Open Pit fills with water (= 18 years after mine closure) and that no groundwater sampling will be done after 5 years post mine closure. I think surface water sampling should be conducted quarterly and field measurements taken monthly for a longer period of time, as should groundwater sampling and analyses, particularly as ARD is predicted to begin after 20 years (although I anticipate ARD will begin much sooner). Assurances should be made that regular surface water sampling in on-site surface water bodies (eg Crusher Lake) and streams on site that flow northerly and easterly to Cameron Flowage will be done also, as well as stream flow to the southwest located south of the NAG stockpile.

11. The precipitation data used in the calculations in the reports covers a 30 year period up to 2010. I would think that more recent precipitation data would have been used considering we are experiencing higher precipitation shorter duration events. We experienced record rainfall last month here in Nova Scotia, which caused flooding and road / bridge washouts. As well, I am not sure whether 1 in 100 year storm data were used in any of the calculations. Our federal government has been applying 1 in 200 year storm events in calculations for their projects for over 15 years now.

I look forward to receiving answers and additional information pertaining to my outstanding concerns and queries.

Respectfully submitted,

<ORIGINAL SIGNED BY>

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