From:	Anthony Geglio
To:	Humphrey, Melanie (EGLE)
Cc:	David Anderson; "Andrea K Martin"; Schowengerdt, Matt
Subject:	MPAA Response to Comments Sept 2019
Date:	Wednesday, September 11, 2019 3:49:49 PM
Attachments:	image002.png M-MPAA Response to Comments Sept 2019.pdf

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Melanie,

Please find attached our Response to Request for Additional Information of August 9, 2019 on the Mine Permit Amendment Application.

Regards,

Anthony Geglio
Environmental Superintendent
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Memorandum

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September 11, 2019

TO: Melanie Humphrey, Michigan Department of Environment, Great Lakes, and Energy

CC: David Anderson, Aquila Resources Inc.
Matt Schowengerdt, Foth Infrastructure & Environment, LLC

FR: Andrea Martin, Foth Infrastructure & Environment, LLC
Steve Donohue, Foth Infrastructure & Environment, LLC

RE: Back Forty Project – Mining Permit Amendment Application MP 01 2016
Response to Request for Additional Information of August 9, 2019

Please find responses to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) request for additional information dated August 9, 2019 referenced above. Of the five items, Foth Infrastructure & Environment, LLC (Foth) and Aquila Resources Inc. (Aquila) have prepared responses to items 2, 3, and 5, provided below. Items 1 and 4 have been primarily addressed by Golder Associates Ltd. (Golder) in the memorandum provided in Attachment A. The EGLE comments are provided in italics, with the responses provided directly below each comment.

Comment 1: *Additional information is requested regarding the assessment of risk to the environment or public health and safety associated with potential embankment failure of the contact water basin and tailings management facility (TMF), and the response measures that shall be followed for such an event [(R425.205(1)(a)(vi)]. Provide and evaluation of potential failure modes of the both the TMF and contact water basin. This analysis should include and assessment of likelihood of the various failure modes as well as flooding and environmental impact associated with failure of these facilities. Based on this analysis, provide an estimated cost to implement response measures for a potential failure. An emergency action plan (EAP) outlining the extent of flooding and environmental impacts and emergency response procedures will be required as part of the Dam Safety Permitting process.*

Response to Comment 1: Attachment A was prepared by Golder and addresses an analysis of potential failure modes as well as the likelihood of failure. As indicated in Attachment A and in the MPAA, the Tailings Management Facility (TMF) and Contact Water Basin are designed so as not to fail. The likelihood of failure, flooding, or environmental impact via any of the failure modes identified is negligible. Cost estimates have been provided for mine closure and reclamation per the Part 632 Rules. Costs for cleanup of unforeseen scenarios

are already covered in the contingency component of the Financial Assurance estimate for the Project.

With respect to the Emergency Action Plan (EAP), an EAP will likely be required per R281.1311(1). The EAP will be submitted to EGLE and local units of government prior to construction and "not later than the date of expiration of the permit for construction of the dam, including any extensions of time for completion" (see Rule R281.1311(1)). Furthermore, it is Aquila's intention to submit final engineering plans and specifications for construction of the TMF and Contact Water Basins to EGLE (both OGM and WRD). These final plans and specifications will be provided prior to construction per the conditions of the Part 632 Permit and anticipated conditions of the Dam Safety Permit.

Comment 2: *Aquila Resources Incorporated (Aquila) has previously indicated that reagents other than sodium cyanide were considered in the beneficiation process but rejected due to lower concentrate recovery. What alternatives other than the use of cyanide were considered for processing? Provide additional information as to why those alternatives were rejected. [R425.202(1)(c)]*

Response to Comment 2: Beneficiation reagents include hydrated lime, methyl isobutyl carbinol (MIBC), sodium isopropyl xanthate (SIPX), and sodium metabisulfite (SMBS) as well as sodium cyanide. The comment focuses on sodium cyanide, which is an important precious metal extraction reagent, although it could be toxic if released to the environment. Cyanide dissolves gold, silver, and some base metals into solution to effectively extract salable metals.

An alternative process to recover gold and other precious metals was considered and tested. Gravity recovery was laboratory tested using a Knelson concentrator. This process separates particles by their specific gravity, with precious metals being typically heavier than the surrounding particles. This physical separation process is unable to extract some mineralized metals and the laboratory test results showed less effective recovery than chemical separation process.

Chemical separation reagents are available and are selected on the basis of the ore and chemical composition and mineralogy. Based on the oxide ore properties, dilute alkaline cyanide solutions are best suited for gold dissolution. Chlorine/chloride media, thiosulfate, thiocyanate, thiourea, bromide, and iodide solutions are being developed as alternatives to cyanide, but have not been used commercially or are currently at the piloting stage. The storage and handling and potential environmental effects for those alternatives are not well developed. Various technology companies are trying to develop and commercialize green alternatives, however, none are currently appropriate for the Back Forty oxide ore.

Comment 3: *Aquila has indicated an anticipated mercury generation captured from processing will be less than 75 liters per year and that costs for disposal of all wastes have been incorporated into the economic evaluation of the Back Forty Project. How and where will mercury be stored, and what is the maximum volume of mercury anticipated to be stored on site at any given time? Were the costs of disposal of wastes included in the financial*

assurance estimates? If so, explain how they were accounted for, including detail of anticipated volume, methods, and frequency of disposal. If not, provide the cost of disposal of wastes that must be removed for off-site disposal at projected maximum volume storage. [R425.301(2)(v)]

Response to Comment 3: Mercury will be generated from the mercury retort equipping the oxide ore processing. Mercury collection flasks are designed to securely and safely manage mercury. Once full, flasks will be replaced with full flasks stored in a secure hazardous materials containment area. Generally, most mercury can be recycled and re-used in other products. If Aquila is unable to sell or recycle the mercury from its operations, disposal will be pursued. All facility wastes will be evaluated for proper disposal in accordance with state and federal rules and the facility Waste Management Plan. All waste materials including mercury will be evaluated for classification as hazardous waste. In accordance with federal and state regulations, storage times for hazardous waste will vary depending on the quantity generated over time. For example, if the facility is classified as a Small Quantity Generator under federal and state hazardous waste rules, it may generate less than 1,000 kilogram waste per month. Hazardous waste accumulation is allowed for 180 days, therefore, approximately 20 liters mercury may routinely accumulate at the facility.

Disposal costs are anticipated to be on the order of $120,000 per year. Specific waste management costs were not included in the financial assurance estimate. A line item can be added to the estimate to account for this cost at the appropriate timeframe, based on disposal of 20 to 25 liters mercury.

Comment 4: *In reference to the amended design of Tailings Management Facility, Waste Rock Facilities, Ore Storage Areas, and Overburden Stockpile, Mining Permit Amendment Application Volume I, Appendix C: Please provide details of any analyses completed in order to determine that tailings will be non-segregating during deposition to the TMF. Is any sorting of tailings expected during placement? Is any washing of fines expected as decant water migrates to the sump areas? Provide a detailed monitoring plan that will ensure tailings have met design strength and drainage parameters, that proper function of installed drains is maintained, that expected consolidation/settlement has occurred, etc. as necessary to ensure stability of the TMF berm system [R425.203(i)(A)].*

Response to Comment 4: Please see Attachment A for a response to this comment. A detailed monitoring plan to assess tailing parameters and drainage parameters will be provided as part of the final design and specification package required as a condition of the Part 632 Permit.

Comment 5. *Also, EGLE has received public comments regarding whether Wisconsin's blasting regulations will apply at the Back Forty Project. The Back Forty Project is under Michigan's jurisdiction, and while Part 632 requires a general description of blasting materials and methods, and disclosure of explosives storage, transportation, and handling plans, a preblasting survey is not specifically required. Has Aquila considered conducting a preblasting survey that meets Wisconsin's requirements?*

Response to Comment 5: Aquila will complete a pre-blast survey that meets Wisconsin requirements and provide the survey results to EGLE Oil, Gas, and Minerals Division prior to the start of construction.

Attachment

Attachment A

Memorandum Prepared by Golder Associates Ltd.

GOLDER

DATE September 11, 2019 **Project No.** 1899291

TO David Anderson
Aquila Resources Inc.

CC Ken Bocking

FROM Kebreab Habte **EMAIL khabte@golder.com**

RE: RESPONSE TO COMMENTS FROM EGLE ON MINING PERMIT AMENDMENT APPLICATION FOR THE BACK FORTY PROJECT, MICHIGHAN

This letter provides the responses to some of the comments Aquila Resources Inc. (Aquila) has received on August 9, 2019 from the Department of Environment, Great Lakes, and Energy (EGLE) on the Mining Permit Amendment Application for the Back Forty Project (MP 01 2016). This letter covers comments 1 and 4. The other comments are addressed by others. Comments are provided in italics. Golder's responses to the comments are provided following each comment.

EGLE Comment 1:

Additional information is requested regarding the assessment of risk to the environment or public health and safety associated with potential embankment failure of the Contact Water Basin and Tailings Management Facility (TMF), and the response measures that shall be followed for such an event [R425.205(1)(a)(vi)]. Provide an evaluation of potential failure modes of both the TMF and Contact Water Basin. This analysis should include an assessment of likelihood of the various failure modes as well as flooding and environmental impact associated with failure of these facilities. Based on this analysis, provide an estimated cost to implement response measures for a potential failure. An emergency action plan (EAP) outlining the extent of flooding and environmental impacts and emergency response procedures will be required as part of the Dam Safety Permitting process.

Response to Comment 1

A detailed Potential Failure Mode Analysis (PFMA) and Emergency Action Plan will be developed during the detailed design of the project. PFMA starts with the premise that failure will occur and analyzes the credible modes of failure, the potential consequences and the means of mitigation of risk. It does not explicitly consider the probability of any particular mode of failure, which may be low to very low.

The Contact Water Basin (CWB) is a low criticality structure because it will contain only water and it will be constructed largely in cut (i.e. below grade). A preliminary PFMA was completed for the TMF, (which is a more critical structure than the CWB) and is provided in the table below. It is noted that the potential failure modes identified have low probability of occurrence (i.e. they are highly unlikely) and that the risk can be mitigated using appropriate design, construction and operation.

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Table 1: Preliminary PFMA of Back Forty TMF

Potential Failure Mode	Potential Causes	Likelihood of Occurrence	Potential Impact	Potential Risk Reduction Measures
Dyke overtopping due to inadequate discharge capacity of spillway	*Storm events higher than 24-hr, PMP (e.g. due to climate change)* *Spillway partially blocked with debris during storm event* *Spillway geometry not maintained during storm event (e.g. invert partially filled for access road)*	*Highly unlikely as the spillway is designed for the PMP and its discharge capacity can easily be maintained throughout the operational years.*	*Most of the tailings water and a very small amount of tailings could flow into the open pit and temporarily disrupt open pit operations. Negligible environmental impact. Repair of spillway crest will be required.*	*Update the PMP to account for climate change* *Regularly inspect the spillway to ensure the discharge capacity is maintained* *Provide a pump capable of dewatering the flooded open pit within two weeks.*
Dyke erosion due to spillway failure	*Inadequate spillway riprap for storm event*	*Highly unlikely as the spillway riprap will be designed to withstand the PMP flow.*	*As above. Repair of spillway chute will be required.*	*As above*
Dyke filter failure	*Damage of filter zone during construction* *Use of filter incompatible materials during construction*	*Highly unlikely as construction will be supervised by an independent geotechnical consulting company.*	*Some tailings particles may flow through the filter, transition and rockfill zones and settle at the external seepage collection pond. Clean up required. No environmental impact.*	*Construction quality control and quality assurance* *Regular cleaning of the external seepage collection pond* *Construct reverse filter at the downstream face*
Dyke overtopping due to inadequate freeboard	*Operational error caused by poor construction sequence, incorrect tailings deposition, poor water management etc.*	*Highly unlikely as staged construction will be planned by an independent*	*Most of the tailings water and a very small volume of tailings could escape the TMF. Clean up and repair of perimeter dyke*	*Regular training of the mine personnel responsible for the TMF*

Potential Failure Mode	Potential Causes	Likelihood of Occurrence	Potential Impact	Potential Risk Reduction Measures
		geotechnical consulting company. Operations will follow an Operations Maintenance and Surveillance (OMS) Manual.	will be required. Environmental consequences would depend on the actual location of breach.	Use of an independent tailings consulting company for construction and operational guidance
Dyke instability due to liquefaction	Upstream dyke high rate of raise causing static liquefaction of tailings foundation Seismic event causing flow liquefaction	Highly unlikely as preliminary liquefaction analyses completed using conservative assumptions confirmed the stability of the facility.	Most of the tailings water and a very small volume of tailings could escape the TMF. Depending on location, a breach could temporarily disrupt open pit operations or damage the process plant infrastructure, impact the wetlands or possibly impact the Menominee River.	Complete static and seismic liquefaction analyses before each dyke raise. Before each dyke raise over the tailings complete piezocone penetration test (CPTu) and confirm the critical state line of the tailings using laboratory tests. Instrument the dykes to monitor performance.
Overall instability of dyke	Seismic event higher than the design causing instability of the perimeter dyke	Highly unlikely as the region is not seismically active.	Ravelling of rocks down the downstream face, which would be a minor consequence.	Repair any ravelling that occurs.

EGLE Comment 4:

In reference to the Amended Design of Tailings Management Facility, Waste Rock Facilities, Ore Storage Areas and Overburden Stockpile, Mining Permit Amendment Application, Volume I, Appendix C: Please provide details of any analyses completed in order to determine that tailings will be non-segregating during deposition to the TMF. Is any sorting of tailings expected during placement? Is any washing of fines expected as decant water migrates to the sump areas? Provide a detailed monitoring plan that will ensure tailings have met design strength and drainage parameters, that proper function of installed drains is maintained, that expected consolidation/settlement has occurred, etc. as necessary to ensure stability of the TMF berm system. [R425.203(i)(A)].

Response to Comment 4

Unlike conventional tailings facilities, the Back Forty TMF will use thickened tailings. Thickening of the tailings will improve the stability of the TMF by reducing the volume of tailings water reporting to the facility and by accelerating consolidation of the tailings. The selected solids content of the tailings is not anticipated to result segregation of the tailings particles. (This is based on Golder's experience on similar projects, where we have carried out sampling transects on beaches of thickened tailings.) Decanting the bleed water for thickening tailings facilities is also easier as migration of fines to the decant area is not common.

During the subsequent stages of the project design, a detailed instrumentation plan and monitoring plan will be developed for the TMF to ensure the stability of the TMF. During each dam raise piezocone penetration test (CPTu) as well as critical state line tests will be completed on the tailings to support the stability analysis of the TMF.

Sincerely,

Golder Associates Ltd.

Kebreab Habte, M.Sc.(Eng.), P.Eng.(ON)
Senior Geotechnical Engineer

Ken Bocking, M.Sc., P.Eng.(ON)
Principal, Senior Geotechnical Engineer

KBH/KAB/jl

https://golderassociates.sharepoint.com/sites/27531g/technical work/9-mine permit amendment application response/rev 0/1899291_response to request for information mpa _sep 11, 2019.docx

REFERENCE

State of Michigan, Department of Environment, Great Lakes, and Energy (EGLE), 2019. Request for Clarification/Amplification of Information, Submission No. HNK-5X9D-9HC0S, County: Menominee, Site Name: Aquila Resources Inc-Back Forty Project-Lake Twp, Project Name: Back Forty Project, May 16, 2019.