

## **Top Ten Concerns with Aquila's Mining Permit Amendment Application**

1. Aquila's Mine Permit Amendment Application has failed to disclose the company's plans for a 16-year life of mine and mill and 16.6 Mt of ore, including both open pit and underground mining. From 2015 until early 2018 Aquila made this claim in their press releases, investor statements, and in correspondence with the Menominee Indian Tribe of Wisconsin. The March 2018 Technical Report concludes: "Aquila's Back Forty Project is an open pit VMS deposit with underground potential (Aquila Resources Inc: Back Forty Resource Estimation, February 7, 2018). The terms **underground, underground mining, underground workings appear dozens of times in the report.**

The discrepancy between a "7 year open pit mine" in their permit materials and the "16 year project" in their investor statements has serious consequences for the Back Forty Tailings Management Facility (TMF). Were the design capacities of the TMF and Waste Rock Storage facilities based on 16.6Mt, or on the 9.60 Mt mentioned in the Golder Report? (Golder Associates Ltd. October 30, 2018. Tailings Management Facility, Waste Rock Facilities, Ore Storage Areas and Overburden Stockpile. Permit Support Design, Back Forty Project, Michigan, p. 1).

If Aquila proceeds with an additional 9 years of underground mining, the TMF will need to accommodate additional waste. But the design of the dam, according to the applicant, is "sized" to accommodate only the tailings waste produced by the 7 year open open pit mine (4.9 million cubic meters).

"The estimated quantity of tailings to be disposed of is particularly important given the evolving nature of most mining projects. Tailings quantity estimates are based on estimated reserves that change continuously as mine development progresses. Accordingly, the final size and design of tailings impoundments can differ substantially from initial projections. This presents major challenges to Federal land managers and State permit writers, who are faced with reviewing and overseeing tailings impoundment planning, design, and performance, **and to the general public, who may ultimately pay for miscalculations resulting in environmental damages.** (EPA Technical Report: Design and Evaluation of Tailings Dams, Washington, DC, August 1994, p. 2).

Will the current TMF design accommodate additional tailings? Would the TMF walls be raised or would an additional TMF need to be constructed? Would the external "downstream" footprint of the TMF wall need to be expanded or reinforced to support additional raises? Specifically during the raises, when dam stability is weakest, what is the Factor of Safety? This was not addressed in the Dam Safety permit, and is not clear in the Mine Permit Amended Application.

TMF impoundments are frequently expanded through additional raises, which greatly increases the height of the dam walls and the total volume of waste rock and water contained within the structure. **This habit of incremental raising greatly exacerbates**

**the problem of instability, and has resulted in the catastrophic collapse of several tailings dams.**

Strict impoundment limits were not defined in the Back Forty mine permit amendment application. It is thus reasonable to assume that Aquila has selected the controversial “upstream dam” method because it could allow for sequential expansion through raising of the dam wall. The tailings dams at Brumadinho, Brazil and Mount Polley, British Columbia were raised higher than originally designed, multiple times.

A study of four recent tailings dam failures in countries with a strong mining tradition (Los Frailes in Spain, Mt. Polley in Canada, Samarco and Brumadinho in Brazil) showed that production had been increased and/or cost cutting measures had been put in place before the accidents. Why should cost cutting and increasing production lead to the rising number of serious tailings dam failures? The study suggests that the management compensation packages which reward cost cutting and increasing production so as to increase their annual bonuses are playing a role by encouraging managers to take risks. (see Margaret Armstrong et al., “Why have so many tailings dams failed in recent years?” *Resources Policy* 63, (2019) 101412.

2. Aquila says that the tailings management facility proposed at the Back Forty project is very different from the typical traditional upstream raised tailings facility. According to Aquila, the facility was specifically designed to mitigate the known risks of traditional upstream tailings facilities. Specifically, the perimeter wall will not be constructed of tailings, but of waste rock “which is strong, free draining non liquefiable and erosion resistant.” (Golder report on Tailings Management Facility, 3.2.1 Design Criteria, October 30, 2018).

However, in Aquila’s mine permit application, the company admits that 75% of the waste rock is expected to be acid-generating. Dr. David Chambers asks: **how will Aquila ensure that the embankment itself does not contribute to acid and metal leaching?**

According to the Environmental Protection Agency, construction materials to build the embankment must be chemically stable “**so potentially acid-generating waste rock is not suitable for embankment construction, particularly in drainage systems**” (see “Technical Report: Design and Evaluation of Tailings Dams, USEPA, Office of Solid Waste, Special Waste Branch, Washington, DC, August 1994. EPA530-R-94-038, p. 23).

Given this warning, why is Aquila planning on using reactive waste rock for the tailings embankment when this method of construction is inherently unstable?

3. The major change in the amended permit application is the expansion of the TMF by some 200 acres. Aquila has claimed that their site design has been “constrained” to avoid wetland impacts. Aquila is proposing the use of an upstream design because the walls will be raised inwards, in sequential lifts, with embankments structurally resting, in part,

upon a plastic mass of deposited tailings. Neither dry-stacked nor liquid, according to Aquila, yet retaining moisture.

Aquila has dismissed dry-stack (filter pressed) storage of tailings although this method is being used by mines around the world – including mines in the portfolio of Aquila’s investor-controllers. Aquila has dismissed less risky dam construction methods that would require the embankment or dam wall to be fully constructed prior to use, or expand outward with each sequential lift, increasing the width/height of the embankment through downstream construction, used with water dam construction. In fact, Aquila has dismissed every other tailings storage method/design and site configuration, including feasible Least Environmentally Damaging Practicable Alternatives (LEDPA) as cost prohibitive. Only the cheapest TMF design, adjacent to the pit, is acceptable to Aquila.

What is costly for Aquila (short term additional costs) must be carefully weighed against what would be costly for the environment, especially water resources, in the long term.

Scientific studies of waste streams point to tailings ponds as one of the primary contamination sources associated with metal extraction because the concentration of potential pollutants, such as arsenic, cadmium, copper, lead, and zinc, is significantly higher in tailings than in waste rock (see Johnnie N. Moore and Samuel N. Luoma, 1990. “Hazardous wastes from large scale metals extraction: a case study,” *Environment, Science, Technology* 24:1278-85.) Aquila cannot offset these costs onto Michigan’s natural resources or the public trust in those natural resources (statute 324.31514)

4. Aquila claims that the Back Forty facility design, especially the design of the TMF, has “mitigated” the mine’s environmental footprint. In fact, the TMF’s location and design directly contribute to the Back Forty project’s direct and indirect wetland losses. Aquila has failed to consider reasonable alternatives to key site features, such as the siting of the TMF, which could have been constructed on uplands adjacent to the Project Area, avoiding or minimizing “significant adverse effect on...natural resources or the public trust in those natural resources.”

In an objection letter (March 2018) the EPA found that Aquila failed to provide adequate support for their determination that “offsite upland alternatives for some mine features (for example, tailings storage) are not practicable.”

In the DEQ Water Resources Division’s Findings of Fact and Conclusions of Law, April 30, 2018: “The application has provided a feasible and prudent alternative analysis in their Least Environmental Damaging Practicable Alternative Analysis (LEDPA) report. The report outlines the conceptual alternatives that include onsite layout configurations and the requirements of offsite conceptual location. **The application does not demonstrate and support the conclusions that no feasible and prudent alternative exists.**”

5. The “upstream” dam design, repeatedly linked to catastrophic dam failures, is now being banned, blamed and closely scrutinized by investors, environmentalists, and the

global mining industry. Experts caution that the upstream dam design is still appropriate in *some circumstances: projects located in arid climates, on flat topography*. **The Back Forty site does not match the criteria for upstream dam use.** According to Attachment 2 of the Dam Safety Permit Application (“Tailings Management Facility – Permit Support Design Package”), the terrain is “rolling hills” with intervening lakes, rivers and wetlands. The climate is “humid” with >31 inches of precipitation.

“A tailings pond that is expected to receive high rates of water accumulation (due to climatic and topographic conditions) should be constructed using a method other than upstream construction. Any change in environmental or operating conditions (heavy rainfall, blockage of seepage outlets, rise in water levels of the pond, etc.) resulting in a rise of the phreatic line and complete saturation of the outer sand shell could quickly lead to failure by piping or sliding.” (US EPA, 1995, p. 3).

In the upper Midwest region, “extreme precipitation has increased 37 percent from 1958 to 2012.” (<https://www.climatesignals.org/events/northern-wisconsin-and-minnesota-flood-july-2016>)

Official rain totals in several northern Wisconsin and Minnesota cities neared the 10 inch mark, with Wascott, Wisconsin registering the highest amount at 10.0 inches exactly. (<https://www.climatesignals.org/resources/map-top-rainfall-reports>)

“The Great Lakes region is warming faster than the rest of the U.S., a trend likely to bring more extreme storms while also degrading water quality. The annual mean air temperature in the region rose 1.6 degrees from 1901-60 and 1985-2016, according to the report commissioned by the Chicago-based Environmental Law and Policy Center. During the same periods, the mean temperature for the remainder of the contiguous U.S. rose 1.2 degrees. As the air warms, it will hold more moisture, which likely will mean heavier winter snow-storms and spring rains – with more flooding in vulnerable areas.” (see John Flesher, “Report: Great Lakes seeing effects of warming,” *Associated Press*, March 24, 2019).

6. Aquila’s Amended Contingency Plan makes the bold assertion that “Impacts from high precipitation are reversible and off-site impacts are not expected to occur (p. 15). There is no evidence to support this absurd claim.

According to the United Nations Environment Programme, “Despite many good intentions and investments in improved practices, large storage facilities, built to contain mine tailings can leak or collapse. **These incidents are even more probable due to climate change effects.** When they occur, they can destroy entire communities and livelihoods and remain the biggest environmental disaster threat related to mining.” ( C. Roche, K. Thygesen and E. Baker (eds.), 2017. “Mine Tailings Storage: Safety is No Accident,” A UNEP Rapid Response Assessment. United Nations and GRID-Arendal.[www.grida.no](http://www.grida.no))

A recent (April 2019) EPA report, titled “Planning for Natural Disaster Debris,” advises local government bodies to assume “the worst case scenario” as they adapt to the “debris-related impacts of climate change.” Across the nation, flooding is expected to intensify even in areas where total precipitation is projected to decline. Climate change is expected to “increase the frequency and intensity of some natural disasters.” Larger amounts of debris will affect wider areas, **contributing to a greater risk of chemical and industrial release from facilities.**” (see Madison Dapcevich, “EPA Releases Report Advising Communities to Prepare for Climate Change-Related Disasters,” *EcoWatch*, May 4, 2019; [https://www.epa.gov/sites/production/files/2019-05/documents/final\\_pndd\\_guidance\\_0.pdf](https://www.epa.gov/sites/production/files/2019-05/documents/final_pndd_guidance_0.pdf))

7. Upstream embankments are not suited to areas of seismic activity. **“Dams built by the upstream method are particularly susceptible to damage by earthquake shaking. There is a general suggestion that this method of construction should not be used in areas where there is risk of earthquake.”** (International Commission on Large Dams, 2001, p. 24).

Aquila’s dam safety permit application 2L, Section 2.5 states that “the project is located in an area of low seismicity” citing the U.S. Geological Survey Seismic Hazard Maps published in 2014. However, this guidance by the USGS **is not intended for tailings dams or other long-term structures, but are intended to assist engineers and planners who design buildings. Higher performance standards are required for structures containing substantial quantities of hazardous contents to prevent uncontrolled release of these materials.**

The USGS has released a draft for new maps in 2018, which will update their 2014 modeling. The draft maps **show that many areas, including the Midwest, will see some increase in seismic risk. In regions subject to seismic shocks, failure of upstream dams by liquefaction can occur at very low dam heights.**

According to Dr. David Chambers, an internationally-recognized expert on tailings dam failures, Aquila’s seismic risk analysis did not do either a probabilistic or determinist analysis to determine the largest ground motion that the tailings dam structure could experience. The International Commission on Large Dams recommends that tailings dams be designed to withstand the Maximum Credible Earthquake or the 1 in 10,000 year event. By using the 1 in 2,475 year seismic event instead of the 1 in 10,000 year event, **Aquila significantly underestimates the size of the seismic event the tailings dam could experience.** The use of the 1 in 2,475-year seismic event for the design basis event, and the lack of probabilistic seismic analysis, **are viewed as unacceptable for tailings impoundment design in most regulatory jurisdictions.**

**While the U.P. region is generally considered low-risk for earthquakes, seismicity is a serious hazard in the design of a permanent structure containing hazardous materials:** “The tailings are potentially acid generating and metal leaching (Foth 2015b, 2016, MPAA Vol. 1.p. 130). Use of the phrase “potentially reactive” is inaccurate. Geochemical modeling provided in the 2015 MPA clearly shows that 77% of the waste

rock and nearly all of the ore is reactive, and tailings are expected to be **highly reactive, not “potentially reactive.”**

It appears that numerous historical seismic events relevant to the Back Forty’s location in Upper Michigan were not included in the seismic risk analysis. Aquila includes no mention of historical seismicity events of regional importance, and limits the analysis to “a design earthquake magnitude of 5.94, which corresponds to a return period of 1:2,475 years.” For permanent tailings waste structures, according to Dr. David Chambers, a 10,000 year return period is recommended.

For additional discussion of Michigan-specific seismic events, including earthquake epicenters identified for Escanaba and Menominee, Michigan, within the immediate project area, see the State of Michigan Report, “Seismic Disturbances in Michigan” (D. Michael Bricker, Geologist Lansing, MI 1977  
[https://www.michigan.gov/documents/deq/GIMDL-CR14\\_216127.PDF](https://www.michigan.gov/documents/deq/GIMDL-CR14_216127.PDF)

8. Unlike conventional dams that have a finite life, “tailings dams have to be designed and constructed to last “forever” and require some degree of surveillance and maintenance long after the mining operation has shut down and generation of cash flow and profit has ceased.” (MMSD, “Stewardship of Tailings Facilities,” T.E. Martin, et al., AMEC Earth & Environmental Limited, April 2002). How long will dam monitoring methods continue, post-closure? **Experts warn that none of these (tailings dam construction) methods has zero risk of accidents – even if the dam is no longer being used. “Dams have to be monitored for the rest of their lives,”** says Rafaela Baldi (an engineer who designs tailings dams). <https://www.bbc.com/portuguese/brasil-47048439>

Aquila fails to disclose what the life of the liners in the tailings and waste rock management facility is expected to be and what will happen in the likely result of the failure of the liners. Will the liner or geomembrane fail under load, either during operation of the mine, or during the (permanent) life of this TMF impoundment?

Tailings impoundments have been using plastic liners for only 35 years, and the leakage or seepage of lined tailings impoundment facilities is already a known problem. Leaking tailings liners are “commonly underestimated” according to the EPA, resulting in leachate seepage and the transport of contaminants into groundwater. What is the likelihood of the Back Forty’s liner failure?

The liners to be used in the Back Forty tailings management facility (TMF) have “no lifetime guarantee” according to an industrial liner manufacturer. Plastic liners will also be adversely affected by acidic chemistry of the TMF. Liners have a finite life, and will fail following the closure of the TMF, when the resources available to remediate the failure will be limited.

Aquila’s Amended Contingency Plan (March 2019) says that “Geochemical data will continue to be analyzed and leachate qualities modeled to ensure a neutral pH will be maintained on the TMF liner throughout the mine life. This mitigates risks associated

with acidic leachate existing on the liner...(p. 4). Why should the people who live downstream of a possible tailings dam failure have any confidence in Aquila's surveillance and maintenance of the tailings dam when Aquila has already demonstrated their inability or unwillingness to keep track of their own monitoring wells which are used to monitor groundwater. It was a local citizen who reported that 20 locks had been removed from monitoring wells at the Back Forty project in April 2019. Further investigation revealed that Aquila had cut off the locks but never reported this to the DEQ. When Aquila's Dan Blondeau was asked if the absence of locks could have potentially led to an increased chance of wells being tampered with, polluted or contaminated, he had no response. (see "Concerns about missing Aquila locks addressed," *Eagle Herald*, May 9, 2019).

9. The total financial assurance required for the Back Forty Project *as of the date of this permit* is \$28,600,000 prior to construction; \$118,500,000 prior to commencement of operations.

In light of Aquila's selection of the "upstream method" for TMF and the dam's extreme risk, financial assurances for the Back Forty project should be substantially increased. The Back Forty's previous financial assurance was calculated in 2016, prior to design details for the TMF, when the project footprint was substantially smaller, before the Eastern Corridor was detailed, before the wetland application was submitted, and before the mine's direct and indirect wetland impacts were revealed.

Post-closure, the TMF will be covered to reduce infiltration, but given the extremely acidic nature of the material that will be enclosed, the presence of a decanting pond atop the tailings (projected to be 50,000 cubic meters at closure), the costs for ongoing operating the Back Forty's wastewater treatment plant (WTP) should be included in financial assurances. According to the Center for Science in Public Participation (CSP2), WTP costs should be anticipated "for at least the 20 year post closure monitoring period." According to CSP2, "It would be prudent to include the cost of a WTP until the pit has flooded" and until monitoring wells demonstrate that "there is no seepage into groundwater or surface water" and "pit backfill water chemistry has stabilized."

10. Aquila is minimizing the importance of airborne mercury deposition that will be caused by the mine project. According to Foth's Air Deposition, Water Quality and Soil Impacts update to the amended EIA file: "Mercury is a constituent typically present in water bodies throughout the state and region at levels higher than the water quality standard. Mercury concentrations for the Menominee River and Spring Lake show baseline exceedances...For both the Menominee River and Spring Lake, the deposition increment for mercury is a fraction of baseline (less than 1% and 16% respectively), indicating negligible effect on the environment from mercury from the Project."

However, in the company's 2015 EIA (p. 40), they stated that "deposition from particulate emissions could potentially affect water quality of the surrounding waterways and damage the aquatic biota." Now Aquila has claimed that deposition of particulate matter will not cause problems for water. Mercury deposition into nearby Spring Lake,

which already shows “baseline exceedances” for mercury, will be increased “16% of baseline.” This is not a “negligible effect on the environment from mercury from the Project” as Foth claims but rather illustrates disregard for Michigan’s goal of zero discharge for mercury.

Strict limits for mercury are needed, especially since the Back Forty is a new source for mercury, and local discharges at the mine site will only worsen the mercury problem (+16%) in Spring Lake, the Menominee River, the Shakey Lakes watershed and surrounding wetlands.

With the extremely high acid generating potential of Back Forty ore and waste rock, heavy metals will be mobilized throughout the mine site – in the dust from blasting and roads, in the tailings, in pit waters, and elsewhere on the site. Mercury (as well as antimony, arsenic, cadmium, selenium, and other heavy metals) are found at high levels throughout the Back Forty lithologies.

The Water Resources Division of the DEQ concluded that “The constituents anticipated to be mobilized will impact water chemistry and have a high likelihood to result in degradation to the aquatic communities within the unnamed streams that discharge to the Menominee, direct discharges of groundwater from the project site to the Menominee River and to the waters of the Shakey River watershed. This alteration of water chemistry will result in changes to the trophic assemblages within these waterbodies impacting micro and macro invertebrates, mussels, fish species, and amphibians, birds and mammals that rely on these aquatic communities to complete their life cycle.” (Finding of Fact and Conclusion of Law, April 30, 2018, p.12).