**Summary Response to Comments**
**Humboldt Mill Amendment Request – MP 01 2010**
**Michigan Department of Environmental Quality**

On August 2, 2017, the MDEQ received a request from Eagle to amend Mining Permit MP 01 2010, issued under Part 632, Nonferrous Metallic Mineral Mining, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA), to accommodate additional tailings as currently projected for the approved mining of the Eagle and Eagle East mineral resources. After an initial review of the request, the MDEQ informed Eagle on September 13, 2017, that the request constitutes a significant change from the conditions of the approved mining permit and the review process of this request will proceed as provided for a new permit application and advised Eagle of the information required for administrative completeness. Once the required information was submitted to MDEQ, Eagle was notified that the amendment request was determined to be administratively complete on October 3, 2017. A determination that an application is administratively complete does not preclude the MDEQ from requiring additional information from the permittee. A public information meeting was held on November 27, 2017, followed by a 28-day written public comment period. The Humboldt Mill Request for Amendment documents were made available on the MDEQ website as well as sent to interested parties upon request. After reviewing the public comments received, the MDEQ sent a request for additional information and clarification on February 6, 2018, to supplement the application and complete the review. The response to this request dated March 12, 2018, was reviewed and deemed by MDEQ staff to be sufficient to complete the review and to recommend a proposed decision to grant the request with amended permit conditions. As allowed in Part 632, the MDEQ may coordinate public hearings if other permit applications under NREPA are under review. As such, the Water Resources Division and Oil, Gas, and Minerals Division held a coordinated public hearing regarding the NPDES Permit Modification and request to amend the mining permit on August 21, 2018. The written public comment period for the proposed decision regarding the mining permit closed on September 18, 2018.

The following is a summary of comments received by MDEQ, Oil, Gas, and Minerals Division during the public hearing through the end of written comment period, and responses to those comments.

1. **Comment:** How can the elevation of the tailings be raised when there isn't a full understanding of how the tailings settle at this time.
   ***Response: A detailed evaluation of tailings deposition for the combined volume of tailings from Eagle and Eagle East was conducted in 2016, which took into consideration geotechnical characteristics of the tailings slurry (including specific gravity, particle size distribution column settling tests, and slurry consolidation testing), and existing deposition performance using bathymetric surveys and tailings production records. Special Permit Condition F7 requires annual bathymetry maps of the HTDF (Humboldt Tailings Disposal Facility) to be developed to continue to monitor tailings placement, which in turn will also allow for continued monitoring and evaluation of tailings settlement.***

2. **Comment:** The reduction in water cover allows for a greater potential of the pit lake to mix, not remain chemically and thermally stratified as it is currently.

***Response: Predictive models for the current closure plan have indicated that the HTDF would remain permanently stratified and complete mixing is not predicted to occur after cessation of tailings placement. While complete mixing has not been observed during operations, Eagle Mine has made changes in water management to maintain a lower elevation of the chemocline to reduce potential for pit mixing. As required by the amended Special Permit Condition F1, the geochemical and limnological characteristics of the HTDF continue to be monitored and characterized during operations, closure, and 20 years post closure, of which the purpose is it to evaluate whether there are any changes in conditions. Results of this monitoring are reported in the Annual Mining and Reclamation Report. Profiling of the physiochemical parameters and water chemistry of the HTDF are included in this monitoring.***

3. **Comment:** Currently the lake temperature stratification shows some stability within the deep water (approx. 90 feet) system; the benefit of a deep lake is stronger, more stable thermal stratification that can last until fall turnover. The success of the current (and projected) treatment is dependent on the stability of the stratification. However, the proposal to significantly reduce the depth to approximately 21 (1536-1515) feet, creates a shallow water system where stratification is unlikely. As stated by Lundin Mining on page 9 of in its March 12, 2018 response document: "If tailings were filled uniformly to 1515 feet, leaving approximately 20 feet of water cover, then there is a very high probability that the entire water column would completely mix seasonally."

   In fact, although applying for an amendment to allow placement of tailings to a height of 1515 feet, Lundin's closure scenario that would prevent mixing requires that most of the basin not be filled to 1515 feet but only to an elevation of 1475 feet. As Lundin states on page 9 of its March 12th response, this would leave a clean water cap of 56 feet. On pages 5 and 9, Lundin describes closure with only a small portion of the pit-lake filled to 1515 feet. The permit amendment should reflect this and have a special condition that only a small portion of the pit-lake may be filled to an elevation of 1515 feet.
   ***Response: The closure plan as approved in the amendment does not include uniformly distributed tailings in the HTDF to 1515 feet MSL. Therefore, Special Permit Condition F4 of the Mining Permit was amended by MDEQ to only authorize the subaqueous disposal of tailings from Eagle and Eagle East ore. Based on the tailings deposition study, there is significant capacity in the HTDF to accommodate Eagle and Eagle East tailings well below an elevation of 1515 feet, and the maximum height of 1515 feet MSL was preferred not because tailings would fill the volume completely below this elevation, but because some tailings peaks might reach this height based on expected tailings dispersion due to physical characteristics of the tailings.***

4. **Comment:** The company has only recently attained their NPDES permit limits and there is not enough evidence presented by the company to indicate that there can be stratification stability in a 20 foot water cap system. Furthermore, there has not been adequate consideration of the effects of wind, strong precipitation, or expected lake turnover in a 20 foot water cap systems. Those factors will effect treatment and intake water quality and make it difficult for the mill to meet water discharge standards. The additional tailings resulting in a significant reduction in

water cover is likely to produce discharges that exceed permit limits and therefore is not in the best interests of the state nor the downstream ecosystems and habitats that will likely be impacted.
***Response: The closure plan as approved in the amendment does not include uniformly distributed tailings in the HTDF to 1515 feet MSL. Therefore, a 20-foot water cap pertains only to tailings peaks that may reach final elevations of 1515 feet MSL, while most tailings will be deposited below 1475 feet MSL, leaving a water cap of approximately 56 feet throughout most of the HTDF.***

***In a response to MDEQ's request for additional information, operational and water treatment modification details were submitted to address how water discharge standards will be met. Currently, the water treatment process includes oxidation (utilizing Fenton's reaction to destruct thiosulfates and lower the chemical oxygen demand), neutralization and metal precipitation, solids settling, Ultrafiltration, and reverse osmosis (RO), including installation of expanded RO capacity to optimize total throughput to allow for maximum discharge allowances.***

5. **Comment:** The failure of the applicant to provide geochemistry monitoring data and modeling reports with the permit amendment application, a serious omission that should have resulted in the application being considered administratively incomplete.
***Response: A determination that an application is administratively complete does not preclude the MDEQ from requiring additional information from the applicant. The MDEQ requested the details of the updated geochemical and limnological model. This information was provided in a response from Eagle Mine that was received by MDEQ on March 12, 2018 and was posted on the MDEQ website.***

6. **Comment:** The company's failure to respond to multiple requests by stakeholders (KBIC, CEMP, MAG and other concerned individuals) for additional data.
***Response: CEMP is a third-party reviewer of Lundin Mining's environmental data and is independent of the of the MDEQ process. The MDEQ requested additional information through the review process, and Eagle Mine submitted a response on March 12, 2018.***

7. **Comment:** Why the company and the Michigan DNR and DEQ claim that chemical and thermal stratification will prevent oxidation of metal sulfides, when the depth of overlying water is projected to be about 20 feet deep overall, and as little as 10 ft at the peaks of the tailings "cones". Even though the water in the pit has so far been significantly deeper than that, mixing still occurred during a high-wind event in April 2017 (and on at least one previous occasion as well), interfering with the effectiveness of the reverse osmosis (RO) treatment system.
***Response: In the approved plan, most tailings will be deposited below 1475 feet MSL, leaving a water cap of approximately 56 feet throughout most of the HTDF. The HTDF continued to be stratified throughout 2017, including during strong wind events, and complete mixing of the water column has not occurred. However, thermodynamically driven shallow turnover events within the mixolimnion have been observed in the spring and fall in the HTDF, and metal concentrations of the influent to the water treatment plant fluctuate during these events due to partial erosion of the upper layer of the chemocline. The water treatment process in place***

***can remove these metals. The 2017 spring turnover event caused iron levels to increase rapidly, which in turn caused nickel removal efficiencies to decline which resulted in chronic toxicity to test organisms. A minor pH adjustment resolved this issue. In addition, to further stabilize and lower the elevation of the chemocline, operational modifications in which the deep-water layer is utilized as both the mill process water supply and water treatment plant influent. Water chemistry profiles continue to be monitored in the HTDF to observe any changes in conditions, including the elevation of the chemocline.***

8. **Comment:** What is the justification for issuing a Part 301 Inland Lakes and Streams permit, allowing further degradation from the addition of toxic tailings materials to "surface waters of the state"?
   ***Response: While the MDEQ has determined that the use of the HTDF for permanent tailings disposal meets the requirements of Part 632, this question cannot be address by the mining permit. Water Resource Division administers Part 301 permits.***

9. **Comment:** What effect will the toxic water in the pit have on migratory waterfowl such as ducks, herons and bald eagles? How will other wildlife such as frogs and muskrats be affected? Will toxic heavy metals such as mercury, cadmium and lead make their way up the food chain and into the surrounding environment, and if so, what will the likely impacts be?
   ***Response: According to previous aquatic studies of the HTDF that were included in the Environmental Impact Assessment (EIA), fish and benthos were sparse even before placement of Ropes Mine tailings, and the pit showed little evidence of primary production and not considered a biologically active system. An evaluation in 2007 supported these conclusions. While birds and mammals have been observed within the fence line of the facility as observed during annual surveys, and by Eagle Mine staff during operations and MDEQ staff during inspections, they have not been observed foraging on the HTDF. This is not surprising considering the high wall banks that impede access, the lack of a food source in the HTDF, and that the HTDF is not located within a known migration pathway. In addition, water samples from the surface waters of the HTDF are collected on weekly basis as required by the NPDES permit (influent samples), and results have been determined to meet the water quality values for wildlife. While impacts to wildlife are not expected to occur, Part 632 requires continued biological surveys during operations and post closure.***

10. **Comment:** Regarding "Eagle East", the company has stated that it will "follow the orebody wherever it leads." What will happen if Eagle East turns out to be more extensive and produces more tailings than currently estimated? What will happen if other satellite mines go into production? What other options for permanent storage of the tailings are being considered?
    ***Response: A detailed evaluation of the tailings deposition plan was provided in Eagle Mine's response to MDEQ's request for additional information that was received on March 12, 2018. Based on this study, there is significant capacity to accommodate the estimated 3.1 million cubic meters of Eagle and Eagle East tailings well below an elevation 1515 feet. While there is***

***a possibility that more or less tailings may be produced than originally estimated, it has been demonstrated that there is a significant contingency built into the plan to accommodate these potential differences and still meet the closure requirements. In addition, the following permit condition has been amended to clarify authorization as approved in this amendment:***

- ***Amended Special Permit Condition F4: This permit only authorizes utilization of the HTDF for subaqueous disposal of tailings from Eagle and Eagle East ore. The surface elevation of tailings shall not exceed 1515 feet mean sea level (MSL).***

***As describe in the response to a request for additional information, a trade-off study was conducted to evaluate the placement of tailings in the underground mine as paste-fill, which would involve pressing tailings slurry at the mill, transferring the supernatant back into the HTDF, and transferring tailings back to the mine. Since the tailings themselves are not the primary driver for water treatment (the tailings slurry water has been determined to drive water treatment), this option would still require treatment of the dewatered tailings liquid. Considering this, and that the HTDF has the volume capacity for the current mineral resource to meet closure requirements, it was determined that the plan to add additional tailings to the HTDF is the better option, both financially and environmentally.***

11. **Comment:** Uranium was identified in Eagle Mine's TDRSA sump water in 2013, leading to an amendment to their Groundwater Discharge Permit to include uranium limits. Yet the Humboldt Mill permit does not include monitoring for uranium. Why not?
***Response: Amendments to water discharge permits are determined by the Water Resources Division of the MDEQ. Trace levels of uranium are present in many of the geologic formations in the Upper Peninsula. However, the geologic formations hosting Eagle and Eagle East are much lower than regional averages as determined by ongoing geochemical analysis, and therefore not predicted to impact water quality from deposition of tailings in the HTDF. The uranium identified by Superior Watershed Partnership (SWP) in 2013 was determined to originate from the liner fill material brought from off site, and only detected in the small volumes of water from the leak detection sump of the TDRSA. In addition, water treatment processes in place are capable of removing Uranium.***

12. **Comment:** How long will treatment of the HTDF water be required? Decades? Centuries? This is a basic question that needs to be answered before a permit is issued.
***Response: Based on the current and predicted conditions of the HTDF and considering water management and treatment practices currently in place, the final estimate for active closure treatment of the HTDF is two years after cessation of tailings deposition. However, the following permit conditions have been amended through the amendment process to monitor and address any observed changes in the conditions of the HTDF:***

    - ***Amended Special Permit Condition F1: The permittee shall conduct ongoing characterization of the geochemistry and limnology of the HTDF throughout the***

***milling operations, closure, and 20 years post closure to monitor the chemical and physical characteristics of the HTDF and to calibrate and adjust the model and predictions of dissolved metals and other related substances. During operations and closure, the permittee shall update predictions of how long treatment of the HTDF water would likely be required for water quality conditions to meet surface water standards after tailings disposal has ceased. Results of this monitoring shall be reported in the Annual Mining and Reclamation Report, and financial assurance estimates shall be evaluated annually, and updated as necessary to account for any added cost of water treatment during closure.***

- ***Amended Special Permit Condition F13: The permittee shall submit a detailed plan for final reclamation of the HDTF and must receive written approval from the MDEQ prior to proceeding with final reclamation of the HTDF.***
- ***Amended Special Permit Condition N9: The water treatment system and associated utilities shall be removed once it is demonstrated that water treatment will no longer be necessary to meet surface water quality discharge standards. Post closure monitoring of the HTDF shall begin once the approved reclamation of the HTDF is complete.***

***While seasonal thermodynamically driven shallow turnover events have been observed to occur within the mixolimnion (above the chemocline), complete mixing has not been observed during operations. A conservative "worst-case scenario" was modeled for required time for water treatment at closure. The model assumed complete mixing of the water column beginning in 2018, doubling of Na and Cl in tailings, high ground water TDS concentrations, complete leaching of mass from all tailings added to the HTDF (not realistically expected), and exclusion of geochemical and biogeochemical reactions to remove mass from the water column. Keeping in mind these conditions are not realistically expected to occur considering observations to date and water management and treatment systems in place, the results of this model concluded that the estimated duration of treatment required treat to water quality standards under these conditions would be 18 years.***

13. **Comment:** Once the Humboldt "waste facility" is closed and abandoned, how will be transformed into a "post-closure integrated watershed feature" that will not release acid mine drainage laden with salts and heavy metals, as claimed by the company and the DEQ? Will there be any financial assurances for remediation if and when things go wrong?
***Response: Updated modeling has indicated that the water quality of the HTDF following the cessation of tailings deposition will stabilize over time until water quality meets the standards for passive discharge into the environment without treatment. Subaqueous deposition of potentially acid generating tailings has been recognized as effective in reducing or eliminating the oxidation of reactive sulfide minerals and thereby eliminating the production of metal-rich, acid mine drainage. Monitoring of the HTDF is required to continue during operations and post closure as specified in the following amended permit condition, including annual evaluation of financial assurance estimates:***

- ***Amended Special Permit Condition F1: The permittee shall conduct ongoing characterization of the geochemistry and limnology of the HTDF throughout the***

***milling operations, closure, and 20 years post closure to monitor the chemical and physical characteristics of the HTDF and to calibrate and adjust the model and predictions of dissolved metals and other related substances. During operations and closure, the permittee shall update predictions of how long treatment of the HTDF water would likely be required for water quality conditions to meet surface water standards after tailings disposal has ceased. Results of this monitoring shall be reported in the Annual Mining and Reclamation Report, and financial assurance estimates shall be evaluated annually, and updated as necessary to account for any added cost of water treatment during closure.***

***Financial assurance is required to include "the costs to remediate any contamination of the air, surface water, or groundwater that is in violation of the mining permit." Eagle Mine is currently in compliance with the requirements of the mining permit.***

14. **Comment:** Lundin's plan to place the brine from its RO process in the bottom of the pit is also a concern. The application states that groundwater at the Eagle East mine has higher brine levels than the Eagle Mine groundwater. This means greater reliance on the RO process and more waste product being deposited into the pit. Will this lead to increased amounts of brine in the upper layers of the Humboldt pit? The company's consulting engineers assume that the brine will be contained at the lower level of the pit, and that chemical and thermal stratification will maintain anaerobic conditions there. Will this assumption hold? Is DEQ hiring independent engineering consultants to review the assumptions of Golder Associates, which has an interest in seeing its client succeed? With the company aggressively constructing a new mine next to its Eagle Mine and exploring for new mineral deposits in the Yellow Dog Plains, and it's success in getting special interest legislation from Senator Casperson, the chances for nasty surprises continues to grow.
***Response: Updated water management methods are described in the response to a MDEQ request for additional information received on March 12, 2018, to include deep-water layer intakes for mill reclaim process water supply and WTP influent to stabilize and lower the elevation of the chemocline. This modification was implemented based on predictive modeling of the HTDF in consideration of additional tailings from Eagle East.***

***Documentation by credible independent testing and certification organizations are accepted by MDEQ. At this time, MDEQ does not find it necessary to require additional review of information submitted.***

***Eagle Mine is not constructing a new mine next to Eagle Mine. An amendment was approved to amend the mining permit to mine the Eagle East ore deposit utilizing the existing mine facilities.***

15. **Comment:** In its amendment application, the company supplied data collected in 2010, prior to the start of operations of the mine. It did not supply critical data describing the current condition of pit, and the long-term effect of adding significantly more tailings than the pit was originally projected to hold. How can the DEQ make a decision to approve this permit amendment when there is no recent data to support the company's assertions?

***Response: The MDEQ agrees that additional information was necessary to support conclusions in the amendment request. Eagle Mine responded to a MDEQ request for additional information on March 12, 2018. The information submitted was reviewed and determined to be sufficient to substantiate Eagle Mine's assertions.***

16. **Comment:** Part 632, 324.63205 states: "(3) The applicant has the burden of establishing that the terms and conditions set forth in the permit application, mining, reclamation, and environmental protection plan, and environmental impact assessment will result in a mining operation that reasonably minimizes actual or potential adverse impacts on air, water, and othernatural resources and meets the requirements of this act." Clearly, the applicant has failed to meet the "burden of proof" as required under NREPA and Part 632.
***Response: The MDEQ agrees that additional information was necessary to support conclusions in the amendment request. Eagle Mine responded to a MDEQ request for additional information on March 12, 2018. The information submitted was reviewed and determined to be sufficient to substantiate Eagle Mine's assertions.***

17. **Comment:** Additional information relevant to this permit, and an expanded monitoring regime, have been requested by CEMP, as follows:
● The parameter list being used for Eagle Mine's Humboldt Tailings Disposal Facility (HTDF) geochemistry monitoring program (66 parameters).
● The HTDF geochemistry monitoring program data.
● Periodic split sampling at locations included in the HTDF monitoring program.
● Addition of parameters to CEMP split sampling of the Humboldt Mill water treatment plant influent andeffluent, including non-permit required parameters identified from the HTDF geochemistry monitoring program.
The failure of the applicant to provide geochemistry monitoring data and modeling reports with the permit amendment application is a serious omission that should result in the application being considered administratively incomplete. MAG fully supports CEMP's request.
***Response: CEMP is a third-party reviewer of Lundin Mining's environmental data and is independent of the of the MDEQ process. However, the MDEQ requested additional information through the review process, and Eagle Mine submitted a response on March 12, 2018. The response included information regarding the geochemistry monitoring program and results.***

18. **Comment:** We are especially concerned about the expanded parameter list used for monitoring the HTDF's geochemistry. These "66 parameters" were first mentioned during a presentation by Devin Castendyk, a senior geochemist working for Hatch Consulting on behalf of Eagle Mine. While Castendyk's presentations to the public were informative and appreciated, and acknowledged and referenced by the DEQ during the recent Public Meeting,
most of the information discussed by Castendyk is wholly outside of the permit amendment: his presentations relied upon data and visualizations of "proprietary" modeling and monitoring results for the HTDF that were not provided to the public during this permit review. Following the lecture, a number of stakeholders requested digital copies of Castendyk's slide presentations and copies of the modeling report and geochemical monitoring data, but these

materials have not been provided by Lundin, to whom he deferred the request. Castendyk's slide presentations were also not included as supporting documents with this permit amendment, and therefore cannot be used to substantiate the permit request.
***Response: The MDEQ requested the details of the updated geochemical and limnological model. This information, including a report prepared by Dr. Devin Castendyk of Hatch Consulting, was provided in a response from Eagle Mine that was received by MDEQ on March 12, 2018, and posted on the MDEQ website***.

19. **Comment:** According to the amendment application: "There are no performance requirements to maintain a certain water quality within the HTDF during operations, provided the treated water quality is acceptable." How about post-operations? Define "acceptable"? Applicant should clearly explain how, when, and to what extent the water of the Humboldt Pit Lake will "maintain a certain water quality" after milling operations have ceased.
***Response: Refer to response to comments 12 and 13.***

20. **Comment:** The applicant has provided NO revised environmental impact assessment (EIA) evaluating the substantial changes they are requesting, as required by R 425, Rule 206(1)(a).
***Response: While modifications to operations have been implemented, it has been determined that the EIA for Humboldt Mill remains valid, and that additional impacts are not anticipated by the placement of additional tailings within the existing footprint of the HTDF.***

21. **Comment:** The applicant offers no revised environmental protection plan or contingency plan, as required.
***Response: As Eagle Mine is operating under an existing permit, the updates to the contingency plan are include in the Annual Mining and Reclamation reports. The existing permit conditions and plans were reviewed, and the following permit condition were amended by MDEQ:***
    - ***Amended Special Permit Condition F1: The permittee shall conduct ongoing characterization of the geochemistry and limnology of the HTDF throughout the milling operations, closure, and 20 years post closure to monitor the chemical and physical characteristics of the HTDF and to calibrate and adjust the model and predictions of dissolved metals and other related substances. During operations and closure, the permittee shall update predictions of how long treatment of the HTDF water would likely be required for water quality conditions to meet surface water standards after tailings disposal has ceased. Results of this monitoring shall be reported in the Annual Mining and Reclamation Report, and financial assurance estimates shall be evaluated annually, and updated as necessary to account for any added cost of water treatment during closure.***
    - ***Amended Special Permit Condition F4: This permit only authorizes utilization of the HTDF for subaqueous disposal of tailings from Eagle and Eagle East ore. The surface elevation of tailings shall not exceed 1515 feet mean sea level (MSL).***
    - ***Amended Special Permit Condition F13: The permittee shall submit a detailed plan for final reclamation of the HDTF and must receive written approval from the MDEQ prior to proceeding with final reclamation of the HTDF.***

- ***Amended Special Permit Condition N9: The water treatment system and associated utilities shall be removed once it is demonstrated that water treatment will no longer be necessary to meet surface water quality discharge standards. Post closure monitoring of the HTDF shall begin once the approved reclamation of the HTDF is complete.***

22. **Comment:** No additional financial assurances have been outlined, as required by Rule 206(1)(e).
***Response: As Eagle Mine is operating under an existing permit, the updated financial assurance estimates are included in the Annual Mining and Reclamation reports and reviewed by MDEQ. In addition, the MDEQ request additional information in the amendment review process that included cost estimates for water treatment. The following permit condition was amended to account for any added cost of water treatment at closure:***
    - ***Amended Special Permit Condition F1: The permittee shall conduct ongoing characterization of the geochemistry and limnology of the HTDF throughout the milling operations, closure, and 20 years post closure to monitor the chemical and physical characteristics of the HTDF and to calibrate and adjust the model and predictions of dissolved metals and other related substances. During operations and closure, the permittee shall update predictions of how long treatment of the HTDF water would likely be required for water quality conditions to meet surface water standards after tailings disposal has ceased. Results of this monitoring shall be reported in the Annual Mining and Reclamation Report, and financial assurance estimates shall be evaluated annually, and updated as necessary to account for any added cost of water treatment during closure.***

23. **Comment:** Humboldt's future remediation phase and the ecological function of the HTDF appears to be vague and hypothetical. Relevant corollaries for such a lake simply do not exist. We request that the applicant present a clear and detailed remediation plan at this time, revised to reflect the addition of Eagle East, detailing how the lake will function, and specific water quality benchmarks anticipated at each phase of reclamation.
***Response: Updated modeling has indicated that the water quality of the HTDF following the cessation of tailings deposition will stabilize over time until water quality meets the standards for passive discharge into the environment without treatment. The requirement for closure has not changed since permit issuance. However, to verify compliance with closure requirements, the following permit conditions were amended by MDEQ:***
    - ***Amended Special Permit Condition F1: The permittee shall conduct ongoing characterization of the geochemistry and limnology of the HTDF throughout the milling operations, closure, and 20 years post closure to monitor the chemical and physical characteristics of the HTDF and to calibrate and adjust the model and predictions of dissolved metals and other related substances. During operations and closure, the permittee shall update predictions of how long treatment of the HTDF water would likely be required for water quality conditions to meet surface water standards after tailings disposal has ceased. Results of this monitoring shall be reported in the Annual Mining and Reclamation Report, and financial assurance***

***estimates shall be evaluated annually, and updated as necessary to account for any added cost of water treatment during closure.***

- ***Amended Special Permit Condition F13: The permittee shall submit a detailed plan for final reclamation of the HDTF and must receive written approval from the MDEQ prior to proceeding with final reclamation of the HTDF.***
- ***Amended Special Permit Condition N9: The water treatment system and associated utilities shall be removed once it is demonstrated that water treatment will no longer be necessary to meet surface water quality discharge standards. Post closure monitoring of the HTDF shall begin once the approved reclamation of the HTDF is complete.***

24. **Comment:** Clearly, Condition F.2 needs to be amended and updated. The Humboldt Water Treatment Plant, which now requires the additional use of reverse osmosis technology, was inadequate for new variables in their "worst case prediction" and Lundin describes it as being at capacity. The fact that it is "at capacity" is a clear admission that it will not have the additional capacity, without WTP amendment, to handle water treatment with increased metals and TDS, displaced by treatment tailings disposal to the pit.
***Response: In a response to MDEQ's request for additional information, operational and water treatment modification details were submitted to address how water discharge standards will be met. Currently, the water treatment process includes oxidation (utilizing Fenton's reaction to destruct thiosulfates and lower the chemical oxygen demand), neutralization and metal precipitation, solids settling, Ultrafiltration, and reverse osmosis (RO), including installation of expanded RO capacity to optimize total throughput to allow for maximum discharge allowances.***

25. **Comment:** Permit Condition J Monitoring 14 (f) Aquatic Biota Sampling and 14 (g) Fish Tissue Sampling – these conditions should be updated to include at least two monitoring points within the HTDF; sampling and the publication of biomonitoring results should continue through the Reclamation period and Post-Closure.
***Response: Refer to response to comment #9. The MDEQ is not recommending amending Special Permit Condition J14 at this time.***

26. **Comment:** Permit Condition J Monitoring 22 – this condition should be updated for greater clarity and transparency to require the permittee to make their "ongoing characterization of the geochemistry" of "HTDF" tailings available for independent and public review.
***Response: Special Permit Condition J22 is directly from Part 632 rules. In relation to this requirement and specific to the HTDF, the following permit condition was amended by MDEQ, which addresses the commenter's recommendation:***
    - ***Amended Special Permit Condition F1: The permittee shall conduct ongoing characterization of the geochemistry and limnology of the HTDF throughout the milling operations, closure, and 20 years post closure to monitor the chemical and physical characteristics of the HTDF and to calibrate and adjust the model and predictions of dissolved metals and other related substances. During operations and***

***closure, the permittee shall update predictions of how long treatment of the HTDF water would likely be required for water quality conditions to meet surface water standards after tailings disposal has ceased. Results of this monitoring shall be reported in the Annual Mining and Reclamation Report, and financial assurance estimates shall be evaluated annually, and updated as necessary to account for any added cost of water treatment during closure.***

27. **Comment:** Information shared by Lundin Mining during a private meeting with stakeholders make it clear that 10 Humboldt's Water Balance calculations continue to change, while recent conversations with DEQ and EPA staff make it clear that the "predictions to decide how long treatment of the HTDF water would likely be required" are now in flux. These fundamental uncertainties need to be answered before an amendment is granted.
***Response: The MDEQ agrees that additional information was necessary to support conclusions in the amendment request. Eagle Mine responded to a MDEQ request for additional information on March 12, 2018. The information submitted was reviewed and determined to be sufficient to substantiate Eagle Mine's assertions. In addition, the mining permit requires quarterly updates of the water balance model as required in Special Permit Condition F9.***

28. **Comment:** Special Condition F Humboldt Tailings Disposal Facility 9 – this condition should be update to reflect the current fate of treated wastewater discharges from the Humboldt Mill. Condition F 9 is deprecated, since Wetland EE is no longer the only NPDES outfall receiving discharges. Condition F 9 should be revised to reflect the current use of Outfall 002
***Response: The purpose of including Special Permit Condition F9 in the mining permit is to monitor the effectiveness and integrity of the cutoff wall. The MDEQ has determined that this permit condition remains effective at implementing the requirements of Part 632. Therefore, the MDEQ does not recommend amending this permit condition at this time.***

29. **Comment:** In the permit amendment request, under "closure and reclamation" (p. 11) the company states without providing evidence that "seasonal stratification and turnover" will occur, creating a shallow, dimictic lake in which the bottom material is regularly exposed to oxygenated water. With a maximum depth of around 20 ft, this lake is very unlikely to develop seasonal thermal stratification, as the applicant is claiming. Data from a study of the stratification of 500 Wisconsin lakes indicate that a lake of 67 acres (27 hectares) and 20 ft deep (the claimed final dimensions of the HTDF) would be HIGHLY UNLIKELY to ever thermally stratify.12 Instead, wind mixing will occur throughout the open-water season, creating acidification, and causing the liberation of dissolved toxic metals from the oxidation of sulfide metallic minerals of toxic metals from bottom sediments.
***Response: Refer to response to comments #2, 3, 4, 5, and 7.***

30. **Comment:** Humboldt's Mine Permit must be revised to, at a minimum, to add monitoring for wind-mixing and high-wind events, in light of the long-term shallow water cap, and the obviously increased potential for wind-mixing events to distribute contaminants throughout the water column. Additionally, if the water cap is diminished, the use of best management

practices for wind-mixing impediments on tailings ponds (such as booms, or sequential compartments) should be evaluated. These management methods are routinely implemented on mine tailings basins, including the ones apparently studied by Lundin's geochemistry experts.
***Response: The following permit condition was amended to clarify required monitoring and reporting of conditions in the HTDF:***

- ***Amended Special Permit Condition F1: The permittee shall conduct ongoing characterization of the geochemistry and limnology of the HTDF throughout the milling operations, closure, and 20 years post closure to monitor the chemical and physical characteristics of the HTDF and to calibrate and adjust the model and predictions of dissolved metals and other related substances. During operations and closure, the permittee shall update predictions of how long treatment of the HTDF water would likely be required for water quality conditions to meet surface water standards after tailings disposal has ceased. Results of this monitoring shall be reported in the Annual Mining and Reclamation Report, and financial assurance estimates shall be evaluated annually, and updated as necessary to account for any added cost of water treatment during closure.***

31. **Comment:** The company's modeling predicted a deep lake, with layers confined by the chemocline and thermocline, strictly limiting the exposure of tailings to oxygenated water. In a Spring 2017 meeting of the Upper Peninsula Environmental Stakeholders Group, however, Joe Maki and Steve Casey stated categorically (to the astonishment of many in the room) that the "Humboldt Pit is turning over – yes, it's turning over." This statement by DEQ regulators alarmingly and directly contradicts a statement in the Humboldt Mill's 2016 Annual Report: "Throughout 2016, the HTDF continued to be stratified." Is the Stratified Model, the basis of the Humboldt Mill permit, untrue? Do the DEQ permitting staff fully understand the modeling that was offered as the scientific basis of the HTDF permit, and the potential for adverse impacts, related to the changing model?
***Response: MDEQ staff were referring to thermodynamically driven shallow turnover events within the mixolimnion that have been observed in the spring and fall in the HTDF. To clarify, the HTDF remains stratified, and complete mixing has not occurred.***

32. **Comment:** According to research conducted in corollary pit lakes used for subaqueous disposal of tailings: "Field observations provided the basis for a numerical model designed to quantify the vertical mass flux of material initially injected at the base of the water column in a small lake; a process called subaqueous disposal. Eddy diffusion estimation largely controlled the transport behaviour, highlighting the need for measurements of diffusion in deep strongly stratified environments. The model followed the contaminant development over 40 years and showed that (i) it is unlikely that any material can ever be completely disposed of over realistic scales and (ii) within the bounds limited by uncertainty in eddy diffusivity, turnover penetration and surface layer precipitation-driven flushing are the mechanisms most likely to have bearing on the contaminant distribution." No information has been provided in the amendment request as to eddy diffusion and its potential impacts on the future water quality of the pit, including the long-term potential for transport of contaminants.

***Response: The MDEQ requested the details of the updated geochemical and limnological model. This information was provided in a response from Eagle Mine that was received by MDEQ on March 12, 2018 and was posted on the MDEQ website. As stated in the geochemical report, vertical transport of mass occurs in each prediction as a product of seiching and eddy diffusion. However, this was taking into consideration in current operational and water treatment modifications that have been designed to decrease the final TDS concentration above the chemocline and lower the elevation of the chemocline during operations, which in turn reduces the time needed for treatment after operations.***

33. **Comment:** According to Lundin staff, there have been additional changes to the inputs used in the HTDF's Water Balance diagram. The Water Balance inputs were previously revised during a NPDES permit amendment, as well. Why –given the strong reliance upon Water Balance in the original Part 632 and NPDES permit – have the Water Balance inputs for the Humboldt Pit Lake been repeatedly miscalculated? Why was Water Balance info not included in the permit amendment request?
***Response: The site water balance is required to be updated on a quarterly basis specifically to adjust and refine the models as additional information is available, and to monitor any changes in conditions at the site. An integrated groundwater, surface water, and water balance model was included in the 2017 Annual Mining and Reclamation report for Humboldt Mill, and was based on several years of operational data.***

34. **Comment:** According to the 2016 Humboldt Mill Report, "The Metallic Minerals Lease (No. M-00589) requires the lessee to furnish a mill waste reject report on an annual basis. In 2016, 3,858 dry metric tonnes of nickel and 598 dry metric tonnes of copper were deposited in the HTDF as tailings." At the current (11-13-17 London Metals Exchange price), the LME rate for copper is $6,796 dollars per tonne, and the LME rate for nickel is $12,280 per tonne. Is the company really flushing more than 4 million dollars of copper and 47 million dollars of nickel into the HTDF every year, unrecovered? This seems both environmentally dangerous, given the toxic nature of the metals, and fiscally irresponsible. Clearly the accumulation of dissolved pollutants in the pit lake will only increase with the addition of Eagle East waste.
***Response: The geochemical characteristics of the tailings take into account the rate of recovery in the processing of ore in modeling predictions. While it is in the best interest of a mining company to recover as much product as possible, no process has 100% recovery. Considering in 2016 the total tonnes of nickel produced was reported to be 171,200 and the total tonnes of copper produced was reported to be 59,400, the recovery appears to be good according to industry standards.***

35. **Comment:** Have additional storage sites or methods of handling (such as dry-stacked tailings) been considered? For the sake of full disclosure, which other facilities/sites are being investigated by Eagle? What are the "innovative tailing solutions" being studied by the company? Which additional sites, other than the Humboldt Pit Lake, have been considered for tailings storage? Which other tailings disposal methods, such as dry stack, were contemplated in this amendment request? In terms of the "potential impacts" on features, it should be

"reasonably foreseeable" that the additional Eagle East ore will be "found" and that the Humboldt Pit Tailings Disposal Facility will be entirely filled by the resulting waste stream, effectively removing the Humboldt Pit Lake from the landscape. At the very least, the potential for this to occur, and the long-term impacts on the "affected area" (Escanaba River Watershed) should be fully considered. A complete alternatives analysis, required under Part 632, is needed.
***Response: As describe in the response to a MDEQ request for additional information submitted on March 12, 2018, a trade-off study was conducted to evaluate the placement of tailings in the underground mine as paste-fill, which would involve pressing tailings slurry at the mill, transferring the supernatant back into the HTDF, and transferring tailings back to the mine. Since the tailings themselves are not the primary driver for water treatment (the tailings slurry water has been determined to drive water treatment), this option would still require treatment of the dewatered tailings liquid. Considering this, and that the HTDF has the volume capacity for the current mineral resource to meet closure requirements, it was determined that the plan to add additional tailings to the HTDF is the better option, both financially and environmentally. In addition, as part of the initial alternatives evaluated prior to permit issuance, dry-stacking of tailings in a nearby surface facility was contemplated. This option was ruled out at the time due to the acid generating potential of the tailings. Subaqueous deposition of potentially acid generating tailings is a preferred option for tailings disposal if feasible.***

36. **Comment:** Where is the applicant's report, showing their updated understanding of the "leaching rate of the tailings"?
***Response: The MDEQ requested the details of the updated geochemical and limnological model. This information was provided in a response from Eagle Mine that was received by MDEQ on March 12, 2018 and was posted on the MDEQ website. Leachate test results on tailings are included in the report.***

37. **Comment:** Why did Lundin expect the DEQ to conduct a third party review of the amendment request? If this was discussed, did MDEQ fail to pursue independent review? According to DEQ's response at the November 27th Public Meeting,"NO independent third party review of the amendment request" is being conducted.
***Response: The MDEQ is not certain why Lundin expected a third-party review of the amendment request. Documentation by credible independent testing and certification organizations are accepted by MDEQ. At this time, MDEQ does not find it necessary to require additional review of information submitted.***

38. **Comment:** Why does the application use a different figure for the depth of the final water cap – 15-20' – rather than the "10 ft (3 m) below the closure water level of the HTDF. Is the closure water level of the HTDF proposed to change?
***Response: The operational level of the HTDF is maintained around 1530 feet MSL. The level at closure once water treatment is no longer determined to be necessary is around 1536 feet MSL.***

39. **Comment:** Because of the presence of uranium in the Eagle commingled ore, we request that a similar "Special Condition" for uranium monitoring limits be added to the Humboldt Mill permit, specific to influent – water pulled from the Humboldt Pit Lake for treatment. Elevated uranium levels should be identified within influent, rather than effluent, to avoid unnecessary exposures in the Wastewater Treatment Plant, or environmental releases. We ask that uranium monitoring be added to the (anticipated) NPDES permit, as well. The Humboldt Mill permit should be revised to contain a Special Condition establishing a strict limit for uranium and monitoring/notification protocols, in order to protect worker safety and environmental safeguards.
***Response: Refer to response to comment #11.***

40. **Comment**: Lundin's shifting "life of mine" calculations for the Eagle / Eagle East mine make it difficult to assess the true extent of environmental impacts. The "life of mine" calculation affects critical portions of the EIA, as it directly relates to the total impact the mine will have on the environment. While the permitting process considers the "ore" under a different EIA, the addition of Eagle East ore is of critical concern to the Humboldt Mill permit amendment request. Is Eagle's increased "life of mine" expected to increase the operational life of Humboldt Mill by one year or two years — or 10? How many tons of additional tailings will be added?
***Response: Based on current rates of production and known mineral resources of Eagle and Eagle East, operations are expected to continue until 2023. The total volume of tailings from Eagle and Eagle East is approximately 3.1 million $m^3$ (5 million tonnes), which is the volume used to evaluate the capacity of the HTDF.***

41. **Comment:** Currently, TDS levels are necessitating the use of Reverse Osmosis technology – "as needed in order to meet NPDES permit requirements" according to the Company – at Humboldt's Water Treatment Plant (WTP). According to the Company, water discharged to adjacent wetlands is "monitored carefully." Has the Company's monitoring data been independently reviewed – by DEQ, CEMP, KBIC or others?
***Response: Monitoring data required to be generated and reported by MDEQ permits is reviewed by MDEQ, and available to the public through the website, MiWaters, or upon request. The MDEQ cannot speak for reviews conducted by other parties.***

42. **Comment:** The Humboldt Mill's permit amendment request pertains not to additional tailings waste of the same sort, but to Eagle East ore tailings, which are known to contain higher quantities of toxic metals and greatly increased quantities of entrained salts, due the orebody's greater depth. It is reasonable to assume that the quantity of salts and toxic metals will both increase, per ton of tailings, under this permit amendment request. Where is the EIA that would show how the watershed will be impacted by a doubling of the total tailings deposited in Humboldt Pit, or the downstream environmental impacts, whether immediate or long term? Again, no EIA updates were provided.
***Response: The water quality standards in the NPDES permit are developed to be protective of surface water quality. While modifications to operations and water treatment have been implemented, it has been determined that the EIA for Humboldt Mill remains valid, and that***

***additional impacts are not anticipated by the placement of additional tailings within the existing footprint of the HTDF.***

43. **Comment:** The details of this anticipated NPDES permit amendment – another "Significant Change" – have not been revealed. This plan was also described in the notes of the DEQ's unscheduled NPDES inspection on August 31, 2017: "The (NPDES) Permit modification application to add outfall location 004 in the Middle Branch Escanaba River and pump river water to maintain hydraulics in wetland EE was also discussed." Since this change is tied to the increase in TDS, and Lundin's request to add Eagle East tailings to the Humboldt Pit, these permits – NPDES, Humboldt Mill, minor permits for building pipelines or changes to the WTP – should be reviewed in a coordinated fashion. The DEQ does a great disservice to the public by treating these permits, and their environmental impacts, separately.
***Response: The MDEQ is required to take into account the extent to which other permit determinations afford protection to natural resources when making Part 632 permit decisions. The Water Resources Division and Oil, Gas, and Minerals Division held a coordinated public hearing regarding the NPDES Permit Modification and request to amend the mining permit.***

44. **Comment:** During a recent phone conversation, Melanie Burdick (EPA Region 5) stated she was "under the impression" that Lundin would be required to remediate the Humboldt Pit Lake by "putting a cover over the tailings" – e.g., installing a physical barrier between the water cover and the reactive tailings. This solution is certainly not among the options described in Humboldt's post-closure remediation plan, and appeared to come as a surprise to the DEQ when it was mentioned at the recent Humboldt Mill Public Meeting.
***Response: While a cover over the tailings could be an option for closure, updated modeling and current conditions do not indicate that this will be necessary.***

45. **Comment:** The applicant's claim that it will be potentially create a littoral zone in the Lake suggests that Lundin has no scientifically rigorous reclamation plan, or even the rough draft of one. Rather, everything is a work in progress that will be finalized sometime in the future. Note the extreme amount of latitude the company uses in the previous statement: initial, conceptual, consider, feasibility, such as, potential. There is no serious reclamation plan here, only vague suggestions.
***Response: The MDEQ requested the details of the updated geochemical and limnological model. This information was provided in a response from Eagle Mine that was received by MDEQ on March 12, 2018, and was posted on the MDEQ website. The reclamation plan of the Humboldt Mill remains in place, and now includes the following amended permit condition:***
    - ***Amended Special Permit Condition N9: The water treatment system and associated utilities shall be removed once it is demonstrated that water treatment will no longer be necessary to meet surface water quality discharge standards. Post closure monitoring of the HTDF shall begin once the approved reclamation of the HTDF is complete.***

46. **Comment:** Have two years of baseline data been collected for the Escanaba River at the new location proposed for a new discharge point ("Outfall 004")?

***Response: The mining permit surface water monitoring requirements include monitoring locations on the Middle Branch of the Escanaba River.***

47. **Comment:** Contingency Plan should be updated.
***Response: Updates to the contingency plan are included in the Annual Mining and Reclamation reports.***

48. **Comment:** Lundin's permit amendment request states: "Subaqueous disposal of tailings is commonly used for long-term storage of sulfide bearing tailings as a best management approach." It appears that this statement is no longer true, given world-wide concerns about the safety of tailings storage facilities. In fact, tailings management technologies and best practices were the focus of a recent international mining conference, "Tailings and Mine Waste 2017" (Banff, Alberta, November 5-8, 2017: "This conference will provide mine waste managers, engineers, regulators and researchers an opportunity to discuss the latest developments in tailings and mine waste management..."). There is an emerging consensus, broadly supported, to "BAN (or avoid) large water covers at closure (dry closure, dry covers), or allow for only small ponds distant enough from any dam crest (at least a distance corresponding to a ratio 5 to 1, one being the height of the dam, and the distance from the crest 5 times the height, again, at closure–if dry closure or cover impossible for entire site)." The applicant 21 fails to consider how the Humboldt Pit Lake could be closed without a water cover, and no other tailings management solutions have been reviewed.
***Response: The avoidance of large water covers is assumed to refer to tailings impoundments, where there is a concern regarding dam failure, since reference to a "dam" is included. The HTDF is not considered a dam. Subaqueous disposal of reactive tailings is the preferred method for tailings disposal, if determined to be feasible.***

49. **Comment:** We find that the DEQ has failed to require Humboldt's interconnected permits to be reviewed as a whole, allowing permits to be issued in a piecemeal fashion.
***Response: The MDEQ is required to take into account the extent to which other permit determinations afford protection to natural resources when making Part 632 permit decisions. The Water Resources Division and Oil, Gas, and Minerals Division held a coordinated public hearing regarding the NPDES Permit Modification and request to amend the mining permit.***

50. **Comment:** How are metals present in Humboldt Mill discharges contributing to the loss of aquatic habitat in the Middle Branch of the Escanaba River? Is this impact contributing to recent observations about low numbers of fish?
***Response: Stream habitat was qualified as "excellent" for both stations of the Middle Branch of the Escanaba River, both upstream and downstream of Humboldt Mill discharges, according to results of the aquatic surveys that have been completed from 2014-2017 using the P-51 protocol. Fish community results were rated as "poor" in these surveys. These observations are consistent with those from 2006-2007 surveys included in the EIA. Recent and past surveys are consistent regarding the fish population. At this time, there is no indication that Humboldt Mill discharges are impacting the aquatic habitat or fish populations.***

51. **Comment:** The Humboldt Mill permit amendment, now proposed to be approved, and the related NPDES direct discharge permit, offer no contingency plan for tailings, treatment, or discharges if the permitted tailings elevation is further exceeded — despite Eagle's own uncertainty about the capacity of the HTDF to store all of the Eagle East tailings.
***Response: In the response to MDEQ request for additional information submitted on March 12, 2018, Eagle Mine included a deposition plan report detailing the evaluation of tailings deposition for then combined volume of tailings from Eagle and Eagle East. The capacity of the HTDF was evaluated for the maximum advised level of 1515 ft MSL. This study took into account the geotechnical characteristics of the tailings slurry, bathymetric surveys, and tailings production records. Based on this study, there is significant capacity to accommodate Eagle and Eagle East tailings below an elevation of 1515 feet MSL. An explanation of water treatment updates was also included in the response to MDEQ request for additional information. The response documents were made available on the MDEQ website. An annual update of the contingency plan is required to be included in the Annual Mining and Reclamation Report to include any substantial change in site conditions.***