SUBJECT: Request for Additional Information - Copperwood Mine - Mining Permit Application Amendment Request March 2018 - MP 01 2012

The Michigan Department of Environmental Quality (MDEQ) has conducted an initial review of the Copperwood Mine Mining Permit Application Amendment Request (Application), March 2018, MP 01 2012. To assist in the completion of the review, please respond by addressing the following items of request for additional information to supplement, clarify, and support the proposed amendment:

1. ***Provide a map that clearly shows the differences in the original site layout and the requested changes to the site layout in an appropriate scale.***

Response:

Separate maps are included as addendums to this response document showing site layout features in the original 2012 Copperwood Project plans and the proposed updates of the 2018 amendment application.

An attempt was made to depict the 2018 updates as an overlay on the 2012 site plan but the result did not communicate the intended purpose to clearly show the differences. Placing a 2012 and 2018 site layout map side by side in the same map document would require use of an inappropriate scale to clearly see details of the differences.

2. ***Explain how tailings will be transported to the Tailings Disposal Facility (TDS) in the proposed site layout, and include a figure showing the location of the tailings transport system.***

Response:

The transport of tailings slurry to the TDF and reclaim water from the TDF to the process plant uses pipelines which will follow the main access road. The cross section in Figure 1 below shows the designated space for pipes on the main access road.

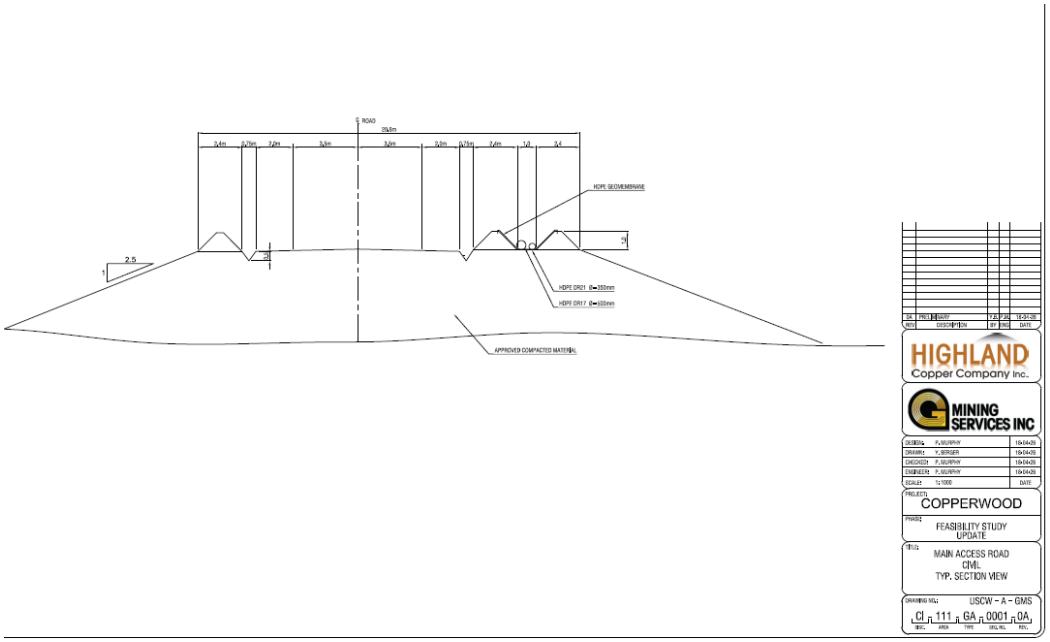

Figure 1: Main Access Road Cross Section

A larger file size Figure 1 is included as an addendum to this response document.

Both the slurry and reclaim pipes will be HDPE pipes. The pipes will have a berm on either side of the pipelines with a geomembrane liner on the interior of the berms and underneath the pipelines. The system will naturally drain to the site event pond located next to the process plant.

3. ***Section 2.3 of the Application indicates changes in surface and mineral rights in the project area since MP 01 2012 was issued. Rule 425.203 (d) of Part 632 Nonferrous Metallic Mineral Mining regulations of the Natural Resources and Environmental Protection Act of P.A. 1994, as amended (Part 632) requires a map and description of ownership of all tracts of land in the mining area and within 1320 feet of the boundary of the mining area, including surface rights and mineral rights. Provide an updated map showing current ownership that meets this requirement.***

Response:
Updated maps of mineral rights and surface owners in the vicinity of the Copperwood Project are included as addendums to this response document.

4. ***Provide additional detail of the plans and design of the ore stockpile, including construction and thickness of the compacted clay till base and liner.***

Response:
The ore stockpile pad uses a combination of low permeability surfaces and designed slopes to direct and capture any contact water on the pad. The base is constructed using a minimum fill layer of 1 foot of very low permeability clayey material, compacted at 95% modified Proctor, produced from the excavation of the box cut and an incorporated 60 mil HDPE geomembrane layer to prevent seepage. An extra layer of 1 foot of uncompacted material will be placed over the liner in order to protect the liner.

The placement of fill above the existing surface allows for the creation of deliberate cross-slopes and lined ditches as well on the designed surface. The pad slopes primarily to the north and secondarily to the west. The cross slopes, combined with low permeability layers, ensure the direction of runoff into the designed ditches on the North and West portions of the pad. The ditches empty into a lift station on the northwest corner of the pad where they can be directed to the event pond near the process plant and ultimately to the tailings or the process plant reclaim water system. All runoff on the pad will be directed to the lift station.

5. ***Specify the area and thickness of topsoil that will be stripped, and area and volumes of overburden and waste rock to be excavated for the proposed site layout. Demonstrate that this material will be adequate in characterization and volumes required for construction and reclamation plans or provide plans for hauling material in from off site.***

Response:

The comprehensive soil balance calculation for Copperwood aggregates the several major areas of the mine including: site infrastructure, box cut, tailings disposal facility, mitigation area, stream relocation, and closure fill. The predicted end of life soil balance is estimated to be approximately 820,000 cubic meters of excess material most of which is low permeability clayey material. The total is the sum of the mentioned areas, each of which are calculated using a designed surface and comparing that to existing surfaces mapped with LIDAR.

The estimated net cut at end of life of mine for each area is listed in the table below.

Area	Quantity (m3)
Net TDF material in Excess	1,810,000
Site Infrastructure	-130,000
Mitigation Area	150,000
Stream Relocations	150,000
Closure Cap for TDF	-1,160,000

Soil on site can be characterized as having minimal topsoil with an underlying layer of low permeability clay - this is confirmed by a review of Coleman Engineering drill logs. Both identified layers can be reused on site either during construction or reclamation activities. The estimated average thickness of topsoil across the site is 3 inches with a total cleared area of 517 acres which results in approximately 160,000 m^3 of topsoil to be stored in the topsoil storage area for later use in reclamation. If the required topsoil is beyond the supply available on site, the nearby 'Lake Pit' has been identified as a potential source to use for topsoil intensive construction activities such as the closure cap or mitigation areas. It is not expected for there to be a shortage of low permeability clay for use in fill activities based on the calculated soil balance. The soil excavated in the TDF area will be used site wide as low permeability fill as it has been deemed suitable by the geotechnical consultant for the feasibility study.

6. ***MP 01 2012 Special Permit Condition G1 requires that all vehicles and equipment leaving the contact area of the main facilities site will be required to be washed before leaving, and wash water shall be used as facility process water, routed to the tailings***

Response:

As Figure 2 below shows, there will be two stations for truck washing located at the concentrate loadout and upon entry to the parking lot from the box cut and ore stockpile roadway. The colors as shown on the figure correspond to non-contact and contact water. All water shown as contact water will either have gravity fed ditches directly flowing or being pumped to the event pond shown. The event pond has a pipeline that conveys water into the TDF pump box and then to the TDF for storage and eventual treatment at the water treatment plant. All non-contact water will be routed to discharge into Unnamed

Creek located between the process plant and the ore stockpile / box cut areas.

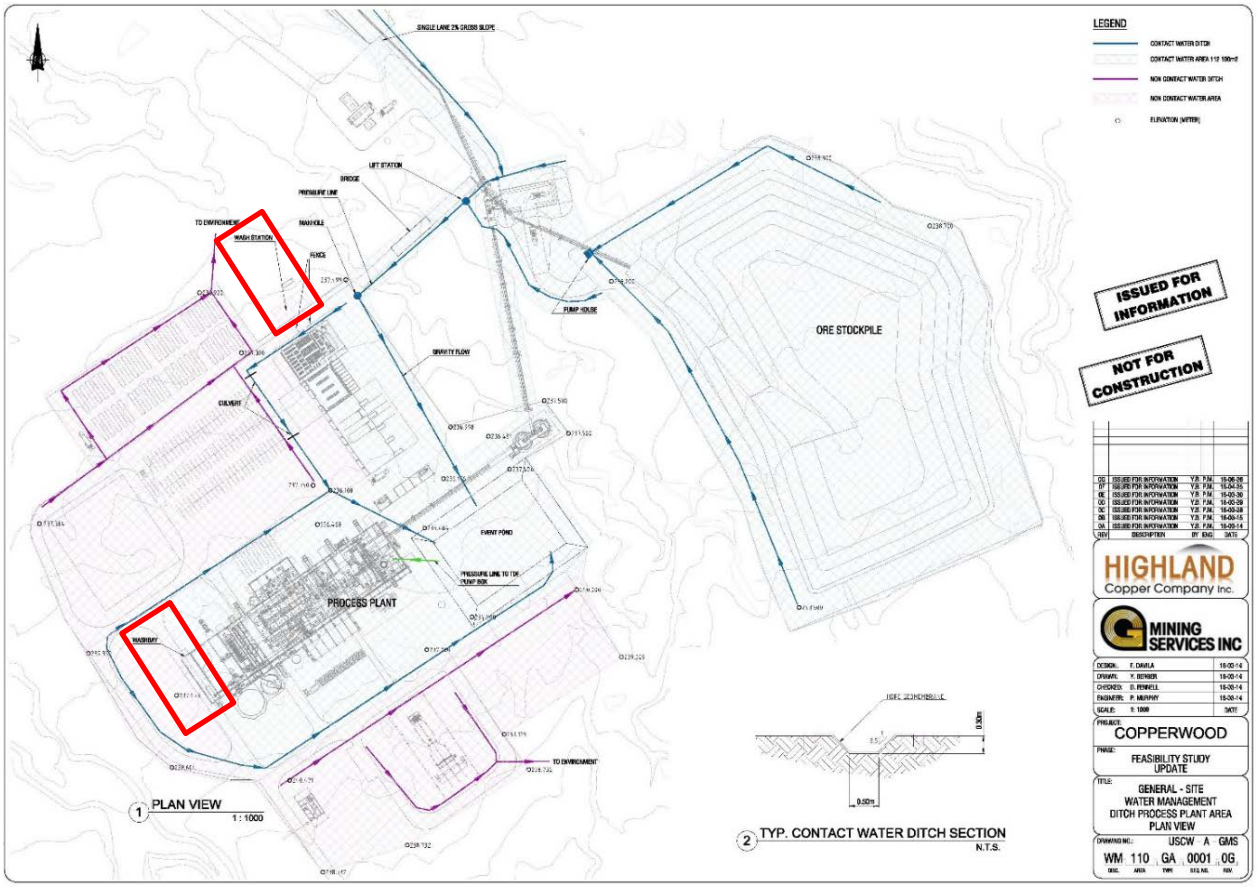

Figure 2: Contact Water Management for the Copperwood Mine

A large file size Figure 2 is included as an addendum to this response document.

7. What plans are in place for subsidence monitoring during operations and post closure?

Response:

When Orvana submitted a Part 632 Mine Permit Application (MPA) to MDEQ in September of 2011, mining methods planned to be utilized at the site were anticipated to result in surface subsidence in areas where mining occurred. The mining plan included removal of the roof support pillars allowing for cave-in of the roof and predicted subsidence of the ground surface. Appendix 203.3.11 – Subsidence Plan was included as part of the Part 632 MPA to describe monitoring and mitigation of the possible effects of subsidence on the environment.

As part of the initial MDEQ review of the Part 632 MPA, Orvana was asked to respond to the following item on post-closure monitoring for subsidence:

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92. In the application it is not clear if post-closure monitoring for subsidence is included. If it is not in the application, provide a plan for post-closure monitoring for subsidence.

Appendix 203.3.11 – Subsidence Plan currently has subsidence monitoring for 12 months after mining in an individual panel is completed but does not specifically address monitoring after the mine is permanently closed. The subsidence model for the mine is under revision. Post closure subsidence monitoring will be specified in the revised Appendix 203.3.11. The post closure monitoring will be scheduled to occur at the same intervals as other post closure monitoring until agreement with MDEQ that the subsidence monitoring can cease.

Subsequent to the above Part 632 permit review response to MDEQ, Orvana modified the mine plan and pillar design. The modified mine plan was developed to include a prediction of no surface subsidence and was included with Orvana's application for an amendment to the Part 632 permit that was approved by MDEQ in February of 2013. With the change to a no-subsidence mine plan, Appendix 203.3.11 – Subsidence Plan was not revised to include a post closure subsidence monitoring program to coincide with other closure period monitoring at the Copperwood site.

In response to MDEQ's current query on planned subsidence monitoring during operations and post closure, Copperwood Resources proposes to complete a revision of Orvana's Appendix 203.3.11 Subsidence Plan that will include a revised set of survey monument locations appropriate to the revised mine development plan included in the updated Feasibility Study, Copperwood Project, completed by GMining Services in July of 2018. The proposed plan will be submitted to MDEQ for review and approval prior to the start of mining operations with subsidence monitoring continuing during the post closure period until agreement by MDEQ that the monitoring can cease.

8. Provide an updated deposition analysis reflecting the revised dispersion modeling that was submitted to the MDEQ Air Quality Division.

Response: ***Pending completion by Foth***

9. Section 3.16 of Volume II of the Application, Environmental Impact Assessment (EIA) Amendment, states that the follow-up field surveys will be completed in the spring of this year, and an updated assessment on potential cultural, historical, and archaeological resources will be provided to the MDEQ. If these surveys have been completed, please provide the results. If they have not been completed, provide a revised schedule.

Response:
The field survey was completed in late May of 2018 and is attached as an addendum to this response document.

10. ***Section 3.17 of Volume II of the Application, EIA Amendment, mentions a mitigation measure/engineering control for emission sources to include "partial cover systems on the ore stockpiles." Explain this reference, including how this is accounted for in the mine plan.***

Response:
The reference to a partial cover system on the ore stockpiles is related to an earlier proposed design for a 24-hour capacity, outdoor ore storage facility that was has been replaced with enclosed bins for directly feeding ore to the process plant. There was never a partial cover system planned for the much larger, 620,000 tonne capacity, outdoor ore stockpile. The large outdoor stockpile is intended for storage of ore during the pre-production development period and to provide surge capacity whenever ore production from the underground mine exceeds the capacity of the enclosed bins that will directly feed the process plant.

Section 3.17 of the EIA should have been edited to remove the reference to "partial cover systems on the ore stockpiles" and replaced with the current emission source controls in the air permit application. Following are the current ore stockpile controls in the Copperwood Resources Fugitive Dust Control Plan (August 2018 revision):

> 3.2 Ore Stockpile
>
> Ore not directed to the Ore Bins/Reclaim Area will be transferred to the Ore Stockpile on a stacker belt conveyor. The feed conveyor will discharge material through an enclosed chute to the stockpile. Fugitive emissions may occur during management and handling of ore including movement from the discharge conveyor drop point, moving ore from the stockpile into the reclaim hopper using a front end loader and due to wind erosion.
>
> Particulate emissions will be controlled through enclosure of the discharge chute, and through work practices such as minimizing drop heights of the front end loader bucket. In addition, the particle size distribution for material in the stockpile shows the silt content to be only 2%, which should aid in minimizing particulate emissions.

11. ***Has additional baseline information been collected since issuance of the permit for surface water and/or biological resources?***

Response:
Since Orvana Resources US Corp. submitted their Part 632 mine permit application in

September of 2011 there has been a limited amount of groundwater, surface water and biological monitoring conducted at the Copperwood Project site, mostly in the expanded Copperwood project area of T49N R45W, Sections 6 and 7:

- July 2011 – Water levels and chemistry at 5 monitoring wells, water flow and chemistry at 1 surface water location.
- November 2011 – Water levels and chemistry at 5 monitoring wells, water flow and chemistry at 7 surface water locations.
- July 2012 – Water levels and chemistry at 5 monitoring wells, water flow and chemistry at 5 surface water locations.
- October 2012 – Water levels and chemistry at 4 monitoring wells, water flow and chemistry at 7 surface water locations.
- April 2013 – Bank full water flow assessments by during snow melt by King & MacGregor Environmental at select reaches of Gypsy and Namebinag Creeks near planned runoff diversions around the east and west sides of the Copperwood TDF.
- May thru August 2013 – Reptile and amphibian survey in the expanded project area of T49N R45W, Sections 6, 7, and 8 (Note: this was a special condition requirement of the issued MP 01 2012 permit).
- July 2013 – MDEQ Surface Water Assessment Section staff conducted targeted biological, chemical and physical habitat surveys near the mouths of Gypsy, Lehigh and Gijik Creeks in the Lake Superior coastal watershed where the Copperwood Project site is located.
- September 2013 – Redside Dace survey by US Forest Service staff to confirm presence, or not, and supply fin clip samples to assist an Ontario Ministry of Natural Resources genetic analysis of Redside Dace. Sampling was performed in the Unnamed and Namebinag Creeks at the Copperwood Project site where Redside Dace were found during the Copperwood baseline EIA for the Part 632 application.
- September 2013 – Water levels and chemistry at 8 monitoring wells, water chemistry at 4 surface water locations.

Since September of 2013 there has been no additional baseline surface water or biological information collected at the Copperwood Project site.

12. Clarify the total area of the TDF in acres. Explain the total area to be reclaimed in Table 9-1, Tailings Disposal Facility, Closure.

Response:

The area of the grading limits for the TDF, which includes the perimeter road, soil borrow area, and areas of excavation around the TDF are approximately 348 US Acres. The total area of the TDF within the outer toe of the dam is approximately 316 US Acres. The area of reclamation at the end of mine life is the closure cap, which encompasses the interior toe of the TDF, this equals approximately 240 US Acres, this is the number used for reclamation totals in Table 9-1, calculated in stages based on the sizing of the basins to be reclaimed.

13. Have alternatives been evaluated for tailings disposal since the permit was issued?

Response:

In May of 2018, Copperwood Resources submitted a Part 301, Part 303 and Part 325 permit application to the MDEQ for stream, wetland and Great Lakes bottomland impacts related to development of its proposed Copperwood Project (Submission Reference Number: HND-EQMB-E27HX). An updated Alternatives Analysis report with appendices was included as part of this application and subsequently revised in June 2018 in response to correction requests received from the MDEQ on the Copperwood application.

The following alternatives for a Tailings Disposal Facility (TDF) have been evaluated for tailings disposal:

- Alternative 1: Underground tailings disposal and on-site TDF
- Alternative 2: South on-site TDF
- Alternative 3: Center on-site TDF
- Alternative 4: North on-site TDF
- Alternative 4A: Reduced-footprint version of Alternative 4
- Alternative 4B: West berm moved east
- Alternative 4C: East berm moved west
- Alternative 5: Off-site TDF
- Alternative 6: On-site TDF over mine workings
- Alternative 7: White Pine mine site

The on-site TDF alternative 4B was selected as the most feasible and prudent (practicable) alternative for the proposed TDF. Alternative 4B is essentially the same TDF conceptual design as that of MP 01 2012 with the west berm moved about 100 feet east to accommodate a natural channel runoff diversion system. It also will occupy the same footprint as that of the previous Part 301 and Part 303 permit number 12-27-0050-P that expired in February 2018. Due to the factors discussed in the TDF analysis, the current mine plan incorporates the use of a TDF for the deposition of 100% of the tailings produced during the mine life.

The updated Alternatives Analysis report is included as an addendum to this response document as is the Golder Associates September 2012 memorandum to Orvana that evaluated the feasibility and practicality of backfilling the Copperwood mine with tailings.

14. What are the plans for the intake structure at closure?

Response:

Fate: If Copperwood Resources Inc. determines it no longer requires water supplied by the proposed water intake system (such as no future ore reserves to mine) and project site reclamation work is completed, there exist two possible fates for the water intake system.

a) Make a good faith effort to transfer the water intake system and permits issued by the US Army Corps of Engineers (USACE) and MDEQ to another party if that party will accept responsibility for maintaining the system in good order and compliance with permit conditions.

b) Develop an abandonment proposal and request approval from the USACE and MDEQ as a modification of the original permit conditions or apply for a new permit to allow for the abandonment activities.

Closure Plan: Copperwood Resources Inc. will propose the following preferred Alternative A to the USACE for abandoning the water intake system in place:

Alternative A - Install a plug in the intake pipe at a distance from the shoreline acceptable to the USACE and MDEQ to ensure no landward or near-shore contaminants can enter the intake pipe. Fill the pipe with grout to the plug location. The remainder of the buried offshore intake pipe and infiltration gallery will remain in place and filled with lake water to maintain back pressure on the pipe and prevent collapse. This alternative is preferred because it involves no physical disturbance of the lake bottom. All above-ground structures at the wet well pumphouse location will be removed. The wet well itself will be backfilled to its previously existing grade and replanted with native vegetation.

Alternative B - If grouting the landward and near shore segment of the intake pipe is not acceptable to the USACE or MDEQ, the alternative closure action will be to physically remove this segment of pipe, cap and re-bury the exposed end of the intake pipe, leave the remainder of the intake pipe and infiltration gallery in place, and restore the lake bottom and shoreline where the intake pipe was removed. Reclamation for the pumphouse and wet well will be the same as Alternative A.

15. Does the financial assurance take into account contractor profit?

Response:
Yes, Contractor profits are built into the engineering estimates for site reclamation work.

16. Verbal information request noted during a meeting with Copperwood Resources and MDEQ staff on August 22, 2018 in Wakefield, MI:

Tailings Disposal Facility - Provide an explanation of the decision to use a geomembrane liner rather than the previously permitted basin drainage blanket.

Response:
The previous decision to use a drainage blanket is the usual way of preventing horizontal water pressure on dams. In the case of the Copperwood project, the ore beneficiation

process requires to grind the ore at P80, 45 µm and down to 20 µm with the regrind circuit. Copperwood Resources believes that over a relatively short period of time, the blanket would plug and ultimately result in increased water pressure on the earth structure being created without having any way to repair or remediate the drainage system.

Using the liner may induce, for a short period, some water pressure on the dams while the initial tailings discharges create the protecting beaches. We believe that this induced water pressure will not structurally damage the dams. The TDF designer increased the safety factor by decreasing the outside slopes of the dams, from 2.5H: 1V to 3H: 1V.

In addition, Copperwood performed static settlement tests on the tailings material. The results show that within 24 hours the percent solids go from 30% to 43% without adding flocculants. Moreover, within 7 days it reaches 51% solids. It indicates that pumping the water from the supernatant pond would be as efficient as pumping the contained water from under the tailings material. Our opinion is that the liner solution is safer and more sustainable.