

Eagle Mine

a subsidiary of **lundin mining**

Eagle Mine
4547 County Road 601
Champion, MI 49814, USA
Phone: (906) 339-7000
Fax: (906) 339-7005
www.eaglemine.com

August 15, 2017

Ms. Melanie Humphrey
Michigan Department of Environmental Quality
Office of Oil, Gas, and Minerals
1504 West Washington Street
Marquette, MI 49855

**RE: Eagle East MPA Request – Additional for Information July 31, 2017
Eagle Mine LLC. Mine Permit MP012007**

Dear Ms. Humphrey

Eagle Mine LLC. (Eagle) received your letter from 31 July requesting additional information related to our mine permit amendment request. Please find, below, responses to your questions.

1. Q: Section 4.1.1: Is ore production for Eagle East anticipated to begin before development of the decline ramp is complete?

A: Ore production at Eagle East will begin in the first quarter of 2020, while the development of the decline continues into the second quarter of 2020. The decline will extend from the existing Eagle ore body to the top of the Eagle East deposit and, once there, will then continue to ramp down to the bottom of the deposit. Table 4-1 of the application does indicate level and vertical development in years 2017 and 2019. To clarify, that development is at Eagle in those years.

2. Q: It is anticipated that aggregate demand for backfilling of secondary stopes will exceed waste rock production at some point? If so, when will this occur in the development schedule?

A: The mine schedule indicates that we will begin importing aggregate to be used for backfilling secondary stopes in the third quarter of 2021. Eagle will notify your department when this import operation begins with results of our neutralization tests on the aggregate.

Currently, Eagle is hauling an average of 1000 tons per day to the mine for backfill. This is not expected to change greatly in 2021. When secondary stopes are being filled, the majority of primary stopes will have already been filled, so truck traffic is not likely to be doubled up to accommodate both aggregate sources; therefore remaining relatively steady. The air permit to install estimated just under 1600 tons per day of aggregate import and associated truck traffic in the emissions estimates, for comparison purposes.

3. Q: Does the TDRSA inventory shown in Figure 5-1 take into account limestone amendment and swell?

A: The calculations used to estimate the TDRSA inventory take swelling into account, but do not include volume from the limestone amendment. Limestone amendment is done at a rate of up to 2% of the total volume as required by permit, and is also verified through pH monitoring of leachate. If Figure 5-1 were to be updated to reflect an increase of 2% of the maximum development rock to take into account the limestone addition, the volume material stored on the TDRSA would be less than the ultimate storage capacity.

4. Q: Would the daily volume of material that is blasted increase if Eagle East is in production?

A: No, the total daily volume of material to be blasted is not expected to increase. In the feasibility study for Eagle East, the operational production capacity was assumed to remain steady state throughout the production time period. Additionally, conditions of Eagle's air permit to install (PTI), effectively, limit the underground production of combined ore and development rock as a control on the emissions produced by the mine.

5. Q: How is the impact of light currently mitigated, and will additional measures be considered?

A: During the construction period, Eagle changed lights at the mine site to minimize light pollution. This involved installation of "downcast" lights (specifically around the TDRSA and main access road) that project downward and not upward into the atmosphere. Eagle does not intend to install any additional lighting to facilitate development of Eagle East, so it is not expected that illumination of the mine site will increase due to mining Eagle East. Furthermore, in accordance with Mine Safety and Health Administration (MSHA) standards (30 CFR 56.17001), Eagle uses lighting to ensure adequate illumination for safety and security purposes, and as such, lights at the mine site have been designed to illuminate the surface facilities where work occurs at night, and also along the perimeter of the site for security management.

In an effort to understand the risk for adverse impacts to wildlife circadian rhythms, Eagle reviewed both the results of the annual mine area fauna studies, and the radiance levels of other areas of Marquette County to gauge whether the radiance from the mine site was appreciably more than what wildlife experience in other lit areas where there is no apparent impact to wildlife or growing environmental concern. The radiance levels from Eagle are similar to that of a gas station, and are less than the radiance that is measured on Presque Isle in Marquette, which appears to be comparatively minimal in Marquette County. Furthermore, the annual fauna surveys surrounding the mine site have detected no changes in wildlife population, distribution, or other forms of habitat disturbance. Due to this, Eagle does not currently have specific light mitigation measures planned. However, in the interest of continuous improvement, a lighting survey will be performed to confirm that illumination near the perimeter of the site is not excessive to meet security requirements, and possible reductions in lighting might then further decrease the environmental footprint of the mine site.

A portion of the illumination that is currently present is related to drill rigs at the adjacent exploration site which, as Eagle understands, is not considered under the purview of the permit to mine Eagle or Eagle East and temporary in nature. Please notify me if this is incorrect. Lighting at that site is done according to drilling industry standards for safety and security. The lights are powered down when the drill site is inactive.

6. Q: While subsidence is expected to be immeasurable at the ground surface above Eagle East, how will this be evaluated to confirmed in the long term?

A: Subsidence of the surface will be monitored through a combination of total station monument surveys, with Global Positioning System (GPS) surveys for redundancy. For this area, a minimum of three pre-mining surveys will be conducted to establish a baseline and eliminate discrepancies in monument positions. Check surveys to verify monument positions will be conducted on a regular basis during mining, then as required in accordance with a defined post-closure monitoring plan.

7. Q: Are impacts to infrastructure and utilities expected due to the extension of the expected Life of Mine? Is an increase in truck traffic anticipated?

A: No impacts to infrastructure or utilities will be needed to support the mine. Specifically speaking to electrical capacity, the expansion of underground electrical infrastructure will increase to the power requirements of the site, and the existing line power is sufficient to support those needs. During the feasibility study, engineers evaluated the backup power requirements to run fans and the emergency elevator (Alimak) of the mine in the event of an evacuation. The existing backup generator at the mine site has adequate capacity to power the ventilation system, which is the primary power requirement in an emergency. After the mine is completely evacuated, the generator has adequate power supply to run the water treatment plant (WTP). This backup power management program has been in effect since operations began and will remain in effect.

8. Q: Are the lands above the Eagle East deposit listed in the CFR program?

A: The land above the Eagle East ore body is owned by the State of Michigan (parcel 52-09-112-001-00) and as such is not subject to the CFR statute.

9. Q: Will microseismic monitoring be conducted at Eagle East? Are additional noise and vibration studies planned?

A: Eagle conducts regular noise and vibration studies at sites around the mine site. The last noise and vibration study was conducted in the fall of 2016. Results from the studies can be compared to the following standards and associated limits:

- 1. US EPA 24-hour noise exposure levels as prerequisites to protecting public health and welfare, where the upper limit is 55 decibels for nuisance noise.*
- 2. Alaska Department of Fish and Game blasting standards for protection of fish (PPV<2.0 in/sec).*

Noise monitoring at the mine site indicates that nearby receivers are unlikely to experience noise levels that occur above background ambient noise levels. Vibration monitors, some of which were

deployed immediately adjacent to the Salmon Trout River, did not detect vibrations above 2.0 in/sec during either of two blasts that occurred in the Eagle mine during the test period. Since Eagle East is much deeper than Eagle and a farther distance from the river, there are no vibration or noise impacts from underground mining that would be expected to exceed the already low levels of noise and vibration that have been measured.

Specific microseismic monitoring is not planned to be conducted at Eagle East, but noise and vibration studies will continue throughout operations, and the study designs are flexible and are likely to have stations added which would be intended to capture any data that may be measurable from Eagle East.

10. Q: How will "tight backfill" be achieved in the top-level stopes?

A: Tight backfill will be achieved through the following backfill process, which is in alignment with accepted industry practice:

- 1. An underground haul truck will empty buckets of cemented rock fill (CRF) into the heading.*
- 2. Using a loader with a front push rod, the loader will ramp up and push CRF tight to the back of the heading.*

Please contact me if you need additional information or have any questions concerning this response. We agree that the proposed decision can be postponed until August 17, 2017.

Respectfully,



Jennifer Nutini, P.E.
Environmental Engineer