Ministry of Northern Development and Mines, Natural Resources and Forestry

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MEMORANDUM: July 19, 2021

To: Marathon Palladium Project Joint Review Panel
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CC: Colin Hovi
Mineral Exploration & Development Consultant, MNDMNRF

From: Andrea Hanson, M.Sc., P.Geo.
Rehabilitation Specialist – Geoscience, MNDMNRF

Re: Marathon Palladium Project – MNDMNRF Rehabilitation Specialist Review

As requested, I have reviewed the Marathon Palladium Project Environmental Impact Statement (EIS) amended in 2021. The objective of this review was to i) review groundwater components and consider potential impacts to groundwater quality from the project; ii) review acid rock drainage and metal leaching potential components and consider potential impacts; and iii) consider the adequacy of information provided in regards to O. Reg 240/00, including Part 6 and Part 7 of the Mine Rehabilitation Code of Ontario (the Code).

Comments:

1. **Information Source:** EIS Section 1.5.2.3, Figure 1.5-3
   Legislative Reference: N/A
   Comment: Section 1.5.2.3 states, "*A combination of approaches are planned to be used to rehabilitate the open pits. The South and Central pits that have been utilized for mine rock storage or for process solids storage will be capped with Type 1 mine rock cover.*" However, Figure 1.5-3 shows the central pit as being water filled rather than capped at closure. Please clarify in the EIS for consistency.

2. **Information Source:** EIS Section 1.5.2.1, Table 1.5-1
   Legislative Reference: N/A
   Comment: Table 1.5-1 under the row "*Excavating and pre-stripping*" states, "*Any Type 2 material that is identified via testing in the Assay Lab will be segregated in a dedicated area adjacent to the pits for temporary management of Type 2 material so that its drainage will be contained and managed, as required*."

However, it is understood that temporary Type 2 storage piles adjacent to the pits are no longer a management method that will be used. Please clarify in Table 1.5-1 for consistency.

3. **Information Source:** EIS Figure 1.5-4, Figure 1.5-5
   Legislative Reference: O.Reg. 240/00 s.24 (2) item 19
   Comment: Figure 1.5-4 and Figure 1.5-5 show that only horizontal surfaces of the MRSA will be covered with overburden, topsoil and revegetated at closure. The sloped areas will remain a "rockfill slope". The Mine Rehabilitation Code (O.Reg. 240/00) s.24 (2) item 19 states that "*all disturbed sites shall be revegetated*". Further support (from qualified professionals, scientific studies) is needed to support the partial revegetation strategy proposed.

4. **Information Source:** EIS Figure 4-5.1
   Legislative Reference: O.Reg. 240/00 Part 6 s.53, s.55, Schedule 2 item 10 ii
   Comment: Figure 4.5-1 in Chapter 4 shows the groundwater monitoring network (2020) for the Marathon Project. However, details of the groundwater monitoring program proposed during the mine life, and post-closure are not detailed in the EIS (i.e. sampling frequency, parameters, seasonal timing). Please clarify if the groundwater monitoring program proposed is certified by a qualified professional (P.Geo/P.Eng) under the Mine Rehabilitation Code. Please elaborate on the proposed details of the groundwater monitoring program. Has consideration been given to monitoring site specific parameters (palladium) and other COPCS beyond those required by the O.Reg. 240/00 Part 6 s.53?

5. **Information Source:** EcoMetrix 2012 (SID#5) Geochemical Assessment of Mine Components at the Marathon PGM-Cu Project
   Legislative Reference: O.Reg. 240/00 Part 6 s.53, Schedule 2 item 10 ii
   Comment: What is the predicted level of Pd in seepage and groundwater from the site at closure and post closure? Pd does not appear to be included as a COPC in the water quality model. What water quality standards will be used for monitoring Pd in groundwater throughout operations and closure?

6. **Information Source:** 660 IR #17 from 2020, EcoMetrix 2012 (SID#5) Geochemical Assessment of Mine Components at the Marathon PGM-Cu Project**,** EcoMetrix 2021 Revision of the Sulphur Cut-off Value to Determine Type 1 (Non-PAG) and Type 2 (PAG) Mine Rock for the Marathon Palladium Project
   Legislative Reference: O.Reg. 240/00 Part 7 s.59
   Comment: It is understood that the proposed segregation method for Type 1 and 2 waste rock is a %S cut-off value of 0.18%. It is also understood that technology to identify the Type 1 and 2 material and on-going testing throughout operations, is also going to be used to identify and confirm the geochemistry of the waste rock material. However, there is a concern regarding the consideration of metal leaching with the proposed management method.

   The studies appended to support the %S cut-off value indicate that "*Other than sulphate and copper, the sulphur content has little to no effect on leaching rates below a sulphur content of 1%S*". The study also appears to indicate that for

other metals that could be leached from the material (Type 1 and 2 leaching), no correlation exists.

In the proponent's response to IR #17 states, "*all other COPCs except copper exhibit no correlation with sulphide or total sulphur at values below 1%S. The correlation between the copper leaching rate and the sulphide content below 1%S has a positive effect on the expected leaching rates in the MRSA. By excluding rock with a sulphur content greater than 0.3%, the expected geometric mean (geomean) sulphur content of rock in the MRSA is 0.04%S or about one-tenth of the cut-off value as shown in SID 5, Table 4.12. This translates to the lowest of the measured copper loading rates for rock in the MRSA*."

O.Reg. 240/00 Part 7 s.59 requires that management plans consider both acid rock drainage and metal leaching (including metal leaching under neutral conditions). Please provide more detail regarding how the proposed management plan considers the potential leaching of all metals of potential concern identified by the geochemistry studies.

7. **Information Source:** Marathon Palladium Project Water Management Discussion Presentation, May 26 21, Slide 7
   Legislative Reference: O.Reg. 240/00 Part 7 s.59
   Comment: The presentation given to the reviewers on May 26, 2021, slide 7, states that Type 2 waste rock will be placed in the PSMF Cell 2A location during year -1. During year -1 construction of the PSMF will only be starting on Cell 1 and the WMP will only start to be constructed. Please elaborate on how the drainage from this ARD/ML material will be managed during this time.

8. **Information Source:** SID 5**,** IR 9.9 from 2012, Marathon Palladium Project Water Management Discussion Presentation, May 26 21, Slide 7
   Legislative Reference: O.Reg. 240/00 Part 7 s.59
   Comment: This comment is regarding the onset to acidic conditions.

   IR 9.9 asks the proponent to provide more detail on "*how the Type 2 waste rock will be managed between the time of excavation and its eventual submergence*" in the open pits. In the proponent's response to IR 9.9, they state, "*While the neutralization potential in the rock will likely prevent acidification for many years to decades for the vast majority of the Type 2 rock, there may be some local acidic conditions generated in the rock prior to the relocation of the rock to the pits and full submergence after mine closure.*" They provide an estimated time for the water level in the pits to cover the Type 2 waste rock, which is 5 to 6 years after dewatering ceases. The proponent also provides mitigation measures for pit water quality, if required, as the pit fills to cover the Type 2 waste rock.

   SID 5 states, "*During mine operations, about 20 million tonnes of mine rock could have the potential to generate acid if left exposed for extended periods of time*."

   The presentation given to the reviewers on May 26, 2021, slide 7, states that Type 2 waste rock will be placed in the PSMF Cell 2A location during year -1. During year -1 construction of the PSMF will only be starting on Cell 1. However,

the proponent does not mention the timing to onset of acidic conditions for Type 2 material, other than the statements quoted above. Please elaborate on the timing of acidic conditions for the Type 2 waste rock material to be placed where Cell 2A of the PSMF will eventually be constructed, in year -1.

Are there mitigation measures for if acidic drainage conditions occur at the Type 2 waste rock placed in the Cell 2A location, prior to the waste rock being covered with water once the PSMF is fully constructed?

If you have any questions regarding the above comments, please do not hesitate to contact me. The purpose of the preceding review is to provide advice to the Ministry of Northern Development and Mines, Natural Resources and Forestry regarding matters pertaining to groundwater quality, acid rock drainage and metal leaching potential based on the information provided in the above referenced document(s). The conclusions, opinions, and recommendations of the reviewer are based on information provided by others, except where otherwise specifically noted; therefore, the Ministry cannot guarantee that the information is accurate or complete. A lack of specific comment by the reviewer is not to be construed as endorsing the content or views expressed in the material being reviewed.

Regards,

<Original signed by>

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