

August 2021

APPENDIX B

ARD/ML MANAGEMENT APPROACH



VALENTINE GOLD PROJECT: AMENDMENT TO THE ENVIRONMENTAL IMPACT STATEMENT

August 2021

IR Response Re: ARD/ML Assessment and Management:

Prior to submission of the EIS and to meet the requirements of the Federal and Provincial EIS guidelines, Marathon completed a Phase 1 and 2 Acid Rock Drainage (ARD)/Metal Leaching (ML) assessment, using methods that generally followed the Mine Environment Neutral Drainage (MEND) publication entitled "Prediction Manual for Characterizing Drainage Chemistry from Sulphidic Geologic Materials" (Price 2009). The geochemistry baseline program included:

- Static testing of approximately 350 samples of waste rock, ore, overburden and tailings for Acid-Base Accounting (ABA), Shake Flask Extraction (SFE), and total metals
- Characterization of composite samples using the static tests and a mineralogical methods
- Kinetic testing of composite samples including 14 humidity cells, two ageing tests and two subaqueous columns tests

Marathon recognizes that further ARD/ML work is required and is committed to completing further assessment and associated refinement of Project mitigation as design of the Project progresses. Note that the schedule for this additional work has been delayed by Covid-19 and resulting health and safety protocols that have limited the number of personnel allowed on site.

Specifically, Marathon is committed to completing the following additional work within the indicated timeframes:

- Continue collection of results from on-going laboratory and field tests in 2021. This work was started in 2020 and will continue until concentrations stabilize. It is expected that updated analysis will be conducted in Q4 of 2021.
- Additional static testing of samples in Q2 and Q3 of 2021:
 - to address deficiencies related to spatial distribution
 - to provide input required for ARD block models for Marathon Pit
 - to define availability and location of non-Potentially Acid Generating (non-PAG) rock, which is required for construction in Leprechaun and Marathon starter pits
- Initiate additional kinetic testing of Potentially Acid Generating (PAG) materials (waste rock, ore and low-grade ore) from major lithologies of the Marathon pit and composite sample of gabbro in Q2 of 2021. These samples will be submitted for static tests including Net Acid Generating (NAG) tests, mineralogy and particle size distribution similar to characterization of composite samples described in the EIS.
- Generate an ARD block model for Marathon pit to provide production schedules for ARD classes of rock and ore and to forecast location of PAG materials on pit walls; this will be completed in Q4 of 2021.
- Update water quality predictions based on available results of kinetic tests in Q4 of 2021.

Marathon will provide the above information and analysis to regulators for discussion and input through the proposed ARD/ML Management Plan. The ARD/ML Management Plan would contain the following sections:

- **Objective:** The objective of the ARD/ML management plan is to provide the most recent information and actions required to reduce the risks of ARD/ML during all phases of the Project.



VALENTINE GOLD PROJECT: AMENDMENT TO THE ENVIRONMENTAL IMPACT STATEMENT

August 2021

- **Project Components and activities:** This section will summarize Project components and activities which pose a potential ARD/ML risk.
 - **ARD/ML Assessment Summary:** This section will focus on current understanding of ARD/ML potentials related to each relevant component of the Project: the Marathon and Leprechaun pits, two waste rock stockpiles, two low grade ore (LGO) stockpiles, high grade ore (HGO) stockpile, tailings management facility (TMF) and rock quarries. The potential ARD/ML risks in these components will be (re)assessed for each phase of the Project based on the most recent results of geochemical testing, the ARD block model for the Marathon pit and updated predictions of water quality.
 - **Mitigation:** Mitigation of ARD/ML risks will be provided for each component and for each phase of the Project in the form of procedures. The following provide example procedures for the identification and the management of PAG rock and ore, but are subject to further refinement as the ARD/ML Management Plan is developed:
 - Samples of drill cuttings from blast holes representing each mine block will be collected.
 - The samples will be tested for total carbon and sulphur using LECO furnace or similar method. Average neutralization potential (NP) will be calculated from total carbon and average Acid Potential (AP) will be calculated from total sulphur using standard conversions per the MEND guidelines. If NP/AP ratios indicate the mine block rock is below 2, the block will be classified as PAG.
 - PAG rock will be marked after the blast, excavated, and dispatched to the waste rock stockpile. PAG rock would only be deposited within a specified distance (to be defined) of the final stockpile shell and preferably next to a non-PAG truck load. Truck load PAG rock will be marked and the coordinates recorded.
 - A portion of PAG and non-PAG rock loads will be mixed during grading each lift of the stockpile.
 - This mixture will be encapsulated with non-PAG rock deposited within a specified distance (to be defined) from the lift face and forming the topmost lift(s) on the final of the stockpile. Non-PAG rock will reduce oxygen flux into interiors of the pile and provide alkalinity to infiltrating water. This approach has been successfully applied for waste rock piles in other mine sites as referenced in Sections 6.6.3.5 and 6.6.3.6 of Global ARD management guide (<http://www.gardguide.com/index.php/Chapter>) and would be applicable to ARD/ML management at the Valentine Gold Project.
 - To limit exposure of PAG high grade ore, this material will be preferentially directed to the mill feed, while non-PAG high grade ore will be allocated to the stockpile, as long as the grade requirement for the mill feed is met.
 - LGO stockpiles will be constructed to maximize non-PAG material in the feed in the two last years of tailings deposition in the TMF, while simultaneously meeting the grade requirement for the mill. This approach will create a non-PAG layer of tailings on the surface of the TMF prior to placement of the soil cover. This layer will consume oxygen, reducing oxygen diffusion into tailings deposited earlier. In the last three years of operation, tailings will be deposited in the Leprechaun pit and immediately flooded limiting further oxidation and ARD/ML.
- This section will also detail progressive rehabilitation planned for waste rock and ARD/ML mitigation activities planned for the closure, such as dry and wet covers.
- **Monitoring:** This section will provide procedures for monitoring of contact water (e.g., the pit lakes) and solids (e.g., tailings). This section will include details on monitoring locations, lists of monitoring parameters and sampling frequencies for each phase of the Project.



VALENTINE GOLD PROJECT: AMENDMENT TO THE ENVIRONMENTAL IMPACT STATEMENT

August 2021

- **Adaptive Management:** The adaptive management section will discuss additional mitigations triggered by monitoring and/or by results of the updated water quality and ARD block model for Marathon pit. This section will describe how the current design of the Project can accommodate these mitigations. For example, if a certain volume of PAG waste rock cannot be accommodated within the waste rock stockpile at the Marathon pit at the end of operation, that volume could be stored within LGO stockpile footprint or west of the LGO. Another approach would be to build a seepage collection system and connect to the LGO sedimentation pond.

While the further analysis described above will allow refinement of the mitigation and adaptive management approaches to ARD/ML for the Project, Marathon is confident based on the analysis conducted to date that future work will not identify issues that cannot be addressed through the overall approach of:

- Preferential milling of PAG ore and stockpiling non-PAG ore
- Blending PAG and non-PAG materials
- Encapsulation of blended material within non-PAG rock
- Use of soil covers to limit infiltration and oxygen flux at closure
- Relocation of any excess of PAG rock remaining at closure to the mined-out pit, where it will be flooded
- Collection and treatment of contact water during operation

The ARD/ML management plan will be updated and revised as information is gathered during the permitting phase of the Project and in consultation with regulators.

