Valentine Gold Project Round 2 IRs – Supplemental (Acid Rock Drainage and Metal Leaching)

IR -1 Reference # (Original IR #)	IR #2 Number	Project Effects Link to CEAA 2012	Reference to EIS (including appendices)	Context and Rationale	Specific Question/ Proposed Follow-up Measure
IR-18	IR(2)-18	5(1)(a)(i) Fish and Fish Habitat	Baseline Study Appendix 5 Attachment 5-B Section 3.1.1, 4.1.1, and 4.3.1 and Appendix A	a. Cross-sections provided in Appendix IR-18.A are sufficient to demonstrate the locations of sample reported in BSA-5 of the EIS; however, some samples are represented with a black line (e.g. Section 16350E borehole MA-18-287, various samples) rather than the three colours (yellow, red, green) used to denote Net Potential Ratio (NPR) value ranges. Due to this potential formatting issue, it is difficult to confirm if there are spatial trends associated with potentially acid generating samples. Significant spatial gaps are noted at depth and in some areas of the pit walls. Per IR-23a, it is understood that spatial data gaps are being addressed in a new sampling program and that these samples have been collected; per IR(2)-23a, provision of this additional information would facilitate a more efficient review. b. It is agreed that longer sample intervals (i.e. greater than anticipated bench heights) can mask variability in mineral properties. However discreet sample intervals do not capture the overall composition of material at a block model and operational management level, especially when narrow intervals such as the mafic dykes and quartz porphyries, are grouped with other lithologies in the block model. It is understood that sample selection was, at least in part, based on gold grades, which are demonstrated to be variable along borehole MA-18-281 (Table IR-18.1). Per IR-19c the proponent states "gold mineralization correlates with sulphide content indicating that under sampled lithological units are likely to have lower acid rock drainage /metal leaching potential". Considering gold is hosted in quartz-tourmaline-pyrite veins, this assumption is not unreasonable. However, it does not preclude the possibility that sulphide mineralization is present in waste rock outside of the gold mineralized zones at lower levels that could cause either acid rock drainage or neutral mine drainage.	a. Provide updated cross sections that correct the formatting issue for some samples reported in Appendix IR-18.a, and include the sample locations and Net Potential Ratio values (if available) for the static test samples described in IR-23. b. For all waste rock, low grade ore and ore samples, provide a correlation analysis between gold grades and Acid Rock Drainage potential, sulphur, carbonate, and parameters of concern listed in Table 5-1 (except cyanide and nitrogen species) to support the use of gold grade for sample interval selection.
IR-19a	IR(2)-19a	5(1)(a)(i) Fish and Fish Habitat	Baseline Study Appendix 5 Attachment 5-A and 5- B	In IR19a, Marathon provided a detailed description of the source of construction materials to be used on the property, as well as an Acid Rock Drainage/Metals Leaching Management Plan. Testing of geological materials is required prior to their use for construction purposes on the site to confirm their suitability and low risk of developing acid rock drainage/metals leaching, and Marathon has initiated additional testing to address data gaps for some geological units. The preliminary Acid Rock Drainage/Metals Leaching Management Plan (Appendix IR-19A) provides a high-level approach to testing and management of geological materials during site operations. It is proposed that acid rock drainage will be determined using total sulphur and total carbon tested on blast hole chips, as surrogates for acid potential and neutralization potential, respectively. However, details were not provided in terms of the frequency of	a. Provide an updated Acid Rock Drainage/Metal Leaching Management Plan that considers testing and results completed subsequent to Appendix 5 Attached 5-A and 5-B. Include a preliminary conceptual approach to sampling and testing of mine rock, and how Marathon intends to integrate this information in the acid rock drainage/metal leaching block model. b. Justify the long-term approach to managing potentially acid generating waste rock should it not be accommodated within the waste rock stockpile

				blast chip testing, nor confirmatory testing at an independent laboratory using more advanced geochemical testing methods including acid base accounting and short term leaching tests. Further, no description was provided of how the Acid Rock Drainage/Metals Leaching block model will be integrated into operational testing and segregation of mine rock, and potentially acid generating rock sequencing to ensure that the proposed encapsulation of potentially acid generating rock within the stockpile is feasible. It is understood that the Acid Rock Drainage/Metals Leaching Management Plan is a live document that will be refined as the project advances and new information becomes available. In the Appendix IR-19A section titled “Adaptive Management”, it is stated “For example, if a certain volume of PAG (potentially acid generating) 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 (low grade ore) stockpile footprint or west of the LGO”. However, in IR-24c, Marathon stated, “The plan is that all low grade ore will be milled, however, if factors arise whereby the ore is not milled, any remaining low grade ore will be relocated to the open pit and flooded to avoid the need for water treatment after mine closure.” The approach to managing potentially acid generating waste rock at closure is not consistent with the plan for unmilled low-grade ore. Further, the suitability of the low grade ore stockpile footprint for long-term storage of potentially acid generating waste rock is not demonstrated.	at Marathon, particularly why this material would not be backfilled in Marathon Pit. Provide details on the approach to managing this material within the low grade ore footprint or to the west of it at the end of mine life to limit acid rock drainage/metals leaching in post-closure.
IR-21	IR(2)-21	5(1)(a)(i) Fish and Fish Habitat	Baseline Study Appendix 5 Attachment 5-B Section 3.1.2, 3.2.2,3.2.3, 4.0, 5.0Chapter 7 Appendix 7A and 7B	a. It is agreed that the composite samples presented in Tables IR-21.1 to IR-21.4 sufficiently represent the average chemical composition of each lithology, assuming that the sample population for each lithology that was used to generate the sample composites captures the chemical variability of the unit as a whole across the deposit. Per IR-21b, new samples were collected for static testing and humidity cell tests are underway on potentially acid generating samples. To allow for a complete understanding of the updated geochemistry testing program, and to address concerns on the reactivity of potentially acid generating material, this information should be provided. b. The results for the two carbonate-depleted samples in Appendix IR-21.A were provided, and were not included in BSA-5. However, the sample pre-treatment method to deplete carbonate minerals was not provided. Depending on the method used, this can influence the initial results, as reagents are flushed from the sample material (Herrell *et al.,* 2008)[1]. Since test weeks 1-4 were used by the proponent for various calculations, this should be evaluated. c. A conservative estimate of the lag time until potentially acid generating material could generate acid rock drainage is critical for mine waste and water management planning. Standard practice is to calculate the lag time from laboratory kinetic test results on potentially acid generating samples by applying various assumptions; this approach is theoretical and does not consider the increasing rate of acid production once acid rock drainage has commenced. It is agreed, that, based on non-potentially acid generating kinetic test samples available at the time of reporting in BSA-5, the proponent has applied a reasonably conservative approach to estimate the lag time for low-grade ore, as detailed in Appendix IR-21B. Discussion is provided comparing laboratory and field depletion rates and field bin depletion estimates are provided in Table 1 of Appendix IR-21B; however, field bin test methods and results have not been provided to date.	a. Provide updated versions of Tables IR-21.1 to IR-21.4 that include the new kinetic testing samples, with lithology statistics including all new samples collected to date in 2021. Include above median percentiles to facilitate evaluation of the conservativeness of the potentially acid generating samples. Note that these tables are also requested in IR-23. b. Provide a summary of the method used to deplete carbonate minerals from both carbonate-depleted humidity cell samples, and how this may have influenced the initial test results. c. Provide a summary of the methods and results to date for all field bin tests. Additionally, provide updated estimates of lag times for the generation of acid rock drainage based on the test work described in IR-23, and a discussion of how this may affect mine waste management planning and assumptions in the water quality model. d. Provide justification for using weeks 1-4 to develop the inflation factors and to calculate the metal loads from potentially acid generating materials for the water quality model. If acidic leachate has been achieved in the new humidity cell tests, develop new loading rates for potentially acid

[1] Herrell, M.K., C. McRae, K. Salzsauler, and J.S. Waples. Practical Application of Accelerated Methods of Acid Rock Drainage and Metal Leaching prediction of Mine Materials. Securing the Future and 8th International Conference on Acid Rock Drainage, Skellefteå, Sweden.

				Calculations should be updated when kinetic test data is available from potentially acid generating samples described in IR-23. Consideration should be given to the results reported by Sexsmith *et al.* (2015)[2]: when comparing calculated and observed lag times for 30 potentially acid generating kinetic test samples, it was noted that actual lag times are shorter than calculated times for the same sample. d. It is agreed that the proponent's approach to develop surrogate metal leaching rates for potentially acid generating materials, in lieu of metal loading rates from acidic kinetic test leachate, is adequate. However, the inflation factors, which were calculated using weeks 1-4 of the low-grade ore standard and carbonate-depleted humidity cells, cannot be replicated. Additionally, as discussed in IR(2)-21b, the reagent used to pre-treat the sample was documented to influence initial test results, resulting in lower initial metal loading rates in one case study (Herrell *et al*., 2008). The authors recommend calculating loading rates using later test weeks to flush residual reagents and deplete any remaining neutralization potential (Herrell *et al.*, 2008). The rationale for using weeks 1-4 was not provided, considering metal loading rates in the carbonate-depleted test are up to two orders of magnitude higher after week 10 compared with week 1-4 for the standard humidity cell, which are the maximum observed concentrations throughout the duration of testing. Justification for this approach is required if the loading rates will not be replaced with results from the current test program on potentially acid generating samples (IR-23), should acidic leachate be realized in these samples.	generating material. Otherwise, provide updated inflation rates using the longer-term concentrations from the carbonate-depleted humidity cell. In either case, provide results from sensitivity analyses using these new rates for potentially acid generating material.
IR-23	IR(2)-23	5(1)(a)(i) Fish and Fish Habitat	Baseline Study Appendix 5 Attachment 5-A and 5- B Section 2.0 Project Description Chapter 7 Appendix 7A and 7B	a. It is acknowledged that Marathon is committed to addressing data gaps in the baseline geochemistry program. These data gaps impart uncertainty to the calculated loading rates, timing to onset of Acid Rock Drainage, and mine waste management assumptions used in the water quality predictions (Chapter 7 of the EIS), and thus reduce the certainty of conclusions regarding mine impacts to the receiving environment and sufficiency of proposed mitigation measures. As indicated by Marathon, new test results will contribute to the refinement of the Acid Rock Drainage/Metals Leaching Management Plan, which will be shared with NRCan in future. However, the response to IR-23a is insufficiently detailed in terms of sample selection to confirm that all data gaps have been addressed. It is anticipated that the provision of additional information, including test data available to date, would facilitate a more efficient review process to ensure the testing plan is sufficiently robust to support the project design moving forward, especially in consideration of the long lead time required to complete geochemical sampling and testing programs. b. In Table IR-23.1, the pit wall exposure for the gabbro unit is 0 m^2 in the first two years, which suggests that this unit will not be mined in the first two years. As indicated in Appendix IR-19.A, potentially acid generating waste rock will not be used for construction purposes. Depending on the volumetric requirements and timing of construction rock needs, it appears that the gabbro unit, which may have potential to generate acid rock drainage based on test results in BSA-5 of the EIS, may not be mined early in the mine life, and thus not at a time of demand for construction materials.	a. Provide the following information: - Updated Tables B-1 and B-2 from BSA-5 of the EIS, including all new composite and kinetic test samples. - Re-issue Tables IR21.1 to IR21.4, adding the new kinetic test samples referred to in IR-23a, with updated statistics per rock type based on all static testing to date, including samples collected and tested as indicated in Tables IR-18.2 and IR-18.3).Note that these tables are also requested in IR-21. - Ensure that the gabbro composite was generated by using the four samples reported in BSA-5 of the EIS, or use samples collected in 2021. - Ensure that the new kinetic test samples will be tested for ABA, SFE and trace metals, in addition to net acid generating, mineralogy, and particle size distribution as indicated. - Ensure that net-acid generating leachate will be analyzed to provide additional data to support the development of acidic loading rates, as discussed in IR(2)-21d. - Ensure that the static and kinetic test results for the new samples will be provided prior to an update to the ARD/ML Management Plan during the permitting stage (IR-24a), and re-issue Appendix IR-20.A including preliminary data available to date for the new kinetic tests underway, as well as updated results for continued tests.

[2] Sexsmith, K., D. MacGregor, and A. Barnes. 2015. Comparison of Actual and Calculated Lag Times in Humidity Cell Tests. 10th International Conference on Acid Rock Drainage & IMWA Annual Conference. Santiago, Chile.

					b. Indicate that based on mine sequencing, the timing of excavation of the gabbro unit will coincide with demand for construction rock. c. Update the results of the sensitivity analysis per IR(2)-21.d.
IR-26	IR (2)-26	5(1)(a)(i) Fish and Fish Habitat	Chapter 7 and Baseline hydrology and surface water quality monitoring program (Appendix D Local water quality tables)	Per Table IR-24.3, mean and 95th percentile cadmium, iron, nickel, and zinc concentrations increased by more than a factor of 1.0 compared with the EIS model predictions. Table IR-24.2, which is supposed to present results of the sensitivity analysis, appears to be a repeat of Table IR-24.1, which is the original EIS predictions. Therefore, it is not possible to ascertain how close the predicted concentrations are to the Metal and Diamond Mining Effluent Regulations limits. Increases to metal loading rates discussed in IR(2)-21.d for potential acid generating low-grade ore could result in predicted concentrations above the Metal and Diamond Mining Effluent Regulations limits. If so, it would be critical to understand the threshold proportion of potential acid generating low-grade ore in the low grade ore stockpile to ensure this threshold is not exceeded over mine life.	Update the results of the sensitivity analysis per IR(2)-21.d and if applicable, determine the threshold proportion of potential acid generation low-grade ore in the stockpile required to maintain water quality predictions below the potential acid generating limits.
IR-41	IR(2)-41	5(1)(a)(i) Fish and Fish Habitat	Chapter 4: Assessment of Effects to Surface Water Appendix 7C – Assimilative Capacity Assessment Report	The EIS guidelines require a sediment quality analysis for key sites likely to receive mine effluents. Sediment quality is an important aspect of a healthy ecosystem especially in supporting fish health in the receiving environment. The proponent has conducted baseline sediment studies but has not modelled or predicted impacts to sediments nor is any monitoring program planned to evaluate sediment quality. While water quality modelling and monitoring programs give good information related to the health of the aquatic environment, continuous loadings of elevated contaminants of potential concern may be deposited to sediments over time which may then act as an ongoing source of contamination in the benthic environment which can affect fish health. Contaminants of potential concern in sediments in streams and rivers can be remobilized over time or during high flow events to create risks to downstream aquatic receptors.	Provide the time series plots of Al, As, AG, Cd, Cr, Cu, Fe, Mn, Hg, Se, U, Zn, NO_2,Cyanide, UN-NH_3, SO_4, F in sediments of Victoria Lake Reservoir, Valentine Lake and Victoria River throughout the project life cycle (construction, operation, closure and post-closure) to characterize the build-up of metal overtime in sediment. The plots must show monthly loading during operations and decommissioning. Update the effects assessment on fish and fish habitat accordingly.