MARATHON GOLD

September 8, 2021
IAAC Registry Project #: 005694

Attention: Brent Keeping
Project Manager
Impact Assessment Agency of Canada
301-10 Barters Hill Street
St. John's, NL A1C 6M1

Dear Mr. Brent Keeping,

Reference: Valentine Gold Project – Project Refinements

The Environmental Impact Statement (EIS) for the Valentine Gold Project (the Project), submitted to the Impact Assessment Agency of Canada (IAAC) by Marathon Gold Corporation (Marathon) on September 29, 2020, is currently undergoing technical review. Given your ongoing review and in keeping with Marathon's corporate value of transparency, Marathon wishes to keep IAAC apprised of proposed Project refinements.

Throughout the environmental assessment (EA) process, Marathon has continued to assess the design of the Project and apply refinements where required or appropriate, in consideration of engineering attributes and reducing environmental effects. The Project description presented in the EIS (Chapter 2) is based on the Prefeasibility Study (PFS) completed by Marathon in April 2020, noting that the PFS Project design incorporated feedback from regulators and stakeholders regarding the potential environmental effects of the Project as outlined in Section 2.1 of the EIS. Marathon has subsequently completed the next required phase of Project engineering, with results described in the Feasibility Study (FS). As expected, the FS confirmed the basis of design used in the PFS; therefore, only minor changes or refinements to the Project design have been identified and there are no substantive changes to the scope of the Project or planned Project components and activities.

Project refinement through on-going planning and engineering is part of the standard evolution of the development of a new mine. The refinements made to the Valentine Gold Project design, which are further described below, have resulted from several factors, including ongoing planning and engineering; feedback from regulators and other information received through the EA process, which have been used to reduce potential environmental effects where possible; and fluctuating market conditions. Note that no further refinements are anticipated by Marathon during the EA process.

This letter summarizes the Project design refinements resulting from the FS and potential implications for the EIS. Attachment A to the letter provides additional details on the proposed refinements, the rationale for these refinements, and implications for the environmental effects predicted for the Valued Components (VCs) assessed in the EIS. Note that the proposed Project refinements (as shown in Figure 1.1 of Attachment A) occur within the Project Area assessed in the EIS and will result in a slight decrease (0.8 ha) in the overall Project footprint (decrease of 0.1% of the total Project footprint).

The following are the main Project refinements proposed, with additional details provided in Table 1.1 of Attachment A:

- Modification of the tailings management facility (TMF) dam alignment to fully avoid and provide a buffer from the stream running west to east along the southern boundary of the TMF.
- Relocation of the polishing pond closer to the plant site.
- Refinements to stockpile and waste rock pile siting and footprints, as a result of engineering optimization and avoidance of fish habitat identified during ground-truthing.
- Optimization of water management infrastructure, including the consolidation of several ponds and reduced overall footprint.
- Modifications to the number and type of haul trucks and heavy equipment, as a result of engineering optimization.
- An extension of the Project's operating period from 12 years to 13 years, as a result of positive changes in the gold market since the PFS was completed.
- Transportation to site of a pre-mixed ammonium nitrate emulsion product, rather than shipping of individual components and manufacturing the emulsion on site.

Given the conservative assumptions adopted in the EIS and the relatively minor nature of the refinements, for most VCs, the predicted residual adverse effects, mitigation and monitoring as described in the EIS are not affected by the proposed refinements:

- For groundwater, given the minor nature of the refinements and the conservative estimate of the mass loading to surface water receivers from groundwater, the Project refinements do not alter the groundwater assessment provided in the EIS.
- For surface water, effluent discharge quality will continue to meet the *Metal and Diamond Mining Effluent Regulations* (MDMER) criteria and the effluent mixing zones described in the EIS remain valid.
- For fish and fish habitat, refinements in the TMF design and stockpile footprints will result in a small reduction in the area of direct habitat loss.
- There are no changes to the EIS assessment of habitat loss and/or alteration for terrestrial VCs, given that the Project refinements will occur within the Project Area and that the EIS conservatively assumed that all habitat would be lost within the Project Area.
- There are no changes to the EIS assessment of residual adverse effects for Indigenous groups, the socio-economic environment, and historic resources. The mine life extension will result in an extension to the positive economic effects predicted for the Project.
- While Project refinements to the numbers and types of mobile equipment will result in a small increase in the predicted sound levels during Project operation, the increase would not exceed the Health Canada criteria of 6.5% for highly annoyed conditions.

For some Project refinements, additional analyses were required to determine whether the assessment provided in the EIS remained valid. The results of these additional analyses are provided in Attachment A and summarized below:

- Refinements related to increased mine life and changes to mobile equipment are anticipated to increase the Project's GHG emissions (direct + indirect) by 6.3% during the peak operational year, and 13% over the life of the mine. However, based on these estimates and as described further in Attachment A, the overall conclusions of the assessment related to GHG emissions do not change.
- As described in Attachment A, the air quality model was updated based on the Project refinements. The results of the updated modelling are consistent with, or slightly lower than, the predicted concentrations presented in the EIS. The EIS predicted maximum 24-hour PM_{10} concentration above the Newfoundland and Labrador Ambient Air Quality Standard, and this remains the case for the updated model results. There were no other exceedances predicted and there were no exceedances predicted at the cabin locations, exploration camp, or the accommodations camp. Based on the

results of the updated dispersion modelling, the Project refinements do not result in changes to the predicted residual adverse effects or proposed mitigation described in the EIS.
- The Dam Break Analysis has been updated based on the Project refinements associated with the TMF. As described in further detail in Attachment A, the updated analysis has resulted in reduced potential effects to the downstream environment compared to those presented in the EIS due to changes in the tailings deposition plan, and relocation of the polishing pond away from the toe of the tailings dam.
- Fate and effects modelling has been conducted for a potential spill of pre-mixed ammonium nitrate emulsion during transportation to site. The predicted residual environmental effects from a spill of ammonium nitrate emulsion are consistent with those predicted in the EIS for a hazardous materials spill.

The proposed Project refinements do not constitute a substantive change to the scope of the Project, either individually or in combination. Given the conservative approach to the effects assessment employed in the EIS, the information presented in Attachment A demonstrates that no further environmental assessment is required related to these proposed Project refinements. The Project refinements do not result in changes to the characterization of residual adverse effects, proposed mitigation, or overall conclusions described in the EIS.

As described, since the submission of the EIS Marathon has continued to work to reduce potential Project-related environmental effects, including through several of the proposed Project refinements. Additionally, Marathon has progressed corporate commitments regarding environmental and social stewardship since submission of the EIS, including the following:

- Marathon has become a member of the Mining Association of Canada (MAC). As a MAC member, Marathon is committed to implementing the ‘Towards Sustainability Mining’ (TSM) initiative, including adopting the TSM guiding principles and conforming with the requirements set forth in the TSM protocols.

- Through TSM, Marathon is required to adhere to the TSM Tailings Management Protocol and Tailings Guide, which has been updated in 2021 to conform with the 2020 release of the International Council on Mining and Minerals’ Global Industry Standard on Tailings Management.

- Marathon has become a signatory to the International Cyanide Management Code and is designing the process facility and process water management system in this context.

- In early 2021, Marathon retained an external consultant to conduct a gap analysis of the Valentine Gold Project against the Equator Principles 4 (EP4) standards and International Finance Corporation (IFC) Performance Standards, used by Equator Principle Financial Institutions (EPFIs) to guide decisions regarding ESG risks for project financing. Marathon is currently implementing the EP4 Action Plan, developed following the gap analysis, including conducting additional biodiversity studies and assessments (Human Rights Risk Assessment and Climate Change Risk Assessment), and developing formal stakeholder engagement plans and grievance mechanisms for workers and communities.

- Marathon has initiated work to develop and implement an ISO 14001-conformant Environmental and Social Management System (ESMS). As per ISO 14001, ESMS scoping has been completed and the functional and workflow processes are currently being developed. It is anticipated that the ESMS will be functional prior to construction.

- Marathon continues to actively engage with communities, Indigenous groups, and stakeholders through in-person and virtual meetings, conference calls, correspondence, quarterly newsletters, notices, press releases, and social media and website updates.

- As part of Indigenous engagement, Marathon has entered into agreements with both Qalipu First Nation (Qalipu) and Miawpukek First Nation (MFN). In April 2021, Marathon and Qalipu concluded a Socio-Economic Agreement (SEA). The SEA provides the framework for a long-term, positive working relationship with Qalipu, and addresses matters such as ongoing engagement processes, training, employment and business opportunities for Qalipu members and Qalipu businesses, environmental stewardship and monitoring, and community investment. Marathon and MFN entered into a Memorandum of Understanding (MOU) in May 2021. The MOU provides for the undertaking of a Traditional Knowledge and Land and Resource Use study. Based upon the terms of the MOU, Marathon and MFN have committed to enter into negotiations with a view to concluding an SEA, similar to that which has been entered into with Qalipu.

Should you have any questions or concerns regarding the above or require additional information, please do not hesitate to contact the undersigned.

Regards,

Marathon Gold Corporation

<Original signed by>

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Attachment: Attachment A – Project Refinements Supplemental Information

c. Joanne Sweeney, Director, Environmental Assessment Division, Department of Environment and Climate Change
Eric Watton, Environmental Scientist, Environmental Assessment Division, Department of Environment and Climate Change
James Powell, Vice-President of Regulatory and Government Affairs, Marathon Gold Corp

Valentine Gold Project: Project Refinements, Supplemental Information

Attachment A

Marathon Gold Corporation
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September 2021

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1.0 PROJECT REFINEMENTS AND RATIONALE

Project refinements are a necessary and expected aspect in the evolution of a mining project throughout the progression of the Environment Assessment (EA), planning and permitting stages of a project. Key factors influencing refinements to the Valentine Gold Project since submission of the Environmental Impact Statement (EIS) (as described in Table 1.1) include:

- Ongoing feedback from regulators and other information received from the EA process, public consultation and engagement with Indigenous groups – where possible, the Project layout and design, and specific activities have been refined to reduce potential environmental effects.
- Engineering optimization –incorporating new and updated environmental and engineering data into the engineering design of the Project components and activities (e.g., further environmental baseline information, geotechnical data).
- Fluctuating market conditions – engineering studies are completed under Canadian Securities Regulatory Standards for Mineral Projects (National Instrument 43-101) requirements and must be updated based on changes in the market conditions (positive or negative). Further, the Newfoundland and Labrador (NL) *Mines Act* requires that all economically feasible minerals must be mined (and not sterilized or made uneconomical). As a result of positive changes in the gold market since the Pre-Feasibility Study (PFS) was completed, the Feasibility Study (FS) includes an extension of the Project operating period of approximately 1 year, or 8% of the original operating mine life (i.e., extension from 12 years to 13 years). Note that market conditions will continue to fluctuate (up and down) prior to and over the life of mine and may continue to affect the operating period, increasing or decreasing based on gold prices.

Due to the above-noted factors, refinements to the Project description have been made since it was presented in Chapter 2 of the EIS. These refinements are described below in Table 1.1, which is referenced to Figure 1.1. Note that all of the proposed Project refinements occur within the Project Area assessed in the EIS and combined will result in a slight decrease (0.8 ha) in the overall Project footprint (decrease of 0.1% of the total Project footprint).

The proposed Project refinements do not constitute a substantive change to the scope of the Project, either individually or in combination. Given the conservative approach to the effects assessment employed in the EIS, the information presented in Section 2 of this document demonstrates that no further environmental assessment is required related to these proposed Project refinements. Note that Marathon Gold Corporation (Marathon) does not anticipate further Project refinements during the EA process.

Table 1.1 Refinements to the Project Description

Corresponding # on Figure 1.1	Project Refinement	Rationale for Refinement
Tailings Management Facility (TMF)		
1	The tailings impoundment dam alignment has been altered and the footprint of the tailings impoundment has been reduced by approximately 5 hectares (ha) (approximately 3%).	The dam alignment has been shifted slightly, primarily along the south and east dam areas, in order to optimize the design (improve tailings storage efficiency without changing the dam height), improve dam safety, and entirely avoid the small stream running along the southern end of the impoundment. The footprint of the TMF has been reduced slightly, and the overall dam safety has been improved due to the new dam alignment following flatter topography.
2	The polishing pond has been relocated closer to the process plant area.	Relocation of the polishing pond results in several improvements: • Reduces the potential effects of a tailings impoundment dam breach in the former pond location (toe of dam to the east of the TMF) • Reduces piping lengths between the process plant and polishing pond, and eliminates pipelines along the crest and downstream slope of the tailings impoundment dam • Proximity to process plant improves accessibility for monitoring and surveillance
Mine Infrastructure		
3	Low-grade ore stockpile footprints have increased (by approximately 1 ha or 10% for Leprechaun and approximately 3 ha or 21% for Marathon).	Increase in footprint of 10 to 20% due to an increase in overall ore extraction and life of mine based on the increased gold price. Stockpile remains in same location with a perimeter expansion to account for additional ore rock and to provide stream/waterbody buffers/setbacks. Water Management through perimeter drains to collection ponds remains the same.
4	Minor changes to the waste rock pile footprints (Marathon has increased by approximately 2 ha or 2% and Leprechaun has decreased by approximately 8 ha or 5%).	Minor changes have been made to the Marathon waste rock pile footprint to provide additional distance (buffer) between the toe of the pile and fish habitat along the southeast side of the pile, and to address topography and geotechnical data collected in 2020. There is an overall increase in footprint of approximately 2 ha. The Leprechaun waste rock pile footprint (perimeter) has been modified slightly to provide consistent buffers to fish habitat. Overall, the footprint has been reduced by approximately 8 ha.

Table 1.1 Refinements to the Project Description

Corresponding # on Figure 1.1	Project Refinement	Rationale for Refinement
5	Minor relocation of topsoil stockpiles (approximately 440 m northeast for Leprechaun and 315 m north for Marathon) and footprints increased (approximately by 0.06 ha for Leprechaun and approximately 0.55 ha for Marathon).	The Leprechaun topsoil stockpile has been relocated a short distance east due to a change in the ramp/access for Leprechaun pit and to improve water/seepage management for this pile. The increased footprints are related to increased volume of topsoil based on improved delineation from advanced geotechnical studies. The Marathon topsoil stockpile has been relocated a short distance north to provide more buffer between the pond and the adjacent stream, and to improve ditching and water management in this area.
6	The Leprechaun overburden stockpiles were combined and the overall footprint decreased (approximately 3 ha or 19%). No changes to the Marathon overburden stockpile.	The Leprechaun overburden stockpiles (originally two stockpiles) have been combined into one and the overall footprint has been reduced by nearly 20%. This change was made due to the discovery (through ground-truthing) that the stream located between the piles was further west than presented on provincial mapping. As a result, a single stockpile design was possible to the east of the stream, which also reduces the overall footprint of the pile and reduces water management infrastructure.
7	The Leprechaun pit slope and perimeter has been adjusted slightly along the southwest and northeast crests, resulting in an increased footprint (approximately 6 ha or 11%). No changes to the Marathon open pit.	Further pit slope assessments have determined that a minor flattening of the pit slope is required along the southwest portion of the pit, and the pit ramp has been adjusted to exit in the northeast/east portion of the pit.
Water Management Infrastructure		
8 (not numbered on Figure 1.1)	Change to the shape and a reduction in the size of the water management pond adjacent to the Marathon topsoil stockpile, and two ponds northwest of the overburden stockpile combined into one.	The number of water management ponds at the Marathon and Leprechaun complexes has been reduced from 16 to 12 ponds. The FS design allowed for the low head pond embankments to be combined, with relatively minor increases in height and volume, thereby reducing the combined pond footprints. In addition, some ponds were relocated to low lying areas, following confirmation that the ponds / watercourse in these areas are not fish habitat.
9 (not numbered on Figure 1.1)	Given the changes to the overburden stockpile and engineering optimization, the Leprechaun water management infrastructure has been refined to consolidate several ponds and reduce overall footprint.	
Other Refinements		
10	The accommodations camp (pad) has been relocated approximately 245 m northeast.	The accommodations camp has been rotated and shifted approximately 245 m northeast to reduce earthworks requirements and potential effects to an adjacent, small wetland. There is no change in the size of the camp.

Table 1.1 Refinements to the Project Description

Corresponding # on Figure 1.1	Project Refinement	Rationale for Refinement
11	The process plant / mine services layout has been changed.	The layout / arrangement of the process plant and mine services area has been altered to address water management and health and safety related issues, as well as engineering optimization. The overall footprints are approximately the same as presented in the EIS. The design of selected point sources (dimensions and orientations of release stacks / vents) at the processing plant was updated to reduce effects to the atmospheric environment.
12 (not shown on Figure 1.1)	Transporting a pre-mixed ammonium nitrate emulsion product to site is being considered rather than shipping of the individual components to the mine site and manufacturing the emulsion on site.	Use of the pre-mixed product eliminates the need for onsite explosives manufacturing and the requisite mixing plant (including the associated operational challenges and risks) and decreases the estimated overall power consumption at site by approximately 5%. The supplier of the pre-mixed product is a locally based (Corner Brook, NL) company, which employs local personnel.
13 (not shown on Figure 1.1)	Changes to the number and types of haul trucks and heavy equipment to be used.	Continued assessment of rock quality, mine design, and equipment options and matching have resulted in the identification of efficiencies in equipment size and numbers. These efficiencies ultimately reduce fuel usage and associated greenhouse gas (GHG) emissions, as the proper equipment selection includes the optimization of fuel usage relative to tonnes moved (as an operating cost).

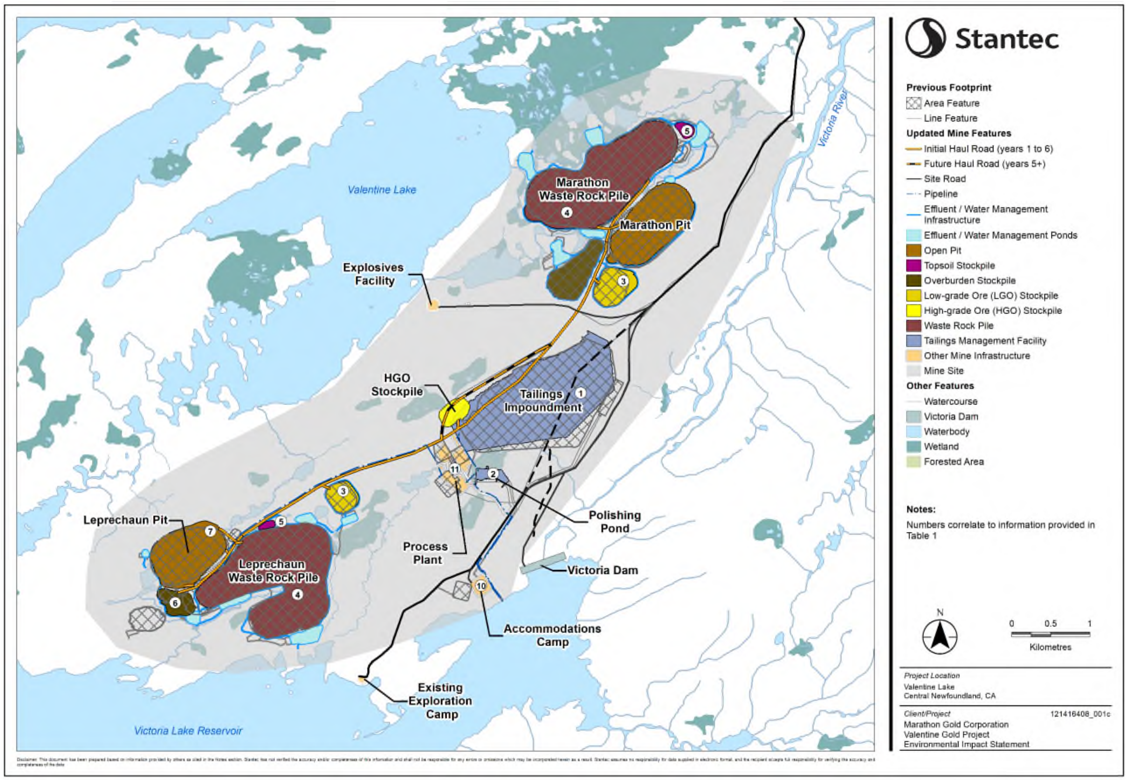


Figure 1.1 Updated Project Layout and Comparison to EIS Site Layout

2.0 IMPLICATIONS FOR THE ENVIRONMENTAL ASSESSMENT

In consideration of the Project refinements described above, a review of the potential impacts to the assessment of valued components (VCs) described in the EIS has been conducted and is provided below.

Note that the geographic boundaries (i.e., Project Area, Local Assessment Areas (LAA) and Regional Assessment Areas (RAA)) described in the EIS for each VC have not changed as a result of the Project refinements. Based on the extension of the mine life by one year, the temporal EA boundary for the operation phase of the Project would extend by one year, therefore the duration of effects associated with Project operation would also extend by one year. The mitigation and monitoring proposed in the EIS to reduce residual effects associated with operation would continue to be effective and applicable throughout the mine life extension.

2.1 ATMOSPHERIC ENVIRONMENT

An assessment for Atmospheric Environment (Chapter 5) was provided in the EIS. The following effects were assessed for this VC:

- Changes in air quality
- Change in greenhouse gas (GHG) emissions
- Change in sound quality
- Change in light levels

The refinements to the design of the TMF and the topsoil, overburden, low and high-grade ore stockpiles and waste rock piles do not alter the findings of the EIS with respect to a change in air quality, GHG emissions, sound quality, or light levels within the LAA. With respect to air quality, the change in location/elevation of the TMF may result in some minor changes related to fugitive dust generated from wind erosion of the tailing beaches; however, these changes are not expected to substantively influence the resulting ambient concentrations of dust or trace metals within the LAA. Minor changes to the releases of fugitive dust from the storage piles are also not likely to result in a substantive change in the resulting downwind ambient concentrations. The assessment of air quality, GHG emissions, sound quality, or lighting levels in the LAA will not change as a result of refinements to water management infrastructure, emulsion mixing approach and other minor refinements. The effects associated with the mine life extension (i.e., additional year of operation) will result in an overall increase in release of GHG emissions (see Table 2.4). An updated GHG emissions inventory is included, and discussed further, below.

The refinements to the numbers and types of mobile equipment result in some larger equipment types being used (e.g., haul trucks, excavators and drills) which will result in some increases in noise levels, and in the quantities of air contaminants and GHGs released to the atmosphere as described further below.

In terms of air quality, since overall emissions and emissions from individual sources (specific pieces of equipment) are expected to increase, additional dispersion modelling has been conducted to assess the potential effects on a change in air quality as a result of the updated number and types of mobile equipment expected to be onsite. In addition to the refinements to the mobile equipment, the following Project refinements were also incorporated into the updated modelling:

- The location and layout of the processing plant (as shown in Figure 1.1).
- The design of selected point sources (dimensions and orientations of release stacks / vents) at the processing plant was updated.
- Particle size fraction information for updated estimates of PM_{10} and $PM_{2.5}$ releases from the processing plant sources (based on average particle size fraction information for the crushed ore) were incorporated in the model.
- The semi-autogenous grinding (SAG) mill conveyor drop point and intensive leaching feed hopper (ore processing / handling sources) were removed from the model. These operations are enclosed and/or under negative pressure and are therefore not expected to result in measurable air contaminant releases to the atmosphere.

Table 2.1 provides a summary of the revised annual releases of air contaminants from the Project based on the refinements described above compared with those presented in the EIS.

Table 2.1 Revised Air Contaminant Emissions – Annual Totals

Air Contaminant	CAS #	Emission Rate (tonnes/year)		Percent Change
		Estimates Presented in EIS	Revised Estimate	(%)
TSP	N/A-1	1,581	1,466	-7%
PM_{10}	N/A-2	611	575	-6%
$PM_{2.5}$	N/A-3	119	109	-8%
NO_X	10102-44-0	782	820	5%
SO_2	7446-09-5	234	251	7%
CO	630-08-0	1,306	1,319	1%
HCN	74-90-8	3.63	3.63	0%
NH_3	7664-41-7	3.70	3.70	0%
As	7440-38-2	2.13E-03	2.10E-03	-2%
Cd	7440-43-9	1.92E-04	1.89E-04	-2%
Cu	7440-50-8	2.13E-02	2.10E-02	-2%
Pb	7439-92-1	5.17E-03	5.08E-03	-2%
Hg	7439-97-6	1.05E-04	1.03E-04	-1%
Ni	7440-02-0	1.63E-03	1.60E-03	-2%
Zn	7440-66-6	3.91E-03	3.84E-03	-2%
Ba	7440-39-3	3.78E-03	3.72E-03	-2%
Sr	7440-24-6	4.58E-03	4.49E-03	-2%
Be	7440-41-7	2.10E-05	2.07E-05	-2%

Table 2.1 Revised Air Contaminant Emissions – Annual Totals

Air Contaminant	CAS #	Emission Rate (tonnes/year)		Percent Change
		Estimates Presented in EIS	Revised Estimate	(%)
Cobalt	7440-48-4	1.29E-03	1.27E-03	-2%
Li	7439-93-2	4.26E-03	4.19E-03	-2%
Sb	7440-36-0	5.49E-03	5.40E-03	-2%
Sn	7440-31-5	8.07E-03	7.94E-03	-2%
Se	7782-49-2	6.40E-03	6.29E-03	-2%
Cr	7440-47-3	1.18E-02	1.16E-02	-2%
Bi	7440-69-9	2.13E-03	2.10E-03	-2%

The updated modelling uses the same methodology and other inputs as those used in the EIS (described in Section 5.5.1 of the EIS).

A summary of the results of the model update is provided in Table 2.2 and Table 2.3. The overall maximum predicted concentrations (outside the Project Area) are provided in Table 2.2. The maximum predicted concentrations at the discrete receptor locations evaluated (cabins and the new locations of accommodations and exploration camps) are provided in Table 2.3. For comparison, the model results presented in the EIS are also provided in each table. In each table, the predicted concentrations combined with the measured background concentrations are compared with the relevant Newfoundland and Labrador Ambient Air Quality Standard (NL AAQS) or adopted standard for the assessment (Ontario Air Contaminant Benchmarks [ACB] or Canadian Ambient Air Quality Standard [CAAQS]).

Table 2.2 Maximum Predicted Concentrations – Model Updates

Contaminant	CAS#	Average Period	Background Concentrations (µg/m³)	Predicted Concentrations Incl. Background (µg/m³)		NL AAQS (µg/m³)	2020 CAAQS (µg/m³)	2025 CAAQS (µg/m³)	Ontario ACB (µg/m³)	Percent of NL/Adopted Standard	
				Prediction from EIS	Revised Prediction					Prediction from EIS	Revised Prediction
TSP	N/A-1	24-hour	13.8	119	118	120	-	-	-	99%	99%
	N/A-1	Annual	2.6	4.95	5.2	60	-	-	-	8%	9%
PM_{10}	N/A-2	24-hour	13.0	**65.7**	**65.2**	50	-	-	-	**131%**	**130%**
$PM_{2.5}$	N/A-3	24-hour	10.3	21.3	20.0	25	27.0	NA	-	85%	80%
	N/A-3	Annual	3.8	5.08	4.57	8.8	8.8	NA	-	58%	52%
DPM	N/A-4	2-hour	-	19.2	23.4	-	-	-	-	-	-
	N/A-4	Annual	-	0.099	0.114	-	-	-	-	-	-
NO_2	10102-44-0	1-hour	3.8	169	194	400	112.9	79	-	42%	48%
	10102-44-0	24-hour	1.9	72.6	77.2	200	-	-	-	36%	39%
	10102-44-0	Annual	1.4	8.53	7.9	100	32.0	28.2	-	9%	8%
SO_2	7446-09-5	1-hour	2.6	341	461	900	183.4	170	-	38%	51%
	7446-09-5	3-hour	2.6	206	274	600	-	-	-	34%	46%
	7446-09-5	24-hour	neg.	75.3	97.0	300	-	-	-	25%	32%
	7446-09-5	Annual	neg.	2.69	3.42	60	13.1	10.5	-	4%	6%
CO	630-08-0	1-hour	206	1,634	1,863	35,000	-	-	-	5%	5%
	630-08-0	8-hour	200	923	1055	15,000	-	-	-	6%	7%
NH_3	7664-41-7	24-hour	neg.	3.42	5.10	100	-	-	-	3%	5%
HCN	74-90-8	24-hour	neg.	3.87	4.93	-	-	-	8	48%	62%
As	7440-38-2	24-hour	2.1E-03	4.95E-03	4.95E-03	0.3	-	-	-	2%	2%
Cd	7440-43-9	24-hour	4.2E-04	6.34E-04	6.34E-04	2	-	-	-	<1%	<1%
Cu	7440-50-8	24-hour	1.3E-03	1.85E-02	0.0185	50	-	-	-	<1%	<1%
Pb	7439-92-1	24-hour	1.3E-03	6.00E-03	6.00E-03	2	-	-	-	<1%	<1%
	7439-92-1	30-day	5.0E-04	2.32E-03	2.32E-03	0.7	-	-	-	<1%	<1%
Hg	7439-97-6	24-hour	neg.	3.07E-04	4.48E-04	2	-	-	-	<1%	<1%
Ni	7440-02-0	24-hour	2.1E-03	3.37E-03	3.37E-03	2	-	-	-	<1%	<1%
Zn	7440-66-6	24-hour	2.1E-02	3.01E-02	3.01E-02	120	-	-	-	<1%	<1%
Ba	7440-39-3	24-hour	2.1E-03	1.20E-02	1.20E-02	-	-	-	10	<1%	<1%
Sr	7440-24-6	24-hour	2.1E-03	9.47E-03	9.47E-03	-	-	-	120	<1%	<1%
Be	7440-41-7	24-hour	1.3E-03	1.32E-03	1.32E-03	-	-	-	0.01	13%	13%
Cobalt	7440-48-4	24-hour	1.3E-03	2.25E-03	2.25E-03	-	-	-	0.1	2%	2%
Li	7439-93-2	24-hour	neg.	3.44E-03	3.44E-03	-	-	-	20	<1%	<1%
Sb	7440-36-0	24-hour	2.1E-03	5.87E-03	5.87E-03	-	-	-	25	<1%	<1%
Sn	7440-31-5	24-hour	1.3E-03	7.41E-03	7.41E-03	-	-	-	10	<1%	<1%
Se	7782-49-2	24-hour	4.2E-03	1.16E-02	1.16E-02	-	-	-	10	<1%	<1%
Cr	7440-47-3	24-hour	2.1E-03	1.19E-02	1.19E-02	-	-	-	0.5	2%	2%
Bi	7440-69-9	24-hour	2.1E-03	4.37E-03	4.37E-03	-	-	-	2.5	<1%	<1%

Table 2.3 Maximum Predicted Concentrations at Cabin Locations – Model Updates

Contaminant	CAS#	Average Period	Background Concentrations ($\mu g/m^3$)	Predicted Concentrations Incl. Background ($\mu g/m^3$)		NL AAQS ($\mu g/m^3$)	2020 CAAQS ($\mu g/m^3$)	2025 CAAQS ($\mu g/m^3$)	Ontario ACB ($\mu g/m^3$)	Percent of NL/Adopted Standard	
				Prediction from EIS	Revised Prediction					Prediction from EIS	Revised Prediction
TSP	N/A-1	24-hour	13.8	44.8	43.6	120	-	-	-	37%	36%
	N/A-1	Annual	2.6	3.39	3.34	60	-	-	-	6%	6%
PM_{10}	N/A-2	24-hour	13.0	27.2	27.2	50	-	-	-	54%	54%
$PM_{2.5}$	N/A-3	24-hour	10.3	15.5	13.4	25	27.0	NA	-	53%	53%
	N/A-3	Annual	3.8	4.20	4.02	8.8	8.8	NA	-	46%	46%
DPM	N/A-4	2-hour	-	3.46	4.21	-	-	-	-	-	-
	N/A-4	Annual	-	0.034	0.039	-	-	-	-	-	-
NO_2	10102-44-0	1-hour	3.8	87.7	91.7	400	112.9	79	-	23%	23%
	10102-44-0	24-hour	1.9	48.5	54.7	200	-	-	-	27%	27%
	10102-44-0	Annual	1.4	4.25	4.58	100	32.0	28.2	-	5%	5%
SO_2	7446-09-5	1-hour	2.6	65.0	83.1	900	183.4	170	-	9%	9%
	7446-09-5	3-hour	2.6	37.6	48.7	600	-	-	-	8%	8%
	7446-09-5	24-hour	neg.	17.4	22.3	300	-	-	-	7%	7%
	7446-09-5	Annual	neg.	0.92	1.16	60	13.1	10.5	-	2%	2%
CO	630-08-0	1-hour	206	507	545	35,000	-	-	-	2%	2%
	630-08-0	8-hour	200	363	385	15,000	-	-	-	3%	3%
NH_3	7664-41-7	24-hour	neg.	1.55	1.68	100	-	-	-	2%	2%
HCN	74-90-8	24-hour	neg.	1.52	1.62	-	-	-	8	20%	20%
As	7440-38-2	24-hour	2.1E-03	3.50E-03	3.50E-03	0.3	-	-	-	1%	1%
Cd	7440-43-9	24-hour	4.2E-04	5.25E-04	5.25E-04	2	-	-	-	<1%	<1%
Cu	7440-50-8	24-hour	1.3E-03	9.73E-03	0.0097	50	-	-	-	<1%	<1%
Pb	7439-92-1	24-hour	1.3E-03	3.60E-03	3.60E-03	2	-	-	-	<1%	<1%
	7439-92-1	30-day	5.0E-04	1.39E-03	1.39E-03	0.7	-	-	-	<1%	<1%
Hg	7439-97-6	24-hour	neg.	1.43E-04	1.47E-04	2	-	-	-	<1%	<1%
Ni	7440-02-0	24-hour	2.1E-03	2.72E-03	2.72E-03	2	-	-	-	<1%	<1%
Zn	7440-66-6	24-hour	2.1E-02	2.55E-02	2.55E-02	120	-	-	-	<1%	<1%
Ba	7440-39-3	24-hour	2.1E-03	6.91E-03	6.91E-03	-	-	-	10	<1%	<1%
Sr	7440-24-6	24-hour	2.1E-03	5.70E-03	5.70E-03	-	-	-	120	<1%	<1%
Be	7440-41-7	24-hour	1.3E-03	1.31E-03	1.31E-03	-	-	-	0.01	13%	13%
Cobalt	7440-48-4	24-hour	1.3E-03	1.77E-03	1.77E-03	-	-	-	0.1	2%	2%
Li	7439-93-2	24-hour	neg.	1.69E-03	1.69E-03	-	-	-	20	<1%	<1%
Sb	7440-36-0	24-hour	2.1E-03	3.95E-03	3.95E-03	-	-	-	25	<1%	<1%
Sn	7440-31-5	24-hour	1.3E-03	4.30E-03	4.30E-03	-	-	-	10	<1%	<1%
Se	7782-49-2	24-hour	4.2E-03	7.82E-03	7.83E-03	-	-	-	10	<1%	<1%
Cr	7440-47-3	24-hour	2.1E-03	6.89E-03	6.89E-03	-	-	-	0.5	1%	1%
Bi	7440-69-9	24-hour	2.1E-03	3.21E-03	3.21E-03	-	-	-	2.5	<1%	<1%

The results of the updated modelling are generally consistent with, or slightly lower than, the predicted concentrations presented in the EIS. The maximum predicted 24-hour PM_{10} concentration (including background) was above the NL AAQS (similar to the results of the EIS). There were no other exceedances predicted. There were no exceedances predicted at the cabin locations or exploration camp, or at the revised location of the accommodations camp (maximum predictions at camp / cabin locations are shown in Table 2.3).

Based on the results of the updated dispersion modelling, the Project refinements do not result in changes to the characterization of residual adverse effects, proposed mitigation, or overall conclusions described in the EIS.

For GHG emissions, based on the increased mine life and changes to mobile equipment, it is anticipated the GHG emissions (direct + indirect) will increase by 6.3% during the peak operational year, and 13% over the life of the mine over the GHG release estimates presented in the EIS. A summary of changes to the GHG emissions is provided in Table 2.4. The GHG emissions are compared to the annual provincial and national GHG totals. The annual GHG emissions for each year of operation of the mine, both for releases as presented in the EIS and based on the proposed Project refinements, are provided in Appendix A.

Table 2.4 Estimated Contribution of Operation GHG Emissions to Federal and Provincial Totals

Parameter	Units	Total (expressed as CO_{2e})	
		Estimate Presented in EIS	**Revised Estimate**
Operation GHG Emissions (direct and indirect) [A]	t/y	92,118	97,283
NL GHG Emissions [B, C]	t/y	11,000,000	11,000,000
National GHG Emissions [B, C]	t/y	729,000,000	729,000,000
Project Operation Contribution to NL GHG Emissions	%	0.8%	0.88%
Project Operation Contribution to National GHG Emissions	%	0.01%	0.01%

Notes:
[A] Indirect emissions include electricity and fuel associated with shipping product and delivery of consumables
[B] Provincial and national GHG emission totals from ECCC NIR (ECCC 2020b)
[C] Provincial and national GHG emission totals include other fluorinated GHGs

Based on these estimates and given that the increases in GHG emissions due to the Project refinements are relatively minor, the Project refinements do not result in changes to the characterization of residual adverse effects, proposed mitigation, or overall conclusions described in the EIS for GHG emissions.

With respect to a change in sound quality, the Project refinements to the numbers and types (i.e., larger) of mobile equipment will likely result in a small increase in the predicted sound levels during Project operation, however, the increase is not expected to result in a change in highly annoyed conditions that exceeds the Health Canada criteria of 6.5%. Therefore, the Project refinements do not result in changes to the characterization of residual adverse effects, proposed mitigation, or overall conclusions described in the EIS for sound quality.

2.2 WATER RESOURCES

An assessment for Groundwater Resources (Chapter 6) and Surface Water Resources (Chapter 7) was provided in the EIS. The following effects were assessed for these VCs:

- Groundwater Resources
  - Change in groundwater quantity
  - Change in groundwater quality
- Surface Water Resources
  - Change in surface water quantity
  - Change in surface water quality

Minor changes to the footprint and location of the TMF are anticipated to result in negligible changes to the seepage from the TMF. This is because the associated water level in the refined TMF design is anticipated to operate at approximately the same elevation as the TMF design presented in the EIS. Therefore, the Project refinements do not result in an appreciable change in the predicted effects to the environment from those provided in the EIS. Because the EIS provides a conservative estimate of the mass loading to surface water receivers from groundwater, the relatively minor changes proposed to the TMF do not change the characterization of residual effects, proposed mitigation, or overall conclusions described in the EIS.

Minor changes to the sizes of the waste rock piles, water management ponds, and other features are anticipated to result in minor alterations to the groundwater flow balance. Due to the minor nature of the changes and the conservative nature of the predictions of mass loading from ore stockpiles to surface water receivers from groundwater (i.e., no attenuation of mass along the flow path through groundwater), the proposed minor refinements do not change the characterization of residual effects, proposed mitigation, or overall conclusions described in the EIS.

Surface water management infrastructure refinements include:

- Adjustment of perimeter drains to account for changes to stockpile footprint and the presence of shallow and outcropping bedrock. Perimeter drains continue to collect all stockpile runoff and intercept seepage and continue to gravity drain to sedimentation collection ponds.
- Sedimentation ponds have the same flood control, climate change, water quality and baseflow augmentation as previously designed. Several ponds have been consolidated to improve operational efficiency and reduce monitoring complexity, including a reduction in the number of Final Discharge Points (FDPs). Due to further geotechnical ground-truthing, pond impoundment dam design has been adjusted from low permeability till cores to use of liners and moderate dam height increases. This has facilitated a general reduction in pond footprint, an increase in maximum pond depth, and the opportunity to consolidate ponds. Increasing pond depth will further reduce the potential for thermal charging and resuspension of deposited sediments and extend inactive storage volumes resulting in improved pond performance.
- Ponds and drains will continue to manage runoff and seepage to the same criteria and effluent limits as those identified in the EIS. The consolidation of ponds and FDPs will not extend effluent mixing zones beyond those described in the assimilative capacity modeling provided with the EIS.

Water management infrastructure design modifications represent refinements to the size and location of ditches and ponds to address stockpile and component footprint refinements, updated geotechnical information and engineering design optimizations to reduce footprint and improve performance. Effluent quality in consideration of Project refinements is predicted to meet the *Metal and Diamond Mining Effluent Regulations* (MDMER) criteria as described in the EIS, and effluent mixing and assimilative capacity are predicted to remain within the mixing zone boundary extents, also as described in the EIS.

Per the descriptions above, the proposed Project refinements do not result in changes to the characterization of residual adverse effects, proposed mitigation, or overall conclusions described in the EIS for Groundwater Resources and Surface Water Resources.

2.3 FISH AND FISH HABITAT

An assessment for Fish and Fish Habitat (Chapter 8) was provided in the EIS. The following effects were assessed for this VC:

- Change in fish habitat quantity
- Change in fish habitat quality
- Change in fish health and survival

Per the Project design presented in the EIS, the proposed refinement in the TMF design will result in no mine waste being placed in fish-bearing waters. However, the tailings dam alignment has now been refined to completely avoid stream 14, and the footprint of the process plant facilities has been altered slightly in the headwaters of stream 14, resulting in a small reduction in direct fish habitat loss. Other Project refinements may result in minor changes in the predicted quantity of indirect loss of fish habitat due to changes in drainage area or flow patterns. As described in Section 8.5.1 of the EIS, the loss of habitat (direct and indirect) will be quantified and offset as part of the *Fisheries Act* Authorization process following consultation with Fisheries and Oceans Canada.

The Project refinements are not anticipated to result in substantial changes in stream flows, runoff, sedimentation, and the introduction of contaminants than those previously described in the EIS. Similarly, Project refinements are not anticipated to result in changes to the concentration of sediment and contaminants from surface water runoff due to overburden and rock management, and water management. Therefore, the proposed Project refinements do not result in changes to the characterization of residual adverse effects, proposed mitigation, or overall conclusions described in the EIS for Fish and Fish Habitat.

2.4 TERRESTRIAL ENVIRONMENT

The EIS assessed potential Project-related effects on Vegetation, Wetlands, Terrain and Soils (Chapter 9), Avifauna (Chapter 10), Caribou (Chapter 11), and Other Wildlife (Chapter 12). The following effects were assessed for these VCs:

- Vegetation, Wetlands, Terrain and Soils:
  - Change in Species Diversity
  - Change in Community Diversity
  - Change in Wetland Function
  - Change in Terrain and Terrain Stability
  - Change in Soils Quality and Quantity
- Avifauna and Other Wildlife
  - Change in Habitat
  - Change in Mortality Risk
- Caribou
  - Change in Habitat
  - Change in Movement
  - Change in Mortality Risk

As described in the EIS, a conservative approach was used to address uncertainty in the environmental effects assessment for habitat loss and/or alteration. This conservative approach also allows for refinements to the site layout, as these typically occur through detailed Project design and planning. Specifically, the assessment assumed the following:

- That all habitat within the Project Area would be disturbed, altered or lost, resulting in a direct loss or change of vegetation and habitat; in practice, not all vegetation will be cleared within the Project Area.
- That all wetlands within the Project Area would be disturbed, altered or lost, resulting in a direct loss of wetland function; in practice, not all wetlands within the Project Area will be altered or disturbed.

Given the conservative assumptions described above and that Project refinements will occur entirely within the Project Area, there is no change in the assessment of habitat loss and/or alteration presented in the EIS for the terrestrial VCs.

In addition, the Project refinements do not result in a change in the assessments of sensory disturbance on avifauna, other wildlife, and caribou. The refinements do not result in substantive changes to noise, dust or light emissions relative to those presented in the EIS (refer to Section 2.1 of this Attachment). The assessment in the EIS also conservatively assumed that indirect habitat alteration/loss would occur within a buffer around the mine site. As the proposed Project refinements are located within the mine site, the assessed buffers as described in the EIS remain valid.

The primary pathways for change in mortality risk are through vegetation clearing and earthworks, vehicular collisions, human-wildlife conflicts, and predation. Project refinements are not anticipated to result in measurable changes to these pathways.

With regards to the assessment of a change in caribou movement, the primary effect pathway is from the alteration or loss of existing caribou paths along a preferred migration corridor within the Project Area. As described in the EIS, a primary spring / fall migration corridor used by Buchans herd caribou directly overlaps with Project infrastructure, and residual effects on a change in movement are predicted to be significant, as the mine site has been determined to present a potential obstacle to caribou migration. Project refinements represent minor changes to the footprints (as presented in the EIS) of mine infrastructure within the preferred caribou migration paths (e.g., the footprint of the Marathon waste rock pile has increased by 2 ha, or 2% of the original footprint) and do not change the EIS prediction of a significant residual environmental effect on caribou.

The proposed Project refinements do not result in changes to the characterization of residual adverse effects, proposed mitigation, or overall conclusions described in the EIS for Vegetation, Wetlands, Terrain and Soils, Avifauna, Caribou, and Other Wildlife.

2.5 SOCIO-ECONOMIC ENVIRONMENT

The EIS assessed potential Project-related effects on Infrastructure and Services (Chapter 13), Community Health (Chapter 14), Economy and Employment (Chapter15), and Land and Resource Use (Chapter 16). The following effects were assessed for these VCs:

- Infrastructure and Services:
  - Change in local housing and temporary accommodations
  - Change in local services and infrastructure
- Community Health
  - Change in community well-being
  - Change in physical health conditions
- Employment and Economy
  - Change in regional labour force
  - Change in economic activities of outfitters
  - Change in economy
- Land and Resource Use
  - Change in land use
  - Change in resource use
  - Change in recreational use

Predicted effects on infrastructure and services are associated primarily with Project-related population growth. Given that the proposed Project refinements will not result in a change to Project-related population growth described in the EIS (other than the increase in duration of predicted Project effects by one year during Project operation), the refinements do not result in changes to the characterization of residual adverse effects, proposed mitigation, or overall conclusions described in the EIS for Infrastructure and Services.

With respect to community health, effects pathways as described in the EIS may result in a change to community well-being (availability of health services and infrastructure) and physical health conditions (potential effects to air and water quality and country foods due to Project-related emissions). Since filing the EIS, a human health risk assessment (HHRA) was completed for the Project and was submitted to both the Impact Assessment Agency of Canada (as part of Marathon's responses to Information Requirements) and to the Newfoundland and Labrador Department of Environment and Climate Change (as part of the EIS Amendment).

The HHRA evaluated potential human health risks associated with exposures to Project-related contaminants of potential concern under Background and Predicted Future Case conditions for Indigenous and non-Indigenous receptors. The results demonstrated that the predicted changes in inhalation exposures, direct contact exposures to soil and surface water, and ingestion exposures from the consumption of country foods represent a negligible change in human health risk for Indigenous and non-Indigenous receptors. The results of the HHRA do not change the conclusions of the assessment presented in the EIS.

As described in Section 2.1 of this Attachment, air quality modelling results have been updated due to refinements to the numbers and types of mobile equipment. While there are minor changes in the results, these changes do not alter the conclusions of the HHRA. The updated maximum 98th percentile 1-hour NO_2 concentrations at the accommodations camp and exploration camps do not exceed the 2025 CAAQS, which represents a lower human health risk than was presented in the HHRA. On an hour-by-hour basis, the exceedance frequency at the accommodations camp increased from 42 to 51 exceedances of the 1-hour NO_2 limit (i.e., an increase from 0.15% to 0.19% of the total 26,280 hours modelled). However, exceedance patterns (number of consecutive hours with predicted exceedances) at the accommodations and exploration camps are unchanged, with a maximum of 4 consecutive hours with predicted 1-hour NO_2 concentrations above 2025 CAAQS of 79 μg/m^3. These changes in predicted 1-hour NO_2 do not alter the conclusions of the HHRA or the conclusions of the EIS related to Community Health.

As described in Section 2.2 of this Attachment, refinements to surface water management, TMF design and a decrease in the number of final discharge points, do not alter the surface water quality predictions presented in the EIS. Therefore, the Project refinements related to surface water quality would similarly not alter the conclusions of the HHRA. The Project refinements therefore do not result in changes to the characterization of residual adverse effects, proposed mitigation, or overall conclusions described in the EIS for Community Health.

Project demand for, and expenditures on, services, labour, materials and equipment are the primary pathways for changes in regional labour force, regional business and economy. The Project refinements do not result in measurable changes to these pathways (other than extension of the mine life by one year, which would result in a temporal extension of economic benefits associated with Project operation) and therefore do not result in changes to the characterization of residual adverse effects, proposed mitigation, or overall conclusions described in the EIS for Employment and Economy.

With respect to land and resource use, the primary effects pathways are through the Project activities and components, as these may restrict access to, or cause loss of, areas used for resource activities and/or recreation. As the Project refinements will occur within the assessed Project Area, they will not result in measurable changes to these pathways, except for the extension of the mine life by one year, which would result in any land and resource use restrictions in place during Project operation to extend for one additional year. Therefore, the Project refinements do not result in changes to the characterization of residual adverse effects, proposed mitigation, or overall conclusions described in the EIS for Land and Resource Use.

2.6 INDIGENOUS GROUPS

An assessment of potential Project-related effects for Indigenous Groups (Chapter 17) was provided in the EIS. The following effects were assessed for this VC:

- Change in current use
- Change in Indigenous health conditions
- Change in Indigenous socio-economic conditions
- Change in physical and cultural heritage

Given that the Project refinements will occur within the existing Project Area, the Project refinements do not result in measurable changes to effects on Indigenous groups related to current use, socio-economic conditions or physical and cultural heritage. Predicted effects associated with Project operation would extend for one additional year due to the proposed mine life extension. With respect to Indigenous health conditions, the discussion provided in Section 2.5 of this Attachment for Community Health is also applicable to Indigenous Groups. As indicated in Section 2.5, the Project refinements do not alter the conclusions of the HHRA, which evaluated potential human health risks for Indigenous and non-Indigenous receptors. Therefore, the Project refinements do not result in changes to the characterization of residual adverse effects, proposed mitigation, or overall conclusions described in the EIS for Indigenous Groups. Marathon will continue to engage with Indigenous groups, including Indigenous resource users, throughout the life of the Project.

2.7 HISTORIC RESOURCES

The EIS assessed potential Project-related effects on Historic Resources (Chapter 18). As noted in the EIS, there are no known registered archaeological sites within the Project Area. As discussed in Section 18.2.3.4 of the EIS, there is one area of archaeological potential within the Project Area, however this area does not overlap with the footprints of the refined Project infrastructure. Therefore, the Project refinements do not result in changes to the characterization of residual adverse effects, proposed mitigation, or overall conclusions described in the EIS for Historic Resources.

2.8 DAM INFRASTRUCTURE

The EIS assessed potential Project-related effects on Dam Infrastructure (Chapter 19). The following effects were assessed for the VC:

- A change in water quality in Victoria Lake Reservoir
- A change in water balance in Victoria Lake Reservoir
- A change in dam stability for the Victoria Dam

The proposed Project refinements do not result in changes in water quality or water balance with respect to Victoria Lake Reservoir, as described in Section 2.2, above. In terms of a potential change in dam stability for the Victoria Dam, the effects pathways include vibrations due to blasting and potential inundation from a failure of the TMF. The proposed Project refinements do not result in changes to the expected vibration frequency or intensity presented in the EIS generally, or specific to the Victoria Dam.

Due to the proposed refinement of the TMF dam alignment and relocation of the polishing pond towards the process plant (and away from the toe of the TMF dam), the inundation resulting from a potential TMF failure (unplanned/accidental event) no longer encroaches on the downstream toe of the Victoria Dam as presented in the EIS. As described in further detail in Section 2.9.2 of this Attachment, the results of the updated dam breach assessment predict that the inundation (water/tailings) zone from a TMF breach would stop approximately 550 m downstream of the Victoria Dam and therefore would not have any impact on the stability of the dam.

Based on these factors, the proposed Project refinements do not result in a change to the characterization of residual adverse effects, proposed mitigation, or overall conclusions described in the EIS for Dam Infrastructure.

2.9 ACCIDENTAL EVENTS

2.9.1 Fuel and Hazardous Material Spill

As indicated in Table 1.1, Marathon is considering transporting a pre-mixed ammonium nitrate emulsion product to site instead of shipping the individual components and manufacturing the emulsion on site as described in the EIS. Stantec was retained to evaluate the fate and behavior of potential spills of an ammonium nitrate emulsion product into the Victoria River, which flows into Red Indian Lake (see Appendix B).

Based on the modelling results, the maximum concentrations of total ammonia, unionized ammonia and nitrate at the Exploits River dam would be below the Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CWQG-FAL) limit. The modelling results indicate that, in the event of a spill, the total ammonia, unionized ammonia and nitrate are not expected to persist in the environment, nor result in potential bioaccumulation. A comparison of the results presented in Chapter 21 of the EIS for an accidental spill of ammonium nitrate in solid prill form, and in Appendix B for an accidental spill of TITAN 1000 G emulsion, indicates the following:

- Hydrodynamic conditions including inflows, water levels and current velocities were identical.
- The main difference in the results is due to the nature of the materials spilled into the water: in Chapter 21 and the technical memo in Appendix 21A of the EIS, it was assumed that the spilled ammonium nitrate becomes soluble in the water immediately after the spill and breaks down to ammonia and nitrate; therefore, the travel time of the material was shorter and resulting concentrations were higher at the Exploits River dam. However, the TITAN 1000 G emulsion behaves differently in the water than does ammonium nitrate. This material does not immediately become soluble in the water and the breakdown process takes longer, which results in a longer total travel time to the dam and lower resulting concentrations.

Based on the results described above, the proposed Project refinements do not result in a change to the characterization of residual adverse effects, proposed mitigation, or overall conclusions described in the EIS for a hazardous materials spill.

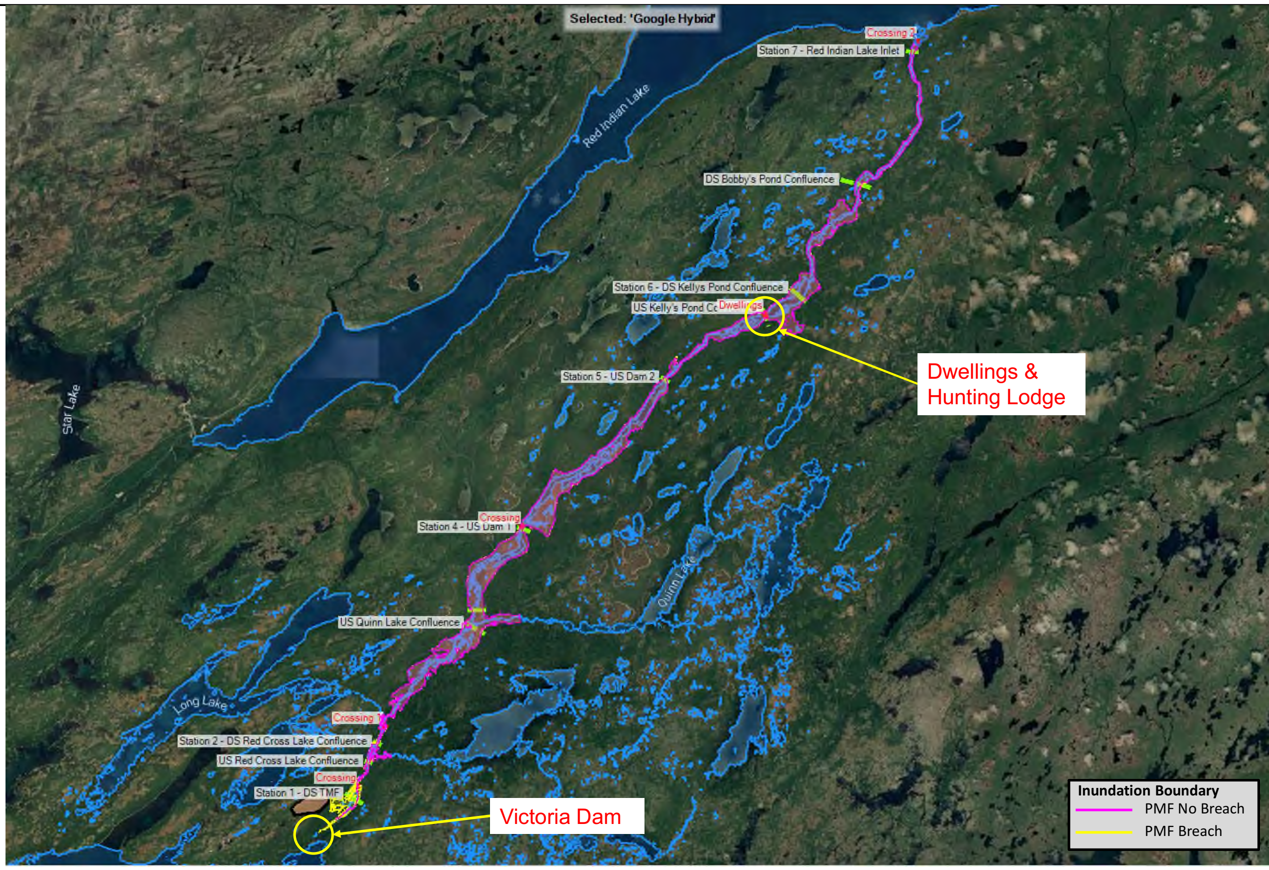
2.9.2 TMF Malfunction

The Dam Breach Assessment (DBA) modeling has been updated, incorporating several design refinements to the TMF. The key refinements (described in Table 1.1) are as follows:

- Modification to the dam alignment to completely avoid and provide buffer to the stream running west to east along the southern boundary of the TMF. The new alignment also improves tailings storage efficiency without changing the dam height, and the overall TMF footprint is reduced slightly (approximately 3%).
- The polishing pond has been relocated closer to the plant site, which improves tailings water management components and eliminates the potential for a cascade failure in the event of a tailings dam breach.

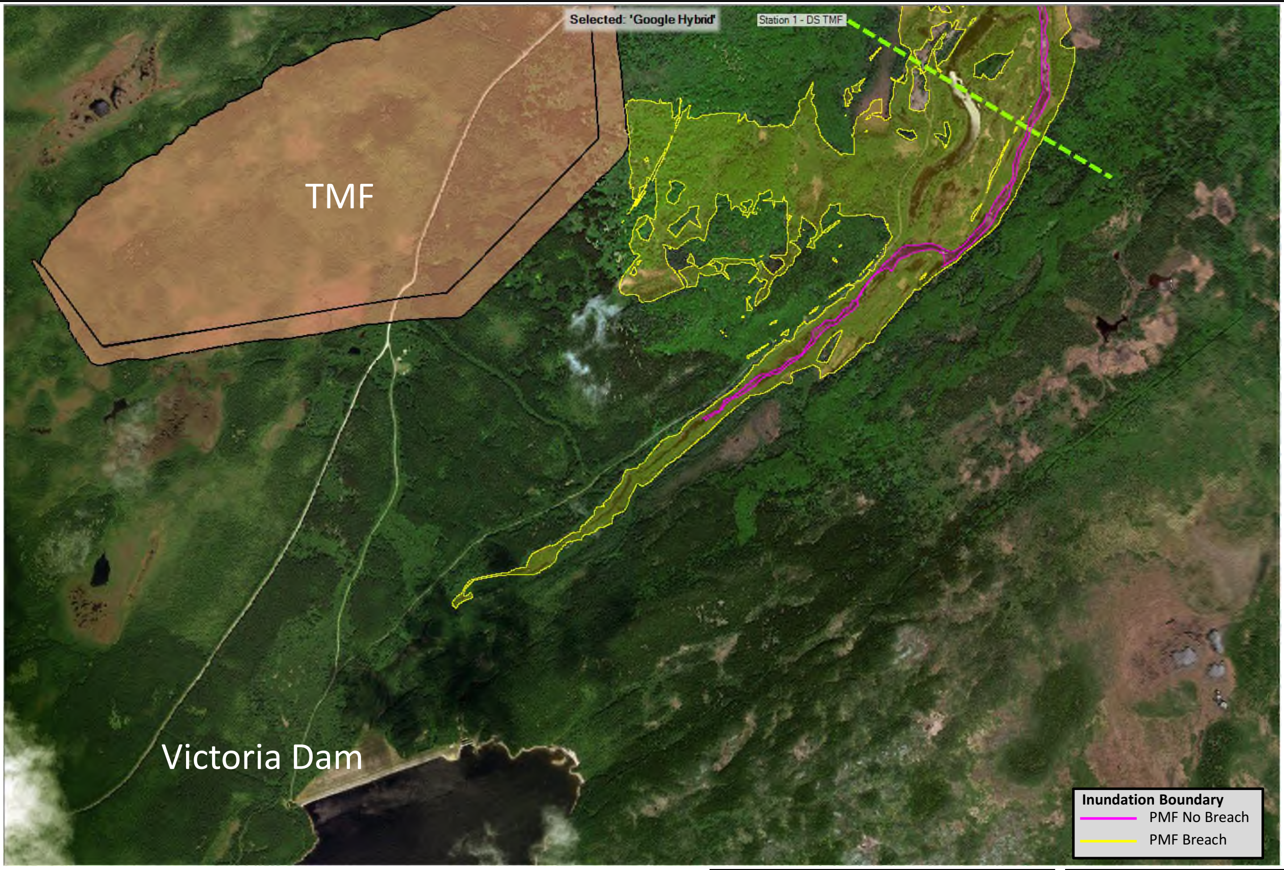
Based on the available meteorological data, in consideration of the advancement of the engineering design for the TMF, and to provide a more conservative assessment of potential effects from the Project, the most conservative values for the long-term design precipitation events have been used in the ongoing update of the DBA. For final engineering design, alternate probable maximum precipitation (PMP) values may be considered, if further collection and assessment of meteorological data indicate these are warranted. These would be included in the final design information submitted for regulatory review and approval via the permitting process. The PMP value only affects the sizing of the emergency spillway for very high consequence category dams and is used in the DBA. In selection of the PMP value, the Buchans meteorological station (ID 8400698) provides the most conservative data, with a PMP of 450 mm. An updated DBA utilizing the Buchans station PMP value is ongoing, and an updated DBA report will be issued separately. It is important to note that the DBA will continue to be updated as the detailed engineering for the TMF and associated infrastructure is advanced.

At this time, the flood-induced dam breach model runs have been completed. Figures 2.1 to 2.3 show the inundation extent under the 450 mm probable maximum flood (PMF) in the Victoria River, with (pink) and without (yellow) a dam breach. In the event of a dam breach under a PMP induced flood, up to a peak discharge of 1,735 m^3/s may be released from the TMF. This is approximately 8% to 16% lower than the peak discharge estimated in the DBA presented in the EIS, as a result of ongoing design refinements including relocation of the polishing pond. The incremental impact upstream and downstream of the TMF was assessed relative to the impact of the PMF.



CLIENT MARATHON GOLD CORPORATION	PROJECT DAM BREACH ASSESSMENT AND INUNDATION STUDY RESPONSE TO IR63
CONSULTANT GOLDER MEMBER OF WSP YYYY-MM-DD 2021-04-23 PREPARED MAR DESIGNED MAR REVIEWED AC APPROVED PM	TITLE INUNDATION AREA OF SIMULATED PMF BREACH AND NO BREACH SCENARIOS PROJECT NO. 20141194 REV. B FIGURE 2.1

CLIENT MARATHON GOLD CORPORATION	PROJECT DAM BREACH ASSESSMENT AND INUNDATION STUDY RESPONSE TO IR63
CONSULTANT GOLDER MEMBER OF WSP YYYY-MM-DD 2021-04-23 PREPARED MAR DESIGNED MAR REVIEWED AC APPROVED PM	TITLE INUNDATION AREA OF SIMULATED PMF BREACH AND NO BREACH SCENARIOS – AREA OF DWELLINGS AND HUNTING LODGE PROJECT NO. 20141194 REV. B FIGURE 2.2



CLIENT
MARATHON GOLD CORPORATION

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-04-23
PREPARED	MAR
DESIGNED	MAR
REVIEWED	AC
APPROVED	PM

PROJECT
DAM BREACH ASSESSMENT AND INUNDATION STUDY
RESPONSE TO IR63

TITLE
INUNDATION AREA OF SIMULATED PMF BREACH AND NO BREACH SCENARIOS – AREA OF VICTORIA DAM

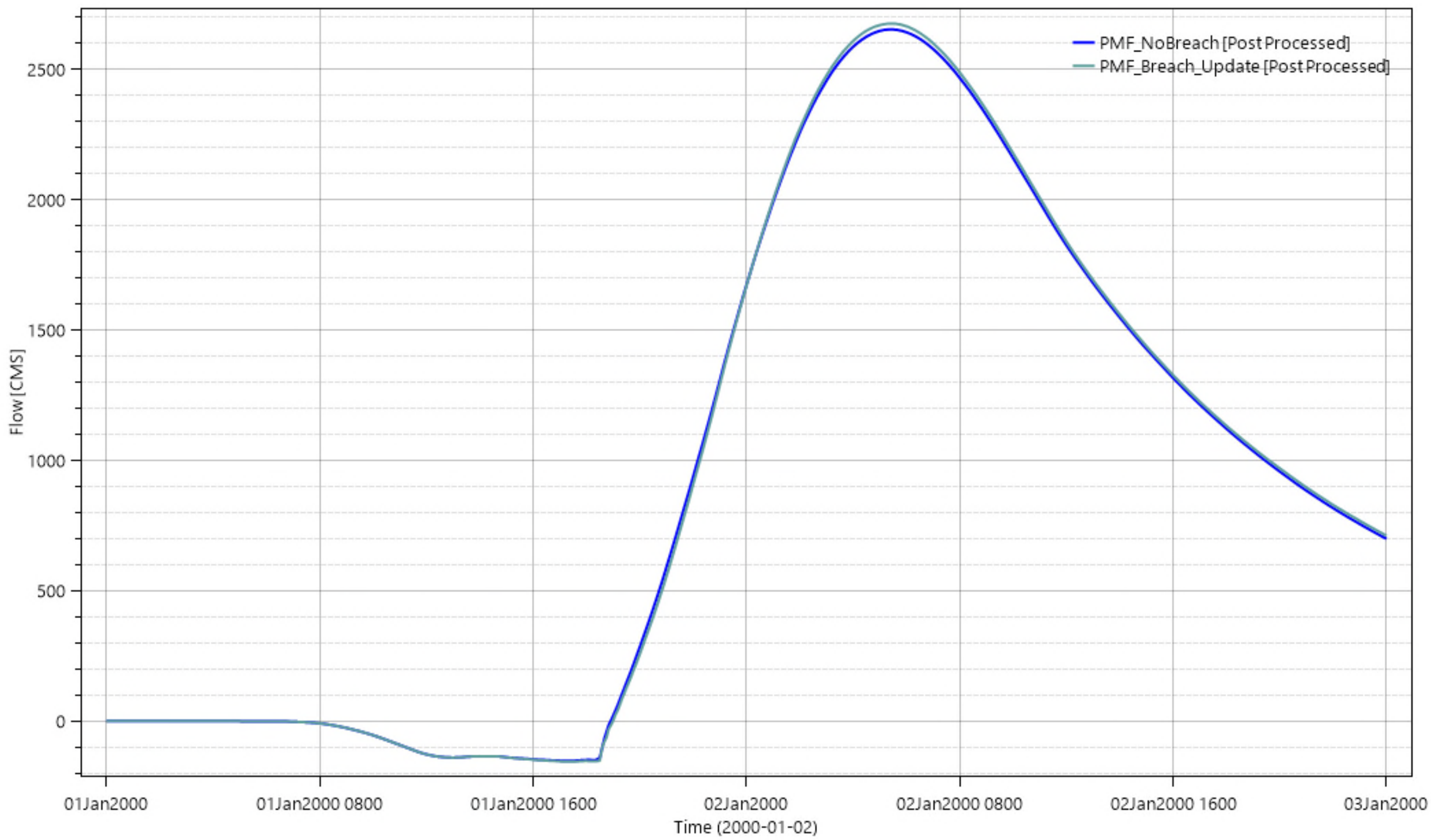
PROJECT NO.	REV.	FIGURE
20141194	B	2.3

Upstream of the TMF, the mild slope of the Victoria River channel is expected to result in backwater flows towards the Victoria Dam. Based on a breach under PMP conditions, the TMF inundation could extend upstream to within 550 m (downstream) of the Victoria Dam, however would not reach the dam toe as was predicted in the DBA presented in the EIS.

Downstream of the TMF, and consistent with the DBA presented in the EIS, a dam breach would result in negligible incremental impact (<0.5%) on the extent of the flood boundary resulting from the natural effects of the PMF. For example, the peak flow under the updated PMP volume (450 mm) at the dwellings and hunting lodge upstream of Kelly's Pond confluence is 2,677 m^3/s under a breach, compared to 2,654 m^3/s with no breach (Figure 2.4). As shown in the figure, the incremental effect (water level) due to the dam breach is almost indiscernible (<0.5%) from the natural flood level. This is consistent with the results of the DBA presented in the EIS.

The updated DBA results described above result in less impact to the downstream environment than what was presented in the EIS, despite using a more conservative design flood (PMP at 450 mm versus 309 mm). This is a result of design modifications that have been made to the TMF to reduce potential environmental effects and improve engineering efficiency. Based on the results of the DBA, the Project refinements do not result in a change to the characterization of residual adverse effects, proposed mitigation, or overall conclusions described in the EIS for a TMF malfunction. As noted in Section 21.5.1.2 of the EIS, the dams required for the tailings impoundment will be designed, constructed, operated and closed in accordance with the Canadian Dam Association (CDA) and Mining Association of Canada (MAC) guidelines, Global Industry Standards on Tailings Management, as well as applicable provincial requirements. The dams will be inspected, maintained and repaired in accordance with the NL *Water Resources Act.*

The Dam Breach Assimilative Capacity Study is being revised to incorporate the TMF design refinements as described in Table 1.1. Based on preliminary results, the findings are similar to those provided in the EIS (Baseline Study Appendix 1, Attachment 1-B), in that a hypothetical failure of the TMF dam would release impounded water and suspended tailings into Victoria River, ultimately reaching Red Indian Lake. Such a failure has the potential to result in adverse environmental effects to aquatic life as a result of increased concentrations of dissolved constituents as described in the EIS.



CLIENT
MARATHON GOLD CORPORATION

PROJECT
DAM BREACH ASSESSMENT AND INUNDATION STUDY
RESPONSE TO IR63

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-04-23
PREPARED	MAR
DESIGNED	MAR
REVIEWED	AC
APPROVED	PM

TITLE
PMP FLOW HYDROGRAPHS DOWNSTREAM OF THE
DWELLINGS AND HUNTING LODGE

PROJECT NO.	REV.	FIGURE
20141194	B	2.4

The preliminary results indicate that short-duration concentrations of the modelled constituents are anticipated to exceed the CWQG-FAL chronic water quality guidelines at one or more locations in Victoria River. The magnitude of concentrations is typically greater closer to the breach and in the fair-weather scenario, while duration of concentrations greater than applicable criteria is typically greater further from the breach on account of attenuation of peak flow rates over distance. The modelled conditions are considered to be fully reversible over a relatively short period of time once all inundated areas have drained to ambient water levels. As with the previous study presented in the EIS, concentrations of constituents have been compared to the CWQG-FAL. However, relatively few constituents are assigned a CWQG-FAL acute guideline as compared to those assigned a chronic guideline value. Therefore, results were compared to CWQG-FAL chronic guidelines. This is considered a highly conservative approach, as the nature of a dam breach event into a river system is a temporary event of short duration (i.e., less than a day), and elevated concentrations in the Victoria River resulting from a dam breach are not expected to persist over the long exposure period for which chronic toxicity guidelines are intended to be applied. If elevated concentrations were to occur in Red Indian Lake during low flow conditions, effects of the dam breach could persist for a longer period of time (e.g., more than 30 days) due to the longer retention time of the lake during low flow conditions. However, during high flow events (e.g., spring freshet), the increased flow rates would likely reduce the retention time.

In consideration of the above preliminary results, the Project refinements do not result in changes to the characterization of residual adverse effects, proposed mitigation, or overall conclusions described in the EIS for a TMF malfunction.

2.9.3 Unplanned Release of Contact Water

Project refinements have resulted in an increase in the dam height of some of the sedimentation ponds to above 2.5 m. In keeping with NL and CDA requirements, a DBA was conducted for dams impounding the sedimentation ponds to determine the Hazard Classification and Inflow Design Flood for each dam using an incremental assessment of loss of life potential, and potential environmental, economic and social/cultural losses. The DBA examined breaches under both dry weather (sunny day) and wet weather (flood-induced) conditions. All sedimentation ponds were assigned the hazard classification of Low, with associated inflow design flood of the 1:100-year return period flood event. Based on the results described above, the Project refinements do not result in a change to the characterization of residual adverse effects, proposed mitigation, or overall conclusions described in the EIS for an unplanned release of contact water.

2.10 CUMULATIVE EFFECTS

Cumulative effects were assessed for the following VCs:

- Atmospheric Environment
- Groundwater Resources
- Surface Water Resources
- Fish and Fish Habitat
- Vegetation, Wetlands, Terrain and Soils
- Avifauna
- Caribou
- Other Wildlife
- Community Services and Infrastructure
- Community Health
- Employment and Economy
- Land and Resource Use
- Indigenous Groups
- Historic Resources

The cumulative effects assessment includes consideration of other physical activities that have been (past), are being (present and ongoing), and will be carried out (future) in the cumulative effects RAA. The pathways for cumulative effects are the same as those described for the assessment of Project residual effects on each VC. As described above, the Project refinements do not result in changes to the characterization of residual adverse effects, proposed mitigation, or overall conclusions described in the EIS and would therefore also not result in a change to the cumulative effects assessment.

3.0 CONCLUSIONS

Based on the above, the proposed Project refinements do not constitute a substantive change to the scope of the Project, either individually or in combination. Given the conservative effects assessment approach used within the EIS, no further assessment, beyond the information provided herein, is considered necessary. The Project refinements do not result in changes to the characterization of residual adverse effects, proposed mitigation, or overall conclusions described in the EIS; the conclusion that routine Project activities will not cause significant adverse environmental effects on any of the VCs, with the exception of caribou, remains unchanged.

APPENDIX A

Projected Operation GHG Emissions over the Lifetime of the Project

Projected Operation GHG Emissions over the Life Time of the Project

GHG Emissions - EIS

	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	LOM
Total Material Mined	40,383.77	44,458.35	59,962.06	52,951.24	49,283.69	41,157.90	33,171.49	14,862.63	5,749.32	0.00	0.00	0.00	-
Total Resource Milled	1,875.40	2,500.40	2,500.07	3,250.01	4,000.10	4,000.39	4,000.10	4,000.10	3,999.54	4,000.00	4,000.00	2,922.82	-
Direct GHG Emissions tCO_2e/year	59,139.06	65,277.42	87,698.08	77,854.39	72,845.63	61,094.58	49,544.87	23,067.40	9,887.90	1,573.67	1,573.67	1,149.89	**510,707**
Indirect GHG Emissions tCO_2e/year	3,793.96	4,420.41	4,420.09	5,171.79	5,923.63	5,923.92	5,923.63	5,923.63	5,923.07	5,923.53	5,923.53	4,843.83	**64,115**
Total (direct & indirect) GHG Emissions tCO_2e/year	62,933.02	69,697.84	92,118.17	83,026.17	78,769.26	67,018.51	55,468.50	28,991.03	15,810.97	7,497.20	7,497.20	5,993.72	**574,822**

GHG Emissions - Project Refinements

	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	
	2024	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**LOM**
Total Material Mined	46,644.44	46,846.89	58,858.23	55,315.79	51,630.11	42,815.84	36,076.30	17,028.65	9,006.52	3,764.07	0	0	0	-
Total Resource Milled	2,460.60	2,500.40	2,500.37	3,625.40	3,999.95	4,000.16	4,000.10	4,000.10	4,000.10	3,999.72	4,000.00	4,000.00	3,502.94	-
Direct GHG Emissions tCO_2e/year	74,557.12	74,892.18	93,842.00	88,695.78	83,028.36	69,122.50	58,489.76	28,438.98	15,782.78	7,511.81	1,573.48	1,573.48	1,377.96	**598,886**
Indirect GHG Emissions tCO_2e/year	3,401.36	3,441.24	3,441.21	4,568.74	4,944.13	4,944.33	4,944.28	4,944.28	4,944.27	4,943.89	4,944.18	4,944.18	4,446.01	**58,852**
Total (direct & indirect) GHG Emissions tCO_2e/year	77,958.48	78,333.42	97,283.21	93,264.52	87,972.49	74,066.83	63,434.03	33,383.26	20,727.05	12,455.71	6,517.66	6,517.66	5,823.97	**657,738**

APPENDIX B

Fate and Behavior Modelling of Hazardous Materials Spill

B.1 VALENTINE GOLD PROJECT – FATE AND BEHAVIOR MODELLING OF HAZARDOUS MATERIALS SPILL

Marathon Gold Corporation (Marathon) retained Stantec Consulting Ltd. (Stantec) to evaluate the fate and behavior of potential spills of an ammonium nitrate emulsion product into the Victoria River flowing into Red Indian Lake in accordance with the provincial and federal guidelines for the Valentine Gold Project. The study area focused on the 100 m extent of the Victoria River, approximately 14 kilometers of Red Indian Lake, and the Exploits River Dam. The accidental spill release was modelled to occur at the bridge crossing of the Victoria River where the river drains into Red Indian Lake. In this memorandum, the Regional Assessment Area (RAA), ambient characteristics, ambient water quality, meteorological data, regulatory frameworks, two-dimensional (2D) hydrodynamic modelling approach, and modelling scenarios are based on the Valentine Gold project – fate and behavior modelling of hazardous materials spill report (Stantec, 2020).

Hazardous Material Information and Spill Assumption

The ammonium nitrate emulsion material proposed is the Dyno Nobel TITAN 1000 G (ungassed) product. TITAN 1000 G is an unsensitized gassable bulk emulsion matrix designed for quarry and open pit mining operation. Chemical gassing can vary the density from 1.10 g/cc to 1.30 g/cc. TITAN 1000 G is a mixture of 45% to 80% ammonium nitrate and 0.1% to 10% diesel. Ammonium nitrate is a chemical compound with the chemical formula NH_4NO_3 (molar mass: 80.043 g/mol). Nitrate (molar mass: 62.004 g/mol) accounts for 77% of ammonium nitrate based on the molar mass (PubChem 2020; Ammonium Nitrate, 2020). Petroleum-derived diesel is composed of about 75% saturated hydrocarbons (primarily paraffin including n, iso, and cycloparaffins), and 25% aromatic hydrocarbons (including naphthalenes and alkylbenzenes) (Bacha et al., 2007). The average chemical formula for common diesel fuel is $C_{12}H_{24}$, ranging approximately from $C_{10}H_{20}$ to $C_{15}H_{28}$ (Petro Canada 2020). three critical characteristics of the emulsion are its viscosity, density, and solubility. The emulsion product has very high viscosity, described by DYNO representative R. Walsh (personal communication, January 26, 2021), as similar to that of mayonnaise. The product is not free-draining and must be pumped to transport. The emulsion is denser than water at a density of approximately 1,25 kg/L, settling in water and is anhydrous and quite insoluble in water. The emulsion will break down in time into its daughter ammonia, nitrate, and diesel products over a period of several weeks. More information about the physical properties and loading methods for TITAN 1000 G emulsion/ Ammonium Nitrate/Fuel Oil (ammonium nitrate emulsion) explosive blends can be found in the material safety data sheet (Bulk Explosives 2020).

TITAN 1000 G is proposed to be transported to the mine site with tanker trucks. Each tanker truck of emulsion will carry up to 20 T of TITAN 1000 G. Due to very high viscosity of the emulsion and the fact that it must be pumped to be transported, it was assumed that 200 kg of TITAN 1000 G will be released to the Victoria River over the course of an hour after the accident. The emulsion material release was conservatively modeled by particle tracking using a particle count of 10,000. The settling velocities for each particle was estimated as 1 mm/s based on Stokes Law.

To consider a worst-case scenario, it was assumed that TITAN 1000 G was composed of 10% diesel and 80% ammonium nitrate. The total mass of 200 kg was considered at the deposited location. Therefore, the total mass of diesel and ammonium nitrate were considered as 20 kg and 160 kg, respectively. The Canadian Council of Ministers of the Environment (CCME) CWQG-FAL[1] concentration limits for nitrate, total ammonia, and unionized ammonia are summarized in Table B.1. The concentration limit of total ammonia is reported at pH 7.5, temperature 15°C.

Table B.1 CCME CWQG-FAL Allowable Concentration Limits

Parameter	CCME CWQG-FAL (mg/l)
Un-ionized ammonia (expressed as nitrogen)[1]	0.019
Total ammonia[2]	1.83
Nitrate	550[3]
Diesel	-

Notes:
[1] Source: http://st-ts.ccme.ca/en/index.html?chems=6&chapters=all
[2] Total ammonia concentration limit varies with pH and temperature, See table at: http://st-ts.ccme.ca/en/index.html?lang=en&factsheet=5
[3] 550 mg/l for short term exposure and 13 mg/l for long term exposure

Modelling Scenarios and Results

The annual minimum 7-day average (7Q1), the mean annual flow, and the 1:30 year high flow (Q30) were considered as three potential flow scenarios to estimate the inflow from each watercourse into the lake. More details about the modelling scenarios can be found in Stantec (2020). The following two-step simulation process was performed:

Step 1: 84 hours (3.5 days) of simulation was performed for each spill modelling scenario to estimate the location that the spilled materials will transport as emulsion material and due to negative buoyancy become sedimented.

Step2: 2 stage spill modelling considers 7 days for the ammonium nitrate emulsion without breakdown and 7 subsequent days for the ammonium nitrate emulsion breakdown to diesel fuel oil and ammonium nitrate and solubilization. As indicated, the solubilization time is expected to take longer than one week, however, to be conservative, it was estimated in this model to occur over a one week period. In the subsequent week, the simulation results for ammonium nitrate and diesel fuel oil concentrations are discussed.

Spill of Titan 1000 G Results

84 hours (3.5 days) of simulation was performed for the 7Q1, mean annual flow, and Q30 scenarios to estimate the location where the spilled TITAN 1000 G will become sedimented. Figure B.1, Figure B.2,

[1] Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CWQG-FAL)

and Figure B.3 present the simulation results for initial fluvial transport and settling location for the emulsion product.

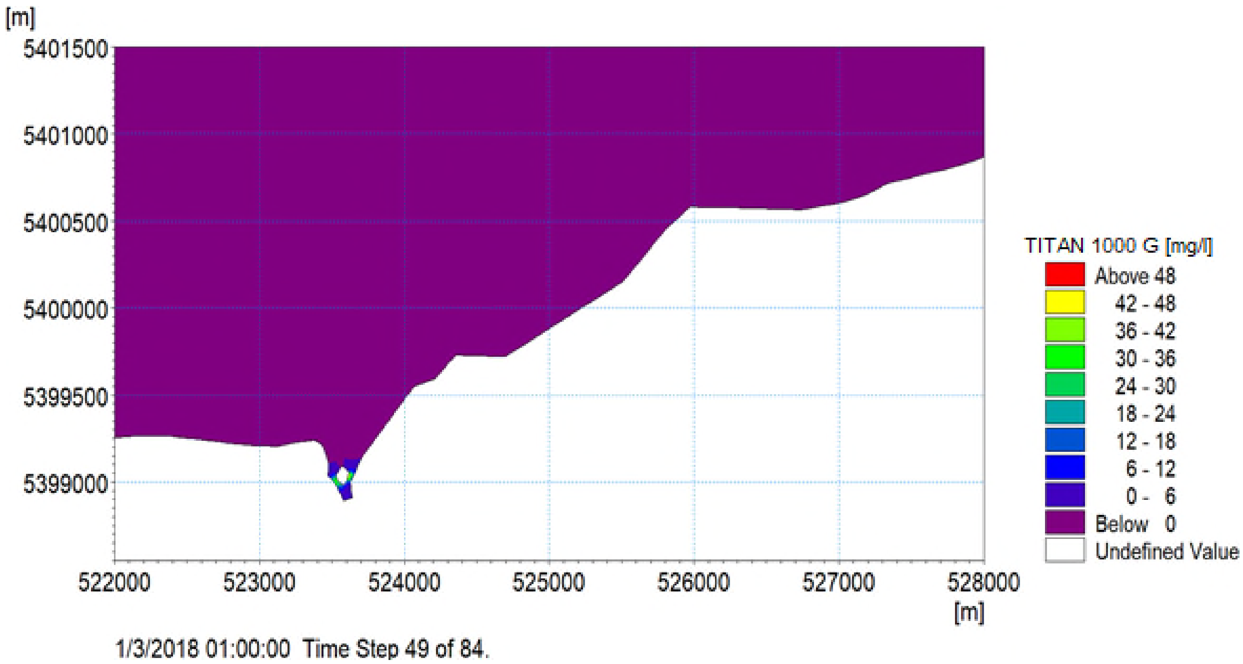


Figure B.1 Q1 Scenario Simulation Results of TITAN 1000 G (Emulsion)

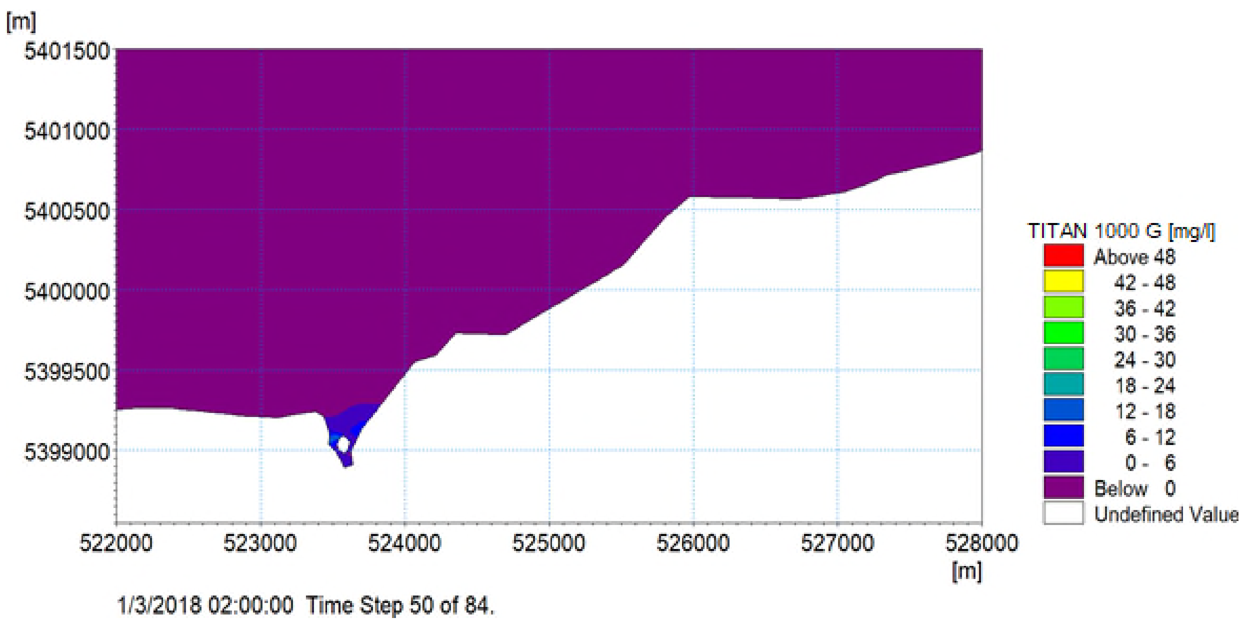


Figure B.2 Mean Annual Flow Scenario Simulation Results TITAN 1000 G (Emulsion)

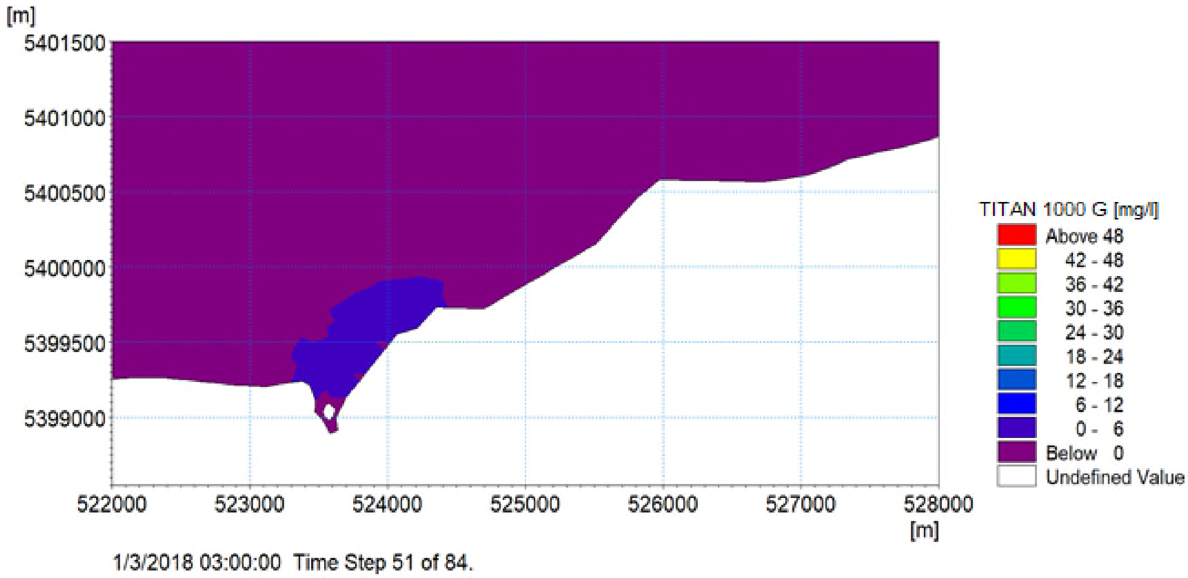


Figure B.3 Q30 Scenario Simulation Results TITAN 1000 G (Emulsion)

Shown in Figure B.1 and Figure B.2, spilled materials settle out in the Victoria River mouth and did not enter Red Indian Lake.

The simulation results for the Q30 scenario (Figure A.3) indicated that TITAN 1000 G deposited in Red Indian Lake and had the highest dispersion area in the Lake. Therefore, step 2 of the simulation process was performed for the Q30 scenario only. The Q30 flow scenario is a 1:30 years high flow. The 1:30 year high flow scenario would not be expected to extend over a two-week period; however, was extended over the two-week modeling period to provide further model conservatism.

The simulation results for ammonium nitrate and diesel for the breakup and dissociation process are shown in Figure B.4 and Figure B.5. In Figure B.4, the breakup process started 7 days after the spilled materials became sedimented. In the Q30 scenario, ammonium nitrate reached to the Exploits River dam after 205 hours of simulation (8 days and 13 hours). The CWQG-FAL limits for total ammonia, unionized ammonia, and nitrate are reported in Table B.1. The maximum ammonium nitrate concentration at the sedimentation location when breakup started was 12.5 µg/l, which included 9.62 µg/l of nitrate and 2.88 µg/l of ammonia. The initial ammonia and nitrate concentrations were below the CWQG-FAL limits. The maximum concentrations at the Exploits River dam were 1.15 µg/l of nitrate and 0.35 µg/l of ammonia, which was reduced by 88% due to material assimilation.

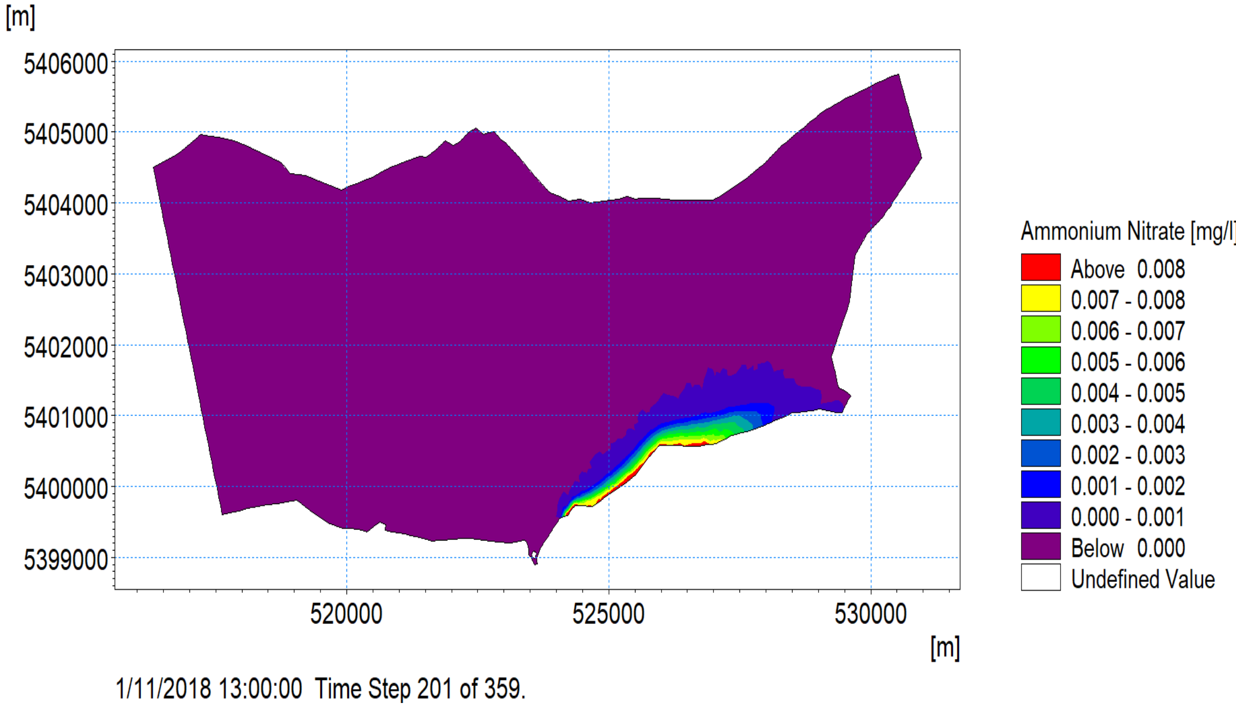


Figure B.4 Ammonium Nitrate Concentration (Q30 Scenario)

Figure B.5 shows the simulation results for diesel after the breakup and dissociation process started. In the Q30 scenario, diesel reached to the Exploits River dam after 205 hours of simulation (8 days and 13 hours). No CWQG-FAL limits are defined for diesel. The maximum concentration of diesel when the breakup process started was 1.5 µg/l at the sediment location. The maximum concentration of diesel at the Exploits River dam was 0.11 µg/l, which was reduced by 93%.

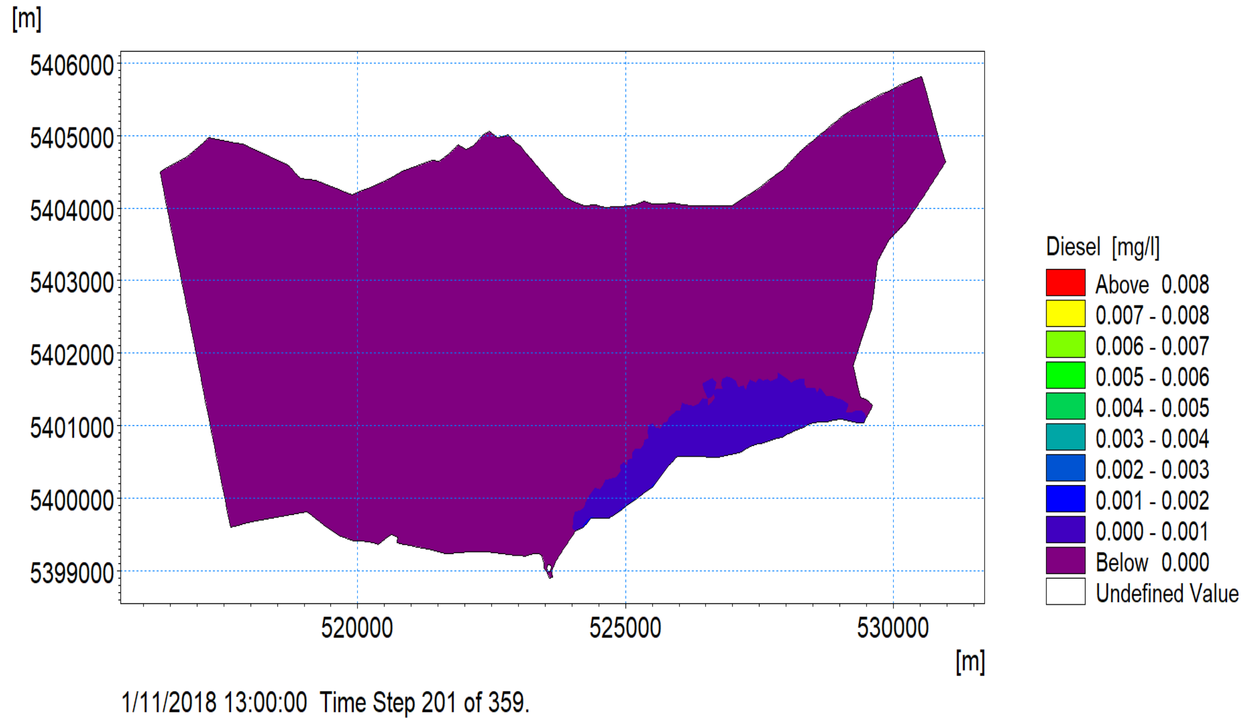


Figure B.5 Diesel Concentration (Q30 Scenario)

Summary of Findings

The potential impacts of an accidental spill of TITAN 1000 G emulsion on the water quality of Red Indian Lake and the Victoria River was evaluated under three spill modelling scenarios over a two-step modeling process. The simulation results showed that the spilled materials have the highest initial dispersion area under flow scenario 3 (high flow). The maximum concentrations of total ammonia, unionized ammonia, and nitrate at the Exploits River dam were below the CWQG-FAL limit. The total ammonia, unionized ammonia and nitrate are not expected to persist in the environment, nor result in potential bioaccumulation. Diesel may attach to nearshore and shoreline vegetation and shallow sediments and thus the potential exists for some further persistence of diesel in the environment. None of the fate and behavior modelling considered spill response, particularly for diesel where the deployment of spill diversion, collection and sorbent booms and product recovery would be reasonably implemented. Thus, the modelling is considered to be conservative and represent a worse-case condition.

The following compares the results presented in Chapter 21 for an accidental spill of ammonium nitrate in solid prill form and in this memo for an accidental spill of TITAN 1000 G emulsion:

- Hydrodynamic conditions including inflows, water levels, and current velocities were identical.

- The main difference in the results is due to the nature of the materials spilled into the water: in Chapter 21 and the technical memo in Appendix 21A of the EIS, it was assumed that the spilled ammonium nitrate becomes soluble in the water immediately after the spill and breaks down to ammonia and nitrate; therefore, the travel time of the material was shorter and resulting concentrations were higher at the Exploits River dam. However, the TITAN 1000 G emulsion behaviour in the water is different than ammonium nitrate. This material does not immediately become soluble in the water and the breakdown process takes some time; therefore, the total travel time to the dam was longer and resulting concentrations were lower as a result of a longer breakdown process.
- The significance of residual environmental effects from a spill of ammonium nitrate emulsion are consistent with the effects predicted in Chapter 21 for a hazardous materials spill as outlined in Section 21.5.2.

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