DALHOUSIE UNIVERSITY

Valentine Gold Project
Impact Assessment Agency of Canada
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December 23, 2020
To whom it may concern,

Enclosed past this covering letter are recommendations for consideration by the Impact Assessment Agency of Canada, the Marathon Gold Corporation, and federal authories in your ongoing assessment of the Valentine Gold Project.

These recommendations were prepared by graduate students as part of coursework for the class *ENVI5001 Environmental Assessment* at Dalhousie University. All the authors have been trained in the governance, substantive components, and procedural components of federal impact assessment. We bring post-graduate degrees in environmental studies and sciences (including Master's and PhDs), and cumulative decades work experience in environmental consulting, research, and management, and lived experience in the resource industry and frontier communities. We have analyzed Valued Components and procedural elements associated with the Valentine Gold EIS and raise concerns with the quality and scope of data collection and the feasibility and adequacy of proposed mitigation measures.

Summary of recommendations

Air quality

- The baseline test for air quality was inadequately repeated (N = 4) to construct an accurate representation of conditions, particularly compared to a similar mine which constructed a baseline over a year. *The proponent should re-do the testing over several months to adequately record baseline conditions.*
- *Baseline information for PM2.5, O_3, NO, NO_{Xa} should be collected nearer to the site rather than relying on an air quality station 120 km away.*
- Similar CEAA 2012-approved projects have air quality and emissions plans, and *the proponent for Valentine Gold should be required to develop an air quality and emissions plan one for this project.*

Community health

- Valentine Gold's EIS includes only one paragraph about anticipated cumulative health impacts, most of which implies that mitigation responsibility largely relies on other projects (e.g. Buchans Resource Limited Project). Given a long operating life and profound anticipated demographic changes in the project area, this paragraph is not sufficient for informed decision-making, and *a specific Health Impact Assessment should be conducted and included.*

Gender equity and diversity

- Despite significant reported adverse impacts from accommodation camps on women and Indigenous communities, like the one planned for the project and which the proponent admits

will be mostly composted of non-Indigneous men, this context is not discussed or approached from a Gender-Based Analysis Plus lens. *The Project should implement a GBA+ framework including GBA+ training for all employees, regardless of level.*

- *The proponent should detail what measures will be specifically taken to protect LGBTQ2S+ persons from adverse outcomes, both within local communities and among the project workforce.*

Species at risk and wildlife

- Despite there being nine identified species at risk expected to have direct impacts from the project, species at risk are not categorized as a unique VC. *Impacts of species at risk should be separated into a standalone section to improve the ability to evaluate provided information.*
- Using the same local assessment area (LAA) and regional assessment area (RAA) for each species is not biologically or ecologically appropriate to capture predicted impacts. *Impacts on species should be re-estimated using appropriate LAA and RAA sizes for those organisms.*
- A subpopulation of an endemic species at risk, the Newfoundland Marten, has critical habitat in the project area. *Habitat offsets should be established and permanently protected.*
- Despite increasing risks to their populations, including white-nose syndrome, northern long-eared bats and little brown bats were not adequately surveyed. T*he proponent should conduct more rigorous bat surveys to better understand their distribution and movements to allow for accurate impact prediction.*
- The mining site occurs directly within a woodland caribou migration route and places this herd at increased risk of predation and disturbance. The proposed buffer distance (500 m) is well below known thresholds for caribou avoidance of industrial operations, and predicted habitat loss is severely underestimated. Given the at-risk status of this species in Newfoundland, *the proponent should increase buffer distances and pause operations yearly during peak migration seasons.*
- *The proponent should explain why the Pot Hill Caribou herd was not included in the analysis.*
- There remain significant risks to habitat of avifauna at risk. To mitigate these, the proponent should *ensure a minimum 120m buffer distance for construction and operation from all freshwater bodies, monitor the site and nearby area for avifauna, and minimize clear-cut amounts*
- The impacts of noise on avifauna were not adequately considered. *The proponent should conduct blasting only during daytime hours, install noise barriers, and use centralized compressors to prevent unregulated noise from machinery*

Surface water quality

- Proposed tailings-related mitigations are not adequate compared to the risk of failure consequences which are described by the proponent as likely to have "very high" environmental impacts. Given the low acid buffering potential of local and regional waters, *a comprehensive grading plan is needed designed to contain, monitor and treat water that has contacted tailings, waste rock piles, and low- and high-grade ore stockpiles, and prevent contaminents from entering proximal water bodies.*
- Due to an already chemically weakened aquatic system, effluent discharge from the project could severely damage the surrounding aquatic environment. *The proponent should continuously monitor effluent interactions with the receiving environment beyond mine closure.*
- The project considers itself spatially isolated from other mining projects in the region, leading to to underestimation of cumulative effects. However, there are larger watershed connections between these projects. *The proponent should increase the LAA to reassess its hydrologic*

connectivity and interactions with other projects for the purposes of cumulative effects assessment.
- *The proponent should more specifically define "high runoff events".*

Vegetation, wetlands, terrain, and soil
- This section includes a large number of subcomponents and is difficult to evaluate as a group. *A revised EIS should be consistent with other CEAA 2012-approved projects and split this section into four separate sections to allow for careful evaluation of methods.*
- The initial ecological land classification study did not include specific details about forest composition or successional stages, which are crucial to understand risks to important habitats and features like old-growth forests as well as landscape fragmentation risks. *The proponent should re-do the ecological land classification study and report on square kilometres of each forest type and age likely to be impacted.*
- Insufficient details given about vegetation sampling regime (e.g. timing, approach to random stratification) to evaluate if the sampling approach met a quality standard needed to detect species at risk/species of conservation concern. *More details about vegetation sampling scheme should be provided, and the Proponent should establish permanent sample plots to monitor vegetation rehabilitation over a realistic timeline for re-establishment of alpine/boreal vegetation on mineral soils (~100 years).*
- Proposed site rehabilitation to restore native vegetation community includes seeding with native species. However, due to the difficulties of revegetation in boreal and alpine habitats, particularly on mineral soils, this is likely to be inadequate to prevent colonization of invasive species and to ensure replacement of original ecosystems. *A more comprehensive and adaptive approach to vegetation rehabilitation should be undertaken by the Proponent, including long-term trials and revegetation studies*.

The remainder of the document is a compilation of 4 brief reports on differing elements of the EIS, each with an executive summary, analysis, recommendations, and supporting citations. The full document may be cited as:

> Westwood, A., Bailie, J., Cameron, J., Carter, L., Ceci, S., Clarke, M., Collison, B., Deblois, K., Dvorski, H., Gardner, D., Haddad, C,. Kavanagh, D., Lopez, M., Reid, P. 2020. Submission on concerns and recommendations related to the proposed Valentine Gold project in Newfoundland and Labrador. Prepared for the Impact Assessment Agency of Canada. 65pp.

All coauthors consent to the public release of our work. Dr. A. Westwood, as the principal investigator and course instructor, certifies the technical soundness of the analysis and recommendations herein.

Thank you for your consideration, and we hope our recommendations can support a project and IA process which is more technically sound, just, and supports long-term environmental and economic prosperity in Newfoundland and Labrador.

Dr. Alana Westwood (on behalf of the coauthors),

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Contents

Report 1: Air quality, forests, species at risk, and surface water

Prepared By: Ben Collison, Hannah Dvorski, Mauricio Lopez, Patrick Reid

1.1 Executive summary

Marathon Gold, a Toronto based mining corporation, is proposing the development of a gold mine at Valentine Lake, an area situated in the west-central region of Newfoundland. Consisting of several open-pit mines within the 240 km^2 mineral licensed project area, the Valentine Gold Project has the potential to cause various adverse effects in the region and is currently being reviewed by the Impact Assessment Agency of Canada (IAAC) under the *Canadian Environmental Assessment Act 2012*. The Environmental Impact Statement (EIS) was recently submitted to the IAAC, prompting the beginning of the public comment period in which this report will serve as a formal submission. Four valued components (VCs) were studied and evaluated for the Valentine Gold Project EIS. These VCs were air quality, forests, species at risk, and water quality. Key recommendations were outlined for the regulator to consider when asking Marathon Gold for further information. A summation of the VCs and their accompanying recommendations are as follows:

Air Quality

- The baseline test for air quality was allotted an inadequate amount of time to construct an accurate representation of conditions. Additionally, external factors that may impact the baseline measurement in favour of the proponent were included. It is recommended that the proponent reconstruct the test over several months to adequately gauge conditions.
- Given the air contamination that will occur, the proponent must generate an air quality and emissions management plan that will dictate an acceptable emissions range, guidance for the proponent and stakeholders, and detail repercussions of emission excess.

Forests

- The EIS section representing forests encompasses too many important VCs and provides limited, scattered information addressing effects to forests. It is recommended that the proponent reconstruct their EIS to divide these VCs into sections titled 'Terrain' and 'Forests' for improved legibility.
- The proponent failed to identify the proportion of specific forest types that would be affected and their respective successional stages. It is recommended that the proponent executes an ecological land classification study to determine the proportion of forested areas affected and their specific forest types and successional growth stages.
- The proposed mitigation measures lacked in addressing the loss of forested areas. It is recommended that the proponent identify candidate areas for tree planting and provide financial support to a nature conservancy for land conservation initiatives to offset the impacts of habitat loss.

Species at Risk

- Proposed mitigation measures do not address project overlap with designated critical habitat for the Newfoundland Marten. It is recommended that the proponent provide funding to officially protect equivalent sized critical habitat areas as will be disturbed by the project.

- Due to insufficient consideration of endangered bat species during wildlife surveys, it is recommended that the proponent conduct adequate surveys for bats during the active season and conduct studies on the potential spread of white-nose syndrome due to project area disturbance.
- The mining site occurs directly within a woodland caribou migration route, therefore it is recommended that the proponent cease all activities during peak migration seasons every year.

Surface Water

- Due to an already chemically weakened aquatic system, effluent discharge from the project could severely damage the surrounding aquatic environment. It is recommended that the proponent continuously monitor effluent interactions with the receiving environment beyond mine closure.
- The project considers itself spatially isolated from other mining projects in the region, which could lead to underestimation of cumulative effects. It is recommended that the proponent reassess its hydrologic connectivity and interactions with other projects for the purposes of cumulative effects assessment.

1.2 Insufficiency of Proposed Mitigation of Air Quality

1.1.1 Background

We chose air quality as a VC to be evaluated for Valentine Gold mine because of its intrinsic importance to the health and wellbeing of humans, wildlife, vegetation, and all other biotas. Emissions from the Valentine Gold Project have the potential to adversely affect all of these elements.

The most substantive air contaminant releases are anticipated to occur during two stages of the project, the construction and operation phases, while decommissioning and post-closure monitoring are expected to generate negligible air emissions (Marathon Gold, 2020a, p. 10). During construction, air contamination primarily stems from site preparation activities. Site preparation activities that may impact air quality include combustion gases from vehicles and heavy-machinery, temporary diesel generators, dust from heavy earth-moving equipment, and wind erosion (Marathon Gold, 2020a, pp. 23-24). During the operation phase, air contamination would primarily be derived from plant processing activities. Plant processing activities that may impact air quality are the same emissions from site preparation activities, and will also include dust generated from blasting, tailings management, stockpiling, handling and transporting ore, water rock and overburden, and milling (Marathon Gold, 2020a, p. 9).

The project is subject to other federal and provincial legislation, policies, and guidance in addition to CEAA, 2012. Specifically, the project must comply with the Air Pollution Control Regulation for Newfoundland, which measures the release of contaminants directly from the source and establishes permissible ground-level concentrations or air contaminants in ambient air (Health Canada, 2020, pp. 13-15). In addition, the project must adhere to federal air quality criteria under the Canadian Ambient Air Quality Standards which control emissions and ground-level concentrations of various air contaminants on a national scale. Both legislations require a

baseline test to be completed in order to accurately measure potential changes that may occur to the atmospheric environment (Health Canada, 2020 pp. 13-15).

To adequately assess baseline conditions, Section 7.1 of the EIS titled 'Atmospheric Environment' requires a survey be conducted of ambient air quality in the airshed that will be affected by the project. This must be done so by allotting a study area that adequately represents conditions of the project to effectively assess potential adverse environmental effects as a result of the project. The proponent will be required to compare anticipated air quality against the Canadian Ambient Air Quality Standards (CAAQS) for fine particulate matter and ozone. To appropriately gauge the potential adverse environmental effects of the project, the study area encompasses the mine site, the portion of the existing access road to be upgraded, and 35 seasonal dwellings. In addition, this area satisfies the local assessment area outlined in the EIS (Marathon Gold, 2020b, p. 6).

1.1.2 Evaluation

The air quality conditions were measured by completing a field survey testing the concentration of specific air contaminants in the prescribed study area over a four-day period. As the study area is largely rural and undeveloped, there are few sources of air contaminants from human activities or large industrial emissions in this area (Marathon Gold, 2020a, p.77). Outside of the study area, the nearest sources of air contaminants are from two non-operational mines, Duck Pond Mine, Barite Mud Services, and a pulp and paper mill which are 57 km, 41 km, and 90 km away, respectively (Marathon Gold, 2020b, p.9).

The results from the baseline test were compared against data from Environment and Climate Change Canada and the Newfoundland Department of Environment, Climate Change and Municipalities to analyze air contaminants of potential concern (Marathon Gold, 2020b, p. 9). The survey consisted of measuring ambient concentrations of total suspended particulate matter less than 10 microns in diameter, metals, sulphur dioxide, and nitrogen dioxide over a period from June 15-19, 2020 (Marathon Gold, 2020b, p. 6). The proponent shared the results in pictorial format, outlining the results for each air contaminant.

Upon conducting the baseline test, the proponent noted that it is unlikely that the air containment released from the distant mines would contribute to reduced air quality enough to impact the baseline testing results (Marathon Gold, 2020b, p. 9). The proponent found that concentrations are deemed representative of the background ambient air quality at the project area. It is important to note that in addition to the two distant mines, both exploratory drilling and tree trimming occurred during the four-day testing period, 15 km and 500 m in the distance, respectively (Marathon Gold, 2020b, p. 13).

A comparable mine to Valentine Gold is the Blackwater Gold mine in BC, proposed by BW Gold (previously New Gold) which was approved under CEAA 2012 in April 2019 (New Gold, 2015). This open-pit gold mine is of similar production rate and operation lifespan, located in British Columbia. BW Gold was also located in a remote area with few emission sources nearby and would also require the creation of an air quality baseline. In addition to this, BW Gold also required detailed mitigation measures and future air quality management practices. Similar to Valentine Gold, BW Gold expected air quality emissions to occur during mine planning, construction, and decommissioning, from point and fugitive sources, particulate matter, diesel

fuel combustion in heavy equipment operation, and emissions from blasting. In addition, BW Gold is also governed by regulations from provincial and national governing bodies.

BW Gold assessed air quality through estimating project emissions by predicting changes in the ambient concentrations of sulphur dioxide, nitrogen dioxide, and particulate matter and comparing them to listed regulatory objectives and standards (New Gold, 2015). This monitoring was conducted for a full year at the mine site (New Gold, 2013, p. 1). In addition, the proponent created an air quality management plan that specifically outlines how BW Gold outlines its monitoring process at the before, during, and after phases of the mine (New Gold, 2015).

In comparing Marathon and BW Gold, it is clear that BW Gold takes a stronger approach to air quality monitoring for two specific reasons. First, BW Gold conducted monitoring of baseline condition for one year at its mine site, while the monitoring by Marathon took place over four days. The short time frame could allow for irregularities in results and does not provide an accurate baseline for air quality conditions such as tree cutting and exploratory drilling which could skew the baseline results in favour of the proponent. Second, BW Gold has created an air quality and dust management plan that would address air quality effects, including detailed descriptions of sources, the environmental receptors to be monitored, and the outlining of a compliance monitoring program that allows for stakeholder accessibility to these specific details. Currently, Marathon has not outlined a management plan specific to air quality.

1.1.3 Recommendations

To properly address concerns related to air quality, further action is required on behalf of Marathon. First, the proponent should be tasked with the reconstruction of the baseline monitoring process. The initial monitoring time of four days is an insufficient timeline to properly gauge air quality. In addition, the proponent indicated that exploratory drilling and tree trimming were taking place during the testing period, which may have had an impact on results. A longer testing period of several months would ensure adequate monitoring of air quality in the absence of background activities that may act as outliers to skew results. According to the Quality Control Guidelines by the Canadian Council of Ministers of the Environment (2019), an accurate elapsed time is necessary to determine the sample concentration - as the baseline concentration is subject to increases or decreases in air quality over a four-day period, a longer sample size is required.

Second, it is recommended that the proponent is charged with the responsibility of creating an air quality and emissions management plan, similar to BW Gold. This will provide the appropriate level of guidance and details to both the proponent and stakeholders to ensure environmental effects and risks are adequately addressed. Detailed measurements of baseline results, as well as projected emissions, should be included, as well as specific repercussions if these emissions levels are exceeded at any point in the project construction.

1.2 Evaluation of the project's consideration of forests

1.2.1 Background

We chose forests as a VC to undergo evaluation from the Valentine Gold Project as they provide a multitude of vital ecosystem services to people, flora, and fauna in the region. Section 7.6 of

the EIS summary titled 'Vegetation, Wetlands, Terrain and Soil' is split into four categories to address VCs including forests: existing conditions, changes to the environment, mitigation measures, and significance of residual effects (Marathon Gold, 2020a, pp. 23-42).

Section 7.6.1 for existing conditions outlines the characteristics of the area proposed for mining operations development (Marathon Gold, 2020a, pp. 23). The proposed project area is situated within the Central Newfoundland Forest Ecoregion (Marathon Gold, 2020a), which is part of the greater boreal forest region of Canada (Boreal Songbird Initiative, n.d.). More specifically, the project is located within the Red Indian Lake Subregion, one of four sub-ecoregions of the Central Newfoundland Forest Ecoregion (Marathon Gold, 2020a; Government of Newfoundland and Labrador, 2020). Touted as having the most productive forest types in Central Newfoundland, this area is dominated by black spruce, white birch, and balsam fir (Government of Newfoundland and Labrador, 2020; Marathon Gold, 2020a). An ecological land classification study of forested ecosystem units in the area found balsam fir forest, black spruce forest, kalmia-black spruce woodland, mixed wood forest, regenerating forest, and alder thicket (Marathon, 2020a). Despite this biodiversity and productivity, succession to alder thickets in the Red Indian Lake Subregion has been identified as a major silvicultural issue resulting from clear-cutting and fire (Government of Newfoundland and Labrador, 2020)

The forested area proposed for development serves as vital habitat for a wide variety of wildlife species. Section 7.9 of the EIS summary titled 'Other Wildlife' lists the species that could be affected by the project, including moose, Canada lynx, muskrat, black bear, and several others (Marathon Gold, 2020a, pp. 55-61). More importantly, the forested area proposed for development is home to the American marten, whose distinct Newfoundland population is listed as 'Threatened' and protected under the federal *Species at Risk Act* (*SARA*) and province's *Endangered Species Act* (*ESA*), the woodland caribou, whose distinct Newfoundland population is listed under the provincial *ESA*, and the northern long-eared bat and little brown bat, which are both listed as 'Endangered' under the *SARA* (Marathon Gold, 2020a). These species rely on the area's forest cover for protection from predators and weather events, for their habitats, and their food sources (COSEWIC, 2007), highlighting the importance of understanding the adverse effects associated with deforestation within the project area.

1.2.2 Evaluation

The large grouping of VCs by Marathon Gold in Section 7.6 of the EIS summary titled 'Vegetation, Wetlands, Terrain and Soil' made it difficult to recognize the effects on forests from the project proposal (Marathon Gold, 2020a, pp. 23-42). As the section compiled a broad range of VCs, these various components were described in a seemingly chaotic fashion with no true indications of order or consistency. For instance, when trying to understand the forest composition of the proposed project area, the information found was scattered between wetland, soil, and terrain features that were described all within the same subsections and paragraphs. While reviewing Marathon Gold's EIS summary, it was compared to the EIS summary submitted by the proponent New Gold Inc. for the Blackwater Gold Project in BC, a project which has since been granted approval by the Impact Assessment Agency of Canada. Their 'Environmental Effects' assessment portion of the EIS featured sections specific to wetlands, physiography and topography, surficial geology and soil cover, soil quality, ecosystem composition, and plant species and ecosystems at risk (New Gold, 2015). By breaking up these important VCs and

giving them their own dedicated sections, it was much easier to grasp the environmental effects associated with each VC.

The methods used to gather pertinent information about the forested area in the Valentine Gold Project vicinity lacked specificity. Field studies and an ecological land classification study were mentioned in the section – however, there was no description of the scale on which these studies were conducted (e.g., samples at meso- or macro-levels). In addition to this, there was no mention of the successional growth stages of the forests in the project area, which is a fundamental component of an ecological land classification (Grondin et al., 2013). Results from research on old-growth forests in eastern Canada indicates that as their tree populations mature, their genetic diversity and reproductive capabilities increase, signifying that these old-growth forests may act as natural reservoirs of genetic diversity and reproductive fitness for native tree species in the region (Mosseler et al., 2003). Given the complex structural heterogeneity of old-growth forests (McCarthy & Weetman, 2006), quantifying and understanding their composition in the project area is imperative in determining potential adverse effects to these important forested areas. In comparison, the BW Gold Project was far more successful in identifying the successional growth stages in their project area. Old-growth forests were used as an indicator in their 'Ecosystem Composition' section, where three project phases were established to facilitate assessment: baseline, project operations, and post-closure (New Gold, 2015). These project phases allow for better measurement of key indicators like old-growth and will help in determining the overall toll of site development on forested areas, providing insight into losses in which mitigation strategies can target.

The mitigation measures outlined in Section 7.6.2.2 of the EIS summary were inadequate in minimizing the impacts on forested areas in the region (Marathon Gold, 2020a, pp 35-39). The only stated mitigation measure addressing trees asserted that "trees will be cut close to ground level, and only large stumps will be removed, where practicable" (Marathon Gold, 2020a). This is hardly a mitigation measure and demonstrates Marathon's failure to consider species composition, overstory and understory cover, successional growth, and habitat as key indicators of forests in the project area. Once again, Marathon underperformed in this regard when compared to the EIS summary of the BW Gold Project. BW Gold's mitigation strategy included a blend of approaches aimed at offsetting the loss of trees at the site while supporting initiatives in the province to support the key tree species affected by development (New Gold, 2015). An example of an approach aimed at offsetting the loss of trees was their efforts in field studies to identify areas on the project site (but outside of the development area) that were candidates for tree planting of key tree species that would be lost during site development (New Gold, 2015). These forms of mitigation measures demonstrate the proponent's commitment to offset and minimize impacts from mining activities, commitments that are thus far absent from Marathon Gold's mitigation measures agenda.

Furthermore, Marathon Gold's EIS summary lacked quantitative information regarding how much deforestation will occur to specific forest types and tree species to indicate which will be most affected. The language used in the EIS summary regarding this important concern was very general and lacked specificity in its details. For instance, in Section 7.6.2.3 outlining the significance of residual effects, it was mentioned that "construction activities could result in changes to plants within an area of 41.0 km^2" (Marathon Gold, 2020a, pp. 40-42). The usage of the word 'plants' as a descriptor provides very little clarity regarding the forest types and tree species affected, as one could interpret plants as anything ranging from small shrubs to old-

growth trees. When compared to the BW Gold Project, this lack of transparency became increasingly evident. In the EIS summary for Blackwater, tree types and their associated coverage were measured in hectares and detailed for both the entire project area and, more specifically, the area that was predicted to be affected by development. The same details were given for ecosystems at risk as well as plant species at risk. This level of detail was absent from the Valentine Gold Project's EIS summary, leaving much uncertainty and speculation regarding the levels of deforestation and their effects in the region.

1.2.3 Recommendations

To sufficiently address concerns related to forested areas within the project site, further action must be taken by the proponent. It is first recommended that the EIS summary and its Section 7.6 for 'Vegetation, Terrain, Wetlands and Soil' be divided into multiple sections. As demonstrated in the EIS summary for the BW Gold Project, it is far easier to understand the implications of development on VCs when they have their own dedicated sections. It is advised that Marathon Gold re-configure its EIS and have separate sections titled 'Terrain,' which will encompass components such as landforms, soils, and geology, and 'Forests,' which will encompass components such as plant species composition, cover, successional growth, and habitat. This reconfiguration will promote an enhanced understanding for stakeholders and decision-makers reading the document about the effects on these important VCs, replacing the convoluted and disorganized section that currently exists.

Additionally, it is recommended that the proponent executes another ecological land classification study to determine the proportions of forest types that will be directly impacted by the site development as well as their respective successional growth stages. The initial study failed to take an inventory of the square kilometres projected to be disturbed for each forest type, nor whether these forests were in their primary succession stages or were considered old-growth forests. These factors are important in determining the overall impacts on forests from the mining operation and should be made available for stakeholders and decision-makers to take into consideration.

Finally, it is recommended that Marathon Gold make meaningful efforts to offset the impacts on forests by implementing a more comprehensive mitigation measures strategy. As Marathon Gold's project area spans 240 km^2 and the estimated area of site development is 41 km^2, it is advised that Marathon identify candidate areas for tree planting outside the project footprint during the ecological land classification study previously mentioned. Such efforts would promote forest growth in nearby areas that may have been previously affected by clear-cutting or fire, replacing lost habitat for plant and wildlife species in the region. In addition to this, it is suggested that Marathon support initiatives operating in the province such as Nature Conservancy Canada that protect and conserve lands across Newfoundland. As mining site developments similar to the Blackwater Gold Project can sometimes incur habitat loss for tree species that are irreversible and permanent (New Gold, 2015), efforts must be made to uphold and protect forests elsewhere in the province should the site be developed.

1.3 Inadequate consideration and mitigation for species at risk

1.3.1 Background

The balsam fir and black spruce forest regions of central and western Newfoundland provide large expanses of natural habitat for iconic species such as woodland caribou (Rangifer tarandus), moose (*Alces alces*), American marten (*Martes americana atrata*), and Canada lynx (*Lynx canadensis*) (Sturtevant et al., 1997). Newfoundland's many freshwater lakes, rivers, and wetlands are also home to species such as Atlantic salmon (*Salmo salar*), American eel (Anguilla rostrata), lake trout (*Salvelinus namaycush*), northern leopard frog (*Lithobates pipiens*), and the harlequin duck (*Histrionicus histrionicus*) (Bradbury et al., 1999). The Valentine Gold Project's EIS has identified nine species at risk listed under Schedule 1 of the Canadian *SARA* that occur or have potential to occur in within or near the project area (Marathon Gold, 2020d). Schedule 1-listed species include the olive-sided flycatcher (*Contopus cooperi*) common nighthawk (*Chordeiles minor*), rusty blackbird (*Euphagus carolinus*), bank swallow (*Riparia riparia*), evening grosbeak (*Coccothraustes vespertinus*), red crossbill (*Loxia curvirostra percna*), American marten, northern long-eared bat (Myotis septentrionalis), and little brown bat (Myotis lucifugus) (Marathon Gold, 2020d). When species of conservation concern are included along with provincially listed species, that number increases to 25 (Marathon Gold, 2020d). Some of the species that will be impacted by the project are described below, with evaluations of the proponent's performance with regards to managing these species, and recommendations for the regulator to consider when analyzing Marathon Gold's EIS for the Valentine Gold Project.

The Newfoundland population of the American marten was added to Schedule 1 of *SARA* in 2003, subsequently designated as 'Threatened' by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2007. Population size estimates indicate that there are 438 – 852 individuals across the entire island, with most of these found in three forest patches in Western Newfoundland, or Terra Nova National Park along the east coast (COSEWIC, 2007). Studies done on the Newfoundland marten have found that habitat selection is more general than the mainland population – preferring coniferous and mixed wood habitat due to the naturally fragmented landscape of Newfoundland (Hearn et al., 2010).

The northern long-eared bat and little brown bat species were both emergency-added to Schedule 1 of the SARA in 2014, after a 94% decrease in population sizes was observed in the Eastern portion of their ranges between 2010 and 2013 due to the rapid spread of white-nose syndrome (WNS) (COSEWIC, 2013). The bat population sizes have not been calculated for Newfoundland, however, they are expected to be fairly healthy due to the limited spread of WNS on the island. Habitat requirements for both species are mature coniferous or mixed-wood forest during the spring/summer and underground caves or abandoned mines for overwintering while undergoing hibernation (Environment Canada, 2015).

Woodland caribou in Newfoundland do not have a SARA listing under Schedule 1, but they have been designated as 'Special Concern' by COSEWIC (2014). There are several herds of caribou in Newfoundland which total around 30,000 individuals, a significant decrease from about 95,000 in the mid-1990's (Randell, 2019). During the warm months, woodland caribou migrate to open habitats such as barrens or wetlands, and in the winter they inhabit forested areas to feed on lichen and other vegetation while reducing predation risk (COSEWIC, 2014).

The American eel was listed as 'Threatened' by COSEWIC (2012), following significant population reductions in Ontario, however it does not have a SARA listing under Schedule 1 despite undergoing review for several years. Total population sizes are unknown, although Newfoundland fishing data has indicated a decline in species abundance (COSEWIC, 2012).

American eels live in freshwater lakes and rivers all throughout Newfoundland and migrate to the Sargasso Sea in the Atlantic Ocean to spawn once in each individual's lifetime (COSEWIC, 2012).

1.3.2 Evaluation

The most obvious critique of the Valentine Gold Project is the lack of an explicit "Species at Risk" VC for the project's environmental assessment, despite there being nine species listed under Schedule 1 of *SARA* that occur or have the potential to occur within the project area (Marathon Gold, 2020c). Caribou and Avifauna were considered as separate VCs, and all of the other species at risk were lumped together under the "other wildlife" VC (Marathon Gold, 2020c). A much better method of VC classification would be to have a specific VC for species at risk, where it is broken down by listed *SARA* species, and other species of conservation concern. For example, the Beaver Dam Mine Project EIS listed "Species of Conservation Interest and Species at Risk" as a VC during environmental effects analysis (Atlantic Gold, 2017).

Adequate habitat for the Newfoundland marten is one of the most important considerations to ensure that the species can persist throughout the island. Although critical habitat for this species was designated by the provincial government in 2010, the Valentine Gold Project area, local assessment area, and regional assessment area all overlap with designated critical habitat (Marathon Gold, 2020c, Figure 12-8, pp. 376). The baseline survey effort to study and monitor this species was sufficient, with GIS layouts produced showing high and low concentrations of Newfoundland marten individuals. However, the proposed mitigation measures do not specifically address the loss of the critical habitat of this threatened species within the province. The mitigation statements that generally discuss habitat retention or wildlife management often end with phrases such as "to the extent possible" or "if feasible," thus leading to concerns about the practicality or legitimacy of these outlined mitigation measures (Marathon Gold, 2020c, Table 12.18, p. 392). The proposed mitigation strategies seem feasible at first glance; however, there is a poor level of detail by the proponent and a lack of enforcement actions for failing to abide by outlined mitigation measures (Gibson, 2012). Because of this, the extent of mitigation measures being implemented is brought into question.

In the Valentine Gold EIS, the northern long-eared bat and little brown bat were largely assessed together due to similar habitat needs, ecological niches, and potential impacts. WNS was cited in Section 8.3.1.1 as the main concern for the continued survival of these species in Newfoundland, and there is a known bat hibernaculum site ~12.2 km from the project area that has tested positive for WNS (Marathon Gold, 2020c, p. 84). WNS was first detected in Newfoundland in 2017, and since then there have been several more deaths in the western part of the island (CBC News, 2018). In the 'species at risk' section of the winter wildlife survey report by Stantec Consulting, there was no mention of bats. Although endangered bat species occur close to the project area as identified through external data, there was no effort to study species abundance despite the habitat value assessment stating that 70% of the local and regional project areas provide suitable habitat for these bat species (Marathon Gold, 2020d, p. 87). The lack of baseline data collected for endangered bat species shows that they were largely ignored during the EIS process. This is concerning, particularly because WNS is present near the project location and sensory disturbance from the project could cause this local population of bats to relocate, further spreading this extremely destructive disease.

The proposed project lies directly within the yearly spring and fall migration routes for the Buchans herd of woodland caribou (Marathon Gold, 2020c, pp. 275-278). By developing the mine at this location, there would be easier access for predators to the direct locations of migrating caribou (Marathon Gold, 2020c, pp. 282-284). Predators such as coyotes, black bears, or lynx would have easier access to the herd due to vegetation clearing and road construction around the project site. Additionally, because this caribou herd has used the migration route for decades, the habitat loss and sensory (light and noise) emissions will adversely affect the herd by forcing them to alter their migration route (Marathon Gold, 2020c, p. 287). A study done by Weir et al. (2007) observed the effect that the Hope Brook Gold Mine had on the La Poile woodland caribou herd in Southwestern Newfoundland. The research found that there was a large area of high-quality caribou habitat around the mining site in which the caribou evaded due to sensory avoidance (Weir et al., 2007). The direct habitat loss due to the Hope Brook Mine Project was ~1.8 km^2, but when the avoidance radius around the mining project was considered, functional habitat loss was roughly 50 km^2 (Weir et al., 2007). The research discussed that although 50 km^2 may not seem like a large portion of the 7,000 km^2 home range of the La Poile herd, "if it is along a migration route, the impact may be substantial, and can contribute to cumulative effects of development" (Weir et al., 2007). Despite citing this evidence and other scientific studies in the EIS (p. 300), Marathon Gold (2020c) only added a 0.5 km buffer of indirect habitat loss to the direct habitat loss from the project area. Therefore, the total amount of functional habitat loss due to this mining development within the caribou migration route was grossly underestimated. The proponent calculated direct habitat loss within the project area as 28.5 km^2, and indirect loss (with a 500m buffer applied) as 85.8 km^2 (Marathon Gold, 2020c, p. 303). Although published studies have observed caribou avoidance of mining projects between 1.5 – 23 km depending on the scale of the project, to model indirect habitat loss and corresponding project mitigation measures for woodland caribou with a 500m sensory avoidance zone is inaccurate and insufficient.

The American eel is a traditional staple in the Newfoundland Mi'kmaq diet, providing nutritious protein during the winter months when caribou and moose hunting is more difficult (Weiler, 2011). The species is known to occur within the local assessment area, along the access road on the south side of Red Indian Lake (Marathon Gold, 2020c, p. 39). Like many other fish species, eels are often subject to bioaccumulation of chemicals, particularly because muscle lipid content is much higher in eels compared to other fish species, allowing chemicals to persist longer (Belpaire et al., 2016). Marathon Gold has stated that tailings seepage will exceed the appropriate water quality guidelines for aluminum and copper fluoride concentrations in the Victoria River (Marathon Gold, 2020c, p. 69). The Victoria River flows into Red Indian Lake, thus allowing heavy metal concentrations to be expelled into the waterbodies. Additionally, under mitigation (Marathon Gold, 2020c, p. 56) the proponent stated that "work will be scheduled to avoid high precipitation and runoff events or periods, which could increase potential for erosion/sedimentation." Marathon Gold indicated that this mitigation technique will be followed during construction and decommissioning of the mine, but not during the mining operation. The allowable levels of pollution and sedimentation in Red Indian Lake may negatively impact the American eel population and other fish species that are present in the waterbodies surrounding the Valentine Gold project.

1.3.3. Recommendations

There are several recommendations for the regulator to consider when assessing the proposed mitigation measures that Marathon Gold put forth to reduce the impacts on species at risk by the Valentine Gold Project. First, it is recommended that the EIS be amended so that there is a 'species at risk' VC that can be examined separately from the other wildlife VCs. Having a VC such as 'Species of Conservation Interest and Species at Risk' with its own set of assessment procedures and mitigation measures would make VC assessment much easier, instead of trying to separate the factors specific to species at risk from multiple VCs.

The Newfoundland marten is one of Newfoundland's most well-known endemic species, with a subpopulation to the southwest of Red Indian Lake, and a provincially designated critical habitat directly overlapping with the mining project. However, this critical habitat is not officially protected. Therefore, to ensure that this species has continuous protection, a new mitigation requirement is recommended that Marathon Gold provide funding to partner with the Nature Conservancy of Canada to officially protect an equivalent area of high-use quality critical habitat that will be disturbed by the project. Due to sensory disturbance, this area should be of equal size or larger than the critical habitat and regional assessment area overlap with the Valentine Gold Project.

It was found during VC evaluation that the northern long-eared bat and little brown bat were not considered while surveying for species, particularly because this was done during the winter while bats were hibernating. Because these species are nocturnal, it is therefore recommended that dusk and nighttime surveys occur during the summer months to determine habitat use for these endangered species around the proposed project and surrounding areas (Whitby et al., 2014). Bat echolocation detectors could be deployed to narrow results down to species and activity type (Whitby et al., 2014). Once the presence or absence of further bat colonies within the project region has been determined, it is also recommended that the proponent partner with the Environment and Conservation branch of the provincial government to conduct studies of the potential spread of WNS due to the project activities and what additional mitigation measures could be implemented to help reduce risk of disease spread.

The Buchans herd was estimated at 4,000 animals during region-wide caribou surveys in 2016 (Randell, 2019). Allowing the largest mining project in Newfoundland to be constructed and operated in the middle of the Buchans herd migration corridor would have impacts on the caribou, regardless of the proposed mitigation efforts (Weir et al., 2007). Therefore, to attempt to reduce these impacts on the Buchans herd, it is recommended that the regulator inserts a mitigation measure to cease mining construction, operation, and decommission activities during the peak caribou migration season. This would typically occur for a two- or three-week period during mid to late April, and late November to early December, depending on the seasonality of that year (Schaefer & Mahoney, 2013). It is recommended that Marathon Gold work with the Wildlife division of the Newfoundland Department of Fisheries and Land Resources to determine the most ideal time for shut down, as the provincial government has access to radio-collar telemetry data for the Buchans herd. It is also recommended that the proponent install high fences around the project area such that the caribou are not exposed to site hazards while operations are ceased (tailings water, open pits, etc.). This mitigation measure would benefit other species that inhabit the surrounding environment as well.

To reduce the impacts on the American eel and other fish species (Atlantic salmon, Arctic char, brook trout, *ouananiche, etc.) in the Victoria River and Red Indian Lake, additional mitigation*

measures are recommended. It is recommended that Table 8.14 (Marathon Gold, 2020c, p. 56) be amended such that the proponent clarifies what thresholds constitute "high precipitation or runoff events," and that mining operations also be ceased during these events, not just construction and decommissioning activities. Near the bottom of Table 8.14 (p. 60), it is recommended that the proponent clarify what water quality guidelines must be met to have the sedimentation ponds "breached to allow drainage into the surrounding areas" during mine decommissioning (Marathon Gold, 2020c). It is also recommended that the proponent strengthens the language in the last mitigation measure of Table 8.14 (p. 60) to make clear that passive water treatment technologies will be employed following project decommission, rather than "where and if required," or "as practicable" (Marathon Gold, 2020c).

1.4 Evaluation of the project's effects on surface water

1.4.1 Background

We chose surface water as a VC to be assessed for the Valentine Gold Project because of its importance in sustaining critical ecological systems and biological life in the area. The proposed project is located within the largest watershed on the island known as the Exploits River Watershed, encapsulating a total area of 10,241 km^2 (O'Connnell, M. & Bourgeois, C., 1987; Marathon Gold, 2019, pp. 52-53). The project area sits on a topographic divide where surface and groundwater drain south via small watersheds to three primary water bodies: the Victoria Lake Reservoirs, Valentine Lake, and Victoria River (Marathon Gold 2020e, pp. 18). The watershed is known to host a variety of fish species, including native Atlantic salmon, Brook Trout, Arctic Char, and Threespine Stickleback, (O'Connnell, M. & Bourgeois, C., 1987), all of which have been recorded within the project area (Marathon Gold, 2019, pp. 52-53). Running approximately 0.5 km from the project site is the Victoria River which feeds into the larger Exploits River, one of the most important Atlantic salmon rivers in Newfoundland (O'Connnell, M. & Bourgeois, C., 1987; Marathon Gold, 2019, pp. 52-53). The watershed is vital for sustaining local waterfowl life including Canadian Geese, Greater Yellowlegs, and American Black Duck, as well as sustaining mammalian wildlife such as river otters, minks, black bears, and beavers (Marathon Gold, 2020d, pp. 52-53). The success of many of these species heavily depends on the overall aquatic health of the watershed. Due to the high degree of watershed surface flow connectivity, a localized impact at or near the project area is likely to travel downstream and become prevalent throughout the watershed, emphasizing the importance of assessing potential effects on surface water near the project.

Outlined in Section 3.4 for Surface Water potential adverse effects to surface water (i.e., effects to quantity and quality) may arise from changes to local watershed networks, open-pit water management (dewatering during operation, flooding after cessation), direct discharge of treated water and effluents into the immediate environment (i.e., Victoria Lake Reservoir, Valentine Lake, Victoria River) at selected final discharge points and indirect contaminant seepage from waste rock and overburden stockpiles or tailings management facility (Marathon Gold, 2020e, pp. 15). Additionally, effects to surface water are anticipated to arise and persist during and after mine construction disrupting waterbodies and watercourses (Marathon Gold, 2020f, pp. 18). Mine development activities and infrastructure will include vegetation clearing, soil stripping and grubbing, access and hauling road construction, mine excavation, project buildings and facilities, a heap leach pad, and material and waste stockpiling; all of which are likely to alter natural surface flow patterns of water (Marathon Gold, 2020a, pp. 18). At project rehabilitation and closure, open pits will be left to flood either naturally from precipitation and groundwater

infiltration or by pumping water from Victoria Lake and Valentine Lake, which could affect the water quantity of the two lakes (Marathon Gold, 2020f, pp. 16-18). Furthermore, raw water from Victoria Lake will be extracted and treated to provide for potable water and fire water needs and support some project operations such as mill motor water cooling, lubrication, and reagent make-up water (Marathon Gold, 2019, pp. 30-31).

To assess the potential effects on surface water, the proponent conducted baseline studies of the local surface water quality and compared results to the regional water quality conditions. The local surface water system is characterized by the surface water flow pathways from the project site into the receiving Valentine Lake, Victoria Lake Reservoir, and the Victoria River (Marathon Gold, 2020e, pp.15). Both the regional and local surface water conditions were found to have naturally elevated levels of metals, before any project development (Marathon Gold, 2020f, pp. 83-94).

1.4.2 Evaluation

Upon analysis of the Hydrology and Water Quality Monitoring Baseline Report, several concerns were brought up relating to water quality exceedances under the Canadian Water Quality Guidelines for Protection of Freshwater Aquatic Life (CWQG-FAL) (Marathon Gold, 2020f, pp.83). In the Local Water Quality section of the EIS, lab results for water quality samples from the project site show several chemical constituent exceedances (Marathon Gold, 2020f, pp. 83-94). Results showed that from 686 water sample collections across 26 water quality monitoring stations, naturally elevated levels in water pH, nitrites, aluminum (Al), arsenic (As), cadmium (Cd), iron (Fe), lead (Pb), and zinc (Zn) were present in the surrounding aquatic environment (Marathon Gold, 2020f, pp. 83-94). In total, 55 pH exceedances were recorded at 18 out of the 26 water quality monitoring stations (Marathon Gold, 2020f, pp. 83). Maximum nitrite measurements were reported to be considerably close to the CWQG -FAL limit of 0.06 mg (CCME, 2014), with one case for nitrite exceedance recorded (Marathon Gold, 2020f, pp. 83-94). The most exceedances in constituent concentrations were seen in the metal concentration results. Exceedances in aluminum were recorded at all but three water quality stations, with a total of 221 recorded exceedances. Arsenic concentrations exceeded limits 16 times across seven of the 26 monitoring stations. Cadmium recorded 17 CWQG-FAL exceedances at 10 stations. Copper concentrations were exceeded 10 times at 13 locations. 114 exceedances for Iron were recorded at all 26 monitoring stations except for two. Lead reported 3 total exceedances at five stations and zinc exceedances were reported at least once at 22 of the 26 water quality monitoring stations (Marathon Gold, 2020f, pp. 83-94).

The naturally elevated levels of these constituents raise concerns regarding the long-term stability and health of aquatic species and habitat. The effects of heavy metals (e.g., Cu, Zn, Cd, Cr, Fe) on the aquatic environment and life are well documented, causing deformities on fish larvae and severely debilitating the success of species populations (Sfakinanakis et al., 2015). Furthermore, the degree of heavy metal accumulation in fish tissues and aquatic plants is dependent on other aquatic conditions such as pH, water temperature, hardness, alkalinity, metal concentration, and metal concentrations (Jezierska & Witeska, 2006). Considering that the project is proposing to discharge effluent and treated water to the direct environment (e.g., Victoria Lake and Valentine Lake), there may be serious risks to what is likely an already debilitated ecosystem. Furthermore, the decommission, rehabilitation, and closure of the mine plan lacks continuous monitoring and waste treatment after the cessation of mining activities. Marathon only intends to mitigate sewage effluent discharge during the construction and

operation of the mine and excludes the treatment and monitoring of discharge from waste-rock stockpiles, flooded open pit, and tailings after mine closure (Marathon, 2020g. pp. 76-82). This may inherit the potential for continuous influxes of harmful chemicals and metals into the aquatic system. Additionally, the baseline analysis categorized the water system to have low pH buffering potential with low to moderate alkalinity, meaning the normal water system may be too weak to restabilize and regain its equilibrium. Thus, any 'safe' activity from the project such as treated water discharge may result in severe impacts due to the environment's already vulnerable state and inability to regulate itself.

The assessment of cumulative effects on surface water from future and active projects also bring up concerns. Section 20.4 of the EIS outlines the cumulative effects of future and present project developments including Cape Ray Gold Project and Buchans Base Meal project (Marathon Gold, 2020g, pp. 21-26). The EIS states that no spatial overlap is considered to occur between the Valentine project and the Cape Ray Gold project as it is located in a different watershed, thus not contributing to cumulative effects on surface water. However, the proposed Cape Ray Gold project is approximately 50 km downstream from the project, meaning both projects are enveloped within the larger Exploits Watershed. Similarly, the EIS states that effects on surface water from Buchans Base Metal project effects are not expected to overlap with those of the project's, regardless of both projects' neighbouring water bodies (e.g., Red Indian Lake and Victoria Lake) being hydrologically connected by the Victoria River and other surface water flow networks (Marathon Gold, 2020g, pp. 5). By not considering its hydrologic connectivity with other project sites, the proponent may be underestimating the cumulative effects on surface water, which could lead to severe and perpetual impacts on the aquatic environment.

1.4.3 Recommendations

To protect the vulnerable aquatic environment, it is recommended that the proponent performs further testing and studies on surface water. Specifically, the proponent should focus on changes to water quality as a result of proposed effluent and wastewater discharge into Victoria Lake Reservoir, Valentine Lake, and Victoria river. Furthermore, the lack in surface water monitoring and mitigation upon mine cessation poses a perpetual risk, as harmful chemicals and metals continue to enter the aquatic environment. Therefore, the proponent should be obligated to continue mitigative and monitoring measures after mine closure.

To avoid further cumulative effects on surface water from project activities and other nearby projects, Marathon should reevaluate the assessment of its cumulative effects. Currently, the proponent considers itself isolated from the effects of other projects as they are spatially distanced. However, two other mining projects (Buchans Base Metal Project and Cape Ray Gold Project) are both within 65 km of the Valentine Gold Mine site, and all are encapsulated within the regional Exploits Watershed. Due to the hydrologic connectivity and surface flow characteristics of the Exploits Watershed, effects from one project will likely be felt at other project sites' immediate aquatic environment, thus contributing to cumulative and residual effects. It is recommended that Marathon reconsiders its regional connectivity with other projects to properly estimate cumulative effects in its EIS.

1.5 Author information

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1.6 References

Atlantic Gold. (2017). Beaver Dam Mine Project Environmental Impact Statement. https://iaac-aeic.gc.ca/050/documents/p80111/119307E.pdf

Belpaire, C., Pujolar, J.M., Geeraerts, C., & Maes, G. E. (2016). Contaminants in eels and their role in the collapse of the eel stocks. Biology and ecology of anguillid eels, 225-250. https://books.google.ca/books?hl=en&lr=&id=w5umCwAAQBAJ&oi=fnd&pg=PA225&dq=Contaminants+in+eels+and+their+role+in+the+collapse+of+the+eel+stocks&ots=UrvcKWX3Fk&sig=1sJhHRANMcDOCLmOlqDTfyVv1C4&redir_esc=y#v=onepage&q&f=false

Boreal Songbird Initiative. (n.d.). *Provincial and Territorial Forest Facts – Newfoundland and Labrador.* https://www.borealbirds.org/province-territory-boreal-forest-facts/Newfoundland-Labrador#:~:text=Newfoundland%20and%20Labrador's%20Boreal%20Forest,in%20size%20%E2%80%93%20larger%20than%20Germany.&text=features%20326%2C000%20km2%20(80,of%20the%20province's%20boreal%20region

Bradbury, C., Roberge, M.H.M., & Minns, C. K. (1999). Life history characteristics of freshwater fishes occurring in Newfoundland and Labrador, with major emphasis on lake habitat requirements. Minister of Supply and Services Canada. https://www.sciencebase.gov/catalog/item/5053ea8ee4b097cd4fcf648f

Canadian Council of Ministers of the Environment [CCME]. (2019). *Ambient air quality monitoring and quality assurance/quality control guidelines.* https://www.ccme.ca/files/Resources/air/Ambient%20Air%20Monitoring%20and%20QA-QC%20Guidelines_en%20SECURE.pdf

CBC News. (2018). Deadly white-nose syndrome confirmed in Newfoundland bats. https://www.cbc.ca/news/canada/newfoundland-labrador/deadly-white-nose-syndrome-bats-1.4658578

COSEWIC. (2007). COSEWIC assessment and update and status report on the American marten (Newfoundland population) Martes americana atrata in Canada. *Committee on the Status of Endangered Wildlife in Canada*. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_martes_americana_atrata_e.pdf

COSEWIC. (2012). COSEWIC assessment and status report on the American Eel (*Anguilla rostrata)* in Canada. *Committee on the Status of Endangered Wildlife in Canada*. www.registrelep-sararegistry.gc.ca/default_e.cfm

COSEWIC. (2013). COSEWIC assessment and status report on the Little Brown Myotis (*Myotis lucifugus)*, Northern Myotis (*Myotis septentrionalis)*, and Tri-colored Bat (*Perimyotis subflavus)* in Canada. *Committee on the Status of Endangered Wildlife in Canada*. www.registrelep-sararegistry.gc.ca/default_e.cfm

COSEWIC. (2014). COSEWIC assessment and status report on the Caribou (Ranger tarandus), Newfoundland population, Atlantic-Gaspesie population and Boreal population, in Canada. *Committee of the Status of Endangered Wildlife in Canada*. www.registrelep-sararegistry.gc.ca/default_e.cfm

Environmental Assessment Office [EAO]. (2019). *Assessment report for Blackwater Gold mine project*. https://projects.eao.gov.math.ca/api/document/5d0d32624d0f33001a9cefa4/fetch/Blackwater%20-%20Assessment%20Report.pdf

Environment Canada. (2015). Recovery strategy for Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*), and Tri-colored Bat (*Perimyotis subflavus*) in Canada [Proposed]. *Species at Risk Act Recovery Strategy Series*. https://www.registrelep-sararegistry.gc.ca/virtual_sara/files/plans/rs_LittleBrownMyotisNorthernMyotisTricoloredBat_e_proposed.pdf

Gibson, R. B. (2012). In full retreat: The Canadian government's new environmental assessment law undoes decades of progress. *Impact Assessment and Project Appraisal, 30*(3), 179-188.

Government of Newfoundland and Labrador. (2020). *Newfoundland Ecoregions.* https://storymaps.arcgis.com/stories/3c85151fec1a452ca1bfed551ecbc4aa

Grondin, P., Gauthier, S., Borcard, D., Bergeron, Y., & Noël, J. (2013). A new approach to ecological land classification for the Canadian boreal forest that integrates disturbances. *Landscape Ecology, 29*(1), 1-16. DOI: 10.1007/s10980-013-9961-2

Health Canada (2020). *Guidance for evaluating human health impacts in environmental assessment: air quality.* https://www.acee.gc.ca/050/documents/p80054/119376E.pdf

Hearn, B.J., Harrison, D.J., Fuller, A.K., Lundrigan, C.G., & Curran, W.J. (2010). Paradigm shifts in habitat ecology of threatened Newfoundland martens. The Journal of Wildlife Management, 74(4), 719-728. DOI: 10.2193/2009-138

Jezierska, B. & Witeska, M. (2006). The metal uptake and accumulation in fish living in polluted waters. *University of Podlasïe.* DOI: 10.1007/978-1-4020-4728-2_6

Marathon Gold. (2020). *Valentine Gold Project Description Summary.* https://iaac-aeic.gc.ca/050/documents/p80169/129223E.pdf

Marathon Gold. (2020a). *Valentine Gold Project Summary of the Environmental Impact Statement*. https://iaac-aeic.gc.ca/050/documents/p80169/136514E.pdf

Marathon Gold. (2020b). *Valentine Gold project baseline study appendix 6: atmospheric environment.* https://iaac-aeic.gc.ca/050/documents/p80169/136534E.pdf

Marathon Gold. (2020c). *Valentine Gold Project Environmental Impact Statement Chapters 8 - 12.* https://iaac-aeic.gc.ca/050/documents/p80169/136564E.pdf

Marathon Gold. (2020d). *Valentine Gold Project Baseline Study Appendix 8: Species at Risk / Species of Conservation Concern (SAR / SOCC)*. https://iaac-aeic.gc.ca/050/documents/p80169/136536E.pdf

Marathon Gold. (2020e). *Valentine Gold Project Environmental Impact Statement: Chapter 7 - Surface Water Resources.* https://iaac-aeic.gc.ca/050/documents/p80169/136563E.pdf

Marathon Gold. (2020f). *Valentine Gold Project: Baseline Study Appendix 3: Water Resources Chapter*. https://iaac-aeic.gc.ca/050/documents/p80169/136531E.pdf

Marathon Gold. (2020g). *Valentine Gold Project Environmental Impact Statement: Cumulative Effects Assessment*. https://iaac-aeic.gc.ca/050/documents/p80169/136566E.pdf

McCarthy, J.W., & Weetman, G. (2006). Age and size structure of gap-dynamic, old-growth boreal forest stands in Newfoundland. *Silva Fennica, 40*(2), 209-230. https://silvafennica.fi/pdf/article339.pdf

Mosseler, A., Thompson, I., & Pendrel, B. (2003). Overview of old-growth forests in Canada from a science perspective. *Environmental Reviews, 11*(S1). DOI: 10.1139/a03-018

New Gold. (2013). *Air quality 2013 baseline report.* https://iaac-aeic.gc.ca/050/documents/p80017/104344E.pdf

New Gold. (2015). *Blackwater Gold Project Environmental Impact Statement.*https://iaac-aeic.gc.ca/050/documents/p80017/104203E.pdf

O'Connell, M., Bourgeois, C. (1987). Atlantic Salmon enhancement in the Exploits River, Newfoundland, 1957-1984. *North American Journal of Fisheries Management, 7*(2): 207-214. https://doi.org/10.1577/1548-8659(1987)7<207:ASEITE>2.0.CO;2

Randell, A. (2019). Newfoundland caribou population decline not alarming, provincial biologist. *The Telegram*. https://www.thetelegram.com/news/local/newfoundland-caribou-population-decline-not-alarming-provincial-biologist-284405/

Schaefer, J.A., & Mahoney, S.P. (2013). Spatial dynamics of the rise and fall of caribou (Rangifer tarandus) in Newfoundland. *Canadian Journal of Zoology, 91*(11), 767-774. 10.1139/cjz-2013-0132

Sfakianakis, D., Renieri, E., Kentouri, m., & Tsatsakis, A. (2015). Effect of heavy metals on fish larvae deformities: A review. *Environmental Research, 137*, 246-255. DOI: 10.1016/j.envres.2014.12.014

Sturtevant, B.R., Bissonette, J.A., Long, J.N., & Roberts, D.W. (1997). Coarse woody debris as a function of age, stand structure, and disturbance in boreal Newfoundland. Ecological Applications, 7(2), 702-712. https://doi.org/10.1890/1051-0761(1997)007[0702:CWDAAF]2.0.CO;2

Weiler, M.H. (2011). Mi'kmaq and the American Eel. *Mi'kma'ki All Points Services Inc.* http://mikmaki.ca/wp-content/uploads/2016/07/MAPS_Mikmaq-and-the-American-Eel.pdf

Weir, J.N., Mahoney, S.P., McLaren, B., & Ferguson, S.H. (2007). Effects of mine development on woodland caribou Rangifer tarandus distribution. *Wildlife Biology, 13*(1), 66-74. https://doi.org/10.2981/0909-6396(2007)13[66:EOMDOW]2.0.CO;2

Report 2: Water quality, community health, species at risk, air quality

2.1 Executive summary

Authored by Samantha Ceci, Camille Haddad, Darcy Kavanagh and Jennifer Baillie

The Valentine Gold Project is an open pit gold mine proposed approximately 55 km southwest of Millertown in Newfoundland and Labrador. The Impact Statement and additional documentation associated with this project are evaluated within this report in terms of their substantive and procedural components. The following four components are explored within this report through literature review:
1) Evaluating the project's water quality monitoring plan and associated mitigation measures.
2) Evaluating the project's impact on the local economy and employment opportunities, with emphasis on underrepresented groups.
3) Evaluating the project's EIS baseline studies for species-at-risk.
4) Evaluating the project's consideration of air quality.

Through these evaluations, two common recommendations emerged. The first being an improvement in how study areas are defined within the project documentation. More specifically, we suggest:

- The Local Assessment Area (LAA) within the water quality monitoring program be expanded to include all potential variables within the drainage basin.
    - This can be accomplished through the use of GIS and hydrological modelling which are proven tools to enhance a cumulative effects analysis.
- The LAA and RAA (Regional Assessment Area) should be unique for each subcomponent within the species-at-risk baseline studies to more adequately address the biological differences and the potential impacts the project may pose.

The second reoccurring recommendation from the evaluations in this report, is in terms of breadth of information that is addressed by the proponent. Some data included in the analyzed EIS have proven to be limited. It is recommended that the proponent enhance the quantity and quality of data they provide during the EA process by:

- Provide transparency on why data on one herd of woodland caribou within the analyzed subpopulation was actively omitted. Currently, no reason is provided by the proponent.
- Provide additional baseline monitoring within the LAA/RAA for PM2.5, O_3, NO, NO_X, and CO rather than relying on ambient air quality monitoring data taken 120 km from the proposed mine site.
- Enhancing the Gender Equity and Diversity Plan and workforce education such as anti-harassment training as the proponent does not address which topics these plans and measures will cover, or the individuals they will protect, notably the LGBTQ2S+ community.

2.1.1 Abbreviations and Acronyms

AC CDC: Atlantic Canada Conservation Data Center
AAQM: Ambient Air Quality Monitoring
BSA: Baseline Study Appendix
CCME: Canadian Council of Ministers of the Environment
COSEWIC: Committee on the Status of Endangered Wildlife Species in Canada
DFO: Department of Fisheries and Oceans
EA: Environmental Assessment
EAC: Environmental Assessment Committee
EIS: Environmental Impact Statement
LAA: Local Assessment Area
LGBTQ2S+: Lesbian, Gay, Bisexual, Transgender, Queer or Questioning and Two-Spirit
NL ESA: Newfoundland and Labrador Endangered Species Act
RAA: Regional Assessment Area
SARA: Species at Risk Act
VC: Valued Component

2.2 Evaluating the Project's water quality monitoring Plan

2.2.1 Background

The proposed site for the Valentine Gold Project sits within the Exploits River Watershed. This is the largest watershed on Newfoundland island which covers approximately 10,241km^2 and its discharge is controlled through three dams (Marathon Gold, 2020a). The entirety of the watershed is a highly dynamic and interconnected system, where the Exploits River and Victoria River feed drainage basins in the region which are home to sensitive fish populations and waterfowl (Marathon Gold, 2020a).

The impact statement released by Marathon Gold includes a regional and local assessment for surface water resources. The regional assessment covers sections of the watershed stretching from the mine site location nearby the Victoria Lake Reservoir, up into the Red Indian Lake which drains into the Victoria River. The local assessment covers the project area along with a highway. Watershed delineations for the project were conducted for predevelopment activities and post-development activities. Associated maps with watershed delineations were included in chapter 7 of the impact statements. In addition, a map outlining surface water monitoring locations can be found in appendix 2A of this report.

Mining operations can have adverse impacts on water quality, particularly in regard to tailings disposal and wastewater. Historical studies like one conducted by Panu (1989) along the Exploits River Watershed linked to peat mining operations have concluded that pH levels were above recommended water quality standards at sampling locations. Runoff volumes were also affected and linked directly to mining activities.

Water monitoring programs associated with this project requires a robust approach as the overall project area covers many smaller sub-watershed systems. The nearby Duck Pond mining operation by Teck Resources which began operation in 2007 is currently undergoing decommissioning. A 10-year water quality report was published in 2016 along with an annual

water quality report to better understand post-mine operation impacts. In addition, multiple other mines have begun drilling or post-exploration phases in the region (see Table A1 in Appendix 2A). The Duck Pond project and its associated impact statement along with the Canadian Council of Ministers of the Environment (CCME) report "Guidance Manual for Optimizing Water Quality Monitoring Program Design" will be utilized to compare the proponent's approach to water resource monitoring for pre- and post-mining activities.

2.2.2 Evaluation

Baseline monitoring is being undertaken by the proponent with regards to hydrology and water quality monitoring. The proponent has acknowledged in the impact statement that changes in water quality might occur as a result to changes in watershed hydrological flow (Marathon Gold, 2020a). The objective of these baseline studies is to provide conditions of water quality and hydrological systems near the project site. The proponent has utilized desktop assessments, which incorporate long term records and short-term field monitoring results to deduce biophysical conditions of the watershed. Additionally, a field program was put into place to using water level monitoring stations within the local assessment area of the project (see Appendix 2A1 for map). Water quality samples were also taken as a part of baseline measurements (Marathon Gold, 2020a).

This program is generally in line with the recommendations put out by the CCME in which monitoring variables are determined, temporal frequency is established, and spatial coverage is considered. In this case, variables are surface and ground water quality, temporal frequency is established through the installation of data loggers to develop time series monitoring. Spatial consideration is considered by monitoring the local assessment area designated by the proponent for the water valued component. This is also achieved by delineating the project area watershed region into smaller drainage areas during construction and operation phases. It is important to note however, that current spatial coverage does not incorporate the entirety of the watershed. Contaminants within a watershed from mine sites have been known to have cumulative impacts across spatial boundaries through transport (Merriam et al. 2011). This should be considered especially with regards to the Victoria Lake reservoir which sits along the proposed mine site. The proponent does acknowledge that significant effects can occur to water quality without mitigation measures. Mitigation measures do cover many facets of water quality concerns such as tailings management and onsite water management. The impact statement does detail certain mitigation measures. However, details on implementation of mitigation measures such as engineered wetlands for contaminant control after mine decommissioning is not expanded upon in the impact statement. For example, the impact statement mentions the mitigation measures however lists no concrete action plan for how they will be implemented, associated cost and cumulative impacts.

The proponent does put forward a comprehensive water monitoring program for all mining activities and post-mining decommissioning. The proponent states that post-closure phases of the project extend up to 18 years past decommissioning. This is noted as a positive when compared to other mines in the region like Duck Pond mine which only has a 10-year post decommissioning plan. The Duck Pond mine site, which is in close regional proximity relative to the Valentine Gold Project underwent provincial environment assessment in 2004 (Whitford,

2004). It should be noted that different laws and procedures dictated the Minister's decision, however, the environmental protection plan submitted by the proponent did cover water quality for several mine related activities. While the plan itself is not a favorable reference for current day impact assessments, it proves useful as a good proxy for judging the viability of resource projects in the region. The mine site, currently owned by Teck Resources, had committed to a 10-year water monitoring program after mine decommissioning. This is achieved through measurements of pH, water temperature, specific conductivity, and additional water quality parameters at designated sites. These sites are also delineated into drainage areas relative to tailings dams (Wright, 2016). It should be considered that Teck Resources has only set up three monitoring stations as opposed to the proponent who has proposed several water quality monitoring stations and hydrometric stations for post-closure watershed areas (Marathon Gold, 2020a). Additionally, the use of contaminant modelling and bathymetry for water quality analysis is beneficial for understanding impacts on water resources when considering tailings disposal. The water resources section of the impact statement utilizes maps and water delineation boundaries for communicating data effectively for all mine related activities and post-closure monitoring. Furthermore, a detailed water quantity and quality modelling report is provided in appendix 27A of the impact statement (Marathon Gold, 2020a). The impact statement also includes water quality sampling within the baseline study and weighs measurements against the CCME water quality guidelines.

2.2.3 Recommendations

The proponent should consider expanding surface water quality baseline studies to encompass a broader region of the Exploits River Watershed. This would allow for more optimal baseline data to be collected in comparison to sites downstream of the project. Currently, the EIS defines the project area and local assessment area as the "anticipated area of direct physical disturbance" (Marathon Gold, 2020). Increasing the spatial boundaries of the project or including regional assessment boundaries in water quality monitoring is recommended. For example, including higher order streams into the local assessment through desktop assessments and hydrological monitoring to ensure true cumulative impacts are accounted for is advised. Including all higher order streams in delineation such as those seen south east of the Victoria River should be considered, particularly for baseline measurements. The incorporation of higher order streams in watershed delineation utilizing desktop assessment (GIS) is stressed as critical for enhancement of cumulative impact analysis (Strager et al. 2009).

The proponent states in section 7 of the EIS that "passive water quality treatment technologies will be employed… including engineered wetlands to treat site seepage and runoff, as practicable" (Marathon Gold, 2020a). Rehabilitation measures listed in the EIS should be expanded upon in more detail to provide a more transparent scientific approach. Additionally, a concrete plan should be outlined in the mitigation measures section to expand upon potential cumulative effects should a contamination event happen. These mitigation measures should touch directly on impacts of water quality issues related to factors outlined in the EIS like fish habitat, vegetation, soils, and terrestrial wildlife. These valued components are directly and indirectly impacted by contamination events as a result of mine activities.

2.3 Evaluating the Project's impacts on community and social components

2.3.1 Background

Newfoundland and Labrador has a longstanding reputation of being the province with the highest unemployment rate in Canada. Like a metaphor for its people, waves of economic growth do not tend to stay for long. Though sporadic, mining has played an important role in in the economic history of NL. The first major mining development in the province was in 1864, and numerous mineral exploration projects have followed suit (Heritage NL, n.d.). Currently there are 11 mines operating in the province, several of which produce gold.

The province has shown great desire for the presence of the mining industry, and the benefits the industry will bring to its people. Since February 2017, NL has focused upwards to $2.3 billion in capital investments for the industry, resulting in a 6.4 percent contribution to the provinces GDP (Mercer, 2020b). A 2018 report released in tandem of the Government of NL and the NL Mining Industry outlined a framework that would see the opening of five new mines by 2030, providing employment for over 6,200 individuals (Government of NL, 2018).

With the central NL gold belt providing promising results to prospectors, companies from all over the world are seeking mineral claims in the area. At completion, the Valentine Gold Project would be the largest gold mine in Atlantic Canada, and Marathon Gold CEO Matt Manson claims that they are going to be a "big employer" (Marathon Gold, 2020a; Mercer, 2020b). The project has an anticipated operation life of 15 years, including construction, operation and rehabilitation, and is expected to generate $750 million for workers and businesses located within the province (Marathon Gold, 2020c).

2.3.2. Evaluation

During stakeholder consultation, surrounding communities such as the Town of Buchans and the Town of Millertown questioned employment, training, and procurement opportunities that will arise from the project. In response, the proponent stated a commitment to supporting these surrounding communities through the hiring of local residents (Marathon Gold, 2020a, Table 5.2). On December 9th, 2020, Marathon Gold signed a cooperation agreement with six communities it deemed within the immediate socio-economic impact of the Project (Marathon Gold, 2020). With five of these six communities registering above the provincial unemployment rate (Table C1), the promise of approximately 11,000 person years of employment provides hope of much-needed opportunity for the area (Statistics Canada, 2016; Marathon Gold, 2020c).

Once the mine reaches the end of its life span, a loss of employment will occur. The proponent claims that the skills and experience gained by workers during their time at the Valentine Project will offset the magnitude of this employment loss by aiding these workers with securing future employment (Marathon Gold, 2020a, section 7.12.2.3). However, there does not seem to be a proper plan in place to mitigate the loss of local procurement and community investment. When neighbouring Duck Pond closed in 2015, proponent Teck Resources collaborated with local communities and government to design a plan that would support employees and communities through the transition. Through services like resume assistance and severance packages, Teck aimed to mitigate the closure-related impacts as much as possible (Teck, 2016).

Other large corporations in this industry, including Goldcorp and Toccara, are taking steps towards increasing inclusivity and diversity throughout their company and its worksites. Meaningful actions include the creation of Diversity Committees, the development of Inclusion and Diversity policies, and the switch to gender neutral titles, such as "supervisor" instead of "foreman" (Women in Mining Canada, 2016). Marathon Gold has developed a diversity policy for its board of directors; however, no such policies have been created for the remainder of the company (Marathon Gold, 2019).

Recent studies by Western University have found that a wage hierarchy persists in Canada. Within this hierarchy, heterosexual men are the most advantaged, proceeded by gay men, lesbians, bisexual men, heterosexual women, and bisexual women (Waite et al., 2020). The mining industry shows no exception to this hierarchy and has been a predominantly male-oriented workforce throughout history. Marathon Gold has outlined steps to better the inclusion of women and Indigenous folks in their project, however they fail to address other minorities, such as the LGBTQS2+ community.

Like many areas in the trades sector, the mining industry has perpetuated a homophobic stereotype. In 2010, American coal miner Sam Hall shed light on the issue by suing his then-employer, Massey Energy Co. Hall reported issues of ill-management, lack of employee protection, and verbal abuse at the workplace (White, 2014). With the discrimination of sexual orientation an illegal act in NL since 1997, the province takes pride in its commitment to inclusivity (Majid, 2014). So, with Marathon Gold expressing interest in breaking the male-dominated stereotype, and NL allowing no room for sexual prejudice, the question is will Marathon Gold work to make their workplace a safer space for those of the LGBTQ2S+ community? And if so, how?

2.3.3 Recommendations

Marathon Gold says that it is committed to providing a workplace where all individuals are treated with respect and dignity (Marathon Gold, 2019). This commitment is futile without the development of proper policy and documentation that protects all those associated with the company from the effects of prejudice and harassment. In order to effectively ensure the protection of its workers, Marathon Gold should seek to release guidelines or adopt policies that explicitly address underrepresented communities, including the LGBTQ2S+ community. Furthermore, Marathon Gold should seek to develop a Diversity Committee for its company to ensure the equal representation and protection of its workers.

Historic sexist and heteronormative connotations with the mining industry may be silencing those of the LGBTQ2S+ community. Lynne Descary, previously a nickel miner with global mining company Vale, said she endured over two decades of insults and inappropriate comments towards her sexuality (Renders, 2015). She described the industry as culturally homophobic and faced ridicule from her colleagues as an openly lesbian individual. The article states that it was difficult to find people like Lynne who were willing to speak out, on account of the silence surrounding the topic within the industry. This silence does not correlate to a lack of LGBTQ2S+ workers, but more so insinuates an aspect of the industry's culture that has discouraged victims from speaking out (Collins, 2015). Marathon Gold should state its commitment to the LGBTQ2S+ community and provide a level of trust that would see to the eradication of such silence.

Another way in which Marathon Gold can work towards better inclusivity of people of the LGBTQ2S+ community is through inclusivity, sensitivity, and diversity training. Such training includes that of the Government of Canadas GBA+ (Gender-Based Analysis Plus) program. The GBA+ program is one that analyzes how different initiatives, policies, and programs effect different groups of people. It facilitates the eradication of assumptions and allows for a better understanding of the lives of others, and their respective needs. In the mining industry, this may look like scrutinizing the socio-demographic characteristics prevalent, and addressing the barriers that may be inhibiting the participation of under-represented groups (Status of Women Canada, n.d.).

2.4 Evaluating the project's EIS baseline studies for species-at-risk

2.4.1 Background

The Minister of the Newfoundland Department of Environment and Climate Change determined that under the 2002 Newfoundland Environmental Protection Act, the proposed Valentine Gold Project would be required to complete an EIA (Environmental Impact Assessment). According to section 7.3 of the EIS prepared in September 2020, the proposed project is projected to have an impact on six valued components (VC), one of being species-at-risk (SAR) (BSA.8 Species at Risk/Species of Conservation Concern (SOCC)). According to section 2 of BSA.8, SAR and SOCC are regulated within in a provincial and federal context (Appendix 2B, Table B1) (Marathon Gold, 2020e, p. 11).

Within BSA.8 there are five subcomponents which are analyzed, including plant SAR/SOCC, fish SAR/SOCC, avifauna SAR/SOCC, woodland caribou (*Rangifer tarandus caribou),* and other wildlife SAR/SOCC. The proponent conducted separate baseline studies for each VC according to the EIS Guidelines issued by the Environmental Assessment Committee (EAC) in January 2020 (Marathon Gold, 2020e, p. 8). According to these guidelines, each baseline study must address baseline data requirements to support the assessment of the VCs and must support the development of mitigation measures and follow-up monitoring programs (Marathon Gold, 2020e, p. 8). Each baseline study can be found within the Baseline Study Appendices of the EIS.

According to section 3.0 of BSA.8, each VC is analyzed within the context of three study areas in order to predict or measure the impacts of the proposed project: the Project Area, the Local Assessment Area and the Regional Assessment Area (Marathon Gold, 2020e, p. 12). Impacts include the environmental, social, heritage, and human effects (Marathon Gold, 2020e, p. 12).

The Project Area is made up of the proposed mine site itself, as well as the access road which will be used to reach the mine site (Marathon Gold, 2020e, p. 12). The mine site also includes a 20 metre buffer on either side of the Access Road (Marathon Gold, 2020e, p. 12). The Local Assessment Area (LAA) is the area in which project-related environmental effects (direct or indirect) can be predicted or measured, including the Project Area (Marathon Gold, 2020e, p. 12). The Regional Assessment Area (RAA) is studied to determine the significance of project-specific effects, (i.e. potential accidental events) and includes the Project Area and the LAA. According to section 3.0 of BSA.8, the LAA and the RAA are unique to the VC being studied (Marathon Gold, 2020e, p. 12).

There are four herds of *Rangifer tarandus caribou* which are included in BSA.8: Buchans, Gaff Topsails, Grey River and the La Poile herd (Marathon Gold, 2020e, p. 54). The home range of *Rangifer tarandus caribou* can vary depending on the lifestyle of the species. The home range for sedentary members of the population can be between 250 km^2 to over 2500 km^2, whereas the range for migratory caribou can be well over 2500 km^2 (Department of Environment and Conservation, n.d.). The combined population ranges for the four subpopulations studied in BSA.8 is 28,809 km^2 (Marathon Gold, 2020e, p. 54).

The Newfoundland population of woodland caribou is in decline, with the population having decreased by 60% from 1990-2000 (Newfoundland Labrador Environment and Conservation, 2015). This decline has been attributed to factors including calf mortality, increased predation pressure from newly introduced coyotes in Newfoundland, as well as habitat degradation and fragmentation (Newfoundland Labrador Environment and Conservation, 2015).

2.4.2 Evaluation

In evaluating the adequacy of the baseline studies conducted for plant, fish, avifauna and other wildlife SAR/SOCC, critical evaluations can be made in regard to the procedural elements of the studies for each of these subcomponents. The first evaluation can be made in regard to the logic used to create the study areas, specifically the LAA and RAA, used in the plant, avifauna and other SAR/SOCC baseline studies. According to section 5.1, 6.1 and 8.1 of BSA.8, the baseline study boundaries for plant, avifauna and other SAR/SOCC respectively, is comprised of a 1 km buffer around the Mine Site and a 500 metre buffer around the Access Road for the LAA, and a 35 km buffer around the Project Area for the RAA (Marathon Gold, 2020e, p. 19, 27 & 78). In other words, the LAA and RAA boundaries are the same for each of these subcomponents. However plants, avifauna and other SAR/SOCC are biologically unique, specifically in terms of their response to disturbances such as the construction of the proposed project. For example, plants will not respond to noise disturbances associated with the construction of the open pit mine, where as avifauna are able to use aerial travel to distance themselves from this type of disturbance. In summary, the biological differences between the subcomponents in BSA.8 should be taken into account when designing the LAA and RAA boundaries, and as such these boundaries should be unique for each subcomponent.

The second evaluation of the procedural elements of BSA.8, is a commentary in regard to the timeline which the baseline studies for fish SAR/SOCC was conducted. According to section 4.2 of BSA.8, baseline data was collected on fish SAR/SOCC using a combination of three sources: existing literature, public engagement sessions and field data (Marathon Gold, 2020e, p. 15). Section 4.2.2 of BSA.8 specifies that field studies were conducted in 2011, 2018, 2019 and the winter of 2020, as per the Standard Methods Guide for Freshwater Fish and Fish Habitat Surveys in Newfoundland and Labrador: Rivers and Streams (Sooley et al. 1998) and Review of Fish Sampling Methods Commonly Used in Canadian Freshwater Habitats (Marathon Gold, 2020e, p. 18; Porter et al. 2006). Furthermore, the section lists the methods used in the field studies to include minnow traps, gillnets, fyke nets or backpack electrofishing (Marathon Gold, 2020, p. 18). According to the guidelines set by Sooley et al. (1998) and Porter et al. (2006), the time of year that fish surveying is conducted depends on the objectives of the survey, as well as compliance with DFO regulations. Electrofishing for salmon in Newfoundland for example, is best conducted between late July and early September when the water flow is more stable, the fry have emerged and distributed to their preferred habitats, and so as to capture their growth period (Sooley et al., 1998). Within BSA.8, the proponent only lists the time of year that

surveying was conducted in 2020; not within 2011, 2018 or 2019. The proponent proves to be able to provide such information, in section 7.2.3.1 of BSA.8 for example, they discuss the seasons and dates used to conduct range density analyses to study woodland caribou (Marathon Gold, 2020e, p. 50). The proponent's choice to exclude this information for fish SAR/SOCC is questionable.

Due to the lack of transparency in the data provided regarding fish SAR/SOCC studies in BSA.8, it is not possible to comment on whether the proponent exercised best-practices when conducting their baseline surveys for this subcomponent. According to the 2018 study published in FACETS by Jacob et al., 95% of written submissions from the 2016 Expert Panel Review of the Environmental Assessment Process, supported open information in the EA process (Jacob et al., 2018). Open information included not only EA documents posted to the Canadian Environmental Assessment Agency, but also methods which are generally not posted, or are posted but with insufficient detail (Ford et al., 2016). According to Jacob et al. (2018), open information can provide many benefits including decreasing the instances of scientific fraud and promoting reproducibility amongst the data.

The third evaluation of the procedural elements of BSA.8, is a commentary in regard to the survey efforts exercised while conducting woodland caribou baseline studies. In several instances during BSA.8, data was actively left out of the studies and sufficient rationale behind these omissions was not provided. In section 7.3 for example, the consultant outlines that only four herds in the South Coast subpopulation, were analyzed: Buchans, Grey River, Gaff Topsails, and La Poile (Marathon Gold, 2020e, p. 54). However, there are five herds in this subpopulation, the fifth herd that was not analyzed is the Pot Hill herd (Randell et al., 2020). In addition, a migration analysis was only conducted on only one of the four herds: the Buchans herd (Marathon Gold, 2020e, p. 53). And lastly, within the migration analysis conducted on the Buchans herd, GPS data was omitted if it was deemed inadequate by the consultant. For example, data was omitted from collared individuals from the herd that did not fulfill a full migration period according to the study (i.e. completed 43 days of a 45 day fall migration) (Marathon Gold, 2020e, p. 51). These omissions accounted for 10 caribous studied in the Buchans herd (Marathon Gold, 2020, p. 51 & 52). Depending on what year these caribou were omitted from the data, this omission could have constituted approximately 38% - 42% of the data collected.

According to Garrard et al. (2014), the probability of detection of SAR in environmental impact assessment is directly linked to survey efforts. When data is actively omitted, this is a direct reflection on survey efforts. It can be speculated that the presence of caribou observed in the LAA and RAA could have increased, and the Project Area could have been studied, given that the efforts were increased by the proponent and the consultant.

2.4.3 Recommendations

There are three general recommendations which can be offered in the context of the procedural elements of BSA.8. The first recommendation is that the proponent assign unique LAA and RAA to each subcomponent analyzed in BSA.8, so as to better achieve the goals of the LAA and RAA which are able to provide a study area in which the projected project impacts can be measured.

The second recommendation is that the proponent should work to achieve better transparency in their methods deployed in BSA.8. For example, transparency could be improved if the proponent

provided an explanation as to why a 35 km buffer was selected for the RAA boundary for plant, avifauna and other SAR/SOCC baseline studies. Improving transparency in EA, specifically the transparency of the methodology used, will help to promote strong science in EA and is desired in 95% of cases within the 2018 study by Jacob et al.

Thirdly, the proponent should work to improve the probability of detection of SAR within baseline studies by increasing their study efforts. This includes refraining from omitting critical data, and when data is omitted, offering a transparent reasoning within the BSA.

2.5 Evaluating the Project's consideration of air quality

2.5.1 Background

Air quality concerns related to emissions, greenhouse gases (GHGs), tailings, and dust from the Project must be carefully managed and monitored throughout the construction, operation, decommissioning, and rehabilitation of the Project site. Section 2.8.2.1 of the Summary of the Environmental Impact Statement (EIS) (Marathon Gold, 2020d) states that emissions during site preparation activities and the construction of Project infrastructure include combustion gases from vehicles, heavy-machinery and temporary diesel generators, and dust from sources such as the operation of heavy earth-moving equipment and wind erosion (Marathon Gold, 2020d). The Proponent also states that atmospheric emissions associated with the Project operations will include airborne particulate matter (dust) and greenhouse gases (e.g., carbon dioxide, methane, and nitrous oxide) from the combustion of diesel and gasoline (Marathon Gold, 2020d).

Within the Guidelines for the Preparation of an Environmental Impact Statement for the Project, the Agency states that in scoping the potential changes to the environment, the Proponent must consider any potential changes in the physical environment such as changes to air quality that could reasonably be expected to occur (Canadian Environmental Assessment Agency, 2019). The Proponent was required to complete a baseline survey of ambient air quality in the Project area and in the airshed likely to be affected by the project by identifying and quantifying emission sources for: total suspended particulates, fine particulates smaller than 2.5 microns (PM2.5), respirable particulates of less than 10 microns (PM10), carbon monoxide (CO), sulphur oxides (SOx), nitrogen oxides (NOx), and volatile organic compounds (VOCs). As well, the Proponent was required to identify and quantify existing greenhouse gas emissions, direct and indirect sources of air emissions, and ensure they are within current Newfoundland and Labrador provincial and Canadian federal limits for greenhouse gas emission targets (Canadian Environmental Assessment Agency, 2019).

Air quality measurements were taken at the ambient air quality monitoring (AAQM) station in Grand Falls-Windsor, approximately 120 km northeast of the mine site and during one field survey from June 15-19, 2020 within 8 km of the Project area (Marathon Gold, 2020a). Section 4.1 of the EIS notes that the nearest sources of air contaminants to the mine are the Corner Brook Pulp and Paper Mill located approximately 90 km to the northwest of the mine site, the Teck Resources Duck Pond Mine which is no longer operational and is in the closure and rehabilitation phase, and Barite Mud Services which is operational on a seasonal basis (Marathon Gold, 2020a). Although both sites are no longer fully operational, potential exists for cumulative effects of fugitive dust to be generated at each site. These baseline studies conducted by the Proponent found that concentrations of air contaminants are likely to be low and close to average background concentrations for similar rural locations in Newfoundland, with measured

concentrations of air contaminants being below the regulatory standards (Marathon Gold, 2020a, section 7.1) The proposed mine site is approximately 49 km southwest of the Town of Buchans, and other than Buchans, there are no nearby communities, year-round residential receptors, or major roads (Marathon Gold, 2020a, section 2.0).

2.5.2 Evaluation

Health Canada (2016) provides specific guidance on conducting an air quality assessment for an environmental assessment through the Guidance for Evaluating Human Health Impacts in Environmental Assessment: Air Quality documentation. According to the guidelines (Health Canada, 2016) a LAA and RAA should be delineated for the air quality assessment, which is shown in Figure 2-1 of the EIS (Marathon Gold, 2020a). As well, Health Canada, (2016, section 6.1) states that maps, diagrams and figures should be used to illustrate the boundaries and locations of all air quality monitoring stations relative to the Project site. Although the Proponent has included a detailed map of the LAA and RAA, the Proponent fails to display the location of the AAQM station in Grand Falls-Windsor which it is reliant on for baseline air quality measurements. In section 6.1, Health Canada (2016) states that spatial definition of the site is particularly important for the application of any microenvironment analysis and that baseline air quality monitoring should be conducted within the identified region and should be described based on the various project phases. In the case of the Project, we see high reliance on baseline air quality data collected outside of the study area as only one spring survey of ambient concentrations of particulate matter, trace metals, SO_2 and NO_2 were measured at one location within the Project Area (Marathon Gold, 2020a, section 5.2.1.2).

The Project's site-specific air quality management plan within the EIS statisfies the common best-practice methods for minimizing releases of airborne particulate matter from mining activities outlined in section 3.3.6 of the Environmental Code of Practice for Metal Mines (Environment Canada, 2009). These best practices include; spraying water on roads to maintain sufficient surface moisture, revegetating the parts of the mine site that will not be disturbed in the future, establishing speed limits on unpaved surfaces that are low enough to minimize dust from vehicle operations, storing ore or concentrate in storage bins, hoppers, or other buildings to eliminate dusting concerns and position the material for loading or transfer, covering or enclosing conveyor lines, using baghouses or precipitators for point sources of releases such as stacks from ore concentrate driers, and covering stockpiles or other material that may be a source of releases (Environment Canada, 2009, section 3.3.6). However, within the EIS there is limited explanation on how the Proponent aims to align and implement the following methods for minimizing releases of airborne particulate matter, including; how environmentally acceptable chemical sprays to stabilize the surface and reduce dust will be used, a program for temporarily ceasing operations if weather conditions are such that the risks of significant releases of airborne particulate matter are unacceptably high, controlling dumping or transfer rates of materials, and if covering dump trucks to minimize releases during the transportation of material will be implemented (Environment Canada, 2009, section 3.3.6).

Historic mines in Newfoundland have been cited as exposure locations for natural radon which seeped into (underground) mines and was released into the mine air. Radon is a colorless, dense, radioactive gas, formed by decay chain of uranium and its exposure is the second leading cause of lung cancer after smoking (Sarkar et al., 2017). As recently as September 2020 a Grand Falls-Windsor, NL school showed levels of radon which were higher than Health Canada recommendations (Mercer, 2020a). In the Grand Falls-Windsor region, approximately 5% of

homes have above the recommended Canadian radon guideline of 200 Bq/m^3, however testing programs are not comprehensive (Health Canada, 2014). It has been noted that in Canada, health authorities have no access to comprehensive profile of the communities built over uranium-rich micro-geological settings and is safe to assume even less data exists for rural, undeveloped regions (Sarkar et al., 2017). Although the primary concern with radon is the build-up of gas in unventilated spaces like residential basements, studies have shown that radon gas can be produced from gold tailings if the host rock is uranium-bearing (Ongori et al., 2015). Therefore, radon may also be of concern where ore is processed within enclosed spaces or in covered tailings piles. Although the risks associated with open pit mines are low, within the EIS, there is no assessment of the risks of radon within the RAA.

2.5.3 Recommendations

Section 5.1.3.1 of the EIS identifies the Local Assessment Area (LAA) and Regional Assessment Area (RAA) as the same 40 x 40 km area where project related effects and cumulative effects on the environment are most likely to occur for the Atmospheric Environment VC (Marathon Gold, 2020a). Furthermore, the Proponent states in section 20.2.4 of the EIS that the zone of influence (the distance from the facility to the point where the air contaminant concentrates) for transport and dispersion of gaseous air emissions is generally less than 10 km (Marathon Gold, 2020a). Therefore, the Agency should question the applicability of the air quality measurements taken at the ambient air quality monitoring (AAQM) station in Grand Falls-Windsor, approximately 120 km northeast of the mine site. It is recommended that the Agency requests additional baseline air quality monitoring is undertaken within the bounds of the LAA/RAA to monitor particulate matter $\leq$ 2.5 microns (PM2.5), O_3, NO, NO_X, and CO. This list represents the compounds not measured directly within the LAA/RAA. As well, since cumulative air quality impacts can be expected for the reasonably foreseeable future from this Project and others (i.e., the Cape Ray Gold Project, Buchans Resources Limited Project, and the NL Hydro Power Line) it is recommended that the Agency requests the installation of an additional AAQM station within the RAA. This would directly support the proposed ambient air quality monitoring program mentioned in Table 8.1 of the EIS (Marathon Gold, 2020a). An ambient air quality monitoring program should be developed to clearly outline the location of the monitoring station, compounds measured, and frequency of measurement (Health Canada, 2016).

Within the EIS there are potential mitigation programs discussed to limit the environmental impacts of particulate matter on the environment. Specifically, Table 5.11 of the EIS outlines the application of chemical dust suppressants to mitigate impacts on the atmospheric environment. It is recommended that this mitigation plan is developed further within the EIS. As application of an undefined chemical dust suppressant is outlined in Table 5.11 (Marathon Gold, 2020a) the Proponent should further define the potential conditions under which chemical dust suppression would be used, what the commonly used dust suppressants are, if any permits or approval from Newfoundland and Labrador Department of Environment, Climate Change and Municipalities would be required, and outline any known potential risks of the chemical that could impact fish, vegetation, soils, wildlife, or human health.

Based on historic issues with radon from mine sites in Newfoundland, we recommend that the Proponent discuss the risks of radon from the proposed project especially in situations where ore, tailings, or overburden may be enclosed. It is recommended that the proponent assess the potential radon risk for the LAA/RAA using at a desktop assessment at minimum. The proponent should also consider the addition of soil gas radon testing to evaluate the radon potential of the

underlying geology using protocols developed for the North American Soil Geochemical Landscapes Project (Friske et al., 2010; O'Brien et al., 2011).

2.6 Author information

Samantha Ceci, Master of Resource and Environmental Management Candidate at Dalhousie University. Samantha has a background in ecosystem restoration and is motivated to use restoration as a tool to mitigate fragmented ecosystems. She has gained critical knowledge regarding the provincial IA process in BC, through a study in partnership with an NGO, studying the inclusion of species-at-risk in consultation-based IA documentation.

Camille Haddad, Master of Resource and Environmental Management Candidate at Dalhousie University. With a background in Geoscience and GIS, Camille is well-versed in how resource development can impact natural systems on local and regional scales.

Darcy Kavanagh, Master of Resource and Environmental Management Candidate at Dalhousie University, former resident of NL, and a member of the LGBTQ2S+ community. Growing up in rural NL, Darcy witnessed first-hand the impacts faced by the province due to a lack of employment opportunities, and a subsequently unstable economy. Through lived experiences, Darcy is familiar with the discrimination faced by the LGBTQ2S+ community and is passionate about creating policy and legislation that provide a safe environment for all.

Jennifer Baillie, Master of Resource and Environmental Management Candidate at Dalhousie University in Halifax, Nova Scotia, student member of the Association of Professional Geoscientists Nova Scotia, and current part-time environmental consultant. Jennifer has professional expertise implementing regulated greenhouse gas emissions monitoring programs under federal and provincial emissions regulations for major natural resource companies in Western Canada. She has also executed methane emissions studies in partnership with NGOs (Petroleum Technology Alliance of Canada, Petroleum Technology Research Centre) and government agencies (ECCC).

2.7 References

Canadian Council of Ministers of the Environment (2015) Guidance Manual for Optimizing Water Quality Monitoring Program Design Executive Summary. Available at: https://www.ccme.ca/files/Resources/water/water_quality/Guidance Manual for Optimizing Water Quality Monitoring Program Design_1.0_e.pdf.

Canadian Environmental Assessment Agency. (2019, July). Guidelines for the preparation of an Environmental Impact Statement—Valentine Gold Project. https://iaac-aeic.gc.ca/050/documents/p80169/130996E.pdf

Collins, J. C. (2015). Characteristics of "Masculinized" Industries. Human Resource Development Review, 14(4), 415–441. https://doi.org/10.1177/1534484314559930

Department of Environment and Conservation. (n.d.). Two distinctive caribou types share Labrador's landscape. https://www.gov.nl.ca/ffa/files/publications-wildlife-our-wildlife-spring2010.pdf

Environment Canada. (2009). Environmental Code of Practice for Metal Mines. https://www.canada.ca/content/dam/eccc/migration/main/lcpe-cepa/documents/codes/mm/mm-eng.pdf

Ford et al. (2016). Improving environmental assessment in Canada: Submission to the expert panel review of environmental assessment processes. https://eareview-examenee.ca/view-submission/?id=1482353579.1985.

Friske, P. W. B., Ford, K. L., Kettles, I. M., McCurdy, M. W., McNeil, R. J., & Harvey, B. A. (2010). North American soil geochemical landscapes project: Canadian field protocols for collecting mineral soils and measuring soil gas radon and natural radioactivity (No. 6282). https://doi.org/10.4095/261633

Garrard et al. (2014). Incorporating detectability of threatened species into environmental impact assessment. Conservation Biology. 29(1). https://doi.org.ezproxy.library.dal.ca/10.1111/cobi.12351
Government of NL. (2018). Mining The Future 2030: A Plan For Growth In The Newfoundland And Labrador Mining Industry.
Health Canada. (2014). Radon in Newfoundland and Labrador. http://publications.gc.ca/collections/collection_2014/sc-hc/H14-132-3-2014.pdf
Health Canada. (2016). Guidance for evaluating human health impacts in environmental assessment: Air quality. Health Canada. http://publications.gc.ca/collections/collection_2017/sc-hc/H129-54-2-2017-eng.pdf
Heritage NL. (n.d.). Mining in Newfoundland and Labrador. Retrieved November 24, 2020, from https://www.heritage.nf.ca/articles/economy/mining.php Jacob et al. (7 May 2018).
Jacob, A., Moore, J., Fox, C., Sunter, E., Gauthier, D., Westwood, Ford, T. Cross-sectoral input for the potential role of science in Canada's environmental assessment. *FACETS*. **3**(1): 512-529. https://doi.org/10.1139/facets-2017-0104
Majid, C. (2014, May 16). International Day Against Homophobia and Transphobia. Newfoundland and Labrador Human Rights Commission. https://www.releases.gov.nl.ca/releases/2014/just/0516n02.aspx
Marathon Gold. (2019). Board Diversity Policy. https://marathon-gold.com/site/uploads/2020/05/marathon-gold-board-diversity-policy.pdf
Marathon Gold. (2020a). Valentine Gold Project: Environmental Impact Statement. https://iaac-aeic.gc.ca/050/documents/p80169/136562E.pdf
Marathon Gold. (2020b). Valentine Gold Project. https://marathon-gold.com/valentine-gold-project/
Marathon Gold. (2020c). Cooperation Agreement.https://marathon-gold.com/site/uploads/2020/12/12-9-2020-Marathon-Gold-Community-Cooperation-Agreements-vFinal.pdf
Marathon Gold. (2020d). Valentine Gold Project: Summary of the Environmental Impact Statement. https://iaac-aeic.gc.ca/050/documents/p80169/136514E.pdf
Marathon Gold. (2020e). Valentine gold project baseline study appendix 8. Species at risk/ species of conservation concern. https://iaac-aeic.gc.ca/050/documents/p80169/136536E.pdf
Mercer, N. (2020a, September 30). Grand Falls-Windsor parent says more information could have been provided about radon levels at school. The Chronicle Herald. http://www.thechronicleherald.ca/news/canada/grand-falls-windsor-parent-says-more-information-could-have-been-provided-about-radon-levels-at-school-503778/
Mercer, N. (2020b, November 17). Island gold: central Newfoundland becoming hotbed for mining activity . The Telegram. https://www.thetelegram.com/business/local-business/island-gold-central-newfoundland-becoming-hotbed-for-mining-activity-521446/
Merriam, E. R. et al. (2011) 'Additive effects of mining and residential development on stream conditions in a central Appalachian watershed', Journal of the North American Benthological Society, 30(2), pp. 399–418. doi: 10.1899/10-079.1.
O'Brien, K. E., Goodwin, T. A., & Risk, D. (2011). Radon soil gas in the Halifax Regional Municipality, Nova Scotia, Canada. Atlantic Geology, 47(0), 112–124. https://doi.org/10.4138/atlgeol.2011.005
Ongori, J. N., Lindsay, R., Newman, R. T., & Maleka, P. P. (2015). Determining the radon exhalation rate from a gold mine tailings dump by measuring the gamma radiation. Journal of Environmental Radioactivity, 140, 16–24. https://doi.org/10.1016/j.jenvrad.2014.10.012
Panu, U. S. (1989) 'Hydrological assessment of peat mining operations in domed bogs: A case study', Canadian Water Resources Journal, 14(3), pp. 54–65. doi: 10.4296/cwrj1403054.
Porter et al. (2006). Review of Fish Sampling Methods Commonly Used in Canadian Freshwater Habitats. https://www3.epa.gov/region1/npdes/merrimackstation/pdfs/ar/AR-1240.pdf
Randell et al. (March 2020). Sustainable development and strategic science: Population projections of newfoundland caribou using population viability analysis. https://www.gov.nl.ca/ffa/files/wildlife-pdf-tech-bulletin-004.pdf
Sarkar, A., Wilton, D. H., & Fitzgerald, E. (2017). Indoor Radon in Microgeological Setting of an Indigenous Community in Canada: A Pilot Study for Hazard Identification. The International Journal of Occupational and Environmental Medicine, 8(2), 69–79. https://doi.org/10.15171/ijoem.2017.1001
Sooley et al. (1998). Standard Methods Guide for Freshwater Fish and Fish Habitat Surveys in Newfoundland and Labrador: Rivers and Streams. https://waves-vagues.dfo-mpo.gc.ca/Library/242052.pdf
Statistics Canada. (2019). Labour force characteristics by province, monthly, seasonally adjusted. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410028703&pickMembers%5B0%5D=3.1&pickMembers%5B1%5D=4.1&cubeTimeFrame.startMonth=11&cubeTimeFrame.startYear=2019&referencePeriods=20191101%2C20191101
Status of Women Canada. (n.d.). Apply GBA+ to your work. Government of Canada. Retrieved November 29, 2020, from https://cfc-swc.gc.ca/gba-acs/apply-appliquez-en.html

Strager, M. P. et al. (2009) 'A spatially explicit framework for quantifying downstream hydrologic conditions', Journal of Environmental Management, 90(5), pp. 1854–1861. doi: 10.1016/j.jenvman.2008.12.006.
Teck. (2016). Collaborating on Closure Planning at Duck Pond Operations. https://www.teck.com/news/stories/2016/collaborating-on-closure-planning-at-duck-pond-operations
Waite, S., Pajovic, V., & Denier, N. (2020). Lesbian, gay and bisexual earnings in the Canadian labor market: New evidence from the Canadian Community Health Survey. Research in Social Stratification and Mobility, 67, 100484. https://doi.org/10.1016/j.rssm.2020.100484
White, K. (2014, November 3). Gay ex-miner now manages 'hate-free' Dollar General . Charleston Gazette-Mail. https://www.wvgazettemail.com/news/gay-ex-miner-now-manages-hate-free-dollar-general/article_f3e2b7ab-2fa8-5af7-8499-19277643db2b.html
Whitford, J. (2004) ENVIRONMENTAL PROTECTION PLAN FOR THE DUCK POND COPPER-ZINC PROJECT.
Women in Mining Canada. (2016). Welcoming to Women: An Action Plan for Canadas Mining Employers.
Wright, R. (2016) Teck Duck Pond Operations Real-Time Water Quality Monitoring Network 10 Year Report.

2.8 Report 2 Appendices

2.8.1 Appendix 2A

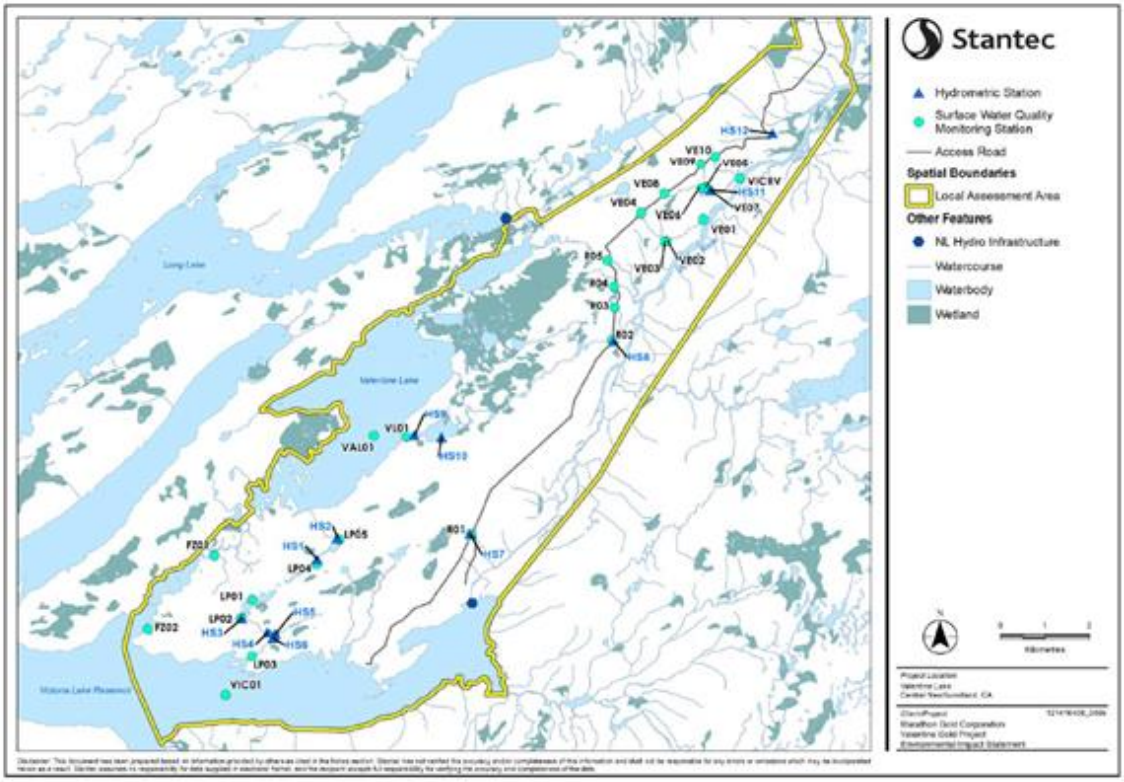

Figure A1. Map of surface monitoring locations produced by Stantec for the Valentine Gold Project.

Table A1. Mines located within proximity of the Valentine Gold Project region and their associated project status.

Mine	Status
Duck Pond	Decommissioning *(Contains water monitoring program)*
Beaver Brook	Producing
Moosehead Gold	Phase 6 - Drilling *(Permit Received)*
Twilite Gold	Drill-ready
Queensway Gold	Drilling

2.8.2 Appendix 2B

Table B1. Provincial and Federal definitions of Species at Risk (SAR) and Species of Conservation Concern (SOCC).

	SAR	SOCC
Provincial	**NL ESA** Listed as Extirpated, Endangered, Threatened, or Vulnerable under the NL ESA	**AC CDC** Defined as provincially rare, which included S-ranked species (S1 (critically imperiled), S2 (imperiled)1, or combinations thereof (e.g., S1S2))
		NL ESA Recommended for listing under NL ESA, but not yet listed
Federal	**SARA** Species that are designated under Schedule 1	**SARA** Recommended for listing as Endangered, Threatened, Vulnerable, or Special Concern, but not yet listed under SARA.
	Committee on the Status of Endangered Wildlife Species in Canada (COSEWIC) Listed as Extirpated, Endangered, Threatened, Vulnerable, or Special Concern by COSEWIC	

2.8.3 Appendix 2C

Table C1. The unemployment rates of the six towns that Marathon Gold deemed of direct socio-economic impact from the Valentine Gold Project, as well as the unemployment rate of the province (Statistics Canada, 2016).

Location	Buchans	Buchans Junction	Millertown	Badger	Grand Falls-Windsor	Bishop's Falls	Newfoundland and Labrador
Unemployment Rate	25%	50%	0%	17.2%	17.7%	20.3%	15.6%

Report 3: Avifauna and species at risk

Julia Cameron, MES Candidate, Dalhousie University

3.1 Executive summary

Valentine Gold is a proposed resource extraction development project in the province of Newfoundland and Labrador that is currently under review through the *Canadian Environmental Assessment Act* (CEAA 2012). This project was evaluated through the examination of its proposed mitigation measures to ensure the protections and conservation of species-at-risk and their habitats during project development. The chosen substantive component for this examination was avian species-at-risk. Three avian species-at-risk were identified as occurring within or near the project area: olive-sided flycatcher (*Contopus cooperi*), common nighthawk (*Chordeiles minor*), and rusty blackbird (*Euphagus carolinus*). Factors considered in the literature for understanding mitigation measures to species-at risk in relation to human development were forest fragmentation, wetland degradation, noise disturbances, and current management practices implemented by similar resource-extraction projects in Canada. From examining the project, it was determined that no clear mitigation measure was outlined for reducing noise disturbances on nesting avian species-at-risk, and mitigation measures proposed to ensure habitat stability and abundance monitoring for avian species-at-risk were non-committal and only effective for the construction phase of the project.

This review suggests the following recommendations for the proponent of Valentine Gold in order to ensure the management and protection of avian species-at-risk and their respective habitats: 1) the proponent must report all progress on developments of the project (i.e. construction, operation, decommissioning) to the ECCC on an annual basis, outlining avifauna surveying and current management practices undertaken to minimize negative impacts on nesting birds and avian species-at-risk; 2) minimize clear-cut amounts to prevent further habitat fragmentation and plant trees during the decommissioning phase to replace the ones cleared from construction, as well as avoid cutting down trees occupied by migratory birds and species-at-risk during the breeding season; 3) adopt a management policy of maintaining a distance buffer of 120 m at minimum from freshwater bodies including streams, riverine systems, and wetlands; and 4) conduct monitoring of all avian nesting sites during all phases of the project (i.e. construction, operation, decommissioning) during in the fall and spring migratory seasons in order to adequately account for presence of avifauna on-site or in proximity of the site. Additional mitigation measures to reduce noise disturbances were recommended for the proponent to consider: 1) conduct blasting only during daytime hours; 2) install noise barriers around the project vicinity to prevent acoustic disturbances to avian species-at-risk; and 3) install centralized compressors to prevent unregulated noise produced from machinery.

3.2 Evaluation of consideration for avian species-at-risk

3.2.1 Background

Valentine Gold Project is a proposed gold mining development to be undertaken approximately 55km near the community of Millertown in the province of Newfoundland and Labrador (Impact Assessment Agency of Canada [IAAC], 2019a). The proponent of the project is Marathon Gold Corporation, a gold mining development company whose headquarters are located in Toronto, Ontario (Marathon Gold, 2020a). The development of Valentine Gold is proposed to include the construction, operation, and decommissioning of an open-pit gold mine near Valentine Lake, which would comprise of two open pits, crushing and stockpiling areas, site infrastructure, disposal piles,

tailings management facility, and mine access roads (IAAC, 2019a). The Newfoundland and Labrador Department of Environment Climate Change and Municipalities (NLECCM) states that, if approved, the mine is expected to be operational 24 hours per day, seven days a week, on a 12-hour shift basis and will produce 18,000 tonnes per day of high-grade and low-grade gold ore over the course of 12 years of operation (NLECCM, 2020; IAAC, 2019a). In May of 2019, the project was deemed eligible by the Impact Assessment Agency of Canada (IAAC, the 'Agency') to undergo an Impact Assessment (IA) under regulations pursuant of the previous CEAA 2012 legislation (IAAC, 2019b). As of July 2019, an IA has been undertaken by Environment Climate Change Canada (ECCC) to assess Valentine Gold and the potential impacts and cumulative effects on valuable components (VCs), such as air quality, noise pollution, and species-at-risk (IAAC, 2019c).

In September 2020, Marathon Gold outlined a management plan for species-at-risk in their Environmental Impact Statement (EIS) for their proposed project area, which would cover approximately 65.6 km^2 of forested lands (IAAC, 2020a). In Section 7.7 (pp. 99-104) of the EIS, the proponent projected that effects on avian species-at-risk from the development of Valentine Gold would include an estimated loss of 32 km^2 of vegetated land from project operations, which includes approximately 6.3km^2 of wetland, and an additional 2.8 km^2 of land is estimated to be altered due to road upgrades for transport vehicles and routine maintenance (Marathon Gold, 2020b). Furthermore, the proponent outlined that an estimated 35 km^2 of avifauna habitat, which is comprised of 78% mixed forest and wetland, may be degraded or lost due to development and commencement of the project (Marathon Gold, 2020b). Disturbances to avian species, such as increased traffic, blasting, and heavy equipment may result in breeding birds, including avian species-at-risk, to abandon their nests and young and may also prevent them from foraging effectively (Marathon Gold, 2020b; IAAC, 2020a). In the EIS, three avian species-at-risk were identified from field studies to be observed in and near the proposed project area: olive-sided flycatcher (*Contopus cooperi*), common nighthawk (*Chordeiles minor*), and rusty blackbird (*Euphagus carolinus*) (Marathon Gold, 2020b).

The olive-sided flycatcher breeds throughout Canada, excluding Nunavut, and winters in Central America and northern South America (Environment Climate Change Canada [ECCC], 2016a). For breeding, it selects open, burned, or coniferous-mixed forest located near wetlands or bogs and its nests are constructed with a combination of twigs, lichens, grasses, and pine needles (ECCC, 2016a). The species has been known to occupy territories as large as 200 m^2 and has been documented in Newfoundland through citizen science and field surveys by governmental organizations, although population trends within the province are currently unknown (ECCC, 2016a; NLFFA, 2019b). The species has been designated as 'Threatened' by both the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and NLFAA, with an estimated annual population decline of 4% from 1968 to 2006 due to its habitat being presently threatened by human activities and industrial development (ECCC, 2016a).

The common nighthawk can be found in every province and territory in Canada during the breeding season, except Nunavut, and winters in northeastern South America (ECCC, 2016b). Common nighthawks breed in a wide range of habitats which include open and mixed coniferous forests, grasslands, sandy areas, and wetlands, and nest on open ground and clearings (ECCC, 2016b). The species occupies large territories ranging from 0.28 km^2 to upwards of 25.6km^2, however, they are considered uncommon in Newfoundland as they nest mainly on the southeastern range of Labrador (ECCC, 2016b; NLFFA, 2016c). The common nighthawk is designated as 'Threatened' by both COSEWIC and NLFAA and has exhibited a nationwide decline of nearly 76% from 1973 and 2012, with current estimates projecting a 4.2% decline annually (ECCC, 2016b).

The rusty blackbird is a rare marsh bird which is found in all provinces and territories in Canada and breeds exclusively in mixed boreal forested regions that are located near wetlands and peatbogs (COSEWIC, 2017). Rusty blackbirds depend on wetlands for their nesting habitats, which are often a result of burns, riparian bogs, or lichen spruce woodlands, and currently a majority of these habitats are presently degraded or lost completely due to human development (COSEWIC, 2017). The species is known to occupy territories averaging 0.11 km^2, and despite current distribution in Newfoundland remains largely uncertain, they are estimated to occupy a breeding density of six birds per km^2 of suitable habitat (COSEWIC, 2017; NLFFA, 2019d). Presently, the rusty blackbird has been designated as 'Special Concern' by COSEWIC and 'Vulnerable' by NLFFA (COSEWIC, 2017; NLFFA, 2019d).

All three of these avian species-at-risk have been documented in the Newfoundland Breeding Bird Atas (NFBBA) as recently as 2019 (Birds Canada, 2019), and have also been observed by field studies within the vicinity of the proposed project area (Marathon Gold, 2020b). The olive-sided flycatcher, common nighthawk, and rusty blackbird all live in habitats comprised of a majority of mixed forest and wetland, and they depend on forested environments for breeding and nesting in Newfoundland, which would be at risk of further degradation or loss if Valentine Gold gains approval from the Agency with ineffective mitigation (NLFFA, 2019a).

3.2.2 Evaluation

To determine if these species would be negatively impacted by the development of Valentine Gold, the proponent had conducted preliminary field studies to observe local avifauna that may be in close proximity to the project area in accordance with the *Migratory Birds Treaty Act* and the *Species At Risk Act* (Marathon Gold, 2020b). From their observations, the proponent has predicted numerous disturbances to avian species that may occur during the construction and operation of Valentine Gold up until its decommission (Marathon Gold, 2020b). Some of these disturbances include noise pollution from blasting, traffic, and heavy machinery, habitat degradation through vegetation removal during construction, visual disturbances through stationary lighting sources from infrastructure, and potential wetland degradation from on-site water management activities (Marathon Gold, 2020b). Outlined in their EIS in Section 7.7.2.1 (p. 100), the proponent has concluded that potential impacts of the construction and operation of the mine may cause changes in avian mortality risk, which include habitat degradation from forest clearing, vehicular collisions, and the potential for increased predator presence on-site, and these impacts would be more severe during breeding and nesting (Marathon Gold, 2020b).

Mitigation measures proposed by the proponent in relation to avian species and their habitat have been outlined in detail in Section 7.7.2.2 in Table 7.6 of their EIS (pp. 101-103), and include the following management strategies: sensitive areas, such as wetlands, will be identified prior to construction and will be monitored; all vehicles will be restricted to site-access roads only and must adhere to the posted speed limits; vehicles will be equipped with noise-reducing mufflers to limit acoustic disturbances; lighting will be limited to what is necessary for safe work practices and will not exceed established thresholds; environmental researchers subcontracted will be briefed on knowledge related to species-at-risk and other wildlife in order to identify fauna within the project area (Marathon Gold, 2020b). Additionally, Marathon Gold included mitigation steps in their EIS specifically related to terrestrial avian species which are: 1) an avian management plan will be implemented to conduct pre-construction surveys to monitor for active nesting sites; 2) trees that contain nests will not be clear-cut during construction and will be removed after the nesting season in order to not disturb nesting broods; and 3) nest sites discovered will be reported to Marathon Gold

and will continue to be monitored by staff (Table 7.6; Marathon Gold, 2020b). However, the proponent did not outline any mitigation measures that are specifically related to reducing noise disturbances to avian species and species-at-risk from blasting. The only indication of mitigation related to on-site blasting is mentioned briefly in Table 7.6, but only goes as far as to state that "Project facilities and infrastructure will be designed to limited noise emissions" (Marathon Gold, 2020b). Thus, the mitigation for this potential disturbance to avian species-at-risk is virtually unknown to the ECCC. A cohesive study on the effects of resource extraction on biodiversity by Northrup and Wittemyer (2013) found that noise disturbances produced from surface mine blasting negatively impacts birds in terms of mate selection, nesting success, and overall abundance. Noise produced by unregulated or uncontrolled blasting may also alter bird song structure, which greatly decreases the chances of birds finding a mate and may potentially increase their exposure to predators (Northrup & Wittemyer, 2013). Studies conducted on noise mitigation from mining have suggested some remedies, which include the installation of barriers and centralized compressors, as well as conducting surface blasting only during daytime hours (Bayne et al., 2008; Francis et al., 2011; Northrup & Wittemyer, 2013).

Many studies focusing on forest avifauna have outlined the impacts of resource extraction on avian habitats (Cadieux et al., 2020). Clear-cutting due to resource extraction and construction of industrial developments results in the fragmentation and degradation of forested avian habitats (Leu et al., 2008; Villard et al, 1999). A study by Cadieux et al. (2020) found that climate change coupled with anthropogenic disturbances greatly decreases available forested habitat for avian species due to the loss of mature coniferous trees and mixed woodlands lost to clear-cutting. A possible solution to habitat loss associated with fragmentation caused by industrial development is to change forest management practices (Cadieux et al., 2020), although this might not be realistically feasible time-wise for Valentine Gold. Another possible mitigation measure that may be more appropriate for Valentine Gold is to plant trees after the construction phase and again after the decommissioning of the mining site (Cadieux et al., 2020). Planting trees has been proposed by many energy sector groups over the years, and while they do eventually yield results, it takes almost decades to see improvements in the ecosystem (Northrup & Wittemyer, 2013). In regard to wetlands and resource extraction, preserving wetland ecosystems has been a national priority of conservation in Canada since 1981 (Rudec & Hanson, 2008). Potential mitigation measures for wetlands that have been used successfully in the past include restoration of the wetland habitat, if degraded by the proponent, and avoiding wetland disturbance altogether by altering project area boundaries to ensure the wetland is not impacted by development (Rubec & Hanson, 2008; Volik et al., 2020). However, these strategies are largely proponent-dependant and require much time and planning to properly implement (Rubec & Hanson, 2008).

A similar gold mining and extraction project to Valentine Gold, Goliath Gold of Dryden, Ontario, has similar mitigation measures to combat potential impacts of avian species-at-risk (IAAC, 2019c). Outlined in their amended Mitigation Monitoring and Commitments List submitted to the Agency, Treasury Metals Incorporated, the proponent of the project, has implemented monitoring strategies to identify avian species-at-risk throughout operation in addition to maintaining at least a 120 m buffer between project development and freshwater streams and wetlands, as well as minimizing the amount of habitat clearing required for the project by avoiding forest clear-cutting during the breeding season (IAAC, 2019c). Additional mitigation strategies that Goliath Gold has proposed include identifying and protecting species-at-risk habitat on-site, training for environmental monitoring staff to identify species-at-risk, and the utilization of offset habitat for species-at-risk, if required (IAAC, 2019c). With these mitigation measures implemented, the impacts of development on avian species-at-risk are likely to be reduced during the commencement of Goliath Gold.

3.2.3 Recommendations

My recommendations for the ECCC to consider in regard to the Valentine Gold project are improvements to existing mitigation measures, which are the following:

1. If approved by the ECCC, Marathon Gold must report all progress on developments of the project, including construction, operation, decommissioning proceedings of the project area to the ECCC on an annual basis, outlining avifauna surveying and current management practices undertaken by Marathon Gold and environmental staff to minimize negative impacts on nesting birds and avian species-at-risk.
2. Minimize clear-cut amounts to prevent further habitat fragmentation of forested lands, and plant trees during the decommissioning phase of the project to replace trees cleared from construction. The proponent should also avoid cutting down trees occupied by migratory birds and species-at-risk during the breeding season and monitor active nesting sites during the duration of tree occupation. Trees can then be cut after the nesting season ends to ensure no avian species-at-risk and their young are harmed.
3. Adopt a management policy of maintaining a distance buffer of 120 m at minimum from all freshwater bodies including streams, riverine systems, lakes, and wetlands in order to preserve local ecosystem function with minimal impacts. Watershed areas should be identified, monitored, and studied throughout the construction, operation, and decommissioning phases of the project.
4. Proponent should conduct monitoring of all avian nesting sites discovered and identified during all phases of the project (i.e. construction, operation, decommissioning) during in the fall and spring migratory seasons in order to adequately account for presence of avifauna on-site or in proximity of the site. Reports gathered by these surveys should conducted by hired environmental staff and be presented to Marathon Gold, the ECCC, and other relevant groups.
5. In terms of noise caused by blasting at the surface level of the mining site, potential mitigation measures that can be implemented into the proponent's management plans to expand their proposed mitigation for noise disturbances are the following:
    a. Conduct surface blasting only during daytime hours to prevent disturbance to diurnal avifauna and other wildlife;
    b. Install noise barriers around the project vicinity to prevent acoustic disturbances to avian species-at-risk;
    c. Install centralized compressors to prevent unregulated noise produced from machinery.

In summary, the mitigation measures proposed by the proponent are on-par with what previous projects and academic studies have undertaken, but much more work can be done to improve current mitigation strategies put forth by Marathon Gold. It would be in the best interests of Marathon Gold, stakeholders, and the Agency for Valentine Gold to implement mitigation strategies for noise disturbances on avian species and species-at-risk, as well as having a plan for dealing with clear-cutting of forested lands and wetlands that may be within the project area. Thus, it would be beneficial for Valentine Gold and the local ecosystems near Valentine Lake in Newfoundland for the proponent to consider expanding their mitigation strategies to include more factors that may negatively impact species-at-risk.

3.3 Author information

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3.4 References

Bayne, E. M., Habib, L., & Boutin, S. (2008). Impacts of Chronic Anthropogenic Noise from Energy-Sector Activity on Abundance of Songbirds in the Boreal Forest. *Conservation Biology*, *22*(5), 1186–1193. https://doi.org/10.1111/j.1523-1739.2008.00973.x

Birds Canada. (2019). Newfoundland Breeding Bird Atlas. *Birds Canada*. Retrieved from: https://www.birdscanada.org/birdmon/nfatlas/main.jsp

COSEWIC. 2017. COSEWIC assessment and status report on the Rusty Blackbird Euphagus carolinus in Canada. *Committee on the Status of Endangered Wildlife in Canada*. Ottawa. xi + 64 pp.

[ECCC] Environment Climate Change Canada. 2016a. Recovery Strategy for the Olive-sided Flycatcher (*Contopus cooperi*) in Canada. *Species at Risk Act Recovery Strategy Series*. Environment Canada, Ottawa. vii + 52 pp.

[ECCC] Environment Canada. 2016b. Recovery Strategy for the Common Nighthawk (*Chordeiles minor*) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. vii + 49 pp.

Francis, C.D., Ortega, C.P. & Cruz, A. (2011). Different behavioural responses to anthropogenic noise by two closely related passerine birds. *Biology Letters*, 7, 850–852.

[IAAC] Impact Assessment Agency of Canada. (2019a). Valentine Gold Project. *Government of Canada*. Retrieved from: https://iaacaeic.gc.ca/050/evaluations/proj/80169

[IAAC] Impact Assessment Agency of Canada. (2019b). Valentine Gold Project: Notice of Environmental Assessment Determination. *Government of Canada*. Retrieved from: https://iaac-aeic.gc.ca/050/evaluations/document/132382

[IAAC] Impact Assessment Agency of Canada. (2019c). Goliath Gold Project. *Government of Canada*. Retrieved from: https://iaac-aeic.gc.ca/050/evaluations/proj/80019?culture=en-CA

[IAAC] Impact Assessment Agency of Canada. (2020). Valentine Gold Project: Environmental Impact Statement Summary (EIS). *Government of Canada*. Retrieved from: https://iaac-aeic.gc.ca/050/evaluations/document/136521

Leu, M., Hanser, S.E. & Knick, S.T. (2008). The human footprint in the west: a large-scale analysis of anthropogenic impacts. *Ecological Applications*, 18, 1119–1139.

Marathon Gold. (2020a). Marathon Gold: Developing the Valentine Gold Project in Newfoundland. *Marathon Gold*. Retrieved from: https://marathon-gold.com

Marathon Gold. (2020b). Valentine Gold Project Environmental Impact Statement. *Government of Newfoundland and Labrador*. Retrieved from: https://www.gov.nl.ca/eccm/files/env-assessment-projects-y2019-2015-rpt_BSA_8_SAR_SOCC.pdf

[NLECCM] Newfoundland and Labrador Department of Environment, Climate Change, and Municipalities. (2020). Valentine Gold Project. *Government of Newfoundland and Labrador*. Retrieved from: https://www.gov.nl.ca/eccm/projects/project-2015/

[NLFFA] Newfoundland and Labrador Department of Fisheries, Forestry, and Agriculture. (2019a). Wildlife: Species At Risk. *Government of Newfoundland and Labrador*. Retrieved from: https://www.gov.nl.ca/ffa/wildlife/endangeredspecies/

[NLFFA] Newfoundland and Labrador Department of Fisheries, Forestry, and Agriculture. (2019b). Wildlife: Species At Risk, Olive-Sided Flycatcher. *Government of Newfoundland and Labrador*. Retrieved from: https://www.gov.nl.ca/ffa/files/wildlife-endangeredspecies-olive-sided-flycatcher-information-sheet.pdf

[NLFFA] Newfoundland and Labrador Department of Fisheries, Forestry, and Agriculture. (2019c). Wildlife: Species At Risk, Common Nighthawk. *Government of Newfoundland and Labrador*. Retrieved from: https://www.gov.nl.ca/ffa/files/wildlife-endangeredspecies-common-nighthawk-information-sheet.pdf

[NLFFA] Newfoundland and Labrador Department of Fisheries, Forestry, and Agriculture. (2019d). Wildlife: Species At Risk, Rusty Blackbird. *Government of Newfoundland and Labrador*. Retrieved from: https://www.gov.nl.ca/ffa/files/wildlife-endangeredspecies-rusty-blackbird-information-sheet.pdf

Northrup, J. M., & Wittemyer, G. (2013). Characterising the impacts of emerging energy development on wildlife, with an eye towards mitigation. *Ecology Letters*, *16*(1), 112–125. https://doi.org/10.1111/ele.12009

Rubec, C. D. A., & Hanson, A. R. (2009). Wetland mitigation and compensation: Canadian experience. *Wetlands Ecology and Management*, *17*(1), 3–14. https://doi.org/10.1007/s11273-008-9078-6

Treasury Metals. (2019). Mitigation, Monitoring, and Commitment List (R.4). *Treasury Metals Incorporated*. Retrieved from: https://iaac-aeic.gc.ca/050/documents/p80019/131110E.pdf

Villard, M.A., Trzcinski, M. K., & Merriam, G. (1999). Fragmentation Effects on Forest Birds: Relative Influence of Woodland Cover and Configuration on Landscape Occupancy. *Conservation Biology*, *13*(4), 774–783. https://doi.org/10.1046/j.1523-1739.1999.98059.x

Volik, O., Elmes, M., Petrone, R., Kessel, E., Green, A., Cobbaert, D., & Price, J. (2020). Wetlands in the Athabasca Oil Sands Region: the nexus between wetland hydrological function and resource extraction. *Environmental Reviews*, (ja).

Report 4: Vegetation and wetlands, community health, surface water, and caribou

Prepared by Maddie Clarke, Kelsea Deblois, Laura Carter, & Destin Gardner

4.1 Executive summary

Marathon Gold (the Proponent) is proposing the Valentine Gold Project (hereafter 'The Project') in central Newfoundland that has a 16-20 month Construction Phase, and 12-year Operation Phase, followed by an extended Decommissioning Phase which is set to occur when it is no longer economically feasible to continue mining or resources are exhausted. The Project comprises two open pit mines and expects to mine process 6 850 tonnes/day, increasing to 10 960 tonnes/day by the fourth year of operations (Marathon Gold, 2020, p. 1.3). Four valued components were identified for consideration within the Valentine Gold Mine Project Impact Statement (IS):

1. **Vegetation & Wetlands**
2. **Community Health**
3. **Surface Water**
4. **Caribou**

With regard to vegetation and wetlands, more information should be provided on the rehabilitation process following the project's end-of-life. Remediation procedures that are described in the IS are vague, and monitoring protocols lack substance. This is concerning given that significant adverse residual effects on vegetation and wetlands are expected to occur that will be irreversible and may affect ~100 km^2 of land.

With regard to community health effects, the consideration of cumulative effects is lacking. Mitigation measures outlined in the IS are vague and should explain in further detail how exactly these measures will alleviate the adverse impacts related to discharges and emissions, directly exposing humans to contaminants, or food security. The IS also lacks adequate consideration of GBA+ insofar as mitigation measures for potential health impacts related to gender-based violence. Descriptions of methodology for each baseline environmental, health, social and economic condition and VC is also lacking in detail, against Section 4.3 of the Guidelines for the Preparation of an Environmental Impact Statement pursuant to *CEAA*, 2012.

With regard to impacts on surface water quality, greater consideration is required in the realm of water quality monitoring standards. Baseline sampling was conducted intermittently and with unclear rationale. A comprehensively defined water quality monitoring protocol is not specified within the IS for The Project, nor is the indication that any consideration has been given to future monitoring procedures after mining operations have ended. Descriptions regarding the proposed grading scheme for The Project area are chaotic and do not instill a high level of confidence in the proponent's ability to execute what is a complex and crucial stage in project construction.

With regards to caribou population, the long-term effects of The Project are uncertain. The Project Area has a very small overlap with only two out of the four herds discussed, at 1% overlap for the Buchans herd, and at 2% overlap for the Grey River herd. However, The Project disrupts the annual migratory pattern of the Buchan herd and can have long-lasting effects that remain unknown. Recommendations include a commitment to combat habitat loss by planting caribou friendly vegetation as well as consulting various First Nations groups to gain knowledge and experience with monitoring caribou populations.

4.2 Consideration of vegetation & wetlands

4.2.1 Background

The Valentine Gold mining project is located in the Central Newfoundland Forest Ecoregion. Publicly available data, remote sensing and field surveys were used to inform the IS concerning vegetation and wetlands. The Project was separated into three main study regions: The Project Area, where buildings and mining operations will take place, the Local Assessment Area (LAA) which encompasses a 1 km buffer around the Project Area and 500 m buffer around the access road, and the Regional Assessment Area (RAA) which encompasses a 35 km buffer around the Project Area and was used to inform cumulative effects.

Remote sensing technology was used to delineate habitats, which were identified from 74 field sites sampled in August 2014 and makes use of an Ecological Land Classification (ELC) map which was corroborated with 106 field sites to 83% accuracy (Marathon, 2020, p. 9.11). Detailed vegetation surveys at 30 sites using the *Forest Site Classification Manual: A Field Guide to Damman Forest Types of Newfoundland* and two rare species surveys were conducted in late June and late July (Marathon, 2020, p. 9.12). Criteria were assessed for significance based on direction, magnitude, geographic extent, frequency, duration, reversibility, ecological and socio-economic context.

Dominant ecotypes noted in the RAA include boreal forest (18%), mixed wood forest (17.3%), black spruce forest (12.5%), and kalmia-black spruce heath (10.3%), among others (Marathon, 2020, p. 9.19). No species were listed under the *Species at Risk Act*, but three Species Of Conservation Concern (SOCC) were identified: short-scale sedge, nodding water nymph, and perennial bentgrass (Marathon, 2020, p. 9.28). 38 species were identified as being non-native or invasive, 4 four of which have the strong potential to be invasive (Marathon, 2020, p. 9.31).

Overall, the Project expects the direct loss or change of 32.0 km2 of vegetation and an estimated 65.6 km2 will be either directly or indirectly impacted (Marathon, 2020, p. 9.61). As for wetlands, there will be a direct loss of 3.4 km2 and 30.3 km2 of wetland habitat will be directly or indirectly affected (Marathon, 2020, p. 9.68). The Project is predicted to have significant adverse residual effects on both vegetation and wetland functioning through a loss of area in the LAA but the Proponent considers the magnitude of these impacts to be low. However, the IS states these impacts will be irreversible (Marathon, 2020, p. 9.64 & 9.70). Changes in wetland function include hydrologic alterations, loss of habitat for moose, bear, beaver, muskrat, and marten, a reduction in carbon sequestration, and more susceptible to colonization by invasive species.

The Proponent will be creating a Rehabilitation and Closure Plan that will be regularly reviewed and updated until implemented (Marathon, 2020, p. 9.58). Mitigation measures include cutting down only what vegetation is necessary to construct the mine and access road, limiting, as much as possible, the impacts on wetlands, the storing of topsoil and subsoils separately, and using native species and avoiding non-native or invasive species, when possible, to rehabilitate the Project Area following the Decommissioning Phase (Marathon, 2020, Table 9.10). 3

4.2.2 Evaluation

Common concerns regarding vegetation and wetlands during the proposal of resource and development include what type of communities are found and if any listed species or SOCC are present, and the amount of area being affected by the construction, operation, and decommissioning of the Project. Several specific concerns were identified regarding the Valentine Gold Mining Project, and these include vague descriptions of sampling methods, lack of consideration for the proliferation of invasive species already present in the LAA that could benefit from the disturbances caused by the Project, and major concerns related to mitigation measures and monitoring following the decommissioning of the Project, which are severely under described.

Sampling methods were not clearly identified such that sampling designs were not described beyond plot counts. Generally, random sampling or regular intervals designs can help to reduce bias and error (Olofsson et al., 2014). Additionally, map accuracy should be determined by response design, sampling design, and analysis (Olofsson et al., 2014). Some accuracy assessments are not always appropriate, and some have criticized the confusion matrix, which was used for this assessment (Stantec Consulting Ltd., 2015, p. 95), as some cases have the potential to be allocated correctly by alone and thus overall accuracy can be overestimated (Foody, 2002). Sampling design directly influences accuracy assessment and so not enough detail is provided to inform its reliability (Foody, 2002). Furthermore, generally recommended

accuracy targets are ≥ 85% (Foody, 2002) and the accuracy of the ELC stands at just 83% (Marathon, 2020, p. 9.11).

With respect of rehabilitation of the site, mitigation includes using native seed mix to control for erosion will be used on exposed soil and overburden during stockpiling (Marathon, 2020, Table 9.10). Any addition of non-native species can lead to a decrease in revegetation as quickly establishing non-species can outcompete native ones (Matesanz & Valladares, 2007) and so should be avoided as described. However, vegetation restoration in boreal and alpine habitats is difficult and it has been shown that simply seeding eroded areas is little better than doing nothing (Ebersole et al., 2004) and so transplanting will be necessary. Using native transplants can also be exceedingly difficult as nurseries rarely carry them and, even if commercial stock of native species were identified, they tend to suffer from inbreeding depression and have reduced performance compared to their wild counterparts (Aavik et al., 2012). Alternatively, using local turf transplants can be quite effective but it should be noted that cutting turfs has significant implications for donor sites and studies in wet barrens, similar to the LAA, where hydrology has been altered can negatively impact soil seed banks (Berg et al., 2003; Jansen et al., 2004) and thus increase the regeneration period of the donor sites. Overall, more information is needed to describe how rehabilitation efforts will be promoted.

It is also unclear how the quality of exposed soil and overburden will affect rehabilitation. Seeding and transplanting are generally more effective in organic-based soils as compared to mineral soils (Rydgren et al., 2017) and it will be important to consider this as waste rock piles attempt to be revegetated. It is good that care will be taken to keep topsoil and subsoils as five separate piles during the construction phases, but it is not clear how these will be used during the rehabilitation of the site especially since the topsoil baseline chemistry levels are unknown (Marathon, 2020, 9.42). Therefore, it will not be possible to determine the impact of storage and mining activities on the quality of the topsoil which is a necessary component for the rehabilitation of the site.

Temporary vegetation for soil stockpiles should be native species reflective of the RAA and it is good to see that this will be cultivated at Year 9 of the operation phase (Marathon, 2020, p. 9.60) prior to the decommissioning of the project to be used as a source of material for rehabilitation. It is unclear how, when, or for how long trials or revegetation studies will be conducted to ensure the successful rehabilitation of the project. The Proponent mentions that closure rehabilitation following some active remediation will occur allowing succession to natural plant communities.
It should be noted that any use or invasion of non-native or invasive plants may disrupt natural succession processes and may not lead to the re-naturalization of the area (Matesanz & Valladares, 2007). Invasive species were already noted in the proponent baseline studies and monitoring and mitigation measures are required as invasive species generally tend to perform well in disturbed soils and thus it can be difficult for native species to regain a foothold following invasive colonization (Matesanz & Valldares, 2007). Additionally, this form of passive regeneration is generally only successful when the soil seed bank remains intact (Sawtshuk et al., 2010) which will likely not be the case for the majority of the Project Area.

Monitoring protocols following the Decommissioning Phase were unclear and mitigation measures for vegetation and wetlands appear to be lacking despite acknowledging a significant

adverse impact from The Project and surrounding area. The proponent has identified that monitoring of the dams will continue for 100 years following the decommissioning of the mine (Marathon, 2020, p. 2.60) but does not specify solutions for the monitoring of the vegetation rehabilitation nor does it specify a timeline for how long this type of monitoring would continue. The irreversible impacts on vegetation and wetlands are concerning, and regardless of magnitude, the footprint of the Project will linger in perpetuity. In line with the proponent's use of the precautionary principle, which states that the proponent will undertake all reasonable measure to protect the environment if the undertaking has the potential to cause a threat of serious or irreversible damage to the environment (Marathon, 2020, p. 2.120). The Proponent must continue to track vegetation changes following the Decommissioning Phase to be able to perform any mitigation that might be required to protect the environment from further degradation.

There are also serious concerns regarding the extent of the affected area as a result of this Project, which total almost 100 km2, for vegetation and wetlands, and how potential soil contamination will be resolved. Main issues are related to lack of information regarding initial sampling designs, and lack of information regarding implementation and monitoring following the Decommissioning Phase.

4.2.3 Recommendations

More consideration should be taken during the rehabilitation and revegetation phases of The Project as it is unclear how the current mitigation strategies will benefit to the decommissioned area. Loss or alteration of vegetation and wetlands will adversely affect ecosystem functioning which will ultimately influence all future activities in the area and impact how wildlife utilize the region. Key recommendations based on the above evaluation of Valentine Gold's IS include:

1. Provide more detail on the execution of vegetation and wetland surveys.
A description of accuracy assessment methods and more detail should be provided to describe sampling design, describe what techniques (e.g., random sampling, stratified random sampling, regular intervals) were used to collect baseline vegetation data and what efforts were implemented to reduce bias and error.

2. Provide more information on the vegetation and methods being used to rehabilitate the Project Area as The Project enters into its Decommissioning Phase.
Species being used for rehabilitation should be locally sourced and native to the RAA. More detailed plans regarding restoration trials implemented in Year 9 should be provided. Possible treatments could include a passive control, seeding, transplanting, the use of biodegradable geotextiles for erosion control, soil scarification to reduce compaction, and soil amendments using different combinations of topsoil and subsoils that were stored from the Construction Phase.

3. Provide a strategy to promote revegetation rehabilitation and natural succession within the LAA.
Non-native and invasive species will hinder natural successional processes that the proponent relies on the rehabilitate the Project Area in the long run. Mitigation and removal of invasive species will be necessary to make natural succession a possibility. Additionally, seed banks of

the topsoil being used to remediate the Project will need to be identified. The seeds of some species are short-lived and may not survive the expected 12-year Operation Phase of the Project.

4. Provide more information on the scope of the monitoring plan for vegetation and wetland remediation following the Decommissioning Phase of The Project.
A comprehensive vegetation survey should be prepared following the completion of the Decommissioning Phase that can be used as a baseline to monitor the success of the rehabilitation over time. Permanent plots should be established by the proponent at regular intervals across the site that can be revisited yearly. Main factors that should be addressed include vegetation cover, soil nutrient quality, as well as presence and quantity of invasive or non-native species. Broader surveys should be conducted in the LAA and RAA to monitor and mitigate potential indirect residual effects that can impact the region on the whole. The Proponent should provide details on how they plan to continue this monitoring for the next 100 years and provide contingencies plans in the case that vegetation and wetlands do not recover naturally.

4.3 Consideration of community health effects

4.3.1 Background

The Local Assessment Area (LAA) encompasses the area in which any anticipated Project-related environmental effects, either direct or indirect, can be predicted or measured for assessment (Marathon Gold, 2020, p. 2.1). The LAA is specific to each Valued Component (VC) and was so selected based on the geographic extent of effects on each individual VC. Regional Assessment Area (RAA) is the area which has been established for context with regard to the determination of significant of project-specific effects. Moreover, the RAA encompasses both the Project Area and LAA and serves to inform the assessment of cumulative effects (Marathon Gold, 2020, p. 11.8). The populations of the LAA and RAA according to the 2016 Census of the Population is included below in Table 1.

Table 1. LAA and RAA Populations (Total and Indigenous)

Location	Total Population			Indigenous Population		
	Total	Male	Female	Total	Male	Female
LAA	38,340	18,495	19,845	2,360	1,125	1,235
RAA (NL)	519,720	253,930	265,790	45,730	22,105	23,625

(Statistics Canada, 2016)

The LAA includes adjacent communities to the Project Area, namely: Bishop's Falls, Grand Falls-Windsor, Badger, Buchans, Buchans Junction, and Millertown; all of which fall under the regional jurisdiction of Newfoundland's Central Regional Health Authority (Marathon Gold, 2020, p. 7.67). Existing conditions with respect to community health within the LAA/RAA considered include educational attainment, availability of services, infrastructure and housing, rates of chronic and communicable disease and disability, mental health status, rates of substance abuse, crime and family violence, social connectivity, and community well-being based on community well-being index scores (Marathon Gold, 2020, p. 7.67). Community health characteristics were based largely on data from Newfoundland's Central Health Regional Health Authority (Marathon Gold, 2020, p. 7.67).

Potential environmental effects predicted to impact community health prior to mitigation measures include:

- "Changes in community well-being due to Project-related changes in population, employment and income, and
- Changes in physical health conditions due to Project-related discharges and emissions, directly exposing humans to contaminants, or changing access to country foods," (Marathon Gold, 2020, p. 7.68).

Changes in community well-being within the LAA/RAA may be affected by Project-related employment, income, and population changes (Marathon Gold, 2020, p. 7.68). Project-related employment and income can affect levels of disposable income and labour force activity, potentially resulting in adverse effects (Marathon Gold, 2020, p. 7.68). These can also stimulate changes in population caused by the presence of a temporary non-local labour force in LAA/RAA communities (Marathon Gold, 2020, p. 7.68). This population growth may change the demographics and social structure of nearby communities, and out-of-region workers could disrupt normal, daily living activities of local people and place additional demands on local services (Marathon Gold, 2020, p. 7.68). Furthermore, this increase in the population of LAA/RAA communities related to Project employment will inevitably increase demands on community services and infrastructure. However, "given the planned use of a Project accommodations camp, Project-related effects are predicted to be negligible," (Marathon Gold, 2020, p. 7.68). Section 2.4.11 describes the Project Accommodations Camp as "a permanent 300-person accommodations camp with associated services and will provide accommodation for construction and later for operating and maintenance staff," (Marathon Gold, 2020, p. 2.17). The use of this accommodations came is among the mitigation measures proposed for the project.

In terms of the significance of residual effects, it is "estimated that the Project will employ more non-Indigenous people than Indigenous people and more men than women given that Indigenous people and women are historically underrepresented in the fields of trades and construction," (Marathon Gold, 2020, p. 7.70). To address issues of diversity and inclusion, the Proponent has promised to implement mitigation and management measures (outlined in Table 7.11), including a "Gender Equity and Diversity Plan" and a business access strategy for members of underrepresented populations. Key mitigation measures outlined for community health impacts include workforce education, a Gender Equity and Diversity Plan, and communication of employment information to local communities and Indigenous groups (Marathon Gold, 2020, p. 7.69). The workforce education will focus on topics such as healthy lifestyle choices, anti-harassment training, cultural awareness training, and Marathon's health and safety policies (Marathon Gold, 2020, p. 7.69). Cumulative effects on community health are briefly outlined in Section 11.3.10, specifically as they relate to the nearby Buchans Resources Limited Project. The anticipated biophysical effects of these projects could lead to adverse effects on food security and additional demands on local health services and infrastructure (Marathon Gold, 2020, p. 11.8). Each of these factors could contribute to cumulative effects on community health. However, Marathon Gold anticipates these effects to be minimal with their proposed mitigation measures alongside the mitigation efforts of the Buchans Project.

4.3.2 Evaluation

Similar in scale and scope to the Valentine Gold Mine Project is the Beaver Dam Gold Project. Initiated by Proponent Atlantic Gold, the Beaver Dam Mine is located in Marinette, Nova Scotia and currently In Progress under CEAA 2012 (IAAC, 2020). Given the similarities between these two projects, Valentine Gold's EIS will be evaluated against Beaver Dam Mine's EIS. This evaluation will be informed by current literature and study on the topic of IA best practice, focused primarily on cumulative health impact assessment and GBA+.

Compared to the level of consideration of cumulative health impacts in the Beaver Dam Mine Project, Valentine Gold's IS only includes a single paragraph, most of which seems to transfer responsibility of mitigation measures to other projects (i.e., Buchans Resource Limited Project). As observed by Parkes and Buse (2017) in a pilot of integrative health impact assessment in British Columbia, resource development influences human health and wellness through multiple pathways, including biophysical exposures, changing sociocultural and economic conditions and impacts to social and health service delivery, all of which create unique public health challenges for resource-dependent communities, (Parkes & Buse, 2017). Furthermore, this study concludes that assessment of Project-related cumulative health impacts provides decision-makers with several opportunities to both quality and quantify community health risks over time (Parkes & Buse, 2020). This could lay the foundation for more robust consideration of cumulative health effects related to the Project.

McCallum et al. (2015) examine the practice of Health Impact Assessment (HIA) and what obstacles and opportunities for its implementation exist in Canada. The United States National Research Council defined HIA as "a systematic process that uses an array of data sources and analytic methods and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program or project on the health of a population and the distribution of those effects within a population," (McCallum et al., 2015). Furthermore, HIAs provide recommendations on monitoring and managing those effects (McCallum et al., 2015). Though this study concludes that HIA has only successfully been conducted in Canada in large-scale infrastructure or natural resource projects, it is believed that it could be an effective tool in evaluating health impacts of smaller-scale projects (McCallum et al., 2015). Incorporating an HIA approach to the Valentine Gold Project could help to further strengthen the consideration of project-related cumulative effects in Marathon's Gold Revised EIS.

While there is mention of a "Gender Equity and Diversity Plan" which will focus on topics such as healthy lifestyle choices, anti-harassment training, cultural awareness training, the Proponent fails to elaborate on how exactly this Plan will employ GBA+ approaches to the Valentine Gold Project. Gender-based Analysis Plus (GBA+) is defined as an "an analytical process used to assess how diverse groups of women, men, and gender-diverse people may experience policies, programs and initiatives," (Government of Canada, 2020). Hoogeveen et al. 2020 observe that attention to GBA+ in association with resource development is needed. Furthermore, from a systematic review of grey and academic literature their research study concluded that there is a failure in both the literature and in practice to attend to gender-based violence within impact assessment (Hoogeveen et al., 2020). This lack of GBA+ consideration can prove particularly problematic within the context of accommodation camps like the one proposed for the Project. Several reports from CBC (Tremonti, 2016), MacLean's (Edwards, 2019), Al Jazeera (Morin,

2020) and other news outlets explain the reputation often associated with similar so-called "man camps" at other resource-development projects, such as Fort MacMurray in Alberta and Fort St. John in British Columbia. Numerous accounts of sexual harassment and assault have been brought forward against the workers living in these camps, spanning back to the 1960s (Edwards, 2019). Though these cases do not represent the whole of resource-development workers, it is still important context to note, and a consideration which must be included so as to ensure there are zero-tolerance policies against harassment and assault in place for resource-development projects like Valentine Gold.

To put the key takeaways from the abovementioned literature into perspective using a tangible example, the Beaver Dam Mine Project's consideration of cumulative health effects is much more extensive than Valentine Gold's as outlined in their respective Impact Statements. Overall, Atlantic Gold's consideration of cumulative effects with respect to community health in the Beaver Dam Mine Project IA documentation is much better than the consideration of this VC in the Valentine Gold Project. Moreover, there is a lack of detail pertaining to the methodology uses to inform the effects to community health. This calls into question Section 4.3 of the Guidelines for the Preparation of an Environmental Impact Statement pursuant to the *Canadian Environmental Assessment Act,* 2012, which prescribes: "For each VC, the EIS will describe the methodology used to assess project-related effects… All data, models and studies will be documented such that the analyses are transparent and reproducible. The uncertainty, reliability, sensitivity and conservativeness of models used to reach conclusions must be indicated," (IAA, 2019). The description of the methodology as it relates to community health effects lacks detail throughout the documentation.

To conclude the evaluation, consideration of cumulative health impacts on the LAA/RAA communities related to the Valentine Gold Project as outlined in the EIS is inadequate. Furthermore, the description of the "Gender Equity and Diversity Plan" is vague and lacks detail with regard to how exactly this mitigation consideration will be measure and monitored (e.g., how often will training be held, will it be mandatory, and what might disciplinary actions for project employees who engage in harassment and/or misconduct look like?). Methodology pertaining to data collection, research protocols and scientific modelling with regard to health impacts is also lacking in the IS.

4.3.3 Recommendations

Key recommendations based on the above evaluation of Valentine Gold's IS include:

1. Provide more detail with regard to cumulative effects on community health. Specifically address mitigation measures to explain in further detail how exactly these measures will alleviate the adverse impacts related to project-related discharges and emissions, directly exposing humans to contaminants, or food security.
2. Implement a Gender-based Analysis Plus (GBA+) framework inclusive of thorough training for all employees and affiliates of the Project on an ongoing basis.
3. Provide more detailed descriptions of methodology for the VC of community health including all data, models and studies "such that the analyses are transparent and reproducible," (IAAC, 2019).

4.4 Considerations for surface water quality

4.4.1 Background

The proposed Valentine Gold Project mine development site is located within hilly elevations, ranging from 273-437 m above sea level within local watersheds (Marathon Gold, 2020, p. 7.23). A ridge that runs through The Project Area allows for drainage to the Victoria River and Victoria Lake Reservoir to the south and east, as well as drainage to Valentine Lake to the north and west (Marathon Gold, 2020, p. 7.23). Noteworthy constructs of The Project site include the two open pit mines (The Leprechaun and the Marathon deposits), two waste rock piles, areas for ore crushing and stockpiling, milling and processing facilities, a large tailings management facility (TMF), as well as water and effluent management facilities (Marathon Gold, 2020, p. E.1).

During the first three years of mine operation, the ore is to be processed through gravity and cyanidation for gold recovery, with the addition of a floatation process added in year four (Marathon Gold, 2020, p. 2.11). Tailings will be treated for cyanide before release into the TMF (Marathon Gold, 2020, p. 2.11). After Year 9, open pit mining is expected to cease, leaving an additional three years for the remaining stockpile of ore to be processed and for all tailings to be pumped from the TMF into the Leprechaun open pit (Marathon Gold, 2020, p. 2.57). Upon full closure of mining operations, at an estimated 12 years, sedimentation ponds will be breached once determined to meet water quality standards (Marathon Gold, 2020, p. 2.14). Open pits are to be permitted to naturally flood through precipitation, groundwater infiltration, and surface water runoff, with additional assistance provided by direction of site contact water to the open pits (Marathon Gold, 2020, p.2.14). The pits are expected to flood within eight years, with post-closure monitoring expected to continue until The Project Area is considered stable, in which 6-10 years is anticipated (Marathon Gold, 2020, p. 7.6).

Waste rock piles as well as low- and high-grade ore stockpiles are to be specifically placed in The Project Area in order to reduce potential surface water effects (Marathon Gold, 2020, p. 2.38). Acid rock drainage testing through humidity cells has determined the expected level of potentially acid generating (PAG) material and elements at moderate risk for leaching for each pile type required in The Project Area (Table 2). Discharge limits outlined by the Metal and Diamond Mining Effluent Regulations (MDMER) as well as Canadian Water Quality Guidelines (CWQG) for protection of Freshwater Aquatic Life in waste rock leachates is to be compared to pile testing (Marathon Gold, 2020, p.2.38). It is noted that to date, no pile testing has exceeded MDMER limits (Marathon Gold, 2020, p.2.38).

Table 2. Level of PAG material and elements of moderate leaching potential for waste rock, low grade ore, and high-grade ore piles (Marathon Gold, 2020, p. 2.38-2.39).

Pile Type	Level of PAG Materials	Elements of Moderate Leaching Potential
Waste Rock	Low	Al, P, Cu, Hg, Se, & Zn
Low-Grade Ore	Moderate	Al, P, Zn
High-Grade Ore	High	Al

Surface water conditions of The Project Area outlined in the IS were measured through field studies and desktop models. The field study utilized 26 local water quality sampling stations, and regional water quality data obtained from 4 managed locations (Marathon Gold, 2020, p. 94). An

additional 12 local hydrometric monitoring stations are included in the IS to provide flow data (Marathon Gold, 2020, p.93). The CWQG and the MDMER are to be considered when comparing baseline local and regional water quality data (Marathon Gold, 2020, p.93). Water quality within The Project Area was determined to display low acid buffering potential and contains naturally elevated levels of aluminum, cadmium, copper, iron, and lead, that typically occur below CWQG limits, but exceeded the standard at least once through testing (Marathon Gold, 2020, p. 94).

Climate is identified in the IS as an important factor in the consideration of the hydrological profile and water quality conditions of The Project Area, as quantity and timing of runoff, stream flow, and tailings pond storage levels are directly affected by climatic conditions (Marathon Gold, 2020, p. 7.18). The Project's regional climate is generally defined as cloudy with strong winds and heavy snow (Marathon Gold, 2020, p. 7.18). Climate statistics from 1937-2011 from the Buchans Climate Station, located northeast of The Project site, are utilized in the IS as the basis for predicting average temperature and precipitation events (Marathon Gold, 2020, p. 7.17). The driest year on record in the region measured 683 mm of precipitation in 1950, with the wettest year measuring 1,563 mm in 2000 (Marathon Gold, 2020, p. 93). The average annual snowfall in The Project Area was found to be 359.3cm (Marathon Gold, 2020, p. 7.19).

4.4.2 Evaluation

It should be noted that the Marathon Gold's IS has determined that The Valentine Gold Project represents "no significant effects on Victoria Lake Reservoir or Victoria Dam resulting from routine Project activities... Due to Marathon's re-location of the TMF downstream of the Victoria Dam, a worst-case TMF dam breach is also not expected to impact the Victoria Dam" (Marathon Gold, 2020, p. E.6). While it is certainly a positive step that the proponent has listened and acted on to the concerns raised about the proximity of the TMF to the Victoria Lake Reservoir, it disregards the inherent potential for surface water contamination through the many other avenues associated with gold mining operations and their receiving water bodies.

Similarly, the IS states that it found "no significant residual effects on groundwater or surface water resources resulting from routine Project activities" (Marathon Gold, 2020, p. E.5). Surface water quality is of significant concern in any open pit gold mine due to the increased likelihood of exposure to contaminants, particularly when the use of cyanide is involved in gold extraction processes within a Project Area in close proximity to multiple water bodies. Cyanide extraction requires millions of litres of alkaline water mixed with sodium cyanide, free cyanide, and complexes of metal-cyanide (Eisler & Wiemeyer, 2004). Cyanide tailings produced in The Project Area are to be treated and diluted before release into the TMF, as cyanide is considered extremely toxic to fish and bird species (Eisler & Wiemeyer, 2004). Cyanide spills have been responsible for mass kill events of fish and other aquatic species and it bares consideration that the long-term effects on aquatic ecosystems from prolonged low level cyanide exposure from mining effluent discharges is not well understood or researched (Eisler & Wiemeyer, 2004).

The nature of the gold mineralisation is characterized in the IS by quartz-tourmaline-pyrite (QTP) veining, hosted within porphyritic trondjemite and quartz sub-units of the Valentine Lake Intrusive Suite (Marathon Gold, 2020, p. 2.21). Sulphides such as chalcopyrite, pyrrhotite, sphalerite, and galena were also reportedly observed, but were considered comparatively minor forms of contamination (Marathon Gold, 2020, p.2.21). Waste rock piles are typically identified

as areas of concern in regard to gold mining projects as acid and heavy metal leaching can pose serious negative effects on surface water quality. Surface and groundwater can become contaminated when precipitation infiltrates the rock piles and dissolves secondary minerals from newly exposed rock surfaces (Liu et al., 2019). The waste rock piles have been determined to contain low percentages of PAG material within The Project site, but remain a focus in the IS, with suggested ongoing testing to ensure initial findings as the proponent wishes to use the waste rock piles for water diversion and damming.

The LGO and HGO stockpiles present the most significant risk to water quality in The Project Area. Two LGO stockpiles and one HGO stockpile are proposed and contain medium and high percentages of PAG material, respectively. Acid mine drainage is considered the current most significant environmental concern in Canadian mining operations (Ontario Nature, 2017). The IS seems to dismiss this risk, by stating that the stockpiles are to be processed before they reach the calculated six year minimum for acid generation, however, the potential for metals such as Al, P, and Zn have been identified as at moderate risk of leaching (Marathon Gold, 2020, p.2.38). It should also be noted that applying laboratory results to an operational scale can be complicated, as variables such as particle size and environmental conditions can affect drainage properties over long periods of time (Maest et al., 2005). The potential for leaching and runoff of acids, metals, and toxic chemicals, into the Victoria River, Victoria Lake Reservoir, and Valentine Lake is underappreciated in the IS. In fact, the IS states that barring a full TMF dam breach, The Project is expected to have no significant residual implications for surface and groundwater resources (Marathon Gold, 2020, p. E.5).

HGO stockpiles, which are classified as containing high PAG materials, are expected to drain to the TMF by gravity (Marathon Gold, 2020, p. 2.40). Runoff from the waste rock piles and the TMF is to be collected through seepage ditches and/or sedimentation ponds and either discharged or redirected to the TMF. Sedimentation ponds and other disturbed areas will be graded to recreate drainage patterns in The Project Area (Marathon Gold, 2020, p. 7.82). Final discharge points are to be reduced through careful grading and construction of diversion channels. (Marathon Gold, 2020, p. 7.82). There remains a distinct lack of clarity regarding how the cycling of contaminants in The Project Area are going to be monitored and managed in a manner that will not pose a risk to downstream ecosystems. The descriptions of safe drainage systems within The Project Area reads more like a landscaping and excavation terminology exercise rather than a clearly outlined plan.

Based on the potential environmental impacts and risk to population, the proposed TMF dams of The Project are classified as having “very high” failure consequences in the IS (Marathon Gold, 2020, p. 2.57). The proposed TMF is expected to hold 9 years of tailings, estimated to total 30 Mt. (Marathon Gold, 2020, p. 2.57). Piping issues have been identified as the most likely cause of TMF failure under fair weather conditions, as tailings and effluents are in constant transport throughout The Project Area (Golder Associates Ltd., 2020, p. 26). The TMF is described as having been designed and positioned to best protect surface and groundwater resources during and after mining has ceased (Marathon Gold 2020, p. 2.58). Vibrations created from the drilling and blasting techniques essential to the effective mining of the pits is identified as a risk to the structural integrity of the tailings dam, and thus to surface water quality (Golder Associates Ltd.,

2020, p. 4). The combined effects of these two risk factors are not adequately addressed, nor is the effect that the relocated TMF could have on the likelihood of a TMF dam failure.

Water quality within The Project Area was determined to display low acid buffering potential and contains naturally elevated levels of aluminum, cadmium, copper, iron, and lead (Stantec Consulting Ltd., 2020, p. 94). The frequency of sampling in monitoring baseline water quality was unclear in the IS, as were the plans for future water quality monitoring during and after The Project site operations. The IS attributes mine site closure time variations as the cause for difficulties in estimating and planning for the monitoring phase post closure, and simply states that it will be addressed in future formal rehabilitation and closure plans (Marathon Gold, 2020, p. 7.7). The language used to describe the water quality monitoring within The Project site is extremely vague regarding what is arguably the most important element in ensuring water quality standards are met. Significant delays can be experienced between the cause of water quality issues and the experienced effect, therefore, the ability to acknowledge small changes is key to water quality maintenance (Mudd, 2008). Robust baseline data and ongoing monitoring must therefore be a priority.

4.4.3 Recommendations

Recommendations related to the significant elements outlined in the above critique on Marathon Gold's Valentine Gold Project's IS include:

1. The creation of a comprehensive grading plan for The Project Area, designed to contain, monitor and treat water that has contacted tailings, waste rock piles, and low- and high-grade ore stockpiles, and prevent it from entering proximal water bodies.
2. The development of clearly defined baseline water quality studies, in which the specific dates of sampling are made clearly available and for which the rationale of the chosen monitoring timeline is outlined.
3. The formation of a thoughtful and detailed future water quality monitoring plan for after mining operations have ceased to ensure the future integrity of local surface water.

4.5 Consideration of caribou populations

4.5.1 Background

The proposed Valentine Gold Project has potential implications for several caribou *(Rangifer tarandus)* herds in the RAA that are listed as a 'Special Concern' by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Marathon, 2020, p. 7.47). Newfoundland is the only region in Canada that still lists caribou as a 'Special Concern' species, while the rest of the country considers their populations to be 'Threatened' (COSEWIC, 2017). Caribou prefer mostly barren land in the summer, and mixed forests during the winter months. Their main food source consists of lichens, otherwise known as 'caribou moss', and other vegetation such as grasses, sedges, and leaves, and they can reach a weight between 300 and 400 lbs (Government of Newfoundland, 2020).

Caribou populations, having reached a peak in the late 1990s at around 95,000 caribou, have steadily declined in Newfoundland beginning in the early 2000s and only about one third of those remain at less than 30,000 individuals total in 2012 (Schaefer et al., 2015; Randell, 2019). The most significant cause of reduced caribou numbers are low rates of calf survival, attributed

to increased predation, reduced food availability (Lewis & Mahoney, 2014), and habitat alterations from industrial development (Festa-Bianchet et al., 2011).

Valentine Gold's EIS has focused on the four herds of caribou in the region that are most likely to be affected by the Project. These herds include the Buchans herd, the Great River herd, the La Poile herd, and the Gaff Topsails herd (Table 3) (Randell, 2019).

Table 3. Range (Marathon Gold, 2020, p. 7.48) and population (Randall, 2019) characteristics of caribou that were considered in the Valentine Gold IS.

Herd	Range (km^2)	Population
Buchans	15 560	4 112
Grey River	15 500	2 022
La Poile	11 200	3 154
Gaff Topsails	5 685	1 824

According to the IS, the Project area has little overlap with the range of these herd populations. The Grey River herd's range overlaps with the project area during winter calving and spring migration, but this overlap only represents approximately 2% of the herd's seasonal ranges (Marathon Gold, 2020, p. 7.53). The Buchans herd is only expected to have a range overlap of 1% with the project area, but this overlap represents a critical migratory corridor, raising the concerns of this herd over the other three (Marathon Gold, 2020, p. 7.53). The La Poile herd is expected to have no range overlap with the project area and the Gaff Topsails herd will have a small overlap in the winter with existing access roads (Marathon, 2020, p. 7.53).

The main concerns regarding caribou in reference to the development Project are the impacts associated with a change in caribou habitat, a change in their migratory patterns, and a change in their mortality risk (Marathon Gold, 2020, p. 7.53). The ultimate reason for caribou population decline in Newfoundland is due to habitat alterations as a result of industrial activities. These activities clear vegetation and reduce food availability, leading to increased predation in the immediate area (Festa-Bianchet et al., 2011). Caribou migration in the region remains fairly consistent and disrupting the migration corridor of the Buchan herd has uncertain long-term effects on the population (Schaefer, & Mahoney, 2013).

4.5.2 Evaluation

Woodland caribou, especially on Newfoundland, are a fairly unique population so it becomes difficult to compare the quality of the Valentine Gold IS to other projects (Marathon Gold, 2020, p. 7.47). The Beaver Dam Mine Project is a similar development currently proposed in Nova Scotia and is undergoing an environmental assessment by the IAAC under CEAA 2012. However, caribou are considered 'Extirpated' in Nova Scotia, making it irrelevant to compare the ISs of the two projects (Government of Canada, 2018).

The Cape Ray Gold Project is a proposed mine development located on the southwest coast of Newfoundland near Channel-Port Aux Basques. This project is located approximately 300km southwest of Valentine Gold's project and is also undergoing an environmental assessment under CEAA 2012 (NRIEL, 2016). Cape Ray is the most similar project to Valentine Gold's in terms of location (Newfoundland), as well as the project type, making it the most suitable project for

comparison. However, the proponent for the Cape Ray Gold Project has yet to release their IS, once again making it difficult to compare the effects on caribou populations between projects. This leaves the IS Guidelines as the only document to compare the two projects.

According to the IS Guidelines of the projects, Valentine Gold specifically included caribou under 'Section 7.3: Predicted effects on valued components' (IAA, 2019). This section explains what will be required of the IS, including the direct or indirect effects to caribou populations, the effects on caribou migration caused by disruption of migratory routes, and the indirect effects on migration caused by sensory disturbances such as noise and light (Shannon et. al., 2016), and the presence of mining workers (IAA, 2019). The Cape Ray Gold Project does not explicitly reference the effects on caribou. Instead, it references species that are designated as of 'Special Concern' by COSEWIC in 'Section 6.3.3: Species at risk', and caribou just happen to fall into that category (IAA, 2017). Another challenge of comparing the effects on caribou in EI Statements is the fact that these projects may affect different herds in different ways, based on their migratory patterns. Based on the herd's location, La Poile is the most likely to be affected by the development of the Cape Ray Gold Project, while that same herd will likely not be affected by Valentine Gold's project due to the low to negligible overlap of their range and the project area. First Nations groups such as the Miawpukek Mi'kamawey Mawi'omi in Conne River have been monitoring caribou populations for years (Randell, 2019) and can provide valuable information on their movement patterns.

The IS for the Valentine Gold project has done well in terms of following the IS Guidelines and providing valuable information about the effects the project will have on caribou. They have given a series of mitigation measures that address the activities associated with the construction, operation, and the decommissioning of the project (Marathon Gold, 2020, p. 7.51 - 7.53). Since Cape Ray Gold has yet to be reviewed, Valentine Gold's IS is the most comprehensive evaluation of the effects on caribou in terms of changes in habitat, migration, and mortality risk.

4.5.3 Recommendations

Key recommendations based on the above evaluation of Valentine Gold's IS include:

1. Committing to combat the proposed habitat loss associated with the development area by replanting caribou friendly food and vegetation around the edge of the project area such as lichens ("caribou moss"), grasses, sedges, and birch trees.
2. Mandatory consulting with First Nations groups such as the Miawpukek Mi'kamawey Mawi'omi in Conne River can provide the Proponent with knowledge regarding their migratory patterns or other valuable insights.

4.6 Author information

Maddie Clarke is a current Master of Resource and Environmental Management (MREM) student at Dalhousie University. She previously completed a MSc in Applied Science at Saint Mary's University in Spring 2020 where she defended her thesis "*Trail degradation in the Cape Breton Highlands National Park: an ecological approach to vegetation restoration*". Maddie led a successful site assessment and implemented a long-term restoration project. She also gained extensive knowledge of boreal and alpine flora and skills in plant identification and vegetation sampling having spent four summers of ecology fieldwork. Her current interests lie with impact assessment and geospatial analysis where she hopes to merge this with her fieldwork experiences and make positive contributions in the government sector or in the consulting field.

Laura Carter is a current MREM student at Dalhousie University and holds a bachelor's degree in Geology from Saint Mary's University, with a research focus on quartz vein hosted fluid inclusions and alteration petrography for mineral exploration applications. Laura gained valuable experience in field research and sample collection, as well as preparing and presenting preliminary reports during her work term position as a core technician in Northern BC. She has a strong interest in environmental monitoring, remediation, and impact assessment, as well as land and water conservation. Laura is eager to combine her scientific and environmental background with her passion for collaborative field work and assessment in a career in environmental consulting

Kelsea Deblois is a current MREM student at Dalhousie University and holds a bachelor's degree in Environmental Sustainability & International Development Studies also from Dalhousie. Kelsea's interest in community-based development and food security led to her pursuit of an international internship wherein she worked with a team to successfully plan and develop a community-shared agricultural site in Uganda. Her current interests lie with impact assessment and climate change mitigation at the local level. Kelsea aspires to a career in environmental policy at the municipal or provincial level in Nova Scotia.

Destin Gardner is a current MREM student at Dalhousie University, having completed a Bachelor of Environmental Science at the University of Windsor last year. Destin gained valuable field experience in his undergrad as a part of a small team who established the basis for a new coastal erosion and monitoring program in southern Ontario for the Essex Region Conservation Authority and the Great Lakes Institute for Environmental Research. Destin's passion for the environment led him to a tree-planting job in northern British Columbia this past summer which provided him with practical experiences and knowledge about sustainable forest management. He has a keen interest in the environmental impact assessment process, with a focus on environmental monitoring and compliance.

4.7 References

Aavik, T., Edwards, P. J., Holderegger, R., Graf, R., & Billeter, R. (2012). Genetic consequences of using seed mixtures in restoration: A case study of a wetland plant Lychnis flos-cuculi. *Biological Conservation*, *145*, 195–204. https://doi.org/10.1016/j.biocon.2011.11.004

Berg, L., Vergeer, P., & Roelofs, J. (2003). Heathland restoration in the Netherlands: effects of turf cutting depth on germination of Arnia montana. *Applied Vegetation Science*, *6*(2), 117–124.

Committee on the Status of Endangered Wildlife in Canada [COSEWIC]. (2017). *Canadian Wildlife Species at Risk 2017.* Species at Risk Registry. https://www.sararegistry.gc.ca/default.asp?lang=En&n=16B141D8-1&printfullpage=true

Ebersole, J. J., Bay, R. F., & Conlin, D. B. (2004). Alpine vegetation restoration of social trails on Colorado's 14,000-foot peaks. *Proceedings of 16th International Conference, Society for Ecological Restoration*, 101–122.

Edwards, K. (2019, May 13). 'How we treat women' Worker camps make it possible to build infrastructure in remote locations in Canada. Is it worth the human cost? *MacLean's*. https://www.macleans.ca/how-we-treat-women/

Eisler, R., & Wiemeyer, S. N. (2004). Cyanide hazards to plants and animals from gold mining and related water issues. *Reviews of Environmental Contaminants and Toxicology, 183*(21), 21-54. https://doi.org/10.1007/978-1-4419-9100-3_2

Festa-Bianchet, M., Ray, J.C., Boutin. S., Côté, S.D., and Gunn, A. (2011). Conservation of caribou (Rangifer tarandus) in Canada: an uncertain future. *Canadian Journal of Zoology. 89*(5), 419-434. https://doi-org.ezproxy.library.dal.ca/10.1139/z11-025

Foody, G. M. (2002). Status of land cover classification accuracy assessment. *Remote Sensing of the Environment. 80*, 185-201.

Government of Canada (2018). *The Woodland Caribou*. https://www.pc.gc.ca/en/pn-np/ns/cbreton/decouvrir-discover/faune-animals/mammiferes-mammals/caribou

Government of Canada. (2020, October 28). *What is GBA+*. https://cfc-swc.gc.ca/gba-acs/index-en.html

Government of Newfoundland (2020, February 10). *Woodland Caribou.* https://www.gov.nl.ca/ffa/wildlife/snp/programs/education/animal-facts/mammals/caribou/

Golder Associates Ltd. (2020, September 18). Marathon Gold Corporation Valentine Gold Project Blast Impact Assessment. In *Valentine Gold Project Baseline Study Appendix 1: Dam Safety.* Marathon Gold. https://www.gov.nl.ca/eccm/files/env-assessment-projects-y2019-2015-rpt_BSA_1_DamSafety.pdf

Hoogeveen, D., Gislason, M., Hussey, A., Western, S., & Williams, A. (2020, April). *Gender Based Analysis Plus: A knowledge synthesis for the implementation and development of socially responsible impact assessment in Canada*. Environment Community Health Observatory Network. https://static1.squarespace.com/static/5c2e40cf5417fc1b3d2e7930/t/5f121b33c8d15d63036085fc/1595022137512/Hoogeveen+%26+Gislason+GBA%2B+IA+KS+April+2020.pdf

Impact Assessment Agency. [IAA]. (2017, April). *Guidelines for the Preparation of an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012 - Cape Ray Gold Project - Matador Mining Ltd.* Impact Assessment Agency of Canada: https://iaac-aeic.gc.ca/050/documents/p80136/118813E.pdf

Impact Assessment Agency. [IAA]. (2019, July). *Guidelines for the Preparation of an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012 —Valentine Gold Project — Marathon Gold Corporation*. Impact Assessment Agency of Canada: https://iaac-aeic.gc.ca/050/evaluations/document/132674#_Toc14261066

Impact Assessment Agency of Canada. [IAAC]. (2020). *Beaver Dam Mine Project*. Impact Assessment Agency of Canada: https://iaac-aeic.gc.ca/050/evaluations/proj/80111

Jansen, A. J. M., Fresco, L. F. M., Grootjans, A. P., & Jalink, M. H. (2004). Effects of restoration measures on plant communities of wet barren ecosystems. *Applied Vegetation Science*, *7*(2), 243–252. https://doi.org/10.1111/j.1654-109X.2004.tb00616.x

Joseph, C., Zeeg, T., Angus, D., Usborne, A., & Mutrie, E. (2017). Use of significance thresholds to integrate cumulative effects into project-level socio-economic impact assessment in Canada. *Environmental Impact Assessment Review, 67*, 1-9. https://doi.org/10.1016/j.eiar.2017.07.003

Lewis, K. P. & Mahoney, S. P. (2014, February). *Caribou survival, fate, and cause of mortality in Newfoundland: a summary and analysis of the patterns and causes of caribou survival and mortality in Newfoundland during a period of rapid population decline (2003-2012).* https://www.gov.nl.ca/ffa/files/wildlife-pdf-tech-bulletin-009.pdf

Liu, Z.S., Huang, C., Ma, L., Dy, E., Xie, Z., Tufa, K., Fisher, E.A., Zhou, J., Morin, K., Aziz, M., Meints, C., O'Kane, M., & Tallon, L. (2019). The characteristic properties of waste rock piles in terms of metal leaching. *Journal of Contaminant Hydrology, 226,* 103540. https://doi.org/10.1016/j.jconhyd.2019.103540

Maest, A.S., Kuipers, J.R., Travers, C.L., & Atkins, D.A. (2005). *Predicting water quality at hardrock mines: methods and models, uncertainties, and state-of-the-art.* EARTHWORKS.https://www.waterboards.ca.gov/academy/courses/acid/supporting_material/predictwaterqualityhardrockmines.pdf

Marathon Gold. (2020, September 29). *Valentine Gold Project Environmental Impact Statement*. https://iaac-aeic.gc.ca/050/evaluations/document/136521

Matesanz, S., & Valladares, F. (2007). Improving revegetation of gypsum slopes is not a simple matter of adding native species: Insights from a multispecies experiment. *Ecological Engineering*, *30*(1), 67–77. https://doi.org/10.1016/j.ecoleng.2007.01.005 20

McCallum, L., Ollson, C., & Stefanovic, I. (2015). Advancing the practice of health impact assessment in Canada: Obstacles and opportunities. *Environmental Impact Assessment Review*, 98-109. https://doi.org/10.1016/j.eiar.2015.07.007

Morin, B. (2020, May 5). Pipelines, man camps and murdered Indigenous women in Canada. *Al Jazeera.* https://www.aljazeera.com/features/2020/5/5/pipelines-man-camps-and-murdered-indigenous-women-in-canada

Mudd, G.M. (2008). Sustainability reporting and water resources: a preliminary assessment of embodied water and sustainable mining. *Mine Water Environ, 27,* 136-144. http://doi.org/10.1007/s10230-008-0037-5

Nordmin Resource and Industrial Engineering Ltd. [NRIEL] (2016, December). *Cape Ray Gold Project Description*. https://iaac-aeic.gc.ca/050/documents/p80136/116688E.pdf

Olofsson, P., Foody, G. M., Herold, M., Stehman, S. V., Woodcock, C. E., & Wulder, M. A. (2014). Good practices for estimating area and assessing accuracy of land change. *Remote Sensing of Environment, 148*, 42-57. http://dx.doi.org/10.1016/j.rse.2014.02.015

Ontario Nature. (2017). *Mining in Ontario: a deeper look.* https://ontarionature.org/wp-content/uploads/2017/10/mining-in-ontario-web.pdf

Parkes, M., & Buse, C. (2017). A pilot of integrative (cumulative) health impact assessment in Northern British Columbia, Canada. *European Journal of Public Health*, *27*(supplement 3). https://doi.org/10.1093/eurpub/ckx187.367

Randell, A. (2019, February 14). Newfoudland Caribou population decline not alarming, provincial biologist. *The Telegram.* https://www.thetelegram.com/news/local/newfoundland-caribou-population-decline-not-alarming-provincial-biologist-284405/

Rydgren, K., Hagen, D., Rosef, L., Pedersen, B., & Aradottir, A. L. (2017). Designing seed mixtures for restoration on alpine soils: who should your neighbours be? *Applied Vegetation Science*, *20*(3), 317–326. https://doi.org/10.1111/avsc.12308

Sawtschuk, J., Bioret, F., & Gallet, S. (2010). Spontaneous Succession as a Restoration Tool for Maritime Cliff-top Vegetation in Brittany, France. *Restoration Ecology*, *18*(supplement 2), 273–283. https://doi.org/10.1111/j.1526-100X.2010.00653.x

Schaefer, J.A. & Mahoney, S.P. (2013). Spatial dynamics of the rise and fall of caribou (Rangifer tarandus) in Newfoundland. Canadian *Journal of Zoology. 91*(11): 767-774. https://doi.org/10.1139/cjz-2013-0132

Schaefer, J. A., Mahoney, S. P., Weir, J. N., Luther, J. G., & Soulliere, C. E. (2015). Decades of habitat use reveal food limitation of Newfoundland caribou. *Journal of Mammalogy, 97*(2), 386-393. https://doi.org/10.1093/jmammal/gyv184

Shannon, G., McKenna, M. F., Angeloni, L. M., Crooks, K. R., Fristrup, K. M., Brown, E., K. Warner, K. A., Nelson, M. D., White, C., Briggs, J., McFarland, S. & Wittemyer, G., (2016). A synthesis of two decades of research documenting the effects of noise on wildlife. *Biological Reviews, 91*(4): 982–1005. https://doi.org/10.1111/brv.12207

Stantec Consulting Ltd. (2015, November 23). Ecosystem classification and mapping of the Marathon Gold Corporation Valentine Lake Project, Central Newfoundland. In *Valentine Gold Project Baseline Study Appendix 7: Avifauna, Other Wildlife and Their Habitats.* Marathon Gold. https://iaac-aeic.gc.ca/050/documents/p80169/136535E.pdf

Stantec Consulting Ltd. (2020, August 5). Valentine Gold Project hydrogeology and surface water quality monitoring baseline report. In *Valentine Gold Project Baseline Study Appendix 3: Water Resources*. Marathon Gold. https://www.gov.nl.ca/eccm/files/env-assessment-projects-y2019-2015-rpt_BSA_3_WaterResources.pdf

Tremonti, A. M. (2016, November 3). Indigenous women and girls at risk due to resource development projects, says Fort St. John activist [Audio podcast]. In *The Current with Matt Galloway*. https://www.cbc.ca/listen/live-radio/1-63-the-current/clip/10677033-indigenous-women-and-girls-at-risk-due-to-resource-development-projects-says-fort-st.-john-activist?