Beaver Dam Mine Project
Impact Assessment Agency of Canada
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December 15, 2021

To whom it may concern,

Enclosed past this covering letter is a report for consideration by the Impact Assessment Agency of Canada, the Atlantic Mining NS Corp (AMNS), and federal authorities in your ongoing assessment of the Beaver Dam Mine Project (henceforth 'the 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 and cumulative decades of 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 Beaver Dam Mine EIS and raise concerns with the quality and scope of data collection and the feasibility and adequacy of proposed mitigation measures. We present in this covering letter a summary of our recommendations with a full analytical report to follow.

Summary of recommendations

Air quality

- The baseline levels for CO_2, CO, SO_2, NO_2, NO, NO_x and PM in the Beaver Dam site and the haul road need to be clearly identified. It is recommended that they collect data for a period of at least one year these greenhouse gases to establish a proper baseline so that the impact from the project can be gauged accurately.

- The statement that no additional GHGs emissions will be caused during the processing of the Beaver Dam mine ore at the Touquoy facility should be supported with evidence.

Surface water quantity and quality

- The location of the open pit mine should be changed so that is further away from the Killag River. Underground mining activities and blasting for ore can cause fractures which could cause the river to drain into the mine pit and the cause harm to the ecosystem downstream.

- Evidence is needed to support the statement that the project impact on the Killag River is negligible. The baseline study of the watershed revealed already elevated levels of heavy metals. A thorough study needs to be conducted to properly gauge the impact that effluent discharge will have on the watershed.

Workforce development

- The Proponent should implement social life cycle assessment to determine if occupational stressors from the Project may influence the local community's livelihoods after mine closure.
- Corporate social responsibility needs to be considered by applying global corporate standards to ensure equitable workforce development and sustainable mining operation.
- The EIS lacks discussion of how the LGBTQ2S+ (Lesbian, Gay, Bisexual, Transgender, Queer or Questioning and Two-Spirit) and Indigenous community is represented in, and engaged by, the mining sector. It is recommended that the Proponent apply Gender-Based Analysis plus (GBA+) initiatives to be more inclusive of minorities in the hiring process.

Community health and safety

- AMNS is strongly urged to ensure the Employee Assistance Program is integrated into employee training programs to raise awareness of mental health disorders, reduce substance abuse, and destigmatize mental illnesses in the mining sector.
- We recommend conducting a Health Impact Assessment HIA to address potential impacts on the local and Indigenous communities' physical, mental, and social health.

- Mining operations often involve movement of people and goods; therefore, the Proponent should detail how they will follow provincial health mandates to ensure that mining operations do not contribute to COVID-19 outbreaks.
- Prior to development, further evaluate flood risks and catchment area flow capacities to ensure staging areas are outside of flood prone areas, flood proof electrical distribution components and re-evaluate haul road ditches for adequate run-off capacity.
- Implement seasonal monitoring programmes for groundwater levels which pre-plan for drought scenarios. Engage in surrounding community with planning and results.
- Each year, conduct seasonal education programming and weekly health surveillance monitoring for worker safety during extreme heat and cold conditions.

Species at risk and wildlife

- Efficient reporting of fish habitat alteration or possible leeching of containments into the water bodies must be tested regularly for water quality assessments to ensure toxic levels of minerals are not harming the fish populations.
- Soil tests must be completed during all phases of the mine lifespan to ensure that containments do not leach from soil to the water creating toxic environments for fish.
- Specify the speed limit for vehicles on roadways with potential snapping turtle presence and make sure that all on-site personnel are educated in spotting them on the road. Introduce a combination of speed limit signs and speed bumps to manage speeding, and indicate if the speed limit of these zones will be adjusted at times with limited visibility such as during the night, rain, or fog.
- Implement a thorough risk plan associated with the potential of the workers being bitten while handling a snapping turtle on the road. There should be more emphasis in the appendix on what *not* to do when handling turtles.
- Specifications on buffer zones should be included in the proponent's impact assessment. Road buffers should either consist of 1.5m of extra pavement or a strip of vegetation added on the road shoulders to deter snapping turtles from nesting there. This would reduce the risks of snapping turtle mortalities and nest destruction, while not being environmentally

destructive in its implementation, especially if the proponent opts to use a vegetative road buffer.

- Provide a detailed outline and steps that the on-site workers can follow and learn of what to do if a moose is spotted near or on the road.
- Indicate specifically where the fencing is planned to be implemented and how far it will extend in the Beaver Dam Site. It would be most beneficial to present a map depicting all the proposed areas that plan to have fencing and display the sightings/observations of moose tracks to have an effective layout of the fences.
- Inclusion of customizable Raspberry Pi nesting cameras for additional monitoring during the construction phase (but not exclusively) in areas where ground-nesting species, such as bank swallows and common nighthawks, have established.
- Inclusion of additional spring migration monitoring information concerning the point survey areas and logistics. The 2014 spring migration point count consisted of only 12 points and had a slightly larger number of species in comparison to the 2015 fall migration point count at 32 points.
- For improved scientific transparency, the proponent should include the results of baseline fish habitat studies for all spatial areas where mining activities will occur. Additionally, a more recent baseline fish and fish habitat survey should be conducted within the Touquoy Site since environmental conditions may have changed since original assessment in 2007.
- Conduct field surveys to sample for priority invertebrate species in the project area during the most appropriate times of the year to gauge their presence.
- Increase monitoring and decontamination of equipment for invasive species. Mitigation for invasive species is currently considered; however, the use of decontamination spray(s) on the underside of equipment used near areas with potential exposure opportunities will assist in reducing the risk of introducing invasive species that may outcompete the Species of Conservation Interest (SOCI) and Species at Risk (SAR) populations.

Wetlands and lichens

- Increase the size of wetland vegetation monitoring plots from 5x5m to at least 10x10m and ensure that there are 40 survey plots for accurate vegetation identification and assessment.

- Identify all wetland functions that will be lost due to project activity in the Wetland Compensation Plan and provide the measures that will offset these losses.
- Include in the Wetland Compensation Plan considerations for wetland habitat restoration of all potentially impacted species at risk identified in the EIS.
- Provide a list of wetland restoration monitoring indicators in the Wetland Compensation Plan to help estimate possible monitoring timelines and the required resources to fulfill wetland restoration obligations.
- The setback distance for Blue Felt Lichen occurrences along those portions of the Haul Road should be increased based on the relevant literature.

Terrain, soil and parks

- The proponent should purchase land equivalent to double the area they intend to disturb for the sole purpose of protection under the Wilderness Areas Protection Act or the Special Places Protection Act.
- The Proponent should acquire more data on Parks and Open Spaces, including air quality surveys, wildlife (wildlife species, composition, abundance, and habitats), vegetation (plant species, composition, abundance, and percent cover of each vegetation stratum), and land type inventories representative of each ecosite in each Provincially Designated Area within the Local Assessment Area's (LAA) and assess Park and Open Spaces' vulnerability to direct and indirect impacts based on newly collected data.
- The Proponent should practice more frequent, periodic forest field surveys either annually or biannually to account for forest changes or discrepancies and integrate a combination of independent datasets and geospatial data (e.g., Landsat Forest cover imagery, NSL&F Forest Inventory), novel aerial reconnaissance surveys, and ground-truthing field-based methods for more robust forest assessments.
- More transparency should be incorporated in EIS baseline condition assessments with detailed descriptions of the timeline, methods, and steps used to reach the baseline condition.

Spatial boundaries

- Spatial boundaries for cumulative effects assessment (CEA), by definition, should expand beyond effects of a single action or local area. The proponent should provide defensible scientific rationale for the designated spatial boundaries used in the CEA.

The remainder of the document reports on valued components and procedural aspects the EIS, each analysis, recommendations, and supporting citations. The full document may be cited as:

Westwood, A., Doucet, T., Fequet, L., Ho, I., MacLean, N., MacNeil, B., Nguyen, P., Sharan, R., Thapar, K., Thurston, E., Vail, C. 2021. Submission on concerns and recommendations related to the proposed Beaver Dam Mine project in Marinette, Nova Scotia. Prepared for the Impact Assessment Agency of Canada. 110pp.

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. Ms. Gianina Giacosa Massa supported the preparation and compilation of this report.

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

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Submission on concerns and recommendations related to the proposed Beaver Dam Mine project in Marinette, Nova Scotia

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1. Overview

St Barbara Limited, which has acquired Atlantic Gold Corporation, and now renamed Atlantic Mining NS Corp (AMNS), has proposed the construction of an open pit gold mine called Beaver Dam in Marinette, Nova Scotia. The Project will have a one-year construction phase, followed by a five-year operation phase with an ore production rate of 2.1 million tonnes/year. It will end with a reclamation phase of two-year active closure and 10-year post-closure monitoring phase. This project is related to other gold extraction projects in Nova Scotia currently undergoing an Impact Assessment (IA) by the Impact Assessment Agency of Canada (IAAC), the other two being the Fifteen Mile Stream Gold and the Cochrane Hill Gold project. The ore from the Beaver Dam mine site will be processed at the existing Touquoy gold mine project which is about 31 kilometres (km) away, and the haul road will need new construction and some upgradation of existing road infrastructure to transport the ore.

The Beaver Dam mine project is being reviewed under the Canadian Environmental Assessment Act of 2012 (CEAA, 2012). The third revision of the Environmental Impact Statement (EIS) was submitted in October 2021 to the IAAC, leading to the public comments' invitation on November 16, 2021. We examined this EIS with particular attention to valued components (VCs) for which we deemed there to be insufficient baseline data, an underestimation of impacts, or inadequate proposed mitigation and/or monitoring measures.

2. Air quality

2.1 Background

The GHG emissions VC was chosen for analysis for AMNS due to the adverse impact they have on the health of the biodiversity of an area (Michelle, 2018). GHGs like CO^2 and methane are also the leading cause of global warming which results in climate change (Borowski et al., 2020).

Open pit mines tend to have higher than average intensity of GHG emissions as compared to underground mines (Ulrich et al., 2019). The Beaver Dam Gold mine project will be an open pit mine and GHG emissions will predominantly occur during the operation and closure of the mine, whereas the construction phase of the haul road and the mine is not expected to have as much GHG emissions (Atlantic Gold, 2021, p 6-119). In my view, the GHG emission numbers during the construction phase seem optimistic because there will be a lot of construction activities happening not only at the site, but also a 4 km stretch of new road will be constructed along with upgrade of existing road network which will integrate into the haul road to the Touquoy mine site (Atlantic Gold, 2021, p 6-41).

The assessment identifies the sources, and the estimated GHG emissions, and the contribution of these emissions to the overall GHGs' numbers of the province of Nova Scotia (Atlantic Gold, 2021, p 6-111). There was no separate baseline monitoring done for GHGs apart from the baseline study done for the air quality VC which does not include GHG baselines.

There is a high possibility that the quantity of GHGs projected by the proponent will be overshot. The majority of the GHGs will be emitted from burning fuel for stationery and mobile vehicles, machinery and equipment. The proponent has also considered the GHG emissions which will occur due to the use of emulsion explosives (Atlantic Gold, 2021, p 6-118) as well as diesel fuel which will be used by diesel generators at the site and the haul road trucks.

The Impact Assessment Agency of Canada (IAAC) and Nova Scotia Environment Department are conducting simultaneous environmental assessment of the proposed project (Nova Scotia, 2017). Neither the Environment Act of Nova Scotia of 1994-1995, nor the Sustainable Development Goals Act of Nova Scotia of 2019 mentioned any sort of standards for GHG emissions. The proponent did not carry out a sperate GHG baseline monitoring for GHG emissions apart from the 24-hour done for the air quality VC. Any project that emits more than 50 kilotonnes (kt) of CO^2 equivalent units (CO^2E) in a year are required to submit a report to the National Pollution Release Inventory (NPRI) under the jurisdiction of the Canadian Environmental Protection Act, 1999 (CEPA). Surprisingly, there is no mention of CO^2 emissions reporting in the NPRI despite it being considered the largest contributor to climate change (Science Daily, 2008). The emission thresholds are mentioned for GHGs like CO, SO^2 and NO^2 however, there is no mention of CO^2 emission thresholds (Environment and Climate Change Canada, 2021). The Intergovernmental Panel on Climate Change (IPCC) has carried out studies which prove that technology is available to accurately measure the CO^2 levels in the atmosphere. Direct measurement of CO^2 in the atmosphere has been happening since 1957, so it is a bit surprising that no standards or thresholds have been set by any of the Government Agencies (Pretince, et al., 2001).

The proponent has carried out an effects assessment to determine the significance of GHG emissions released into the atmosphere for each phase of the project. AMNS estimates that it will fall below the threshold of the 50kt CO^2E emissions in a year, but will still report its GHG emissions to the NPRI for the Beaver Dam mine project, just as it does for its Touquoy facility.

AMNS has projected the GHG emissions based on the unverified *"available information"* and has predicted that approximately 2,426.19 tonnes of CO^2E will be expelled during the mine construction phase which includes the haul road in the year 2022, 40,638.55 tonnes during the operations phase from the year 2023 to 2027 and about 9,114.01 tonnes during active closure from the year 2028 to 2029 (Atlantic Gold, 2021, p 6-119). Based on these projections the proponent is of the opinion that there will be no *"significant adverse environmental effect for GHG"* (Atlantic Gold, 2021, p 6-122).

2.2 Evaluation

The proponent has calculated its air quality baseline based on data which was collected over a period of 24 hours (Atlantic Gold, 2021, p 6-39). There is no mention of GHGs in this test and it only depicts the total suspended particulate (TSP) and particulate matter less than 10 micrometres (PM_{10}). Moreover, apart from the 24-hour period study carried out in June 2008, October 2014, September 2016, January 2007 and November 2017, there is no other study done to measure the baseline for air quality or any of the GHGs.

An open pit mine of similar size and lifespan, the Blackwater (BW) Gold mine in British Columbia, was approved under the jurisdiction of the CEAA 2012 in April 2019 (New Gold, 2015). BW Gold project mines gold and silver and its processing unit is located at the mine site which means that there are no additional emissions caused from hauling the ore over a distance to be processed thus reducing the adverse impacts from additional emissions.

BW Gold has carried out a more comprehensive study to establish the baseline of the GHGs in the atmosphere at the location of the mine and nearby areas. In their baseline report for air quality, hourly CO measurements were taken over a period of one year from 2009 to 2010 to arrive at the mean value of the GHG in the atmosphere (New Gold, 2015, p16 Appendix 5.1.1.2A). AMNS has done no such study for GHG emissions and there is no GHG baseline established for the Beaver

Dam Gold mine project. The proponent has stated that it will develop an Air Quality Management Plan in the future and review GHG emissions on an annual basis during the construction, operation and closure of the mine project whereas BW Gold had prepared its air quality and dust management plan which clearly outlines the steps it would take to moderate the effects of the GHG emissions (Atlantic Gold, 2021, p 6-122).

AMNS has mentioned that they will start processing ore from the Beaver Dam mine site once the ore extraction from the Touquoy site has stopped (Atlantic Gold, 2021, p 6-234). There is no evidence presented by the proponent to support this plan. Touquoy mine is still operational and the ore is being processed at the facility. If approved, the Beaver Dam mine ore will also be processed at the Touquoy mine site which could significantly increase the GHG emissions.

2.2 Recommendations

The proponent needs to establish a baseline for GHG emissions which is missing from the revised EIS which was submitted in October 2021 and the previous EIS submitted by them. It is recommended that they collect data for a period of at least one year for GHGs like CO^2, CO, Methane and NO^2 to establish a proper baseline so that the impact from the project can be gauged accurately. Since GHGs are directly associated with air quality it is also recommended that the air quality baseline is reworked with more current data for a period of one year so establish an accurate baseline which hasn't been done.

The proponent also needs to conduct a proper study of how much GHG emissions will increase by at the Touquoy processing facility owing to the increase in the processing amount of the ore. They need to provide a substantial plan of when the Touquoy mine's ore extraction process will cease and when they estimate the ore from Beaver Dam mine will be extracted so that any overlaps can be identified.

3. Surface water quantity and quality

3.1 Background

The reliance of humans on clean drinking water cannot be overstated as it is directly related to good health and long-term sustainability (Davies et al., 2003). Mitigation and water treatment of pollutants generated from mining and industrial activities have largely been unsuccessful both in Canada and globally (Abu-Zeid, 1998). For the Beaver Dam mine project, the water quality and quantity are under federal and provincial legislation protection environment and are protected under both provincial and federal legislation (Canada Water action 1985a, *Fisheries Act* (1985b), *Fisheries Protect Act* (1997), *Nova Scotia Environment Act* (1995)) (Atlantic Gold, 2021, p 6-213). It is highly likely that the effluent discharge from the project will adversely affect the surface quality, aquatic and terrestrial species and potentially human health. This affect will be widespread because the stormwater runoff from the watershed feeds into other water systems like rivers, lakes and oceans. Furthermore, there are various species at risk whose habitat will be affected by the project, including the Atlantic Salmon (*Salmo salar*), which is an endangered species, the American Eel (*Anguilla rostrata*), which is a threatened species and the Brook Trout (*Salvelinus fontinalis*) (Atlantic Gold, 2021, p 6-711). Threatened and endangered terrestrial species that are dependent on clean sources of water like the endangered bat population including the little brown myotis, eastern red bats and many more have the potential to be adversely affected. Larger mammals like the mainland moose are also dependent on clean surface water and may be affected by the project effluent discharge (Atlantic Gold, 2021, p 6-724).

The Beaver Dam mine project site is located in area where historical logging has taken place and are under various stages of regrowth (Atlantic Gold, 2021, p 6-213). The Killag River, Crusher Lake, Mud Lake, Tent Brook and Cope Brook are the watercourses which will receive effluent discharge from the potential Beaver Dam Gold mine project during the construction phase, operations and the mine closure. Numerous surface water monitoring studies have been conducted since 2014 to establish baselines for the surface water quantity and quality (Atlantic Gold, 2021, p 6-217). The proponent has prepared a Mine Water Management Plan in EIS Appendix P.4 where they have identified and evaluated the water treatment methods and potential technologies which will be utilized to reduce the pollutant release in the water bodies (Atlantic Gold, 2021). Historically though, AMNS does not have a good track record of adhering to the plans and mitigation methods that it has laid out. In January 2021, a freshwater brook near the Touquoy mine facility was polluted with sedimentation despite assurances from AMNS that this would not happen (Baxter, 2021a). AMNS has also been charged by Nova Scotia Environment (NSE) on 32 environment-related offenses (Baxter, 2020).

3.2 Evaluation

Surface run off from mine activities will be treated in settling ponds before the treated water is discharged into the Killag river. Furthermore, the open pit mine at the Beaver Dam Gold mine site will span over a location of 30 hectares, 900 metres (m) long, 450m wide and 170m deep (Baxter, 2021b). This pit will operate daily with explosives being used to blast rock and ore in very close proximity to the Killag river. It is concerning to note that there has been no mention of this operation causing any adverse effect on the natural flow of the river or on the species that live in it. Underground blasting in such close proximity to the river can cause a fracture to occur which will drain the river thus causing irreparable damage downstream and permanently modify the flow of water (Zhang, et al., 2017).

The baseline studies carried out for the quality of the surface water showed some concerning results. The baseline studies were carried out by AMNS at locations near the Beaver Dam mine site, the haul road and the existing Touquoy facility. Data for the baseline study was collected from 19 stations at the Beaver Dam mine site, 29 stations across the haul road and 13 stations at the Touquoy mine (Atlantic Gold, 2021, p 6-238-240). Based on the data collected from these sources, minerals like aluminium, iron, mercury, lead, copper, arsenic, cadmium and total suspended solids were found to be elevated under the parameters set out both under the Canadian Council of Ministers of the Environment Freshwater Aquatic Life (CCME FWAL) and the Nova Scotia Environmental Quality Standards (NSEQS) (Atlantic Gold, 2021, p 6-244). The elevated levels of these minerals even before the mine operations have started could have a serious adverse impact on the aquatic species and habitats. Any additional effluent discharge could completely destroy the already delicate habitat of the wild Atlantic Salmon and other fish species (Baxter, 2021b). Mining of metallic resources consistently leads to huge quantities of tailings which contain significant amounts of sulphide minerals (Egiebor, et al., 2007). These minerals have a devastating effect on both land and freshwater bodies as they are not conducive to supporting life forms. The Killag river is infused daily with lime to reduce its acidity so that the river remains conducive to the fish population. Prodigious steps have been taken by the Nova Scotia Salmon Association

(NSSA) to deacidify the river, which was polluted in the 1970s and 1980s by acid rain, causing the endangered wild Atlantic salmon population to be seriously impacted. This multi-million-dollar project has resulted in the salmon population being restored in the area. It is possible that this could all be undone if the proposed mine project is approved.

3.3 Recommendations

Firstly, it is recommended that the proponent changes the location of the open pit so that it is not in such close proximity to the Killag River. The proponent has anticipated that the effect of pit activities on the flow of Killag River will be minimal (Atlantic Gold, 2021, p 6-316). Blasting activities for ore extraction can potentially have a serious impact on the flow of the river and cause permanent damage to the environment where so many endangered species are known to exist. Moving further away from the river will also be advantageous because it will prevent accidents which can cause untreated discharge and waste to be directly dumped into the river owing to its close proximity to the site. The Mount Polley mine disaster in the province of British Columbia can be viewed as an example of accidents causing catastrophic adverse effects to the environment and effecting the water quality and quantity (Gills, 2014).

Secondly, the proponent has summarized that the impact of the effluent discharge into the Killag River will be negligible (Atlantic Gold, 2021, p 6-316). It is recommended that AMNS carry out further studies to gauge the effect of the effluent discharge into the river and its impact on aquatic and terrestrial life around the area and downstream. The baseline study already shows that there are elevated levels of heavy metals in the water. The NSSA is taking daily steps to ensure the habitat of the endangered fish species is not destroyed by artificially liming the river. Heavy metal concentration levels in fish have increased due to industrial activities (Li et al.,2017). This can be seen with the already elevated levels of heavy metals in the studies conducted to establish the baseline. This can be dangerous not only for the aquatic habitat but transferred to terrestrial species including humans through water and fish consumption.

4. Workforce development

4.1 Background

Nova Scotia's economic prospects declined when the province was closed due to COVID-19 health mandates in spring 2020. Total provincial employment saw a 10% loss, and the populations most affected were young people, female employees, and those reaching retirement (Halifax Partnership). With the three-month average unemployment rate in Eastern Nova Scotia in October 2021 to be 13.1%, AMNS aims to attract new employment while developing the workforce to adequately handle the construction of the Project (Statistics Canada, 2021).

The mining industry is highly specialized with a disproportionate gender distribution in the workforce. Of 2,800 full-time workers in the mining, quarrying, and oil and gas extraction sectors in Nova Scotia in 2020, only 600 were women (Statistics Canada, 2021). With the number of those reaching retirement increasing by 32% in the next 30 years, an influx of immigration is vital to drive Nova Scotia's economic growth and labour productivity (MacDonald, 2021). The Nova Scotia Office of Immigration and Population Growth 2021-2022 Business Plan, the Finance and Treasury Board lists core functions of the plan as "attraction and recruitment of immigrants to Nova Scotia" (Finance and Treasury Board, 2021). Furthermore, Nova Scotia supports the Youth Project's aim to: "make Nova Scotia a safer, healthier, and happier place for lesbian, gay, bisexual and transgender youth through support, education, resource expansion and community development" (Youth Project).

AMNS is expecting to produce direct and indirect job employment as related to the Beaver Dam Mine. Taken from KPMG's Economic Impact Assessment of the Project, direct effects are revenues directly attributed to the Project, and indirect effects are revenues raised from the demand of goods and services generated by the Project (KPGM, 2021). With expected 137 full-time employment (FTE) during the construction phase, 311 FTE during the operation phase under direct employment and 161 FTE under indirect employment, AMNS is looking for local and migrant hiring opportunities as the Proponent expand their workforce demographic to cater to all phases of operation (AMNS 2021, 6.16.5.1.2, p.890). With the Project situated near the Millbrook First

Nation and Sipekne'katik First Nation, public engagement has aimed at identifying proper land-use and involvement opportunities for the Indigenous communities (AMNS 2021, 4.1.1, p.1).

4.2 Evaluation

While the Project may have economic benefits, there are concerns as to how AMNS will maintain such benefits after operational phases. Because the Proponent emphasized the necessity of attracting and hiring migrant workers, economic and population growth may occur as these employees settle into nearby towns (AMNS 2021, 6.16.5.1.2). With their settlement into Eastern Nova Scotia, their dependency on the extractive industry will affect the rise of resource boomtowns. Boomtowns are remote towns that rely on resource extractive activities, making them volatile and vulnerable to economic boom and bust (Lawrie et al., 2011). As AMNS plans to build residential infrastructure to accommodate local and migrant workers, it could lead to these individuals reliant on the Beaver Dam Mine for housing and finances (AMNS 2021, 6.16.4.6.1).

Moreover, research on the socio-economic wellbeing of resource boomtowns demonstrates that mining dependency often led to high median income levels but created a wide gap in poverty, income, and educational status (Jacobsen & Parker, 2016). With mining projects often disproportionately prioritizing those in management or specialized occupations than those engaged in unskilled labour, AMNS's focus on rehiring older generations may leave younger and minority workers with lower-paying jobs (Jacobsen & Parker, 2016; Lawrie et al., 2011). This is important as AMNS was reported to engage in wage inequality for mining workers, causing many workers to join labor unions (The Canadian Press, 2021; Baxter, 2021). AMNS' failure to ensure fair wage distribution may actively undermine the Project's strategies in properly establishing a resource community in Eastern Nova Scotia (The Canadian Press, 2021; Baxter, 2021).

Similarly, AMNS currently has no plan to monitor economic growth after project closure which will not allow for adaptive management should a resource boomtown "bust" arise. According to their EIS, the region will be sufficiently funded by recreational tourism during and after operational phases, with direct and indirect employees hired to supply these demands (AMNS 2021, 6.16.5.5). However, unskilled labour for the mining industry may find themselves unemployed even if indirect employment becomes present in resource boomtowns. With a male-dominated community out-of-work, social problems such as violent crimes and substance abuse may threaten the socio-economic wellbeing of boomtowns (Ennis & Finlayson, 2015). With overt emphasis on positive economic impacts from job employment and possible mining community from the Project, AMNS may have neglected to highlight potential problems that can lead to societal unrest.

Lack of workforce development and societal unrest do not just target unskilled male workers in the mining industry. AMNS did make comments about aligning their values to gender diversity in employment and workplace environment, quoting to “facilitate a diverse and representative workforce and management structure” (St Barbara, 2021). However, they do not give a clear guidance for how the Project would enforce this vision, much less mention any identities outside the two binary genders. With little acknowledgement to the LGBTQ2S+ and Indigenous community, employment may be biased to cater to conservative ideologies of the mining sector. For example, the income gap between heterosexual men and individuals from gender minorities is significantly large as heterosexual women and the LGB community are less likely to work full-time and earn much less (Waite et al., 2020). Similarly, Aboriginal people earned 34% less than non-Aboriginal people on urban reserves and 88% less on rural reserves (Wilson & Macdonald, 2010). Failure to address the income inequality of gender and Indigenous minorities living in remote areas may further bar individuals from these communities from seeking job opportunities in the mining industry.

4.3 Recommendations

To assess the full social impacts of the Project throughout its life cycle, the Proponent can utilize Social Life Cycle Assessment (SLCA) in conjunction with its environmental assessment. The SLCA may help guide decisions in identifying the impacts of unemployment and wage inequality on workers, which address factors such as poverty, crimes, socio-economic status, and expectancy of re-employment that may affect a workers’ financial stability and mental health (Jørgensen et al., 2010). This may help the Proponent visualize the risk of various employment and workforce development decisions, reducing the risks of boomtown abandonment from mine closures and economic downturn.

To address the issue of wage inequality, AMNS needs to admit its track record in the unfair wage distribution. With its workers joining the United Steelworker unions due to an inferior work environment, the Proponent can implement sector standards for social and corporate governance.

Since the Proponent has already integrated the Sustainable Development Goals into their EIS, they can look towards the Global Reporting Initiatives for corporate sustainability efforts in the mining sector (Strozzilaan, 2021). Creating a multi-stakeholder working group may also help keep AMNS accountable for transparently distributing fair wages, career advancement opportunities, and education to employees at all stages of the Project (Strozzilaan, 2021).

To resolve wage discrimination against the LGBTQ2S+ and Indigenous community, AMNS should release guidelines that fully supports diversity and inclusion in the hiring process and work environment. The Proponent can incorporate the Government of Canada GBA+ program into its training and employment protocols for a comprehensive understanding of identity and gender-based issues. GBA+ is an approach to developing an equity-based implementation of sex and gender indicators in the workforce, promoting awareness of how government initiatives affect different minority groups (Hoogeveen et al., 2020). GBA+ also focuses on Indigenous voices, especially the cultural values and expertise of Indigenous women, as vital stakeholders of any impact assessment process (Manning et al., 2018). In the case of the Project, implementation of GBA+ may help break the barriers to employment for the Indigenous and LGBTQ2S+ communities.

5. Consideration of community health and safety

5.1 Background

Under provincial jurisdiction, AMNS must comply with Nova Scotia's Occupational Safety General Regulations that ensure owners', supervisors' and employees' accountability of all occupational health and safety (Occupational Safety General Regulations, 2013). Furthermore, they must take the necessary precaution to maintain employees' safety and wellbeing, such as supplying personal protective equipment and providing hospital access (Occupational Safety General Regulations, 2013). Similarly, the Mineral Resource Regulations also contain a clause requiring mining projects' operating expenses to cover workers' compensation and other contributions of workers' health while working at the mine (Mineral Resources Regulations, 2018). While both Acts specify the Proponent's monitoring of on-site behaviors, many external stressors can influence health and safety. As the Project already proposes plans for local community development, AMNS must also account for health and safety protocols in case of on-site and off-site emergencies.

Nova Scotia's health statistics have been comparable to other provinces in Canada. In a 2015 health profile report, 58% of the population self-expressed as having excellent physical health and 72% self-reported as having excellent mental health (Nova Scotia, 2015). While the number covers all populations, the gap between the health profile of a non-Aboriginal population and that of the First Nation varied drastically. From 2010 to 2014, 62.2% of non-Aboriginal perceived excellent physical health and 72.7% perceived excellent mental health, but only 48.5% of First Nations perceived excellent physical health, and 61.3% expressed excellent mental health (Statistics Canada, 2016). Because the Musquodoboit Valley Memorial and the Eastern Shore Memorial are the only two hospitals near the Project, mine workers and local community will have to share hospital access (AMNS 2021, 6.16.5.3.2, p.896). Therefore, the statistics suggest that the Indigenous community does not have equal accessibility when seeking health services.

Like most provinces, Nova Scotia was heavily affected by COVID-19 impacts on human health, economic growth, and infrastructural development. Since March 15 of 2020, 84.4% of cases have been from unvaccinated individuals, with 3,020 cases between 20 – 39 years old (Nova Scotia, 2021). In Eastern Nova Scotia, 82% of the population is fully vaccinated (Nova Scotia, 2021). In the current EIS, the Proponent considers remote work for office workers, but all operational staff will need to be on-site (AMNS 2021, 6.16.5.2.3, p.896).

5.2 Evaluation

In a summary of accident and malfunction characterization criteria, the Proponent has listed several potential risks to workers' health and safety, including mobile equipment accidents, transportation accidents, infrastructure failures, and unplanned explosives events (AMNS 2021, 6.18-13). The Proponent plans corresponding emergency responses for each possible risk, which do not fully involve hospital services to the emergency response. For example, Emergency services will be contacted once on-site staff have conducted assessments on the cause of the accident and what Emergency services are required (AMNS 2021, 6.18.7.3.3, p.967). This could slow contacts to Emergency services and delay workers' ability to get help on time. Similarly, there may not be enough hospital beds for emergency services if there is a significant mining accident. The Proponent has admitted that current hospitals have shortages in beds and staff to supply emergency services to the Project (AMNS 2021, 6.16.5.3.2, p.896). While AMNS expects workers to comply with Health and Safety thoroughly conducts, pre-existing stressors such as wage inequality and occupational stress may increase the risks of potential accidents. In a report completed on workers' mental health, research has demonstrated that lack of sleep, fatigue, and burnout are detrimental influences on workers' ability to maintain a safe work environment (Larivière et al., 2018). While there are training courses on compliance and expectation of health and safety, AMNS does not have proper measures to prevent work-related accidents from debilitating mental health. With mental health disorders such as depression and post-traumatic stress disorder (PTSD) commonly found in miners, it is concerning that AMNS does not have infrastructure or advocacy for mental health awareness integrated into their training and Project management (Larivière et al., 2018). Substances are also prevalently distributed between workers, which may further detriment their mental well-being and ability to efficiently comply with health standards (Larivière et al., 2018). With the mining industry predominantly occupied by men, AMNS are neglecting social impacts to local and Indigenous communities should they remain complacent on the feasibility of mental health disorders in mining workers.

In a table detailing the residual effect of the Project on the Mi'kmaq of Nova Scotia, AMNS categorized potential impact to human health, economic, social, and mental well-being of the Mi'kmaq as not significant (AMNS 2021, 6.14-10, p.843). However, mining projects can contribute social harms to the Indigenous community. In Amnesty International's report on the Indigenous perspective of the resource sector, labour camps where workers would stay are often plagued with drugs and alcohol abuse, which lead to physical and sexual assaults against female employees (Amnesty International, 2016). These "man-camp" also exploit Indigenous women, who are often most targeted for trafficking and sexual violence (Amnesty International, 2016; Meloney, 2021). These camps not only bring horrific physical damages but also increased mental health disorders in the Indigenous community. In a 2008 survey, 19% of Aboriginal females and 13% of males admitted having attempted suicide, which is dangerously high compared to the 4% of females and 3% of males in the total Canadian population (Khan, 2008). Depression and substance abuse are also frequently found in Indigenous communities in the proximity of resource extractive projects, with the community experiencing social and environmental discrimination against their livelihoods (Ridgen, 2020). These findings directly contradict AMNS's claim of the Project's low significant impact on the Mi'kmaq physical and mental well-being, demonstrating how AMNS lacks observations and engagement with the Indigenous community.

While the Proponent include COVID-19 baseline conditions in their economic report, AMNS fails to mention possible pandemic outbreaks from their mining operations. Notably, MiningWatch Canada identified 4,000 positive cases from 61 mines, one mining convention, and 247 cases caused by contamination to local communities (Jones, 2020). Currently, the Proponent only mentions possible COVID-related influences on economic growth such as tourism and workforce development (AMNS 2021, 6.16.4.2, 6.16.4.9).

5.3 Recommendations

Mitigating and resolving mental health disorders can be difficult as they are complex issues with various stressors. Early detection will be beneficial as the Proponent can provide adequate help and support before emergencies, which can be accomplished through an on-site health promotion program, on-site support from coworkers and supervisors, and an employee assistance program (Tetzlaff et al., 2021). Mental health awareness programs are also integral in promoting health and safety both on-site and off-site, for which the Proponent should directly advocate in their EIS (Asare-Doku et al., 2022; Tetzlaff et al., 2021). Destigmatizing the stereotypes of mental health illnesses may encourage more workers to seek help, contributing to an accepting and healthy work environment for all employees (Tynan et al., 2018). While hospital staff are limited, monthly physical and mental health checks may aid early detection of any significant illnesses, preventing possible work-related incidents from mental illnesses and reducing emergency overloads (Tynan et al., 2018). As the *Mineral Resource Act* requires owners to apply operating expenses to maintain workers' physical and mental well-being, the Proponent may fund the expansion and construction of hospitals to increase staff and resources, benefiting both mining workers and the local communities (Mineral Resources Regulations, 2018; Tynan et al., 2018). AMNS's emphasis on implementing mental health programs will address individual workplace risks and adequately demonstrate their commitment to care for workers' health and safety.

A health impact assessment will support the Proponent in understanding how the Project may have health impacts on the local and Indigenous community and provide appropriate mitigation measures (Habitat Health Impact Consulting, 2012). GBA+ will also allow for the inclusion of Indigenous women in the impact assessment process, promoting awareness of institutional and social issues that harm Indigenous' prosperity and livelihoods (Manning et al., 2018). Both could help the Proponent detect potential harms to the Indigenous community and allow for early intervention to prevent future risks. Similarly, investing in health resources such as accessibility to hospital services may reduce mental tolls on Indigenous people and allow them to seek help safely and timely. Overall, recognizing constructive criticisms and actively engaging in remedying those challenges will benefit the Proponent in their ability to address the problems of the extractive industry productively.

While preventative measures against COVID-19 varied, the Proponent must ensure that all operational staffs comply with provincial health mandates. These include personal mask requirements, sufficient COVID-testing to detect cases, and distribution of vaccines to workers and the local community (Nova Scotia). Proper COVID-19 detection and quarantine measures must also be implemented to contain spread from impacting vulnerable groups. Outreach to healthcare providers to enforce COVID-19 directive will also benefit the Proponent should an outbreak occurs.

6. Priority mammals

6.1 Background

Atlantic Mining NS Inc (October 2021a) states in the environmental assessment report that there are multiple species of conservation interest (SOCI) and species at risk (SAR) occurring in the project area. The terrestrial mammals presented as species at risk fall under the federal protection of the *Species at Risk Act*, SC 2002, c2 9. The province of Nova Scotia also has a Wildlife and Endangered species act, which is under the authority of Nova Scotia Lands and Forests. The species found of most concern are the mainland moose (endangered), Eastern pipistrelle (endangered), Little brown myotis (endangered) and Northern long-eared myotis (endangered).

Table 1 lists the terrestrial mammals that can potentially occur in the project area and states their at-risk status through the Species at Risk Act (SARA), Committee on the Status of Endangered Wildlife In Canada (COSEWIC) and Nova Scotia Endangered Species Act (NSESA).

Table 1: Priority Terrestrial Mammals occurring in the project area from the Environmental Impact Assessment Submitted by Atlantic Gold NS Inc.

Common Name	Scientific Name	SARA	COSEWIC	NSESA	S-Rank
Eastern pipistrelle (Tri-coloured bat)	*Perimyotis subflavus*	Endangered	Endangered	Endangered	S1
Eastern red bat	*Lasiurus borealis*	-	-	-	S1S2B, S1M
Hoary bat	*Lasiurus cinereus*	-	-	-	S1S2B, S1M
Little brown myotis	*Myotis lucifugus*	Endangered	Endangered	Endangered	S1
Maritime shrew	*Sorex maritimensis*	-	-	-	S3
Mainland moose	*Alces americanus*	-	-	Endangered	S1
Northern long-eared myotis	*Myotis septentrionalis*	Endangered	Endangered	Endangered	S1
Rock vole	*Microtus chrotorrhinus*	-	-	-	S2
Silver-haired bat	*Lasionycteris noctivagans*	-	-	-	SUB, S1M

The Mainland Moose species (*Alces alces americana*) is listed as an endangered species under Nova Scotia's Endangered Species Act in 2003 as the population has been decreasing by 20% over the past 30 years and has a current population of approximately 1000 moose (Government of Nova Scotia, 2021). The three bat species with the potential to occur in the project area have populations struggling recently as a disease called White-nose syndrome has killed approximately 7 million bats in Nova Scotia (Government of Nova Scotia, 2021). The disease is lethal, and there is no cure, causing the remaining populations to need protection to avoid extinction. During the bat surveys, multiple species of bats were found in abandoned mine shafts used as hibernation areas. Terrestrial mammals will experience adverse effects from the mining construction, operation, and remediation, such as sensory disturbance from noise, and lights, mortality from vehicle strikes and habitat alternation (Shonfield & Bayne, 2019).

6.2 Evaluation

As the species of terrestrial mammals are present around the proposed project area, more vigorous mitigation efforts should be taken to protect these species and allow their populations to recover. The mainland moose has quite a small population in Nova Scotia, and it is crucial to protect the population now instead of trying to recover an even lower number. Mainland Moose are highly concentrated in the proposed project area (Atlantic Mining NS Inc.,2021a) amplifying this concern. Mining operations are difficult to remediate as it has been found that years after mining operations have come to a halt, the effects on the environment, such as trace metals in soil that negatively affect mammals (Camizuli et al., 2018). Rodents such as the Rock Vole and the Maritime Shrew were found within proximity to the project area, and these species can be used as biomarkers to indicate levels of toxicity from leeching that can occur from mining activity (Shahsavari et al., 2019).

The mitigation measures listed in Table 2-1 Mitigation for Species of Conservation Interest and Species at Risk (Atlantic Mining NS Inc., October 2021b) focus on accidental and unintentional effects on mainland moose. The likelihood and risk of accidents may be underestimated. The province of Nova Scotia has released recovery plans for the three species of bats at risk and mining activity where there could be abandoned mines where bats have used them as places for hibernating (Nova Scotia Department of Lands and Forestry, 2020).

6.3 Recommendations

Habitat is crucial for terrestrial mammals. During the construction and operation of the gold mine, fencing can be built surrounding the project area to protect the terrestrial mammals (Ringma et al., 2017). Conservation fencing can be set up as a protective measure, so the risk of vehicle collisions with mammals is reduced. The fencing also allows for the animals to safely migrate and not interact with the project area.

As Nova Scotia is a province with Indigenous people living off the land, these Rightsholders should be engaged and deferred to with regard to mitigation planning and expressing their concerns about the effects of mining on the wildlife at risk (Boiral, 2014). The experiential knowledge they have of mammals can help the developers understand the migratory patterns and what can be completed to protect the species from harmful mining activities.

The risk of increased mortality of mammals due to poaching, vehicle strikes, habitat degradation, and operational disturbances may be high. The provincial government of Nova Scotia has a department of Natural Resources and Renewables that released a recovery plan for the Mainland

Moose population in Nova Scotia states that human activity such as mining can permanently alter the Moose habitat, which can then cause population decline (Nova Scotia Department of Natural Resources and Renewables, 2021). Other, indirect impacts may occur but were not stated in the EIS. Small mammals present in the project area can be exposed to toxic chemicals that will be passed on throughout the ecosystem by bioaccumulation, increasing the influence effects of the mine (Shahsavari et al., 2019). Public comments on the Beaver Dam Mine project express concern for the environment as some say the mine is a short-term gain that will cause long-term issues that may take years to fix or never really be improved (Impact Agency of Canada, 2019).

7. Fish

7.1 Background

The fish species presented as species at risk fall under the federal protection of the *Species at Risk Act*, SC 2002, c 29 and the federal *Fisheries Act* R.S.C., 1985, c. F-14, which includes the Metal and Diamond Mining Effluent Regulations under the authority of the Department of Fisheries and Oceans. Six priority fish species were identified during field surveys within proximity to the project area (PA). The species found of most concern are the American Eel (threatened) and the Southern uplands population of Atlantic Salmon (endangered), which have their species at risk evaluation designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), as stated in Table 2.

Table 2: Priority Fish Species possible in the project area from the Environmental Impact Assessment Submitted by Atlantic Gold NS Inc.

Common Name	Scientific Name	SARA	COSEWIC	NSESA	S-Rank
Alewife	*Alosa pseudoharengus*	-	-	-	S3
American eel	*Anguilla rostrata*	-	Threatened	-	S2
Atlantic salmon – Southern Uplands Population	*Salmo salar pop. 6*	-	Endangered	-	S1
Brook stickleback	*Culaea inconstans*	-	-	-	S3
Landlocked Rainbow smelt	*Osmerus mordax (landlocked)*	-	-	-	S3
Brook trout	*Salvelinus fontinalis*	-	-	-	S3

The Southern upland population of Atlantic Salmon has experienced a 61% net decline over the last three generations, mainly affected by increasing human activity developments of fish farms, dams, and logging (Government of Canada, 2021). The spawning grounds of the Atlantic salmon population are decreasing because of increased acid rain contaminating their frequented waters. The American Eel and Atlantic Salmon who frequent the waters close to the project area are at higher risk of losing habitat, being exposed to harsh chemicals which could drive them from their spawning grounds reducing overall population sizes.

7.2 Evaluation

As fish species are present around the proposed project area, stronger mitigation efforts should be taken to protect these species and allow their populations to recover. Mining is known to impact water bodies as the contaminants of the mining process are transferred through wind, leaching, and runoff from tailings ponds, waste pits and other fuel storage forms (Compaore et al., 2019). Public comments on the Beaver Dam Mine project express concern for the environment as some say the mine is a short-term gain that will cause long-term issues that may take years to fix or never really be improved (Impact Agency Of Canada, 2019).

The fish species presented in the impact assessment rely on their habitats for migration and breeding. Even though buffers will be set in place, there is a chance of a catastrophe that could pollute the waters and ruin the fishes' habitats past the point of no return. An example of a past disaster is the Tulsequah Chief Mine Site, where the contaminants have been leaching into nearby waters, polluting them for decades which has created an extensive and costly remediation process (Simmons, 2020).

Both the direct and indirect effects from construction to the closure of the project could affect the fish species. The effects are not worth the risk as the changes made to the habitat and the effects the fish populations will experience can be devasting. The storage of materials during the mine operation leaves adverse effects, potentially creating toxic water for many fish spawning grounds (Gusso-Choueri et al., 2016). The American Eel and Atlantic Salmon are a protected species at risk with their populations on declines due to human activity such as mining which will only be increased with the approval of the Beaver Dam Mine Project.

7.3 Recommendations

The proposed Beaver Dam Mine Project poses risks that could devastate fish species already struggling. It is stated in the EIS submitted by Atlantic Mining NS Inc. (2021a) that the American Eel habit is most likely to be degraded or potentially lost as the areas they were known to frequent will be affecting form mining operations and transportation activity. The construction and operational disturbances occurring around the Beaver Dam mine site must operate during the season where the fish are not spawning in the nearby water bodies. Kefeni et al. (2017) have suggested through a case study that to prevent acid mine drainage, which will have an effect on the soil and water bodies in the project area that the best option is to prevent acid rock drainage through dry and wet covers for the tailings ponds projected for the mine site. The covers will prevent the risks of containments leaching through soil into the water and contain toxic chemicals from reaching water bodies where species of fish may occur. Efficient reporting of fish habitat alteration or possible leeching of containments into the water bodies must be tested regularly for water quality assessments to ensure toxic levels of minerals are not harming the fish populations. Soil tests must also be completed during all phases of the mine site to ensure that containments cannot leach from soil to the water creating toxic environments for fish. All sightings of fish habitat destruction or disturbance must be reported and therefore should create a priority effect over construction or operational tasks.

8. Snapping turtle

8.1 Background

The common snapping turtle is a herpetofauna that is ranked S3 (vulnerable designation by the Atlantic Canada Conservation Data Centre) as a species at risk in its Nova Scotian distribution (Government of Canada, 2014 and Atlantic Canada Conservation Data Centre, 2021). The snapping turtle is Canada's largest freshwater turtle species, where they are characterised for their proportionally large head, hooked-like upper jaw, and posterior serrated scutes (particularity noticeable in adults) (Government of Canada, 2014). Other defining characteristics of snapping turtles is a comparatively long tail to other turtle species which is almost the length of the carapace, and their defensive behaviours as they often lunge at perceived threats and bite with necks extended (Government of Canada, 2014). This species has reached the vulnerable designation due to the high mortality rates of the hatchings and eggs from predation and human related activities, extended time to reach sexual maturity, and lack of parental care. Deposition of eggs typically occurs during May and June of which females usually lay up to eggs per dug up nests (Government of Canada, 2014).

General characteristics of optimal snapping turtle habitats mostly consists of mild water currents that is richly vegetated with muddy bottoms (Government of Canada, 2014). It is possible for these turtles to reside in developed areas such as golf course ponds and irrigation canals, but less likely for populations of snapping turtles to be established there (Government of Canada, 2014). Additionally, female snapping turtles will search for areas that have loose sedimentation (ex: sand, soils, gravel…etc.) to deposit their eggs, and will often make oviposition's on the shoulders of roadsides due to the relatively loose ground, though at a higher mortality risk for the eggs and hatchlings (Government of Canada, 2014).

Snapping turtles are found in the central to eastern-southern regions of Canada in which they have been observed/recorded in most areas of Nova Scotia. Specifically, they are most abundant in upper Tusket River, Medway River, Annapolis River, Musquodoboit River, and St. Mary's River (Government of Canada, 2014). A few of these turtles have been identified through field recordings near and within the Beaver Dam mining site in Marinette, Nova Scotia. Specifically, a female snapping turtle was observed near Haul Road along Mooseland Road in 2016, and another female was observed in the Beaver Dam site by DFO on June 27th, 2019 (Refer to Fig 1. in the Appendix for map depicting Beaver Dam site observation). Other sightings of these turtles were recorded at the Tuoqouy Mining site in which two turtles were found (Atlantic Mining NS Incorp., 2021).

8.2 Evaluation

The EIS notes in Table 3.16-16: Mitigation for Priority Terrestrial Fauna. Page 758 "Vehicles will adhere to safe speed limits, particularly around blind corners" (Atlantic Mining NS Incorp., 2021). This is a simple yet effective strategy that the proponent has suggested as a mitigation measure to reduce the likelihood of snapping turtle mortalities from vehicle collision on Haul Road and other parts of the mining site. However, there is no additional detail as to how the speed limit will be enforced, and if the speed limit will change based on areas that had past turtle sightings or areas that are considered as potential snapping turtle habitat or nesting grounds especially on the roadside.

A case study in Kejimkujik National Park proved the effectiveness of reducing speeding in "Turtle Zones" by getting test subjects to drive on a designated road with certain conditions applied to observe any changes to their speed (Reed, 2008). These conditions included the road with turtle signs, and another that consisted of both signs and speed bumps. Another test was conducted to determine the ability of motorists to identify turtles (display representations) on the road while driving at different speeds (Reed, 2008). The results of the speed reduction management demonstrated that drivers did slow down with the presence of just the turtle signs, but were still driving above the maximum speed limit (20km/h in areas of previously reported turtle sightings). The second condition that consisted of both turtle signs and speed bumps were more successful in reducing speeding (Reed, 2008). The results of the second test displayed the importance of educating drivers on turtle presence (especially hatchlings) as those that were informed about turtle presence and key identifications of them were able to spot both adults and hatchlings at a much higher rate than those that were not informed (Reed, 2008).

In conclusion, the proponent has stated the bare minimum detail of the road policy with regards to mitigating snapping turtle mortalities and should specify the speed limit for potential turtle zones, make sure that all on-site personnel are educated in spotting them on the road. The proponent should also mention if they plan to adjust the speed limit of these zones in particularly limited visibility such as during the night, rain, fog…etc.

The EIS also notes in Table 3.16-16: Mitigation for Priority Terrestrial Fauna. Page 758 "Vehicles will yield to wildlife on roads" (Atlantic Mining NS Incorp., 2021). This particular species of turtle is known to display defensive measures if it feels threatened and will often lunge/snap at objects that get too close to it (Reed, 2008). In response to this situation, the proponent of the Beaver Dam Mine site has made detailed procedure on the management plan for removing the turtle, but failed to mention any countermeasures for those that get bitten. In Appendix P.7 (draft Wildlife Mitigation and Monitoring Plan) on page 4-3 of 4.1.2 Snapping Turtle, the proponent has stated:

“Once the face is protected, you can try to move the turtle. Never lift a turtle by its tail or legs. Grip the top shell on either side of the tail, and use that grip to drag the turtle away from the road, or lift it into a crate, box, or wheel barrow” (NS Mining Incorp., 2021). This instruction is accurate, however there needs to be more clarity in which part of the snapping turtle’s shell is grabbed. Specifically, snapping turtles have the ability to extend their necks to the mid-section of their shell, but cannot reach past. Thus, the workers, if comfortable, must grab the section of the shell under the tail, in which turtle can be lifted off the ground and transferred, if small enough, to prevent injury from dragging it on the roadside (Skolmoski, 2009).

The proponent has also mentioned in the same section: “Improvise other solutions to cover the turtles face, such as a cardboard box, hard hat, bucket, etc.” (NS Mining Incorp., 2021). Covering the face of the turtle is an unnecessary step that may injure the turtle’s neck with the extra weight and removal has been proven effective without covering the head (Toronto Zoo, 2010).

The major component that is missing with the proponent’s plan to safely remove any snapping turtles on the roads are the countermeasures to a worker that still gets bitten by this species of turtle. Snapping turtles in particular have a tendency to hold their bite, especially if it feels threatened. The victim must remain calm to prevent further injury to themselves and harming the turtle out of desperation (Yates, 2020).

Some methods that can be applied in order for the turtle to let go of the victim is to submerge the animal in a bucket full of water (if nearby) which should make it feel more relaxed (feeling in its habitat). Another strategy that can be applied to get the animal to release is to pour rubbing alcohol onto the turtle’s face and in any gaps of its mouth. The application of rubbing alcohol should immediately present an unpleasant sensation in its mouth forcing it to let go, leaving the turtle unharmed (Peterson, 2017).

In Table 3.16-16: Mitigation for Priority Terrestrial Fauna. Page 758 “An un-vegetated buffer along roadsides will be maintained, where possible, to improve visibility along roadsides and reduce the potential for collisions with wildlife” (Atlantic Mining NS Incorp., 2021). The proponent should include more descriptions of what this buffer system will look like, how it will be implemented, and will it impact any of the ecosystems/wildlife adjacent to the roadsides.

Ontario as an example often implements 1.5 meters of extra pavement alongside the main road to cover the road shoulders (Turtle Guardians, 2017). This buffer method provides an extended barrier for potential turtle nesting areas from ongoing traffic while still offering loose substrates on the edge of the buffer zone to nest. It also encourages community members to use the extra space for reactional activities such as walking, running, and cycling (Turtle Guardians, 2017).

Extra pavement as a buffer has been proven to be effective for reducing destruction of nearby turtle nests, however it can cause impacts to the environment adjacent to the roads especially during construction and implementation of the payment (Turtle Guardians, 2017). An alternative buffer proposed by Ontario that is not as impactful to the environment while still limiting/preventing turtles nesting next to the roadside is implementing vegetative shoulders, low-growing covers, and grass beds (Turtle Guardians, 2017). Since snapping turtles have a preference for establishing nests in areas of loose sediments, the vegetated areas will limit the presence of this sediment type with its dug-in roots and its foliage's.

8.3 Recommendations

To ensure maximum road safety for any snapping turtles in close proximity or on the road, the proponent should establish a series of animal crossing/observation signs throughout the main Haul Road. Where there has been recorded sightings of snapping turtles previously, or areas that is considered suitable habitat, the proponent should have road signs specifically highlighting potential snapping turtle presence. In addition, there should be speed bumps implemented throughout the entire Haul Road so that vehicle speeds are passively controlled/regulated. All site workers and especially drivers should be educated on identifying snapping turtles from a distance to prevent risks of collision. Lastly, the proponent should consider changing the speed limits based on unclear atmospheric conditions such as during the nighttime, or if there is rain, fog…etc.

The proponent should implement a thorough risk plan associated with the potential of the workers being bitten while handling a snapping turtle on the road. There should be more emphasis in the appendix on what no to do when handling turtles.

The proponent should implement a more clear and detailed description of what type of unvegetated buffer zone is planned to be implemented and maintained. As mentioned previously in the Ontario

Road turtle safety case study, the proponent should consider add 1.5m of extra pavement alongside the main Haul Road to reduce the risk of snapping turtle mortalities via vehicle collisions and nest destruction if directly adjacent to the road. The proponent should also look into the possibilities of implementing vegetated road buffers as this method would be less environmentally destructive than add more pavement.

9. Eastern Moose

9.1 Background

The eastern moose is the largest member of the deer family that is ranked as an S1 species at risk (critically imperiled designation by the Atlantic Canada Conservation Data Centre), with a current approximate population of just 1200 in mainland Nova Scotia (excluding Cape Breton) that may experience extirpation from the province (Parker, 2003 and Atlantic Canada Conservation Data Centre, 2021). The physical characteristics of mainland moose includes long legs, short tail, large ears, high shoulders, short neck, and a large snout with colours varying from shades of brown, black and grey. Adult bulls can be identified with large palmate protruding antlers (Parker, 2003). Since 1981, Nova Scotia (except for Cape Breton) has shutdown hunting season of the mainland moose due to its decreasing population size (Parker, 2003).

Moose distributions are present within every Canadian province with the exception of Prince Edward Island. Eastern moose subspecies populations are present in geographically fragmented parts of Nova Scotia, with its Canadian geographical range extending to the eastern Ontario boundary and including all other Atlantic provinces (not including PEI) (Nova Scotia Department of Natural Resources and Renewables, 2021). In the proposed Beaver Dam Mine itself, there have been multiple of identifications in the mining site boundary and many of track observations in and adjacent to Haul Road as well (refer to Fig 1. and Fig 2. in the Appendix for maps depicting Beaver Dam site and Haul Road observations) (Atlantic Mining NS Incorp., 2021).

Moose habitats are commonly characterized of areas consisting of boreal and mixed wood forestry, where they will consume their preferred diet of twigs, foliage and stems of shrubs and young deciduous trees (Parker, 2003). Their habitat is also characterized by being recently disturbed by elements such as wind, fire, disease and wood clearances. It is vital that there is suitable habitat for moose populations as it allows for higher chances of population recovery, and overall health (Parker, 2003).

9.2 Evaluations

The EIS states in Table 3.16-16: Mitigation for Priority Terrestrial Fauna. Page 758 that "Vehicles will yield to wildlife on roads • Vehicles will adhere to safe speed limits, particularly around blind corners. • An un-vegetated buffer along roadsides will be maintained, where possible, to improve visibility along roadsides and reduce the potential for collisions with wildlife" (Atlantic Mining NS Incorp., 2021)

Similar to the snapping turtle presence, there is no detailed plan of what the proponent will do if a moose is encountered on the road. The proponent should follow the principles and guidelines that government of Maine provides if one was to encounter a moose. They emphasize to use extreme caution if a moose is on or near the roadway especially during August-October (mating season) (Maine.gov, 2021). It is strongly advised that drivers slow to a stop, not to drive around the moose (may charge the vehicle), and to give the moose space and wait for it to move off the road on its own (Maine.gov, 2021). If a crash is inevitable, depending on the circumstances, the Maine government recommends to put on the brakes and to continue to drive straight. It is also recommended to aim for the hind side of the moose so that there is less chance of it to hit the windshield and a higher possibility to avoid the animal. For maximum protection of the personnel in the vehicle, they should lower themselves to lessen the possibilities of being struck with windshield fragments (Maine.gov, 2021).

Table 3.16-16: Mitigation for Priority Terrestrial Fauna. Page 758 states the proponent will "Install fencing, where practicable, to prevent wildlife from accessing areas with increased risk of injuries to wild species - appropriate dimensions to address and eliminate accidental falls of species of varying size including deer and moose into the open pit" (Atlantic Mining NS Incorp., 2021)

Connectivity is a huge issue with mainland moose as populations are fragmented for an already at-risk terrestrial species (Parker, 2003). It is valid to put fences as boundaries for direct mining sites to prevent falls, but extensive fencing on the main Haul Road of the mining site may lead to potentially more fragmentation of the moose populations. However, the proponent has not indicated nor presented a detailed outline anywhere in the EIS of exactly where the fencing is planned to be implemented and a far it will extend.

A case study in Sweden was conducted to prevent/minimize the number of collisions of moose crossing highways annually. Specifically, boundaries via fencing were constructed on the edge of the highways to prevent moose from directly crossing the roads to out of risk of collision with motorists (Olsson & Widen, 2008). In order to prevent complete disconnection between the forested areas intersected by the highways, a total of three wildlife crossings were constructed above the highways to allow habitat connectivity for the moose population. The results of these barriers showed that approximately 67-89% of moose crossings decreased during the construction and implementations of the fences and no crossings were observed after the completion of the fences with some areas permitting speeds up to 110km/h (Olsson & Widen, 2008). The fences have therefore significantly decreased moose collision injuries/mortalities and improved driver safety; however, the results of the wildlife crossing were not as promising. Specifically, the moose that had collared trackers to monitor their movements, did not use the bridges to get access to different areas divided by the roads (Olsson & Widen, 2008). Consequently, despite the good intentions of the crossings, the neighbouring moose population experienced more dysconnectivity, potentially leading to lack of resource access and restrictions on gene flow (Olsson & Widen, 2008).

Based on the Swedish case study, the proponent of Beaver Dam mine should not block off any roads or areas other than the open pit sites as they have originally mentioned. Since the eastern moose population in Nova Scotia is already heavily fragmented, the implementation of fences and wildlife crossways would most likely cause further fragmentation of the moose near the site (Parker, 2003). The map depicting moose track observations of the Beaver Dam mine EIS, Section 6, page 619, clearly shows that the majority of movements were on/near the Haul Road, which would potentially cause further fragmentation (Atlantic Mining NS Incorp., 2021). In addition, it would not be practical for the proponent to fence the entire roads as it would be relatively expensive, and it would have to be taken down during the closing stages of the project to restore the environment.

9.3 Recommendation

There should be a detailed outline and steps that the on-site workers can follow and learn of what to do if a moose is spotted near or on the road. The proponent should use also implement a combination of wildlife/speed signs and speed bumps to regulate driving speeds as well. These mitigation strategies should reduce the likelihood of collisions with moose.

The proponent should indicate and have a detailed outline of where the fencing is planned to be implemented and a far it will extend in the Beaver Dam Site. It would be most beneficial to present a map depicting all the proposed areas that plan to have fencing and display the sightings/observations of moose tracks to have an effective layout of the fences.

10. Priority Bird Species

10.1 Background

Priority bird species, specifically those considered under the SOCI and SAR sections, are good indicators of specific habitat types within a region. Different species of birds require different habitat types and as such, are good samples for monitoring (Bibby et al., 1998). Due to specific habitat preferences of certain species, it is important to monitor development sites in case there are potential niche areas for these species that are being altered.

Throughout the entire area the projects covered, there were 32 priority bird species were observed within the survey process, 23 of these species were listed as SOCI, and 9 were listed as SAR (Atlantic Gold, 2017). While the 2021 Beaver Dam EIS left the 23 SOCI species in bold characters within the table due to spatial constraints, the 9 at-risk species were further expanded upon as the Common Nighthawk, the Peregrine Falcon, the Chimney Swift, the Olive-sided Flycatcher, the Canada Warbler, the Rusty Blackbird, the Barn Swallow, the Eastern Wood-Pewee, and the Evening Grosbeak (Atlantic Gold, 2021). The Peregrine Falcon is considered a location-sensitive species under Atlantic Canada Conservation Data Centre (ACCDC) ranking system, in which the organization omits specific locations from any project proponents (ACCDC, n.d.). Alternatively, ACCDC will provide estimates of the nearest sightings within proximity of the project, none of which occurred within 5 kilometres of all Beaver Dam Mine site portions, including Haul Road and the Touquoy site (Atlantic Gold, 2019).

10.2 Evaluation

The biggest issue that arose when attempting to read the various renditions of the EIS documents lay within the layout. The 2021 Beaver Dam Mine EIS revision appears to have reduced the amount of information fragmentation that occurred in previous versions of the EIS. Some evidence of this is just how much easier the targeted information is for searching within the table of contents. The placement does not change much, but the formatting is much more pleasing to read. Supporting tables, while containing the same amount of content, are also more legible in this instance. There is some counterproductivity in this decision though. While the document becomes somewhat easier to read, sections have been broken up into smaller documents. Overall SAR information in the document is displayed in section 6, the mitigation tables are in another document containing all of section 9, and other key information is scattered between these various documents (Atlantic Gold, 2021). The average reader could become easily confused when information about the subject is split between several documents.

In terms of mitigation strategies for the VC from section 6.12.9 and Table 9.1-1 of the 2021 EIS report, the proponent does an acceptable job in anticipating potential issues concerning avifauna through their mitigation strategies, specifically those that are migrant species. Efforts committed to changing required light sources to face downwards to avoid attracting migrant species, as well as committing to reducing the presence of upturned soils and gravel mound deposits to deter ground nesters, such as bank swallows and common nighthawks respectively, are positive steps (Atlantic Gold, 2021). However, there is required monitoring of nests should a species manage to find a suitable location to ensure that buffer zone standards are being met adequately when necessitated (Atlantic Gold, 2021). The intended course of action is to monitor the nesting sites with the use of spotting scopes and binoculars; however, current trends indicate monitoring effectiveness is higher when nesting cameras are included (Cox et al., 2012).

10.3 Recommendations

The first recommendation for the proponent is to add nesting cameras to the monitoring efforts in areas where ground-nesting has failed to be stopped, specifically models like the customizable Raspberry Pi cameras (Hereward et al., 2021). With proper installation locations, these cost-effective cameras can reduce the amount of involvement required by humans concerning monitoring. During mining development, habitat suitability of ground nesters from upturned soil and gravel mounds increases, the proponent acknowledges this fact in section 6.13.7.1.4 of the 2021 EIS document (Atlantic Gold, 2019). This triggers the requirement for nest monitoring and since these cameras can cover up to 24 hours, they can provide better insight into how far fledgelings are along concerning growth, as well as nest activity to determine the best times of day to monitor (Hereward et al., 2021).

The second recommendation would be to conduct additional spring point migration monitoring. In section 6.12.5.5 concerning the baseline 2015 avifauna spring migration monitoring, it is stated that there were only 12 point count stations assessed within the Beaver Dam Mine project site due to constraints from poor weather conditions (Atlantic Gold, 2021). The report indicates that the most abundant category of avifauna observed were passerines, a group that covers 7 of 9 species within the SAR listing concerning priority birds. Contrarily, section 6.12.5.4 of the 2021 EIS indicates that there were 32 point counts during the baseline 2014 fall migration monitoring (Atlantic Gold, 2021). Once again, passerines were the more abundant species observed. While the method of point count survey logistics varies from species, sample time (time of year, time of day), and sample size, the survey also relies on spending additional time in areas when fewer points are involved to boost monitoring efficiency (Savard & Hooper, 1995). The main concern here is survey consistency and efficiency. Therefore, it is suggested that the proponent conduct additional monitoring to reduce any ambiguity present surrounding the survey methodology.

11. Priority vascular plants

11.1 Background

Vascular plants provide essential benefits in terms of nutrient, water, and carbon cycling within forest ecosystems (Merchant, 2016). When the scope of vascular plants is refined, even more, there can be species-specific benefits towards the habitat that they encompass, specifically those near wetlands and waterbodies (Ström et al., 2005). These functions will continue to be of increasing importance as climate change continues to escalate. Vascular plant surveys were conducted within 5 kilometres of the project site in the spring of 2015 and fall of 2016 to encompass as wide of scope necessary to verify as many species as possible (Atlantic Gold, 2021). Additional surveys were also conducted between these periods, all surveys prioritizing habitat types and priority species (SAR and SOCI).

The 2017 Beaver Dam Mine EIS report indicated that there were no priority vascular plants listed as species at risk or species of concern present within 5 km of the project area and this did not change in the two revised EIS documents that proceeded it (Atlantic Gold, 2017). Within the Beaver Dam project area, there were a total of 294 different species of vascular plants. While there were no species at risk identified within the site, there were five species of concern located within the parameters of the project area: Wiegand's Sedge (*Carex wiegandii*), Lesser Rattlesnake Plantain (*Goodyera repens*), Southern twayblade (*Listera australis*), Appalachian polypody (*Polypodium appalachianum*), and Highbush blueberry (*Vaccinium corymbosum*) (Atlantic Gold, 2021). As these species were not at risk, they were designated of concern through the provincial classification.

It should be noted that there were three species that, while not at-risk, were also listed as potential present species with varying levels of concern. These plant species were the following based on the 2017 Beaver Dam Mine EIS: redroot (*Lachnanthes caroliniana*), spotted pondweed (*Potamogeton pulcher*), and black ash (*Fraxinus nigra*). The conservation statuses given to these species were provided through the Nova Scotia Endangered Species Act (NSESA) registry list, associated the following designations with the three species respectfully: NSESA vulnerable, NSESA vulnerable, and NSESA threatened (Government of Nova Scotia, 2017). Additionally, the ACCDC ranking of black ash is considered a location-sensitive species, once again omitting the sighting locations from the proponent (ACCDC, n.d.).

11.2 Evaluation

In terms of legibility, the same pitfalls that occurred with the priority birds/priority avifauna sections did not seem to occur to the same extent in the vascular plant section. Instead, the concern lies with the fact that priority vascular plants and priority lichens share a lot of the same sections regardless of the information being presented, such as section 6.10.6.2 of the 2017 Beaver Dam EIS document. The report sorted the information relatively well, but there remains concern in the way some information was displayed, such as the priority vascular plant information appearing under the heading "Priority Vascular Flora Species" in section 6.10.3.2 of the statement. These kinds of documents are already difficult enough to interpret to the average reader therefore having different titles of subjects when addressing relevant information can create confusion.

This confusion does not change in the 2019 Beaver Dam Mine EIS document, as priority flora information concerning both lichens and vascular plans is present within section 6.10, dedicated to habitat and flora. The conglomeration of priority lichens and priority vascular plants continues in this document and with this being a persisting issue, it may have been more efficient to designate this section simply as priority flora since little effort has been made to separate the two. This seems to be a commitment made by the proponent as there is little change when reviewing the 2021 Beaver Dam Mine EIS report. Concerning the VC, there were a lot of valuable mitigation measures included within the most recent revision of the EIS regarding priority vascular plants. One mitigation measure appeared in the form of checking machinery over after travelling near areas with potential exposure from invasive species. Additional monitoring for invasives will be even more crucial due to the travel frequency of heavy machinery throughout the project area.

11.3 Recommendations

The recommendation is to consider a recording procedure and decontamination protocol to put into place for machinery operating and travelling near areas with recorded invasive species. While the current mitigation strategies listed in Table 9.1-1 of the 2021 Beaver Dam Mine EIS report intends for invasive monitoring to reduce the risk of introduction (Atlantic Gold, 2021), the use of decontamination spray for undersides of equipment used near sites with potentially invasive species is suggested (Miller et al., 2015). Additional recommendations are to have these reported sites readily available for operator viewings, as this will provide an understanding of potential exposure sites.

12. Fish habitat

12.1 Background

The complex nature of watersheds includes three characteristics: upland zones consisting of ground and surface water flow, riparian zones with shade or surface water runoff, and surface water bodies that provide habitat, food, and residence for aquatic fish, invertebrates, and plants (Provincial Aquatic Ecosystems Technical Working Group, 2020). Human activities, such as mining development, have the potential to degrade riparian zones, decrease or increase surface water flows, and increase sedimentation or erosion near waterbodies. Resulting impacts from these changes may result in changes to food webs within the aquatic environment and thus may pose Harmful, Alteration, Disruption, or Destruction (HADD) to fish or fish habitat. Habitat conversion or degradation and fragmentation are the primary drivers of fish population decline in Canada (Kanno & Beazley, 2004).

Within Nova Scotia, fish assemblages are determined by water temperature where species populations will differ between cold-water, cool-water and warm-water habitats (Kanno & Beazley, 2004). Thus, the temperature of receiving environments is an important consideration for fish and fish habitat sampling and mitigation. Additionally, acidity and lake-surface area changes have been found to impact fish community size and composition in Nova Scotia (Peterson & Martin-Robichaud, 1989).

The Beaver Dam Mine Project is located within the West River Sheet Harbour Watershed. The West River Sheet Harbour (WRSH) watershed (see Appendix II Fig 3) is located within the Southern Upland region of Nova Scotia and has two main tributaries: the Killag River and Little River (AMNS, 2021, Appendix J.2). Notably, the Killag River is a tertiary river that is considered to be an important spawning area for the Atlantic salmon (*Salmo salar*) (Ducharme & Jansen, 1973). Other fish species present in WRSH include *Salvelinus fontinalis* (Brook trout), *Anguilla*

Rostrata (American eel), *Catostomus commersoni* (White sucker), *Perca flavescens* (Yellow perch), *Ictalurus nebulosus* (Brown bullhead), *Couesius plumbeus* (Lake chub) and *Fundulus diaphanous* (banded killifish) (Halfyard, 2007). The Cameron Flowage is the primary receiving waterbody from the Beaver Dam mine site prior to draining towards the Killag River (AMNS, 2021, p.6-57). Reports of very low pH have been found in the West River. Reports indicate that Atlantic salmon angling landing reached as high as 600 fish annually; however, flooding in the East River in 1971 led to effluent discharges from a nearby paper and pulp mill. This event led to highly acidic conditions (pH levels of 4.9) and an acid management plan and strategy was implemented in 1995 (O'Neil et al., 1996).

The proponent conducted Baseline fish and fish habitat testing in two separate sampling programs: 2015-2017 Baseline Report occurred in September 2015 and June 2016 within PA and 2019-2020 Baseline Report surveying conducted in July and August 2019 and December 2020 (AMNS, 2021, p-438). These surveys identified the presence of 11 fish species, matching previous records of species recorded in the area (Halfyard, 2007). The 2019-2020 field program identified suitable spawning habitat within the Cameron Flowage for generalist species (AMNS, 2021, p-59). The programs followed *Standard Methods Guide for Freshwater Fish And Fish Habitat Surveys In Newfoundland And Labrador: Rivers & Streams* (Sooley et al., 1998) and key diagnostic feature of fish habitat for watercourses in the Fish Habitat Assessment Area are included within Table 6.9-2 of the EIS (AMNS, 2021, p. 6-464).

Fish and fish habitat baseline studies conducted in the 2019-2020 fish sampling identified the presence of *Anguilla rostrata* (American Eel), *Fundulus diaphanus*) (Banded killifish), *Salvelinus fontinalis* (brook trout), *Ictalurus nebulosus* (brown bullhead), *Notemigonus crysoleucas* (golden shiner), *Couesius plumbeus* (lake chub), *Pungitius pungitius* (ninespine stickleback), *Catostomus commersoni* (white sucker), and *Perca flavescents* (yellow perch) at Mud Lake/WC27. The species diversity in this watercourse is higher than the other surveyed areas. This specific area is predicted to experience reductions in flows due to stockpiles placement and "influence of the open pit on roundwater flow patterns" (AMNS, 2021, 6.7.10.1, p. 6-311). The anticipated flow reduction is 18.3% end-of-mine and 13.7% post-closure (Section 6.7.10.1, p. 6-311).

12.2 Evaluation

In consideration of the present species in the watercourses and fish habitat areas, the proponent can further improve the transparency and ecological survey methodology of the fish and fish habitat surveys. As noted by the proponent, the project and proposed infrastructure likely will cause Harmful, Alteration, Disruption, or Destruction (HADD) to fish or fish habitat which requires authorization from the Department of Fisheries and Oceans under the *Fisheries Act, s. 35* (AMNS, 2021, Appendix J.3). DFO interprets HADD to include both "temporary or permanent changes to fish habitat that directly or indirectly impairs the habitat's capacity to support one or more life processes of fish" (Fisheries and Oceans Canada, 2019, s. 8.3). Thus, the importance of transparent and thorough description of fish assessment methodologies is needed.

The guidelines, *Standard Methods Guide for Freshwater Fish And Fish Habitat Surveys In Newfoundland And Labrador: Rivers & Stream,* indicate that characteristic for each section of stream/river surveyed, should be include: section length and width; water level (low, moderate, or high); water temperature; surface velocity; and gradient. Subsequent parameters may also include channel width, wetted width, and bank height (Sooley et al., 1998). While parameters such as channel width, wetted width, and dominant substrate type are all included within the Table 6.9-2 that denotes key diagnostic features of fish habitat within watercourses of the FHAA; there are no site specific temperature or pH values provided (AMNS, 2021, p 6-464). This omission raises concern as both temperature and alkalinity are important determinants of overall water quality and fish habitat suitability. Due to their significance at determining fish population health and composition, section specific levels of temperature and alkalinity are listed as required metrics in the field methods for *Nova Scotia Freshwater Fish Habitat Suitability Index Assessment* (NSLC Adopt a Stream, 2018).

Furthermore, the proponent has considered changed to water quality and quantity to be indirect impacts to fish and fish habitat (AMNS, Appendix J.2, p. 11). However, water temperature, acidity, and flow have demonstrated impacts on fish populations in the region. Additionally, the Killag River hosts an extensive salmon species recovery program (O'Neil et al., 1996). In regards to the information provided on baseline fish program surveys, additional documentation is needed to fully describe potential indirect or direct effects. The baseline fish and fish habitat surveys were conducted within only two of the three Project Area components: Beaver Dam Mine Site and the Haul Road. The proponent has included the Baseline Fish and Fish Habitat 2015-2017 Technical Report (AMNS, 2021, Appendix J.2) as well as the Fish and Fish Habitat 2019-2020 Technical Reports (AMNS, 2021, Appendix J.2) in the updated EIS but the information from the 2007 Touquoy survey is absent from consideration.

The proponent has noted that potential residual effects from erosion and sedimentation are likely to occur along the Haul Road during Construction and Closure phases of the mine (AMNS, 2021, p. 6-298). However, the Haul Road crosses three watercourses and is the primary transport route between the Project site and Touquoy mine. The project proponent has plans to construct 29 watercourse crossings and states that 12 of which are anticipated to improve fish passage due to the condition of existing culverts (AMNS 2021, Section 6.9.9, p. 6-553). Detailed fish Long-term mining transportation corridors require sufficient considerations for factors such as sedimentation, potential spill of ore or petroleum products from vehicles, and increased access from the public. Additionally, the proposed addition of the haul road may lead to increased public access in the area, particularly in the form of ATV vehicles. This access has the potential to lead to increased angling or use of existing fishing sites. In British Columbia, core aquatic ecosystem indicators include road densities and stream crossing densities (Provincial Aquatic Ecosystems Technical Working Group, 2020). Due to the extent of proposed activities with water crossings, consideration of stream crossing and road densities should be included within the assessment of aquatic ecosystem, in particular fish habitat.

12.3 Recommendations

The proponent has indicated that several watercourse crossings will be required to support the proposed projects. To ensure that these crossings do not pose HADD for fish and fish habitat, the proponent should adhere to the *Fisheries and Oceans Canada's Guidelines for Watercourse Crossings in Nova Scotia* to ensure the free passage of fish. In the development of the Aquatic Effects Monitoring Plan (AEMP), these guidelines should be considered particularly for crossings along the Killag River due to the presence of fish species, in particular the Atlantic Salmon. DFO outlines measures to protect fish habitat that include maintaining riparian vegetation, ensuring fish passage, limiting sedimentation, preventing entry of deleterious substances in water (Fisheries and Oceans Canada, 2019b).

Unlike cool water or warmwater rivers and streams, coldwater streams that experience habitat degradation may result in increased species richness (Lyons et al., 1996 as cited by Kanno & Beazley, 2004). Researchers caution that an understanding of existing populations is necessary to conclude accurate and ecologically significant changes to fish community composition. DFO is responsible for ensuring that proponents have implemented plans to compensate the loss of fish habitat. However, effects from metal mining and effluent require monitoring to ensure that mine waste is properly disposed of. In a report from the Auditor General of Canada, it was found that Fisheries and Ocean Canada monitored only 60% of the compensation plans for tailings impoundment areas that used existing bodies of water Continued compliance monitoring of fish and fish habitat should occur (2019). Additionally, this report identified that reporting on metal mine compliance in regards to fish and fish habitat was incomplete (Office of the Auditor General of Canada, 2019). There is potential for improvements for both the federal government and the proponent regarding risk-based analysis and consideration of fish and fish habitat loss. Monitoring should minimum occur during the construction, operation, and reclamation of the site.

Due to significance of pH and temperature effects on fish, the proponent should adhere to the *Metal and Diamond Mining Effluent Regulations* which state that final discharge point grab samples should test for pH and temperature between 24 hours and one week (12(1)). Additionally, temperature and pH characteristics of the watercourses identified as having potential indirect or direct impacts should be denoted clearly within tables that describe the reaches and fish support potential. This would support future water quality monitoring efforts to clearly demonstrate any changes to receiving waterbodies that may pose as HADD.

Lastly, for scientific transparency, fish habitat and fish baseline data collected at the Touquoy Mine site should be included as an Appendix to the recent submission of the EIS. The Touquoy Mine site will be the site of processing and subaqueous tailings disposal. The fish and fish habitat baseline study conducted in 2007 at the Touquoy Mine site is likely out of date due to prevailing climate change considerations. Within Nova Scotia's Eastern shore watersheds, the effects of acidic rainfall and acidification of soils have affected freshwater productivity and impacted fish species (Montgomery et al., 2020). Baseline conditions should assessed in keeping with both the *Nova Scotia Freshwater Fish Habitat Suitability Index Assessment* and *Standard Methods Guide for Freshwater Fish And Fish Habitat Surveys In Newfoundland And Labrador: Rivers & Stream.*

13. Spatial boundaries for cumulative effects

13.1 Background

Per federal legislation, an impact assessment must take into account "any cumulative effects that are likely to result from the designated project in combination with other physical activities that have been or will be carried out" (*Impact Assessment Act*, SC 2019, c 28, s 1, s 22). Cumulative effects assessments aim to assess effects over a larger (regional) area and from both past and future projects in addition to considering effects to VCs through interactions of impacts and actions (Hegmann et al., 1999). Specific VCs related to airsheds or watersheds span larger spatial scales and have complex interactions across many pathways. The initial steps of conducting a CEA require that a proponent identify both spatial and temporal boundaries for VCs. The proponent has identified a Project Area (PA) where "Project activities may occur and are likely to cause direct and indirect effects to VCs" (AMNS, 2021, S. 5.5.2). This area was utilized to conduct baseline studies and includes the Beaver Dam Mine site, Haul Road, and the Touquoy Mine site. The local assessment area (LAA) is defined as the area where project activities are likely to have indirect effects on the VCs, and the proponent notes that variation may occur in this spatial delineation due to biological or physical aspects of the VC (AMNS, 2021, S. 5.5.2). The regional assessment area (RAA) is defined as "all Project and VC interactions including diffuse or longer-range effects" and also is described as varying for each VC dependent upon biophysical attributes.

According to guidelines established under CEAA, 2012, there are four methods for determining spatial boundaries for cumulative effects: VC centered boundaries, ecosystem-centred, activity-centered, and administrative or human-made centred boundaries. The latter two are not recommended as they may fail to consider environmental effects acting on a VC (Impact Assessment Agency ofCanada, 2018).

The proponent has included the valued components (VCs) that were determined to have adverse effects from the environment assessment portion within the cumulative effects assessment (CEA). These valued components are: noise, air, light, surface water quantity and quality, fish and fish habitat, ground water quality and quantity, species of conservation interest and species at risk, and the Mi'kmaq of Nova Scotia (AMNS, 2021, p. 8-1). The two VCs excluded from the CEA were geology, soil and sediment quality, and physical and cultural heritage due to the determination that no adverse residual effects or other projects or activities were identified within the spatial boundaries (AMNS, 2019, S. 8.3, p. 633).

13.2 Evaluation

In response to Information Requests, the proponent has stated that both spatial and temporal boundaries will be considered for each selected VC individually. This approach is in line with recommendations for CEA as limitations may arise if boundaries are set on a jurisdictional basis (Hegmann et al., 1999; Impact Assessment Agency ofCanada, 2018).

The proponent reasons that the spatial boundaries for PA, LAA, and RAA, established within the environmental effects assessment are appropriate for determining cumulative effects (Section 8.4.2.1). However, there are limitations to this methodology as cumulative effects by nature extend past spatial and temporal boundaries. Yet, CEA guidelines note that consideration of all potential impacts of a project may be inefficient and impractical, thus experienced judgement must be applied in determining these boundaries (Hegmann et al., 1999). The Magino Gold Project, proposed by Prodigy Gold Incorporated in Ontario in 2017, underwent a federal review under CEAA, 2012 and was required to revise their cumulative effects considerations for the project. To improve the rationale and designation of the cumulative effects, the proponent was required to justify reasoning for spatial and temporal boundaries for the VCs (Magino Gold, 2017). The approved project described cumulative effects based on a VC-centered approach with concerns for zones of influence (ZOI). This methodology is comparative to the methods described by AMNS as each VC underwent consideration, rather than adhering to jurisdictional boundaries.

The proponent identified that the location of the Touquoy Mine site was within the boundaries of the Regional Assessment Area, and thus outside of the scope for the Local Assessment Area where FHAA surveys were conducted (AMNS, 2021, p.6-481). Considering that ore and tailing will be transported to this location via the Haul Road, the spatial boundaries set for both indirect and direct effects to this VC are questionable. Additionally, AMNS has other proposed projects, Cochrane Hill and Fifteen Mile Stream, that will intend to utilize the Haul Road and Touquoy mine site for processing and deposition. Presumably, cumulative effects on nearby surface water quality and quantity and fish and fish habitat from these projects is likely due to the increased usage of the road and mine site. Another area of consideration is the air quality monitoring stations cited within Section 6 of the EIS. The nearest monitoring station is the Lake Major Ambient Air Quality site, located 70 km away and thus detection of potential contaminants of concern is limited, see Appendix II Fig. 4 for the provincial monitoring stations.

According to Table 8.3-1, the spatial boundaries for cumulative effects for air, surface water quality and quantity, and groundwater quality and quantity were listed as the same for Project effects (AMNS, 2019). See Appendix II Fig. 5 for the RAA of groundwater features. In other words, the proponent has limited the spatial scales to areas only with the identified indirect or direct impacts identified within baseline conditions from the PA.

13.3 Recommendations

The proponent has made efforts to describe rationale for cumulative effects assessment that are generally in line with other projects approved under CEAA, 2012. However, concerns regarding VCs that span larger regional distances, such as airshed and watersheds, exist. The Agency should question the rationale used to limit the environmental assessment of all PA components for fish and fish habitat. Omitting this section of the PA from the spatial boundaries for the fish and fish habitat environmental assessment limits the potential to identify baseline conditions that may be later impacted by the proposed activities and infrastructure of the Beaver Dam Mine Project. The Agency should request additional environmentally defensible rationale for the boundaries set for the watershed and air quality VCs specifically. Site specific air quality monitoring is needed to ensure that detection is earlier than relying on distant air quality monitoring stations. Additionally, the proponent should ensure that the fish and fish habitat environmental assessment testing occurs in areas of the PA, including the heavily trafficked Haul Road.

14. Wetlands

14.1 Backgroundand evaluation

Within the proposed project area, AMNS has identified a total of 179 wetlands associated with the Beaver Dam Mine Site and the Haul Road that were classified as either: (1) wetland complex, (2) treed or shrub swamps, (3) bog, (4) fen, or (5) marsh (Atlantic Gold, 2021). All wetlands identified in the project area were assessed and were determined as having high plant community integrity. This indicated that all wetlands were mostly composed of native species, with minor non-native species findings. AMNS has stated that the project has been designed to avoid wetlands where possible. However, due to the nature of the project activities and fixed location of the gold ore, wetland avoidance was limited. It was anticipated that 20 wetlands would be completely lost, and 24 wetlands would have partial loss in the Beaver Dam Mine Site, resulting in an estimated total direct impacted area of 221 080 m^2 (Atlantic Gold, 2021). Additionally, in the Haul Road area it was anticipated that one wetland would be completely lost, and 62 wetlands would experience partial loss, resulting in an estimated direct impact area 23 565 m^2 (Atlantic Gold, 2021). Many of the impacted wetlands were identified as habitats for species at risk. AMNS identified that 36 hectares of these species at risk habitat wetlands would need to be compensated or offset (Atlantic Gold, 2021). The majority of the direct impacts to these wetlands was anticipated to occur mostly during the construction phase of the project, associated with clearing, grubbing, infill, and development of the mine and its associated infrastructure (Atlantic Gold, 2021).

Section 6.8.8.2 outlined the wetland mitigation measures intended to be taken by AMNS "to mitigate and reduce overall loss of function of wetland habitat… where direct impacts and potential indirect impacts to wetland habitats are expected" (Atlantic Gold, 2021, p. 6-426). The EIS report outlined mitigation measures that would be taken throughout the lifespan of the project that would be confirmed through monitoring of the impacted wetland areas, as described in the Wetland Compensation Plan found in Appendix H.3.

Two methods were provided within the section of Appendix H.3 describing monitoring activities, which were visual habitat surveys and vegetation plots. While sampling and surveying vegetation in wetlands are common methods of evaluating and assessing restoration and mitigation projects (United States Environmental Protection Agency, 2002), there are concerns regarding the details and considerations given to the vegetation surveys suggested in the Wetland Compensation Plan. Vegetation plots as described in the plan are intended to be 5 metres by 5 metres, which does not align with plot size recommendations found in academic literature or government guidelines. In a report outlining guidelines for evaluating wetland condition, the United States Environmental Protection Agency (2002) outlined that vegetation plots should be at least 10 metres by 10 metres. This is especially recommended for plots that are used to assess woody plants, such as the shrubs and trees that are targeted for assessment in the Beaver Dam plots. Even larger plots have been used in academic literature. In a study by Andrew, Moe, Totland, and Munishi (2012) investigating the impact of different factors on plant function groups within a wetland setting, survey plots used measured 20 metres by 50 metres. Further, in their study assessing habitat quality of the threatened Least Bittern in created wetlands, Chabot, Carignan, and Bird (2014) used survey plots with a 50 metre radius. Additionally, there have not been any details regarding the intended number of plots or survey area size for this method in the plan. Existing literature has identified the need for at least 400 m^2 – 1000 m^2 to adequately characterize woody plant communities (USEPA, 2002). Additionally, the number of survey plots recommended in existing literature was 40 plots, after which diminishing returns on identifying special richness begins (USEPA, 2002). Based on these findings, the wetland monitoring methods currently proposed would not adequately assess the success of mitigation measures and the proponent should alter their methodology to better capture the actual effects of their restoration actions.

Section 6.8.3.4 outlines the use of the NovaWET 3.0 wetland evaluation technique to assess the various functions of each wetland found within the project area (Atlantic Gold, 2021). The major functions identified were:

- Watershed Characteristics
- Wetland Characterization
- Condition and Integrity of Adjacent Land
- Identification of Exceptional Features
- Hydrologic Condition and Integrity
- Water Quality
- Groundwater Interactions
- Shoreline Stabilization and Integrity
- Plant Community
- Fish and Wildlife Habitat and Integrity
- Community Use/Value

Wetlands are valued for the numerous functions that they provide for their surrounding ecosystems (Mitsch & Gossilink, 2000). However, when outlining the key wetland functions for monitoring and restoration in the Wetland Compensation Plan, consideration has only been given for the restoration of the function of wildlife habitat. This is despite a thorough characterization of functions for each wetland found the project area, summarized in Section 6.8.4.1 of the EIS (Atlantic Gold, 2021). In other projects, much more consideration has been given to the restoration of other wetland functions, in addition to wildlife habitat. In the Wetland Compensation Plan prepared by Aurora LNG (2016), functions considered in the plan included wildlife habitat, as well as hydrological (such as surface and subsurface water storage, groundwater recharge and discharge, surface flow moderation) and biogeochemical functions (such as carbon sequestration, water quality improvement, excess nutrient reduction). Inclusion of all functions of impacted wetlands and the description of the proposed measures to offset these lost functions have been identified as an important component of wetland compensation plans in the Wetland Compensation Guidance document from the Province of New Brunswick (New Brunswick Department of Environment and Local Government, 2020).

The Wetland Compensation Plan found in Appendix H.3 is focused on the restoration of breeding and foraging habitats in potentially impacted wetlands for four specific species at risk (Atlantic Gold, 2021). These species were the three landbird species, Canada warbler (*Cardellina canadensis*), olive-sided flycatcher (*Contopus cooperi*), and rusty blackbird (*Euphagus carolinus*), and the snapping turtle (*Chelydra serpentina*). Although only four species at risk were considered in the designing of the compensation plan (Atlantic Gold, 2021), there were a number of other species at risk identified as potentially being impacted by the removal of wetlands (Table 3) from the project area in the EIS that were not considered.

Table 3: Species at risk potentially impacted by wetland removal.

Terrestrial species	Mainland moose – *Alces alces americana*
Fish	Brook trout - *Salvelinus fontinalis*

	American eel - *Anguilla rostrata* Atlantic salmon – *Salmo Salar*
Vascular plants	Wieland's sedge - *Carex wiegandii* Lesser rattlesnake plantain - *Goodyera repens* Southern twayblade - *Listera australis* Appalachian polypody - *Polypodium appalachianum* Highbrush blueberry - *Vaccinium corymbosum* Nova Scotia Agalinis – *Agalinis neoscotica*
Lichen	Blistered jellyskin lichen - *Leptogium corticola* Blistered tarpaper lichen - *Collema nigrescens* Blue felt lichen - *Pectania plumbea* Boreal felt lichen - *Erioderma pedicellatum* Frosted glass-whiskers lichen - *Sclerophora peronella* Peppered moon lichen - *Sticta fuliginosa* Eastern candlewax lichen – *Ahtiana aurescnes* Slender monk's hood lichen – *Hypogymnia vittata* Salted shell lichen – *Coccocarpia palmicola* Powdered fringe lichen – *Heterodermia speciosa* Fringe lichen – *Heterodermia neglecta*

In section 6.8.8.2 of the updated 2021 EIS, AMNS included consideration for the blue felt lichen, stating that there would be the option for the "translocation of blue felt lichen from WSS WL17, where direct and indirect effects are expected (as described in Appendix H.3)" (Atlantic Gold, 2021, p. 6-427). However, no such details have been included in the updated plan of Appendix H.3. This lack of consideration for other impacted species at risk, and the incongruity between the Wetland Compensation Plan and the EIS are significant issues that should be addressed by the proponent.

In section 2.4 of the Wetland Compensation Plan outlining the wetland restoration monitoring program, reference is made to the use of known performance indicators (Atlantic Gold, 2021).

These known indicators are intended to help define monitoring timelines and develop adaptive management strategies based on the results of annual reporting. Despite their importance and acknowledgement, there are no such indicators listed in the Wetland Compensation Plan. A common indicator that has been identified in academic literature has been the presence of different species. In a study of wetland restoration success by Gonzalez, Rochefort, Boudreau, and Poulin (2013), the presence of different species was associated with an increased likelihood of wetland restoration success or failure. Specifically, the researchers found that typical wetland bryophyte (*Sphagnum rubellum* and *Mylia anomala*) and tree (*Picea mariana*) species were commonly found in successful wetland restoration sites during mid-successional restoration stages. On the other hand, they had found that bare peat, lichen, and one species of ericaceous shrubs (*Empetrum nigrum*) found during these mid-successional stages were common of less successful sites and a decreased chance of restoration success. This study took place over 10 years. However, it is possible that restoration monitoring could take many more years. A study by Mitsch and Wilson (1996) highlighted that proper wetland mitigation monitoring did not have a set duration and could take upwards of up to 20 years. Monitoring programs of such long duration would require extensive resources and persistence to ensure that wetland restoration measures have helped achieve wetland offsetting goals.

14.2 Recommendations

The proponent should:

- Include list of wetland restoration monitoring indicators in the Wetland Compensation Plan to help estimate possible monitoring timelines and the required resources to fulfill wetland restoration obligations.
- Include considerations in the Wetland Compensation Plan for wetland habitat restoration of all potentially impacted species at risk identified in the EIS and ensure that the information provided in each document is consistent with one another.
- Identify in the Wetland Compensation Plan all wetland functions listed in the EIS for each impacted wetland that will be lost due to project activity and the measures that will offset the function losses.

- Increase the size of vegetation survey plots from 5x5m to at least 10x10m and ensure that there are 40 survey plots used in surveying for proper vegetation identification and assessment.

15. Priority Invertebrates

15.1 Background and evaluation

Section 6.13.4.7 discussed the impact of the Beaver Dam Mine project on the priority invertebrates valued component within the project area (Atlantic Gold, 2021). Based on the findings of their analysis, no evidence of species designated as 'location sensitive' were documented. Similarly, no priority damselfly or dragonfly species or aquatic invertebrate species were identified throughout the project area. A list of eight priority invertebrate species were identified as having elevated potential to be found in the project area. These species included:

- Monarch (*Danaus plexippus*)
- Skill clubtail (*Gomphus ventricosus*)
- Triangle floater (*Alasmidonta undulata*)
- Pepper and salt skipper (*Amblyscirtes hegon*)
- Common roadside-skipper (*Amblyscirtes vialis*)
- Baltimore checkerspot (*Euphydryas phaeton*)
- Grey comma (*Polygonia progne*)
- Striped hairstreak (*Satyrium liparops*)

The methodology to determine baseline priority invertebrate species was found in section 6.13.3.2.7 of the EIS (Atlantic Gold, 2021). This section highlighted the use of a desktop review for the identification of possible priority invertebrate species within the project area. The review used data from different resources such as Odonata Central, the Maritime Butterfly Atlas, and the Atlantic Canada Conservation Data Centre. However, with the exception of the aquatic invertebrates, this desktop review constituted the only review of potential priority species within the project area. This does not align with available EIS guidelines that suggest that proponents should take the appropriate technical staff to properly assess and survey project areas (Toronto and

Region Conservation Authority, 2014). Meeting this field survey guideline is not uncommon, as there are examples of proponents who have followed through with similar actions. In their EIS of the Blackwater Gold Project, New Gold Inc. (2015) had established the baseline presence of invertebrate species within the project area through a series of field surveys that spanned two years. A desktop review may not provide enough insight into the possible presence of priority invertebrates within the project area and the project would benefit from field surveys being conducted during appropriate times of the year, when species are most likely to be in their adult lifecycle stage. Conducting such surveys would provide a more definitive understanding of the invertebrate species that may be impacted by activities in the project area.

15.2 Recommendations

The proponent should conduct field surveys to sample for priority invertebrate species in the project area during the most appropriate times of the year to gauge their presence.

16. Lichen

16.1 Background

Eleven species of SOCI or SAR lichens were found during a series of lichen surveys completed February 19th – May 23rd 2015 and September 18th - October 29th 2018 by the proponent. Among those, occurrences of Blue Felt Lichen, *Pectenia plumbea*, were observed 33 times (Atlantic

Mining, 2021a, p.720). Seventeen occurrences were observed in the Beaver Dam Mine Site, 12 in the broader LSA, and four were found along the Haul Road where construction is required (Atlantic Mining, 2021a, p.720). The proponent notes that where direct impacts on SAR lichens cannot be avoided, the lichen mitigation and monitoring plan will be implemented (Atlantic Mining, 2021a, p.425). The lichen mitigation and monitoring plan is composed of a brief description of some aspects of lichen biological requirements, the observed SAR lichens, and a translocation and monitoring program. This mitigation and monitoring plan has been proposed in response to the direct impact on two occurrences of Blue Felt Lichen (*Pectenia plumbea*) that exist within the immediate footprint of the mine: one within the proposed non-acid generating stockpile, and another within the proposed crusher pad (Atlantic Mining, 2021b, p.9). Five other observations that are considered indirectly impacted by the project will be considered for transplanting on an occurrence-specific basis (Atlantic Mining, 2021b, p.9).

16.2 Evaluation

The main portions of concern within the mitigation and monitoring plan are sections 5.1.1 *Lichen Translocation Feasability*, and 5.2.1 *Proposed Monitoring Approach*. These sections are riddled with inaccuracies, misrepresentation of the results of several papers, and use out-of-date literature. The proponent opens this section mentioning an article published by Smith (2014) to frame the usages of transplantation of lichens as a viable option for conservation management. This study not only includes successful stories of transplantations, but also failures and methodologies used for transplantation – it is simply an overview of the research thus far (as of 2014). This study provides an overview of not only transplantation of epiphytic foliose lichens, but also terricolous and saxicolous species, all in pursuit of understanding 'the environmental influences on lichen form and vitality'; not to establish new colonies (Smith 2014, pp.18). The first study used to provide the justification of the feasibility of this plan, by Sonesson et al. (2007), observed the results of an 8-year transplantation experiment conducted on terricolous lichens. The proponents themselves recognize 'Understanding species-specific lichen biology and habitat requirements is important to develop a lichen translocation and monitoring plan.', (Atlantic Mining, 2021b, pg. 4). Using a study examining the physiological effects of transplanting on a select species of terricolous lichen to justify transplantation of a sensitive epiphytic species is not considering these individual requirements. At the very least, studies examining the viability of transplants of lichens that have the same substrate type and growth form (epiphytic foliose) should be considered exclusively. This established, Sonesson et al., despite being a scientifically robust study, should not be mentioned.

Most of the studies used to rationalize the feasibility of lichen transplants use a temporal scale within their studies of ~14 months, with the longest period being 25 months (Hazzel & Gustafsson, 1999; Hilmo 2002; Sillett & McCune 1998). Using studies with such a small temporal scale as a reference for the feasibility of long-term transplants is hardly advisable in cases where these organisms will be spending the rest of their lifespans in their transplanted locations. This was not the case in many of these studies, where only the physiological responses to habitat change were recorded, and the thalli were promptly removed after experimentation. In the case where this did not happen, Gustafsson et al. returned to the site 14 years later in 2012 and found that only 23% of the 1120 transplants originally planted in 1994 were still extant. The proponents cite this article yet neglected to include these results. In fact, the document seems to confuse the temporal scale of the articles by Hilmo (2002) and Gustafsson et al. (2012) – stating that Hilmo's study lasted 14 years, when it only lasted 14 months. The proponent, citing the later article by Hazzel and Gustafsson, opts instead to include the survival rate stated in the earlier 1999 article. Using the results of a study that lasted 25 months to justify the transplantation of thalli to be monitored for the length of the operations life does not seem as congruent as using the results of a study with a longer interval. Further misconstruing the data from this study, the proponent places the proportion of transplants which survived the experiment at 89%, when in fact it was 85% (Hazzel & Gustafsson 1999). All of this suggests that the shorter 14-25 month period in which the other studies suggested a successful transplantation may not have been long enough to truly observe the viability of the transplants. To quote Sillett & McCunes' interpretation of their results in 1998, 'our results must be interpreted with caution because of the limited spatial and temporal scales of the observations', (Sillett & McCune 1998, p.28). Their results were the growth rates of lichen species after one year of being transplanted in young forest, compared to growth rates of those left in old growth stands (Sillett & McCune, 1998).

In justifying the graduated approach of the monitoring plan, the proponent suggests the maximum modeled deposition levels along the Haul Road, specifically three sections, (R1, EC, STP), are insufficient to damage lichen populations (Atlantic Mining 2021b, p.14). 'Along these sections the maximum predicted deposition rate is 0.4 g/m²/day (136 g/m²/year) from Project related activities. This rate is below the dust deposition threshold of 1.0-2.5 g/m²/day where lichen species decline was observed in Farmer (1993).', (Atlantic Mining 2021b, pg.14). Farmer (1993) makes no mention of 'dust deposition thresholds' in lichens. Instead, the 1.0 – 2.5 g/m²/day estimate refers to the point where declines in health were noticed in *Sphagnum lenense*, (Farmer 1993, pg.). *Sphagnum lenense* is not a lichen species. It is a bryophyte – a completely different type of organism, which would have a different response to dust deposition. Watkinson et al. (2021), however, found that effects in lichens were seen as far as four kilometers from a diamond mine in the North West Territories, and those communities within 500m of the mine had a disproportionate amount of vascular plant cover and decreased lichen and bryophyte cover, (Watkinson et al. 2021). A study conducted in the Alaskan taiga and tundra noted that significant kill-off of ground lichen species were observed up to 70m from a gravel highway road, even in a zone wherein dust deposition reached a minimum of 0.06g/m2/day – and epiphytic species were observed to have experienced much worse, (Walker and Everett, 1987). If this is the case, though the critical load threshold of these species is not known, it is likely that effects will be seen in those occurrences even 125m from sources of fugitive dust emissions, where dust deposition is projected to reach 0.05g/m2/day. This entails that the current 100m setback from these sources is simply not enough.

16.3 Recommendations

Nova Scotia Environment and ECCC should reject this mitigation and monitoring plan for lichen wholesale. The supporting literature, and thus justification of the plan is misrepresented. Their results are either mismatched with the wrong literature, temporal scale misreported, or results reported incorrectly. This sets an incredibly poor precedent for this mitigation plan. The temporal scope of the monitoring plan is unsupported and should be expanded to a reasonable amount of time post-closure. With any indication from the existing literature, monitoring should at the least extend to 14 years after transplantation. It is evident the proponent has not done everything in its power to consider all the evidence to support the mitigation measures proposed. It is recommended that the proponent rewrite the mitigation and monitoring plan to include the correct results of each piece of literature and consider all bodies of evidence supporting a sufficiently feasible methodology of transplanting sensitive epiphytic lichen species.

Further, the setback distance of those occurrences of Blue Felt Lichen nearest sources of fugitive dust emissions exceeding 0.05g/m²/day should be increased to at least 125m from 100m. If the translocation of these species cannot be proven feasible and no form of mitigation is possible, the proponent should purchase land that is considered good lichen habitat equating double that area they intend to disturb. This land would then be protected under the *Wilderness Area Protection Act* or *Special Places Protection Act*. This sort of land purchase for environmental compensation is already performed in Nova Scotia when wetlands are altered or destroyed during development (Nova Scotia Environment and Climate Change, n.d.). Therefore, a 2:1 ratio protection of identified critical habitat for Blue Felt Lichen should be considered in the compensation of these lost occurrences, equating to double the minimal-management 100 metres an occurrence is given, as provided in the 2020 COSEWIC Management Plan (COSEWIC 2020, Section 6.1). This should be completed in consultation with lichen ecologists and experts, as to provide the best possible protected habitat for these species. As well, considering the relevant literature on the effects of dust deposition on lichen species, a focus report should be produced by the proponent in consultation with lichen experts to examine the effectiveness of mitigation plans for those occurrences predicted to be impacted by dust deposition.

17. Protected Areas

17.1 Background

There are two Protected Natural Areas (PNAs) within 1 kilometer of the project area, and they are not considered as a Valued component (VC). Tait Lake, a wilderness reserve, provides habitat for the endangered mainland moose, and incorporates four kilometers of frontage on the Killag River, which provides critical habitat for Atlantic Salmon, (NS Protected Areas 2017). The Ship Harbour Long Lake Wilderness Area is also adjacent to the Touquoy Gold Mine, wherein the tailings from the Beaver Dam Mine site will be taken to the exhausted open pit, which further lies adjacent to Moose River. This watercourse feeds directly into several wetlands of special significance within the boundaries of the wilderness area. The proposed haul road also runs adjacent to terrestrial and wetland portions of the protected area. This zone contains 16,000 hectares of protected area, providing habitat for a multitude of species at risk, as well as providing opportunities for individuals to engage in recreational wilderness activities and nature tourism, (Nova Scotia Protected Areas 2020).

17.2 Evaluation

The Tait Lake Wilderness area is in the local area of assessment for both noise and air pollution, as well as the local assessment area for ground water, among others, (Atlantic Mining 2021a, pp.10,43,183). The Ship Harbour Long Lake Wilderness Area is also included in the project area of the haul road in Figure 6.7-2D, (Atlantic Mining 2021a, pp.229), as well as the Local Assessment spatial boundaries for noise coming from the project, and other effects (Atlantic Mining 2021a, pp.10). The proposed operations pose a significant risk, and at the least - damaging nuisance, to the flora and fauna residing within the boundaries of both protected areas. The overall ecological integrity of these PNAs are thus threatened by ongoing and proposed operations. These risks come in the form of air and noise pollution, as well as potential surface water quantity and quality problems, specifically for the Ship Harbour Long Lake Wilderness Area. Noise levels are predicted to be up to 45 dBa in portions of Tait Lake Wilderness Area. In the Ship Harbour Wilderness Area, some portions closest to the Haul Road are projected to reach 65 dBa due to road usage (Atlantic Mining 2021a, pp.17-18). Goodwin et al. found in 2011 that species of birds that vocalized in low frequencies, those frequencies that would overlap with traffic noise, were 10 times less likely to be found in noisy (44-57 dBa) areas than quieter plots. These noise levels are predicted in both the Tait Lake and Ship Harbour Long Lake Wilderness Areas because of both mine activity and haul road usage, as per figures 6.1-3a-e (Atlantic Mining 2021a, pp.14-18). These levels of disturbances will most definitely negatively affect bird populations and recreational activities, masking vocalizations in some species and causing a nuisance for human users. This level of noise will likely have a significant impact on terrestrial and aquatic species, as well as recreational activities within the PNAs – which contravenes on the *Wilderness Area Protection Act*, Section 17, subsection 2 (m).

The current threat of the exhausted open pit in Touquoy Mine to the stream flow and water quantity/quality of Moose River has not been disproven, (Office of the Minister 2021). This watercourse feeds into several wetlands of special significance, due to their presence in the Ship Harbour Long Lake Wilderness Area. Any alteration to the water quantity in this watercourse would be an alteration to any waterbodies of wetlands downstream, which the proponent predicts will occur. The proponent indicates that dewatering of the open pit at Touquoy mine will reduce the mean summer flow of Moose River by 339m^3/d, which accounts for 1.7% of the mean summer flow of 18,938m^3/d, (Atlantic Mining 2021a, p.156). Further, there is no monitoring station in the stream running from Square Lake to Scraggy Lake to monitor baseline conditions, despite there being surface water monitoring stations in watercourses immediately to the east (SW-47 and SW-46), as shown in Figure 6.7-2D (Atlantic Mining 2021a, p.222). Figure 6.7-3, which details the locations of surface water monitoring stations for the currently operating Touquoy mine, also does not indicate a monitoring station within this water course, (Atlantic Mining 2021a, p.223). A baseline surface water monitoring station in this watercourse would be essential in supplying reference data. Appendix P.5, the Aquatic Effects Monitoring Program, focuses spatially on the mine site area and sections of the haul road to be constructed. In fact, the proposed AEMP design for surface water quality, Table 4-2 in appendix P.5; proposes monitoring stations at SW-42 and SW-41, (Atlantic Mining 2021c, p.18) Specifically, there should be monitoring stations proposed downstream of SW-43 through to 47, and at the unnamed watercourse that connects Square Lake and Scraggy Lake. Sedimentation and erosion, according to the proponent, “represent the primary pathways of interaction for the Project to Surface Water along the Haul Road.” (Atlantic Mining 2021a, p.266). If this is the case, there should be monitoring stations where watercourses are likely to be affected by the existing haul road, where there will still be risks of sedimentation and erosion.

The maximum dust deposition from the project alone at site R9, the study zone adjacent to the Ship Harbour Long Lake Wilderness Area, is projected to be 116g/m^2/yr, or 0.32g/m^2/day in the proponents’ appendix, F.9, (Atlantic Mining 2021d, p.2), – well above a threshold where negative effects were observed in *Sphagnum lenense*, (Farmer 1993). Also see above that in Walker & Everett (1987), populations of lichens within 70m of a dirt road experienced severe kill-off in response to dust deposition below this level. Pursuant of the 1998 *Wilderness Area Protection Act*: article 17 subsection 2 (j) No personal shall... ‘introduce a substance or thing that may destroy or damage existing flora, fauna or ecosystems' within a protected area. The added deposition resultant of the project alone, even with an 80% dust mitigation plan, is likely to have a damaging effect on the local flora existing within the protected area. The maximum dust deposition from other projects in the area are not enough to pose a provably significant risk to flora species within the wilderness areas, however, with the added deposition resulting from this project, flora mortality and overall ecosystem degradation is likely. Details of proposed dust monitoring for the Beaver Dam Project are included in Appendix C.3 draft Fugitive Dust Control Plan, as mentioned by the proponent (Atlantic Mining 2021a, p.89). However, this form was not made available with the published documentation. The proponent must prove they have taken the proper steps to mitigate the ecological damage from dust deposition and cannot do so if they have not provided this plan.

17.3 Recommendations

The observable and potential future damages to the protected areas within an immediate proximity to the current and proposed projects are far too significant for the proponent to not consider Protected Areas as a VC. It is frankly negligent that the proponent has not supplied the necessary analyses that would ensure that proper mitigations are placed to reduce the risk or amount of damage to these ecologically and culturally important zones. The Minister requested an analysis of the potential impacts of the Touquoy Site Modifications on the Ship Harbour Long Lake Wilderness Area, as well as proposed mitigation measures from the proponent. In this request, the minister cited numerous concerns voiced by a variety of experts, (Office of the Minister 2021; Nova Scotia Environment and Climate Change 2021). It is recommended that the proponent also provide a full analysis on Protected Areas as a VC for the potential impacts from the Beaver Dam Mine Project and its corresponding components. It is further recommended that proper analysis and mitigation plans be produced in consultation with Protected Areas and Ecosystems staff, and that any observable damages or future damages be compensated with purchases of land for the sole purpose of protection under the *Wilderness Area Protection Act* or *Special Places Protection Act*. These purchases should also be done in consultation with Protected Areas and Ecosystems Staff.

18. Parks and open spaces

18.1 Background

Section 6.16.4.8 of the revised EIS (2021) assess the VC "Parks and Open Space". The health benefits associated with exposure to nature, such as parks and outdoor spaces, are well documented (Buxton et al., 2021). Beyond the health benefits associated with parks and open space, there are financial incentives to the protection and remediation of Parks and Open Spaces – "Parks and Open Space serve the tourism goals of the province and local communities" (Atlantic Mining NS Inc., 2021, p. 6-905). In Nova Scotia, unfortunately, many of these landscapes are at risk of the compounding impacts of diminishing residual forests, even in spite increasing outdoor recreation demand (Bissix, 2002). Bissix (2002, pp.42-43) characterizes this problem – "increasingly degraded forests, increasing specialization and privatization of the remaining prime forest recreation space, and more Nova Scotians as well as visitors demanding broad public access to the forest backcountry for recreation."

Formerly, the EIS included the Parks and Open Space VC under Protected Areas, Nature Reserves, and Parks (Atlantic Mining NS Inc., 2017) or Land and Resource Use (Atlantic Mining NS Inc., 2019). In the EIS (2021), Parks and Open Space are identified as a VC independent from Land and Resource Use. The Proponent defines three land use types under Parks and Open Space as: 1) Game Sanctuaries, 2) Wilderness Areas and 3) Nature Reserves. The provincially designated areas within the PA (Project Area) are summarized in Table 4.

Table 4: Protected areas with provincial designation considered in the Beaver Dam EIS (Atlantic Mining NS Inc., 2021, p. 6- 880)

Name	Approximate Distance from Project area (km)	Type
Tait Lake Nature Reserve	1.0	Nature Reserve
Twelve Mile Stream Wilderness Area	4.5	Wilderness Area
Liscomb Game Sanctuary	7.3	Game Sanctuary

18.2 Evaluation

The EIS understates the significance of the LAA's Parks and Open Spaces to the public. Anecdotal evidence from the Project's public consultation suggests these sites are valued as recreational spaces (Cosgrove, 2021; Dewolfe, 2021), and as aforementioned, Bissix (2002) attests to the growing demand for parks within the province. There is a data deficiency in the EIS surrounding relevant inventory and impacts identified. This data deficiency is a product of the Proponent:

a) not quantifying the direct or indirect impacts that will likely be associated with the Project;
b) aggregating a range of land use types in their assessment, and thus, offering assessments that are only broadly applicable to Parks and Open Spaces.

The lack of data concerning Parks and Open Spaces influences a lack of remediation efforts specific to the VC.

Nemaska Lithium is the proponent of the Whabouchi mining project – an exploration and development mine project on the James Bay territory in Québec. (Nemaska Lithium, 2013, p. 1-1). The Whabouchi mining project was selected as a case study in this report because of the depth of the Proponent's analysis of Parks and Open Spaces was a stark contrast to the analysis in the Beaver Dam Mine project. Nemaska Lithium offers a much more comprehensive evaluation despite its parks being geographically much further from the PA (and presumably at lower risk). Atlantic Gold justifies its poor evaluation of Parks and Open Spaces by explaining, "there are no protected and wilderness areas within the PA. There are Protected areas within the LAA" (Atlantic Mining NS Inc., 2021, p.6-906). Appendix III Fig. 6 is map prepared for the EIS (2021) which shows Parks and Open Spaces in proximity to the Project. As evidenced by the map, the Project is certainly within a proximity of Provincially Designated Protected areas that these areas would feel direct and/or indirect impacts, potentially altering the conditions and physical landscape of these spaces.

The Whabouchi mining project analyzes various landscapes independent from one another, namely Wildlife Reserves, Protected Areas, Biodiversity Reserves and two National Parks (Albanel-Témiscamie-Otish National Park and Assinica National Park Reserve). The Proponent proceeded to evaluate the VCs for each respective space (Nemaska Lithium, 2013, p. 9-18). In comparison, the Proponent of the Beaver Dam Mine project assesses provincially designed areas like Game Sanctuaries, Wilderness Areas and Nature Reserves broadly as “Parks and Open Space”.

Atlantic Mining does not identify any effects specific to Parks and Open Spaces. Rather the VC is interpreted broadly under the EIS regulated guidelines for noise and air (Atlantic Mining NS Inc., 2021, p.6-906). The specificity of Nemaska Lithium’s assessment offers a standard for evaluating impacts on parks and open spaces. The Proponent of the of Nemaska Lithium’s project was able to identify a host of negative cumulative effects concerning Parks and Open Spaces including:

- Increased dust and atmospheric emissions due to circulation
- Increased noise pollution
- Reduced quality of habitat; habitat disturbance during deforestation; displacement of individuals
- Increased hunting, fishing, and trapping because of improved access from construction roads (Nemaska Lithium, 2013, pp. 57-58).

These impacts are likely relevant to the Parks and Open Spaces in the Beaver Dam Mine project.

18.3 Recommendations

This report recommends the Proponent acquire more information on the site’s Parks and Open Spaces preceding construction on the Project to account for the current data deficiency. The Proponent should assess each provincially designated protected area in isolation from one another and consider the geographical extent of impacts from the Project. The Proponent must acquire field surveys and baseline condition assessments for each of the designated Parks and Open Spaces.

Additionally, despite the “Parks and Open Spaces” remaining outside the delineated PA, the Proponent should seek to identify impacts on the VC regardless. Drawing on literature and case studies not unlike Nemaska Lithium’s, developing a suite of impacts will better prepare the Proponent for future remediation and monitoring efforts. Tait Lake Nature Reserve is 1 km from Beaver Dam Mine Site, yet the Proponent does not classify it as being vulnerable to air pollutants and noise. Although the Parks and Open Spaces may not be directly impacted during construction, there are indirect impacts that pose significant risk.

19. Old forest and interior forest

19.1 Background

Beyond their inherent value, forests, particularly old forests, provide a myriad of biophysical and socioeconomic ecosystem services to humans and surrounding landscapes (Carpenter et al., 2008). Unfortunately, anthropogenic disturbances, such as development, are one of the primary threats to terrestrial species richness, habitat conversion, and fragmentation (Kuipers et al., 2021), limiting forests' capacity to provide these services.

LAA includes a range of forest types including 637.3 ha of hardwood dominant stands, 3,081.3 ha of softwood dominant stands, 668.6 ha of managed forests and 470.4 ha of unclassified forested land (Atlantic Mining NS Inc., 2021, p. 6-587). The prominent ecosites identified within the Beaver Dam Mine support vegetation types from the spruce-pine and spruce-hemlock forest groups (Atlantic Mining NS Inc., 2021, p. 6-560). The Proponent delineated 437.4 ha of forested land entitled Old Forest Unit 582 – representative of the forested land most at risk of adverse impacts from the Project (Atlantic Mining NS Inc., 2021, p. 6-593). While all forest in the LAA is vulnerable to adverse effects of the Project, Old Forest Unit 582 is understood to be directly impacted through clear-cutting and fragmentation for the construction of the Haul Road.

The Project proposes a multitude of practices during construction and operation that will adversely impact the forests within the LAA. Some risks of concern to Old Forest and Interior Forests are as follows:

- Clearing Old Growth forested land for the construction of the Haul Road, expected to be permanent with no intention of reclamation following the Project completion (p.6-603). One hundred and ten hectares of interior forest will be directly impacted (p.6-600).
- Edge effects from habitat fragmentation resulting in stress to plant communities and vegetation structure (p. 6-603)

- Dust accumulation on vegetation smothering and stressing plants and availability of minerals and nutrients (p. 6-603).
- Invasive species introduction or spread (p. 6-598)
- Altered hydrology (Atlantic Mining NS Inc., 2021, p. 6-602).

Moreover, the site's forests are particularly vulnerable, having endured both historical and extant mining and logging operations. The Proponent justifies the Project's Forest impacts by citing that "overall, the increase in physical fragmentation is expected to be low, based on the current high level of disturbed habitat as discussed" (Atlantic Mining NS Inc., 2021, p. 6-600). Landscape connectivity helps facilitate the movement of organisms and their genes and thus maintaining this connectivity should be prioritized by the Proponent (Rudnick et al., 2012). Additionally, to bias forest management and operations for both the greatest acquisition of ecosystem services and the greatest chance of survival, practitioners are dependent on reliable and credible inventory and monitoring programs (Smith, 2002).

19.2 Evaluation

The old forest and interior forest initial surveys and baseline condition assessments are negligible. Without a strong foundation of current site conditions, the proponent has no means of assessing site specific vulnerabilities nor would it be possible to benchmark where the original condition once was, thus hindering reclamation efforts. It is of the utmost importance to have thorough and accurate base condition data.

Atlantic Mining NS Inc. (2021) acknowledges that the revised update reflects field survey results and changes to previously interpreted baseline conditions (p. 6-561). In the former drafts of the EIS, the Proponent lacked the field surveys necessary to make substantive claims regarding the baseline condition. Previously, a desktop mapping exercise was conducted to identify mature forest and interior forest habitat, including a visual review of a 2014 aerial photograph and the NSL&F Forest Inventory (Atlantic Mining NS Inc., 2019, pp. 521-522). However, there is no mention of field surveys intended to assess the baseline condition of old forest or interior forests. For the most recent draft of the EIS, the Proponent states one field survey was conducted within Old Forest Unit 582 by a Registered Professional Forester (Atlantic Mining NS Inc., 2021, p. 6-572).

The Proponent explains there are limitations to their desktop analyses. The Proponent states that the area and boundaries of old forest stand in which the PA falls into, directly impacted by the Project construction and operations, are estimates as it was not field delineated (Atlantic Mining NS Inc., 2019, p. 537). A Preferred Alternative Haul Road PA was identified using Nova Scotia's Old Forest Layer (2006), with the document noting that area is "[an] estimate based on the Nova Scotia Old Forest Layer (2006) and the patches were not field delineated" (Atlantic Mining NS Inc., 2019, p. 545). Limitations are evident in later updates, the Proponent states, "it should be noted that this area is an estimate based on the Old Forest layer and the stand boundaries were not field delineated" (Atlantic Mining NS Inc., 2021, p. 6-593).

The methods behind the specific field surveys in the EIS (2021) included delineating forest stands or polygons with common characteristics using photo interpretation of aerial imagery. Forest stands or polygons that shared significant characteristics of Old Forest were then field assessed. (Atlantic Mining NS Inc., 2021, p. 6-572). However, as stated by the proponent, "it is acknowledged that certain habitats which are presented in the database may be over or under-represented compared to the current ground conditions." (Atlantic Mining NS Inc., 2021, p. 6-587). The above examples illustrate the Proponent's lack of substantive knowledge on the composition and dynamics of the PA's old forest and interior forests to make evidence-based decisions regarding protection and remediation.

IAMGOLD Corporation (henceforth referred to as IAMGOLD or "the Proponent") carried out an open pit gold project at the Côté Gold Project site in the Chester and Neville Townships, District of Sudbury, Ontario. Despite the Côté Gold Project being larger in scale than Beaver Dam Mine Project, the construction and remediation processes – including the construction of open pit, access roads, stockpiles, operational facilities – and anticipated adverse environmental impacts are comparable to those of the Beaver Dam Mine Project – including an emphasis on primary point source air emissions of suspended particulate (dust), anthropogenic noise, and substantial landscape change (AMEC Earth & Environmental, 2013; Atlantic Gold, 2021(2)). Given the similarities in these projects, this report will compare the surveys and baseline condition assessments of the Beaver Dam Mine Project to those practiced in the Côté Gold Project.

In contrast to the Beaver Dam Mine Project, the Côté Gold Project completed a terrestrial baseline survey with a breadth of methods while offering more transparency in the dissemination of their survey and inventory techniques. The process included:

- a novel aerial reconnaissance survey for land cover delineation producing digital image maps.
- plant community mapping using desktop analysis, followed by ground-truthing and the creation of a detailed plant species inventory.
- survey of representative subset of each land cover type and ecosite identified during the initial desktop analysis for vegetation cover and terrain performed by a biologist. In these surveys, contracted biologists inventoried plant species, composition, abundance, and percent cover of each vegetation stratum.
- the survey process involved coring the two tallest trees in each plot and recording diameter at breast height and height of trees.

The methods used by IAMGOLD will inform recommendations for the Beaver Dam Mine project.

19.3 Recommendations

This report recommends the Proponent practice more robust and frequent surveys before the implementation of the Beaver Dam Mine Project. The Côté Gold Project's ground-truthing and plant species inventory were completed from September 1 to 10, 2012 and from July 6 to 8, 2013 – nearly one year apart. Beaver Dam Mine's Proponent lacked reoccurring or systematic methodology to their baseline condition assessments. Scott et al. (1999) states data inventorying forests using periodic as opposed to annual assessments can be problematic because of fluctuating survey results that do not account for forest dynamics between measurements. The Proponent should complete additional field survey assessment one year following the initial field survey conducted by the Registered Professional Forester.

To remediate the old forest and interior forest data deficiency, this report proposes a data collection approach characterized by Woodall et al. (2010) where independent datasets are integrated with quality and repeated sampling of aerial data and field-based forest assessments to fully inform the monitoring of forest stands. Adequate understanding of the extent and variability within old growth stands and their structure and processes are imperative (Shorohova et al., 2011). Upon the acquisition of updated baseline condition data, protection and remediation practices should be tailored to reflect the current condition of the forest, particularly because of the irreversibility of clearing of old-growth forests. Shorohova et al., (2011) states that in “areas where old-growth forests have been reduced to merely a few fragmented patches, the extinction of several old-growth dependent forest species is probable unless “new” old-growth is created.”

Lastly, a revised EIS should incorporate more transparency in baseline condition assessments. As previously mentioned, the Proponent for the Côté Gold Project outlined a detailed description of the methods and steps used to assess baseline condition. Additionally, the Proponent added the temporal bounds of to each of the aforementioned surveys (AMEC Earth & Environmental, 2013, Appendix K, p.10). The results of future iterations of the field surveys and baseline condition assessments should be appropriately incorporated into updated EIS and more importantly, disseminated to the public and to the Mi’kmaq community.

20. The effects of the environment on the Project, including severe weather events

20.1 Background

Analysis of the effects of the environment on the Beaver Dam Mine Project are presented in Section 7 (Atlantic Mining NS Inc., 2021). The effects are assessed to determine impacts and magnitude to the project (Impact Assessment Agency, 2020, p. 6). The types of environmental criteria reviewed include flooding, drought, and extreme temperatures (Atlantic Mining NS Inc., 2021). An evaluation of these components will include a review of the applicable legislation, evaluation as well as recommendations for a more effective EIS.

Legislation and guidelines examining the impacts of extreme weather events are available federally and provincially. As per the Guidelines for the Preparation of an Environmental Impact States provided to Atlantic Gold Corporation, requirements for examining the effects of the environment on the proposed project must take into consideration weather condition and external events that could cause an adverse impact on the mine (Nova Scotia, 2016, p. 33). This is also supported by ensuring sustainable development practices through project implementation as outlined in the Nova Scotia Environment Act including goals such as the ‘polluter-pay principle’ focusing responsibility of adverse environmental effects on the culpable entity (1994-1995, c. 1). Guidance documents such as Adapting to a Changing Climate in Nova Scotia: Vulnerability Assessment and Adaptation Options (Nova Scotia, 2005) provide insight on sectorial impacts of climate change with topics such as the increase in frequency and intensity of heat waves, droughts, and flash floods (Nova Scotia, 2005, p. 35). Additional guidance illustrating the process of using future variables of the effect of climate and weather on projects is outlined in the Guide to Considering Climate Change in Environmental Assessments in Nova Scotia (2011) as well as the Practitioners Guide to Federal Impact Assessments under the Impact Assessment Act (2021) examining the commitments to analysing and mitigating for climate challenges.

Within this context, the Beaver Dam Mine EIS (Atlantic Mining Inc., 2021) reviews weather-related impacts utilizing data from adjacent weather and climate stations to understand potential impacts and outline mitigation measures. The assessment covers temperature, precipitation, wind and extreme weather events such as flood, drought, and extreme temperatures. The report concludes with mitigation measures which focus on the project design through to closure. Interactions include feedback from provincial Information Requests regarding the use of weather stations as well as community engagement and Mi’kmaq consultation with specific communications regarding accidents and malfunctions (Atlantic Mining Inc., 2021).

20.2 Evaluation

We focus specifically on extreme weather events including 1) flooding, 2) drought, and 3) extreme temperatures. The baseline data for flooding is illustrated in tables which document annual mean rainfall as well as extremes (Atlantic Mining NS, 2021, Section 7, p. 7.4). Strategies are examined which include water management, modelling site infrastructure based on Hurricane Beth rainfall and vegetative plantings for erosion mitigation. Regarding mitigation measures, the EIS indicates the implementation of an emergency response plan for severe weather events. Reviewing the data and mitigation strategies highlights several missed opportunities in assessing impacts and risk avoidance measures. There is a lack of data presented regarding the catchment area capacity, which, if exceeded through flood events, may damage equipment in staging areas as well as damaging critical electrical transmission systems. These project components may be outlined in the emergency response plan, however, as it is not available as an appendix, flood impacts appears incomplete. A variety of potential flood risk avoidance measures may also be considered such as regular monitoring of catchment area capacity and flow rates, re-evaluating equipment staging areas and staff common use areas, ensuring electrical distribution components are flood-proofed as well as adequate haul road maintenance plans that may be washed away in flood events (Mason *et al*., 2013, p. 3-12).

Water is a critical need for mining operations (The Canadian Minerals and Metals Plan, 2021) and while flooding will inundate a site and cause significant impacts, the lack of water is a serious issue as well. Drought conditions will cause significant deterioration of the mining operations and impact their relationship with local landowners (Mason *et al*., 2013, p. 21). In 2016, Nova Scotia had the worst drought in the past 100 years (Taylor, *et al*., 2020) and with global warming affecting temperature highs and lows (Atlantic Mining NS Inc., 2021, Section 7.2.3.2, p. 7-7), it can be argued that drought conditions will be more prevalent in the coming years. The only mitigation related to drought in the EIS states that project design will consider drought conditions (Atlantic Mining NS Inc., 2021, Section 7.2, p. 7-10). The vagaries of the mitigation results should include a great deal more information highlighting specific and measurable opportunities for mitigating drought. These include additional community planning efforts needed for an area where many residents are on well water, regular groundwater supply monitoring, water intensity targets and water balancing models (Mason *et al*., p. 19-23). Current drought monitoring methods may also be employed such as drought modeling using remote sensing data (Shen *et al*., 2019) Furthermore, additional implementation of effluent water recycling and reuse will integrate best practices of water consumption.

Extreme temperatures may also affect mining operations with effects to staff and equipment. Limited information is provided in the EIS which only states workers may be impacted, and an Occupational Health and Safety Plan will be in place (Atlantic Mining NS Inc., 2021, Section

7.2.2.2, p. 7.5; Section 7.3, p. 7.10). This provides little baseline data on addressing worker safety. Risk factors from heat stress due to extreme heat may include issues with acclimatization, dehydration, employee health conditions, medications, as well activities performed on site (CDC, 2021). Results may include a spectrum of afflictions from minor to severe including sunburn, fatigue, exhaustion, and stroke (United States Department of Labor, 2012). Furthermore, extreme cold may result in stress conditions such as respiratory issues, hypothermia, and frostbite as well as higher risks for work related trips and falls (Golder, 2019). While an Occupational Health and Safety Plan implementation provides a foundation for ensuring workers are cared for during construction, operations and closure of the mine, additional opportunities for education and medical surveillance program (United States Department of Labor, 2012, p. 16-18) can also be implemented.

Reviewing the effects of the environment against other mining projects including the Hardrock Gold Mine (Greenstone Gold Mines, 2019) and the Goliath Gold Mine (Treasury Metals Inc., 2019) show similarities and differences. The Goliath Gold Mine provides less baseline data, however, gives a more thorough evaluation of effects, mitigations, and interactions with Indigenous peoples on this valued component (Treasury Metals Inc., 2019). The Hardrock Goldmine (Greenstone Gold Mines, 2019) provides less baseline data as well and focuses on climate change, forest fires and seismic activity with no further mention of flooding, drought, and extreme temperatures. These inconsistencies show the Beaver Dam Mine paying greater attention to data but less focus on effects and mitigation measures.

20.3 Recommendations

Based on the severe weather event evaluations provided above, recommendations for improving workplace safety include:

- Prior to development, further evaluate flood risks and catchment area flow capacities to ensure staging areas are outside of flood prone areas, flood proof electrical distribution components and re-evaluate haul road ditches for adequate run-off capacity.

- Implement seasonal monitoring programmes for groundwater levels which pre-plan for drought scenarios. Engage in surrounding community with planning and results.
- Each year, conduct seasonal education programming and weekly health surveillance monitoring for worker safety during extreme heat and cold conditions.

21. Author Information

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Appendices

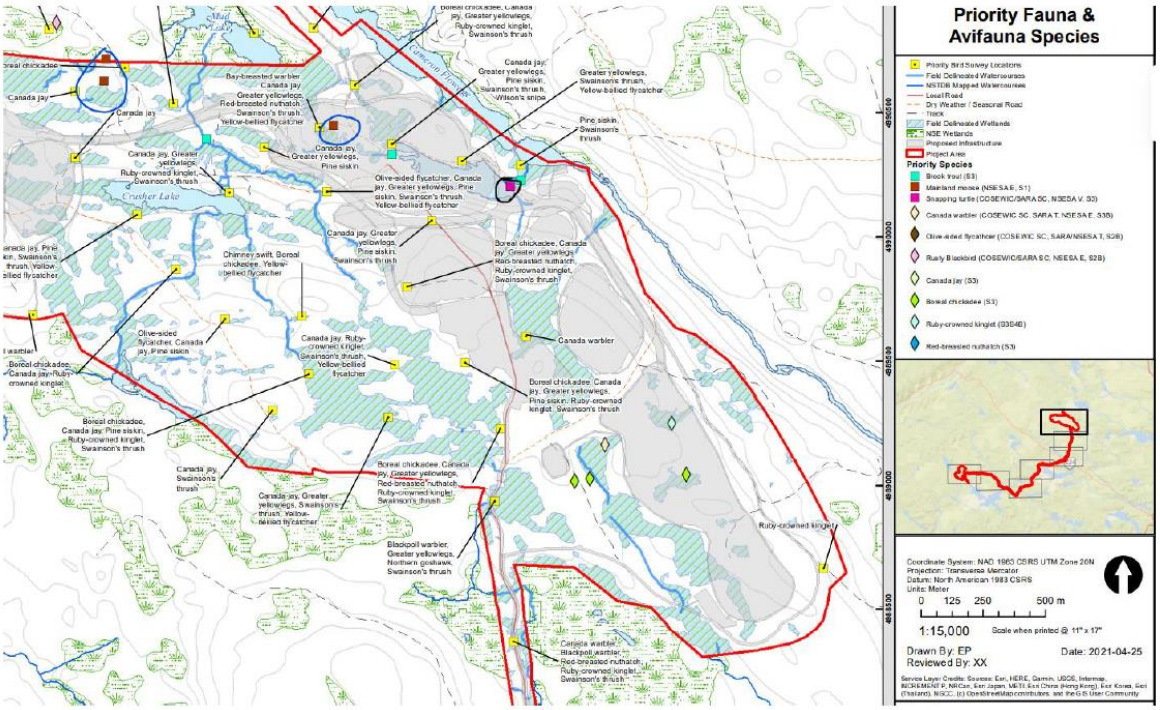

Figure 1. Beaver Dam Mine main mining site, blue circled areas represent eastern moose recordings, and 302 the black circled area represents the female snapping turtle sighting. Figure 6.13-1A page 688 in Section 303 6 of the EA is where the figure was retrieved (Atlantic Mining NS Incorp., 2021).

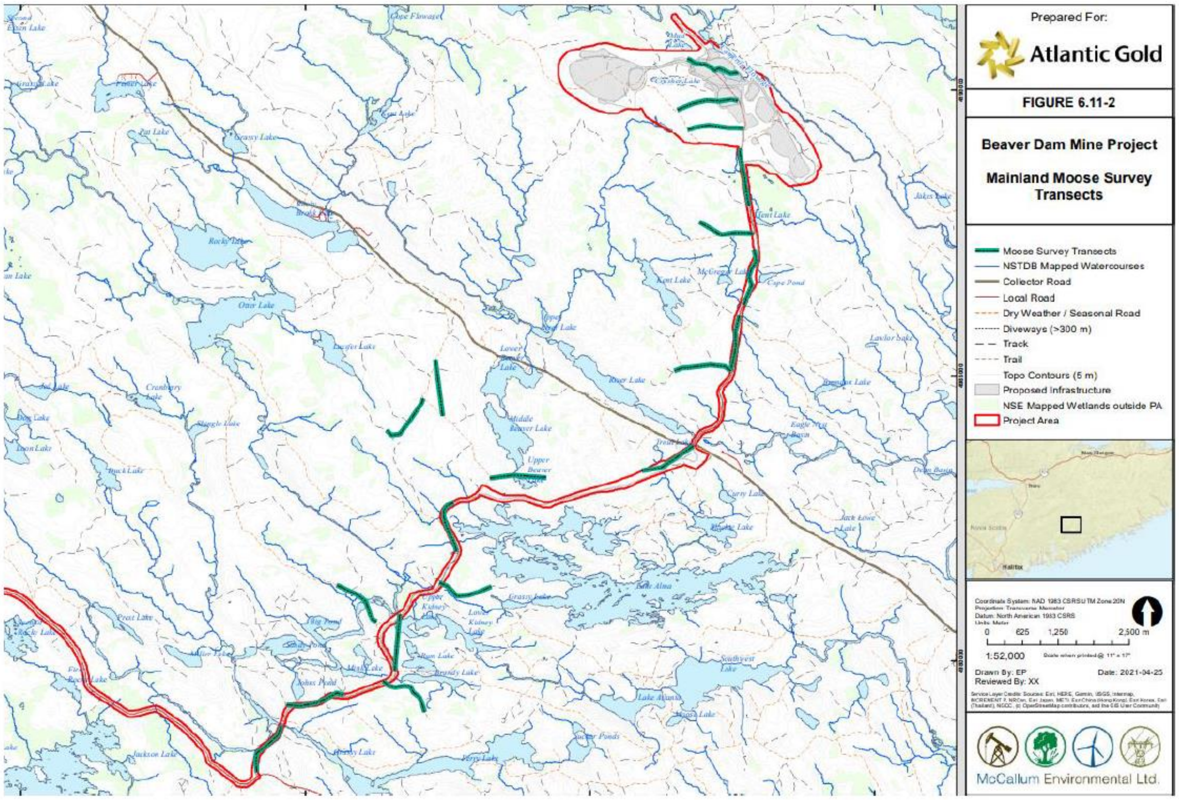

Figure 2. Haul Road of Beaver Dam mining site (north), the blue stripes depict moose recordings in close 313 proximity or on the road. Figure 6.11-2 page 619 in Section 6 of the EA is where the figure was retrieved 314 (Atlantic Mining NS Incorp., 2021).

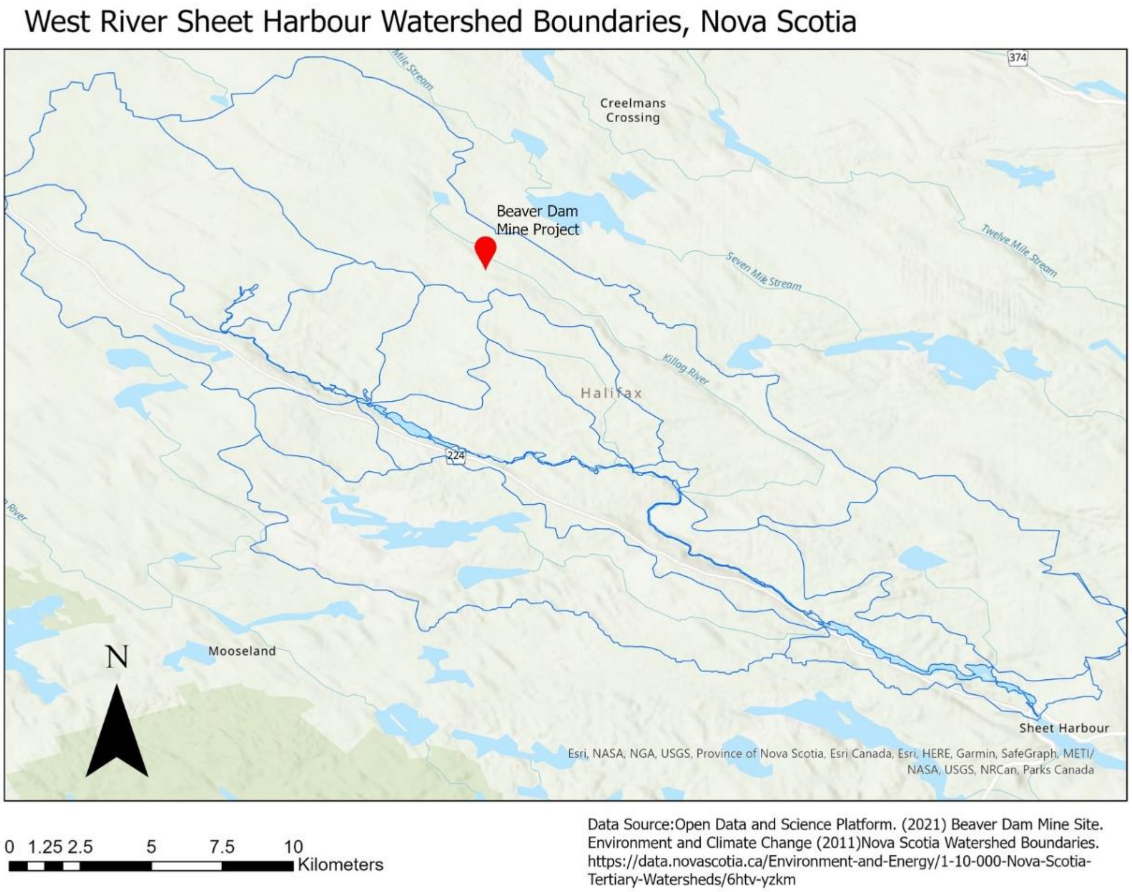

Figure 3. West River Sheet Harbour Watershed Boundaries (map by Nicole MacLean).

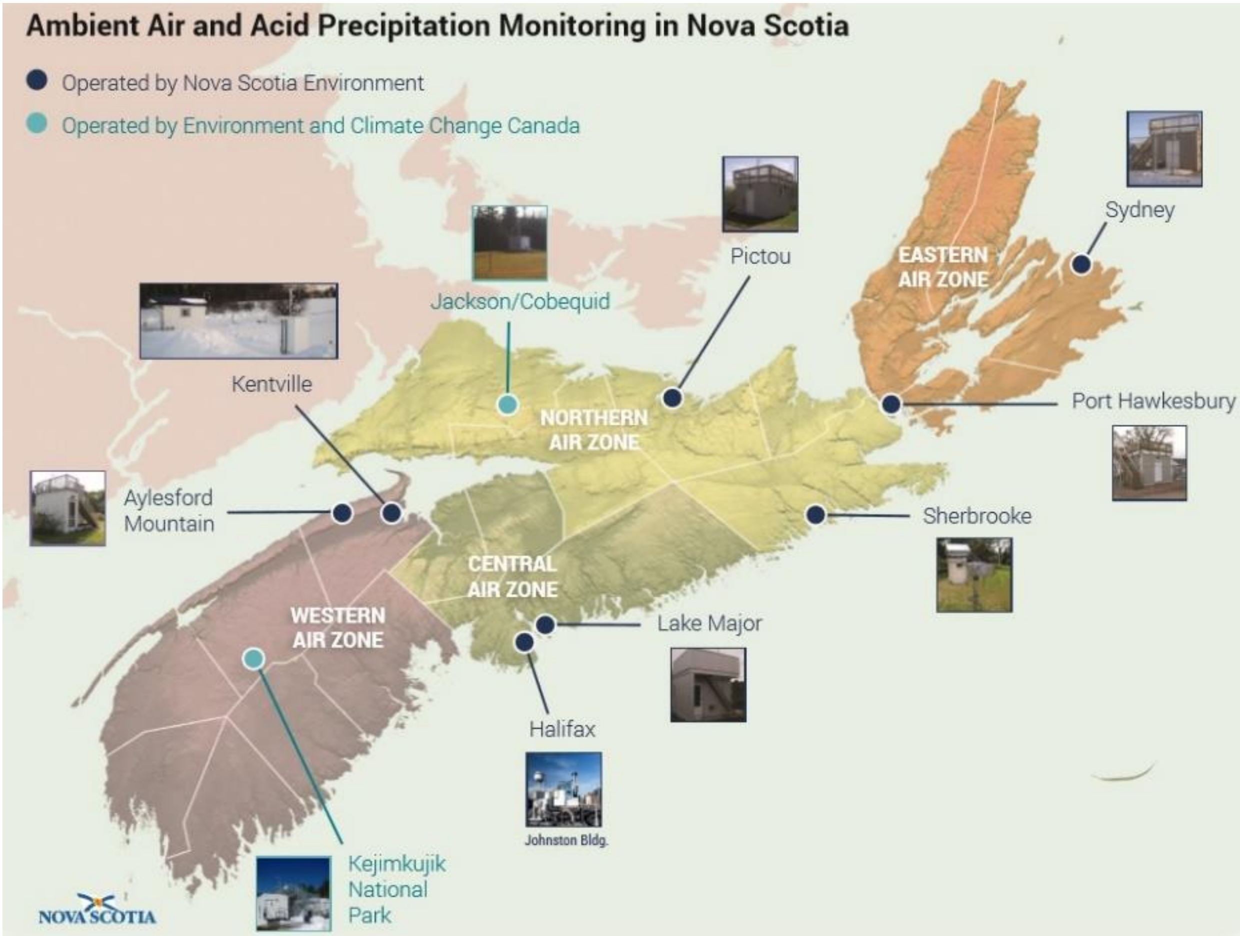

Figure 4. Air Quality Monitoring Stations in Nova Scotia (Nova Scotia Environment, 2018).

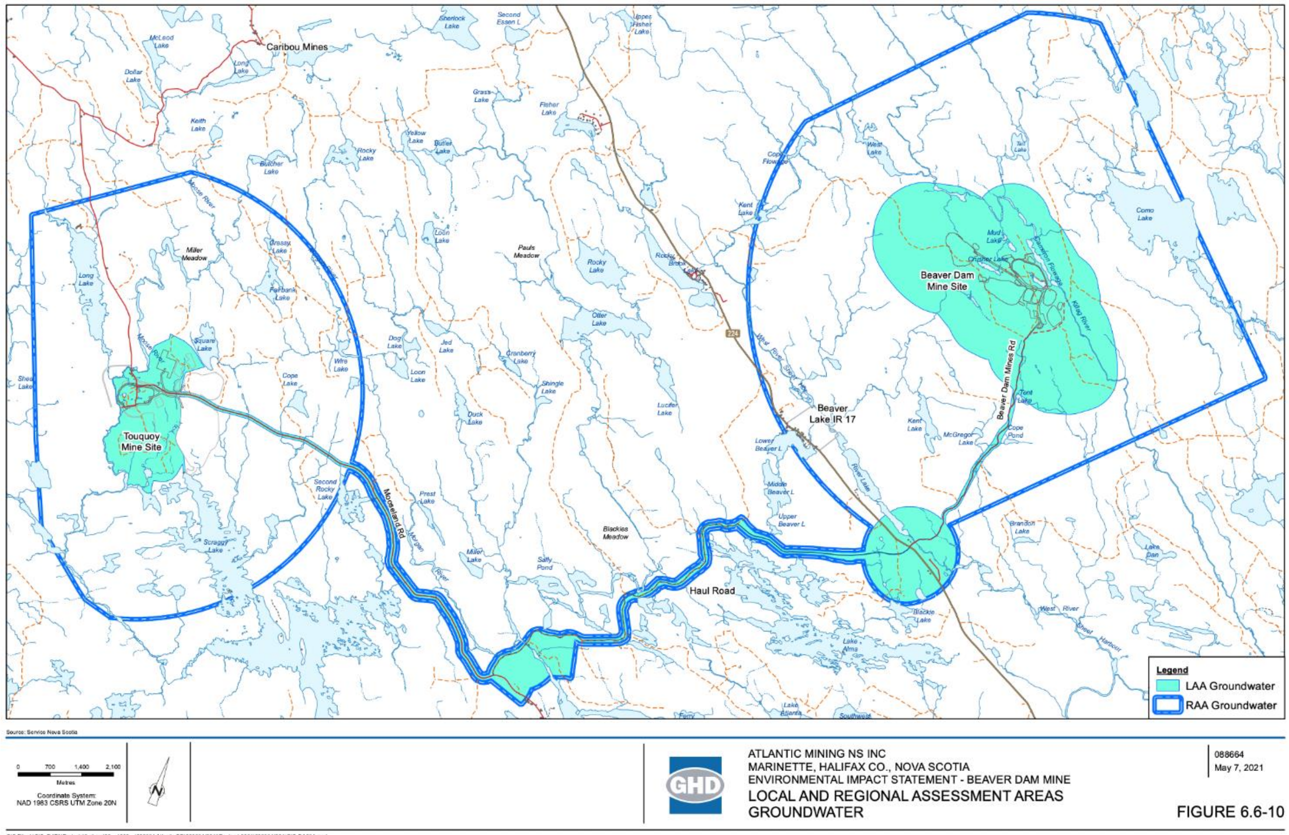

Figure 5. Regional Assessment Area for Groundwater (AMNS, 2021).

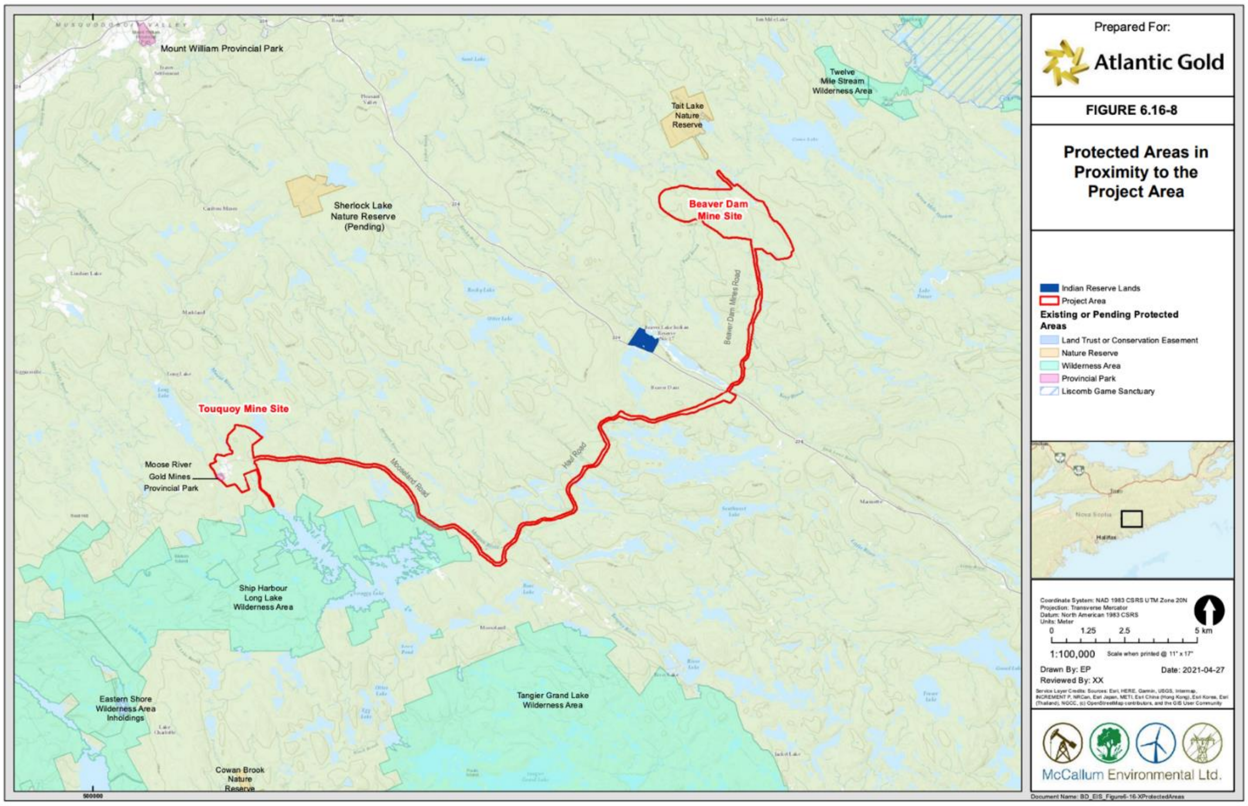

Figure 6. Map of protected areas in proximity to the project area. (Atlantic Gold, 2021, p.6-881)