8 CUMULATIVE ENVIRONMENTAL EFFECTS ASSESSMENT

8.1 Introduction

8.1.1 Summary of the Cumulative Effects before Updates

A Cumulative Effects Assessment was carried out in order to meet the general requirements of the CEAA 2012, as well as the specific requirements laid out in the Guidelines for the Preparation of *an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012 and Nova Scotia Registration Document pursuant to the Nova Scotia Environment Act – Beaver Dam Mine – Atlantic Gold Corporation*. A 35 km radius of the PA was used to identify 'other projects' with potential cumulative effects for all VCs.

Through the scoping methodology, the following VCs were selected for evaluation of cumulative effects: air, surface water quality and quantity, wetlands, fish and fish habitat, birds, species of conservation interest and species at risk, and Indigenous Peoples. Once the mitigation measures are taken into account, there are no significant residual cumulative effects anticipated for air, surface water, wetlands and fish and fish habitat.

Historical and current land use within the region has undeniably affected the local habitats in ways that have affected the local distribution and abundance of several species of flora terrestrial fauna and birds, including SOCI and SAR. However, the mitigation of the effects originating from regional forestry and land management practices falls outside the scope of the project proponent's authority and responsibility.

The predicted residual cumulative effects on Indigenous Peoples with regards to indirect effects from impacts to water quality, wetland habitats, and road safety, are assessed to be adverse, but not significant. The significant residual effects of historical and current land use within the region to the local distribution and abundance of several species of flora and fauna has presumably affected there use for traditional purposes.

8.1.2 Summary of Updates to the Cumulative Effects

The Cumulative Effects Assessment (CEA) has been revised for all Valued Components (VCs), to ensure consistency with the Cumulative Effects Assessment Methodology Interim Technical Guidance document (version 2), prepared by CEAA (2018), and in response to the second round of information requests related to the Revised 2019 EIS Submission. This evaluation includes clearly defined determinations of Projects and spatial boundaries for each VC, which demonstrates the decision-making process for inclusion and exclusion of particular projects for each VC. The component specific criteria for significance thresholds have been revised through each VC chapter, and carried forward through the CEA, in response to CEAA-2-02. Specific to the Mi'kmaq of Nova Scotia, the spatial boundary has been updated to reflect the Eskikewa'kik territory, as requested in CEAA-2-51.

The Proponent has determined that an ecosystem-based approach to the spatial boundary determination is the most appropriate to identify cumulative effects of the Project. The spatial boundary determination is based on the VC geographic range and the zone of influence (ZOI) for that VC. The ZOI sets a spatial limit beyond which the residual effects of the Project on a VC are not detectable. Through the CEA, it has been determined that the RAA for each respective VC is the appropriate spatial boundary for this assessment, rather than a 35 km radius of the PA for all VCs.

The residual environmental effects for each VC have been updated throughout the CEA, based on the results presented in each updated VC chapter (CEAA IRs 2-05, 2-07, 2-08, 2-09, 2-10, 2-13, 2-14, 2-16, 2-17, 2-26, 2-27, 2-28 and 2-53). Furthermore, the

list of 'other projects' included in the CEA has been updated to reflect all Projects registered or proposed within the RAA for the Mi'kmaq of Nova Scotia since the 2019 EIS submission.

Through the scoping of valued components for inclusion in the CEA, it was determined that further evaluation was warranted for cumulative effects to noise, air, light, surface water quality and quantity, fish and fish habitat, species of conservation interest and species at risk, and the Mi'kmaq of Nova Scotia.

8.1.3 Summary of Approach to Cumulative Effects Assessment

Section 19(1)(a) of the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) requires that an EA of a designated project take into account any cumulative environmental effects that are likely to result from the designated project in combination with the environmental effects of other physical activities that have been or will be carried out[81]

This section presents methodology of the Cumulative Effects Assessment (CEA) that was carried out to meet the general requirements of the *CEAA 2012*, as well as the specific requirements laid out in the *Guidelines for the Preparation of an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012* and *Nova Scotia Registration Document pursuant to the Nova Scotia Environment Act – Beaver Dam Mine – Atlantic Gold Corporation* (CEAA 2016) and the second round of information requests (AMNS 2021).

8.2 Types of Cumulative Effects

When considering possible cumulative effects on VCs it is important to understand how the effects may interact and manifest in order to make reasonable and technical sound predictions about the significance of the cumulative effects[82].

There are four main ways that cumulative effects can interact, additive, synergistic, compensatory and masking. The definitions as presented in the draft Technical *Guidance for Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012* (2018) are as follows:

> *"An **additive cumulative effect** is the sum of individual effects of two or more physical activities" (page 42).*
>
> *"A **synergistic cumulative effect** occurs as a result of the interaction between two or more effects, when the resultant combination is greater or different than the simple addition of the effects" (page 42).*
>
> *"**Compensatory cumulative effects** are effects from two or more physical activities that "offset" each other" (page 43).*
>
> ***Masking cumulative effects** are "the effects of one project might mask the effects of another in the field" (page 44).*

81 *Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012*. https://www.canada.ca/en/environmental-assessment-agency/news/policy-guidance/assessing-cumulative-environmental-effects-under-canadian-environmental-assessment-act-2012.html

82 Ibid

8.3 Cumulative Assessment Methodology

The general approach of the cumulative impact assessment is based on the Agency's Operational Policy Statement entitled Addressing Cumulative Environmental Effects under the *Canadian Environmental Assessment Act*, 2012 and the guide entitled Cumulative Effects Assessment Practitioners' Guide, 1999 (Hegmann et al., 1999).

The main steps involved in this approach are as follows:

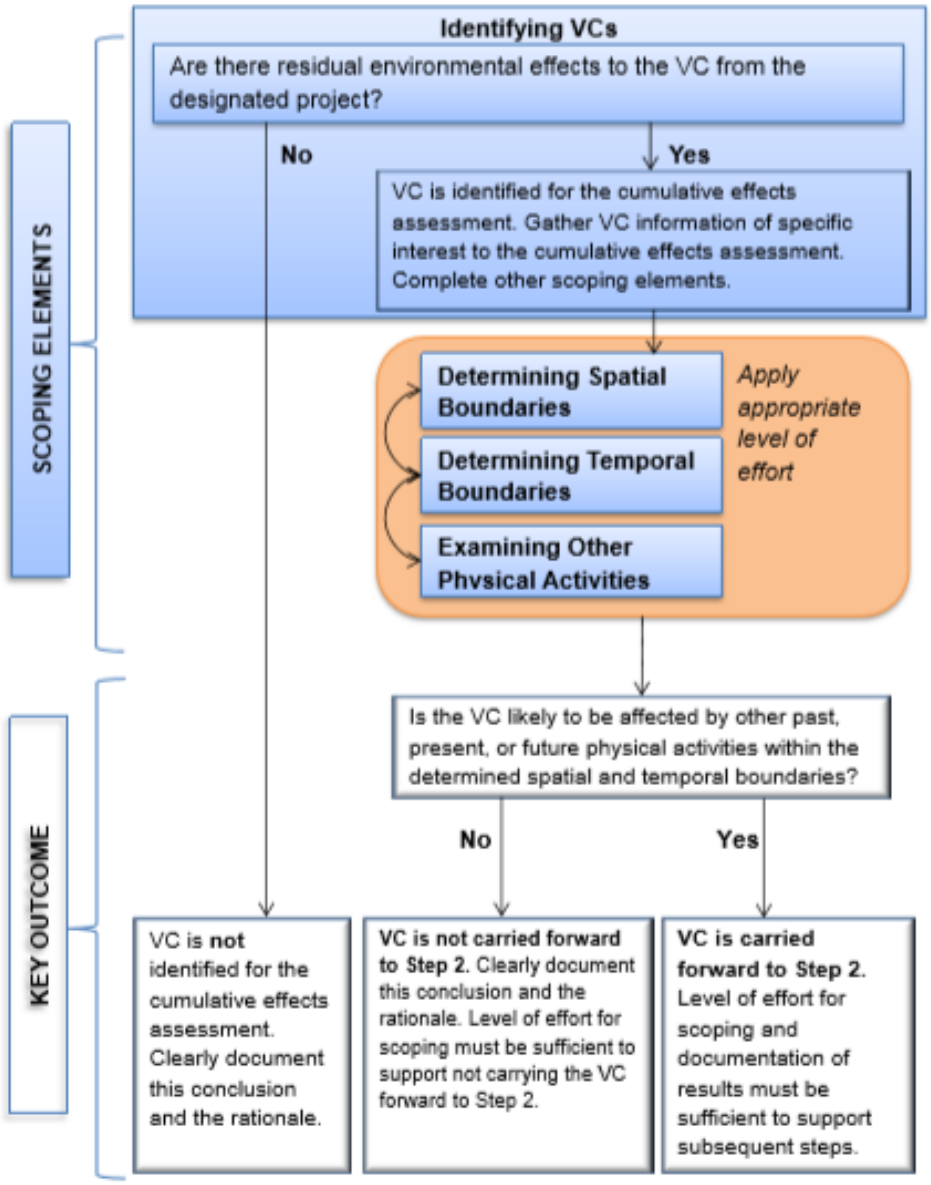
- The initial steps cover the scoping of the Cumulative Effects Assessment and include:
  - Identification of the VCs that will constitute the focus of the Cumulative Effects Assessment.
  - Determining the spatial and temporal boundaries for each VC.
  - Identification, selection and description of physical activities (projects) in the area.
  - Confirmation of the VCs to be carried forward to the assessment stage.
- The following steps constitute the analysis of the CEA and are presented separately for each VC selected at the scoping stage:
  - Description of the baseline conditions.
  - Description of the residual effects of the proposed Project.
  - Description of the effects of other projects in the area.
  - Description of the cumulative effects.
  - Proposed mitigation and monitoring.
  - Residual Cumulative Effects and Significance Assessment.
  - Follow-up.
  - Scoping Approach

8.3.1 Scoping Approach

The scoping methodology as depicted in the draft Technical Guidance for Assessing Cumulative Environmental Effects under the *Canadian Environmental Assessment Act*, 2012 (2018)[83] is presented in Figure 8.3-1 below.

83 Canadian Environmental Assessment Agency. (2014). *Technical Guidance for Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012*

Figure 8.3-1: Generic Approach to Scoping for Cumulative Effects Assessment Adapted from the Technical Guidance for Assessing Cumulative Environmental Effects under the *Canadian Environmental Assessment Act,* 2012



The methodology followed for the four main steps associated with scoping or CEA is described below:

Step 1 - Identification of the Valued Components (VCs) That Will Constitute the Focus of the Cumulative Effects Assessment.

In order to identify the VCs that are likely to be affected by cumulative effects resulting from the proposed Project and other projects in the area, each of the VCs taken into account in the environment effects assessment of the proposed Project (Section 6) was analyzed. In order to be included in the CEA, adverse residual effects must have been identified for the VC. As per the Agency's *Guidelines for the Preparation of an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act,*

2012 and *Nova Scotia Registration Document pursuant to the Nova Scotia Environment Act – Beaver Dam Mine – Atlantic Gold Corporation* (EIS Guidelines, 2016) the following valued components at a minimum must be considered:

- fish and fish habitat;
- birds (including migratory birds);
- species at risk; and
- Mi'kmaq of Nova Scotia.

As stated in the EIS Guidelines "Valued components that would not be affected by the project or would be affected positively by the project can therefore, be omitted from the cumulative effects assessment" (Section 6.7.3 of the EIS guidelines, CEAA 2016). As such, if any VCs were only positively affected, or if it was determined through the EIS that a particular VC had no residual effects, they were not carried forward to the assessment phase. Documentation of the step is provided in Section 8.4.1.

Step 2- Determining the Spatial and Temporal Boundaries for Each VC.

The spatial and temporal boundaries to be considered in the cumulative effects assessment are determined individually for each selected VC. The Regional Assessment Area (RAA) outlined in each VC section is used as the basis for the cumulative effects assessment. The RAA for each VC was determined based on the potential for cumulative effects.

The main points taken into consideration in determining spatial boundaries were:

- Whether the effects of different projects to a VC could be additive if felt at separate locations; and
- The expected geographical extent of the project effects on the VC.

The determination of the appropriate geographic scale required to assess the effects on a biological population. In most cases, a broad, regional area was considered appropriate, though the existence of physical boundaries between populations was taken into account. For example, effects to fish populations were considered cumulative within a watershed.

In the determination of temporal boundaries, the following points were taken into account:

- Duration of the expected environmental effects;
- The timing of the expected environmental effects; and
- Whether or not the effects are only additive if felt simultaneously.

For example, it was considered for most physical VCs that effects could only be cumulative if the effects of two projects overlap in time and space. For instance, cumulative effects on water quality that exceed those assessed for an individual project are only possible if two projects affect the same body of water. However, for other VCs, such as wildlife or bird populations, effects from projects that do not overlap in space or time may have cumulative effects if their effects reach the same population. The spatial cumulative effects boundaries for such VCs may therefore be wider than those used to assess the effects of an individual project and should generally be determined in a way that is ecologically defensible.

Temporal cumulative effect boundaries take into account the timing at which a type of effect has occurred, is occurring or is expected to occur in the future, as well the expected duration of the effect. For example, the cumulative effects of habitat loss could start with the first historical effects on the habitat in question and end with the recovery of the lost habitat. Documentation of the step is provided in Section 8.4.2.

Step 3 - Identification, Selection and Description of Projects in the Area.

Information regarding upcoming and past projects (also referred to as physical activities under CEAA guidance) was obtained from a review of new and existing projects listed on the NSE Environmental Assessment Division website as well as the CEAA's online registry. In addition, a generalized internet search was used to identify other anticipated or ongoing projects.

A search was conducted to identify all major projects within the region with a potential to have cumulative effects with the Project. Each VC's RAA was used to determine which projects were included in the CEA. Each VC's RAA is considered appropriate for this analysis, because the effects will be assessed within a boundary that is relevant to that particular VC. The Project is not expected to have any direct effects on any VCs outside of their RAA. The RAAs used for the cumulative effects assessment were determined given the social and ecological context of each VC (i.e., the RAA and pursuant cumulative effects assessment for socio-economic impacts is based on municipal boundaries, whereas effects to aquatic ecosystems are based on watershed boundaries). Identified projects in the RAAs were included in the evaluation, regardless of their respective temporal boundaries. Documentation of this step is provided in Section 8.4.3.

Step 4 - Confirmation of the VCs to be Carried Forward to the Assessment Stage.

Upon completion of the three steps listed above, the residual effects to VCs that would likely interact with the effects from other past, present, or future physical activities within the spatial and temporal boundaries of each VC were determined through the application of screening criteria.

The following screening criteria were used:

- level of concern noted during engagement;
- current state of the VC (health/status/condition);
- potential for significant cumulative effects;
- uncertainty in predictions of cumulative effects; and
- potential for follow up or additional mitigation.

The results of the application of the screening criteria for each VC were documented along with a rationale for each VC, which describes whether the VC was carried forward to the CEA or not with an accompanying rationale. Where significant adverse effects are identified, the EIS will discuss the likelihood or probability that the effect will occur.

8.3.2 Assessment Approach

8.3.2.1 Baseline Conditions

A description of the baseline conditions is given for each of the selected VCs through the scoping phase carried forward for analysis within their designated spatial and temporal boundaries. Emphasis is put on aspects of the VC that are likely to be affected by cumulative effects between the Project and the other identified projects in the area.

8.3.2.2 Identification and Assessment of the Cumulative Effects

The first step in the assessment of the cumulative effects is to describe the residual effects of the Project, based on the results of the environmental effects assessment presented in Section 6. The environmental effects assessment methodology used for the Project is presented in Section 5.

This is followed by the identification of any effects of the other projects identified in the area that may act in combination with the residual effects of the Project. If available, environment impact statements or environmental assessments for identified projects with potential cumulative effects were consulted. In addition, information contained in the baseline conditions for a VC often included a description of the effects of past and ongoing activities as these have left their mark on the current conditions.

In the case of past activities, their effects can be used to contextualize the current state of the VC as described in the baseline conditions. Taking this information into consideration, the total cumulative effects of all projects having an effect on the selected VC is then described as to their nature, scope and intensity. An assessment of the relative contribution of the Project on the overall cumulative effects is given by comparing these effects with and without the inclusion of the proposed project.

As indicated in the EIS Guidelines (CEAA 2016), the assessment of cumulative effects on current use of lands and resources for traditional purposes by Mi'kmaq of Nova Scotia focusses on the effects on specific activities such as hunting, fishing, trapping and plant harvesting.

8.3.2.3 Mitigation

As a first step, an assessment of whether any additional mitigation measures beyond those proposed in the environmental effects assessment of the Project (Section 6) is made. If additional technically and economically feasible measures are warranted to reduce the cumulative effects, these are proposed.

Given the large spatial and temporal cumulative effects boundaries of certain VCs, the implementation of mitigation measures may exceed the scope of the Proponent's responsibility. In such cases the parties that have the authority to act are identified and any discussions that have taken place in order to implement the necessary measures over the long term are summarized.

8.3.2.4 Residual Cumulative Effects and Significance Assessment

The residual cumulative effects, taking into account the implementation of the mitigation measures, are described in Section 8.5. These are then compared to the significance thresholds identified for each VC in order to determine if they are significant.

8.3.2.5 Follow-up and Monitoring

If it is considered warranted, after taking into account the confidence level of the predictions of the residual cumulative effects and the expected scale of the effects, a follow-up program is proposed to verify the accuracy of the assessment or to address the uncertainty concerning the effectiveness of mitigation measures for certain cumulative effects.

8.3.3 Consideration of Engagement Results and Indigenous Traditional Knowledge

Key issues raised during public and Mi'kmaq engagement relating to Mi'kmaq of Nova Scotia include: potential habitat loss and effects on individual flora and fauna used in traditional hunting, fishing and trapping activities and medicinal food and plants; loss of access to traditional areas; potential impact to traditional foods from dust deposition; potential impact to surface water and groundwater; and potential impacts to fish and wildlife.

8.4 Scoping of the Valued Components

8.4.1 Identification of the Valued Components

All of the VCs (as listed below) included in the environmental effects assessment of the Project (Section 6) were taken into consideration in the scoping exercise for the CEA.

- Physical Environment:
  - Noise;
  - Air;
  - Light;
  - GHGs
  - Geology, Soil and Sediment;
  - Groundwater Quality and Quantity; and
  - Surface Water Quality and Quantity.
- Biophysical Environment:
  - Wetlands;
  - Fish and Fish Habitat;
  - Habitat and Flora;
  - Terrestrial Fauna;
  - Avifauna; and
  - Species of Conservation Interest and Species at Risk.
- Socio-Economic Environment:
  - Mi'kmaq of Nova Scotia;
  - Physical and Cultural Heritage; and
  - Socio-Economic Conditions.

The initial screening of the VCs listed above is based on the outcome of the environmental effects assessment (Section 6) and is summarized in Table 8.4-1. The table provides the possible pathways for VCs to cause cumulative effects as well as possible linkages of the residual effects on a VC to other VCs. Both the pathway of an effect and possible linkages of the residual effect to other VCs are important to consider from a cumulative effects perspective, specifically when determining the possible interaction of the Project's residual effects with the effects from other activities in the area.

The residual effects of 15 of the 16 identified VCs for the Project were determined not to be significant but were assessed as adverse. The Projects' effects to Socioeconomic Condition are determined to be positive. As described above, VCs with positive residual impacts are not carried forward through the CEA exercise. All other VCs were carried forward for additional consideration in the scoping process.

8.4.2 Determining the Spatial and Temporal Boundaries

8.4.2.1 Spatial Boundaries

Spatial boundaries for cumulative effects assessment are based on setting adequate spatial boundaries that represent anticipated geographic limits that will aid in defining the scale and range of interactions between Project activities and VCs.

A map of the PA is presented in Section 5.5, Figure 5.5-1. The PA used for the environmental effects assessment for all VCs and the LAA and RAA used for each specific VC, as described in Section 6, were established to capture areas broader than the expected Project impacts in considerations of other project boundaries as per cumulative effects methodology. Therefore, the spatial boundaries (PA, LAA, and RAA), established for the environmental effects assessment are appropriate for determining potential cumulative effects. Each boundary is discussed below and presented on a figure in each per VC in Section 6 of this EIS.

8.4.2.1.1 Project Area (PA)

The PA encompasses the immediate area in which direct Project activities may occur and are likely to cause direct and indirect effects to VCs. The PA consists of the three components: the Beaver Dam Mine Site, the Beaver Dam Haul Road, and the Touquoy Mine Site, extending from Marinette to Moose River Gold Mines, Halifax County, NS (Section 5.5, Figure 5.5-1). The PA is the same for each VC.

8.4.2.1.2 Local Assessment Area (LAA)

The LAA encompasses adjacent areas outside of the PA where Project related direct and indirect effects to VCs are reasonably expected to occur. Generally, the LAA is limited to the area in which Project activities are likely to have indirect effects on VCs; however, the size of the LAA can vary depending on the VC being considered, and the biological and physical variables present. The LAA for each VC is defined in Table 8.4-1 and are described in detail in relevant VC sections in Section 6 of this EIS.

8.4.2.1.3 Regional Assessment Area (RAA)

The RAA encompasses all Project and VC interactions and are defined intending to be spatially larger than expected for direct and indirect Project interactions, with the exception of VCs that may have diffuse or longer-range effects such as those from Project activities on socio-economic environments. The RAA varies in size depending on the VC being considered, and the biological and physical variables present. The RAA for each VC is defined in Table 8.4-1 and are described in detail in relevant VC sections in Section 6 of this EIS.

8.4.2.2 Temporal Boundaries

The Project has three distinct phases - Construction (1 year), Operations (5 years), and Active Closure (2 years) with post-closure monitoring proposed for 10 years after the active closure, dependent on water quality and monitoring requirements. These phases define the maximum temporal boundary for assessment of impacts on each VC. The maximum Project life is 8 years for the construction, operation and active closure phases. Monitoring and water treatment, as required, is expected be required for longer during the post-closure stage.

Table 8.4-1: Initial Screening of the Valued Components based on the Outcome of the Environmental Effects

Project VC	EIS Section	Spatial Boundaries		Temporal Boundaries	Summary of A Significant Effect*	Pathway	Adverse Residual Effects			Include in Scoping Exercise	Rationale
		Local Assessment Area (LAA)	Regional Assessment Area (RAA)				Summary	Significance	Linkages to Other VCs (If Applicable)		
PHYSICAL ENVIRONMENT											
Noise	6.1	The LAA for Noise encompasses adjacent areas outside of the PA where Project related effects to Noise are reasonably expected to occur. The LAA constitutes the noise modelling domain based on the location of the Project noise emission sources and predicted noise levels for Project Constriction and Operations phases, as well as the location of potential sensitive receptors. The Noise modelling domain was established so that it would be inclusive of, at minimum, any predicted noise contours above 35 dBA, a threshold value criterion for baseline nighttime noise levels adopted from the Alberta Energy and Utilities Board. See Figure 6.1-2.	The Regional Assessment Area (RAA) extends beyond the LAA as to encompass potential indirect effects of Noise with other related VCs, such as human health and wildlife. See Figure 6.1-2.	The temporal boundary for the assessment of effects to air quality includes the construction, operation and closure (active reclamation and decommissioning) phases.	Significant residual effects for the Noise VC would be defined as having high magnitude (i.e., an exceedance of the maximum noise or vibration limits), occur beyond the PA and LAA, be of long-term to permeant duration, occur at regular intervals or be continuous throughout the Project, and be only partially reversible to irreversible.	Atmospheric	Increased ambient noise.	Adverse, not significant	Fauna, Birds, SAR/SOCI, Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation
Air	6.2	The LAA encompasses a 15 km zone in all directions from the PA. (Figure 6.2-1).	The RAA encompasses 35 km buffer from the PA, which represents the maximum zone of influence. The RAA covers the anticipated maximum extent of particulate deposition under worst case scenarios (Figure 6.2-1).	The temporal boundary for the assessment of effects to air quality includes the construction, operation and closure (active reclamation and decommissioning) phases.	Significant residual effects for the Air VC is defined as having high magnitude (i.e., an exceedance of applicable criteria), occur beyond the LAA, be of long-term to permeant duration, occur at regular intervals or be continuous throughout the Project, and be only partially reversible to irreversible.	Atmospheric	Increased ambient dust.	Adverse, not significant	Flora, SAR/SOCI, and Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation
Light	6.3	The LAA for light variable based on a 1 LUX threshold. Preliminary modelling and evaluation of light has determined this to be the maximum distance of light propagation to a 1 LUX threshold. See Figure 6.3-1.	The RAA for light encompasses a distance defined by 0.1 lux surrounding the PA. This is based on the maximum extent of light propagation. See Figure 6.3-1.	The temporal boundary for the assessment of effects to air quality includes the construction, operation and closure (active reclamation and decommissioning) phases.	Direct light trespass that meets 1 lux light trespass into windows at the nearest receptor. This was determined as a result of the baseline environmental light classification of E2 at the Beaver Dam Mine Site.	Atmospheric	Increased ambient light.	Adverse, not significant	Fauna, birds, SAR/SOCI, Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation
GHG	6.4	The Local Assessment Area (LAA) encompass a 15 kilometre (km) zone in all directions from the PA, based on the expected maximum extent of potential ground level emissions (Figure 6.4-1).	The Regional Assessment Area (RAA) encompasses the province of Nova Scotia. GHG emissions will be compared to Nova Scotia targets and totals (Figure 6.4-1)	The temporal boundaries used for the assessment of effects to GHGs are the construction phase, operational phase, and active closure phase.	An increase in GHG greater than 0.2% pf NS 2018 (CO_2e) levels at the regional scale.	Atmospheric	Increased greenhouse gas emissions	Adverse, not significant	NA	Yes	Adverse residual effects were identified.
Geology, Soil and Sediment	6.5	There is no LAA or RAA for geology, soil and sediment, as impacts to this VC are only expected to occur within the PA.		Project-related impacts may occur during construction, operation, and closure (active reclamation and decommissioning stage) phases of the Project.	There are no regulated or proposed thresholds for geology and soils effects for this site and Project. Both sediment and soils that become mobilized have a linkage with surface water and quality that have regulated thresholds and can be assessed through predictive efforts for the Surface Water VC (Section 6.7 and 6.9) or through the monitoring program proposed.	Soils and Sediment	Erosion, soil and sediment quality	Adverse, not significant	Surface Water, Wetlands, Fish Groundwater, Flora, Fauna.	Yes	Adverse residual effects were identified within VC evaluation

Table 8.4-1: Initial Screening of the Valued Components based on the Outcome of the Environmental Effects (continued)

Project VC	EIS Section	Spatial Boundaries		Temporal Boundaries	Summary of A Significant Effect*	Pathway	Adverse Residual Effects			Include in Scoping Exercise	Rationale
		Local Assessment Area (LAA)	Regional Assessment Area (RAA)				Summary	Significance	Linkages to Other VCs (If Applicable)		
Groundwater	6.6	The LAA for Groundwater Quality and Quantity encompasses an 800 m buffer from the Beaver Dam Mine Site, an 800 m buffer along the portion of the Haul Road that will be upgraded where receptors are present, and the portion of down-gradient habitat from the Touquoy Mine Site. See Figure 6.6-7.	The RAA for Groundwater Quality and Quantity encompasses tertiary watersheds intersecting the PA. See Figure 6.6-7.	The temporal boundary for the assessment of effects to Groundwater Quality and Quantity includes the Construction, Operation and Closure Phases.	A significant adverse effect from the Project on groundwater quality is defined as an effect that results in groundwater quality exceeding the NSE Tier 1 EQS for potable groundwater, GCDWQ or NSE Tier 2 PSS for groundwater discharge to surface water (>10 m). Detailed definition provided in Section 6.6	Groundwater	Disturbance to groundwater quality and quantity	Adverse, not significant	Surface Water, fish, wetlands, SAR/SOCI, Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation
Surface Water	6.7	The LAA is defined by the tertiary watersheds that encompass or intersect the PA, and contains surface water features upstream, downstream and within the PA. The lakes and watercourses that are included as part of the baseline programs and/or predictions of effects are located within the LAA boundary. See Figure 6.7-11.	The RAA in the context of surface water quality and quantity encompasses Secondary Watersheds (East River Sheet Harbour and Fish River), see Figure 6.7-11.	The temporal boundary for the assessment of effects to Surface Water Quality and Quantity includes construction, operation and closure phases.	A repeated or sustained change in water flows that differ substantially from baseline flow conditions (15%); and/or an indicator is predicted to be greater than guidelines and differ substantially from baseline water quality (outside of the 75th to 95th baseline water quality), resulting in a detectable change beyond the range of natural variation. Detailed definition provided in Section 6.7.	Surface Water	Change in Water Quality and Quantity Habitat Loss and disturbance	Adverse, not significant	Fish, Wetlands, SAR/SOCI, Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation
BIOPHYSICAL ENVIRONMENT											
Wetlands	6.8	The LAA is defined by the tertiary watersheds that encompass or intersect the PA (Beaver Dam Mine Site, Haul Road and Touquoy Mine Site), and contains surface water features upstream, downstream and within the PA. The lakes and watercourses that are included as part of the baseline programs and/or predictions of effects are located within the LAA boundary. See Figure 6.7-11.	The RAA encompasses three Secondary Watersheds: West River Sheet Harbour, Tangier River and Fish River-Lake Charlotte). See Figure 6.7-11.	The temporal boundary for the assessment of effects to wetlands includes the construction, operation, closure (active reclamation and decommissioning) and post-closure phases.	A significant adverse effect from the Project on wetlands is defined as an effect that results in an unmitigated or uncompensated net loss of wetland habitat as defined under the NSE Wetland Conservation Policy, and its associated no-net loss policy, or an effect that is likely to cause a permanent loss of >10% wetland habitat for a SAR species identified in the PA within the LAA.	Vegetation, Hydrology	Habitat loss and disturbance	Adverse, not significant	Habitat and flora, fauna, avifauna, fish, SAR/SOCI, surface water, groundwater, Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation
Fish and Fish Habitat	6.9	The LAA is defined by the tertiary watersheds that encompass or intersect the PA (Beaver Dam Mine Site, Haul Road and Touquoy Mine Site), and contains surface water features upstream, downstream and within the PA. The lakes and watercourses that are included as part of the baseline programs and/or predictions of effects are located within the LAA boundary. See Figure 6.7-11.	The RAA encompasses three Secondary Watersheds: West River Sheet Harbour, Tangier River and Fish River-Lake Charlotte). See Figure 6.7-11.	The temporal boundary for the assessment of effects to wetlands includes the construction, operation, closure (active reclamation and decommissioning) and post-closure phases.	A significant adverse effect from the Project on fish and fish habitat is defined as an effect that results in an unmitigated or uncompensated net loss of fish habitat as defined under the *Fisheries Act*, and its associated no-net loss policy.	Aquatic Resources	Habitat loss and disturbance Increased habitat connectivity Decreased water quality	Adverse, not significant	SAR/SOCI, Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation

Table 8.4-1: Initial Screening of the Valued Components based on the Outcome of the Environmental Effects (continued)

Project VC	EIS Section	Spatial Boundaries		Temporal Boundaries	Summary of A Significant Effect*	Pathway	Adverse Residual Effects			Include in Scoping Exercise	Rationale
		Local Assessment Area (LAA)	Regional Assessment Area (RAA)				Summary	Significance	Linkages to Other VCs (If Applicable)		
Habitat and Flora	6.10	The LAA includes a 2 km buffer around the Beaver Dam Mine Site and a 500 m buffer surrounding the Haul Road (excluding Mooseland Road). See Figure 6.10-7.	The RAA encompasses portions of Ecodistrict 440 within Halifax Regional Municipality (HRM), east and north of Lake Charlotte. Where the Ecodistrict boundary approached the northern extent of the Beaver Dam Mine Site, the RAA was enlarged to include a 5 km buffer around the PA. See Figure 6.10-7.	The temporal boundary for the assessment of effects to habitat and flora includes the construction, operation, closure (active reclamation and decommissioning) and post-closure phases.	A significant adverse effect from the Project on habitat is defined as an effect that is likely to cause a permanent, unmitigated, alteration to habitat that supports flora species distribution. For the purposed of this analysis, habitat is defined as: A **natural** environment composed of both living organisms (biotic) and non-living components (abiotic) which function together as an ecological unit and includes managed forests (e.g. treated stands, cutblocks, plantations). Urban and industrial developments (e.g. roads, houses, quarries etc.) are excluded from this definition.	Vegetation	Disturbance and loss of habitat	Adverse, not significant	Fauna, avifauna, SAR/SOCI, wetlands, Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation
Terrestrial Fauna	6.11	The LAA includes a 5 km buffer around the Beaver Dam Mine Site and a 500 m buffer surrounding the Haul Road and Touquoy Mine Site. See Figure 6.11-3.	The RAA encompasses portions of Ecodistrict 440 within Halifax Regional Municipality (HRM), east and north of Lake Charlotte. Where the Ecodistrict boundary approached the northern extent of the Beaver Dam Mine Site, the RAA was enlarged to include a 5 km buffer around the PA. See Figure 6.11-3.	The temporal boundary for the assessment of effects to terrestrial fauna includes the construction, operation, closure (active reclamation and decommissioning) and post-closure phases.	A significant adverse effect from the Project on terrestrial fauna is defined as an effect that is likely to cause a permanent, unmitigated, alteration to habitat that supports fauna species distribution.	Wildlife	Disturbance and loss of habitat	Adverse, not significant	Habitat and flora, SAR/SOCI, wetlands, Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation
Avifauna	6.12	The LAA includes a 5 km buffer around the Beaver Dam Mine Site and a 500 m buffer surrounding the Haul Road and Touquoy Mine Site. See Figure 6.12-2.	The RAA encompasses portions of Ecodistrict 440 within Halifax Regional Municipality (HRM), east and north of Lake Charlotte. Where the Ecodistrict boundary approached the northern extent of the Beaver Dam Mine Site, the RAA was enlarged to include a 5 km buffer around the PA. See Figure 6.12-2.	The temporal boundary for the assessment of effects to avifauna includes the construction, operation, closure (active reclamation and decommissioning) and post-closure phases.	A significant adverse effect from the Project on avifauna is defined as an effect that is likely to cause a permanent, unmitigated, alteration to habitat that supports avian species distribution.	Wildlife	Disturbance and loss of habitat	Adverse, not significant	Habitat and flora, SAR/SOCI, wetlands, Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation

Table 8.4-1: Initial Screening of the Valued Components based on the Outcome of the Environmental Effects (continued)

Project VC	EIS Section	Spatial Boundaries		Temporal Boundaries	Summary of A Significant Effect*	Pathway	Adverse Residual Effects			Include in Scoping Exercise	Rationale
		Local Assessment Area (LAA)	Regional Assessment Area (RAA)				Summary	Significance	Linkages to Other VCs (If Applicable)		
Species at Risk (SAR) /Species of Conservation Interest (SOCI)	6.13	The LAA for SAR and SOCI is equivalent to those described for Habitat and Flora, Terrestrial Fauna, Fish and Fish Habitat, and Avifauna.	The RAA for SAR and SOCI is equivalent to those described for Habitat and Flora, Terrestrial Fauna, Fish and Fish Habitat, and Avifauna.	The temporal boundary for the assessment of effects to SAR and SOCI includes the construction, operation, closure (active reclamation and decommissioning) and post-closure phases.	A significant adverse effect from the Project on SAR and SOCI is defined as an effect that is likely to cause a permanent, unmitigated, alteration to habitat that supports a species' distribution, or alteration of critical habitat. An adverse effect that does not cause a permanent alteration to habitat of SAR or SOCI species is not considered to be significant. Sedentary species such as vascular and non-vascular flora do not have the opportunity to move to avoid direct or indirect impact. For these species, the loss of an individual or individuals of a SAR species that is important in the context of the province, or that species' overall abundance or distribution, may be considered significant, if appropriate mitigation measures are not implemented. Mortality of a single SAR could, under some circumstances, be considered a significant effect.	Wildlife, Vegetation, Aquatic Resources	Disturbance and loss of habitat	Adverse, not significant	Wetlands, Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation
SOCIO-ECONOMIC ENVIRONMENT											
Mi' kmaq of Nova Scotia	6.14	The LAA encompasses a 5 km radius from the PA. The LAA includes the maximum extent of physical disturbance from project and interactions with expected Mi'kmaq current use of lands and resources, and physical and cultural heritage (Figure 6-14.1).	The RAA for the assessment of the Mi'kmaq of Nova Scotia is defined as the territorial boundaries of the *Eskikewa'kik* (meaning 'skin dressers territory'). See Figure 6.14-1.	The temporal boundary for the assessment of effects to the Mi'kmaq of Nova Scotia includes construction (one year), operations (five years), and active closure (two years) phases.	An effect that results in long-term (greater than 20 years) loss of the availability of, or access to, land and resources currently relied upon for traditional use practices or the permanent loss of traditional use areas within a large portion of the PA; an effect on health identified through conclusions of the Human Health Risk Assessment, and/or an unmitigated loss of a physical or cultural structure, site or thing that is of historical, archaeological, paleontological or architectural significance to the Mi'kmaq A detailed definition is provided in Section 6.14.6.2.	Physical and Biophysical pathways and Socio-economic conditions	Loss of plant specimens and habitat Loss of fish habitat Change in species movement pattern Sensory disturbance Visual change Increased Traffic Loss of Access	Adverse, not significant	NA	Yes	Adverse residual effects were identified within VC evaluation
Physical and Cultural Heritage	6.15	There is no LAA or RAA for physical and cultural heritage, as the loss or destruction of heritage or archaeological resources could occur only within the disturbed footprint of the Project (PA).		The temporal boundaries used for the assessment of effects to physical and cultural heritage are limited to the construction phase of the Project. Construction is estimated to take approximately one year.	A significant adverse effect is an uncontrolled (without appropriate study, analysis and mitigation measures in conjunction with the Province and Mi'kmaq archaeologists as required) disturbance to, or destruction of, any unassessed historical or cultural resource of importance in context of the *Special Places Act*.	Cultural Heritage	Loss of archaeological features Site 6 and Areas 2 and 3 will be impacted by the Project. Additional shovel tests were completed within Site 6, Area 2 and Area 3 in fall 2020. No Pre-contact Mi'kmaq archaeological resources were encountered.	Adverse, not significant	Mi'kmaq of Nova Scotia	Yes	Adverse residual effects were identified within VC evaluation

Note: A summary of each VCs threshold for determination of a significant effect is presented herein. For the full definition of a significant effect, including determination of the magnitude, see the effects assessment methodology for each VC in Section 6.

8.4.3 Identification, Selection and Description Past, Present and Future Physical Activities

Major industrial projects that have taken place, are taking place or are known to potentially take place in the future within the RAA for each VC are described in the following sections. Projects were identified as per the methods described in Section 8.3.1 and consider major industrial projects (i.e., those requiring federal or provincial environmental assessment) as well as projects that are known to be present in the area from engagement efforts, common knowledge, aerial imagery review of the local area, or other methods as available. This list is meant to be inclusive, but the Proponent acknowledges the limitations of these methods of project identification; some projects may have been excluded due to ignorance on the part of the EIS team and limited publicly available data. This list of physical activities is current as of April 2021.

The ability to draw conclusions from publicly available data is a considerable limitation for the cumulative effects assessment. The best source of publicly available data for other projects being considered lies in the provincial and federal environmental assessment websites. Some of the projects identified below do not trigger an EA process, but would be regulated under provincial Approvals (i.e., Water Approvals, Integrated Resource Management approvals, or Industrial Approvals). These approval documents, and the supporting information are not readily publicly available. Projects which do trigger a formal environmental assessment process have EARDs or EISs available online, but they do not necessarily follow consistent methodology in the assessment or determination of effects. Furthermore, the details associated with information requests or insufficient information requests are not readily publicly available. Some projects may be currently in review so the outcome of that decision is unknown. As such, there is a risk in using conclusions presented in environmental assessments, because the Proponent is unable to confirm whether the effects assessment determinations presented therein were satisfactory, rigorous or appropriate. Furthermore, some projects (such as timber harvesting on private land, or the Nova Scotia Salmon Association's Acid Mitigation project) relevant to the evaluation of cumulative effects, do not trigger regulatory approvals or an EA process. As a result, publicly available information is limited.

A preliminary assessment of the potential cumulative effects of these projects with the Project is presented. A summary of the identified projects and their potential cumulative effects can be found in Section 8.4.3.1. Where possible the distance of the identified projects from the FMS Mine Site and the Touquoy Mine Site were determined along with the anticipated duration of the identified projects to determine potential interaction of the effects of those projects with the Project's adverse residual effects.

If a project falls within a particular VCs RAA, it is considered in that VCs cumulative effects assessment. As such, within each Project listed below, a list of relevant VCs is provided based on the RAA spatial boundary for each VC. Socioeconomic effects have already been screened out of the CEA, based on predicted residual positive effects.

There is a direct spatial overlap with the Project PA and several projects. These include:

- Historic and current mining activity at the Touquoy Mine Site;
- Historic mining activity at the Beaver Dam Mine Site;
- Proposed usage of the Haul Road for transportation of concentrate from the proposed Fifteen Mile Stream Project;
- Regional forestry operations within the PA; and
- Terrestrial liming within Tent Lake Watershed.

As a result of the direct spatial overlap with the Project PA, these projects are considered in the CEA for all VCs.

8.4.3.1 Current and Past Projects

8.4.3.1.1 Fifteen Mile Stream Historic and Proposed Mining Operations (Past and Future)

Gold mining is known to have occurred in the Fifteen Mile Stream (FMS) Study Area near Trafalgar, NS, since 1874, when development along the Jackson Lead took place, approximately 300 m south of the Egerton-MacLean area). Between 1874 and 1893, a number of different companies were active in the Old Egerton and MacLean Shaft area. At this time, small mines were worked from various shafts with the deepest recorded workings located on the Egerton Lead. In 1879, gold was discovered in the Hudson area, west of Egerton-MacLean, and some mining took place here until 1887, when a fire destroyed the mill and hoist. Mining operations appear to have stopped between 1903-1938. Very little, if any work, occurred between 1941-1980, with the exception of a tailings sampling program which occurred at the Egerton Stamp Mill in 1973. Exploration activities recommenced in the 1980's, but little activity occurred between 1990-2008.

In 2009, Acadian Mining started re-examining some of the historic drill core and in 2010, Acadian took 2,139 samples representing previously unsampled intervals from 22 of the historic drill holes. They demonstrated that much of the previously unsampled core was mineralized and that mineralization was more extensive than had been recognized. In 2011, Acadian drilled 29 diamond holes for 3,741 m. Twenty holes were drilled in the Egerton – MacLean area, ten holes in the Hudson area and the remaining hole in the 149 East Zone. This new information was used, together with the historic drill data by Snowden Consulting for a 2012 estimate of resources.

In 2014, Acadian Mining was acquired by Atlantic Gold Corporation. FSSI Consultants completed a resource update using the same database as that used by Snowden Consulting in the 2012 estimate. In 2016, Atlantic Gold commenced an exploration drilling program to determine mineralization extents at the FMS site. A total of 11 holes were drilled for 945 m. The program was continued in 2017 with a further 180 holes drilled for 23,044 m. In the same year Atlantic Gold commenced infill drilling to improve resource confidence and supplement drilling completed in the early 1980s. A total of 186 holes were drilled for 26,062 m. These additional holes were used, together with the historical drill data, by FSSI Consultants to complete a 2017 resource update. Historic mining activities within the FMS Study Area resulted in some habitat fragmentation and general disturbance, in addition to deposition of tailings along Seloam Brook.

The FMS Gold Project EIS has been submitted to IAAC for review. Upon approval of the proposed Project, extraction will commence in 2024. Concentrate from FMS will be hauled to the Touquoy Mine Site for processing. Tailings from FMS concentrate will be deposited into the exhausted Touquoy pit. The FMS Mine Site is in Trafalgar, Halifax County, Nova Scotia. It is located on land owned partially by MacGregor Properties Ltd, with whom the Proponent has a lease, and the remainder is owned by the Crown and access to the land will be granted by a Crown land lease.

Upon approval and the commencement of mining operations, concentrate from the FMS Gold Project will be transported and processed at the existing plant at the Touquoy Mine Site. The FMS Gold Project is anticipated to commence construction in 2022, come into production in 2023, cease operations in 2027, and then be reclaimed. From 2024 to 2030, concentrate from FMS Gold Project will be processed at the Touquoy Facility along with ore from the Project and concentrate from the Cochrane Hill Gold Project.

As part of the Beaver Dam Mine Project, a Haul Road will be constructed to transport ore to the Touquoy Mine Site. The effects assessment for construction and operation of the Haul Road are presented in this EIS. However, when this haul road is completed, the proposed FMS Gold Project and the proposed Cochrane Hill Gold Project will use the Haul Road to transport gold concentrate to the Touquoy Mine Site. The cumulative effects of increase traffic levels on the Haul Road are assessed herein as a stand-alone

project. The Fifteen Mile Stream site is located approximately 19 km northeast of the Beaver Dam Mine Site, and 38 km northeast of the Touquoy Mine Site.

Spatial overlap with the following RAAs: All VCs

8.4.3.1.2 Beaver Dam Mining Operations (Past)

The area has been subject to exploration and mining activity since gold was first discovered in 1868. Between 1871 and 1949, there were intermittent attempts to develop and mine the area, initially focused on the Austen Shaft area and later on the Mill Shaft area located approximately 1.2 km west of the Austen Shaft. The small Papke Pit located approximately 400 m west of the Austen Shaft was excavated in 1926; however, the majority of development was focused on a belt of quartz veins in greywacke and slates that was approximately 23 m wide where intersected from the Austen Shaft. Approximately 967 ounces of gold production is recorded for Beaver Dam gold deposit between 1889 and 1941. From 1978 until 1988, several companies drilled a combined 251 diamond drill holes for 47,935 m. Some of these drill holes were completed underground via an exploration decline that reached a maximum depth of 100 m below surface. In 1987, a small open pit was also excavated in the Austen Shaft zone. Approximately 2,445 ounces of gold production was also recorded for Beaver Dam gold deposit between 1986 and 1989. Between 2005 and 2009 two companies drilled a combined 153 diamond drill holes for 22,010 m and also completed several other exploration programs including an aeromagnetic survey, a till survey, and a follow-up reverse circulation drilling program for geochemical purposes.

Spatial overlap with the following RAAs: All VCs

8.4.3.1.3 Touquoy Mining Operations (Past, Present and Future)

The Touquoy Mine Site is a fully permitted and approved gold mine in Moose River, Halifax County, Nova Scotia. It is located on land owned by the Proponent and NSL&F. This area has a long history of gold mining, with mining activities occurring periodically since the 1890's. Further details related to the Touquoy Mine Site are presented in Section 2. The Touquoy Gold Project has been fully operational since October 2017 and is described in detail in the Project Description as it relates to the current Project. The current proposed Project involves a temporal extension of the operation of the Touquoy Processing Facility as part of its project description and the effects of the temporal extension are evaluated as effects of the proposed Project.

In the future, it is proposed that the Touquoy pit be expanded to extract additional high grade ore (Appendix F.10). To support cumulative effects assessment for the Project, this expansion is considered herein.

In the future, it is currently proposed that tailings from the processing of ore or ore concentrates from four deposits at the Touquoy mill will be disposed of in the Touquoy pit. These tailings include the processing of lower grades of ore stockpiled for the Touquoy Project, processing of ore transported from the Beaver Dam Project, and processing of ore concentrates from the Fifteen Mile Stream Gold Project and Cochrane Hill Gold Project. Each of these proposed tailings depositions into the Touquoy pit are being evaluated separately as required to reach regulatory approvals. However, to support this cumulative effects assessment for the Project, the cumulative effects from the disposal of tailing from all four projects on Water Resources are assessed in (Appendix F.7). This cumulative assessment memo also considers the proposed expansion of the Touquoy pit.

Possible cumulative effects on the VCs are summarized in Table 8.4-2.

Spatial overlap with the following RAAs: All VCs

8.4.3.1.4 Regional Forestry Operations (Past, Present and Future)

The PA is located on a combination of lands owned by the Crown, and by Northern Timber Nova Scotia Corp. Leases allow forestry to occur on Crown land. In addition to the current forestry activity in the area, evidence of historical forestry is present; clearcutting is a widespread practice throughout the region. The PA contains a diversity of habitat types and landscape features but has experienced a considerable amount of disturbance and habitat fragmentation as a result of historic mine operations, and current and historic timber harvesting practices.

Forestry activities occur in the region surrounding the PA. Due to these operations, the regional area spanning between the Beaver Dam Mine Site and the Touquoy Mine Site is a mosaic of forested habitats at different stages of regeneration, including some relatively undisturbed mature forest. Harvested wood in this area is transported from the area by road. Regional forestry operations are likely to continue into the future following current forest management practices. Forest harvesting may also contribute to traffic on the Beaver Dam Haul Road during the life of the mine projects.

MEL consulted the Nova Scotia Harvest Map Plan Viewer (NSL&F, 2021) and NSL&F to attempt to quantify timber harvesting activity on Crown Lands, to help advise the assessment of potential cumulative effects. NSL&F confirmed that the Harvest Map available to view online identifies forest patches that are proposed or approved for timber harvesting on crown land. This tool has limited application in quantifying harvest operations, because its' intention is for public consultation purposes, and NSL&F does not use this tool to confirm if and when any approved forest patch has been actually harvested. As such, the total area of past, current and proposed crown land timber harvesting within the RAA could not be quantified. Furthermore, this layer applies to crown lands only, and there is no equivalent tracking system for timber harvesting operations on private land (which accounts for approximately 67% of the RAA). As such, timber harvesting operations cannot be discussed in any meaningful, quantitative way. Given the limitations of available data, discussions related to timber harvesting are qualitative in nature. Timber harvesting practices and standards are currently being reviewed under recommendations provided in the Leahy Report (2018). The details associated with which recommendations will be implemented are unknown at this time, though the general intent is to promote more ecologically driven timber harvesting. As a result, the implementation of recommendations outlined in the Leahy report are only anticipated to reduce residual effects of timber harvesting moving into the future, rather than increase residual effects.

Spatial overlap with the following RAAs: All VCs

8.4.3.1.5 Nova Scotia Salmon Association – Acid Mitigation Project

The WRSH watershed is home to one of the largest and longest Atlantic salmon restoration projects in Canada – the WRSH Acid Mitigation Project. Like most watersheds in the SU region, the WRSH has experienced acidification, reducing the habitat quality for spawning Atlantic salmon. Before intervention, the pH range of the main WRSH and Killag River was approximately 4.3 to 5.5 and 4.7 to 5.5, respectively (Halfyard, 2013). In an effort to improve the quality of fish habitat, the Nova Scotia Salmon Association (NSSA) with support from the Atlantic Salmon Federation and numerous other organizations has operated a continuous lime dosing station in the West River since 2005 (6 km southwest of the Beaver Dam Mine Site, and 13 km northeast of the Touquoy Mine Site). A second lime dosing station was installed on the Killag River in 2017. The Killag River dosing station is located approximately 500 m east and downstream of the Beaver Dam Mine Site, and 13 km northeast of the Touquoy Mine Site. Their purpose is to increase the pH of the water to a range that is more suitable for juvenile Atlantic salmon (approximate pH levels of 5.5). As a result of the Acid Mitigation Project, treated river pH within the WRSH has increased to 5.5 to 7.5 (Halfyard, 2013).

In addition to the operation of two lime dosing stations, the NSSA has implemented a terrestrial liming program, to remediate effects of chronic acidification in the watershed, and to complement the ongoing aquatic liming programs. Terrestrial liming involves deposition of dolomitic limestone across the catchment by helicopter, while lime dosers add a slurry of limestone directly into the

watercourse on a continuous basis. To date, terrestrial liming has occurred within the Keef Brook, Paul Brook and Tent Brook tertiary watersheds (Rotteveel, 2018; DFO, 2020; NSSA, 2017).

Spatial overlap with the following RAAs: All VCs

8.4.3.1.6 Goldboro Gas Plant – Sable Offshore Energy Project (Past)

The Goldboro Gas Plant was built to collect and distribute natural gas from the Sable Offshore Energy Project in 1999. The gas plant completed initial processing to prepare natural gas to be sent via pipeline to the Point Tupper Fractionation Plant for additional processing. The gas plant operated for more than ten years, and decommissioning studies and planning commenced in 2012. Well plug and abandonment commenced in 2017. This site is approximately 87 km northeast of the Beaver Dam Mine Site, and 105 km northeast of the Touquoy Mine Site.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.1.7 Port of Sheet Harbour (Present)

The Port of Sheet Harbour is a deep-water port located 25 km southeast of the Beaver Dam Mine Site and 35 km southeast of the Touquoy Mine Site on the coast of the Atlantic Ocean. The terminal consists of a 152 m wharf with a minimum draft of 10 m and is capable of handling ships of up to 214 m (Port of Sheet Harbour, 2017).

This facility has the capacity to handle aggregates and dry bulk, scrap metal and a variety of large bulky equipment such as neobulk marshalling and load out, fabrication modules including construction equipment and heavy lift project cargo, pipes and tubulars, boilers and transformers, and wind turbines (Port of Sheet Harbour, 2017).

Spatial overlap with the following RAAs: Air, Mi'kmaq of Nova Scotia

8.4.3.1.8 Cook's Brook Sand and Gravel Pit (Present and Future)

Gallant Aggregates Limited operates a sand and gravel pit in Cooks Brook, located approximately 46 km west of the Beaver Dam Mine Site and 30 km west of the Touquoy Mine Site. An eastward extension of the site was approved in 2013 and scheduled to commence that same year. The sand and gravel pit is approximately 500 m long by 250 m wide.

Spatial overlap with the following RAAs: Air, Mi'kmaq of Nova Scotia

8.4.3.1.9 ScoZinc Ltd. Mine (Past and Future)

ScoZinc Limited owns and operates a zinc/lead operation in Cooks Brook, approximately 49 km west of the Beaver Dam Mine Site and 33 km west of the Touquoy Mine Site. The footprint of this mine is approximately 160 hectares. An EARD for the project was approved in 2011; and several temporal extensions of the Approval have been granted as the Project did not commence within the approved timelines. According to the EARD (CRA, 2010), the project includes mineral extraction, milling and reclamation activities.

Spatial overlap with the following RAAs: Air, Mi'kmaq of Nova Scotia

8.4.3.1.10 National Gypsum Quarry (Present)

National Gypsum operates a large quarry in Milford Station, approximately 55 km west of the Beaver Dam Mine Site and 38 km west of the Touquoy Mine Site. It is the largest gypsum quarry in the world and was first constructed in 1955 (National Gypsum 2015). The footprint of the quarry is approximately 2.5 km by 1.1 km. It is anticipated to be in operation for the next 40 plus years.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.1.11 Murchyville Gypsum Mine (Past)

A small, approximately 275 m by 200 m, gypsum quarry is located in Murchyville, 35 km southwest of the Beaver Dam Mine Site and 18 km west of the Touquoy Mine Site. This quarry is not currently operational and is currently on care and maintenance.

Spatial overlap with the following RAAs: Air, Mi'kmaq of Nova Scotia

8.4.3.1.12 Tangier Gold Mine (Past and Future)

The Tangier Gold Mine is located approximately 29 km south of the Beaver Dam Mine Site, and approximately 28km southwest of the Touquoy Mine Site. The footprint of this mine is approximately 500 m by 150 m, as measured on Google Earth.

The area of the Tangier Gold Mine has seen mining activity since the 1860s. The existing mine began its activities in the 1980s and is currently inactive. According to a press release dated January 29, 2019, the proponent had filed a Notice of Intention to make a proposal under the *Bankruptcy and Insolvency Act* (Resource Capital Gold Corp. 2017), and was deemed officially bankrupt on July 13, 2019 (PwC Canada, 2021).

Spatial overlap with the following RAAs: Air, Mi'kmaq of Nova Scotia

8.4.3.1.13 Dufferin Gold Mine (Past, Present and Future)

The Dufferin Gold Mine is located approximately 27 km southeast of the Beaver Dam Mine Site, and 42 km east of the Touquoy Mine Site. The footprint of this mine is approximately 375 m by 150 m.

Mining has been active in this area for more than a century. The site of the Dufferin Gold Mine began activity in the 1980s and has had sporadic development over the years. In 2014, the mine operated for a short period of time before closing. It is currently under the same ownership as Tangier Gold Mine and there were plans for re-opening to begin in 2017. A bulk sampling program and associated milling was completed in 2018, but in 2019 the proponent (Resources Capital Gold Corporation) filed a Notice of intention to make a proposal under the *Bankruptcy and Insolvency Act* so future plans for this Project are uncertain.

Spatial overlap with the following RAAs: Air, Habitat and Flora, Terrestrial Fauna, Avifauna, SAR and SOCI, Mi'kmaq of Nova Scotia

8.4.3.1.14 Great Northern Timber Wood Chipping and Shipping (Present)

Great Northern Timber owns and operates a chipping and ship loading facility in Sheet Harbour, approximately 25 km southeast of the Beaver Dam Mine Site. Great Northern Timber procures wood chips and roundwood fibre from industrial landowners, sawmills, Crown lands, Private land contractors and Private woodlot management organizations in Nova Scotia, Prince Edward Island, New Brunswick and Quebec.

Spatial overlap with the following RAAs: Air, Mi'kmaq of Nova Scotia

8.4.3.1.15 Taylor Lumber Co. Ltd. Mill (Present)

Taylor Lumber Co. Ltd. has operated a mill in Middle Musquodoboit since 1945. This site, located approximately 30 km west of the Beaver Dam Mine Site and 17 km northwest of the Touquoy Mine Site, includes a saw mill, a finishing plant, a pallet plant, a power plant, a dry-kiln, and a chipping plant. The power plant is a co-generation facility that burns biomass produced from their operation that provides power to their operation as well as to homes and businesses within a 30 km radius (Taylor Lumber, 2017).

Spatial overlap with the following RAAs: Air, Mi'kmaq of Nova Scotia

8.4.3.1.16 Regional Wind Power Projects (Present)

A total of at least five Wind Power Projects (WPP) are present within the broadest RAA (Mi'kmaq of Nova Scotia) to be considered in the cumulative effects assessment. Wind power Projects within this RAA range from single turbines projects with a 1.5 MW capacity to projects with 6 turbines with a capacity of 13.8 MW. The closest WPP to the Study Area is the Sheet Harbour WPP, 24 km southeast of the Beaver Dam Mine Site. The projects reviewed include the Mulgrave WPP, Chebucto – Pockwock WPP, Sable WPP, Gaetz Brook WPP, and Chebucto Terence Bay WPP.

Given the distance between regional WPPs and the proposed Project, and the comparatively small scale of WPPs, and the limited expected residual effects of these wind projects post mitigation efforts, these projects are determined to be unlikely to contribute to cumulative effects with the Project. As such, they are not discussed in any further detail in this Cumulative Effects Assessment. These WPPs fall within the RAA for Mi'kmaq of Nova Scotia, and except at the sites of the turbines themselves, they are not believed to limit land and resource use by the Mi'kmaq of Nova Scotia.

Wind Power Projects spatially overlap with the RAA for Mi'kmaq of Nova Scotia, however these projects are not specifically considered in any VCs, based on justification provided above.

8.4.3.1.17 Porcupine Mountain Quarry (Present)

Porcupine Mountain Quarry is a large aggregate quarry located at Porcupine Mountain, near Mulgrave, Guysborough County. This aggregate quarry exceeds 200 hectares in disturbed area. It has been in operation for more than 70 years, having been used as the source of rock for construction of the Canso Causeway in the 1950s. This site is 119 km northeast of the Beaver Dam Study Area and 138 km northeast of the Touquoy Mine Site.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.1.18 Mosher Lake Limestone Co. (Present)

Mosher Limestone processing facility is located approximately 20 km northwest of the beaver Dam Mine Site Dam Mine and 16 km north of the Touquoy Mine Site. Mosher Limestone processes and sells limestone products in Nova Scotia and Atlantic Canada. Products include pelletized limestone, powdered limestone, granular limestone, powdered gypsum, pelletized gypsum, and traction sand. The processing facility crushes, packages and ships product.

Spatial overlap with the following RAAs: Air, Mi'kmaq of Nova Scotia

8.4.3.1.19 Great Northern Timber Pellet Facility (Present)

Great Northern Timber Group owns and operates a wood pellet manufacturing facility at Upper Musquodoboit – Great Northern Pellets, since 2017, located approximately 21 km northwest of the Beaver Dam Mine Site and 16 km north of the Touquoy Mine Site. The plant has had a capacity for processing 60,000 tons of wood pellets per year. Past operators shipped product to Europe through the Port of Halifax.

Spatial overlap with the following RAAs: Air, Mi'kmaq of Nova Scotia

8.4.3.1.20 Goff's Quarry Expansion (Present and Future)

Scotian Materials currently operates a quarry on private land, approximately 70 km southwest of the Beaver Dam Mine Site and 52 km southwest of the Touquoy Mine Site. Currently, the quarry is permitted under an industrial approval, as it operates under 4.00 ha. Scotian Materials has submitted an EA registration document to expand the quarry to approximately 41 hectares, extending the life of the quarry by an estimated 25-50 years.

A provincial EA was registered August 7th, 2018 for the proposed undertaking. The Minister released a decision on September 25th, 2018 requesting additional information. On 25 October 2019, the Minister granted Approval for a 14-ha expansion (Phase 1 and Phase 2) of the Project described in the registration document, to ta total quarry footprint of 18 hectares. Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.1.21 Lake Major Dam Replacement (Present)

On December 16, 2016, Halifax Water submitted a provincial Environmental Assessment Registration Document for the replacement of a dam on Lake Major in Halifax County. The Project is located 55 km southwest of the Touquoy Mine Site and 70 km southwest of the Beaver Dam Mine Site. The Minister approved the Project on February 9th, 2017, subject to a number of conditions.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.1.22 Loch Katrine Quarry (Present and Future)

On November 2nd, 2016, Dexter Construction Company Limited submitted a provincial Environmental Assessment Registration Document. The proposed undertaking involves an expansion of the existing 3.94 ha aggregate quarry in Loch Katrine, Guysborough County. The expanded quarry will occupy a maximum footprint of 27.3 ha, providing aggregate for road and local construction industries for up to 40 years. This site is located 73 km northeast of the Beaver Dam Mine Site and 90 km northeast of the Touquoy Mine Site. This project was granted ministerial approval on December 22nd, 2016.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.1.23 Chedabucto Aggregates Quarry (Present and Future)

On September 17th, 2014, Chedabucto aggregates Limited submitted a provincial Environmental Assessment Registration Document. The proposed undertaking involves an expansion of the existing hectares aggregate quarry in Queensport, Guysborough County to a maximum size of 11.4 ha. This site is located 113 km northeast of the Beaver Dam Mine Site and 130 km northeast of the Touquoy Mine Site. This project was granted ministerial approval on November 6th, 2014.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.1.24 Highway 107 – Bedford to Burnside (Present)

In June of 2017, Nova Scotia Transportation and Infrastructure Renewal submitted a provincial Environmental Assessment Registration Document for the construction of an extension to Highway 107, from Bedford to Burnside. The Project involves construction of a four-lane highway, approximately 9 km in length, connecting Akerley Boulevard and Burnside Drive to the west end of Duke Street. This project also proposes to widen approximately 1.5 km of Duke Street in Bedford which leads to Highway 102. On August 25, 2017, the Minister released a decision requesting supplemental information. This was provided on June 18, 2018, and the Project was approved on August 7, 2018. The registration document submitted in June 2018 proposed a construction schedule of 5 years (2018-2022). The project lies approximately 63 km southwest of the Touquoy Mine Site and 80 km southwest of the Beaver Dam Mine Site. Construction commenced on this project in September 2019.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.2 Future Physical Activities (Certain, Reasonably Foreseeable or Hypothetical)

It is expected that the forestry industry will continue into the foreseeable future throughout the RAA for Mi'Kmaq of Nova Scotia (the largest RAA). The mining industry could become more active if the price of minerals, notably gold, increases. This could hypothetically lead to the expansion of existing projects or the proposal of other new mining projects as exploration for mining is active in the region.

In addition to the ongoing forestry industry and the potential increase in general mining activities, two projects proposed by the Proponent, the Fifteen Mile Stream Mine Project and the Cochrane Hill Gold Project that are associated with the Touquoy Mine Site were identified as potential future projects. Neither project has been approved, as they are both currently undergoing federal environmental assessments; they are therefore determined as reasonably foreseeable projects for the purpose of this CEA.

8.4.3.2.1 Cochrane Hill Gold Project (Future)

The proposed Cochrane Hill Gold Project comprises of the development, operation, closure and reclamation of a surface gold mine in association with the Touquoy mine, which would produce approximately two million tonnes of gold-bearing ore a year. The Cochrane Hill surface mine is located within Guysborough County, in central Nova Scotia, approximately 145 km northeast of Halifax, and 62 km northeast of the Beaver Dam Mine Project. The property covers the historic Cochrane Hill Gold District located on NTS sheets 11E01/D, 11E08/A, and 11E05/B. Concentrate from Cochrane Hill Mine Site will be trucked to the Touquoy Mine Site for processing, along with FMS concentrate and ore from Beaver Dam. This proposed transportation route includes the use of the Beaver Dam Haul Road.

Processing the gold concentrate produced the Cochrane Hill Gold Project at the Touquoy facility will eliminate the need for a separate processing facility at the Cochrane Hill Mine Site. It is anticipated that 350,000 tonnes of tailings would be deposited into the Touquoy exhausted pit as a result of processing the gold concentrate from the Cochrane Hill Gold Project.

To facilitate the processing of the gold concentrate produced at the Cochrane Hill Mine Site, minor changes to the Touquoy facility would be needed. Additional concentrate storage and the addition of a second gravity concentrate leach reactor and a gravity electrowinning cell would have to be added. However, all of these items can be accommodated within existing footprint at the Touquoy mine.

There is also potential for cumulative effects associated with the effects resulting from the continued use of the Touquoy Mine Site. The residual effects for the Cochrane Hill Gold Project resulting from use of the Touquoy Mine Site would be a temporal extension

of the residual effects defined for the Touquoy Gold Project. The cumulative impacts of the addition of the Cochrane Hill Gold Project must take into account the extension of the temporal boundaries for the effects at the Touquoy Mine Site, alongside the same extension from the Project and the Beaver Dam Mine Project. Also, any such effects that are lasting could accumulate over time. Possible cumulative effects on the VCs are summarized in Table 8.4-2.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.2.2 Beaver Dam Haul Road use by the Project, Cochrane Hill (Future), Beaver Dam Mine Project, and Forestry Activities (Future)

The gold concentrate from the Cochrane Hill Mine Site and FMS Mine Site as well as ore from the Beaver Dam Mine Site will be transported to the Touquoy Mine Site for processing. The Beaver Dam Haul Road is proposed for construction as part of the Beaver Dam Mine Project, at which point, it will be used to transport ore and concentrate from the Project to the Touquoy Mine Site. A total of 95 return trips (e.g., round trips or two-way trips) are expected to travel on the Beaver Dam Mine Haul Road to facilitate transportation of Beaver Dam ore to the Touquoy Mine Site. Both Cochrane Hill and FMS Projects will contribute an additional 11 return trips each per day.

In addition, the Haul Road may also occasionally be used by forestry harvesters in the local area. In addition to 7 return trips by forestry trucks estimated per day, it is estimated 3/4-ton service trucks would make up to approximately 20 round trips per day on the haul roads.

The Project Team was unable to ascertain specific data regarding schedule or frequency of cutting within this area, or the resulting number of trucks that could be present from harvesting activities in the same temporal boundary as the projects as the Beaver Dam, Fifteen Mile Stream and Cochrane Hill Projects. As a result, this activity has been evaluated in a qualitative way as part of this cumulative effects assessment, where possible, given the data limitations.

The possible cumulative effect includes an expected increase in traffic on the Beaver Dam Haul Road between Highway 224 and the Mooseland Road, and the small contribution of each project to the overall disturbance of natural habitats at the regional scale for both humans (traditional usage and local residents) and flora and wildlife.

Spatial overlap with the following RAAs: All VCs

8.4.3.2.3 Goldboro Gold Mine (potential Future)

In August 2018, Anaconda Mining Inc. submitted a provincial Environmental Assessment Registration Document for construction and operation of a gold mine in Goldboro, Guysborough County. This site is approximately 86 km east of the Beaver Dam Mine Site, and 100 km east of the Touquoy Mine Site. Based on the project description available in the 2018 EARD, the proposed Project would involve operation of surface and underground mine facility producing 575 tonnes per day, 24 hours/day, 7 days/week, within a project footprint of approximately 126 ha. An on-site concentrator and tailings facility would be built as well. The proposed Project timeline involved production commencing in 2020, with project completion occurring in 2029, pending approval. On September 19th, 2018, the Minister released a decision, indicating that additional information would be required before approval could be granted. The Minister released terms of reference for a Focus Report to be submitted by the Proponent. The proponent withdrew their Environmental Assessment Registration Document on September 16, 2019.

The Goldboro area has been an active and productive mining area around the turn of the century from 1893-1910. There are historic mine workings as well as contamination throughout the area due to this history of mining.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.2.4 Sheet Harbour Quarry (Future)

On January 31st, 2019, Dexter Construction registered an Environmental Registration Document with Nova Scotia Environment. The Minister released a decision on November 8th, 2019, approving the proposed undertaking. It is unknown whether the project has commenced. The Project is located in the community of Mushaboom, Halifax, County, Nova Scotia, approximately 26 km south of the Beaver Dam Mine Site, 6.6 km south of the community of Sheet Harbour, and 4 km southwest of the Port of Sheet Harbour. The total infrastructure footprint of the project is approximately 85 ha.

The purpose of the undertaking is to meet local and regional aggregate demand for projects carried out by Dexter Construction in the Sheet Harbour regional area. There is future potential for aggregate material to be sold offshore using the Port of Sheet Harbour as a shipping point. This quarry will replace existing smaller quarries in the region that are nearly exhausted and will be reclaimed. The extractable reserves in the quarry as designed is anticipated to be 50 plus years with production commencing at approximately 50,000 tonnes per year and increasing to 500,000 tonnes per year by Year 16 depending on markets.

Site activities will include the drilling, blasting, crushing, stockpiling, and transporting by trucks of aggregate for sale or for use in projects that are contracted to Dexter Construction. The operation will consist of a lay down area for the portable crushing equipment and screens, various aggregate stockpiles, and weigh scales, as well as the physical features of the site such as the quarry floor and active working faces, and site settling pond(s).

Assuming the mitigation, monitoring, and progressive reclamation measures specified in this report are implemented, and the quarry is operated according to provincial guidelines and approvals, no significant adverse residual environmental or socio-economic effects are likely. Effects are expected to be of small spatial magnitude, low frequency, short duration, and/or limited geographical extent. Operation of the quarry will result in economic benefits, including employment and an economic source of quality aggregates to local demand markets.

Environmental effects will include the loss of some habitat within the proposed quarry property area. The property has been the subject of past forestry- activities.

Localized impacts on air quality can be expected through the formation of airborne particulate matter. These impacts are readily controlled through standard mitigation measures (e.g., dust suppression) and follow-up monitoring as necessary to ensure compliance with the Pit and Quarry Guidelines at the property boundaries.

Spatial overlap with the following RAAs: Air, Mi'kmaq of Nova Scotia

8.4.3.2.5 Black Point Quarry (Future)

On March 4th, 2014, Black Point Aggregates Inc. submitted a Provincial Environmental Assessment Registration Document and federal EIS for the operation of a granite quarry in Guysborough County. It is located 180 km east of the Beaver Dam Mine Site and 143km northeast of the Touquoy Mine Site. On April 26, 2016 federal and provincial approval was granted for this project to proceed. On March 29th, 2018, the Minister authorized an extension for the commencement of work. The Proponent must commence work on or before April 26th, 2020 unless granted an extension by the Minister. It is uncertain whether an extension was sought, or has been granted by the minister; so this Project will remain in this list as reasonably foreseeable in an effort to be conservatively inclusive.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.2.6 Bearpaw Pipeline (Future)

On March 30th, 2016, Bear Paw Pipeline Corporation Inc. submitted a provincial Environmental Assessment Registration Document for the construction and operation of a 62.5 km high pressure steel natural gas pipeline from Goldboro to the future location of the Bead Head LNG liquefied natural gas export facility in Richmond County, Nova Scotia. The project will include a compressor facility to deliver natural gas pressure to Bear Had LNG. On November 2nd, 2016, the Proponent submitted an addendum to the Registration Document. The Minister granted approval to this project on December 22nd, 2016. The western extent of this proposed pipeline in in Goldboro, approximately 86 km east of the Beaver Dam Mine Site, and approximately 100 km northeast of the Touquoy Mine Site. The proposed pipeline route runs northeast across Guysborough County towards the Strait of Canso.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.2.7 Goldboro LNG Facility (Future)

In September 2013, Pieridae Energy (Canada) Ltd. submitted a provincial Environmental Assessment Registration Document for the construction and operation of a Natural Gas Liquefaction Plant and Marine Terminal in Goldboro, Guysborough County. The Project received ministerial approval on March 21, 2014, and an extension for the commencement of work on October 24, 2017. The proponent must commence work on or before March 21, 2019, unless granted an extension by the Minister. This site is approximately 86 km east of the Beaver Dam Mine Site, and 100 km east of the Touquoy Mine Site.

Associated with this project, Pieridae Energy (Canad) Ltd. submitted a provincial Environmental Assessment Registration Document for the Realignment of Marine Drive (Highway 316) project on March 10, 2021. The purpose of this project is to permanently re-align approximately 3.5 km of the existing Marine Drive (Highway 316) around the proposed Goldboro LNG Project site. This project is pending a decision from the Minister.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.2.8 Canso Spaceport Facility (Future)

Maritime Launch Services Ltd. (MLS) has proposed to construct and operate a private commercial space launch site near the communities of Little Dover, Hazel Hill, and Canso, within the Municipality of the District of Guysborough (MODG) of Nova Scotia. The purpose of the Project is to establish a commercially-controlled, commercially-managed, launch site that would provide launch site options in North America, in support of the growing commercial space transportation industry. The site location is approximately 140 km northeast of the Beaver Dam Mine Site and 155 km northeast of the Touquoy Mine Site.

The Project will be situated on a portion of Crown Land designated by Property Identification Number (PID) 35096320 and consist of three components; the Launch Control Center (LCC), the Horizontal Integration Facility (HIF), and the Vertical Launch Area (VLA) connected by a transportation route. Access to the Project site is expected to coincide, in part, with the access road to the Sable Wind Farm, owned and operated by the MODG, in partnership with Nova Scotia Power.

A provincial EA was registered in June of 2018 for the proposed undertaking. The Minister released a decision in August 2018 requesting additional information. A focus report was submitted on March 11th, 2019, and Minister issued an Approval for the Project on June 4, 2019.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.2.9 Waste Dangerous and Non-Dangerous Goods Temporary Storage Facility (Future)

On August 7 2019, Envirosystems Incorporated (Envirosystems) registered an environmental assessment for the Waste Dangerous and Non-Dangerous Goods Temporary Storage Facility at 11 Brownlow Avenue in Burnside, NS. The Minister decided additional information was required to make a decision on this Project. On 11 February 2020, the Minister decided to approve the undertaking. The project lies approximately 63 km southwest of the Touquoy Mine Site and 78 km southwest of the Beaver Dam Mine Site. The Project involves construction and operation of a new waste dangerous and non-dangerous goods temporary storage facility (Storage Facility) at their existing site at 11 Brown Avenue, a fully permitted Used Oil Collection and Storage operation (Approval No. 2001-024626-R10). The existing site is approximately 20,940 square metres (m^2) in size with the proposed facility occupying roughly 1.55% of the site.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.2.10 Liquid Asphalt Storage Facility (Future)

On 1 May 2020, General Liquids Canada and the municipal Group of Companies registered an environmental assessment document for a proposed Liquid Asphalt Storage Facility Project. This facility is proposed to be located on Pleasant Street in Dartmouth, which is approximately 61 km southwest of the Touquoy Mine Site and 76 km southwest of the Beaver Dam Mine Site. This facility would allow transferring, storage and preparation of liquid asphalt for shipment. On 22 June 2020, the Minister decided to approve the undertaking, subject to a number of conditions.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.3.2.11 Highway 102 Aerotech Connector Road Project (potential Future)

On 20 September 2019, Nova Scotia Transportation and Infrastructure Renewal submitted a provincial Environmental Assessment Registration Document for the construction of a connector road from Highway 102 Aerotech Interchange (Exit 5A) to Trunk 2 in Wellington. This 5 km connector road is designed as a four-lane road. According to the registration document, the project may commence in 2020 and is expected to take 5 years to complete. The Minister of Environment approved this undertaking on January 5, 2021. The project lies approximately 52 km southwest of the Touquoy Mine Site and 68 km southwest of the Beaver Dam Mine Site.

Spatial overlap with the following RAAs: Mi'kmaq of Nova Scotia

8.4.4 Confirmation of Valued Components to be Carried Forward Cumulative Effects Assessment

The three steps listed above include identification of the valued components, determination of spatial and temporal boundaries, and identification of past, present and future physical activities or projects relevant to the selected VCs based on identified RAAs for each VC. This exercise allowed for the identification of pathways for potential cumulative effects per VC based on:

- The extent of predicted Project effects on each VC;
- Potential extent of other Projects' impacts based on publicly available or published data;
- The timeframe of Project impacts;
- The timeframe of other Projects potential impacts, based on publicly available or published data; and,

- Types of potential cumulative effects (additive, synergistic, compensatory and masking).

This fourth step takes these confirmed pathways and potential intersections with other Projects, and then identifies which VCs will be brought forward to the CEA, based on the following criteria:

- level of concern noted during engagement;
- current state of the VC (health/status/condition);
- potential for significant cumulative effects with other projects as identified for each VC; and
- uncertainty in predictions of cumulative effects especially project knowledge and data limitations.

As described in Table 8.4-2 the following VCs warrant further assessment:

- Physical Environment:
  - Air;
  - Noise;
  - Light; and
  - Surface Water Quality and Quantity.
- Biophysical Environment:
  - Fish and Fish Habitat; and
  - Species of Conservation Interest and Species at Risk.
- Socio-Economic Environment:
  - Mi'kmaq of Nova Scotia.

Noise and light VCs associated with the defined Beaver Dam Project do not trigger evaluation of cumulative effects based on confirmed Project Areas and VC spatial boundaries (RAAs) and locations of other identified projects. However, due to the proposed interactions of the Fifteen Mile Stream Project with the Project and Cochrane Hill Gold Project, as well as forestry trucking activities, relating to the use of the Beaver Dam Haul Road for transportation of gold concentrate from the Project, the noise and light VCs are carried forward to evaluation for cumulative effects herein only in consideration of the plan to use the Beaver Dam Haul Road for transportation of gold concentrate to the Touquoy Mine Site. Trucks associated with the transportation of this concentrate have additive cumulative potential for increased dust, light intrusion into the forest, and noise when considered with the Beaver Dam Haul Road truck traffic, and also the truck traffic associated with the proposed Cochrane Hill Gold Project (additional transportation of gold concentrate using this Haul Road) and potential forestry traffic.

SOCI/SAR is being evaluated with regards to cumulative effects for rare species, including Avifauna. As such, cumulative effects to migratory birds more generally will be addressed through the effects assessment for Avifauna SAR.

Table 8.4-2: Selection of Valued Components for the Cumulative Effects Assessment

Project VC	Residual Adverse Effects	EIS Finding	Boundaries		Criteria for Determining Whether Further Assessment Is Required			Carried Forward to Cumulative Effects Assessment		
			Spatial – Geographical Extent of Residual Effects	Temporal - Timeframe Associated with Residual Effects	Level of Concern Noted During Engagement	Current State of The VC (Health/Status/ Condition)	Potential for Cumulative Effects: Screening Evaluation Summary	Uncertainty in Prediction of Cumulative Effects	Yes/No	Rationale
Noise	Increased ambient noise	Not Significant	Residual effects related to ambient noise levels are not anticipated to extend outside the LAA	Residual effects to ambient noise levels may occur throughout the duration of the project including Construction, Operation and Active Closure	Medium. Local residents and Mi'kmaq are concerned with potential noise from the mine. Noise along the Beaver Dam Haul Road is a concern for the Millbrook First Nation and local residents.	Good. Project noise is predicted to be in compliance with the Pit and Quarry Guideline nighttime guideline of 55 dBA at the proposed property boundaries for the Beaver Dam Mine Site, the Haul Road and the Touquoy Mine Site.	No. It is likely that forestry operations will occasionally coincide with those of the Beaver Dam Mine Project within the RAA and cause increased ambient noise levels, compared to the levels that these operations produce individually. However, such additive periods are likely to be limited in duration and frequency and are not expected to be significant. The NSSA AMP overlaps with the Noise RAA, however with the exception of annual helicopter deposition of limestone over a several week period, the project does not generate noise. No other projects were identified within the RAA for noise. Cumulative effects of transportation of gold concentrate from Fifteen Mile Stream Gold Project, the Cochrane Hill Gold Project and forestry activity, together with the Project, is possible (trucking on Beaver Dam Haul Road)	Moderate. The principal assumption behind the potential of significant cumulative effects is that local forestry practices will not change in any substantial, meaningful way throughout the Project. This assumption is considered as having a moderate uncertainty. No data was available to confirm this statement.	Yes.	The predicted cumulative effects are not anticipated to be significant and the residual effects of the Project are anticipated to revert back to baseline conditions upon completion of the project. However, due to potential for cumulative effects of trucking on the Beaver Dam Haul Road, further evaluation is warranted specific to this location only.
Air	Increased ambient dust	Not Significant	Residual effects related to air quality are not anticipated to extend outside the LAA.	Residual effects to ambient air quality levels may occur throughout the duration of the project including Construction, Operation, and Active Closure	Medium to high. Concerns were specifically expressed by the Mi'kmaq relating to atmospheric environment include potential dust from mining operations at the Beaver Dam Mine Site and Touquoy Mine Site for traditional practices Dust along the Beaver Dam Haul Road is a concern for the Millbrook First Nation and local residents.	Good. Concentrations of all parameters are predicted to be in compliance with appropriate regulatory criteria at the proposed property boundaries for the Beaver Dam Mine Site and Haul Road. Compliance will be reached through the application of chemical dust suppressants along the Haul Road (proposed 80% dust suppression). There are no predicted impacts from the Project at the Touquoy Mine Site.	No. It is likely that forestry operations will occasionally coincide with those of the Beaver Dam Project and cause increased ambient dust levels, compared to the levels that these operations produce individually. However, such additive periods are likely to be limited in duration and frequency and are not expected to be significant. Cumulative effects of transportation of gold concentrate from Fifteen Mile Stream Gold Project, the Cochrane Hill Gold Project and forestry activity, together with the Project, is possible (trucking on Beaver Dam Haul Road)	Moderate. The principal assumption behind the potential of significant cumulative effects is that local forestry practices will not change in any way throughout the Project. This assumption is considered as having a moderate uncertainty. No data was available to confirm this statement.	Yes.	Further assessment is required to determine if there is the possibility of significant residual cumulative effects to Air at the Beaver Dam Mine Site. Also, due to potential for cumulative effects of trucking on the Beaver Dam Haul Road, further evaluation is warranted specific to this location.
Light	Increased ambient light	Not Significant	Residual effects related to ambient light levels are not anticipated to extend outside the RAA.	Residual effects to ambient light levels may occur throughout the duration of the project including Construction, Operation and Active Closure.	Medium. Local residents and Mi'kmaq are concerned with potential light from the Beaver Dam Mine Site Light intrusion into the forest along the Beaver Dam Haul Road is a concern for the Millbrook First Nation and local residents.	Good. The RAA is a rural area and is mostly wooded. Ambient nighttime light conditions would be minimal and typical of an undeveloped rural area. There are no predicted impacts from the Project at the Touquoy Mine Site	No. It is likely that forestry operations will occasionally coincide with those of the Beaver Dam Mine Project and cause increased ambient light levels, compared to the levels that these operations produce individually. However, such additive periods are likely to be limited in duration and frequency and are not expected to be significant. Cumulative effects of transportation of gold concentrate from Fifteen Mile Stream Gold Project, the Cochrane Hill Gold Project and forestry activity, together with the Project, is possible (trucking on Beaver Dam Haul Road)	Moderate. The principal assumption behind the potential of significant cumulative effects is that local forestry practices will not change in any way throughout the Project. This assumption is considered as having a moderate uncertainty. No data was available to confirm this statement.	Yes.	The predicted cumulative effects are not anticipated to be significant and the residual effects of the Project are anticipated to revert back to baseline conditions upon completion of the project. However, due to potential for cumulative effects of trucking on the Beaver Dam Haul Road, further evaluation is warranted specific to this location only.
GHG	Increased greenhouse gas emissions	Not significant	Residual effects related to GHG emissions are anticipated to extend throughout the RAA (the Province of Nova Scotia)	Residual effects to GHGs may occur throughout the duration of the project including Construction, Operation and Active Closure.	Limited concern has been noted specific to greenhouse gas emissions associated with the Project	Good. The total GHG emissions from Nova Scotia were identified to be 17,000 kilotonnes CO_2e during 2018, which achieved the legislated reduction goal of 10% below 1990 levels by 2020	No. All phases from this project would represent approximately 0.128% of the total GHG emissions for Nova Scotia. It is therefore considered that the proposed project contributes very little to the overall cumulative effects of regional industry to GHG emissions.	Low. Although there is some uncertainty in levels of GHG emissions, there is good confidence in the fact that the Beaver Dam Mine will only contribute a small percentage for Nova Scotia.	No.	As the predicted cumulative effects are not anticipated to be significant and given the small contribution of the Beaver Dam Project to total GHG emissions, the effects with and without the project are very similar. Therefore, no further assessment is warranted.

Table 8.4-2: Selection of Valued Components for the Cumulative Effects Assessment (continued)

Project VC	Residual Adverse Effects	EIS Finding	Boundaries		Criteria for Determining Whether Further Assessment Is Required			Carried Forward to Cumulative Effects Assessment		
			Spatial – Geographical Extent of Residual Effects	Temporal - Timeframe Associated with Residual Effects	Level of Concern Noted During Engagement	Current State of The VC (Health/Status/ Condition)	Potential for Cumulative Effects: Screening Evaluation Summary	Uncertainty in Prediction of Cumulative Effects	Yes/No	Rationale
Geology, Soil and Sediment Quality	Erosion, soil and sediment quality, (i.e. flora and fauna/habitat, etc.)	Not Significant	Residual effects related to erosion, soil and sediment quality are not anticipated outside of the Beaver Dam Study Area.	Residual effects to Geology, Soil and Sediment Quality may occur throughout the duration of the project including Construction, Operation and Active Closure.	Medium. Concerns were expressed relating to potential ARD, suspended solids and mobilization of historical tails from the Beaver Dam Mine Site, which may affect receiving water and its fish habitat.	Good. Based on a number of conservative assumptions, the results indicate that there is very low potential for acidic conditions to occur during operations. During closure phase, there is potential for acidic conditions to occur, however, through mitigation these conditions can be mitigated. Historical tailings present at Beaver Dam Mine Site will be delineated, tested and managed on site before new mining activities commence. Options for disposal on-site or off-site are being considered in conjunction with regulatory consultation.	No. Potential cumulative effects related to sediment release are not anticipated. Historic Beaver Dam mining operations, forestry, haul road usage and the NSSA AMP are the only activities identified within the RAA for Soil, Sediment and Geology. Effects of historic tailings will be mitigated during construction including "working in the dry" and effective water management. Effects of forestry on sediment transport are expected to be minimal, providing forestry operators adhere to Provincial Wildlife Habitat and Watercourse Protection Regulations. Furthermore, FMS Mine Site erosion and sedimentation control measures will have a localized compensatory effect of any sediment release from local forestry activities. Therefore, it is unlikely that other projects would interact with this VC.	Low. Based on the residual effects being confined to the Beaver Dam Mine Site and Haul Road, with proper mitigation, it is unlikely that other projects would interact with this VC. This assumption is considered as having a low uncertainty.	No.	As the predicted cumulative effects are not anticipated to be significant with only two projects overlapping spatially with the Project, and the residual effects of the Project are anticipated to limited to the Beaver Dam Mine Site and Haul Road, no further assessment is warranted.
Groundwater Quality and Quantity	Disturbance to groundwater quality and quantity	Not Significant	The potential for residual groundwater quality effects are limited to the PA.	Residual effects to groundwater quality and quantity may occur throughout the duration of the project including Construction, Operation and Active Closure.	Medium. Concerns were expressed regarding groundwater drawdown and potential effects on surface water and potential impacts to potable wells at the Beaver Lake IR. The nearest potable well is 5km south of the Beaver Dam Mine Site (drilled well Beaver Lake IR).	Good. Maximum radius of influence (groundwater drawdown) is predicted at 1000 m (to the south) from the pit during operations, and less that this during closure, when the pit is re-filling with water. The nearest potable well is 5 km south of the Project. Groundwater seepage has been predicted through modelling efforts and these seepage rates have been included in operational and closure surface water modelling efforts to understand potential effect of groundwater seepage on surrounding surface water features for both the Beaver Dam Mine Site and the Touquoy Mine Site.	No. Historic mining activities within the PA, haul road usage, forestry and the NSSA AMP are the only projects within the RAA for groundwater quantity and quality. Potential cumulative effects on groundwater are not anticipated at the mine site because of the lack of other activities affecting this VC at this location. Furthermore, the potential groundwater seepage at the Touquoy site has been evaluated as part of the surface water VC.	Low. Uncertainty will be addressed through the monitoring and follow-up programs established for the Project.	No.	The predicted cumulative effects are not anticipated to be significant due to the spatial boundaries of the residual effects (zone of influence for groundwater interactions). Therefore, no further assessment is warranted.
Surface Water Quality and Quantity	Change in Water Quality and Quantity Habitat Loss and disturbance	Not Significant	The potential for residual surface water quality and quantity effects are limited to the PA and LAA.	Residual effects to surface water quality and quantity may occur throughout the duration of the project including Construction, Operation and Active Closure phases, along with the Post Closure phase when water monitoring and possible treatment is on-going.	Moderate to high. Key issues raised during stakeholder engagement was the concern about effect on water quality and quantity in downstream receiving environments and associated potential effect on fish.	Moderate. All mine contact water during operations will be directed to the North Settling Pond for treatment as required prior to release. Discharge water will meet MDMER at the end of pipe. There is a 100 m modelled mixing zone from the water discharge point within Cameron Flowage/Killag River at which point, water quality will meet CCME/Tier I, background and/or Site Specific Criteria. During closure, a cover planned for the PAG stockpile to improve water quality.	Yes. Historic mining activities within the PA, timber harvesting, Haul Road usage and the NSSA Acid Mitigation Projects are located within the RAA for surface water. Cumulative impacts based on forestry are expected to be low, providing forestry operators adhere to Wildlife Habitat and Watercourse Protection legislation. There is potential for cumulative effects between the Project and NSSA Acid Mitigation Project. The Project will adhere to all applicable water quality guidelines. However, the use of the Touquoy processing plant and deposition of tails into the exhausted pit at Touquoy extends the temporal scale of potential effects to surface water. Deposition of tails into the exhausted pit must be considered for cumulative effects. Also, the Project may require an extension to the use of Scraggy Lake as one of the sources of fresh water to process concentrate. The cumulative effect of the combined projects could mean a reduction in the streamflow from Scraggy Lake to the Fish River system. In addition, subsequent deposition of tails into the exhausted Touquoy Pit will result in release of discharge into the Moose River once the pit has filled.	Low. Uncertainty will be addressed through refinement of modelling, and the monitoring and follow-up programs established for the Project.	Yes	Further assessment is required to determine if there is the possibility of significant residual cumulative effects to Surface Water Quality and Quantity at both the FMS Mine Site and the Touquoy Mine Site.

Table 8.4-2: Selection of Valued Components for the Cumulative Effects Assessment (continued)

Project VC	Residual Adverse Effects	EIS Finding	Boundaries		Criteria for Determining Whether Further Assessment Is Required			Carried Forward to Cumulative Effects Assessment		
			Spatial – Geographical Extent of Residual Effects	Temporal - Timeframe Associated with Residual Effects	Level of Concern Noted During Engagement	Current State of The VC (Health/Status/ Condition)	Potential for Cumulative Effects: Screening Evaluation Summary	Uncertainty in Prediction of Cumulative Effects	Yes/No	Rationale
Wetlands	Habitat loss and disturbance	Not Significant	The potential for residual effects to wetlands are limited to the PA and LAA. No change in footprint at the Touquoy Mine Site is required for the Project.	Residual effects to wetlands may occur throughout the duration of the Project including Construction, Operation and Active Closure.	Low-moderate. Key issues raised during stakeholder engagement was the concern about wetlands being impacted at the Project and future compensation, and potential reduction in habitat, water quality and flood control due to loss of wetlands.	Good. Wetlands within the PA generally offer high quality wildlife habitat and water quality and quantity functions. 95% of all wetlands assessed were determined to provide moderate-high plant community integrity with a diversity of species generally composed of native species characteristic of the wetland type. Wetlands within the PA, have experienced disturbance from historic mining activity and timber harvesting in adjacent uplands.	No. The loss of wetlands from the PA results in a direct loss of 31.8 ha of wetlands which will require compensation under the Nova Scotia Wetland Conservation Policy. A cumulative wetland loss assessment exercise was carried out in Section 6.8.7.2, which determined that there was no expected significant effect on wetland loss within the LAA. Within the RAA, other activities are limited to historic mining and forestry. Effects of historic tailings will be mitigated. Effects of forestry on sediment transport are expected to be minimal, providing forestry operators adhere to Provincial Wildlife Habitat and Watercourse Protection Regulations and the Nova Scotia Wetland Conservation Policy. No additional wetland impacts are proposed at the Touquoy Mine Site.	A moderate level of uncertainty exists in the potential effect of Project changes to local hydrology and resultant impacts to wetlands. Little to no uncertainty exists related to direct wetland impacts. The potential cumulative effects (loss of wetlands within the Project footprint) is based on the planned footprint of the Project which is unlikely to change.	No.	The predicted cumulative effects are not anticipated to be significant due to the limited spatial boundaries of the residual effects (LAA) and the magnitude of these effects (Moderate). Therefore, no further assessment is warranted
Fish and Fish Habitat	Habitat loss and disturbance Decreased water quality and quantity	Not Significant	The potential for adverse residual effects to fish and fish habitat is limited to the PA and LAA.	Residual effects to fish and fish habitat may occur throughout the duration of the project including Construction, Operation and Active Closure along with the Post Closure phase when water monitoring and possible treatment is on-going.	Moderate to High. Key issues raised during public and Mi'kmaq engagement relating to fish and fish habitat include potential impacts to the Nova Scotia Southern Uplands population of Atlantic Salmon; based on proximity of the Project to the Killag River, and Acid Mitigation Projects being completed by the Nova Scotia Salmon Association, and potential indirect effects from wetland alteration or changes to surface water and groundwater quality and quantity on fish and fish habitat.	Moderate. Habitat quality within the areas proposed for direct impact do not provide suitable habitat for coldwater species and comprise anthropogenically altered habitat within the proposed open pit. High temperatures and low pH are limiting factors to fish habitat quality. Suitable habitat for a variety of species including Atlantic Salmon is present within the Killag River, immediately downstream of the proposed Project.	Yes. Within the RAA, other activities are limited to historic mining and forestry, and the ongoing Acid Mitigation Project operated by the Nova Scotia Salmon Association. Effects of historic tailings will be mitigated. Effects of forestry on sediment transport are expected to be minimal, providing forestry operators adhere to Provincial Wildlife Habitat and Watercourse Protection Regulations. Potential interaction between the Project and the NSSA works require further evaluation of cumulative effects. Site infrastructure has been micro-sited for fish habitat avoidance wherever practicable Development of the Beaver Dam Pit and associated mine infrastructure will require direct impact to fish habitat. A Fish Habitat Offset Plan has been developed to facilitate compensation for direct and indirect impacts to fish habitat (Appendix J.3)	Moderate. The uncertainty of cumulative effects to fish habitat will correspond with the level of detailed information available from the Nova Scotia Salmon Association. The uncertainty as to the Project effects on fish and fish habitat would be addressed through monitoring and follow-up programs established for the Project.	Yes.	Although the potential for significant cumulative effects to fish and fish habitat is not anticipated given appropriate mitigation, the VC was carried forward due to the concern expressed relating to fish and fish habitat including the proximity to the Killag River, and its population of southern uplands Atlantic Salmon.
Habitat and Flora	Habitat loss and disturbance	Not Significant	The potential for adverse residual effects to habitat and flora is limited to the PA and LAA. No change in footprint at the Touquoy Mine Site is required for the Project.	Residual effects to habitat and flora may occur throughout the duration of the Project including Construction, Operation and Active Closure phases.	Low-moderate. Concerns were raised during public and Mi'kmaq engagement relating to habitat and flora include potential effect on biodiversity and loss of habitat associated within the PA.	Moderate. Ecosites are predominantly poor to medium nutrient regimes with acidic soils and dominated by mixedwood and conifer forest stands. Historical mining and disturbances from timber harvesting have affected the habitat and flora communities with the PA.	No. Projects which lie within the RAA for Habitat and Flora include current and proposed mining activities at Touquoy Gold Project, historic mining at the Beaver Dam Mine Project and Dufferin Gold Mine, future mining activities at Fifteen Mile Stream, Nova Scotia Salmon Association's Acid Mitigation project (3 components), along with various regional forestry activities. Project effects on Habitat and Flora for the Beaver Dam Mine Site are limited to the LAA, which does not overlap the LAA for the proposed Project. While spatial boundaries for potential residual effects for the Dufferin Project were not available, it is expected that effects to habitat and flora would occur on a similar spatial scale to the proposed Project (2km buffer of the Study Area). Provided this is a reasonable assumption, project effects to Habitat and Flora would not overlap spatially. The Dufferin Project is not expected to overlap temporally with the proposed Project either, as the Proponent for the Dufferin Project has declared bankruptcy. The lime dosing stations operated by the Nova Scotia Salmon Association are not expected to have a significant interaction with terrestrial flora and habitat; however, the potential interaction between the terrestrial liming and flora is unknown. Any interaction between terrestrial liming and rare flora will be discussed in the cumulative effects assessment for SAR and SOCI. Forestry activities within the RAA could result in a cumulative impact to habitat and flora.	Moderate uncertainty. The generalized disturbance of the landscape by forestry on crown land is well documented in the NSL&F Forest Inventory. However, timber harvesting on private land, and potential effects of terrestrial liming on flora has a moderate level of uncertainty.	No.	Overall, the generalized disturbance of the landscape by forestry activities, past, present and future are the main source of cumulative effects of habitats throughout the area. Without the Project, the loss of habitat in the Beaver Dam Mine Site during the construction and operation phases would be avoided, however the current observed generalized disturbance of the landscape would be unaffected. Any potential significant cumulative effect based on habitat fragmentation will be discussed in the context of SAR and SOCI.

Table 8.4-2: Selection of Valued Components for the Cumulative Effects Assessment (continued)

Project VC	Residual Adverse Effects	EIS Finding	Boundaries		Criteria for Determining Whether Further Assessment Is Required			Carried Forward to Cumulative Effects Assessment		
			Spatial – Geographical Extent of Residual Effects	Temporal - Timeframe Associated with Residual Effects	Level of Concern Noted During Engagement	Current State of The VC (Health/Status/ Condition)	Potential for Cumulative Effects: Screening Evaluation Summary	Uncertainty in Prediction of Cumulative Effects	Yes/No	Rationale
Terrestrial Fauna	Habitat loss and disturbance	Not Significant	The potential for adverse residual effects terrestrial fauna occurs within the LAA and possibly may extend into the RAA when considering habitat fragmentation.	Residual effects to terrestrial fauna may occur throughout the duration of the Project including Construction, Operation and Active Closure.	Low. Concerns raised during public and Mi'kmaq engagement relating to terrestrial fauna include potential for direct mortality and indirect effects of other VCs, such as dust, noise and light, as well as potential effects on avifauna associated with loss of habitat from construction of the Project.	Moderate. The PA was evaluated for bat hibernacula potential through both desktop and field evaluations. A single abandoned mine opening was identified as a potential bat hibernaculum, however no bat species were observed, nor evidence found that indicates any usage of the PA by priority bat species. Three set of moose tracks were observed incidentally and during targeted moose surveys between 2015 and 2021. One female snapping turtle and nest was observed within the Beaver Dam Mine Site. Three snapping turtles were observed incidentally along the Haul Road and at the Touquoy Mine Site.	No. Projects which lie within the RAA for Terrestrial Fauna include current and proposed mining activities at Touquoy Gold Project, historic mining at the Beaver Dam Mine Project and Dufferin Gold Mine, future mining activities at Fifteen Mile Stream, Nova Scotia Salmon Association's Acid Mitigation project (3 components), along with various regional forestry activities. Project effects on Terrestrial Fauna from the Fifteen Mile Stream Gold Project are limited to the LAA, which does not overlap the LAA for the proposed Project. While spatial boundaries for potential residual effects for the Dufferin Project were not available, it is expected that effects to habitat and flora would occur on a similar spatial scale to the proposed Project (2km buffer of the Study Area). Provided this is a reasonable assumption, project effects to Terrestrial Fauna would not overlap spatially, and given the proponents bankruptcy declaration, the projects are not likely to overlap temporally. No significant cumulative effect is expected from the Nova Scotia Salmon Associations' Acid Mitigation Project on terrestrial fauna. Although both the Beaver Dam Project and the Touquoy Gold Project will cause the loss and disturbance of habitats within the PA, these effects are relatively small given the fact that most of the affected areas are already disturbed.	Low. The main assumption behind this assessment is that the overall patterns of land use in the region will remain unchanged in the foreseeable future.	No.	As the potential cumulative effects are not anticipated to be significant and loss of habitat will be restored during the reclamation stage no further assessment is warranted. SAR/SOCI is being evaluated with regards to cumulative effects for rare species, including Mainland Moose and Snapping Turtle. As such, cumulative effects to terrestrial fauna more generally will be addressed through the effects assessment for Mainland Moose and Snapping Turtle.
Avifauna	Habitat loss and disturbance Decreased surface water quality (Touquoy Mine Site)	Not Significant	The potential for adverse residual effects to avifauna is limited to the PA and LAA.	Residual effects to avifauna may occur throughout the duration of the Project including Construction, Operation and Active Closure.	Low. Concerns raised during public and Mi'kmaq engagement relating to avifauna include potential for direct mortality and indirect effects of other VCs, such as dust, noise and light, as well as potential effects on avifauna associated with loss of habitat from construction of the Project.	Good. Abundance and diversity of avian species observed was moderate to high based on observer experience in the geographic area. The common species assemblage of forest birds was observed, along with many priority species.	No. Projects which lie within the RAA for Avifauna include current and proposed mining activities at Touquoy Gold Project, historic mining at the Beaver Dam Mine Project and Dufferin Gold Mine, future mining activities at Fifteen Mile Stream, Nova Scotia Salmon Association's Acid Mitigation project (3 components), along with various regional forestry activities. Project effects on Avifauna from the Fifteen Mile Stream Gold Project are limited to the LAA, which does not overlap the LAA for the proposed Project. While spatial boundaries for potential residual effects for the Dufferin Project were not available, it is expected that effects to habitat and flora would occur on a similar spatial scale to the proposed Project (2km buffer of the Study Area). Provided this is a reasonable assumption, project effects to Avifauna would not overlap spatially. The temporal scale of the Dufferin project is not expected to overlap either, as the Proponent has declared bankruptcy. The lime dosing stations operated by the Nova Scotia Salmon Association are not expected to result in any negative effects to avifauna, nor is the terrestrial liming activities as liming typically occurs in the fall outside of the active nesting season. Within the RAA, there is some potential additive cumulative effects with respect to habitat loss on the broad scale. Overall habitat loss and potential additive cumulative effects will be addressed in SAR-SOCI cumulative effects. Although both the Beaver Dam Project and the Touquoy Gold Project will cause the loss and disturbance of habitats within the PA, these effects are relatively small given the fact that most of the affected areas are already disturbed.	Low. The main assumption behind this assessment is that the overall patterns of land use in the region will remain unchanged in the foreseeable future.	No.	The predicted cumulative effects are not anticipated to be significant and loss of habitat will be restored during the reclamation stage. As such, the VC was not carried forward to the Cumulative Effects Assessment. SAR/SOCI is being evaluated with regards to cumulative effects for rare species, including Avifauna. As such, cumulative effects to avifauna more generally will be addressed through the effects assessment for Avifauna SAR.

Table 8.4-2: Selection of Valued Components for the Cumulative Effects Assessment (continued)

Project VC	Residual Adverse Effects	EIS Finding	Boundaries		Criteria for Determining Whether Further Assessment Is Required			Carried Forward to Cumulative Effects Assessment		
			Spatial – Geographical Extent of Residual Effects	Temporal - Timeframe Associated with Residual Effects	Level of Concern Noted During Engagement	Current State of The VC (Health/Status/ Condition)	Potential for Cumulative Effects: Screening Evaluation Summary	Uncertainty in Prediction of Cumulative Effects	Yes/No	Rationale
Species of Conservation Interest (SOCI) and Species at Risk (SAR)	Habitat loss and disturbance	Not Significant	The potential for adverse residual effects to SOCI and SAR is limited to the PA and LAA, with the exception of Moose, which is evaluated at the RAA level relating to potential habitat fragmentation.	Residual effects to avifauna may occur throughout the duration of the Project including Construction, Operation and Active Closure.	High. Key issues raised during public and Mi'kmaq engagement relating to SAR and SOCI include potential direct effects on priority flora and fauna, particularly Atlantic Salmon, associated with construction of the Project and potential indirect effects associated with changes to other VCs, such as air, wetlands, surface water and groundwater.	Good. Evidence of Mainland Moose and Snapping Turtle was recorded within the Beaver Dam Mine Site. Thirty-two priority avifauna species were recorded, including nine SAR. Six priority vascular species were recorded. No SAR were observed. Eleven priority lichen species were recorded, including three SAR. Three priority fish species were observed. No SAR were observed. Direct habitat loss is expected as a result of the Project. Direct priority vascular plant loss includes one observation of southern twayblade. Direct priority lichen loss includes two observations of blue felt lichen, six observations of salted shell lichen three observations of slender monk's hood lichen and one observation of eastern candlewax lichen.	Yes. Projects overlapping the RAA for SAR fish, flora, terrestrial fauna and avifauna, and potential interactions therein, are discussed in respective VCs above.	Low. The main assumption behind this assessment is that the overall patterns of land use in the region will remain unchanged in the foreseeable future.	Yes.	Although, the potential for significant cumulative effects to SOCI and SAR is not anticipated, the VC was carried forward due to the concern expressed by the Mi'kmaq of Nova Scotia and the Nova Scotia Salmon Association relating to SAR and SOCI, and as required by the per the EIS guidelines (See 8.3.1). Concerns included the potential direct effects on rare flora, fish, and terrestrial fauna associated with construction of the Project and the potential indirect effects associated with changes to other VCs, such as wetlands, surface water and groundwater.
Mi' kmaq of Nova Scotia	Loss of plant specimens Habitat loss Sensory Disturbance Visual Change Aesthetics effect Loss of Access	Not Significant	The potential for adverse residual effects to Mi'kmaq of Nova Scotia are limited to the PA and LAA.	Residual effects to Mi'kmaq of Nova Scotia may occur throughout the duration of the project including Construction, Operation and Active Closure.	High. Key issues raised during public and Mi'kmaq engagement relating to Mi'kmaq of Nova Scotia include concerns related to pathways of adverse effects, primarily related to access and resources and harvesting, from Project activities during construction and operation.	Moderate. The nearest Mi'kmaw community is the Beaver Lake IR 17, located approximately 5km southwest of the Beaver Dam Mine Site; followed by the Sheet Harbour IR, located approximately 21km southeast of the Beaver Dam Mine Site.	Yes. Potential significant adverse cumulative effects to surface water, could cause effects on the use of surface waterbodies and the fish inhabiting them by the Mi'kmaq of Nova Scotia. There is also the potential for cumulative effects on habitats, flora, terrestrial fauna and birds to lead to effects on current use of land and resources for traditional purposes.	Moderate. Effects are linked to a number of VCs and therefore can be more difficult to predict.	Yes.	Further assessment is required to determine if there is the possibility of significant residual cumulative effects to Mi'kmaq of Nova Scotia.
Physical and Cultural Heritage	Loss of archaeological features	Not significant	The potential for adverse residual effects to Physical and Cultural Heritage are limited to the PA	Residual effect to Physical and Cultural Heritage are anticipated to occur through the Construction phase.	Low. Concern was noted during Mi'kmaq engagement regarding areas of elevated potential for Mi'kmaq resources (near Crusher Lake, Killag River and Cameron Flowage).	Good. Thirteen sites/areas with elevated archaeological potential were identified with the Beaver Dam Mine Site. Most sites are associated with historical mining activities and Euro-Canadian archaeological resources. Three sites were identified as having elevated potential for historic Mi'kmaw archeological resources. Three sites will be impacted by the Project. No direct or indirect impacts to Mi'kmaq archaeological features are expected. Additional shovel tests were completed within Site 6 and Areas 2 and 3 in 2020. No Pre-contact Mi'kmaq archaeological resources were encountered, and CRM Group recommends these areas be cleared of requirements for further investigation.	No. While other archaeological features may be present in the LAA or RAA, there is no pathway for disturbance of these features outside of the PA.	Low. The expected disturbance to archeological features is assessed and well understood. Chance find protocols for archaeological resources will be implemented as part of the Project Environmental Protection Plan (EPP). Personnel will receive the appropriate level of EPP training to properly implement the chance find protocol.	No	As the potential cumulative effects are not anticipated to be significant no further assessment is warranted.
Socio-Economic Conditions	Disturbance to recreational usage of site.	Not Significant	Positive residual effects are expected to occur through the RAA.	Residual effects to socio-economic conditions may occur throughout the duration of the project including Construction, Operation and Active Closure.	Medium. Concern about volumes of truck traffic in context of safety on public roadways and recreational access to the areas surrounding the Project to fish, hunt and for ATV access and throughflow access.	Good. The area sees public use for access to hunting, fishing and ATV activity. Between 2014-2018, 93 jobs were created for exploration. An estimated 289 jobs will be created during construction and operation.	No. Disturbance to recreational usage is restricted to the PA so, with proposed mitigation and bypass roads, no cumulative effects are anticipated. The overall effect of the Project on Socio-economic Conditions is positive.	Low. Prediction made on the assumption that the local road usage will not change, with proposed mitigation measures in place.	No.	As the overall potential effect of the Project on Socio-economic Conditions is positive, no further assessment is warranted.

8.5 Cumulative Effects Assessment of the Valued Components

Using appropriate data and information is critical to the analysis of cumulative effects. Exhaustive baseline studies have been completed to characterize the environment within the PA, LAA and RAA for the Project. Baseline information for all VC's is described in detail in Section 6 of the EIS, and for the reader, has also been summarized in the subsequent sections for those VC's that have been carried forward for the cumulative effects assessment. Baseline information provided for each valued component is limited by the evaluation methods and frequency of surveys. It is representative of the current status of the Project footprint. However, there are limitations to this data collection and analysis.

The following VCs have been carried forward for cumulative effects assessment based on the parameters and screening tools described in the previous sections:

- Noise (Beaver Dam Haul Road component of the Beaver Dam Mine Project only- qualitative);
- Air;
- Light (Beaver Dam Haul Road component of the Beaver Dam Mine Project only- qualitative);
- Surface Water;
- Fish and fish habitat;
- Species of Conservation Interest (SOCI) and Species at Risk (SAR); and
- Mi'kmaq of Nova Scotia.

Data and information for the other projects considered in the cumulative effects section is provided from public sources of information only. Data is collected from environmental assessment websites (both federal and provincial) and review of publicly available documents. There are significant limitations in this approach. Environmental assessments do not follow a standard methodology so often the data available is not in a format that can be directly comparable to the data available for the Project, or the same level of data analysis was not completed (air dispersion modelling for example, or quantitative predictive water quality modelling). Past projects can be devoid of published information (historical tailings for example) limiting the ability to quantitatively evaluate the potential cumulative impact of this project with the Project. Furthermore, projects that do not require environmental assessment (timber harvesting, or the NSSA Acid Mitigation Project, for example) have very limited data available for review and inclusion in these cumulative effects analyses. The EIS team has attempted to avoid sweeping qualitative statements and conclusions and has acknowledged data limitations where necessary in this section and in some instances, these data limitations limit conclusions.

8.5.1 Noise Cumulative Effects Assessment

8.5.1.1 Baseline Conditions

8.5.1.1.1 Baseline Noise Levels

Ambient noise has been sampled at several representative locations. Noise data was recorded in A-weighted decibels (dBA) and presented as equivalent continuous noise level (Leq) averaged over a time period and compared to Nova Scotia Environment criteria by time of day. Sound level measurements for all sample locations, except for Location #1 at the Beaver Dam Mine Site, met NSE Pit and Quarry criteria for all time intervals.

At the measurement locations around the Beaver Dam Mine Site, based on the 2014 values, the average value is 33 dBA ±. The dominant noise sources noted are natural, including birds, the movement of leaves, and possibly the odd vehicle on a logging road. The measurement locations at Beaver Dam Mines Road and Mooseland Road would be mostly from natural sources. Mooseland Road measurements are comparable to the Beaver Dam Mine Site. It is located on a little used gravel road. The Beaver Dam Mines Road is elevated and is near a paved highway with regular traffic. This road also passes through Beaver Dam IR and ambient sound will be the same as at the measured location.

Potential Noise interactions and effects for Construction and Operations are quantitatively assessed by acoustic modelling. The technical reports documenting the updated approach and inputs for Noise modelling (Construction, Operations) are provided in Appendix B.1 and Appendix B.2 and are summarized in this section.

The updated noise analysis results include all identified worst-case human receptor locations (R1 to R9, Figure 6.1-3A to 6.1-3E). Specific non-residential locations of traditional land use and recreation have not been identified for inclusion in the analysis; however, it is understood that traditional and recreational uses such as hunting may occur in areas close to the Project Area.

In summary, an updated acoustical model was undertaken to provide an order of magnitude estimation of the estimated noise from the blasting operations at the Beaver Dam Mine Site and haul truck travel along the Haul Road. The noise sources and topography were input into an industry standard acoustic model. Computer Aided Noise Abatement Acoustical Modeling Software (Cadna A), version 4.6, is based on the ISO 9613-2 standard "Acoustics - Attenuation of Sound During Propagation Outdoors - Part 2: General Method of Calculation." The Cadna A model is the industry standard for environmental noise modeling in Canada. The nearest receptor considered in the preliminary acoustical model included Beaver Lake IR 17, located approximately 5 km from the Mine Site and 3 km from the nearest point of the Haul Road.

To predict the future worst-case noise impacts from the Project activities, representative octave band noise data was used, measured from processing equipment similar to what is noted to be required for the Project. This data was obtained from the Department of Environment Food and Rural Affairs (DEFRA) "Update of Noise Database for Prediction of Noise on Construction and Open Sites, 2005 and 2006". The United States Department of Transportation, Federal Highway Administration (FHWA) document "FHWA Roadway Construction Noise Model User's Guide, 2006" was used as a supplemental document to obtain sound level data for equipment not listed by DEFRA.

8.5.1.1.2 Regional baseline Noise conditions

The relatively steady ambient noise of the surrounding area is a conglomeration of distant noise sources including wind in trees, bird and animal noise, rainfall, distant aircraft, logging activities, traffic and all-terrain vehicle use. The acoustic monitoring completed in the vicinity of the Beaver Dam Mine Site and Haul Road is considered representative of the local baseline conditions.

8.5.1.2 Analysis of Effects

8.5.1.2.1 Residual Effects of Proposed Project

The predicted residual environmental effects of Project development and production of noise are assessed to be adverse, but not significant within the PA. During construction, operations and active closure phases, the noise levels defined in the Pit and Quarry Guidelines will be met at the property boundary for both the Beaver Dam Mine Site and Haul Road, while baseline noise levels are met at the RAA boundary.

8.5.1.2.2 Effects of Other Projects in the Area

The RAA for noise, and projects which fall within this RAA are shown on Figure 8.5-1. The NSSA Acid Mitigation Project has a spatial and temporal overlap with the Projects' RAA for noise. However, this project is not being discussed in the context of cumulative noise, because aside from several days per year of helicopter flights for terrestrial liming, the NSSA work does not generate additional sources of considerable noise.

Current Regional Forestry Operations

The local forestry industry has the potential to have cumulative effects on noise levels due to timber harvesting and trucking of timber. Anthropogenic sources of noise have been excluded from noise modelling calculations. Data is publicly unavailable to quantify the level of noise expected from timber harvesting and trucking due to regional forestry operations. However, the baseline forestry activity on the Haul Road has been considered in this cumulative effects assessment (Section 8.5.1.2.3). However, noise associated with timber harvesting is likely to be relatively seasonal and sporadic, and not likely to affect regional noise levels in any significant or sustained manner.

Touquoy Mine Site

The Noise Impact Study (Appendix B.2) shows that the predicted levels for sound propagation from the Touquoy Mine Site for the Project will be below the Pit and Quarry Guidelines noise thresholds (day/evening/night) at the property boundaries. As indicated in the EARD, the maximum sound generated at the processing plant is 80 dBA, which attenuates to the background of 40 dBA over a distance of 500 m.

The Touquoy Mine Site is in production. The primary effect of the continued use of the Touquoy Mine Site is the continued generation of noise due to haul truck traffic on the site, processing of Beaver Dam ore. There are no new or additional effects from noise anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Project, as no new construction or disturbance is required at the Touquoy Mine Site related to the processing of Beaver Dam ore.

Beaver Dam Haul Road Use by the Project, the Fifteen Mile Stream Project, Cochrane Hill Gold Project and Regional Forestry

Trucks from other projects and forestry operations on the Haul Road have the potential to increase the cumulative effect of noise at the receptors. Noise levels due to cumulative effects of trucks on the Haul Road were assessed, and the predicted noise levels remain within the applicable NSEL sound level limits at all identified residential receptors. Details of this assessment are provided in Appendix B.2 and summarized below.

A cumulative effects analysis has been conducted to determine the potential effects of truck traffic from the proposed Fifteen Mile Stream Gold Project, Cochrane Hill Gold Project and Forestry operations that may use the Haul Road concurrently with trucks from the Beaver Dam Mine Site. Truck traffic volumes used in the direct (i.e., Project only) and cumulative effects analysis are summarized in Table 8.5-1.

Truck traffic from the Project will operate on the Haul Road 16 hours per day, during day and evening time periods only (7:00 AM to 11:00 PM). It is assumed that trucks originating from the other projects and industries will operate during the same hours for the purposes of the cumulative effects analysis.

Prepared For:

Atlantic Gold

FIGURE 8.5-1

Beaver Dam Mine Project

Cumulative Effects Assessment: Noise

Mosher Lake Limestone Co.

Great Northern Timber Pellet Facility

Upper Musquodoboit

Mount William Provincial Park

Fraser Settlement

Sheet Harbour Road

Pleasant Valley

Caribou Mines

Beaver Dam Past and Future Mining Operation

Beaver Dam Mine Site

NSSA - AMP: Killag Doser

NSSA - AMP: WRSH Doser

NSSA - AMP: Terrestrial Liming

Regional Forestry Operations

Beaver Dam Haul Road

Touquoy Mine Site

Touquoy Mining Operations

Haul Road

Projects Evaluated in the Cumulative Effects Assessment

Regional Assessment

Project Area

Note: Forestry operations occur throughout the RAA and are not displayed on this figure

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 1.25 2.5 5 km

1:100,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: KR

Date: 2021-04-29

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

Document Name: BD_EIS_Figure8-4-X_CEA_Noise

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In addition to the heavy truck traffic summarized above, it is estimated 3/4-ton service trucks would make up to approximately 20 round trips per day on the haul roads. Noise emissions from these service trucks have also been included in the cumulative effects noise model.

Table 8.5-1 shows the predicted cumulative effects of truck traffic for noise during the Operation Phase of the Project are within the applicable sound level limits at all of the identified residential receptors and the property boundary for the Beaver Dam Mine Site and Haul Road, including noise emissions from equipment and activities at the Beaver Dam Mine Site, Touquoy Mine Site, and Haul Road.

Table 8.5-1: Operation Phase Predicted Cumulative Noise Effects

Receptor ID	Receptor Description	Noise Level (dBA) (Day/Evening/Night)	Sound Level Limit [(a)] (dBA) (Day/Evening/Night)	Compliance
R1	9 Beaver Dam Mine Road (Marlborough Property)	50 / 50 / 27	65 / 60 / 55	Yes
R2	4112 Highway 224 (Beaver Lake IR 17)	31 / 31 / 28	65 / 60 / 55	Yes
R3	4115 Highway 224 (Cottage on Crown Land)	33 / 33 / 28	65 / 60 / 55	Yes
R4	3492 Highway 224 (Hobbs Property)	56 / 56 / 27	65 / 60 / 55	Yes
R5	3379 Highway 224 (McLeod Property)	51 / 51 / 27	65 / 60 / 55	Yes
R6	3373 Highway 224 (Smith Property)	51 / 51 / 27	65 / 60 / 55	Yes
R7	Tangier River (Deepwood Estates Property)	55 / 55 / 20	65 / 60 / 55	Yes
R8	Tanger River (Musqudoboit Lumber Co. Ltd. Property/John Dickson Lease)	44 / 44 / 20	65 / 60 / 55	Yes
R9	5579 Mooseland Road (Lloy Property)	51 / 51 / 26	65 / 60 / 55	Yes

Notes: Truck traffic used in the noise assessment and related modelling has been adjusted to a 16-hour shift (7:00 AM to 11:00 PM).
(a) NSEL 1990.

Overall, the findings summarized in the Noise Impact Study, and the EIS for Beaver Dam Mine Project will remain valid, and the cumulative effects of noise along the Haul Road are predicted to remain within the guideline limits specified by Nova Scotia Environment and Labour (NSEL) at all of the identified receptors, and with consistent conclusions relating to the property boundary along the Haul Road. Based on those predictions, noise levels at all nearby residential receptors are anticipated to be within the NSEL noise level limits with the additional vehicles included in the assessment. Speed limits would be implemented as a part of each of these projects will mitigate the potential increase in ambient noise from the associated trucking operations.

8.5.1.2.3 Cumulative Effects on Noise Levels

It is likely that forestry operations will occasionally coincide with activities at the Beaver Dam Mine Site and cause greater disturbance to noise levels that these operations produce individually. However, such additive periods are likely to be limited in duration and frequency and are not expected to be significant. This cannot be quantified for the purpose of this CEA due to a lack of available data relating to forestry activities and future plans for harvesting. The principal assumption behind this assessment is that local forestry practices are not expected to change in any important way during the life of the Project. Data to support the quantification of timber harvesting is limited, particularly related to noise levels.

The gold concentrate transportation and processing activities associated with the Fifteen Mile Stream Gold Project and the Cochrane Hill Gold Project overlap in both time and space with the Project. Therefore, the potential effects from the transportation

and processing from the three projects, along with forestry activities on the Beaver Dam Haul Road, have the potential to act in an additive and cumulative nature. The additive cumulative effects on noise from transportation to the Touquoy Mine Site from the cumulative projects are not expected to be significant, provided mitigation measures for noise are implemented.

Truck traffic from other projects operating on the Haul Road, in addition to truck traffic from the Project, have the potential to produce increased cumulative effects noise levels at the identified receptors. As such, a Cumulative Effects analysis has been conducted to determine the potential Cumulative Effects of truck traffic from the proposed Fifteen Mile Stream Gold Project, Cochrane Hill Gold Project and Forestry operations that may use the Haul Road concurrently with trucks from the Beaver Dam Mine Site.

Truck traffic volumes used in the Direct (i.e., Project only) and Cumulative Effects analysis are summarized in Table 8.5-2 below.

Table 8.5-2: Summary of Estimated Truck Traffic on Haul Road

Originating Facility / Industry	Truck Traffic Volume (round trips per day, 7:00 AM to 11:00 PM)	
	Direct effects	Cumulative Effects
Project (Beaver Dam Mine Site)	95	95
Cochrane Hill Mine	-	11
Fifteen Mile Stream Mine	-	11
Forestry	-	7
Total	**95**	**124**

Note : With the addition of the approximate 20 round trips from ¾ ton service trucks per day the total would be 144 round trips (e.g., return trips or two-way trips).

Truck traffic from the Project will operate on the Haul Road 16 hours per day, during day and evening time periods only (7:00 AM to 11:00 PM). It is assumed that trucks originating from the other projects and industries will operate during the same hours for the purposes of the Cumulative Effects analysis.

In addition to the heavy truck traffic summarized above, it is estimated 3/4-ton service trucks would make up to approximately 20 round trips per day on the haul roads. Noise emissions from these service trucks have also been included in the cumulative effects noise model.

Table 6.1-12 shows the predicted cumulative effects of truck traffic for noise during the Operation Phase of the Project are within the applicable sound level limits at all of the identified residential receptors, including noise emissions from equipment and activities at the Beaver Dam Mine Site, Touquoy Mine Site, and Haul Road (Appendix B.2, Figures 4A to 4F).

8.5.1.3 Mitigation

Standard mitigation measures for noise generated by the Project at the Beaver Dam Mine Site, Haul Road and Touquoy Mine site are presented in Section 6.1.8, and mitigation measures associated with use of the Beaver Dam Haul Road are described in the (Section 6.1.8). As no pathway for significant cumulative effects are identified, no additional mitigation measures are warranted.

8.5.1.4 Residual Cumulative Effects and Significance Assessment

A significant adverse effect to noise at the Beaver Dam Mine Project is defined as having high magnitude (i.e., an exceedance of the maximum noise or vibration limits), occurring beyond the PA and LAA, of long-term to permeant duration, occurring at regular intervals or be continuous throughout the Project, and be only partially reversible to irreversible. The cumulative effects to noise are predicted to be low, diverging from existing conditions but in compliance with appropriate guidelines; these effects do not extend into the RAA, are long-term, and are considered reversible. The overall residual cumulative effects on noise is assessed as not likely to have significant adverse effects after mitigation measures have been implemented. Thus, predicted residual environmental effects of Project development and production on Noise are assessed to be not significant (Table 8.5-2).

Table 8.5-2: Residual Cumulative Environmental Effects for Noise

Residual Adverse Cumulative Effects (After Mitigation)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Cumulative increased noise levels (Noise from construction, operation, reclamation, and operation of mining, haul trucks, forestry activities and haul road usage)	L Noise levels are expected to be less than or equal to appropriate guidelines or threshold values at the Beaver Dam Mine Site and Haul Road property boundary. Additive cumulative effects may occur when forestry operations occasionally coincide with Project activities and hauling ore from FMS and Cochrane Hill to Touquoy Mine Site for processing	LAA The cumulative effects causing increased background noise levels will not extend beyond the LAA.	A VC is expected to be affected by timing, with sporadic nature of timber harvesting.	LT Effects may extend beyond 8 years.	R Additive periods of potential effects from the Project and forestry operations are likely to be limited in frequency. However, cumulative effects to baseline noise levels from the use of the Beaver Dam Haul Road by Beaver Dam, Fifteen Mile Stream and Cochrane Hill Gold Projects will occur regularly throughout the operational phase of the Project.	R VC will recover to baseline conditions once operations have stopped.	Low Adverse Effect (Not Significant) Effects are limited to the LAA based on Project interactions and usage of the Beaver Dam Haul Road by various activities. Furthermore, the VC is anticipated to recover to baseline conditions once the operation of the mine has stopped. Effects would be confirmed through monitoring.

Notes: Specific characterization criteria listed below for noise are defined in Table 6.1-4. Standard characterization criteria listed below are defined in Section 5.11, Table 5.11-1.

Magnitude	
N	Negligible
L	Low
M	Moderate
H	High

Geographic Extent	
PA	Project Area
LAA	Local Assessment Area
RAA	Regional Assessment Area

Timing	
N/A	Not Applicable
A	Applicable

Duration	
ST	Short-Term
MT	Medium-Term
LT	Long-Term
P	Permanent

Frequency	
O	Once
S	Sporadic
R	Regular
C	Continuous

Reversibility	
R	Reversible
PR	Partially reversible
IR	Irreversible

8.5.1.5 Follow-up and Monitoring Programs

Noise monitoring will be completed during each blasting event, as required by the Nova Scotia Environment and Labour (NSEL) Pit and Quarry Guidelines (NSEL 1999). No additional follow-up or monitoring will be completed unless directed by regulators or as a result of a complaint or agreed to during on-going engagement activities (Section 6.1.8).

8.5.2 Air Cumulative Effects Assessment

8.5.2.1 Baseline Conditions

8.5.2.1.1 Baseline Air Quality Monitoring Program

Preliminary baseline particulate monitoring was undertaken for TSP and PM_{10}. Baseline air quality measurements were obtained from nine locations near the Beaver Dam Mine Site and along the proposed Haul Road, five locations on the Touquoy Mine Site, two locations near the proposed Fifteen Mille Stream Gold Project, and two locations near the proposed Cochrane Hill Gold Project (Section 6.2, Table 6.2-4).

Baseline TSP concentrations ranged from 1.7 to 41.7 micrograms per cubic metre (µg/m³), with the highest value obtained at Location #2 during monitoring in June 2008. Results for PM_{10} concentrations ranged from 7.1 to 13.1 µg/m³, with the highest value also obtained at Location #2 during monitoring in June 2008. This monitoring station was located in a recently clear-cut area, which may have contributed to higher particulate levels in comparison to the other locations. This area was resampled in 2014 (AN#2). The 2014 results for that area were 4.6 µg/m³. All samples collected were below the NSAQS for TSP, there is no NSAQS for PM_{10}.

The data obtained as part of the baseline program reported herein provides a preliminary snapshot of air quality in the area of the Beaver Dam Mine Site and Haul Road, and a general understanding of local air quality. Due to a lack of other sources of data for ambient TSP, the background concentration for TSP is based on the maximum measured 24-hour TSP concentration (there are insufficient data to provide a meaningful 90^{th} percentile value), and the average of all the TSP measurements. There is uncertainty in how representative these values might be for background, but they represent the best available data at this time.

To support the effects assessment of the Air VC, air dispersion modelling was performed. Emission rates from the Project-related sources were calculated using USEPA AP-42 (5th Edition) emission factors for the Beaver Dam Mine Site and Haul Road dust emissions, and MOBILE6.2 (M6.2) for Haul Road vehicle emissions. There is currently no guidance on the use of models in Nova Scotia, and therefore the O.Reg. 419/05 requirements were used as a framework. The version of the air dispersion model used in this project is currently accepted in Ontario, and AERMOD is used across Canada and throughout the United States as a regulatory model of choice. AERMOD is an advanced steady state plume model that has the ability to incorporate building cavity downwash, actual source parameters, emission rates, terrain and historical meteorological information to predict ground level concentrations (GLCs) at specified locations.

Air compounds evaluated included TSP, PM_{10}, $PM_{2.5}$, NO_X, SO_2 and VOC.

Haul Road emissions calculations assume that the roads are unpaved, and a dust management plan (targeting 80 to 90% dust suppression efficiency). This will be achieved through the implementation of a fugitive dust control plan that includes the use of dust suppressant (Section 6.2.8 and Appendix C.3).

The Beaver Dam Mine Site mining, crushing, and transfer operations will primarily operate from adjacent to the open pit. Although vehicle traffic is also expected, it was assumed that most of these operations also occur adjacent to the open pit. Therefore, the

Beaver Dam Mine Site emissions were modelled using as an open pit source such that all emissions from mining operations were summed and attributed to the pit source. As discussed in Project Description (Section 2) the Beaver Dam Mine site may not rely on a primary crusher if the ore can be broken using jawbreaker and other mining equipment. For the purposes of this air assessment, a conservative assessment approach has been applied and assumed that a primary crusher would be in use.

The Touquoy Mine Site consists of crushers and mining sources as volume sources. These sources were previously modelled in AERMOD for an Emissions Summary and Dispersion Modelling Assessment (CRA 2007a). As the Beaver Dam Mine Site will use the Touquoy Mine Site for its refining capabilities, the crushing and mining operations remained unchanged.

8.5.2.1.2 Regional ambient air quality

Ambient air quality in Nova Scotia is monitored using a network of 10 sites operated by NSE and Environment and Climate Change Canada (ECCC) through the NAPS. Common air pollutants monitored at these stations include the following:

- SO_2;
- $PM_{2.5}$;
- ozone (O_3); and
- oxides of nitrogen (NO_2, NO, and total NO_X).

Data collected at these stations is used by NSE to report the Air Quality Index (AQI) and by ECCC to report the Air Quality Health Index (AQHI). There are currently no permanent air monitoring stations within the vicinity of the PA. The Beaver Dam Mine Site is located in a relatively undeveloped rural region of Nova Scotia with infrequent industrial operations that would affect air quality. As the NAPS monitoring stations are typically located in areas with local industry, measured concentrations of indicators are likely lower at the Beaver Dam Mine Site than at NAPS stations.

The nearest representative stations which report concentrations for the air quality parameters assessed include:

- Lake Major, Nova Scotia (Station ID 030120) – $PM_{2.5}$, NO_2, and SO_2;
- Port Hawkesbury, Nova Scotia (Station ID 030201) – $PM_{2.5}$, NO_2, and SO_2;
- Aylesford Mountain, Nova Scotia (Station ID 030701) – $PM_{2.5}$, and NO_2; and
- Pictou, Nova Scotia (Station ID 030901) – $PM_{2.5}$, and NO_2.

VOCs are not measured at these stations. PM_{10} are not measured in many areas in Canada. Of the locations which do measure PM_{10}, most are in British Columbia urban centres, four are in Manitoba cities, one is in Regina, Saskatchewan, and four are in the Northwest Territories. In terms of locations that are somewhat comparable to the Project site (human habitation, regional activities that may generate airborne particulate, etc.), Norman Wells, NWT Regional Office (Station ID 129102) appears the most appropriate location that has recent data available (Appendix C.1, Section 3).

8.5.2.2 Analysis of Effects

8.5.2.2.1 Residual Effects of Proposed Project

The Project will result primarily in the generation and airborne transport of fugitive dust particles and exhaust emissions from equipment. Fugitive dust typically refers to small particles of geological or other origin that are moved into the atmosphere from non-ducted, open sources. Fugitive dust sources can originate from both stationary and mobile sources such as open fields, open burning, agricultural activity, construction sites, logging road traffic, vehicle traffic on paved and unpaved roads, aggregate pits and storage piles, as well as open pit mines.

Airborne particulate matter will be generated during construction and operation of the proposed Haul Road. Sources of project-related particulate matter would include upgrading the existing road to be suitable for the mine traffic, and truck traffic hauling ore from Beaver Dam Mine to the Touquoy Mine Site for processing. Dust can be generated from mine haul truck tires interacting with gravel surfaced Mine Haul Roads and Beaver Dam Haul Roads. Dust is also generated during the truck loading and dumping activities. Dust is not expected from uncovered trucks because the ore material is of a size that is unlikely to generate dust. Dust can be tracked across asphalt roads and re-entrained by traffic or by the wind.

Results of air dispersion modelling for maximum predicted concentrations of emitted particulate species from the Beaver Dam Mine Site operations are summarized in Section 6.2.7.1, Table 6.2-8. This table summarizes the particulate size fraction considered (i.e., TSP, PM_{10} and $PM_{2.5}$), the averaging period, the assessment criteria against which the results are compared, the maximum predicted concentration from the modelling, the ambient background concentration, the combined effect (i.e., the modelled concentration from the site added to the assumed existing background concentration for that averaging period), and the percentage of the assessment criteria for the site modelling results alone and the cumulative effects.

For this site, maximum predicted concentrations occurred at the property boundary. Predicted concentrations for all indicator compounds and averaging periods were lower than existing background concentrations, and below relevant assessment criteria (Section 6.2.4.2, Table 6.2-2).

Results of air dispersion modelling for maximum predicted concentrations of emitted particulate species from the Haul Road are presented in Section 6.2.7.2, Table 6.2-11. This table summarizes the particulate size fraction considered (i.e., TSP, PM_{10} and $PM_{2.5}$), the averaging period, the assessment criteria against which the results are compared, the maximum predicted concentration from the modelling, the ambient background concentration, the combined effect (i.e., the modelled concentration from the site added to the assumed existing background concentration for that averaging period), and the percentage of the assessment criteria for the site modelling results alone and the cumulative effects.

For this site, maximum predicted concentrations occurred within 30 m of the road, and predicted concentrations decreased, with increasing distance from the road. The maximum predicted concentrations for all compounds occurred in close proximity to the road, in areas that are not continuously occupied. Maximum predicted concentrations presented occur at 30 m from the road and decrease rapidly with distance.

Maximum predicted concentrations of emitted particulate species from the Touquoy Mine Site are presented in Section 6.2.7.3, Table 6.2-14. This table summarizes the particulate size fraction considered (i.e., TSP, PM_{10} and $PM_{2.5}$), the averaging period, the assessment criteria against which the results are compared, the maximum predicted concentration from the modelling, the ambient background concentration, the cumulative effect (i.e., the modelled concentration from the site added to the assumed existing background concentration for that averaging period), and the percentage of the assessment criteria for the site modelling results alone and the cumulative effects.

For this site, maximum predicted concentrations occurred at the property boundary. Predicted concentrations for all indicator compounds and averaging periods were lower than existing background concentrations, and well below relevant assessment criteria (Section 6.2.4.2, Table 6.2-2).

Modelling of contaminant sources at the Beaver Dam Mine Site and the Touquoy Mine Site showed maximum predicted concentrations at the respective property boundaries are below applicable air quality criteria, which are unlikely to cause adverse effects. The Haul Road between the proposed Beaver Dam and the Touquoy Mine Sites is the source primarily responsible for the maximum predicted concentrations at both the gridded receptors and the sensitive receptors identified for this assessment.

Maximum predicted $PM_{2.5}$ concentrations did not exceed the CAAQS for either the 24-hour or annual averaging periods at any of the sensitive receptor locations, based on Project alone predictions, or Project plus background. PM_{10} was predicted to exceed the Ontario Interim 24-hour guideline at Deepwood Estates up to 2% of the time without background) and up to 57% of the time with background concentration included. PM_{10} was also predicted to exceed the Ontario Interim 24-hour guideline at 9 Beaver Dam Mines Road up to 13% of the time with background concentration included but met the guideline without background. TSP was predicted to exceed the 24-hour Nova Scotia Air Quality Standard up to 0.3% of the time with background included at the Deepwood Estates receptor. There is uncertainty in the presented background concentrations of both PM_{10} and TSP. The Deepwood Estate property, the most impacted, has been acquired by AMNS so there will be no permanent or seasonal resident at this property. In addition, this property will likely be used as part of the monitoring to confirm impact predictions and assess the effectiveness of the mitigations.

8.5.2.2.2 Effects of Other Projects in the Area

The RAA for air, and other projects which fall within this RAA are shown on Figure 8.5-2. The NSSA Acid Mitigation Project has a spatial and temporal overlap with the Projects' RAA for air. However, this project is not being discussed in the context of cumulative air impacts, because aside from several days per year of helicopter flights for terrestrial liming, the NSSA work does not generate air emissions. The Gaetz Brook Wind Power Project is within the RAA for Air; however, this project is not anticipated to generate emissions. The existing Touquoy project lies within he RAA for air; however, it is an integral component of the Beaver Dam Project and air emissions from the Touquoy project are considered in the modelling for the Beaver Dam Project. As a result, this project is not being described further in the cumulative effects assessment for Air.

Current Regional Forestry Operations

The local forestry industry has the potential to have cumulative effects on air quality. As the forestry industry is ongoing in the region and has been for many decades, its effects on air quality are already accounted for in the local baseline conditions. The largest effect noted from the baseline data was the measurement of the highest suspended particulate concentrations from a monitoring station located in a recently clear-cut area. As a result of the expected inclusion of forestry contributions to air quality in baseline data, no additional analysis for cumulative effects of this industry related to air is necessary.

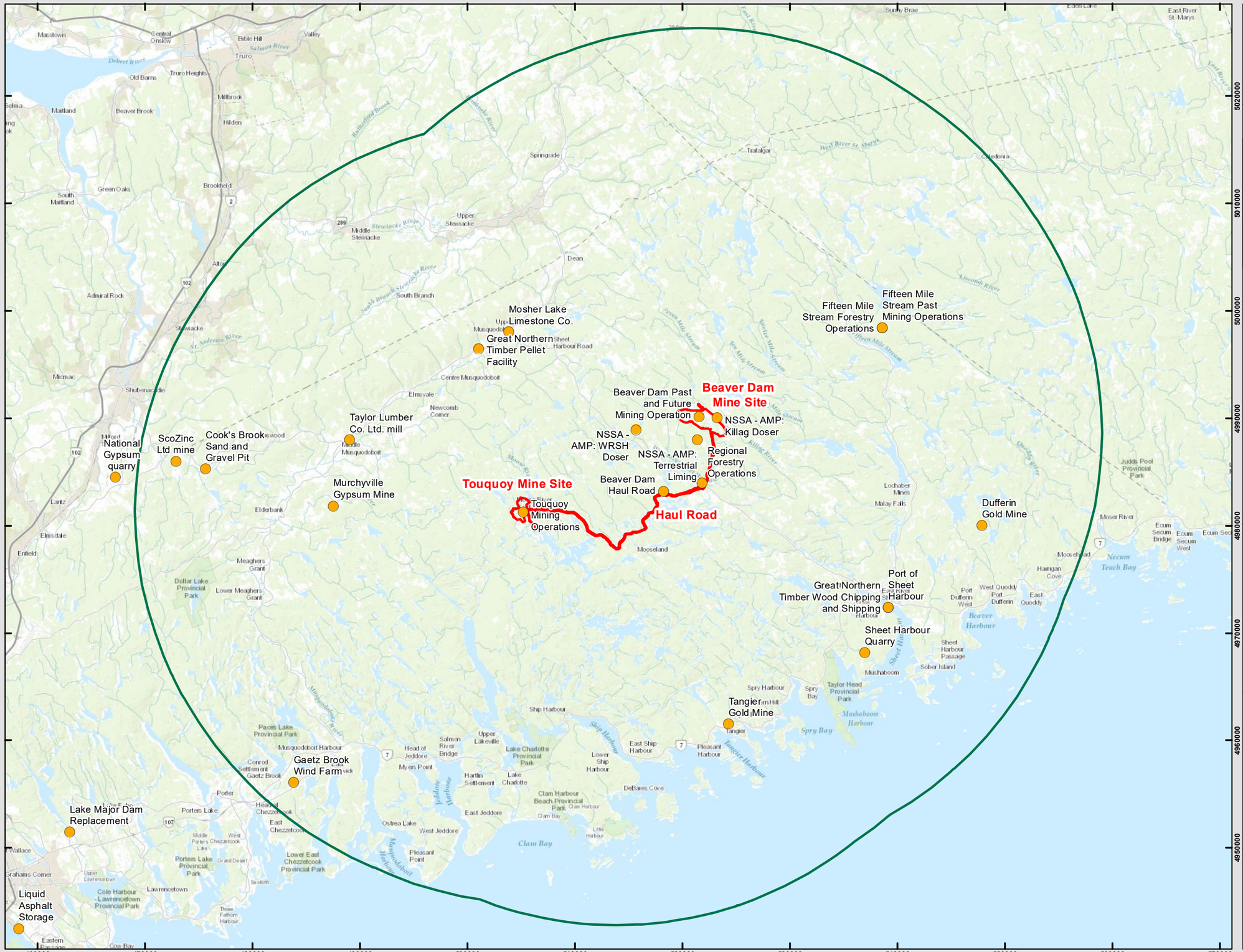
Beaver Dam Haul Road Use by the Project, Fifteen Mile Stream Project, Cochrane Hill Gold Project and Regional Forestry

During the operation phase of the Fifteen Mile Stream Gold Project and the Cochrane Hill Gold Project, gold concentrate from each surface mine will be transported to the Touquoy processing site for final processing into gold doré bar. The proposed haul route for each of these projects is proposed to overlap with the Beaver Dam Haul Road west of the Highway 224, along with potential trucking activity associated with the forest industry. Eleven round-trips are proposed to carry gold concentrate from each of the Fifteen Mile Stream Gold and Cochrane Hill Gold projects per day (totaling 22 vehicle round-trips [i.e., two-way trips] or 44 one-way trips per day), plus 95 round-trips (e.g., return trips or two-way trips) per day between Beaver Dam Mine Site and Touquoy Mine Site. This could be further compounded by forestry trucks and service trucks activity (e.g., approximately seven forestry truck round-trips per day plus 20 service truck round-trips per day). The total number of trucks for cumulative effects

assessment is 144 truck round-trips or 288 one-way trips (Appendix C.1, Table 1). Mitigation measures proposed in the Beaver Dam Mine Project will result in an 80 to 90% targeted dust suppression efficiency.

The modelled particulate concentration results of the Cumulative Haul Road emissions scenario for the four road sections modelled (Figure 3 in Appendix C.1) are summarized in Table 7A for the 80% road dust mitigation scenario. All predicted Cumulative maximum concentrations are well below the air quality assessment criteria with background added, as shown in Table 7A in Appendix C.1. Table 7B in Appendix C.1 summarizes the predicted maximum concentrations of the gaseous species (i.e., NO_2, SO_2 and VOCs). There are no exceedances of the air quality criteria for NO_2 and SO_2. There are no criteria applicable for total VOCs. The predicted concentrations of VOCs as presented in Table 7B show that the VOC concentrations are very low (less than 1 microgram per cubic metre) and are provided for reference only.

The maximum concentrations for all contaminants occur at 30 m from the Haul Road centerline, which is the project boundary for the Haul Road. Figures 4A to 4E in Appendix C.1 show the 30 km haul road contour plots for TSP, PM_{10} and $PM_{2.5}$ modelled for the 80% dust mitigation scenario. As shown on these figures, there are no exceedances of the applicable criteria along the haul road.



Prepared For:

Atlantic Gold

FIGURE 8.5-2

Beaver Dam Mine Project

Cumulative Effects Assessment: Air

- Projects Evaluated in the Cumulative Effects Assessment
- Air Regional Assessment Area
- Project Area

Note: Forestry operations occur throughout the RAA and are not displayed on this figure

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 4.25 8.5 17 km

1:330,000 Scale when printed @ 11" x 17"

Drawn By: EP
Date: 2021-04-25
Reviewed By: KR

McCallum Environmental Ltd.

Document Name: BD_EIS_Figure8-4-X_CEA_Light

Sheet Harbour Quarry (Future)

On January 31, 2019, Dexter Construction Company Limited submitted an Environmental Assessment Registration Document for the Sheet Harbour Aggregate Quarry Project, located approximately 26 km southeast of the Beaver Dam Mine Site, and 35 km southeast of the Touquoy Mine Site. According to the EARD, Project activities will result in release of dust and exhaust type emissions through construction, operation, and reclamation phases of this proposed quarry. Mitigation measures proposed include wet suppression of unpaved surfaces, equipment maintenance, and the use of low-sulphur fuel. Assuming appropriate mitigation measures are employed, the EARD indicates that the effect of the Project on air quality are minor. The EARD does not predict air quality concentrations from the project, nor does it predict the spatial extent of this potential dust deposition.

The spatial boundaries used to make this determination are not provided in the EARD. However, the Projects' effects on air is not expected to spatially overlap with the proposed Beaver Dam Project, based on the distance between the two sites. The EARD was determined to provide insufficient information for the Minister to grant approval to the Project. On March 22, 2019, the Minister requested submission of additional information. The Minister approved this undertaking on November 8, 2019, but it is unclear in the public records whether operation has commenced. As such, there is additional uncertainty in the potential temporal overlap between this project and the Project.

Great Northern Timber Pellet Facility (Present)

The Great Northern Timber Pellet Facility is located approximately 22 km northwest of the Beaver Dam Mine Site, and 16 km north of the Touquoy Mine Site. This facility produces chips for pulp and paper, MDF, and biomass, in addition to selling whole birch logs.

Data to support conclusions about residual effects of this project on Air quality is unavailable, however it is not expected that this project would result in a significant additive effect to Air quality with the Project. Neither of these projects triggered provincial or federal environmental assessment processes. As such, no air dispersion modelling was completed for either of these activities, and neither is expected to result in cumulative effects with the Project. There is some uncertainty in this conclusion, however, due to lack of available data.

Murchyville Gypsum Mine (Past)

This small gypsum mine is located approximately 36 km west of the Beaver Dam Mine Site and 18 km west of the Touquoy mine Site. As a small extraction mine with no processing of materials on site (beyond crushing), air emissions are not expected to be generated at this location. This project is not currently operational; therefore, there is no expectation of cumulative effects to Air between the Murchyville Gypsum Mine and the Project.

Dufferin Gold Mine (Historic and Proposed)

The Dufferin Gold Mine is located approximately 26 km southeast of the Beaver Dam Mine Site, and 43 km west of the Touquoy Mine Site. The footprint of this mine is approximately 375 m by 150 m. A bulk sampling program and associated milling was completed in 2018, but in 2019 the proponent (Resources Capital Gold Corporation) filed a Notice of intention to make a proposal under the Bankruptcy and Insolvency Act so future plans for this Project are uncertain. As such, the potential temporal overlap of this project and the Beaver Dam Project are unknown. Should the project proceed and overlap with the beaver Dam Project temporally, the potential spatial overlap of effects to Air needs to be considered. Details associated with the effects of the Dufferin project on air are limited. Considering the Beaver Dam Project is able to mitigate residual effects on Air and meet applicable guidelines within the Property boundary, the relatively small size of the proposed operation at the Dufferin site, and the distance

between the two (26 km), a spatial or temporal overlap between these projects is unlikely. Therefore, there is little potential for cumulative effects on air quality.

Tangier Gold Mine (Historic and Proposed)

The Tangier Gold Mine is located approximately 28 km south of the Beaver Dam Mine Site, and 27 km southwest of the Touquoy Mine. The footprint of this mine is approximately 500 m by 150 m, as measured on Google Earth. The Tangier Gold Mine was purchased by Resource Capital Gold Corp and plans are being developed for re-opening the mine. However, according to a press release dated January 29th, 2019, the proponent had filed a Notice of Intention to make a proposal under the Bankruptcy and Insolvency Act. The planned activities are limited to mining as no processing is planned at this site. Processing would take place at the Dufferin Gold Mine (Resource Capital Gold Corp. 2017). The potential temporal overlap of this project and the Project are unknown. Should the project proceed and overlap with the Project temporally, the potential spatial overlap of effects to Air needs to be considered. Details associated with the effects of the project on air are limited. Considering the Beaver Dam Project is able to mitigate residual effects on Air and meet appropriate air quality guidelines within the property boundary, the relatively small size of the proposed operation at the Tangier site, and the distance between the two (28 km), a spatial or temporal overlap between these projects is unlikely. Therefore, there is little potential for cumulative effects on air quality.

Taylor Lumber Co. Ltd. Mill (Present)

Taylor Lumber Co. Ltd. has operated a mill in Middle Musquodoboit since 1945. This site, located approximately 30 km west of the Beaver Dam Mine Site and 17 km northwest of the Touquoy Mine Site, includes a saw mill, a finishing plant, a pallet plant, a power plant, a dry-kiln, and a chipping plant. The power plant is a co-generation facility that burns biomass produced from their operation that provides power to their operation as well as to homes and businesses within a 30 km radius (Taylor Lumber, 2017).

It is possible that the Taylor Lumber Mill may result in an additive cumulative effect to Air quality, however the extent of the residual impact of the lumber bill on Air quality is unknown. No additional information is available to predict potential cumulative effects in a quantitative manner. Given that the Project is able to meet applicable air quality guidelines at the property boundary, the likelihood of a cumulative effects on air quality is low.

Mosher Lake Limestone Co. (Present)

Mosher Limestone processing facility is located approximately 21 km northwest of the Beaver Dam Mine Site and 16 km north of the Touquoy Mine Site. As such, the project lies within the RAA for Air for the Project, and there is a potential spatial overlap of residual effects. Mosher Limestone processes and sells limestone products in Nova Scotia and Atlantic Canada. Products include pelletized limestone, powdered limestone, granular limestone, powdered gypsum, pelletized gypsum, and traction sand. The processing facility crushes, packages and ships product. While very little data is publicly available, the Moser Lake Limestone Quarry is expected to generate dust and exhaust type emissions similar to other construction projects. This site has the potential for an additive cumulative effect on air quality with the Project, though it is expected to be minor given the distance between the two projects. No additional information is available to predict potential cumulative effects in a quantitative manner. This project did not trigger an environmental assessment and no publicly available data was found to provide air quality results associated with this project.

Fifteen Mile Stream Past and Proposed Mining Operations (proposed)

The Fifteen Mile Stream Gold Project is located approximately 17 km northwest of the Beaver Dam Mine Site, and 37 km northwest of the Touquoy Mine site. Residual effects on air quality from operation of the proposed Fifteen Mile Stream Mine Project include dust from onsite activities, vehicle travel, material handling and crushing of ore prior to transportation to the Touquoy Mine Site for processing. Residual effects are expected to be adverse, but not significant, and limited to the LAA, which represents a 1.5 km buffer of the PA. These effects will be mitigated through equipment maintenance, dust suppression, enforcement of speed limits, stabilization of stockpile slopes, covering of haul trucks and minimizing blasting events. There is no spatial overlap of residual effects between the FMS and Beaver Dam Gold Projects, as such, there is no expectation of additive cumulative effects. There is little uncertainty in this determination, given the clear definition of the spatial and temporal extent of residual impacts to Air presented in the EIS for the Fifteen Mile Stream Project.

ScoZinc Ltd. Mine (Past and Future)

ScoZinc is a proposed future (and past) zinc mine located approximately 50 km west of the Beaver Dam Mine Site, and 32 km west of the Touquoy Mine Site. While this Project is not currently in operation, it has an approved EARD and is expected to commence operation in the near future, so a temporal overlap of the Projects is possible. The ScoZinc Mine is expected to generate emissions related to trucking primarily. The spatial extent of impacts of the ScoZinc Mine on air quality has been defined as a 5 km zone of influence surrounding the Project. As such, there is no expectation for spatial overlap of residual effects between the ScoZinc Mine and the Beaver Dam Project, and no pathway for cumulative effects.

Cooks Brook Sand and Gravel Pit (Present)

This sand and gravel pit is located 47 km west of the Beaver Dam Mine Site and 29 km west of the Touquoy Mine Site. The primary operation at this facility is extraction and crushing of sand and gravel; air emissions are not expected to be generated at this location. Given that the spatial extent of residual effects of the Project on Air quality are limited to the LAA, there is no expectation of additive cumulative effects of these two facilities, given the distance between the sites.

Port of Sheet Harbour and Great Northern Timber Wood Chipping and Shipping (Present)

The Port of Sheet Harbour is a deep water port located 23 km southeast of the Beaver Dam Mine Site and 35 km southeast of the Touquoy Mine Site on the coast of the Atlantic Ocean. The terminal consists of a 152 m wharf with a minimum draft of 10 m and is capable of handling ships of up to 214 m (Port of Sheet Harbour, 2017).

At this same location, Great Northern Timber owns and operates a chipping and ship loading facility in Sheet Harbour, approximately 25 km southeast of the Beaver Dam Mine Site. Great Northern Timber procures wood chips and roundwood fibre from industrial landowners, sawmills, Crown lands, Private land contractors and Private woodlot management organizations in Nova Scotia, Prince Edward Island, New Brunswick and Quebec.

Data to support conclusions about residual effects of these projects on Air quality is unavailable, however it is not expected that either of these projects would result in a significant additive effect to Air quality with the Project. Neither of these projects triggered provincial or federal environmental assessment processes. As such, no air dispersion modelling was completed for either of these activities, and neither is expected to result in cumulative effects with the Project. There is some uncertainty in this conclusion, however, due to lack of available data.

8.5.2.2.3 Cumulative Effects on Ambient Air Quality

It is likely that forestry operations will occasionally coincide with those of the Project and cause greater disturbance to air quality that these operations produce individually. However, such additive periods are likely to be limited in duration and frequency and are not expected to be significant.

The gold processing and transportation activities associated with the Fifteen Mile Stream Mine Project, the Cochrane Hill Gold Project and the Project overlap in both time and space, with additional consideration to potential forestry activities that could also overlap spatially and temporally. Therefore, effects from the transportation and processing of gold from the three projects and forestry activities have the potential to act in an additive and cumulative nature. The operation of Beaver Dam Mine Project, the Project and the Cochrane Hill Gold Project are proposed roughly to occur during the same timeframe, with all three mines operating at the same time from 2023 to 2027. During this time all three projects will use the portion of the Beaver Dam Haul Roads west of the Highway 224 to transport gold concentrate to the Touquoy Mine Site resulting in potential additive cumulative effects to air quality through increased ambient dust levels along the Beaver Dam Haul Road. The addition of trucking from the two projects and forestry activity will not result in a significant cumulative effect (Appendix C.1).

The principal assumptions behind this assessment is that local forestry practices will not change in any important way during the Project, the Fifteen Mile Stream Project or the Cochrane Hill Gold Project. Limitations related to data availability do not allow us to make meaningful conclusions related to cumulative effects and project interactions for many of the projects listed throughout Section 8.5.2.2.2, however, given the limited spatial scale of the individual project effects, the mitigation measures proposed, and the distance between the projects, it is unlikely that any cumulative effects would be significant.

8.5.2.3 Mitigation

As the cumulative effects are not anticipated to be significant, additional mitigative measures (beyond those proposed to mitigate Project related effects, Section 6.2.8) for cumulative effects to air are not warranted.

8.5.2.4 Residual Cumulative Effects and Significance Assessment

Significant residual effects for the Air VC Are defined as having high magnitude (i.e., an **exceedance** applicable criteria), occur beyond the LAA, be of long-term to permeant duration, occur at regular intervals or be continuous throughout the Project, and be only partially reversible to irreversible, as described in Section 6.2.6.2.

The residual cumulative effects on the atmospheric environment are considered to be adverse but not significant (Table 8.5-3).

Table 8.5-3: Residual Cumulative Environmental Effects for Air

Residual Adverse Cumulative Effects (After Mitigation)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Increased cumulative dust during operation of the Project (Dust from mining and haul trucks)	M Possible exceedance of guidelines or threshold values when forestry operations occasionally coincide with hauling from the Project to the Touquoy Processing Facility along with ore or concentrate from Fifteen Mile Stream and Cochrane Hill Projects.	LAA The cumulative effects causing increased background air concentrations will not extend beyond the LAA.	A VC will be affected by timing – drier periods will increase fugitive dust emissions relative to wetter times of the year.	LT Effects may extend beyond 7 years.	R Additive periods of potential effects from the Project and forestry operations are likely to be limited in frequency. However, cumulative effects to ambient dust levels from the use of the Beaver Dam Haul Road by the Project, the Fifteen Mile and Cochrane Hill Gold Projects will occur regularly throughout the operational phase of the Project.	R VC will recover to baseline conditions once operations have stopped.	Moderate Adverse Effect (Not Significant) Effects are limited to the LAA where there are limited sensitive receptors, and the use of the Beaver Dam Haul Road. Furthermore, the VC is anticipated to recover to baseline conditions once the operation Project has been completed. Effects would be confirmed through monitoring.

Notes: Specific characterization criteria listed below for air are defined in Table 6.2-5. Standard characterization criteria listed below are defined in Section 5.11, Table 5.11-1.

Magnitude
- N Negligible
- L Low
- M Moderate
- H High

Geographic Extent
- PA Project Area
- LAA Local Assessment Area
- RAA Regional Assessment Area

Timing
- N/A Not Applicable
- A Applicable

Duration
- ST Short-Term
- MT Medium-Term
- LT Long-Term
- P Permanent

Frequency
- O Once
- S Sporadic
- R Regular
- C Continuous

Reversibility
- R Reversible
- IR Irreversible

8.5.2.5 Follow-up and Monitoring Programs

No additional follow-up or monitoring beyond that presented in Section 6.2.10 is warranted.

8.5.3 Light Cumulative Effects Assessment

8.5.3.1 Baseline Conditions

8.5.3.1.1 Baseline Light Levels

As part of the 2007 Focus Report, a background light study was conducted at the Touquoy Mine Site. At all locations where baseline measurements were taken at the Touquoy Mine Site, ambient light measurements were under exposed, indicating ambient light levels were too low (<0.01 lux) to be measured (CRA, 2007). The Touquoy baseline conditions fell under the classification for rural areas, small villages, or relatively dark urban areas: “E2 Low District Brightness Areas”.

The conditions around Beaver Dam Mine Site, Haul Road, and surrounding area are similar to that of the background conditions for Touquoy Mine Site 2007 Focus Report, due to its remote, rural and mostly wooded, location. Ambient nighttime light conditions are minimal and typical of an undeveloped rural area. The largest artificial light sources in the Project Area are from the nearest residences, the Beaver Lake IR, and the occasional all-terrain vehicle. As such additional on-site light monitoring was not required to support the light impact assessment. The Beaver Dam Mine Site, Haul Road and surrounding area also fall under the classification for rural areas, small villages, or relatively dark urban areas: “E2 Low District Brightness Areas”.

A light impact assessment (Appendix D.1) was completed for the Beaver Dam Mine Project and included nine points of reception (Section 6.3). For the purposes of this assessment, "pre-curfew" was assumed to be before 11:00 PM, and included road activity, and "post-curfew" was between 11:00 PM and 7:00 AM and included only overnight activities at the Beaver Dam Mine Site. The assessment of light impacts along the Haul Road was completed by considering a “worst case” scenario when two trucks are closest to each receptor and shining light towards the receptor. Because receptors along the Haul Road are not located on any road bends, with limited line of site to the travelling trucks, the assessed light impacts to these receptors were likely overestimated (Appendix D.1).

The calculated light levels at all receptors are below the limits recommended by the ILP guidelines during both pre- and post-curfew conditions (i.e., before 11:00 PM [i.e., pre-curfew] and between 11:00 PM and 7:00 AM [i.e., post-curfew], respectively; Section 6.3.7.1, Table 6.3-7 and Figure 6.3-2). The assessment considers worst-case operating conditions, for example, if all mobile equipment was in use at the same time and illuminating towards the receptors and the potential for light from both the Beaver Dam Mine Site and the Haul Road trucks to affect a receptor in a cumulative way.

The calculated light levels from the Haul Road are also below the limits recommended by the ILP guidelines (Section 6.3.7.1, Table 6.3-7 and Figure 6.3-2).

Ambient night-time (post-curfew) light levels at the Beaver Dam Mine Site are predicted to meet the 1 lux guideline within 1.6 km from the site and as such not anticipated to affect the Beaver Lake IR or other receptors. The Beaver Lake IR 17 is located approximately 5 km southwest of the Beaver Dam Mine Site and is separated from the Beaver Dam Mine Site by forest and two topographic ridges.

Distance to Sky Glow dissipation is summarized in Section 6.3.7.1, Table 6.3-8 along with total luminous flux from the Beaver Dam Mine and Haul Road, and distance to the 5.0 lux and 1.0 lux assessment criteria. Section 6.3.7.1, Table 6.3-7 shows the distance

to a maximum 0.1 lux illuminance level which is considered as background light level for this assessment. Section 6.3.7.1, Figure 6.3-2 shows the Light shed map depicting these distances. The light shed map (Figure 6.3-2) shows that the light levels from the Beaver Dam Mine Site reach maximum 5 Lux at a distance of 719 m from the source, maximum 1 Lux light level at distance of 1,607 m from the source and maximum 0.1 Lux (background level) at a distance of 5,082 m from the source. Section 6.3.7.1, Table 6.3-7 and Figure 6.3-2 also show that during pre-curfew conditions when the Haul Road is in operation, when two trucks pass the same point simultaneously, the ambient light may be 5 lux or more out to a maximum distance of 39 m from the Haul Road (on an instantaneous basis, this will not be a continuous light level, it will occur only where two trucks are passing each other, and only for the brief period they are both affecting the same receptor). At a distance of 279 m, the light under these same conditions will be less than 0.1 lux (or less than background) (Appendix D.1).

8.5.3.1.2 Residual Effects of Proposed Project

The predicted residual environmental effects of Project development and production of light are assessed to be adverse, but not significant. The calculated light levels at all receptors are below the limits recommended by the ILP guidelines during both pre- and post-curfew conditions. The calculated light levels at all receptors from the Haul Road are also below the limits recommended by the ILP guidelines.

The resulting area of illumination elevated above background conditions (sky glow) from the Beaver Dam Mine Site will be seen within 5,082 m. This encompasses receptors R1, R2, R3, and R4 (Figure 6.3-2). The predicted illuminance levels represent the worst-case operating conditions of the Beaver Dam Mine Site. The assessment considers when all of the mobile equipment at the mine would be in use at the same time, illuminating towards receptors. The areas surrounding the site are wooded with varying topography and inhibit the spread of light. It was conservatively assumed for screening purposes that 50% of the light will not reach the receptors due to directionality and line of sight obstructions. The amount of light blocked by the surrounding woodland and topographic changes, however, will likely be much greater than this (>90%), especially during the seasons when deciduous trees are leaf on (Appendix D.1). It is therefore not expected that the illumination will cause any significant visual impact, due to a combination of distance and the screening effects of topography and vegetative cover.

Beaver Dam ore will be trucked to the operating Touquoy Mine Site for processing. The primary effect of the continued use of the Touquoy Mine Site is the continued lighting of facilities and vehicular traffic during the processing of FMS concentrate. There are no new or additional effects from light anticipated to be caused by the processing of concentrate and the management of tailings from the Project and are therefore not further evaluated in this cumulative effects assessment.

8.5.3.1.3 Effects of Other Projects in the Area

The RAA for light, and projects which fall within this RAA are shown on Figure 8.5-3. The NSSA Acid Mitigation Project has a spatial and temporal overlap with the Projects' RAA for light. However, this project is not being discussed in the context of cumulative light impacts, because aside from several days per year of helicopter flights for terrestrial liming during daytime, the NSSA work does not generate light.

Current Regional Forestry Operations

The local forestry industry has the potential to have cumulative effects on light. As the forestry industry is ongoing in the region and has been for many decades, its effects on light are already accounted for in the local baseline conditions. Impacts on light associated with timber harvesting would be limited to temporary increases in light based on transportation to timber, and cannot be quantified in a meaningful with publicly available data.

Prepared For:

Atlantic Gold

FIGURE 8.5-3

Beaver Dam Mine Project

Cumulative Effects Assessment: Light

Mosher Lake Limestone Co.

Great Northern Timber Pellet Facility

Beaver Dam Mine Site

Beaver Dam Past and Future Mining Operation

NSSA - AMP: Killag Doser

NSSA - AMP: WRSH Doser

NSSA - AMP: Terrestrial Liming

Regional Forestry Operations

Beaver Dam Haul Road

Haul Road

Touquoy Mine Site

Touquoy Mining Operations

- Projects Evaluated in the Cumulative Effects Assessment
- Light local Assessment
- Light Regional Assessment
- Project Area

Note: Forestry operations occur throughout the RAA and are not displayed on this figure

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 1.25 2.5 5 km

1:100,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: KR

Date: 5/10/2021

McCallum Environmental Ltd.

Document Name: BD_EIS_Figure8-4-X_CEA_Light

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Beaver Dam Haul Road Use by the Fifteen Mile Stream Project, Cochrane Hill Gold Project and Regional Forestry

During the operation phase of the Project, ore will be transported to the Touquoy Mine Site for processing. The Fifteen Mile Stream and Cochrane Hill Gold Projects plan to also transport gold concentrate from each surface mine to the Touquoy processing site for final processing into gold doré bar. The proposed haul route for each of these projects is proposed to overlap with the Beaver Dam Haul Road west of the Highway 224, along with potential trucking activity associated with the forest industry. Eleven round-trips are proposed to carry gold concentrate from each of the Fifteen Mile Stream Gold and Cochrane Hill Gold projects per day (totaling 22 truck round-trips [i.e., return trips or two-way trips] or 44 one-way trips per day), plus 95 round-trips (e.g., return trips or two-way trips) per day between Beaver Dam Mine Site and Touquoy Mine Site. This could be further compounded by forestry trucks and service trucks activity (e.g., approximately seven forestry truck round-trips per day plus 20 service truck round-trips per day). The total number of trucks for cumulative effects assessment is 288 one-way truck trips (or 144 round trips or two-way trips) (Appendix C.1, Table 1).

The assessment of light impacts along the Beaver Dam Haul Road was completed by considering a "worst case" scenario when two trucks are closest to each receptor and shining light towards the receptor. Because receptors along the Beaver Dam Haul Road are not located on any road bends, with limited line of site to the travelling trucks, the assessed light impacts to these receptors were likely overestimated.

The 22 additional vehicle round trips along this Haul Road are not anticipated to change the assessment presented. The worst-case would still occur when two trucks are close to a single receptor and shining lights toward that receptor. As the road is only two lanes, only two trucks could approach a receptor at one time (one from each direction). During daylight hours, the truck lights are insignificant compared to ambient light levels, in the dawn, dusk and evening hours (until 11:00 PM when post-curfew is implemented), potential light impacts will be as presented in Section 6.3.7.1.

Within the Beaver Dam Mine Project EIS, the calculated light levels at all receptors from the Haul Road are also below the limits recommended by the ILP guidelines, as a result of road traffic. This will be unchanged with the additional vehicles from Fifteen Mile Stream and Cochrane Hill and with consideration of baseline forestry activity (Appendix D.1).

8.5.3.1.4 Cumulative Effects on Light

It is likely that forestry operations will occasionally coincide with those of the Beaver Dam Mine Project and cause localized elevated light levels relative to what these operations produce individually, especially along the Beaver Dam Haul Road. However, such additive periods are likely to be limited in duration and frequency and are not expected to be significant. There are no available data to quantify timber harvesting accurately on crown land or on private land. This is a substantial data limitation, which prevents us from making any more meaningful conclusions related to cumulative effects on light from the Project, in the context of a resource driven landscape with unknown amounts of timber harvesting. Based on the current understanding of proposed lumbering operations, it has been assumed that forestry operations may add 7 truck trips per day plus service vehicles (20 trips per day), but it clear that forestry will not be a significant source of traffic on the Haul Road.

The gold concentrate processing and transportation activities associated with the Beaver Dam Mine Project, the Project and the Cochrane Hill Gold Project overlap in both time and space. Therefore, the potential effects from the transportation from the three projects have the potential to act in an additive and cumulative nature. The operation of Beaver Dam Mine Project (2023 to 2027), the Project (2023 to 2029) and the Cochrane Hill Gold Project (2025 to 2030) are proposed roughly to occur during the same timeframe, with all three mines likely operating at the same time from 2025 to 2027. During this time all three projects will use the portion of the Beaver Dam Haul Road west of the Highway 224 to transport gold concentrate to the Touquoy Mine Site resulting in potential additive cumulative effects to light levels from trucking along the Haul Road. Given the limitations of traffic on the Beaver

Dam Haul Road (two lanes, only tow trucks can be in one place at one time), the increase in volume of traffic will not result in a cumulative impact on light levels, particularly related to light levels at reception points.

The principal assumptions behind this assessment is that local forestry practices will not change in any important way during the Project, the Beaver Dam Mine Project or the Cochrane Hill Gold Project. These assumptions are considered to have a low uncertainty.

8.5.3.2 Mitigation

As the cumulative effects are not anticipated to be significant, additional mitigative measures (beyond those proposed to mitigate Project related effects, Section 6.3.8) for cumulative effects to light are not warranted.

8.5.3.3 Residual Cumulative Effects and Significance Assessment

For the purpose of this assessment, the threshold of determination of significant effects from light at the Beaver Dam Mine Site was determined to be 1 lux light trespass into windows at the nearest receptor. This was determined as a result of the baseline environmental light classification of E2 at the Beaver Dam Mine Project.

The residual cumulative effects on the atmospheric environment are considered to be adverse but not significant (Table 8.5-4).

Table 8.5-4: Residual Cumulative Environmental Effects for Light

Residual Adverse Cumulative Effects (After Mitigation)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Increased light levels during operation of the Project (operational light levels and light from transportation of gold concentrate and use of the Beaver Dam Haul Road by other projects)	L Less than or equal to appropriate guidelines or threshold values.	LAA The cumulative effects causing increased background light concentrations will not extend beyond the LAA. Exception to this is the cumulative light along the Beaver Dam Haul Road which is outside of the Project LAA but described herein.	N/A VC is not expected to be affected by timing.	LT Effects may extend beyond 8 years.	R Additive periods of potential effects from the Project and forestry operations are likely to be limited in frequency. However, cumulative effects to ambient light levels from the use of the Beaver Dam Haul Road Use by Fifteen Mile Stream and Cochrane Hill Gold Projects will occur regularly throughout the operational phase of the Project.	R VC will recover to baseline conditions once operations have stopped.	Low Adverse Effect (Not Significant) Effects are limited to the LAA where there are limited sensitive receptors, and the use of the Beaver Dam Haul Road. Furthermore, the VC is anticipated to recover to baseline conditions once the operation of the Beaver Dam Mine Site has been completed.

Notes: Specific characterization criteria listed below for light are defined in Section 6.3.6.3. Standard characterization criteria listed below are defined in Section 5.11, Table 5.11-1.

Magnitude	
N	Negligible
L	Low
M	Moderate
H	High

Geographic Extent	
PA	Project Area
LAA	Local Assessment Area
RAA	Regional Assessment Area

Timing	
N/A	Not Applicable
A	Applicable

Duration	
ST	Short-Term
MT	Medium-Term
LT	Long-Term
P	Permanent

Frequency	
O	Once
S	Sporadic
R	Regular
C	Continuous

Reversibility	
R	Reversible
PR	partially reversible
IR	Irreversible

8.5.3.4 Follow-up and Monitoring Programs

No additional follow-up or monitoring beyond that presented in Section 6.3.10 is warranted.

8.5.4 Surface Water Quality and Quantity Cumulative Effects Assessment

8.5.4.1.1 Baseline conditions

Surface Water Features

Beaver Dam Mine Site and Haul Road

The Beaver Dam Mine Site lies within the West River Sheet Harbour (WRSH) drainage basin, which is directly east of the Musquodoboit River Valley system. The watershed occupies an area of roughly 576 square kilometers (km^2), a moderately sized watershed in the Province. The area is characterized by rolling till plains, drumlin fields, extensive rockland, and numerous freshwater lakes, streams, bogs and wetlands having relatively low relief, hummocky type terrain. This inland area is somewhat removed from the immediate climatic influence of the Atlantic Ocean and is characterized by warmer summers and cooler winters.

The Killag River and Cameron Flowage is the main mapped linear watercourses of the Beaver Dam Mine Site, and Crusher Lake and Mud Lake are the major mapped lakes. The complex system of streams, lakes, bogs, and wetlands is a direct result of the underlying bedrock geology of greywacke and slate found in the region. The basin ultimately drains to the south via the West River Sheet Harbour, and discharge peaks are likely attenuated to a large extent by the numerous lakes and wetlands through which runoff is routed. The West River Sheet Harbour and Tangier River Secondary boundary runs through the center of the Project Area (Section 6.7.3) along the proposed Haul Road. Elevations within the catchment vary from approximately 135 to 165 meters above sea level (masl) in the headwater areas and gradually decrease to sea level at the final outlet located at Sheet Harbour. The headwaters of the drainage basin are located along the topographic divide separating the Musquodoboit River Valley to the northwest.

An inventory of surface water features was undertaken to identify water features may be impacted directly or indirectly by the proposed mine and Haul Road construction and operations. Initially three waterbodies (Crusher Lake, Mud Lake, and an unnamed waterbody in the southwest section of the Project Area) were identified through a desktop review of available mapping as requiring characterization of baseline conditions. During the 2019 field evaluations, 10 additional watercourses were identified within the Beaver Dam Mine Site, totaling 24 watercourses within the mine area. Three additional watercourses outside of the Beaver Dam Mine Site were also delineated (WC-23 [Outlet to Cope Brook], WC-26 [Outlet to Killag], and WC-27 [Outlet of Mud Lake]), due to potential impacts to fish and fish habitat within the LAA (Section 6.9). New watercourses are described in Section 6.7.3 and shown in Figures 6.7-1 and 6.7-2A to 6.7-2D.

Most watercourses within the Beaver Dam Mine Site are first order streams originating within headwater wetland habitat inside of the PA. Many streams across the Beaver Dam Mine Site are generally small with minimal pool/riffle structure and consist of mucky organic substrate. While most are generally perennial in nature, many have intermittent patches, which go dry during prolonged rainless periods when percolation depletes all flow (Alberta Transportation 2009).

Tertiary basins potentially affected by the Project including four within the Beaver Dam Mine Site and six along the Haul Road footprint; were identified as a result of baseline characterizations studies, are listed below and shown on Figure 6.7-4.

The four tertiary basins constituting the PA and LAA identified for the Project:

- Portion of Killag River (1EM-2-D);
- Tent Brook (1EM-2-F);
- Paul Brook (1EM-2-H); and
- Cope Brook (1EM-2-J).

The six tertiary basins affected along the Haul Road:

- Tent Brook (1EM-2-F);
- Keef Brook (1EM-2-G);
- Jack Lowe Brook (1EM-2-N);
- Little River (1EM-2-P);
- Portion of Sandy Pond (1EL-2-C); and
- Portion of Morgan River (1EL-2-H).

Touquoy Mine Site

The Touquoy Mine Site is an active Mine Site that commenced operation on October 11, 2017 and is subject to an Industrial Approval to operate issued by NSE. A Class I Environmental Assessment under the *Nova Scotia Environment Act* and Environmental Assessment Regulations for the Project was reviewed and approved in 2008, subject to Approval conditions. The use of the Touquoy Mine Site for the processing of Beaver Dam Mine ore and deposition of the associated tailings will occur after ore extraction from the Touquoy open pit has ceased. As such, the baseline conditions for the Touquoy Mine Site for the Project operations will be the conditions expected near the end of the Touquoy ore processing operations.

Existing conditions with respect to surface water for the watershed was based on the available data collected as part of the 2007 submission (CRA), 2013 LiDAR (Leading Edge), and Water Management Plan (Stantec 2017a) for operation, the Reclamation Plan (Stantec 2017b) for reclamation and closure, and the 2017 surface water quality/quantity monitoring reports (Stantec 2018b).

The existing Touquoy Mine Site is part of the Moose River drainage basin, which is directly east of the Musquodoboit River Valley system. As described in the Environmental Assessment Registration Document (CRA 2007b), the Moose River watershed can be characterized by rolling till plains, drumlin fields, extensive rock land, and numerous freshwater lakes, streams, bogs and wetlands in the headwaters and the relatively low relief hummocky terrain. Forests are predominantly coniferous of red and black spruce (CRA 2007b). Local ground surface elevations at the Touquoy Mine Site range from 102 to 145 masl. The Touquoy Mine Site is approximately 10 kilometers (km) northwest of the Tangier Grand Lake Wilderness Area. This protected area consists of 16,000 ha of predominantly coniferous forest and has abundant lakes, wetlands, and waterways. The waterbodies within the Wilderness Area are contained within a separate watershed from that of the Touquoy Mine Site, which lies in the Fish River Watershed.

The Moose River drainage basin ultimately drains to the south via Moose River, and runoff through the catchment to Moose River is likely attenuated by the many lakes and wetlands in the catchment thus reducing the peak flow. The catchment area of Moose River is 3,904 ha at surface water monitoring station TQ-SW-2 draining from topographical highs of 180 to 110 masl in elevation (CGVD 2013) at the banks of Moose River. Moose River flows south approximately 2.3 km downstream of SW-2 where it joins the

Fish River. Watercourse No. 4 has a catchment area of 136.3 ha at surface water monitoring station TQ-SW-3 and flows south between the existing open pit and Tailings management Facility (TMF) to Moose River and eventually to the Fish River.

Surface Water Quality

The Killag River, Crusher Lake, Mud Lake, Tent Brook and Cope Brook (Beaver Dam Mine Site area), and Moose River (existing Touquoy Mine) constitute the primary focus of the Project baseline surface water characterization studies, as well as subsequent effects assessment, as these watercourses will receive direct discharge and/or catchment areas have potential to be impacted by Project water management activities.

The Project is in a highly mineralized region and the geology contributes to naturally elevated concentrations of many water quality parameters in the area, including iron, arsenic and aluminum. The occurrence of naturally elevated concentrations in surface waters is commonly observed in regions of planned/proposed mining activities, all over the world (e.g., “Golden Triangle“ of northwestern British Columbia, Canada). In such regions, naturally elevated concentrations of certain water quality parameters generally occur where exposure of rock or other geologic materials to oxygen and water results in natural weathering processes, including chemical oxidation and leaching of solid-phase constituents (e.g., metals), which are then transported to surface waters.

Natural exceedances of water quality guidelines in baseline conditions are not a Project effect and, for these parameters, generic water quality guidelines (WQG) such as Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic life (CCME FAL), do not necessarily apply. That is, WQG generally represent generic criteria that are developed by governments or international organizations to identify the concentrations of parameters in the receiving environment that are not expected to cause an adverse effect on various receptors or uses (e.g., aquatic life, wildlife, livestock/agriculture, drinking water. As WQG are intended to apply universally, they do not necessarily account for site-specific factors including the presence/absence of specific species in the receiving environment, or naturally occurring elevated existing water quality due to mineralization of the watershed.

To support baseline characterization for the Project, and subsequent effects assessment, site-specific water quality objectives (SSWQO) have been developed for arsenic (As). SSWQOs are site-specific criteria developed by proponents as part of ESIAs or permit applications in many jurisdictions, for example Canada, on a site-by-site basis to replace the generic WQG guidelines of the receiving environment; take instead, site-specific water quality. Here, arsenic is naturally elevated in Project area-streams and, in this instance, CCME FAL is not appropriate.

Baseline surface water monitoring was conducted at 19 locations around the Beaver Dam Mine Site and 29 locations along the Haul Road and 13 locations at the Touquoy Mine site, to obtain water quality data. The purpose of this program was to establish a baseline for comparison of surface water quality and quantity before site activities for the Beaver Dam Mine site commence.

At the Beaver Dam Mine Site, most nutrients were below or slightly above detectable concentrations, but below available water quality guidelines, indicating little to no influence from agricultural operations in the area. The watersheds have been logged extensively, yet turbidity is low, indicating generally little long-term impacts and a lack of silt in the soils and/or little erosion from logging practices. The existing Haul Roads at the in and around the Beaver Dam Mine Site have been used to haul timber as well; however, measured TSS levels were low, which may be attributable to limited use, existing road conditions and allowable speeds.

Along the Haul Road, similar to as described for the Beaver Dam Mine Site Area, most nutrients were below or slightly above detectable concentrations, but below available water quality guidelines, indicating little to no influence from agricultural operations in the area. The watersheds have been logged extensively, yet turbidity is low, indicating generally little long-term impacts and a

lack of silt in the soils and/or little erosion from logging practices. Metal concentrations were typically below detectable levels and/or available water quality guidelines.

Based on a review of the 2017 baseline surface water quality results (Stantec 2018a), surface water at the monitoring stations upstream and downstream of the Touquoy Mine Site had elevated baseline concentrations of arsenic, aluminum, cadmium, copper, iron, lead, manganese, and zinc that exceeded NSE Tier 1 EQS. In addition, cobalt, manganese, silver and mercury exceeded the Canadian Council of Ministers of the Environment (CCME 2018) guideline for the protection of freshwater aquatic life. These exceedances are considered to be naturally occurring, or the result of historical anthropogenic (i.e., non-Project related) activities, varying seasonally and representing baseline conditions at the Touquoy Mine Site.

Surface Water Quantity

FMS Mine Site

The average monthly temperature at the site ranges from a low of -6.2°C in January to a high of 18.5°C in July. The lowest average total monthly precipitation occurs in June (94.8 mm), while the highest occurs in November (137.1 mm). Snowfall was converted to snowmelt using the degree-day method. The rainfall plus snowmelt values were taken from this analysis for use in the water balance and predictive water quality assessments. Rainfall plus snowmelt depths peaked in March due to the rising temperature depleting the snow pack, creating a greater volume of available water for discharge. The lowest rainfall plus snowmelt occurred in June to August.

The total contributing drainage area to the Killag River downstream of the site, which includes the Project Site and Mud Lake and Crusher Lake, is approximately 3,933.5 ha.

Touquoy Mine Site

Scraggy Lake is part of the Moose River drainage system. It has an area of 6.4 km^2 (Stantec 2018c) and forms two major basins which are separated by islands and peninsulas. Scraggy Lake is the freshwater make-up supply for the active Touquoy mill process. Water flows into Scraggy Lake from approximately twenty-two inlets consisting of mapped watercourses or adjacent waterbodies. Water flows out of Scraggy Lake over the Fish River Dam and into the Fish River. The Fish River drains Square Lake located north of the existing Touquoy waste rock area to Scraggy Lake. Both lakes are part of the Fish River Watershed which flows west and then south into Lake Charlotte, eventually emptying into the Atlantic Ocean at Ship Harbour.

As per the Reclamation Plan for Touquoy (Stantec 2017b), Moose River is proposed as a second point of final discharge under closure of the exhausted Touquoy open pit. At SW-2, Moose River is a 3rd order watercourse with an approximately 12.5 m bankfull width as measured in the 2017 hydrometric program. The substrate was noted in the 2017 hydrometric monitoring report (Atlantis 2017) as characteristically muddy consisting predominantly of cobbles and small boulders, silt/sand with gravel.

Baseline flow in Moose River and Scraggy Lake at the end of Touquoy operations will be similar to the existing conditions prior to the development of the Touquoy Gold Project. The flow conditions in Moose River are represented by a stage-discharge curve derived based on an annual hydrometric monitoring program at stations SW-2, HM-1, and SW-11. Baseline flow statistics on Moose River were generated based on a regional analysis of thirteen representative ECCC (ECCC 2018) hydrometric stations, prorated to the Moose River catchment area at TQ-SW-2. The record of daily average flow for each station was fitted to the Log Pearson Type III distribution and prorated to the site based on catchment area. The log relationship of catchment area and flow was graphically plotted to establish a relationship between the catchment area and the average spring flow (April), summer flow (June/July/August), and low flow (July).

Surface water in Moose River is based a statistical analysis of regional flow records. As presented on Figure 6.7-6, strong linear trends exist between the average monthly flow rates of the selected monitoring stations and drainage area for April, August, and June to August with a correlation coefficient (R^2) of 0.98, 0.93, and 0.96, respectively. From these regional relationships, the average April and August flows for SW-2 in Moose River (catchment area of 39.03 km^2) are estimated to be 2.42 m^3/s and 0.45 m^3/s, respectively. Results of the analysis indicated that generally the peak and low flow events occur in April and August, respectively.

8.5.4.2 Analysis of Effects

8.5.4.2.1 Residual Effects of Proposed Project

Beaver Dam Mine Site Water Quantity Summary

A water balance analysis was conducted to assess the hydrologic impact of mine development on the surrounding water features. The water balance was calculated for five assessment points where the site will discharge or impact flows in the natural environment, including the Killag River, Mud Lake (outlet to WC-27), Crusher Lake (outlet to WC-5), Tent Brook and Cope Brook systems.

Mine site development will increase the Killag River catchment area, and decrease the Mud Lake, Tent Brook and Cope Brook catchments due to the placement of mine features in their baseline drainage areas. Surface runoff from mine features will be directed to settling ponds for treatment prior to being released into the Killag River and Tent Brook systems. The north settling pond will receive and treat runoff from the waste rock, low-grade ore and topsoil stockpiles, the crusher pad, administrative building area and site roads. Surface water and groundwater collected in the pit sump will also be dewatered to the north settling pond. The east settling pond will receive runoff from the till stockpiles, part of the organic stockpile and site roads. The north and east settling ponds discharge to the Killag River. The south settling pond will receive runoff from another other part of the organic stockpile and a topsoil stockpile. The south settling pond discharges to WC-19 of the Tent Brook system.

As part of the site reclamation plan, the pit will be filled with water from groundwater inflows, direct precipitation, and site contact water. Water will no longer be pumped from the pit to the north settling pond, and the north settling pond discharge will be re-directed into the pit. Once the pit is filled, the north settling pond will be decommissioned and site runoff will be diverted directly into the pit (Figure 6.7-14). Overflow from the pit will be directed to the Killag River through an engineered outfall in the east pit wall and existing outlet channel (WC-13). The capacity of the pit is approximately 16,000,000 m^3. During PC conditions an additional 8.6 ha will be routed to Mud Lake, reducing the impact to the Mud Lake drainage area to from a 18.3% decrease between baseline and EOM conditions to a 13.7% decrease between baseline and PC conditions. The impact to the drainage area of the Tent Brook and Cope Brook assessment points remain the same as in EOM conditions.

Beaver Dam Mine Site Water Quality Summary

During EOM conditions site water from the waste rock, low grade ore stockpiles and the pit will be routed through the North Settling Pond prior to discharge into the Killag River. Additionally, clean water from the site will be diverted and discharged directly to Mud Lake. There will also be clean discharge from the eastern till stockpiles to the Killag River. During PC conditions, site water from the waste rock stockpiles will be routed through the pit prior to discharge into the Killag River.

In summary, under the EOM scenarios, predicted mass balance near-field mixing zone and far-field mixing zone chemical concentrations in the base case are consistently below selected water quality benchmarks. The initial analysis assumed no treatment of mine contact water in the north settling pond and only analyzed the results from a mass balance (dilution) calculation

at the extent of the predicted mixing zone. The results indicated that, while concentrations for some parameters are anticipated to increase above baseline levels, at the near-field mixing zone there are no exceedances of either CCME, NSE Tier 1 criteria. As water quality criteria are defined by national and international entities as protective of the receiving environment and all water users, there are no anticipated effects to surface waters are a result of discharges from the Project to the Killag River.

However, in the EOM upper case scenario, nitrite is predicted to exceed CCME regulatory guidelines in three months of the year. Note, modelling for the Project is conservative, and based on the principles of mass balance. That is, while mass and water balance models (including GoldSim) provide capabilities for simulating mass and water balances, these processes do not represent complete reaction paths and water quality predictions are expected to be further governed by in situ processes. This included equilibrium reactions, sorption reactions and solubility limits which, together, would generally service to reduce concentrations of many quality parameters predicted by the mass balance. In particular, nitrite is known to be unstable in oxygenated environments (such as the Killag River), oxidizing to Nitrate and/or bio-assimilated. Thus, it is likely that nitrite concentrations have been overestimated for the Killag River, in both base case and upper-case scenarios. However, in response to IR2, potential nitrite removal technologies have been identified and evaluated for the Project (Appendix F.2 [Water Treatment Assessment Operation] of Appendix P.4 Mine Water Management Plan).

During PC conditions the pit lake discharges into the Killag River directly. Predictions were generated for the PC at near-field mixing zone assessment point and PC far-field mixing zone assessment point. The initial analysis assumed no treatment of mine contact water in the pit lake and only analyzed the results from a mass balance (dilution) calculation at the extent of the predicted mixing zone. There is contingency for an interception trench during PC if there are potential impacts from the PAG pile on groundwater. Water from the interception trench will be directed to the pit and/or treated

At the near-field and far field mixing zones the results from the analysis concluded that during base case scenario, while concentrations for some parameters are anticipated to increase above baseline levels, there are no exceedances of either CCME, NSE Tier 1 criteria. As water quality criteria are defined by national and international entities as protective of the receiving environment and all water users, there are no anticipated effects to surface waters are a result of discharges from the Project to the Killag River. However, results from the upper-case scenario suggest there is potential for a slight exceedance of the CCME guideline for cobalt and zinc in July and August, which is within range of natural variability. If monitoring data deviates from impact predictions, then water treatment will be undertaken.

Under the PC scenarios, there is little difference between predicted chemical concentrations at near-field mixing zone (pit lake discharge) and far-field mixing zone locations for each assessment each case. The results for the mass balance assessment during the base case PC scenarios the chemical concentrations are consistently below selected water quality benchmarks. In upper case PC scenarios, cobalt and zinc concentrations are predicted to exceed selected water quality benchmarks at both locations without during the months of July and August. An aquatic ecological risk assessment is provided in (Appendix G.2). If monitoring data deviates from impact predictions, then water treatment will be undertaken. Results for cobalt and zinc, are further discussed below.

- **Cobalt**, the predicted PC cobalt concentration at the near-field location marginally exceeds the Federal Environmental Quality Guideline (FEQG; 0.78 µg/L) in the upper case (0.8 and 0.85 µg/L in July and August; Table 6.7-35). The concentrations are up to 1.1 times the FEQG. A similar situation occurs with the PC far field location, wherein cobalt concentrations are predicted to range between 0.8 to 0.84 µg/L in July and August (upper case; Table 6.7-39). Additional water quality modelling was conducted to confirm hardness levels in the receiving environment, following effluent release. his modelling indicates that hardness in the near field receiving environment is predicted to increase to 11.4 mg/L $CaCO_3$ in the PC upper case. These hardness levels are also predicted for the far field location. The FEQG considers hardness as a modifying factor, and was derived for water hardness values ranging between 52 to 396 mg/L. The FEQG of 0.78 µg/L

represents the guideline value using a water hardness of 52 mg/L. Given that the water hardness in the near field receiving environment is predicted to be below this range, there is some uncertainty associated with the use of this guideline value. However, the SSD model developed by Environment Canada in this guideline setting approach is very conservative, and the data used in the assessment do not fit the selected model of the SSD in the lower quartile of the dataset well (see Figure 1; ECCC, 2017). This results in the estimated HC5 value being considerably lower than it should be, relative to the toxicity dataset. This indicates that the selected guideline is over predicting toxicity of cobalt, and hence, the marginal exceedances predicted are unlikely to pose a risk in the receiving environment. In addition, Dissolved Organic Carbon (DOC) is an additional modifying factor for cobalt toxicity (Stubblefield et al., 2020). This factor was not considered in the development of the FEQG, and would assist in mitigating potential for toxicity, based values that cobalt is largely non-detect in the baseline data, at a detection limit of 0.4 µg/L (Table 6.7-12). The predicted concentrations have been added to a mean value which may be biased high due to the non-detect samples. For additional context, it is interesting to note that Stubblefield et al. (2020) published two water quality guidelines for cobalt recently as follows:

- European-based approach and EC_{10} values and a species sensitivity distribution (SSD), yielding a median hazardous concentration for 5% of the organisms (HC5, 50%) of 1.8 µg/L; and
- A US EPA-style approach, using EC_{20} values in a SSD to derive a final chronic value (FCV) of 7.13 µg/L (note: this approach is more relaxed than typical Canadian approaches for deriving water quality standards, and hence, it is not recommended to use this value).

Neither of these approaches used hardness, or other water quality factors as modifiers. Based on the marginal degree of exceedance, the presence of elevated DOC concentrations, and increased hardness levels associated with the release of effluent, cobalt is considered unlikely to pose a risk to aquatic life.

- **Zinc**: The predicted concentrations do not exceed the new CCME guideline for zinc (7 µg/L) in the EOM scenarios for near field or far field. Additionally, predicted concentrations do not exceed the CCME guideline for zinc in the PC scenarios for near or far field in the base case, but do in the upper case. In the near field PC scenario, upper case predicted exceedances from the pit are 7.09 and 7.39 µg/L in July and August, respectively (Table 6.7-35). In the far field PC scenario, upper case predicted exceedances are 7.05 and 7.35 µg/L in July and August, respectively (Table 6.7-39). The Lowest observed effect concentration (LOEC) listed in the CCME (2018) fact sheet is 9.89 µg/L (11-week study; development; Chironomid sp.; normalized to 50 mg/L $CaCO_3$ and Dissolved Organic Carbon (DOC) of 0.5 mg/L). The predicted concentrations are within the range of background (<5 to 7.8 µg/L; based on sample size N=15). The waters of the Killag River are soft (<10 mg/L $CaCO_3$), but the DOC is reasonably high (ranging from 7 to 20 mg/L; mean of 12.2 mg/L, based on 2019 and 2020 data), and would be expected to provide adequate protection, for several of the months where predictions indicate elevated levels. Additional water quality modelling was conducted to confirm hardness levels in the receiving environment, following effluent release. This modelling indicates in the PC base case, hardness in the near field receiving environment is predicted to increase to 11.4 mg/L $CaCO_3$ in the PC upper case. These hardness levels are also predicted for the far field location. Based on these hardness levels, and accounting for site specific pH and DOC, the zinc guideline changes to 33 µg/L (based on an assumed mean hardness: 11.4 mg/L; mean pH: 5.43; mean DOC: 12.2 mg/L). None of the predicted concentrations exceed this guideline value, and hence, predicted zinc concentrations are considered to have a low potential for toxicity.

The site will be monitored during construction and operations. The outcomes from the modelling will inform updates to water quality model to refine PC predictions. The principals of adaptive management will be applied if the outcomes from modelling differ from those predicted.

In response to IR2 issued by Canadian Environmental Assessment Agency and Nova Scotia Environment, and as a result of ongoing water quality, water quantity and geochemical studies for the Project, water treatment for both EOM and PC is planned

for the Project. Details for water management and evaluation of water treatment alternatives are presented in Appendix P.4 (Mine Water Management Plan) and the water treatment assessments for operations and post-closure, which are included under Appendix F of the Mine Water Management Plan (Appendix P.4). Note, the treatment system will be designed to ensure that all site effluent water meets MDMER and will reflect assimilation capacity of the receiving environment, such that any potential effects to the Surface Water Quality VC, and downstream water users, will be fully mitigated.

Touquoy Surface Water Quality

Based on the water balance model results (Appendix A of Appendix P.4 [Mne Water Management Plan]), no water will be discharged from the exhausted Touquoy open pit until the pit reaches the spillway elevation in Year 12. This allows for many years of water treatment in the pit as a batch reactor with the objective of adjusting the pH to precipitate metals, potentially improving discharge criteria toward MDMER discharge criteria. As an additional benefit of the slow filling of the pit over time, the residence time and exposure to the atmosphere will increase, thus enhancing the natural UV degradation of cyanide and improving water quality in the pit lake.

The water quality in the Touquoy open pit will be monitored during the pit filling and as the pit level approaches the spillway elevation. The water quality will be compared to the MDMER discharge limits and will be treated as required to meet these limits. The MDMER discharge limits will decrease from the existing limits to those presented in Appendix F.8, Table 1, effective June 2, 2021. The discharge from the Touquoy Mine Site is anticipated to occur after this period, and therefore the lower MDMER limits will apply.

The water quality model of Moose River predicts the effluent concentrations under normal discharge from the Touquoy open pit combined with the groundwater seepage contributions in Moose River under the same climate conditions. Moose River will primarily be driven by climatic conditions, and April flows were selected in the modelling to represent a worst-case dilution ratio between the effluent discharge from the Touquoy open pit and Moose River. This results in conservatively higher estimates of mass loadings to the receiving environment from the Project.

It is important to note that the NS Tier 1 guideline of 5 µg/L (which is based on the CCME guideline), is for free cyanide. This guideline is not a relevant guideline to compare Total cyanide, SAD or even WAD forms of cyanide to, as it is based on the free ion, as opposed to bound forms of cyanide, which have far lower toxic potential. Based on the receiving environment predictions, WAD cyanide is approximately half of the Total Cyanide predicted concentration (0.0032 mg/L WAD, compared to 0.0074 mg/L Total). This implies that the half of the Total Cyanide prediction would be SAD, and hence, less likely to dissociate in the receiving environment (mean pH in receiving environment is 6.05). Predicted WAD concentrations in the receiving environment are below the NS Tier 1 guideline, indicating acceptable levels of risk to aquatic life. Based on this, risk to aquatic life are predicted to be low.

Predicted cobalt levels in the receiving environment (0.0011 mg/L) marginally exceed the new FEQG for cobalt (0.00078 mg/L), but are less than the NS Tier 1 cobalt value of 0.01 mg/L. The FEQG considers hardness as a modifying factor, but the SSD model developed by Environment Canada in this guideline setting approach is very conservative, and the data used in the assessment do not fit the selected model of the SSD in the lower quartile of the dataset well (Figure 1; ECCC, 2017). This results in the estimated HC5 value being considerably lower than it should be, relative to the toxicity dataset. This indicates that the selected guideline is over predicting toxicity of cobalt, and hence, the marginal exceedance is not considered to represent a concern, with respect to toxicity to aquatic species. Cobalt concentrations are predicted to decrease to 0.0010 mg/L by 120 m from the effluent discharge point (Appendix F.8, Table 10 [Project Assimilative Capacity Study of Moose River - Touquoy Open Pit Discharge]), which is 0.1 ppb above the guideline. Risks to aquatic life at this concentration are anticipated to be low (Appendix G.2).

Touquoy Surface Water Quantity

The use of the exhausted Touquoy facility for tailings storage will result in the accelerated filling of the pit from that of the Touquoy reclamation plan.

Based on a three-dimensional model of the Touquoy ore body presented in the water and tailings management plan (Appendix F.7 [Touquoy Integrated Water and Tailings Management Plan]), the total storage capacity of the exhausted open pit at the maximum surface water elevation of 108 m CGVD2013 is estimated at 8.962 Mm^3. The water balance model predicted the amount of water and tailings stored in the pit until the pit was filled to 108 m CGVD2013. Based on results of the water balance model and the derived elevation storage relationship, tailings will be deposited in the open pit for a total of 41 months reaching an elevation in the pit of 93.2 m CGVD2013. This amounts to approximately 14.8 m of water cover above the tailings, assuming the spillway invert elevation of 108 m CGVD2013. The water balance model simulated that it would take an additional 100 months or a total of 141 months from commencement of operation to fill the pit to the spillway invert elevation.

Initially, process water will be reclaimed at a rate of 8,960 m^3/d from the existing Touquoy TMF until surplus water storage in the pond is depleted. Based on results of the water balance model under climate normal conditions, three to five months of process water surplus will be available depending on the month of start-up. Subsequently, process water will be reclaimed from the exhausted Touquoy open pit at the same rate, recirculated as a closed loop through the mill facility during the remaining period of processing Beaver Dam ore at the Touquoy facility. As the current practice at Touquoy, this water management strategy reduces the quantity of mine contact water or the at the site and a lower demand on freshwater supplies.

8.5.4.2.2 Effects of Other Projects in the Area

The RAA for surface water quality and quantity, and projects which fall within this RAA are shown on Figure 8.5-4. There is direct spatial overlap between the Project and historic mining operations in the Beaver Dam Haul Road, Touquoy Mine Site, regional forestry operations and the NSSA AMP. Any potential cumulative effects from these projects related to surface water would be based on potential impacts to water quality from mobilization of historic tailings. The potential impact of this interaction will be mitigated by implementation of the Historical Tailings Management Plan (Appendix E.9). As such, these historic operations are not carried through the CEA process.

Regional forestry operations

The local forestry industry has the potential to have cumulative effects on surface water. As the forestry industry is ongoing in the region and has been for many decades, its effects on surface water quantity and quality are already accounted for in the local baseline conditions. Furthermore, in Nova Scotia forestry operations are regulated under the *Wildlife Habitat and Watercourse Protection* regulations, which imposes various restrictions on timber harvesting with the purpose of limiting impact of forestry on aquatic habitats. Presuming forestry operators adhere to these regulations, the likelihood of a cumulative effect on surface water from timber harvesting and the Project is limited.

Prepared For:

Atlantic Gold

FIGURE 8.5-4

Beaver Dam Mine Project

Cumulative Effects Assessment: Surface Water Quality and Quantity & Fish and Fish Habitat

Great Northern Timber Pellet Facility

Upper Musquodoboit

Mosher Lake Limestone Co.

Fifteen Mile Stream Past Mining Operations

Beaver Dam Mine Site

Beaver Dam Past and Future Mining Operation

NSSA - AMP: Killag Doser

NSSA - AMP: WRSH Doser

NSSA - AMP: Terrestrial Liming

Taylor Lumber Co. Ltd. mill

Beaver Dam Haul Road

Regional Forestry Operations

Touquoy Mine Site

Haul Road

Murchyville Gypsum Mine

Touquoy Mining Operations

Great Northern Timber Wood Chipping and Shipping

Port of Sheet Harbour

Sheet Harbour Quarry

Tangier Gold Mine

- Projects Evaluated in the Cumulative Effects Assessment
- Project Area
- Aquatic Regional Assessment Area

Note: Forestry operations occur throughout the RAA and are not displayed on this figure

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 2.5 5 10 km

1:175,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: KR

Date: 2021-02-28

McCallum Environmental Ltd.

Document Name: BD_EIS_Figure8-4-X_CEA_SW_Fish

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NSSA Acid Mitigation Project

The NSSA AMP operates three main components. Two lime dosing stations are located on the West River Sheet Harbour and on the Killag River, downstream of Cameron Flowage. Neither of these components have direct spatial overlap with the Proposed Project, although the dosing station on the Killag River is approximately 650 m southeast of the proposed pit. Despite its close proximity to the proposed Project; the spatial extent of direct and indirect impacts to fish and fish habitat does not extend to this portion of the Killag River, as specified in Sections 6.9.7.2 through 6.9.7.6.

Terrestrial liming has occurred within the Paul Brook, Keef Brook and Tent Lake watersheds. According to Rotteveel (2018), terrestrial liming occurred in MacGregor Brook and Colwell Brook during the fall of 2016, with some expected 'blowout' from helicopter liming affecting Cope Brook as well. The upper portion of the Killag River (above the lime dosing station) and Brandon lake Brook were used as control sites for this study. On September 25, 2019, MEL and AMNS met with the NSSA and ASF to discuss the second round of information requests related to the Project. During that meeting, it was stated that the NSSA would be commencing terrestrial lime application in the Tent Lake watershed; but indicated that terrestrial liming would not occur in proximity to the proposed organics stockpile until 2020. Of the three watersheds where terrestrial liming is known, or expected to have occurred, the Project only has a spatial overlap with the Tent Lake watershed (1EM-2-F) and the Keef Brook watershed (1EM-2-G). According to Rotteveel (2018), acidification of Nova Scotia's freshwater ecosystems has resulted in decreased habitat quality for Southern Uplands Atlantic Salmon, due in part to the mobilization of aluminum which has been mobilized due to low pH.

The residual effect of the NSSA AMP on surface water quality, is a positive due to reduction of the effect of historic acidification on water quality within the treated catchment areas of the West River Sheet Harbour watershed. This Project is defined as having direct spatial and temporal overlap with the Beaver Dam Project specifically within the Tent Brook watershed (Project effects related to low magnitude flow reductions), and to a lesser extent, the Keef Brook watershed (Project effects related to Haul Road construction).

Touquoy Gold Project

The effects of the Touquoy Gold Project on surface water include (based on CRA 2007a and GHD 2017b):

- Reduced water quality from sedimentation/siltation, deposition of fines during construction, operation and decommissioning;
- Introduction of contaminants (e.g., nitrate) from blasting operations and pit dewatering;
- Effluent released into Scraggy Lake from the tailings and polishing ponds;
- Water withdrawal from Scraggy Lake; and
- Potential impact to surface water quality from spills of hazardous materials stored on site during mine construction and operation.

Given the implementation of mitigation measures to control erosion and sedimentation, significant adverse effects from operation of the Touquoy Gold Project are not anticipated on surface water resources. The Touquoy Gold Project currently holds an Industrial Approval for water withdrawal, permitting withdrawal of up to 720 m^3 per day, to a maximum of 262,800 m^3 annually from Scraggy Lake (Approval #2017-103502-01). Treated effluent is released form the polishing pond into Scraggy Lake, with monitoring completed under the EEMP to ensure compliance with MDMER.

The discharge of treated mine effluent is controlled by MDMER regulations. The effluent must meet the limits put in place to protect the aquatic environment and the effects monitoring program will ensure that operational discharges are compliant. Therefore, no significant adverse effects on surface water resources from tailings effluent on Scraggy Lake are expected. Water monitoring

completed under the EEMP for release of water to Scraggy Lake, and authorization for water withdrawal, it Is not expected that the Touquoy Gold Project results in a significant adverse effect to aquatic resources in Scraggy Lake.

Touquoy Gold Project and Beaver Dam Mine Project- deposition of tailings in Touquoy exhausted pit

The Proponent proposes the operation and closure of a tailings management facility in the exhausted Touquoy pit developed for the Touquoy Project. Tailings from the processing of ore or ore concentrates from four deposits at the Touquoy mill are proposed to be disposed of in the Touquoy pit. These include the processing of lower grades of ore stockpiled for the Touquoy Project, processing of ore transported from the Beaver Dam Mine Project (the Project), and processing of ore concentrates from the Fifteen Mile Stream Gold Project and Cochrane Hill Gold Project.

The total capacity of the expanded Touquoy pit at the proposed spillway elevation of 108.0 m is 11.83 million cubic metres (Mm^3). This is sufficient to store tailings using subaqueous deposition. Considering subaqueous deposition, the exhausted Touquoy pit can accommodate the estimated total deposited volume of 7.91 Mm^3 based on an average tailings density of 1.3 tonnes per cubic metre (t/m^3) from the four projects (Appendix F.10).

Modelling conducted for the Beaver Dam Mine Project simulates the filling of the Touquoy pit with tailings, which are assumed to have a hydraulic conductivity of 1×10^{-6} m/s (Appendix F.6). The volumes of tailings disposed of in the Touquoy pit are the only important difference between the groundwater models prepared for the Beaver Dam, Fifteen Mile Stream, and Cochrane Hill projects.

In addition to the deposition of tailings from the Beaver Dam, Fifteen Mile Stream, and Cochrane Hill projects, an expansion of the Touquoy open pit is proposed to extract additional high-grade ore. Groundwater modelling was conducted to assess the dewatering of the expanded open pit (Appendix F.6). This model forms the basis of the modelling for the cumulative effects, following the scenarios generally described in Appendix F.6.

The cumulative effects of the various projects on groundwater are simulated through the deposition of tailings in the expanded Touquoy open pit. The processed tailings were assumed to share the same source terms for the prediction of downstream groundwater quality effects. These source terms are based on the geochemical testing conducted on the Touquoy tailings (Appendix E.3).

Cumulative Conclusions (Water Quality) (provided in Appendix E.3):

- The water quality modelling considered the pore water quality in the tailings and the pit floor/ walls, the dilution from surface runoff, direct precipitation in the pit and the water quality of the mixture based on the geochemistry of the individual water quality parameters using source terms presented by Lorax (as described in Appendix E.3). The geochemical source term predictions of pore water quality of pit walls/floor had elevated metal (e.g., arsenic, cobalt, copper), ammonia, nitrate and cyanide concentrations thus reducing pit lake water quality at the time of discharge.
- The updated water quality modelling presented in Section 3 of Appendix E.3 shows that the pit lake is simulated to reach the spillway elevation in March of Year 9 of the operation of the expanded Touquoy pit for tailings disposal. The corresponding water quality model predicted elevated concentrations of arsenic, cobalt, copper, nitrate, nitrite as summarized in Table 4.1 not considering planned water treatment.
- Water quality that is predicted to exceed the MDMER discharge limits will be treated prior to discharge. The pit lake will be treated to meet MDMER discharge limits for an existing mine prior to discharge to Moose River. As the pit lake is simulated to take about 10 years to fill from commencement of tailings deposition in the exhausted Touquoy pit, the final water treatment design will be fully developed during operation and pit filling.
- As presented in the assimilative capacity study of Moose River by Stantec (Appendix F.8), the effluent concentrations under normal discharge from the filled exhausted Touquoy pit, combined with the groundwater seepage contributions in Moose

River under the same climate conditions are predicted. Moose River will primarily be driven by climatic conditions, with April flows representing a worst-case dilution ratio between the effluent discharge from the exhausted Touquoy pit and Moose River. Based on results of the assimilative capacity model (Appendix F.8), once mixed with the background water quality in Moose River, the concentration 100 m downstream of SW-2 is predicted to be 0.0238 mg/L for arsenic and 0.184 for aluminum. Although the simulated arsenic concentration is above the NSE Tier 1 and CCME guidelines of 0.005 mg/L, the background levels at SW-2 also exceed the guidelines at 0.018 mg/L. The aluminum concentration is predicted below the 75th percentile receiver quality in Moose River.

- An assessment of the potential environmental effects of elevated arsenic in the downstream environment in Moose River are presented in Appendix G.2 and the cumulative effects of operating the four projects are not likely to result in adverse arsenic concentrations for the existing aquatic environment.
- Groundwater seepage discharging to Moose River will be consistent between scenarios and therefore groundwater quality predictions are also consistent with the Beaver Dam project.

Cumulative Conclusions (Water Quantity) (provided in Appendix F.10):

- The potential effect of the addition of tailings from Touquoy, FMS, Beaver Dam and Cochrane Hill Projects to the Touquoy Pit has been outlined in Appendix F.10. Tailings will be deposited in the exhausted Touquoy pit for a total of 47 months reaching an elevation in the pit of 94.0 m CGVD2013. As presented in the Touquoy Gold Mine Project Reclamation Plan (Stantec 2017), the inflow of groundwater, surface runoff and precipitation into the pit will naturally create a lake upon closure of the site. The water balance model simulated that it would take an additional 48 months or a total of 95 months from commencement of tailings deposition in the exhausted Touquoy pit to fill the pit to the spillway invert elevation.
- The proposed Touquoy pit extension and subsequent tailings deposition from all four deposits has been evaluated (Appendix F.10). Based on results of the water balance model, process water can be reclaimed from the TMF for approximately three to seven months depending on the climatic conditions and with no water discharged to the effluent treatment plant during this time to maintain the reservoir supply. When the TMF pond volume is no longer adequate for process water supply, process water will be reclaimed from the Touquoy pit as a closed loop, with the exception of freshwater make-up from Scraggy Lake.
- Water supply in the Touquoy pit is adequate for operation of the Project under normal and wet climate conditions, considering the 5.8% freshwater make-up from Scraggy Lake. Should operation commence under dry climate conditions, there will be little water available in the TMF for reclaim and insufficient time to store water in the Touquoy pit prior to start-up. The water balance simulated a water deficit under dry climate conditions that would require takings exceeding the permitted water volume from Scraggy Lake for Touquoy operation. Therefore, under dry climate conditions or based on the operational requirements of pumping infrastructure, start-up water in the Touquoy pit may be supplied from Scraggy Lake (subject to provincial permitting) and/or effluent from the effluent treatment plant.
- As mill production rates are simulated to remain consistent throughout the processing of ores from all projects, the existing Touquoy reclaim water lines and tailings slurry lines are anticipated to be adequate both in capacity and length for continued ore processing. Additional lift booster pumps may be required to reclaim water from the Touquoy pit. Methods for tailings deposition in the Touquoy pit will differ during cold and mild climatic conditions and the tailings deposition progress should be monitored and updated as more information becomes available.

8.5.4.2.3 Cumulative Effects on the Surface Water Quality and Quantity

The use of the Touquoy processing plant and waste disposal systems by the Beaver Dam Mine Project (2023 to 2027), the Project (2023 to 2029), and the Cochrane Hill Gold Project (2025 to 2030) extends the period in which effects to the surrounding surface water (both Scraggy Lake and the Moose River) may occur by up to 8+ years. Water withdrawal from Scraggy Lake may be required to be extended for the life of the Beaver Dam Mine, Fifteen Mile Stream Gold and Cochrane Hill Gold projects. An extension to the existing approval will be requested by the Proponent. Incremental effects to surface water quantity at Scraggy Lake is not expected, due to the extended withdrawal period and small daily operational water withdrawal needs in comparison to the large size of the lake. Water will also be recycled from the exhausted Touquoy pit when sufficient supply is available. However, with the application of the mitigation measures proposed for the operation of the site for both projects, the residual effects of both projects are predicted to be not significant.

The cumulative effect of the combined projects could mean a reduction in the streamflow from Scraggy Lake to the Fish River system; however, assuming that the rate of withdrawal is consistent with current needs of the project, then it has been shown that the withdrawal from Scraggy Lake is sustainable given the current level of inputs to the watershed. The cumulative effects of the three projects using the Touquoy processing facilities and the Touquoy Gold Project itself are therefore also expected to be not significant. There is some uncertainty as to the effects assessments for these projects. These would be addressed through the monitoring and follow-up programs established for the Project (Section 6.7.10).

No surface water will be discharged from the exhausted Touquoy pit to Moose River until the pit reaches the spillway elevation in Year 10 of the Project. Water withdrawal from Scraggy Lake will require to be extended to process ore associated with the Project. As the pre-development and post-development catchment areas draining to the ultimate discharge location at Moose River are similar, Moose River is capable of handling the resultant flow. No cumulative effects to surface water quantity in the Moose River are predicted. Modelling for the cumulative scenario (all four projects tailings deposition into the exhausted pit) predict water levels in the pit will reach the spillway elevated in 10 years.

The use of the Touquoy processing plant and waste disposal systems by the proposed extension of the Touquoy pit and deposition of these tailings into the exhausted pit, the Beaver Dam Mine, Fifteen Mile Stream Gold, and the Cochrane Hill Gold projects have been modelled (Appendix F.10) and predict the same conclusions relating to surface water quality in the receiving environments (Moose River) as that described in Section 6.7 for the Project. The potential effects of these projects to surface water quality in the receiving environment will be mitigated by a commitment to treat effluent to MDMER discharge limits and water quality objectives prior to release and a commitment to acceptable water quality in the receiving environment that is protective of aquatic health.

8.5.4.3 Mitigation

The effects of each project with the potential to result in a cumulative effect to surface water all require a suite of mitigation to ensure compliance with MDMER, and water quality objectives. Through monitoring and aquatic effects assessment, there is no expectation that these projects will result in a cumulative adverse effect to fish and aquatic species. As the potential effects are limited to the area surrounding the Project's LAA, no mitigation measures beyond those already presented to mitigate Project effects (Section 6.7.11) are warranted.

8.5.4.4 Residual Cumulative Effects and Significance Assessment

The thresholds for the determination of significant effects to surface water quality and quantity are thoroughly defined in Section 6.7, but it includes an effect to water quantity or quality that is high magnitude, regional geographic extent and medium to long term duration, and be partially reversible or irreversible. Overall, the residual cumulative effects are considered to be not significant (Table 8.5-5).

Table 8.5-5: Residual Cumulative Environmental Effects for Surface Water

Residual Adverse Cumulative Effects (After Mitigation)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Potential for residual cumulative effects to all surface water systems within each RAA (Touquoy Mine Site and Beaver Dam Mine Site).	L With mitigation strategies, predicted receiver concentrations are predicted to be greater than guidelines and increase by greater than 10% over baseline levels, but remains well within the observed range of natural variation (25th to 75th percentile baseline water quality).	LAA Cumulative effects are confined to the LAA.	A Cumulative effect would be more significant during low flow conditions and/or sensitive spawning windows.	LT Effects may extend beyond 7 years.	R Effects will occur at regular intervals throughout operations.	PR Mitigation cannot guarantee a return to baseline conditions.	Minor Adverse Effect (Not Significant) Given implementation of proposed mitigation methods, no significant adverse cumulative effect is expected.

Notes: Specific characterization criteria listed below for surface water quantity and quality are defined in Table 6.7-19 and 6.7-20. Standard characterization criteria listed below are defined in Section 5.11, Table 5.11-1.

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	PR	Partially reversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular	IR	Irreversible
H	High					P	Permanent	C	Continuous		

8.5.4.5 Follow-up and Monitoring Programs

No additional follow-up or monitoring beyond that presented in Section 6.7.11 is warranted.

8.5.5 Fish and Fish Habitat Cumulative Effects Assessment

In response to NSE-IR-123, the Proponent has determined that an ecosystem-based approach to the spatial boundary determination is the most appropriate to identify cumulative effects to fish and fish habitat. The spatial boundary determination is based on the VC geographic range and the zone of influence (ZOI) for that VC. The ZOI sets a spatial limit beyond which the residual effects of the Project on a VC are not detectable. For all aquatic VCs, the secondary watershed boundary (West River Sheet Harbour, 1-EM-2) has been selected as the appropriate spatial boundary (ZOI, or regional assessment area) for the Beaver Dam Mine Site (plus the Tangier River and Fish River-Lake Charlotte secondary watersheds for the Haul Road and Touquoy Mine Site). Based on the pathways of effects to fish and fish habitat, the spatial boundary for the CEA followed the ecosystem-based approach. This approach is supported by the CEA methodology guidance document (CEAA 2016).

While the Southern Upland (SU) Atlantic Salmon range encompasses the entire southern coast of Nova Scotia, from Canso through to Cape Split in the Bay of Fundy, Gibson et al. (2009a,b) state that they have very "precise homing to natal streams [which] restricts gene flow among fish at different spawning locations". They continue to state that "this can lead to local adaptation and dissimilarities in life-history characteristics among fish inhabiting geographically distinct or environmentally distinct rivers". Given that salmon return to natal rivers, the probability of a Project in one watershed or natal stream affecting a population in another natal stream is very low. Fish from each natal stream would experience the same effects in the marine environment, but effects to salmon from inland projects do not have a pathway of effect from one watershed to the next.

The determination of the secondary watersheds as the appropriate scale for the CEA (rather than the entire SU Atlantic Salmon range) is supported by the CEA methodology in another manner. The CEA methodology states that "adopting a large spatial area may lead to misinterpreting the incremental cumulative effects of the project as being insignificant relative to everything else that is affecting the VC in that region, i.e., negligible. If the Regional Assessment Area (RAA) were to be expanded to incorporate the entire range of the SU Atlantic salmon, it would necessitate inclusion of all marine effects, which present substantial threats to the recovery of the Atlantic salmon, negating the incremental effects of land-based Projects.

The salmon's return to natal streams and the incremental cumulative effect of the project being insignificant relative to everything else when adopting a large spatial area (i.e., negligible effect) justifies the determination of the secondary watershed as the appropriate spatial boundary for the CEA of fish and fish habitat. Therefore, the CEA focuses on identifying cumulative effects of projects within the defined RAA.

8.5.5.1 Baseline conditions

8.5.5.1.1 Fish Habitat

Beaver Dam Mine Site

Watercourses, waterbodies and wetlands within the PA are known to support various life stages of 12 species of fish. Within the Beaver Dam Mine Site, the quality of the habitat is generally limited by low pH in small, first order streams. The majority of habitat proposed for direct alteration is limited to an anthropogenic, shallow open water wetland complex (3.7 ha of open water), created in the 1980's to support mining activities. Indirect effects to fish habitat are anticipated; primarily related to flow reduction. The Beaver Dam Mine Site is located adjacent to Cameron Flowage/Killag River, a tributary to the West River Sheet Harbour. Both the West River and the Killag River are known to support Southern Uplands Atlantic Salmon. Historic effects of acid rain have reduced

habitat quality for Atlantic Salmon; as a result, the Nova Scotia Salmon Association has implemented a three-pronged Acid Mitigation project, which includes two lime dosing stations and a terrestrial liming program. Preferred Atlantic Salmon habitat within and in proximity to the Beaver Dam Mine Site is confined to the main bodies of the Killag River/Cameron Flowage.

Development of the Beaver Dam Pit and associated mine infrastructure will result in direct loss of fish habitat within the proposed pit and associated site infrastructure. Smaller impacts are expected within watercourses intersected by the Haul Road, to facilitate upgrades to the existing road and associated culverts. A Fish Habitat Offset Plan and Habitat Bank: Preliminary Design (Offset Plan; Appendix: J.3) has been developed to compensate for loss of fish habitat. Site infrastructure has been micro-sited for fish habitat avoidance wherever practicable. A *Fisheries Act* Authorization will be required for the Project.

Touquoy Mine Site

Moose River, which runs along the western extent of the Touquoy Mine Site, was determined to provide habitat for Atlantic salmon and brook trout during surveys conducted in 2005 as part of the Environmental Assessment (CRA, 2007a). Atlantic salmon (juveniles) were observed and suitable rearing and potential spawning habitat is available for the species. It was presumed that the Atlantic salmon observed were landlocked due to their proximity to a known landlocked population within Scraggy Lake. American Eel, White Sucker, and various forage fish species were also observed in Moose River. Although not observed, surveys determined that there is good adult and juvenile Brook Trout feeding habitat, fair rearing habitat, and potential spawning habitat available within Moose River (CRA, 2007a).

8.5.5.1.2 Fish Species

Beaver Dam Mine Site

A desktop review was conducted for fish species within major watercourses and waterbodies within the SA. The West River Sheet Harbour, contiguous with the Killag River, is known to support Atlantic salmon, brook trout, American eel, brown bullhead, yellow perch, lake chub, creek chub, banded killifish, ninespine stickleback, golden shiner, and white sucker (Halfyard, 2007; NSFA, 2016). The Morgan River located near the south end of the Haul Road within the Tangier River secondary watershed, is known to support white sucker, brook trout, white perch, yellow perch, banded killifish, rainbow trout, American eel, golden shiner, sticklebacks, alewife, northern redbelly dace, and brown bullhead (Alexander, Kerekes, & Sabean, 1986).

A portion of the Haul Road lies within the Tangier River secondary watershed. Fish species known to occur within this watershed include white sucker, brook trout, white perch, yellow perch, banded killifish, rainbow trout, golden shiner, stickleback sp., alewife, northern redbelly dace, and brown bullhead (Alexander et al, 1986). Nova Scotia Fisheries & Aquaculture (2019) have also recorded common shiner and smallmouth bass in this watershed. Atlantic salmon are considered extirpated from the Tangier River (DFO, 2009).

Fish surveys were completed throughout the PA within the Beaver Dam Mine Site and Haul Road through 2015-2020. Methods employed include electrofishing, minnow traps, eel pots, fyke nets and eDNA (using a non-species-specific primer called eFish). During 2015-2017, 145 individuals representing 10 species were identified within the Beaver Dam Mine Site and Haul Road – 84 individuals across nine species were captured within the Beaver Da Mine Site, while 61 individuals representing seven species were identified in watercourse along the Haul Road. In 2019-2020, the level of fishing effort was increased within the Beaver Dam Mine site, and a total of 1732 individuals representing 11 species were identified. Species identified during all surveys include Atlantic Salmon, American Eel, Banded Killifish, Brook Trout, Brown Bullhead, Creek Chub, Golden Shiner, Lake Chub, Ninespine Stickleback, Northern redbelly Dace, White Sucker and Yellow Perch. Atlantic Salmon was identified only within the Killag River, downstream of the NSSA lime dosing station.

Touquoy Mine Site

Fish observed from 2006 electrofishing surveys of Moose River as part of the EARD include; American Eel, White Sucker, and various forage fish (CRA 2007a). Further aquatic baseline studies completed by Stantec Consulting Ltd. In 2017 and 2018 confirmed presence of alewife, American eel, Atlantic salmon, banded killifish, brown bullhead, brook trout, golden shiner, lake chub, lake trout, white perch, white sucker and yellow perch.

8.5.5.2 Analysis of Effects

8.5.5.2.1 Residual Effects of Proposed Project

The development of the proposed open pit within the Beaver Dam Mine Site will require direct impact to open water wetland habitat within wetlands 59 and 56, along with several small tributaries to support construction of associated mine infrastructure. Direct impacts to fish bearing habitats are expected along the Haul Road to allow for widening of the existing Haul Road and construction of an ATV Bypass Road. For the most part, this involves upgrades to an existing road and culverts (many of which are improperly installed based on current watercourse crossing standards), though one section of the Haul Road will require new construction. The Project is expected to result in indirect effects to fish habitat, primarily through reduction in flows from groundwater interaction and collection of surface water to allow for treatment prior to release. Indirect impacts to fish habitat are described in Section 6.9.7.2.2.

The impacted area includes open water wetland habitat within the proposed open pit. This habitat was anthropogenically formed by construction of a berm during the 1980s to support historic mine activity. Other habitats propose for direct impact within the Mine Site includes small, first order streams, which are typically limited in habitat quality by low pH and/or high summer temperatures. The pit development and associated fish habitat loss is considered an unavoidable impact of the Project development. The development of site infrastructure, primarily the pit is anticipated to result in a total direct impact area of 4.18 ha of fish habitat. Extensive work has been completed to revise the site infrastructure layout to avoid direct impacts to fish habitat. Direct impact to fish habitat is described in Section 6.9.7.2.1. Further to the efforts to avoid impacts to fish habitat, mitigation measures are described in Section 6.9.8.2. Mortality is anticipated to be low, given the implementation of appropriate mitigation measures, such as a fish rescue prior to the completion of construction. The fish rescue plan is outlined in Section 6.9.8.2.2. Finally, a draft Fish Habitat Offset Plan (Appendix J.3) has been developed to compensate for both direct and indirect impacts to fish habitat, as required under the *Fisheries Act* (summarized in Section 6.9.8.3 and detailed in Appendix J.3).

Indirect effects to fish habitat have been evaluated through a series of pathways, including water quality effects, groundwater interactions, blasting and surface water interactions. Through this evaluation, it was determined that effects to fish habitat are of low magnitude; and not anticipated to require authorization under the *Fisheries Act*, with the exception of reduction in surface flow in four watercourses. The detailed evaluation of indirect impacts to fish is outlined in Section 6.9.7.2.2 and Section 6.9.3.2.

Based on reduced flow comparisons to DFO framework for ecological flow, it was determined that reductions in four watercourses would have a moderate probability of detectable impacts to ecosystems that support fisheries. Flow reduction is anticipated due to drainage area and/or baseflow reductions in Crusher Lake Outflow (WC-5), South Tributary (WC-23), West Tributary (WC-26), and Mud Lake Outflow (WC-27). Although the actual area of reduced wetted channel due to the flow reductions is quantified at 322.41 m^2 we have quantified a much larger area as potentially altered. Through discussion with DFO the entire area below 30% MAD (approximately 7,728.88 m^2) is considered potentially altered due to uncertainty associated with extreme low flow and physicochemical habitat parameters. The amount of this habitat considered harmfully altered with be determined with DFO during the fisheries authorization process and is expected to be reduced or require less offsetting given that the habitats are expected to maintain the ability to support the existing fish communities.

Direct and potential indirect impacts to fish habitat are expected to require authorization under the *Fisheries Act*, and both are incorporated into the draft Fish Habitat Offset Plan (Appendix J.3).

The maximum expected spatial extent of direct and indirect effects to fish and fish habitat is shown on Figure 6.9-5. This includes direct impacts to fish habitat within the Beaver Dam Mine Site and Haul Road, and indirect impacts to watercourses 5, 23, 26 and 27 related to flow reduction. Water quality modelling shows compliance with all applicable guidelines at the North Settling Pond effluent release point within the 100 m mixing zone.

8.5.5.2.2 Effects of Other Projects in the Area

The RAA for fish and fish habitat, and projects which fall within this RAA are shown on Figure 8.5-5. There is direct spatial overlap between the Project and historic mining operations in the Beaver Dam Mine Site and the Touquoy Mine Site. Any potential cumulative effects from these projects related to surface water would be based on potential impacts to water quality from mobilization of historic tailings. The potential impact of this interaction will be mitigated by implementation of a draft Historical Tailings Management Plan (Appendix E.9). As such, these historic operations are not carried through the cumulative effects assessment process. Additional overlapping projects include regional timber harvesting, Haul Road usage, and the NSSA Acid Mitigation Project (specifically the terrestrial liming component of their project). Timber harvesting is not expected to result in adverse cumulative effects to fish and fish habitat, provided timber harvesters adhere to the Watercourse and Wildlife Habitat Protection Regulations.

Regional Forestry Operations

Forestry operations have been ongoing through the region for many decades. As such, the effects of these operations are included in the baseline conditions. Forestry operators are obliged to follow provincial *Wildlife Habitat and Watercourse Protection* regulations, which provide restrictions to timber harvesting with the purpose of protecting wildlife habitat and water quality. Presuming forestry operators adhere to these regulations, the potential for cumulative impacts occurring where the Project and forestry operations overlap is minimal.

Touquoy Gold Project and Beaver Dam Mine Project- deposition of tailings in Touquoy exhausted pit

The deposition of tailings from the Project, the proposed use of the exhausted pit for Touquoy tailings deposition, the FMS Project and the Cochrane Hill Gold Project at the Touquoy Mine Site has potential to affect water quality in the receiving environment (Moose River), and ultimately the fish and other aquatic organisms which inhabit it. The effect of tailings deposition on surface water quality in the receiving environment is described in Section 6.7, and the potential cumulative effect thereof is discussed in Section 8.5.4. Overall, the residual effect of tailings deposition in the Touquoy Pit, and the potential cumulative effect is expected to be minimal, considering that treatment to meet MDMER and water quality objectives will be implemented where necessary.

NSSA Acid Mitigation Project

The NSSA AMP operates three main components. Two lime dosing stations are located on the West River Sheet Harbour and on the Killag River, downstream of Cameron Flowage. Neither of these components have direct spatial overlap with the Proposed Project, although the dosing station on the Killag River is approximately 650 m southeast of the proposed pit. Despite its close proximity to the proposed Project; the spatial extent of direct and indirect impacts to fish and fish habitat does not extend to this portion of the Killag River, as specified in Section 6.9.7.1.

Terrestrial liming has occurred within the Paul Brook, Keef Brook and Tent Lake watersheds. According to Rotteveel (2018), terrestrial liming occurred in MacGregor Brook and Colwell Brook during the fall of 2016, with some expected 'blowout' from helicopter liming affecting Cope Brook as well. The upper portion of the Killag River (above the lime dosing station) and Brandon Lake Brook were used as control sites for this study. On September 25, 2019, MEL and AMNS met with the NSSA and ASF to discuss the second round of information requests related to the Project. During that meeting, it was stated that the NSSA would be commencing terrestrial lime application in the Tent Lake watershed; but indicated that terrestrial liming would not occur in proximity to the proposed organics stockpile until 2020. Of the three watersheds where terrestrial liming is known, or expected to have occurred, the Project only has a spatial overlap with the Tent Lake watershed (1EM-2-F) and the Keef Brook watershed (1EM-2-G). According to Rotteveel (2018), acidification of Nova Scotia's freshwater ecosystems has resulted in decreased habitat quality for Southern Uplands Atlantic Salmon, due in part to the mobilization of aluminum which has been mobilized due to low pH.

The residual effect of the NSSA AMP on fish and fish habitat, particularly Atlantic salmon, is a positive due to reduction of the effect of historic acidification on water quality within the treated catchment areas of the West River Sheet Harbour watershed. This Project is defined as having direct spatial and temporal overlap with the Beaver Dam Project specifically within the Tent Brook watershed (Project effects related to low magnitude flow reductions), and to a lesser extent, the Keef Brook watershed (Project effects related to Haul Road construction).

8.5.5.2.3 Cumulative Effects on the Fish and Fish Habitat

Residual effects on fish and fish habitat within the Beaver Dam Study Area are primarily related to loss of fish habitat from the development of the pit and other infrastructure. The key mitigation measures associated with this loss of fish habitat involve the fish rescue and offsetting for loss of fish habitat.

Spatial and temporal overlap of other projects within the RAA for fish and fish habitat is limited to the NSSA AMP; specifically terrestrial liming within Tent Brook and Keef Brook Watersheds. Given the proximity of the Project to the Killag Dosing station, a summary of water quality effects is provided herein. The downstream extent of impact to Cameron Flowage/Killag River is defined as the 100 m mixing zone of the effluent release location from the North Settling Pond, upstream of the Killag River Dosing Station (no spatial or temporal overlap of effects). The results of the predictive water quality assessment demonstrate the need for treatment of the mine effluent water prior to discharge to the Killag River. Nitrite (EOM) and cobalt and zinc (PC) have the potential to exceed CCME, background or site-specific guidelines within the Killag River at the near-field mixing zone locations and far-field mixing zone location. Treatment will occur, as required, prior to discharge into the receiving environment to ensure discharge meets MDMER regulations and concentrations in the Killag River do not exceed CCME or site-specific guidelines.

The Killag lime dosing station was installed to mitigate the effects of historic acidification within the Killag River, and to improve the quality of fish habitat within the Killag River, particularly for Atlantic salmon. As part of the predictive water quality modelling, the effect of the Project on pH in the receiving environment was evaluated. pH cannot be predicted with certainty by mass-balance models as used in the predictive water quality evaluation. That is, while modelling for the Project is conservative, mass balances modelling processes/predictions do not represent complete reaction paths and thus for non-conservative parameters (such as pH) water quality predictions are expected to be further governed by in situ processes. Note, discharges from the project will be subject to the MDMER such that effluent concentrations must be within pH range of 6.0 to 9.5, which is protective of aquatic life. Therefore, there are no effects to Surface Water Quality as a result of Project effluent discharges; and no expected negative cumulative impact of the Project on pH in the Killag River.

The Project is expected to have a direct spatial overlap within the Keef Brook Watershed, and the Tent Brook watershed. The spatial scale of terrestrial liming within each of these watersheds is unknown; therefore, it was assumed that the entire catchment

areas are treated with lime in an effort to be conservatively inclusive. Impacts of the Project to fish habitat within the Keef Brook watershed are limited to upgrading the existing Haul Road and associated watercourse crossings. Upgrading the Haul Road is expected to result in direct impacts to fish habitat (420.2 m^2, in WC J and WL76) to allow for culvert installation, which has been incorporated in the draft Fish Habitat Offset Plan (Appendix J.3). Of the watercourse crossings located within the Keef Brook watershed, five are currently acting as barriers to fish passage, so upgrading Haul Road infrastructure is expected to result in improvements to fish passage in watercourses E, F, G, J and K. Provided mitigation measures for watercourse crossings are adhered to (as will be required under provincial watercourse permits), no indirect effects are expected to fish habitat within this tertiary watershed. Furthermore, it is unknown whether terrestrial liming within this system is ongoing, based on results published by Rotteveel (2018) and communication from DFO (2019). Terrestrial liming was selected as a treatment within several catchment areas in this watershed due to the long-lasting effects of helicopter-based liming; which essentially acts as a 'slow-release' of lime through the soil into the watercourses. While the benefits of liming may continue to occur through the temporal scale of the Project; activities within this watershed are not expected to have any type of cumulative interaction with terrestrial liming which has already occurred.

Within the Tent Brook tertiary watershed, Project interactions include construction of an organics stockpile, ATV bypass road, crusher pad, and topsoil stockpile. The ATV bypass road will remain in place through post-construction, while the crusher pad, topsoil stockpile and organics stockpile will be reclaimed in the active reclamation stage of the Post Closure phase of the Project. Upgrading Haul Road infrastructure is expected to result in direct impacts to 535 m^2 of fish habitat in Wetlands 64 and 66, and will result in fish passage improvements in watercourses A and B. Direct impacts to fish habitat have been incorporated into the Offsetting Plan (Appendix J.3). Provided mitigation measures for watercourse crossings are adhered to, no indirect impacts in watercourses within the Tent Brook watershed are expected based on upgrades to the Haul Road.

To identify potential indirect effects to fish and fish habitat within Tent Brook watershed, an updated Water Balance Assessment is provided. Based on the results of the water balance, collection of contact water is expected to result in a 1.1% reduction in flow at EOM, and a 1.2% reduction at PC. As a result, a low magnitude of effect is expected to fish habitat within the Tent Brook watershed, as this change has been determined to fall within natural variation. Furthermore, water quality effects are not expected within the Tent Brook watershed; as all site contact water will be collected in the South Settling Pond prior to release. The primary purpose of the south settling pond is to reduce the TSS levels to acceptable limits, and control stormwater runoff. Effects to the downstream environment are not expected.

Data related to the NSSA terrestrial liming program inputs, objectives, and results were not available with sufficient detail to allow interpretation of interacting effects between terrestrial liming and direct and indirect effects within the Tent Brook or Keef Brook watersheds. AMNS requested further detail from the NSSA; however, NSSA did not provide a response (Appendix A.4b). Therefore, the evaluation of cumulative effects within the Tent Brook and Keef Brook watersheds are qualitative in nature. Direct impacts to fish habitat within each of these watersheds is limited to construction of the Haul Road and associated watercourse crossings. These impacts range from negligible to high, based on the area of impact within each individual crossing. Given implementation of mitigation measures including Offsetting, these effects are determined to be not significant, especially considering the improvements to fish passage which will be provided. The indirect effects of the Project on fish habitat within the Tent Brook watersheds are limited to low magnitude effects to flow reduction in the Tent Brook watershed, and no indirect effects are expected within the Keef Brook watershed. The Project related effects to fish habitat within these two watersheds are adverse and not significant; given that the residual effects of the terrestrial liming are positive (magnitude and significance are unknown); it is likely that any cumulative effect to fish habitat would be classified as a compensatory interaction, with a non-significant residual cumulative effect.

The deposition of tailings from the proposed Fifteen Mile Stream Project and the existing Touquoy Gold Project in the Touquoy Pit overlap the current Project both spatially and temporally. As discussed, with appropriate mitigation to ensure compliance with MDMER criteria and water quality objectives, the potential for residual cumulative effect on fish and fish habitat is expected to be minimal.

There is some uncertainty as to the Project effects on fish and fish habitat. This uncertainty is addressed through the monitoring and follow-up programs established for the Project (Section 6.9.10). No significant cumulative effects on fish habitat beyond the effects assessed for the Project are anticipated.

8.5.5.3 Mitigation

No mitigation measures beyond those proposed in Section 6.9.8 are warranted.

8.5.5.4 Residual Cumulative Effects and Significance Assessment

A significant adverse effect from the Project on fish and fish habitat is defined as an effect that results in an unmitigated or uncompensated net loss of fish habitat as defined under the *Fisheries Act*, and its associated no-net loss policy. The screening of project effects, mitigation measures, and the subsequent fish and fish habitat results are assessed in aggregate to determine whether the residual impacts are "Not Significant" or "Significant" according to the following definitions:

Significant Residual Effect: residual effects have high magnitude, be of potential regional geographic extent and of medium to long term duration, occur at any frequency and only be partially reversible to irreversible.

Not Significant Residual Effect: is defined as: negligible to moderate magnitude, are restricted to the PA or near-field receiving environment, are of sporadic or short-term duration, occur at any frequency or are reversible to partially reversible.

A residual cumulative effect would be determined using the same determination provided in Section 6.9; however, the evaluation of a significant residual cumulative effect would be based on the RAA spatial boundary, considering the interacting and overlapping project interactions within the RAA.

Within the RAA for fish and fish habitat, the Project effects overlap spatially and temporally with other Projects only within the Tent Brook and Keef Brook Watersheds. Within these watersheds, direct impacts are proposed to allow for construction of the Haul Road, and indirect effects are predicted for a minor level of flow reduction to the Tent Brook watershed (<2%). The predicted residual cumulative effects on fish and fish habitat are assessed to be adverse, but not significant (Table 8.5-6).

8.5.5.5 Follow-up and Monitoring Programs

No additional follow-up or monitoring beyond that presented in Section 6.9.10 is warranted.

Table 8.5-6: Residual Cumulative Environmental Effects for Fish and Fish Habitat

Residual Adverse Cumulative Effects (After Mitigation)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Cumulative disturbance to fish and fish habitat within the RAA.	L Differing from the existing environment/ baseline conditions, within natural variation	LAA Potential adverse cumulative effect to fish habitat outside of the PA.	A Cumulative effect would be more significant during sensitive spawning windows.	P Effect is expected to be permanent.	C Effects will occur on a continuous basis throughout operations and closure.	IR Effects of flow reduction and direct impacts from Haul road crossings are expected to be irreversible.	Low Adverse Effect (Not Significant) Fish habitat offsetting is anticipated to compensate for lost fish habitat from the Project itself. No other pathway for residual effects from surrounding projects has been identified.

Notes: Specific characterization criteria listed below for fish and fish habitat are defined in Table 6.9-8. Standard characterization criteria listed below are defined in Section 5.11, Table 5.11-1.

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	PR	Partially reversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular	IR	Irreversible
H	High					P	Permanent	C	Continuous		

8.5.6 Species of Conservation Interest and Species at Risk Cumulative Effects Assessment

8.5.6.1 Baseline conditions

8.5.6.1.1 Priority Fish Species

A desktop evaluation for priority fish species revealed that four priority species have been identified within 5 km of the SA. These include Atlantic salmon (*Salmo salar*), American eel (*Anguilla rostrata*), alewife *(Alosa pseudoharengus*) and brook trout (S*alvelinus fontinalis*) (ACCDC 2021). Priority fish species identified as having an elevated potential to be located within the PA, based on habitat preferences, and broad geographic range, include American eel, Atlantic salmon, brook trout, brook stickleback (*Culaea inconstans*), and landlocked rainbow smelt *(Osmerus mordax*).

Within and in proximity to the Beaver Dam Mine Site and Haul Road, three priority species (Atlantic Salmon, American Eel and Brook Trout) were identified during electrofishing and fish collection. Atlantic Salmon were only identified within the Killag River in the 2020 fish sampling program, downstream of the NSSA lime doser, which is considered to provide suitable spawning and rearing habitat for Atlantic Salmon.

From 2015-2017, adult American Eel were confirmed in watercourses along the Haul Road including WC-N, WC-V, and WC-AH. Juvenile Eel were also observed in WC-N and WC-AH. During the 2019-2020 field program, adult American Eel were confirmed in Mud Lake/WC27, Cameron Flowage, WC13, and the Killag River. Juvenile Eel were also observed in WC13. Based on the wide distribution of American Eel within the province, their generalist habitat preference, and capacity to migrate over barriers, all hydrologically connected watercourses within the PA are believed to be potentially accessible to the American Eel, even if habitat provision in those watercourses is determined to be low.

From 2015-2017, juvenile Brook Trout were captured in WC5 (north of Crusher Lake), WC12, and WC13 within the Beaver Dam Mine Site. Along the Haul Road, juvenile Brook Trout were confirmed in WC-N and WC-V. One individual adult Brook Trout was captured in WC-AH. During the 2019-2020 field program, adult Brook Trout were captured within Crusher Lake, WC5 Reach B, Mud Lake/WC27, Cameron Flowage, WC13, and WC23. Juvenile Brook Trout (young of the year and parr) were also documented in WC13, WL59, Crusher Lake, WC5, and the Killag River. Potential brook trout spawning habitat was identified within four watercourses within the Beaver Dam Mine Site (Watercourses 5, 12, 13, and 14), and 11 watercourses along the Haul Road (Watercourses E, K, L, N, S, T, V, Z, AE, AF, and AH). Suitable rearing areas were also identified within these watercourses, along with WC23 in the Beaver Dam Mine Site, and Watercourses I, H, P, Q, and AG within the Haul Road.

According to the Nova Scotia Salmon Association (pers. comm. 2016), rainbow smelt and brook stickleback are not known to be present within the West River Sheet Harbour or Tangier River systems. Therefore, the likelihood of these species being present within the PA is very low. Alewife has been historically documented within the Tangier River secondary watershed, and may use watercourses within the Haul Road as migration corridors to upstream spawning areas. The likelihood of alewife being present within the Beaver Dam Mine Site and Haul Road watercourses within the West River Sheet Harbour watershed is considered low.

Moose River, within the Touquoy Mine Site, provides habitat for Atlantic Salmon and Brook Trout. Good juvenile and rearing habitat and potential spawning habitat is available for Atlantic Salmon. Several juvenile Atlantic Salmon were observed, however, these species were believed to be from the landlocked population known to Scraggy Lake. Good adult and juvenile Brook Trout feeding habitat, fair rearing habitat, and potential spawning habitat is available within Moose River (CRA 2007a).

The Nova Scotia Department of Agriculture and Fisheries conducted a fisheries resource study in Scraggy Lake in July of 1975. Fish captured included; brook trout and American eel. Atlantic Salmon smolts were recorded during creel census in 1979. Fingerling landlocked Atlantic Salmon and Brook Trout were stocked in Scraggy Lake between 1998-2000 and 1994-1996, respectively (CRA 2007a). Additional fish community and fish habitat assessments were completed under the EEM to support MDMER regulations under the *Fisheries Act*. These baseline aquatic environment surveys were completed by Stantec Consulting Ltd. in 2017 and 2018. According to the 2017 report, fish surveys completed in Scraggy Lake identified a total of 1,091 individual fish, representing 12 species of fish. Priority species observed include American Eel, Atlantic salmon, Brook Trout, and Lake Trout.

8.5.6.1.2 Priority Vascular Flora and Lichens

Priority Vascular Flora Species

A comprehensive list of species identified is provided in Appendix K.1 and discussed in Section 6.10.4.3. No SAR vascular plant species were observed. A total of six plants are priority species (SOCI), based on provincial status ranks (S3 and S3S4), including weigand's sedge, lesser rattlesnake plantain, southern twayblade, Appalachian polypody, highbush blueberry and Nova Scotia agalinis. Micro-siting of infrastructure has been completed to avoid priority flora species, wherever practicable, and has reduced the direct impact of the Project on flora and lichens. One occurrence of a southern twayblade, within Wetland 161, is expected to be impacted by the proposed Haul Road alignment. No priority vascular flora are anticipated to be directly impacted within the Beaver Dam Mine Site.

Southern twayblade (*Listera australis*, syn. *Neottia bifolia*) is a small inconspicuous member of the orchid family (Orchidaceae), which has been found in eight locations (wetlands 80, 115, 129, 137, 135, 147, and 161, and in upland habitat north of Wetland 136) within the PA. This species belongs to the Atlantic Coastal Plain Flora community and its primary habitat is shaded sphagnum mosses in bogs or coniferous treed swamps. Within the PA, it was typically found in clusters of 5-10 individual plants at the base of small sphagnum hummocks in treed swamps. Its distribution is scattered throughout Nova Scotia, and it is considered vulnerable by the ACCDC (S3).

Surveys of the Touquoy site did not detect any plant species of special status within surveyed area (CRA 2007a). During follow up evaluation for wetland alteration permitting in 2015, a single black ash (NSESA Threatened) was identified in Wetland 2, within the (at the time) proposed TMF. Through consultation with NSE and the Mi'kmaq of Nova Scotia, this tree was harvested prior to construction of the TMF. No other Priority species of vascular flora were identified in the Touquoy Study Area.

Priority Lichen Species

Eleven priority lichen species were observed within the broader Lichen Study Area (LSA) as described in Section 6.10.4.4. Of the eleven species, three SAR and eight SOCI species were observed, as provided in Table 6.13-7. Of the three SAR identified, two are located within the PA. Blue felt lichen was observed in the Beaver Dam Mine Site and Haul Road and in the broader Lichen Study Area, while frosted glass whiskers was identified within the Beaver Dam Mine Site. Boreal felt lichen was identified in the LSA originally by the Project Team, but not within the PA. However, upon return in 2016 and 2017, the three observed locations of the boreal felt lichen were no longer present.

While micro-sitting infrastructure has avoided occurrences of priority lichen wherever practicable, the Project is expected to result in direct impacts to two blue felt lichen (*Pectenia plumbea*) occurrences and 10 SOCI lichen occurrences: six salted shell lichen *(Coccocarpia palmicola*), three slender monk's hood lichen (*Hypogymnia vittata*) and one eastern candlewax lichen (*Ahtiana aurescens*) within the Beaver Dam Mine Site. No priority lichens are anticipated to be directly impacted along the Haul Road.

Locations of all priority lichen species documented within the LSA and the proposed Haul Road are provided in Figure 6.13-2A to 6.13-2E.

Lichen surveys conducted in the Touquoy Mine Site in 2004 and 2005 as part of the EARD process found the presence of blue felt lichen (*Pectenia plumbea* syn. *Degelia plumbea*). An additional lichen survey in 2007 found seven additional SOCI including; salted shell lichen (*Coccocarpia palmicola*), corrugated shingles lichen (*Fuscopannaria ahlneri*), powdered fringe lichen (*Heterodermia speciosa*), blistered jellyskin lichen (*Leptogium corticola*), blue-gray moss shingle lichen (*Moelleropsis nebulosa*), naked kidney lichen (*Nephroma bellum*), and peppered moon lichen (*Sticta fuliginosa*) (CRA 2007a). These lichens were observed in the northern, southern and south eastern portions of the Project Area. Both locations of blue felt lichen have not been directly impacted by infrastructure from the Touquoy Project, however, direct impacts to corrugated shingles lichen and blue-gray moss shingle lichen have occurred.

8.5.6.1.3 Priority Terrestrial Fauna

Priority Mammal Species

Through all targeted surveys and incidental observations, evidence of a single mammalian priority species was observed. Within the PA, mainland moose tracks were observed within the Beaver Dam Mine Site in disturbed, roadside habitat north of Wetland 56 on May 24, 2015 during a targeted pellet group inventory (PGI) survey. Moose tracks were observed incidentally in two locations on September 9, 2014. One set of tracks was observed in Wetland 210 and a second set of tracks was observed adjacent to Wetland 206, just beyond the Beaver Dam Mine Site. No signs of mainland moose were observed during any survey within Haul Road. Mainland moose are not particularly affected by habitat fragmentation based on habitat preference; however, increased access into a site (construction of new roads) may increase poaching levels. As such, low-level habitat fragmentation can indirectly affect mainland moose.

Eighteen AMOs within the Beaver Dam Mine Site were evaluated for their potential to provide bat hibernacula on September 18, 2014. Of the eighteen AMOs evaluated at the site, all were either in-filled, contained a concrete cap blocking access, or were flooded, with the exception of one (BED-1-003), which was identified during the desktop evaluation as a potential bat hibernaculum. The BED-1-003 AMO was determined to be inaccessible to bats, as described further in Section 6.13.3.2.5. No bat hibernacula were identified within the Haul Road. According to the ACCDC reports, no known bat hibernaculum are present within 5 km of the Haul Road or Beaver Dam Mine Site. No bats, or evidence thereof, were observed incidentally during biophysical surveys, particularly bird surveys which are conducted when bats are more active.

Mainland moose tracks were observed within the Touquoy Mine Site in a bog during field surveys to support the Touquoy Gold Project EARD in 2006. Moose are known to the Tangier Grand Lake Wilderness Area (CRA, 2007a). In addition to the information above, a Post-Construction Moose Monitoring Program for Mainland Moose has been underway in lands surrounding the Touquoy Mine Site during each winter and spring since 2017. Surveys are ongoing throughout 2021 and include a combination of winter tracking surveys and spring pellet group inventory surveys. Surveys are completed on foot along transects surrounding the Touquoy Mine Site throughout a diversity of habitat types. During surveys, moose observations are recorded including a description of moose sign observed, a GPS location and a microhabitat assessment. To date, three observations of Mainland Moose Sign (scat and tracks) were documented during 2017, and two sightings of moose were encountered during 2018 surveys. No signs of the animal were observed during surveys in 2019, however, an incidental observation of a moose on a road near the mine was reported by an Atlantic Gold staff member. No moose were observed in 2020; 2021 surveys are ongoing. Annual reports have been provided to NSL&F as per the Touquoy Gold Project Environmental Assessment Approval conditions.

No suitable bat hibernacula were found within the Touquoy Mine Site during environmental screening to support the Touquoy Gold Project EA (CRA, 2007a).

Priority Herpetofauna Species

One female snapping turtle (SARA/COSEWIC, Special Concern; NSESA, Vulnerable; S3) and nest was observed by DFO within the Beaver Dam Mine Site on June 27, 2019. The observation was on a rocky, man-made berm east of Wetland 59 (historic settling pond; Figure 6.13-1. Previously, there were only incidental observations, outside field surveys, of this species; one on June 26, 2016 where the Mooseland Road section of the Haul Road crosses Fish River, during bird surveys (near PC45), and two adjacent to the Touquoy Mine Site in the scope of the EIS (Figure 6.13-1).

Potential suitable habitat for snapping turtles has been observed in Wetlands 8, 10, 14, 17, 29, 44, 56, 59, 61, 64, 66, 68, 69, 159, 168, 171, and 207 within the Beaver Dam Mine Site and the Haul Road. These wetlands are identified as potentially providing hibernacula for snapping turtles where open water is present (i.e., standing water to a depth exceeding 0.5 m).

Targeted turtle surveys within the Beaver Dam Mine Site did not reveal any sightings of wood turtles, painted turtle or suitable nesting habitat. No opportunistic observations of wood turtles, painted turtle or suitable nesting habitat were documented during any wetland or watercourse surveys throughout the PA.

No wood turtle or suitable habitat were observed within the Touquoy Mine Site during Wood Turtle habitat surveys conducted in 2004 (CRA 2007a). No snapping turtles were recorded within the Touquoy Mine Site during the EARD process. A WMMP was implemented upon commencement of operations of the Touquoy Mine Site. Under this Plan, wildlife sightings, particularly turtles, were reported to the site Environmental Technicians. Between 19 June 2017 and 2 July 2020, sixteen observations of snapping turtles were recorded by Atlantic Gold staff and contractors at various locations throughout the Touquoy Project Area, typically in close proximity to the Moose River (AMNS, Pers. Comm., 2021).

Priority Invertebrates

A review of data provided by the Maritime Butterfly Atlas confirmed that one monarch butterfly was observed in squares 20NQ17, 20NQ18, 20NQ19, 20NQ28, and 20NQ29. This 10 km x 10 km survey grid covers Mud Lake and Crusher Lake, extending north to Beaver Lake, and east to Smith Lake and Rocky Lake. As the monarch has been recorded in this survey square, it is possible that it uses the Beaver Dam Mine Site, at least periodically, such as during migration. Monarch butterflies rely on milkweed as a host plant for their larvae; as such, it is a key indicator for presence of the monarch. Surveys for vascular plants were conducted throughout the PA, and staff were instructed to identify any suitable habitat for monarchs based on presence of milkweed. No milkweed was documented during surveys for vascular flora, or opportunistically during any other surveys.

No other targeted surveys were completed for invertebrates; however, no opportunistic observations of priority invertebrate species were recorded. No other priority invertebrate species were identified during the desktop review.

Aquatic benthic invertebrates were surveyed during the aquatic surveys. No priority invertebrate (terrestrial and aquatic) species were observed within the Touquoy Mine Site during environmental screening to support the Touquoy Environmental Assessment (CRA, 2007).

8.5.6.1.4 Priority Avifauna

Across all survey seasons completed within the PA, a total of 32 priority species were observed either during dedicated survey periods or incidentally, including 23 SOCI and nine SAR. All avifauna SAR observed were as expected based on habitat and geographic range. The presence of wetlands, forested uplands, watercourses, clearings and fragmented habitats (resulting in edge habitats) provided suitable habitat for many of the priority bird species in Nova Scotia.

During all breeding bird surveys, evidence of breeding behavior was recorded for all species, with particular attention towards SAR and SOCI. Breeding evidence was recorded in accordance with guidance provided by Bird Studies Canada (2016), which defines behavior in terms of possible, probable, and confirmed breeders. Any species observed during breeding season singing in suitable habitat is identified as a possible breeder. Signs of probable breeding observed are agitation and established territories. Evidence of confirmed breeders observed includes distraction displays, feeding young or carrying food, nests with young, or recently fledged young. Canada warbler is identified as a probable breeder, while olive-sided flycatcher and common nighthawk are identified as possible breeders. Breeding evidence for other SAR was not observed. Nine SOCI are identified as possible breeders, while five show evidence of probable breeding. One SOCI species (Swainson's thrush) was recorded as a confirmed breeder.

The 2005 breeding bird surveys of the Touquoy Mine Site found ten priority species. They are as follows; pine grosbeak, willow flycatcher, yellow-bellied flycatcher, barn swallow, boreal chickadee, ruby-crowned kinglet, rusty blackbird, bay-breasted warbler, Swainson's thrush, and pine siskin.

8.5.6.2 Analysis of Effects

8.5.6.2.1 Residual Effects of Proposed Project

Priority Fish Species

The geographic extent, timing, duration, frequency, reversibility, and magnitude of direct and indirect impacts to priority fish species remains the same as is with non-priority specific fish and fish habitat, however, the level of scrutiny and analysis undertaken to determine the magnitude of each effect was substantially higher for priority species, particularly Atlantic salmon. Direct impacts are proposed in several habitats known to support brook trout and American eel. The residual effects to these species is reflected in Section 6.9.9.

The Project is expected to result in direct impact to fish habitat within the Beaver Dam Mine Site and Haul Road to facilitate infrastructure development. Specific habitats proposed for direct impact have been identified as providing suitable habitat for American eel and brook trout; however, no direct impacts are proposed in habitats known or expected to support Atlantic salmon. Indirect effects to fish and fish habitat are predicted occur in watercourses 5, 23, 26 and 27 due to flow reduction, incorporating both daily and monthly flow estimates. Extensive work has been completed to predict indirect effects to fish and fish habitat in Cameron Flowage/Killag River due to the presence of Atlantic salmon downstream within the Killag River. This modelling is presented in Section 6.9.7.1. Through this evaluation, it was determined that no harmful alteration disruption or destruction to fish or fish habitat is expected within Cameron Flowage/Killag River.

Along the Haul Road, it is expected that direct impact to fish habitat can be minimized through proper planning, micro-sighting of the upgraded road footprint, and installation of culverts in accordance with the Nova Scotia Watercourse Alteration Standard (2015). All direct impacts to fish habitat proposed for construction of the Beaver Dam Mine Site and Haul Road are quantified and accounted for in the draft Fish Offset Plan (Appendix J.3).

The mitigation sequence was used to avoid, mitigate, and offset impacts to fish and fish habitat, with an emphasis on mitigating impacts to priority fish species. Project infrastructure was redesigned to avoid direct impacts to fish habitat relative to the 2019 EIS, however direct impacts to fish habitat within the proposed pit was determined an unavoidable impact of the Project. Indirect impacts to fish habitat were reduced through re-evaluating the site water balance Mitigation measures include collection and treatment of surface water, and development of a plan to supplement baseflow in Cameron Flowage if required. The details of this plan are outlined in the Mine Water Management Plan (Appendix P.4), and described in Section 6.9.7.

Project activities are not expected to result in significant adverse effect to fish and fish habitat in general, or specifically to priority fish species, with appropriate mitigation measures in place (including obtaining a *Fisheries Act* authorization and implementing the Offset Plan).

The Touquoy Mine Site is currently operational. Potential impacts to surface water quality and quantity as a result of the storage of Beaver Dam tailings in the exhausted Touquoy open pit mine were examined in Section 6.7.8. There are no direct or indirect effects to priority fish or fish habitat anticipated to be caused by the processing of ore and the management of tailings (exhausted pit) from the Beaver Dam Mine Project.

Priority Vascular Flora and Lichens

Clearing and grubbing will occur during the construction phase of the Project and is limited to the Beaver Dam Mine Site and Haul Road where infrastructure is proposed. No additional clearing and grubbing are required at Touquoy Mine Site to support the Project. Clearing and grubbing requires full vegetative removal which will directly affect vascular and non-vascular individuals, and to flora communities at the full or partial forest stand level. One priority vascular species, an occurrence of southern twayblade, is expected to be directly impacted by the proposed Haul Road alignment. No priority vascular flora are anticipated to be directly impacted within the Beaver Dam Mine Site. No SAR vascular flora were observed within the PA.

Translocation of SAR lichen species is proposed for occurrences directly and indirectly impacted by the Project, as described below. Blue felt lichen populations expected to be directly and indirectly (within 60 m of Project infrastructure) impacted by the Project are proposed to be translocated, as described in the Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.6). Furthermore, this plan includes a monitoring component to monitor all SAR lichen transplants and occurrences proposed to be indirectly impacted by the Project. Monitoring is proposed to occur for the duration of operations and to be continued post-closure (timeline to be determined).

Heavy machinery operation and vehicle activity will occur within the Beaver Dam Mine Site and Haul Road during the construction phase and throughout the PA during the operation and closure phases. Both heavy machinery operation and vehicle activity can cause impacts to vascular and non-vascular flora from edge effects, dust, erosion, invasive species transportation and accidents (e.g., spills). Due to their non-vascular physiology, lichens are especially sensitive to changing environmental conditions, particularly air quality and edge effects (Boudreault et al. 2008; COSEWIC 2002). The impact of edge effects (depth of influence) on lichen has been well studied (Moen and Jonsson, 2002). The dept of influence on lichen species can range from 60 to 240 m (Esseen and Renhorn, 1997; Gauslaa et al., 2018; Haughian and Harpre, 2020) and is highly species and context dependant.

Studies, such as Neitlich et al. (2017); Naeth and Wilkinson (2008); Loppi and Frati (2005) and Farmer (1993), present the primary drivers of atmospheric contamination to lichen from mine operations: sulfur dioxide and nitrous oxide emissions, metal mobilization and dust generation. The Project is predicted to result in localized particulate and metal mobilization through dust generation during construction and operations (i.e., mining and hauling ore; Appendix C.1). Deposition of dust on flora can temporarily reduce evapotranspiration, photosynthesis and can bioaccumulate within tissue, which may reduce overall growth rates, especially for non-vascular flora such as lichen (Degtjarenko, 2016; Naeth and Wilkinson 2008; Farmer, 1993). The Haul Road is expected to

the be largest source of particulate emissions within the PA. While dust deposition-related impacts to lichens were assessed for Project only truck traffic, the modelled deposition rates have been reviewed under the cumulative truck traffic scenario and did not result in changes to predicted effects.

Potential indirect impacts to vascular plants and lichens surrounding Project infrastructure will be reduced through best management strategies and mitigation measures. No SAR vascular flora will be directly impacted by the Project. Mitigations for the two blue felt lichen occurrences that are expected to be directly impacted and for additional Lichen SAR where indirect impacts are anticipated is proposed in the Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.6) and Section 6.10.8. As a result, no lichen SAR will be directly impacted by the Project. Through the implementation of mitigations, the magnitude for residual environmental effects to flora is assessed as moderate, primarily as a result of direct loss of habitat area.

Priority Terrestrial Fauna

Clearing and grubbing is limited to the Beaver Dam Mine Site and Haul Road during the construction phase. Clearing and grubbing are not required at the Touquoy Mine Site. Clearing and grubbing will result in habitat loss for priority fauna. Best management practices will be used to limit unnecessary loss of habitat, and infrastructure layout has been planned to limit unnecessary clearing and grubbing. Grubbed material will be stockpiled and used for remedial efforts during the closure phase of the Project. Clearing and grubbing is expected to have a low magnitude of impact on priority fauna. This is based on the lack of direct impact to fauna SAR and the recognition that the loss of habitat within the PA is expected to be temporary in nature (considering reclamation of habitat following operations). Clearing and grubbing can reduce cover for priority turtle species (e.g. snapping turtle), indirectly affect water quality, and can isolate populations (ECCC 2016c). Regarding Mainland Moose, it is documented that habitat loss and fragmentation caused by clearing and grubbing interferes with the long-term population viability and is a serious threat to the species (NSDNR 2007).

Fragmentation of a particular species' habitat implies a loss of habitat, reduced patch size, and/or increasing distance between patches. While Project activities are expected to result in increased habitat fragmentation and a decrease in habitat quality (e.g., sensory disturbance), the level of new fragmentation associated with the Beaver Dam Mine Site is anticipated to be low, given the current level of disturbance within the PA. The Beaver Dam Mine Site infrastructure footprint is situated primarily on an area of high existing disturbance and is expected to only have fringe effects on the interior forest availability. There will be minimal isolation of habitat that is currently contiguous. Undisturbed, unfragmented habitat is present in the LAA and RAA, and the larger tracts are maintained around the PA, particularly to the north. The RAA is generally remote, with a moderate network of roads and forestry activity, though large tracts of forest landscape undisturbed by roads still exist in this region (NSDNR 2015b). A total of 72,663 ha of predicted interior forest has been identified within the RAA. The maximum Project edge effect as discussed in Section 6.10.7.1.2, will affect 237 ha of interior forest habitat, which accounts for 0.3% of predicted interior forest in the RAA.

Sensory disturbance to terrestrial fauna would result from rock blasting (weekly during operation), clearing and grubbing, infrastructure construction during the construction phase and, overall increased traffic, mining activities and trucking during operations within the PA. Changes to ambient noise and light levels and the presence of periodic vibrations have the potential to adversely affect fauna by influencing circadian patterns, seasonal patterns, movement and distribution, and community interactions and composition (Pauwels, 2018). The Environment Code of Practice for Metal Mines (Environment Canada, 2012) has established parameters for ambient noise levels for wildlife. These parameters indicate that ambient noise observed above 55 dBA during the day and 45 dBA at night can affect wildlife. Noise may simply act as a sensory disturbance resulting in avoidance (Ware et al. 2015), however, noise can also affect fauna behavioral patterns (Patthey et al. 2008), stress levels (Knight and Swaddle, 2011), affect communication and hunting success (Barber et al. 2009). Combined, these effects can negatively impact the overall population health of a particular species (Ware et al. 2015). Studies, some specific to ungulates, have found that sound levels of

46 to 68 dBA can elicited responses and have observed impacts on mammals (Maier et al. 1998; and Flydal et al, 2001; Drolet et al., 2016; Shannon et al. 2016). Elevated noise above background concentrations around the PA may cause avoidance by terrestrial fauna within 400 m (S, W, E) to 1,100 m (N) of the Beaver Dam Mine Site, <360 m on either side of the centre line of the Haul Road and within 750 m the Touquoy Mine Site property boundaries, based on the most conservative guideline (45 dBA) identified for potential broad wildlife effects (Appendix B.2; Environment Canada, 2012).

Light effects on terrestrial fauna include changes to circadian patterns, seasonal patterns, movement and distribution, and community interactions and composition (Pauwels, 2018). Artificial light can also disrupt habitat connectivity and indirectly create habitat fragmentation (Bliss-Ketchum et al. 2016). However, there is limited data is available for larger mammalian species. While effects of light on wildlife are documented, it is still an emerging area of research and artificial lighting thresholds (e.g., duration, intensity, spectrum, etc.) for fauna are not well defined. Light levels from the Project have been modeled in the Light Impact Assessment (Appendix D.1). While the calculated light levels at the sensitive receptors are below the guidelines recommended by the Institution of Lighting Professionals (ILP) guidelines, nighttime light propagation from the Project may still cause sensory disturbance to fauna. Project-related changes in ambient light levels are likely to result in localized avoidance of the Beaver Dam Mine Site and Haul Road and directly surrounding areas by some species. The impact distance will also be dependent on the type of lighting used. These distances have been considered in the delineation of the RAA. Light impacts from trucks on the Haul Road are expected to be insignificant compared to baseline daylight illuminance and will be blocked by the surrounding natural buffers and topography. The impacts of Haul Road lighting on fauna is expected to be less than that of noise. No permanent lighting will be installed on the Haul Road. There are no new or additional effects from light anticipated at the Touquoy Mine Site, with the exception of temporal increase of the life span as a result of the Project.

Mainland moose are likely to be less significantly affected by sensory disturbance due to their ability to easily travel to avoid this disturbance. Hibernating snapping turtles, on the other hand, are unable to easily escape sensory disturbance easily during hibernation. As such, practices should be implemented to reduce blasting near wetlands with suitable snapping turtle hibernacula during hibernation. Hibernation generally occurs from October through March, depending on seasonal temperatures (i.e., hibernation can start later in a warm fall and end sooner in an early spring, and vice versa).

Construction of the Haul Road will involve a combination of new road construction (4.0 km) and upgrades to the existing logging road. The majority of the proposed Haul Road (30 km) follows an existing road corridor, used by local residences and lumber trucks. Vehicle traffic volumes will increase throughout the PA during the construction, operation, and closure phases. Vehicle and haul truck activity can cause impacts to priority fauna from wildlife vehicle collisions, dust, noise, and accidents (e.g., spills). Mitigation measures such as spill preparedness, emergency response measures, and best management practices (e.g., noise/dust control, speed limits) will minimize the likelihood of a negative impact.

Direct mortality of priority fauna species could result from Project activities, particularly due to the increase in traffic during construction and operation of the facility. Increased traffic poses a risk to wildlife such as the mainland moose and snapping turtle along the entire length of the Haul Road between the Beaver Dam Mine Site and the Touquoy Mine Site. Indirect mortality to these species could also occur from exposure to contaminants or spills from unplanned incidents.

Through the implementation of mitigations, overall, the magnitude of the Project's effect on priority fauna species is determined to be low. A low magnitude of effect on priority species is defined as an effect which results in no direct loss of SAR individuals, and loss of habitat for those species is mitigated in the long term through reclamation planning. Table 6.11-7 presents a habitat loss by observed fauna species (or species group) based on the habitat analysis described in Section 6.10.3.5. Based on the definitions of magnitude of impact, it is anticipated that all impacts to habitat types used by observed SAR terrestrial fauna (i.e., mainland moose and snapping turtle) will be low, in comparison to habitat availability within the LAA.

Priority Avifauna

The geographic extent, timing, duration, frequency, and reversibility of the effects of clearing and grubbing to priority birds remains the same as is with non-priority specific birds. Clearing and grubbing is limited to the Beaver Dam Mine Site and portions of the Haul Road during the construction phase. No clearing and grubbing is required at the Touquoy Mine Site. Clearing and grubbing will result in habitat loss for avifauna.

Avian usage of the PA during construction and operation of the Beaver Dam Mine will largely be driven by changes to habitat, resulting in localized avoidance of the PA by some species. Habitat connectivity is critical for maintaining biodiversity and healthy species populations and interior forests are often an important feature that supports this movement (NSDNR, 2015b). While Project activities are expected to result in increased habitat fragmentation and a decrease in habitat quality (e.g., sensory disturbance), the level of new fragmentation associated with the Beaver Dam Mine Site is anticipated to be low, given the current level of disturbance within the PA. The Beaver Dam Mine Site infrastructure footprint is situated primarily on an area of high existing disturbance and is expected to only have fringe effects on the interior forest availability. There will be minimal isolation of habitat that is currently contiguous, limited to the patch of potential interior forest west of the NAG waste rock stockpile (Figure 6.10-6). Undisturbed, unfragmented habitat is present in the LAA and RAA, and the larger tracts are maintained around the PA, particularly to the north. The LAA is covered with a network of roads, historical mining and forestry activities, and forestry trails creating a largely disturbed forest landscape. Section 6.10, Figure 6.10-5 shows the extent of the simulated existing disturbance and edge effect largely covering the majority of the LAA. As presented in Section 6.10, the Project will affect 237 ha of interior forest habitat, which accounts for 9% of the predicted interior forest area within the respective LAA (Section 6.10, Figure 6.10-5A to 6.10-5E).

The effect of the Project on avifauna can largely be attributed to sensory disturbance, specialty noise and light. Sensory disturbance would result from rock blasting, clearing and grubbing, infrastructure construction, lighting and operations, internal mine traffic and traffic along the Haul Road during operations. Artificial noise and light, especially at night, have been shown to influence avian migration and behavior pattens, which could affect individual fitness and reproductive success (Da Silva et al. 2014). The Environment Code of Practice for Metal Mines (Environment Canada, 2012) has established parameters for ambient noise levels for wildlife. These parameters indicate that ambient noise observed above 55 dBA during the day and 45 dBA at night can affect wildlife. A literature review conducted by Shannon et al. (2016) found that avifauna have the potential to exhibit changes in song characteristics, reproduction, abundance, stress levels, and species richness at levels greater than 45 dBA, on average. Impacts can also differ between acute and chronic noise sources. Elevated noise above background concentrations around the PA may cause avifauna avoidance within 400 m (S, W, E) to 1,100 m (N) of the Beaver Dam Mine Site, <360 m on either side of the center line of the Haul Road and within 750 m the Touquoy Mine Site property boundaries, based on the most conservative guideline (45 dBA) identified for potential broad wildlife effects (Appendix B.1 and B.2; Environment Canada, 2012). These ranges of noise distribution are due to changes in local topography. Avifauna within these approximate ranges of noise distribution surrounding the PA have the potential to be affected by noise during the day and overnight. However, it should be noted that noise effects are rarely isolated from other disturbances and impacts likely coincide with habitat suitability changes that accompany increased noise levels (Shannon et al, 2016).

Light can impact avifauna by potentially causing disorientation or by causing attraction or avoidance (Langcore and Rich, 2004). Avifauna may be attracted to or disoriented by open pit lighting at night, particularly during migration periods, leading to mortality (Jones and Francis 2003). While effects of light on wildlife are documented, it is still an emerging area of research and artificial lighting thresholds (e.g., duration, intensity, spectrum, etc.) for wildlife are not well defined. Light levels from the Project have been modeled in the Light Impact Assessment (Appendix D.1). While the calculated light levels at the sensitive receptors are below the guidelines recommended by the Institute of Lighting Engineers (ILE) guidelines, nighttime light propagation from the Project may still cause sensory disturbance to avifauna. Project-related changes in ambient light levels are likely to result in

localized avoidance of the Beaver Dam Mine Site and Haul Road and directly surrounding areas by some species. The impact distance will also be dependent on the type of lighting used. These distances have been considered in the delineation of the RAA. Light impacts from trucks on the Haul Road are expected to be insignificant compared to baseline daylight illuminance and will be blocked by the surrounding natural buffers and topography. The impacts of Haul Road lighting on fauna is expected to be less than that of noise. No permanent lighting will be installed on the Haul Road. There are no new or additional effects from light anticipated at the Touquoy Mine Site, with the exception of temporal increase of the life span as a result of the Project.

Some priority species may avoid the PA in favor of undisturbed habitat in the surrounding landscape. Other priority species are anticipated to be attracted to the mine infrastructure and newly created habitat. The common nighthawk, for instance, is a crepuscular insectivore which nests on exposed gravel and disturbed areas. Lighting of buildings at dawn and dusk can create a foraging opportunity where insects are attracted to the lights. Barn swallows commonly nest in the eaves of built structures and bank swallows can nest in vertical slopes in sandy or silty soil, even in areas with high activity levels. These species of swallows have similar feeding habits as the common nighthawk. As such, Project activities may increase habitat suitability for both these species.

Direct mortality of avifauna species could result from Project activities, particularly due to the increase in traffic during construction and operation of the facility. Increased traffic poses a risk to avifauna along the length of the Haul Road between the Beaver Dam Mine Site and the Touquoy Mine Site. Vehicle and haul truck activity can cause impacts to priority avifauna from wildlife vehicle collisions, dust, noise, and accidents (e.g., spills). Wildlife vehicle collisions can directly affect priority fauna and noise can indirectly affect priority fauna by encouraging avoidance behaviour. Mitigation measures such as spill preparedness, emergency response measures, and best management practices (e.g., noise/dust control, speed limits) will minimize the likelihood of a negative impact.

Overall, the magnitude of the Project's effect on priority fauna species is determined to be low. A low magnitude of effect on priority species is defined as an effect which results in no direct loss of SAR individuals, and loss of habitat for those species is mitigated in the long term through reclamation planning. With appropriate mitigations, best management practices and operational monitoring (Appendix A of Appendix P.7 draft Wildlife Mitigation and Monitoring Plan), no direct mortality of priority bird species is anticipated, with the exception of the low potential for a bird strike with a haul truck. Best management practices include the avoidance of clearing and grubbing during the breeding season for migratory birds where practical. Table 6.12-11 presents a habitat loss by observed avifauna functional groups based on the habitat analysis described in Section 6.10.3.5. Based on the definitions of magnitude of impact, it is anticipated that all impacts to habitat types used by observed SAR avifauna will be low, in comparison to habitat availability within the LAA.

8.5.6.2.2 Effects of Other Projects in the Area

For SOCI and SAR, the RAAs align with taxa specific RAAs defined previously. There is direct spatial overlap between the Project and historic mining operations in the Beaver Dam and Touquoy Mine Sites (Figure 8.5-5). Any potential cumulative effects from these projects related to SOCI and SAR would be based on potential impacts to water quality from mobilization of historic tailings. The remediation of historic tailings is expected to result in a positive effect of the Project. The potential impact of this interaction will be mitigated by implementation of the draft Historical Tailings Management Plan (Appendix E.9). As such, these historic operations are not carried through the cumulative effects assessment process.

Prepared For:

Atlantic Gold

FIGURE 8.5-5

Beaver Dam Mine Project

Cumulative Effects Assessment: Species of Conservation Interest and Species at Risk

- Projects Evaluated in the Cumulative Effects Assessment
- Project Area
- Aquatic Regional Assessment Area
- Terrestrial Fauna, Avifauna, and Flora Regional Assessment Area

Note: Forestry operations occur throughout the RAA and are not displayed on this figure

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 2.5 5 10 km

1:210,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: KR

Date: 2021-02-28

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

McCallum Environmental Ltd.

Document Name: BD_EIS_Figure8-4-X_CEA_SAR_SOCI

Great Northern Timber Pellet Facility
Upper Musquodoboit
Mosher Lake Limestone Co.
Fifteen Mile Stream Past Mining Operations
Beaver Dam Mine Site
NSSA - AMP: Killag Doser
Beaver Dam Past and Future Mining Operation
NSSA - AMP: WRSH Doser
NSSA - AMP: Terrestrial Liming
Taylor Lumber Co. Ltd. - mill
Beaver Dam Haul Road
Regional Forestry Operations
Touquoy Mine Site
Haul Road
Murchyville Gypsum Mine
Touquoy Mining Operations
Dufferin Gold Mine
Great Northern Timber Wood Chipping and Shipping
Port of Sheet Harbour
Sheet Harbour Quarry
Tangier Gold Mine
Gaetz Brook Wind Farm

490000 500000 510000 520000 530000 540000 550000

5000000 4990000 4980000 4970000 4960000

Current Regional Forestry Operations

Habitat throughout the region exhibits fragmented conditions related to current and historic timber harvesting activity. This has led to habitat fragmentation and an increase in young regenerating stands to the detriment of older undisturbed forest, and the species which rely on these forests.

The existing roads that service the regional forestry industry contribute to the disturbance and risk of collision to species such as Moose. Timber harvesting is expected to have direct and indirect impacts to priority avifauna. According to Freedman, Woodley & Loo (1994), the effects of timber harvesting on birds is reflective of the physical and botanical changes in the structure of the forest in a given landscape. Habitat preferences for avifauna vary quite widely, so the effects of timber harvesting can result in creation of habitat for some species, while negatively affecting habitat for others. As described previously, this can be particularly important for species relying on old forest conditions, which is not supported in a landscape with abundant timber harvesting activity.

Generally speaking, the removal of trees for timber harvesting is anticipated to have a negative effect on priority avifauna species. The extent of the impact of timber harvesting on priority avifauna within the LAA is not well documented in literature. The likelihood that timber harvesting would have an adverse residual effect on priority fish species is moderate, presuming forestry operators adhere to provincial Wildlife Habitat and Watercourse Protection regulations. These regulations also provide stipulations to reduce the effect of habitat fragmentation on terrestrial and avifauna, by requiring stream buffers (to act as corridors) and patches of live trees, protection of Moose shelter patches, allowing for passage of wild species across clear-cut landscapes. As such, while habitat loss and fragmentation do occur as a result of timber harvesting, some level of habitat connectivity is provided by these regulations and provincial oversight and integrated resource management processes.

Touquoy Gold Project

Some loss of Mainland Moose habitat, although limited to the Touquoy Project footprint, has occurred through the construction of the Touquoy Mine Site. Snapping Turtles have been observed in the riparian zone of the Moose River, and the Moose River is known to support priority fish species such as Atlantic Salmon and Brook Trout. The construction of this facility has resulted in some loss of habitat for avifauna, including priority species. The Touquoy Project has resulted in the loss of a single Black Ash to allow construction of the TMF. While the Touquoy Gold Project is discussed in terms of a cumulative effects assessment, the extension of the operation of this facility is also tied directly to the FMS Project. As such, the effects assessment of the temporal extension of the Touquoy Gold Project is presented herein. The effects of the Touquoy Gold Project are similar in nature to the effects of the addition of the FMS Project to the Touquoy facility, with the primary difference related to the temporal extension of effects.

Potential impacts to priority species include direct mortality (vehicles), alteration or loss of habitat, disturbance of reproductive or feeding activities (generally due to noise or site activity), increased predation (natural predators, vehicle collision or hunting/trapping) due to improved access and traffic or disruption of migration patterns and habitat fragmentation. Accidental events could result in similar impacts. Vehicle use on-site could result in accidental mortality of Mainland Moose and Snapping Turtles. As few moose are in the area, it is unlikely that encounters will occur; however, the importance of individual moose within this area is recognized. As collisions can be avoided by ensuring on-site vehicle speeds are under 50 km/hr, speed limits below this level will be enforced year-round.

A WMMP has been implemented at the Touquoy Mine Site, requiring reporting of wildlife, particularly turtles and Mainland Moose observations to the site Environmental Technicians. No additional clearing or grubbing is required at the Touquoy Mine Site to facilitate deposition of FMS tailings, so additional habitat loss is not an important factor in assessing cumulative effects to SOCI

and SAR at the Touquoy Mine Site. Aside from trucking of gold concentrate and deposition of tailings, the effects of the FMS Project and the Touquoy facility do not overlap spatially or temporally, reducing potential cumulative effects to SOCI and SAR.

Fifteen Mile Stream Mine Project

Some loss of interior forest is expected to occur to support development of the Fifteen Mile Stream (FMS) Project. Project activities are expected to result in increased habitat fragmentation and a decrease in habitat quality for those species, including mainland moose and several bird species, which rely especially on interior forest conditions. The decrease in habitat quality for species relying on interior forest condition is based on increased activity and sensory disturbance, along with increased physical fragmentation and direct habitat loss. The loss of interior forest has been determined to represent approximately 0.49% of predicted interior forest within the RAA (AMNS, 2020).

Twenty-two (six of which are SAR) priority avifauna species were observed within the Beaver Dam Mine Site and proposed Project infrastructure and a direct loss of their habitat is expected. The six SAR avifauna species are common nighthawk, Canada warbler, rusty blackbird, olive-sided flycatcher, evening grosbeak, and eastern wood-peewee. A cumulative effects modelling exercise was completed within the FMS EIS, to understand the effects of cumulative wetland loss on several Species at Risk. This exercise is described in Section 6.7.5.2 of the FMS EIS (AMNS, 2021c). Through the cumulative effects modelling completed regarding wetland loss and species at risk, it was determined that the FMS Project will result in a 5.2% loss of wetland area in the LAA, and a 1.2% loss of wetland area in the RAA. Specific to Species at Risk, habitat suitability across the entire RAA was not modelled for specific species. The FMS Project is predicted to result in a 2.5% loss of modelled wetland habitat for mainland moose, along with a 5.5% loss of suitable modelled wetland habitat for olive-sided flycatcher, and a 0.3% loss of suitable modelled wetland habitat for the rusty blackbird, within the Projects' LAA. This demonstrated that large amounts of equivalent habitat is available to these mobile species in close proximity to the FMS Project; therefore, there is no predicted significant adverse effect from the Project on wetland habitat for the selected species.

The FMS Project is expected to result in loss of habitat for brook trout to support development of Project components including the diversion and realignment of Seloam Brook. Within the Beaver Dam Mine Site, four locations with a total of 11 thalli of blue felt lichen are expected to be directly impacted by the construction of the TMF (3) and WRSA (1). An additional four individuals representing three lichen SOCI are expected to be impacted, along with four individuals of three species of SOCI vascular flora.

Project interactions for the FMS Mine are detailed in the respective VC chapters. The Projects' effects on SOCI and SAR were determined to be adverse, but not significant. The RAA associated with the proposed Beaver Dam Haul Route overlaps the FMS Project both spatially and temporally due to trucking of gold concentrate to the Touquoy Mine Site, which is described below. As a result, there is some potential additive cumulative effect to priority species due to habitat fragmentation and sensory disturbance, especially given the concurrent timelines of the Beaver Dam Mine Project and the Project.

Beaver Dam Haul Road Use by the FMS Project and Cochrane Hill Gold Project

As stated above, during the operation phase of Project and the Cochrane Hill Gold Project, gold concentrate from each surface mine will be transported to the Touquoy Mine Site for final processing into gold doré bar. The proposed haul route for each project is proposed to overlap with the Beaver Dam Haul Road west of the Highway 224, which will be constructed to transport ore from Beaver Dam Mine Site to the Touquoy Mine Site. It is expected that the Fifteen Mile Steam Gold and the Cochrane Hill Gold Project sites will each transport 11 round-trip truckloads of gold concentrate to Touquoy Mine Site per day for final processing. This accounts for a total of 22 round trip trucks per day from both projects, in addition to the 95 round trips (e.g., return trips or two-way trips) using the road to transport Beaver Dam ore, and average of seven round-trips per day are anticipated from timber harvesting

operations. The total number of trucks for cumulative effects assessment is 144 trucks round trips (e.g., return trips or two-way trips) or 288 one-way trips (e.g., single way trips) (Appendix C.1, Table 1).

The trucking operations associated with the Project and Cochrane Hill Gold Project along the Beaver Dam Haul Road west of Highway 224 has the potential to increase the potential impact SOCI and SAR from wildlife vehicle collisions, dust, noise, and accidents (e.g., spills) due to cumulative truck traffic from these projects. The pathway for effects of this activity to SOCI and SAR involves disturbance through increased air, noise and light, potential physical interaction with trucks, and habitat disturbance from construction of the haul road. The incremental effects related to disturbance are expected to be similar with respect to impact to SOCI and SAR. Adherence to provincial and federal guidance, along with mitigation measures presented in the Beaver Dam Mine Project EIS will limit the effects to priority species from trucking on the Beaver Dam Haul Road.

NSSA Acid Mitigation Project

One or more component of the Acid Mitigation Project overlap the RAA for priority fish species (Terrestrial liming component in the Tent Lake and Keef Brook watersheds), priority flora fauna and avifauna. The NSSA AMP operates three main components. Two lime dosing stations are located on the West River Sheet Harbour and on the Killag River, downstream of Cameron Flowage. Neither of these components have direct spatial overlap with the Proposed Project, although the dosing station on the Killag River is approximately 650 m southeast of the proposed pit. Despite its close proximity to the proposed Project; the spatial extent of direct and indirect impacts to fish and fish habitat does not extend to this portion of the Killag River, as specified in Section 6.9.6.1.1.

Terrestrial liming has occurred within the Paul Brook, Keef Brook and Tent Lake watersheds. According to Rotteveel (2018), terrestrial liming occurred in MacGregor Brook and Colwell Brook during the fall of 2016, with some expected 'blowout' from helicopter liming affecting Cope Brook as well. The upper portion of the Killag River (above the lime dosing station) and Brandon lake Brook were used as control sites for this study. On September 25, 2019, MEL and AMNS met with the NSSA and ASF to discuss the second round of information requests related to the Project. During that meeting, it was stated that the NSSA would be commencing terrestrial lime application in the Tent Lake watershed; but indicated that terrestrial liming would not occur in proximity to the proposed organics stockpile until 2020. Of the three watersheds where terrestrial liming is known, or expected to have occurred, the Project only has a spatial overlap with the Tent Lake watershed (1EM-2-F) and the Keef Brook watershed (1EM-2-G). According to Rotteveel (2018), acidification of Nova Scotia's freshwater ecosystems has resulted in decreased habitat quality for Southern Uplands Atlantic Salmon, due in part to the mobilization of aluminum which has been mobilized due to low pH.

The residual effect of the NSSA AMP on fish and fish habitat, particularly Atlantic salmon, is a positive due to reduction of the effect of historic acidification on water quality within the treated catchment areas of the West River Sheet Harbour watershed. This Project is defined as having direct spatial and temporal overlap with the Beaver Dam Project specifically within the Tent Brook watershed (Project effects related to low magnitude flow reductions), and to a lesser extent, the Keef Brook watershed (Project effects related to Haul Road construction). The residual effects of the NSSA AMP on other taxa of rare species are unknown.

Dufferin Gold Mine

The Environmental Assessment Registration Document for this project is not currently publicly available. As such, a thorough cumulative effects assessment for the Dufferin Gold Mine is limited to the Project's description on the companies' website and a review of satellite images in Google Earth, along with MEL biologists' experience with SOCI and SAR in that region of the Province.

According to the proponents' website, "The Dufferin Mine is a high-grade underground gold mine and fully permitted mill in Nova Scotia, Canada, with historic and recent production, a planned near-term restart, and potential for extensive expansion. The mine

has a 300 tpd gravity and flotation mill and, with certain upgrades and refurbishment, all necessary infrastructure in place to conduct full-scale gold mining operations" (Resource Capital Gold Corp, 2019).

"The Company has completed refurbishment of the major mill components and is performing test milling. As part of the test milling process, the Company produced its first gold on the project in early March 2017. RCG is preparing to begin trial mining of an initial approximately 15,000 tonnes in order to confirm mineralization grade and prepare for a full restart of the mine and mill. The project comprises 1,684 ha, accessible by gravel road 25 km from Sheet Harbour in southeastern Nova Scotia, about 135 km northeast of Halifax " (Resource Capital Gold Corp, 2019).

The Dufferin deposit consists of mineralized gold in quartz veins, mined by underground shafts, rather than an open pit. Milling operations continued through 2017, and according to a press release dated January 29, 2018, the bulk sampling program was completed with favorable results. A press release dated January 29, 2019 indicated, however, that the company has filed a Notice of Interest to make a proposal under the *Bankruptcy and Insolvency Act*. According to the press release, "The initial NOI period will allow RCG to evaluate, with its partners, all available legal recourses and financial alternatives that may allow the Company to resume its operational production efforts as soon as possible and continue as a going concern" (Resource Capital Gold Corp, 2019).

Given this most recent press release, the future development of the Dufferin Project is uncertain. In its current state, the shaft, plant site and access road has resulted in some habitat fragmentation which could impact habitat quality for SOCI and SAR at a localized level. Given the uncertainty moving forward, it is unknown whether the Dufferin Project will overlap temporally with the FMS Project. The Dufferin Project Area is located more than 26 km southeast of the Beaver Dam Mine Site, though there is potential for an additive cumulative effect between the projects, based on habitat fragmentation if the Project were to proceed.

8.5.6.2.3 Cumulative Effects on the Species of Conservation Interest and Species at Risk

Cumulative effects to SOCI and SAR are specific to each species, meaning that cumulative effects are only considered for species on which the Project has adverse residual effects and for which adverse effects from other identified projects in the area are expected.

Priority Fish

Residual effects on priority fish and fish habitat within the Project Area are primarily related to loss of fish habitat from the development of the pit and other infrastructure. The key mitigation measures associated with this loss of fish habitat involve the fish rescue and offsetting for loss of fish habitat.

Spatial and temporal overlap of other projects within the RAA for fish and fish habitat is presented in Section 8.5.5.2.3.

The Killag lime dosing station was installed to mitigate the effects of historic acidification within the Killag River, and to improve the quality of fish habitat within the Killag River, particularly for Atlantic salmon. As part of the predictive water quality modelling, the effect of the Project on pH in the receiving environment was evaluated. pH cannot be predicted with certainty by mass-balance models as used in the predictive water quality evaluation. That is, while modelling for the Project is conservative, mass balances modelling processes/predictions do not represent complete reaction paths and thus for non-conservative parameters (such as pH) water quality predictions are expected to be further governed by in situ processes. Note, discharges from the project will be subject to the MDMER such that effluent concentrations must be within pH range of 6.0 to 9.5, which is protective of aquatic life. Therefore, there are no effects to Surface Water Quality as a result of Project effluent discharges; and no expected negative cumulative impact of the Project on pH in the Killag River.

The Project is expected to have a direct spatial overlap within the Keef Brook Watershed, and the Tent Brook watershed. The spatial scale of terrestrial liming within each of these watersheds is unknown; therefore, it was assumed that the entire catchment areas are treated with lime in an effort to be conservatively inclusive. Impacts of the Project to fish habitat within the Keef Brook watershed are limited to upgrading the existing Haul Road and associated watercourse crossings. Upgrading the Haul Road is expected to result in direct impacts to fish habitat (420.2 m^2, in WC J and WL76) to allow for culvert installation, which has been incorporated in the Offsetting Plan (Appendix J.3). Of the watercourse crossings located within the Keef Brook watershed, five are currently acting as barriers to fish passage, so upgrading Haul Road infrastructure is expected to result in improvements to fish passage in watercourses E, F, G, J and K. Provided mitigation measures for watercourse crossings are adhered to (as will be required under provincial watercourse permits), no indirect effects are expected to fish habitat within this tertiary watershed. Furthermore, it is unknown whether terrestrial liming within this system is ongoing, based on results published by Rotteveel (2018) and communication from DFO (2019). Terrestrial liming was selected as a treatment within several catchment areas in this watershed due to the long-lasting effects of helicopter-based liming; which essentially acts as a 'slow-release' of lime through the soil into the watercourses. While the benefits of liming may continue to occur through the temporal scale of the Project; activities within this watershed are not expected to have any type of cumulative interaction with terrestrial liming which has already occurred.

Within the Tent Brook tertiary watershed, Project interactions include construction of an organics stockpile, ATV bypass road, crusher pad, and topsoil stockpile. The ATV bypass road will remain in place through post-construction, while the crusher pad, topsoil stockpile and organics stockpile will be reclaimed in the active reclamation stage of the Post Closure phase of the Project. Upgrading Haul Road infrastructure is expected to result in direct impacts to 535 m^2 of fish habitat in Wetlands 64 and 66, and will result in fish passage improvements in watercourses A and B. Direct impacts to fish habitat have been incorporated into the draft Fish Habitat Offset Plan (Appendix J.3). Provided mitigation measures for watercourse crossings are adhered to, no indirect impacts in watercourses within the Tent Brook watershed are expected based on upgrades to the Haul Road.

To identify potential indirect effects to fish and fish habitat within Tent Brook watershed, an updated Water Balance Assessment is provided (within the Mine Water Management Plan, Appendix P.4). Based on the results of the water balance, collection of contact water is expected to result in a 1.1% reduction in flow at EOM, and a 1.2% reduction at PC. As a result, a low magnitude of effect is expected to fish habitat within the Tent Brook watershed, as this change has been determined to fall within natural variation. Furthermore, water quality effects are not expected within the Tent Brook watershed; as all site contact water will be collected in the South Settling Pond prior to release. The primary purpose of the south settling pond is to reduce the TSS levels to acceptable limits, and control stormwater runoff. Effects to the downstream environment are not expected.

Data related to the NSSA terrestrial liming program inputs, objectives, and results were not available with sufficient detail to allow interpretation of interacting effects between terrestrial liming and direct and indirect effects within the Tent Brook or Keef Brook watersheds. AMNS requested further detail from the NSSA; however, NSSA did not provide a response. Therefore, the evaluation of cumulative effects within the Tent Brook and Keef Brook watersheds are qualitative in nature. Direct impacts to fish habitat within each of these watersheds is limited to construction of the Haul Road and associated watercourse crossings. These impacts range from negligible to high, based on the area of impact within each individual crossing. Given implementation of mitigation measures including Offsetting, these effects are determined to be not significant, especially considering the improvements to fish passage which will be provided. The indirect effects of the Project on fish habitat within the Keef Brook and Tent Brook watersheds are limited to low magnitude effects to flow reduction in the Tent Brook watershed. The Project related effects to fish habitat within these two watersheds are adverse and not significant; given that the residual effects of the terrestrial liming are positive (magnitude and significance are unknown); it is likely that any cumulative effect to fish habitat would be classified as a compensatory interaction, with a non-significant residual cumulative effect.

The deposition of tailings from the proposed Fifteen Mile Stream Project and the existing Touquoy Mine in the Touquoy Pit overlap the current Project both spatially and temporally. As discussed, with appropriate mitigation to ensure compliance with MDMER criteria and water quality objectives, the potential for residual cumulative effect on fish and fish habitat is expected to be minimal.

There is limited uncertainty as to the Project effects on priority fish species. Follow-up monitoring programs established for the Project (i.e., monitoring the effectiveness of fish habitat offsetting measures) will be used to address any uncertainty (Section 6.9.10). Surface water quality and quantity monitoring completed within the AEMP (Appendix P.5) identifies any potential indirect cumulative effects to fish and fish habitat.

Priority Vascular Flora and Lichens

Projects which overlap the RAA for priority vascular flora and lichens include historic mining operations at both FMS and Touquoy Mine Sites, current operations of the Touquoy Mine Site, the FMS Project, cumulative use of the Haul Road west of the Highway 224 by the FMS Mine Project and the Cochrane Hill Mine Project, regional forestry operations, the Dufferin Gold Mine, and the NSSA Acid Mitigation Projects. No significant adverse effects to priority vascular flora and lichens are anticipated as a result of the Touquoy Gold Project or FMS Project.

Residual effects to priority vascular flora and lichens as a result of the timber harvesting, historic mining operations, the Dufferin Gold Project and the NSSA Acid Mitigation Projects are largely unknown, and little information is available, with the exception of the general understanding that habitat loss or change from these projects results in potential loss of priority flora and lichen species. The general habitat disturbances from historic and ongoing forestry activities, and these projects listed above, are likely to have had some effect on species that prefer undisturbed habitat and especially those sensitive to edge effects, such as priority lichens.

The NSSA Acid Mitigation Projects, specifically the terrestrial liming component in the Tent Lake and Keef Brook watersheds, may have an adverse effect on priority lichen. As one of the main factors affecting epiphytic lichen occurrences is the pH of the host tree on which it is growing (Marmor & Randlane, 2007), aerial lime dosing may cause a shift in lichen community and result in alteration in cell tissue pH which can impact lichen health and richness (Naeth and Wilkinson 2008; Farmer, 1991). The level and spatial extent of impact will depend on the specifics of the project, such as weather conditions at time of dosing, elevation of lime release, concentration, etc. Aerial liming impacts will be considered during the implementation of the Lichen SAR translocation and Monitoring Plan, specifically when selecting transplant recipient sites.

The Air Emission Assessment Technical Report (Appendix C.1) presents Project only and cumulative dust deposition rates along the Haul Road. While the cumulative use of the Haul Road west of the Highway 224 by the FMS Mine Project and the Cochrane Hill Mine Project does increase deposition rates, these rates have been reviewed with respect to lichen impacts and it was found that they did not result in changes to predicted effects. As a result, no additional monitoring or mitigations are recommended.

There is a significant level of uncertainty as to the cumulative effects, especially as to the effects from past disturbances and other projects in the region. However, given the small footprint of the Project on the regional scale there is some confidence that the Project's effects on priority flora contributes only a small portion to the total cumulative effects, and that any additive cumulative effects would be negligible.

Priority Terrestrial Fauna

Projects which overlap within the RAA for priority terrestrial fauna include historic mining operations at both FMS and Touquoy Mine Sites, current operations of the Touquoy Mine Site, the FMS Project, cumulative use of the Haul Road west of the Highway 224 by the FMS Mine Project and the Cochrane Hill Mine Project, regional forestry operations, the Dufferin Gold Mine, and the

NSSA Acid Mitigation Projects. No significant adverse effects to priority terrestrial fauna are anticipated as a result of the Touquoy Gold Project or FMS Project.

The Beaver Dam Mine Project will result in the loss of 10 ha of mainland moose wetland habitat. The additional wetland impacts from the FMS Mine Project will result in a loss of 26 ha of this habitat, resulting in a cumulative loss of 36 ha of mainland moose wetland habitat within the terrestrial fauna RAA, as a result of these Projects. This habitat loss represents 0.03% of the total RAA area. Large amounts of equivalent mainland moose habitat are still available within the RAA and abundant intact area exists between these projects to maintain unimpeded movement.

Residual effects to priority terrestrial fauna as a result of the timber harvesting, historic mining operations, the Dufferin Gold Project and the NSSA Acid Mitigation Projects are largely unknown, and little information is available, with the exception of the general understanding that these projects can result in habitat loss or change for priority fauna species. Given the distance between the Dufferin Gold Project and all components of the PA, a spatial overlap in effects is unlikely. Given the current state of the Dufferin Gold Project (Section 8.5.6.2.2), it is unlikely that there will be a temporal overlap with the current proposal.

The general habitat disturbances and fragmentation from historic and ongoing forestry activities are likely to have had some effect on priority species that prefer undisturbed habitat and interior forest. Specifically, timber harvesting, the Project, the FMS Project and the Touquoy Gold Project are expected to have an adverse effect on the mainland moose. A Mainland Moose Management Plan will be developed as part of the Project's draft Wildlife Mitigation and Monitoring Plan (Appendix P.7) to help mitigate these effects. The effects are the result of loss of habitat and from the risk of collision with vehicles. Habitat loss and disturbance, and traffic from other activities in the region contribute to the resulting cumulative effects.

Similar cumulative effects are expected for the snapping turtle, which have been observed at the Beaver Dam Mine Site and along roadsides near the Touquoy Mine Site during nesting season. Increasing traffic levels will increase risk of collisions to snapping turtles. A Wildlife Management Plan has been implemented at the Touquoy Mine Site and has been developed for the Beaver Dam Mine Site (Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]) to reduce potential impact to wildlife, specifically turtles. No other specific project causing loss of habitat for this species has been identified.

There is a significant level of uncertainty as to the cumulative effects on priority terrestrial fauna. Given the small footprint of the Project on the regional scale there is some confidence that the Project's effects on priority terrestrial fauna contributes only a small portion to the total cumulative effects, and that there is low potential for significant additive cumulative effects.

Priority Avifauna

Projects which overlap within the RAA for priority avifauna include historic mining operations at both FMS and Touquoy Mine Sites, current operations of the Touquoy Mine Site, the FMS Project, cumulative use of the Haul Road west of the Highway 224 by the FMS Mine Project and the Cochrane Hill Mine Project, regional forestry operations, the Dufferin Gold Mine, and the NSSA Acid Mitigation Projects. No significant adverse effects to priority terrestrial fauna are anticipated as a result of the Touquoy Gold Project or FMS Project.

The Beaver Dam Mine Project will result in the loss of a total of 35 ha of SAR avifauna wetland habitat for Canada warbler, olive-sided flycatcher and rusty blackbird. The additional wetland impacts from the FMS Mine Project will result in a loss of 72 ha of this habitat, resulting in a cumulative loss of 107 ha of Canada warbler, olive-sided flycatcher and rusty blackbird wetland habitat within the avifauna RAA, as a result of these Projects. This habitat loss represents 0.07% of the total RAA area. Large amounts of equivalent habitat is still available within the RAA and abundant intact area exists between these projects to maintain unimpeded movement.

Residual effects to priority terrestrial fauna as a result of the timber harvesting, historic mining operations, the Dufferin Gold Project and the NSSA Acid Mitigation Projects are largely unknown, and little information is available, with the exception of the general understanding that these projects can result in habitat loss or change for priority avifauna species. Given the distance between the Dufferin Gold Project and all components of the PA, a spatial overlap in effects is unlikely. Given the current state of the Dufferin Gold Project (detailed in Section 8.4.3.1.13), it is unlikely that there will be a temporal overlap with the current proposal.

The general habitat disturbances and fragmentation from historic and ongoing forestry activities are likely to have had some effect on priority species that prefer undisturbed habitat and interior forest. The cumulative effects to priority birds are therefore driven by habitat loss and disturbance and are essentially the same as those noted for birds in general. Overall, the generalized disturbance of the landscape by proposed and active gold projects, and forestry activities (past, present and future) are the main source of cumulative effects to priority birds throughout the area. A Landbird SAR Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan]) has been developed for the Project to help mitigate effects to avifauna SAR during operations. The largest adverse effects expected would be to species preferring undisturbed and unfragmented habitats, although the impact to interior forest from the Beaver Dam Mine Project and FMS Project have been determined to be low.

There is a moderate level of uncertainty as to the cumulative effects on priority avifauna. The main assumption behind this assessment is that the overall patterns of land use in the region will remain unchanged in the foreseeable future and that the Project will be approved and carried out during the anticipated timelines. Considering the temporal scale and small footprint of the Project on the regional scale, there is some confidence that the Project's effects on priority avifauna contributes only a small portion to the total cumulative effects, and that there is low potential for significant additive cumulative effects.

8.5.6.3 Mitigation

No specific mitigations are recommended to reduce cumulative effect, other than those presented in Sections 6.8 to 6.13 (Fish and Wetlands, Fish Habitat, Habitat and Flora, Terrestrial Fauna, Avifauna and SAR/SOCI, respectively). The Touquoy Gold Project and FMS Gold Projects will adhere to their own mitigation measures as outlined in their Approval and EIS, respectively. The mitigation of the effects originating from regional forestry and land management practices falls outside the scope of the Proponent's authority and responsibility.

8.5.6.4 Residual Cumulative Effects and Significance Assessment

A significant adverse effect from the Project on SAR and SOCI is defined as an effect that is likely to cause a permanent, unmitigated alteration to habitat that supports a species' distribution, or alteration of critical habitat. Sedentary species such as vascular and non-vascular flora do not have the opportunity to move to avoid direct or indirect impact. For these species, the loss of an individual or individuals of a SAR species that is important in the context of the province, or that species' overall abundance or distribution, may be considered significant, if appropriate mitigation measures are not implemented.

Within the Project, the FMS Gold Project, the Touquoy Gold Project and the use of the Beaver Dam Haul Road by all three projects, there is no expectation of significant cumulative effects to SAR or SOCI. The NSSA AMP has a partial spatial and temporal overlap with the Project where terrestrial liming is ongoing within the Tent Brook and Keef Brook watersheds. The effects of this project on fish and fish habitat is anticipated to be positive, and there is no predicted adverse cumulative effect on fish and fish habitat when combined with residual effects of the Project. Based on lour limited understanding of the details of the NSSA AMP, particularly related to the potential effects to priority species, we anticipate the potential cumulative effects as not significant; however available information was limited for this assessment, and therefore, there is some uncertainty in this conclusion.

The alteration of the disturbance of habitats throughout the region from historic and current land use is likely to have affected the local distribution and abundance of various species, especially those associated with undisturbed mature habitats. However, the overall footprint of mining activities in the area, including the Beaver Dam and Touquoy Mine Sites, is quite small in relation to the VCs respective RAAs. As such, no significant residual cumulative effects are anticipated (Table 8.5-7).

8.5.6.5 Follow-up and Monitoring Programs

No additional monitoring beyond that indicated for the Project in Section 6.12.10 is proposed.

Table 8.5-7: Residual Cumulative Environmental Effects for SOCI and SAR

Residual Adverse Cumulative Effects (After Mitigation)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Cumulative loss, alteration and the disturbance of habitats throughout the RAA relating to SOCI and SAR.	L The maximum cumulative Project edge effect will affect 512 ha of interior forest habitat in consideration of the Beaver Dam and FMS Projects, which accounts for 0.7% of predicted interior forest in the RAA. There is limited additional development pressures from other projects in the RAA, as demonstrated by the few projects identified within this evaluation.	RAA Loss of habitat used by priority species has occurred on a regional scale.	A Cumulative effect would be more significant during sensitive period for each priority species.	LT Effects may extend beyond 7 years.	S The loss of habitat associated with the Beaver Dam Mine Site will occur once. However, the potential future loss of habitat associated with the Beaver Dam Project and other regional projects in the future could occur throughout the lifetime of the Project.	PR Reclamation cannot guarantee a return to baseline conditions.	Low Adverse Effect (Not Significant) The small proportion of regional habitat that supports priority species that would be lost as a result of this Project will be restored during the reclamation stage of Closure Phase. There is limited additional development pressure from projects in the RAA.

Notes: Specific characterization criteria listed below for SOCI/SAR are defined in Section 6.13.6.2. Standard characterization criteria listed below are defined in Section 5.11, Table 5.11-1.

Magnitude	
N	Negligible
L	Low
M	Moderate
H	High

Geographic Extent		
PA	Project Area	
LAA	Local Assessment	Area
RAA	Regional Assessment	Area

Timing	
N/A	Not Applicable
A	Applicable

Duration	
ST	Short-Term
MT	Medium-Term
LT	Long-Term
P	Permanent

Frequency	
O	Once
S	Sporadic
R	Regular
C	Continuous

Reversibility	
R	Reversible
PR	Partially reversible
IR	Irreversible

8.5.7 Mi'kmaq of Nova Scotia Cumulative Effects Assessment

8.5.7.1 Baseline conditions

There are 13 Mi'kmaq communities in Nova Scotia, with two First Nation (Mi'kmaq) reserves in the vicinity of the Project: Beaver Lake IR 17 (49.4 ha) is located approximately 5 km southwest from the Beaver Dam Mine Site, and Sheet Harbour IR 36 (32.7 ha) is located 20 km south of the Project. Both these reserves belong to the Millbrook First Nation which is located in Truro, Nova Scotia, 54 km northwest of the Beaver Dam Mine Site. The 2017 Census reports 21 and 25 Mi'kmaw residents at Beaver Lake and Sheet Harbour, respectively (Statistics Canada 2017, 2017a).

Beaver Lake: established in 1867 and approximately 49.4 ha in size is situated along Highway 224. The estimated population on reserve is 21 with a total of five homes and four small cottages/camps.

Sheet Harbour: set aside under Millbrook administration in 1960 and approximately 32.7 ha along Highway 7, the estimated population on reserve is 25 with a total of nine homes, two trailers, a community hall and a convenience/gas bar.

The Sipekne'katik First Nation, located in Indian Brook, Nova Scotia, is located approximately 61 km west of the Project. The Pictou Landing First Nation (PLFN), located north of the town of New Glasgow, is located 66 km north of the Project.

Mi'kmaq rights are communal rights and therefore shared amongst all members of the Mi'kmaq Nation in Nova Scotia. Community profiles of the 13 Mi'kmaq First Nations in Nova Scotia have been included in Table 6.14-2 (Stantec 2018c, CBU 2020).

8.5.7.1.1 Historic Mi'kmaq Land and Resource Use

Mi'kmaq traditional use of the land in Nova Scotia involved semi-permanent and permanent settlements. Summer villages of the Mi'kmaq were usually located on the banks of streams or rivers. The most important factor in the choice of a site was the proximity of the site to a navigable body of water. Sites around the mouths of rivers with heavy spawning runs were highly favourable for use, as well as smaller rivers running back into a system of lakes (Appendix M.1).

Beaver Dam lies within Eskikewa'kik or the "skin dressing territory". This particular district spans from Halifax County across to Guysborough County. Various authors and historians have differed in their description of how far this territory expands, but all have agreed that Beaver Dam lies within this district (Appendix M.1).

Although little historical information has been written about Mi'kmaq inhabiting these areas in large numbers, there is some documentation that suggests that they mainly inhabited Halifax and Port Mulgrave. Bernard Hoffman has noted that there were seven main sites within Eskikewa'kik; including sites at Ship Harbour, Spry Bay Harbour and Liscomb Harbour near the study area (Appendix M.1).

Mi'kmaq cultures hunted land and marine mammals and fish for sustenance and some trading until the late sixteenth century, when traditional activities began to change in response to contact with the Europeans. Settlements, although not permanent, were located near major waterways and harbours, providing accessibility to trade with the Europeans. The Mi'kmaq traveled inland through minor streams and rivers, either by canoe or on foot (Appendix M.1).

More details outlining historic land and resource use by the Mi'kmaq of Nova Scotia are presented in Section 6.14.

8.5.7.1.2 Current Mi'kmaq Land and Resource Use

Drawing from information provided through the MEKS, the TLRUS (MFC 2019), direct information gathered from engagement activities between AMNS and the Millbrook First Nation and Sipekne'katik First Nation, and the KMKNO, and the Project team's knowledge of the Beaver Dam Mine Site and the Haul Road, the following summary of current Mi'kmaq land and resource use has been prepared as a basis from which to understand and evaluate Project interactions and potential effects of the Project on the Mi'kmaq of Nova Scotia. The description and analysis in this section has been tailored to Millbrook First Nation, unless specific mention of information relating to a different Mi'kmaq community is noted. Information was requested from all Mi'kmaq communities in Nova Scotia through the MEKS and direct engagement with KMKNO and Sipekne'katik First Nation; however, the TLRUS (MFC 2019) prepared for Millbrook First Nation and information received directly from the Millbrook First Nation community informs AMNS's specific understanding of traditional and current use. Some generalized information, especially relating to traditional use, was available through the MEKS and is presented herein. The baseline information provided in the MEKS is generally consistent with that baseline data collected by the Millbrook First Nation through the TLRUS (MFC 2019).

The following key aspects were considered and requested from the Mi'kmaw communities during collection of baseline data (either through direct engagement or the completion of the MEKS and TLRUS):

- General information about Mi'kmaq of Nova Scotia populations;
- General description of baseline conditions within the Beaver Dam Mine Site and Haul Road and surrounding landscape to support an understanding of the current experience of the traditional practice for the Mi'kmaq of Nova Scotia;
- Sites or areas that are used by the Mi'kmaq of Nova Scotia either for permanent residences or on a seasonal/temporary basis and the number of people that use each site/area identified;
- Drinking water sources (permanent, seasonal, periodic, or occasional);
- Consumption of country foods (also known as traditional foods) including food that is trapped, fished, hunted, harvested, or grown for subsistence or medicinal purposes, outside of the commercial food chain;
- Which country foods are consumed by which groups, how frequently, and where these country foods are harvested;
- How are different subpopulations of the Mi'kmaq communities using the land;
- How often is the right practiced or exercised and timing/seasonality of the practice; the context in which the right is practiced;
- Commercial activities (e.g. fishing, trapping, hunting, forestry, outfitting) and the frequency, duration and timing of these activities including maps and data sets; and
- Recreational uses and the frequency, duration and timing of these activities.

Baseline information that was shared and available for the Project is described in this section. This summary of current use is specific to the Millbrook First Nation, through the completion of the TLRUS (MFC 2019), supported by conclusion of the MEKS. This report describes Millbrook traditional land and resource use in the regional and local study areas through careful documentation of harvesting and occupancy locations, as well as the presentation of qualitative information relating to participants' relationships with these locations (MFC 2019).

It is important to note that some limitations relating to baseline information are present and thus, evaluation of Project interactions and potential effects to the Millbrook First Nation and more broadly the Mi'kmaq of Nova Scotia, are provided with some limitations on specific analysis:

- **Drinking Water Sources:** No surface drinking water sources were identified through the MEKS or TLRUS, and direct engagement activities with the communities. As a result, no analysis of specific surface water drinking water sources is completed. However, a discussion of impact to drinking water at the Cameron Flowage/Killag River (the discharge location from the Project) is included as it is considered the reasonable worst case predicted water quality conditions stemming from the Project.
- **Residences (Permanent or Seasonal):** No specific detail relating to location of seasonal or temporary camps/cottages/residences were provided to AMNS. The MEKS did not provide any information relating to seasonal or permanent residences, with the exception of the Beaver Lake IR. The TLRUS identified several Millbrook camp locations, but no specific locations were provided. Thus, no analysis of specific Millbrook residential receptors has been included in this Project EIS. Conclusions relating to Project interaction at the Beaver Dam Mine Site and Haul Road property boundaries have been provided for each VC in Table 6.14-5 and these conclusions can support analysis of camps/cottages that have been identified in a more generalized way surrounding, and in close proximity to, the Beaver Dam Mine Site and Haul Road.
- **Ceremonial/Spiritual Activities and Sites:** General or specific information about sacred sites was not provided in the MEKS (Appendix M.1) or TLRUS (MFC 2019 – Under Confidential Cover).

Additional information relating to strengthening AMNS understanding of current Millbrook and more broadly, Mi'kmaq, land use was requested as documented in detail in Section 4 and summarized herein. AMNS will continue to work with the Millbrook First Nation and the Mi'kmaq of Nova Scotia to identify any outstanding traditional and current use information related to the Project.

The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights. This includes traditional rights to hunt, gather and fish, as well as treaty-protected rights to hunt and gather, and to fish for a "moderate livelihood", which may take place throughout the year. According to the TLRUS (MFC 2019 – Under Confidential Cover), the LAA is used by the Millbrook First Nation for the following purposes:

- hunting deer, bear, rabbit and grouse for sustenance;
- trapping rabbits, bobcat, beaver, coyotes, musrat, mink, otter, weasel and other small fur bearing animals for pelts and food;
- gathering/harvesting various plants for medicinal and sustenance purposes;
- gathering/harvesting fallen wood and birchbark for handicrafts and cultural items;
- fishing for trout and other freshwater species; and
- modern-day camps for recreational purposes.

The TLRUS (MFC 2019 – Under Confidential Cover) states that local residents of the Beaver Dam, Sheet Harbour and Millbrook IRs frequently use the area (range of use from weekly to yearly, depending on availability of species) for hunting (deer, bear, rabbit, grouse, porcupine) and rely on the wild harvest as an important food and dietary source. Equally, community members harvest berries when in season, and a number of plants that are also used for sustenance, as well as traditional medicines. The seasonal and recreational use of animals and plants important to the Millbrook community members supports the continuity of traditional practices and is very important to the maintenance of their culture and the practice of their rights. Millbrook harvesting activities and practices are culturally important as they ensure the sharing and maintenance of cultural values and their practice. Millbrook First Nation community members use plants and animals harvested in the area for traditional sustenance purposes, health-related medicinal purposes, and spiritual and cultural purposes.

Additionally, the MEKS (Appendix M.1 [CCM 2016]) provided the following information related to current Mi'kmaq land and resource use sites, species of significance to Mi'kmaq, and Mi'kmaw communities, with the current Mi'kmaq land and resource uses categorized and identified as:

- Kill/hunting: trout, eel, bear, rabbit, deer, porcupine, partridge, coyote, mink, muskrat, weasels, raccoon, fox, otter and beaver;
- Burial/birth: potential burial sites recorded within the MEKS study area on the western side of the Beaver Dam Mine Road but not within the PA;
- Ceremonial: none identified;
- Gathering: wild fruit, berries, water, food plant, specialty wood, logs, feathers, quills; and
- Habitation: anchored boat, travel route, overnight site.

Species of significance to the Mi'kmaq are associated with three categories; these are listed below with the number of occurrences in the study area based on field work completed by CMM in summer 2016:

- Medicinal: 49 species present;
- Food/beverage: 27 species present; and
- Craft/art: 11 species present.

An overview of the Millbrook First Nation local fisheries activity within the identified LAA was provided in the TLRUS (MFC 2019 – Under Confidential Cover). Additional information relating to the local Mi'kmaq fisheries was also reported in the MEKS and through direct engagement with the Mi'kmaq of Nova Scotia which supports the conclusions presented in the TLRUS (MFC 2019 – Under Confidential Cover).

Fishing is generally for sustenance/subsistence, as well as for recreational purposes. Trout is the key fish species described in the TLRUS (MFC 2019) with additional species including brook and rainbow trout, sea trout, American eel, Atlantic salmon, herring, mackerel, gaspereau, various groundfish species, smelt, striped bass and sucker. Shellfish harvesting within the LAA include clams, lobster, mussels, snowcrab, and scallop (MFC 2019). Fishing is practiced across the LAA in most major rivers and lakes, as documented in the TLRUS and MEKS. Within the Beaver Dam Mine Site, there is documentation of trout fishing within Cameron Flowage/Killag River and possibly Mud Lake and Crusher Lake (MFC 2019 – Under Confidential Cover). Within the 4km footprint of new construction for the Haul Road, there are no documented rivers or lakes that support the Mi'kmaq fisheries. However, adjacent to this new construction corridor and along the road footprint proposed for upgrades to construct the Haul Road, fishing locations are common, and Millbrook First Nation use of these lakes (and rivers) is well documented from the Beaver Dam Mine Site to the Mooseland Road (MFC 2019 – Under Confidential Cover). AMNS acknowledges documented fish harvesting by Millbrook First Nation within the area directly surrounding the Project and the broader LAA.

There are a number of activities associated with the harvest and use of plants, animals and fish within the PA and in the LAA that relate to historical traditions and customs of the Mi'kmaq that are still practiced today. As described, the TLRUS (MFC 2019 – Under Confidential Cover), the MEKS and residents of the Beaver Lake IR identify trapping and hunting activities, plant and berry gathering, and fishing in, near and surrounding the PA for purposes of sustenance, spiritual and cultural practice. The TLRUS (MFC 2019 – Under Confidential Cover) described the frequency of use within the LAA which can be summarized as regular: weekly to annually across all seasons. This means the area was, and still is, an important resource area for the Millbrook First Nation community members and by extension, all Mi'kmaq of Nova Scotia, and any Project activities may have potential impacts on the ability of the Mi'kmaq of Nova Scotia to access certain areas to practice their rights where species with important cultural

relevance may be found. Wild meat was traditionally a staple of the Millbrook First Nation diet, and a few of the harvesters interviewed for the TLRUS (MFC 2019 – Under Confidential Cover) indicated they rely mainly on this food source and they share their food with other community members, rather than purchase their meat at a local supermarket.

Some Mi'kmaq community members have camps on Crown land where they go to enjoy peaceful recreational and traditional activities with family and community members. There are five camps documented within 1 km of the Haul Road and multiple other camp locations throughout the LAA (MFC 2019 – Under Confidential Cover). The Millbrook community is concerned that noise and activity from the Beaver Dam Mine Site and the Haul Road will negatively impact their ability to enjoy the remoteness and quiet of the area, as well as impact wildlife patterns and their hunting practices.

The evidence presented above shows Mi'kmaw occupancy and land/resource use in the PA, LAA and wider region of Eskikewa'kik – are changing, and more limited but uninterrupted use from pre-contact times to today.

In summary, both those aspects, the economic and cultural motivations for traditional land and resource uses, feed into a third impetus: the need to express, affirm and exercise their Aboriginal rights to live their cultural heritage within Mi'kma'ki, and their Treaty rights to continue harvesting the resources of their traditional territory.

8.5.7.2 Analysis of Effects

8.5.7.2.1 Residual Effects of Proposed Project

The predicted residual environmental effects of the Project on the Mi'kmaq of Nova Scotia are assessed to be adverse, but not significant following implementation of applicable mitigation measures (Table 6.14-9). Potential residual effects to the Mi'kmaq of Nova Scotia's physical health from Project-related changes to the environment (e.g., changes to country foods, water, and soils) are anticipated to be not significant. Potential pathways of effects on human health associated with consumption of or contact with country foods, water and soils will be minimized by implementing mitigation measures such as dust control, water management infrastructure and processes and water treatment (if required). Mitigation measures to reduce atmospheric emissions will be implemented to minimize potential related effects on human health, and the residual risk to human health from inhalation of Project-related dust and airborne contaminants is considered low.

Mitigation measures and conclusions relating to impacts to traditional practices and socio-economic, mental and social well-being will continue to be evaluated directly with Millbrook First Nation and the Mi'kmaq of Nova Scotia throughout the environmental assessment process, and throughout the lifecycle of the Project. AMNS has reviewed with Millbrook First Nation and the Mi'kmaq of Nova Scotia the proposed mitigation measure of a multi-use bypass road to access to lands surrounding the Haul Road and north of the Beaver Dam Mine Site, as well as the availability and proposed suitability of nearby Crown land as partial mitigation for loss of access during the eight years that the mine will be limiting access to the Beaver Dam Mine Site and Haul Road. Feedback on the summary of impacts and proposed mitigation measures is expected once Millbrook First Nation community meetings can be safely and effectively completed, given COVID restrictions. Mitigations and monitoring can be adjusted at the permitting stage as necessary.

8.5.7.2.2 Effects of Other Projects in the Area

The Project is located in a rural area, with a rural community of residents, and the presence of regional forestry activities. The RAA for the Mi'kmaq of Nova Scotia is spatially large, based on historical migration patterns and movements of the Mi'kmaq and territorial boundaries of the *Eskikewa'kik (Skin Dressing Territory).* This RAA allows for impacts that may be felt locally from the Project to be contextualized within the geographical setting of *Eskikewa'kik* land and resource use.

There are 37 identified projects within the RAA for the Mi'kmaq of Nova Scotia (Figure 8.5-6A). Cumulative effects on the Mi'kmaq of Nova Scotia are indirect and will be caused by effects to other VCs from the Project and other projects that have been shown to act cumulatively with overlapping effects within the RAA.

The 37 projects can be categorized in five categories by activity:

- **Mining** including Fifteen Mile Stream Gold Project, Touquoy Gold Project, Cochrane Hill Gold Project, Beaver Dam Gold Project, Beaver Dam Haul Road use, Anaconda Gold Mine, Scozinc Mine, Tangier and Dufferin Gold Mines, and the Goldboro Gold Mine.
- **Pits and Quarries** including Cooks Sand and Gravel, National Gypsum, Murchyville Gypsum, Porcupine Mountain, Chedabucto Quarry, Black Point Quarry, Sheet Harbour Quarry, Goff's Quarry, Mosher Lake Limestone, and Loch Katrine Quarry.
- **Forestry and Associated** including forestry activities, Taylor Lumber Mill, Great Northern Timber Wood Chipping and Shipping, and Great Northern Timber Pellet Facility.
- **Wind Power Projects (WPP)** including Gaetz, Mulgrave, Chebucto/Pockwock, Sable, Terence Bay WPPs.
- **Infrastructure and other** including the Lake Major Dam Replacement, Port of Sheet Harbour, Highway 107 Bedford to Burnside Connector, Liquid Asphalt Storage, Waste Dangerous and Non Dangerous Goods Storage, Canso Spaceport Facility Goldbro LNG Facility, Goldboro Gas Plant, Bearpaw Pipeline, and the Highway 102 Aerotech connector.

8.5.7.2.3 Cumulative Effects on the Mi'kmaq of Nova Scotia

Cumulative effects on the Mi'kmaq of Nova Scotia are indirect and will be caused by effects to other VCs from the Project and other projects that have been shown to act cumulatively with overlapping effects within the RAA.

Assessment of the potential for cumulative effects to the Mi'kmaq of Nova Scotia is included in consideration of its socio-economic, socio-cultural, and/or traditional importance; in recognition of potential or established Aboriginal and Treaty rights; and due to the nature of potential Project-VC interactions, and cumulative-VC interactions of other projects in the RAA. Additionally, subparagraph 5(1)(c) of CEAA 2012 and the EIS Guidelines require assessment of potential effects to Indigenous Peoples including consideration of:

- Health and socio-economic conditions;
- Physical and cultural heritage, including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; and
- Current use of lands and resources for traditional purposes.

In order to evaluate the potential cumulative effect to the Mi'kmaq from the Project and other projects within the RAA, a summary of VC cumulative conclusions identified within Section 8 has been prepared and is presented in Table 8.5-8. These conclusions are then considered in the context of the broader categories of projects within the RAA provided in Section 8.5.7.2.2, and then finally reviewed to evaluate the potential effect to the health and socio-economic condition, physical and cultural heritage and current use of the lands for traditional purposes of the Mi'kmaq of Nova Scotia.

Prepared For:

Atlantic Gold

FIGURE 8.5-6A

Beaver Dam Mine Project

Cumulative Effects Assessment: Mi'kmaq of Nova Scotia

Porcupine Mountain Quarry
Mulgrave Wind Power Project
Loch Katrine Quarry
Chedabucto Aggregates Quarry
Black Point Quarry Project
Canso Spaceport Facility
Sable Wind Power Project
Cochrane Hill Gold Project
Bearpaw Pipeline Project
Anaconda Gold Mine
Goldboro LNG Facility
Goldboro Gas Plant
Fifteen Mile Stream Past Mining Operations
Fifteen Mile Stream Forestry Operations
Great Northern Timber Pellet Facility
Mosher Lake Limestone Co.
NSSA - AMP: WRSH Doser
Beaver Dam Mine Site
Beaver Dam Past and Future Mining Operation
Regional Forestry Operations
Touquoy Mine Site
Haul Road
Touquoy Mining Operations
Dufferin Gold Mine
Port of Sheet Harbour
Sheet Harbour Quarry
Great Northern Timber Wood Chipping and Shipping
Tangier Gold Mine
Cook's Brook Sand and Gravel Pit
ScoZinc Ltd mine
National Gypsum quarry
Taylor Lumber Co. Ltd. mill
Murchyville Gypsum Mine
Aerotech Connector
Goffs Quarry Expansion
Chebucto - Pockwock Wind Power Project
Highway 107 - Bedford to Burnside
Waste Dangerous and Non-Dangerous Goods
Waste Dangerous and Non-Dangerous
Liquid Asphalt Storage
Lake Major Dam Replacement
Gaetz Brook Wind Farm
Chebucto Terence Bay Wind Power Project

Note: Forestry operations occur throughout the RAA and are not displayed on this figure

Category

- Forestry and Associated
- Mining
- Other
- Other Industries
- Pits and Quarries
- Wind Power Projects

- Project Area
- Mi'kmaq Regional Assessment Area

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 10 20 40 km

1:760,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: KR

Date: 2/25/2021

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Document Name: BD_EIS_Figure8-4-X_CEA_Mikmaq_Categories

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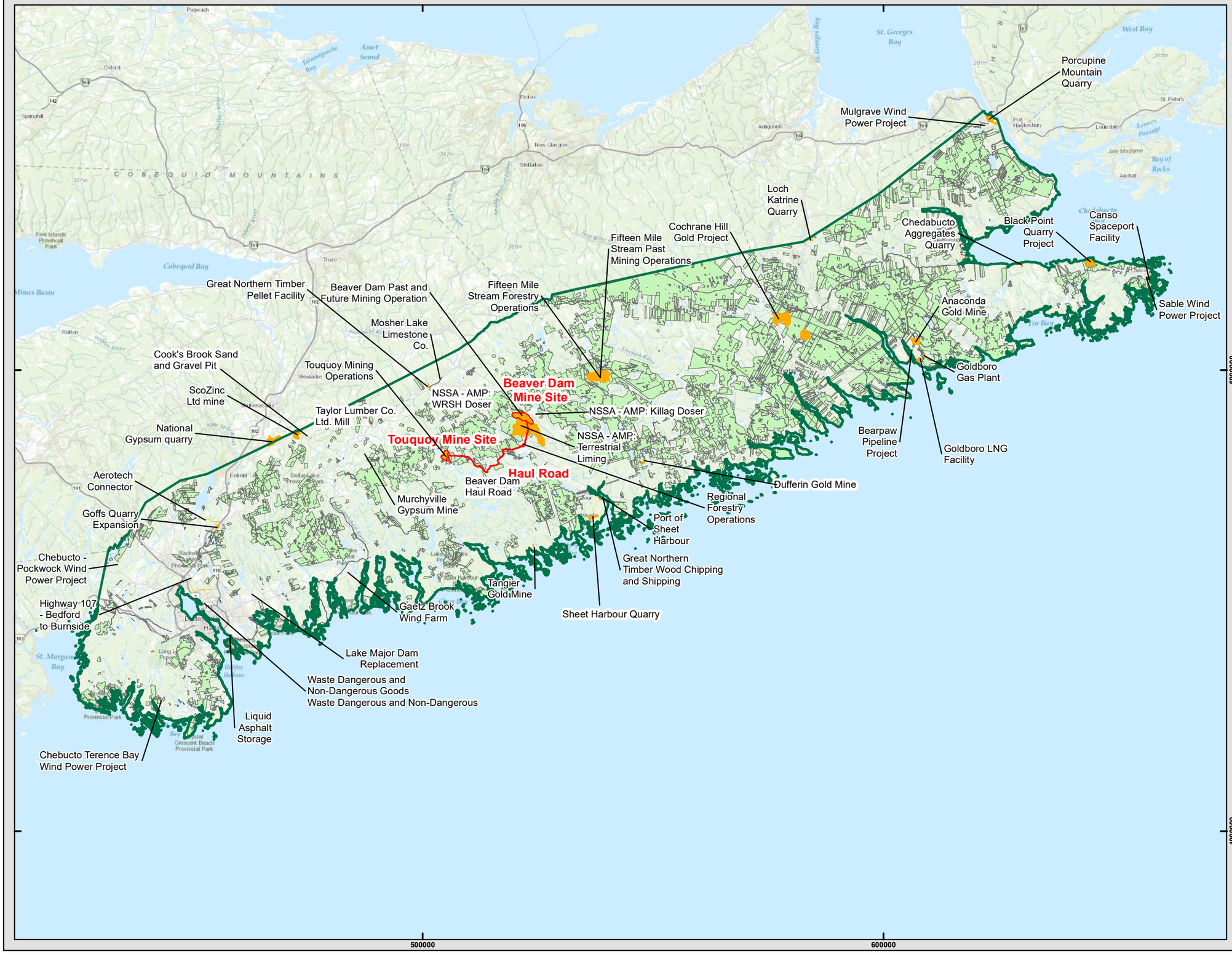

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FIGURE 8.5-6B

Beaver Dam Mine Project

Cumulative Effects Assessment: Mi'kmaq of Nova Scotia

- Projects
- Crown Land
- Project
- Mi'kmaq Regional Assessment Area

Note: Forestry operations occur throughout the RAA and are not displayed on this figure

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 10 20 40 km

1:760,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: KR

Date: 2/25/2021

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Document Name: BD_EIS_Figure8-4-X_CEA_Mikmaq_Polygons

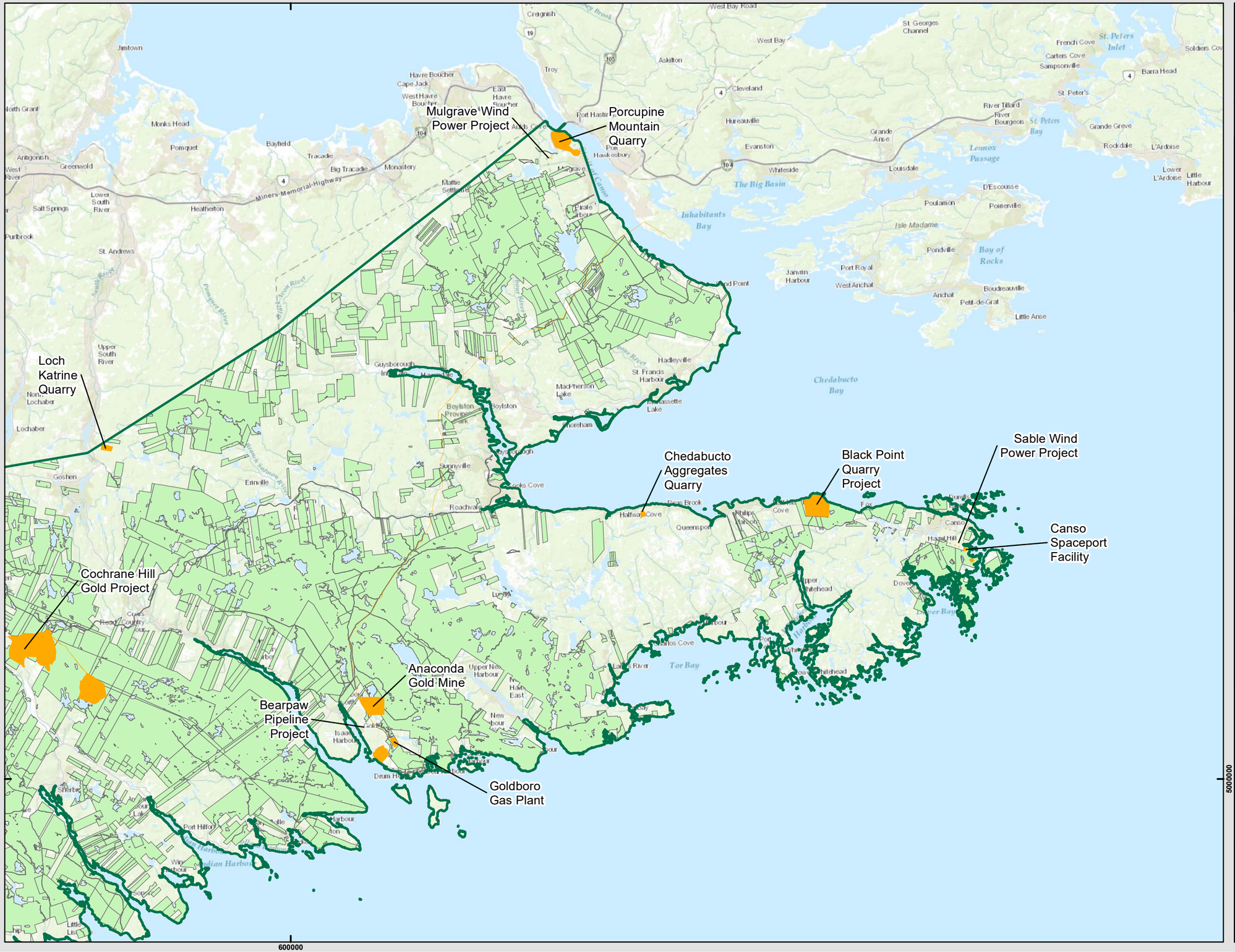

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FIGURE 8.5-6C

Beaver Dam Mine Project

Cumulative Effects Assessment: Access to Crown Land within the Mi'kmaq Regional Assessment Area Eastern

Projects

Crown Land

Mi'kmaq Regional Assessment Area

Note: Forestry operations occur throughout the RAA and are not displayed on this figure

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 4 8 16 km

1:300,753 Scale when printed @ 11" x 17"

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Reviewed By: KR

Date: 2/25/2021

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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Document Name: BD_EIS_Figure8-4-X_CEA_Mikmaq_Polygons_East

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FIGURE 8.5-6D

Beaver Dam Mine Project

Cumulative Effects Assessment: Access to Crown Land within the Mi'kmaq Regional Assessment Area Central

Projects
Crown Land
Project
Mi'kmaq Regional Assessment Area

Note: Forestry operations occur throughout the RAA and are not displayed on this figure

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 3.75 7.5 15 km

1:300,000 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: KR

Date: 2/25/2021

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

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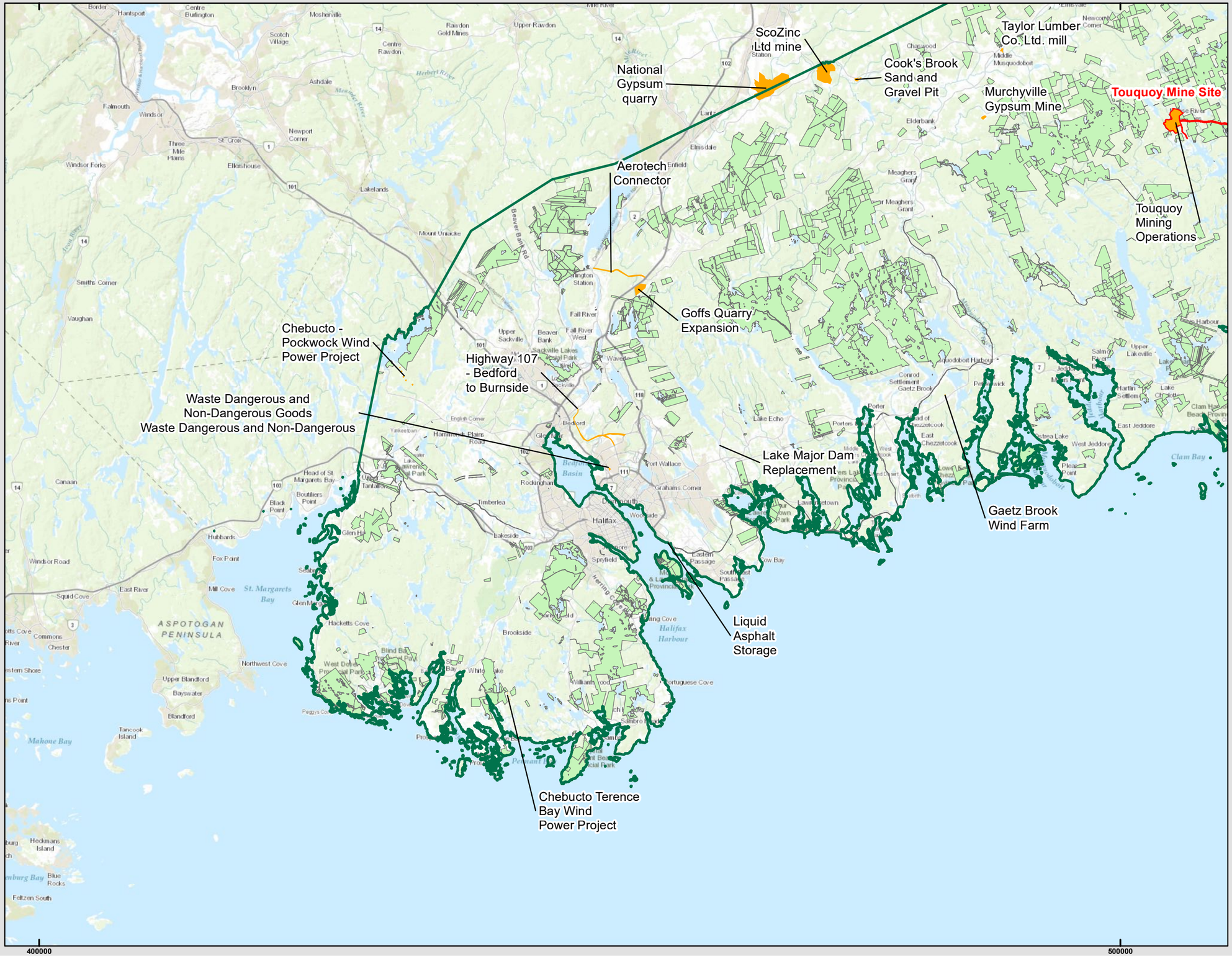
Document Name: BD_EIS_Figure8-4-X_CEA_Mikmaq_Polygons_Central

500000

5000000

Great Northern Timber Pellet Facility
Mosher Lake Limestone Co.
Fifteen Mile Stream Past Mining Operations
Fifteen Mile Stream Forestry Operations
Cochrane Hill Gold Project
Cook's Brook Sand and Gravel Pit
Taylor Lumber Co. Ltd. mill
Beaver Dam Past and Future Mining Operation
Beaver Dam Mine Site
NSSA - AMP: Killag Doser
NSSA - AMP: WRSH Doser
NSSA - AMP: Terrestrial Liming
Beaver Dam Haul Road
Touquoy Mine Site
Haul Road
Regional Forestry Operations
Murchyville Gypsum Mine
Touquoy Mining Operations
Dufferin Gold Mine
Port of Sheet Harbour
Tangier Gold Mine
Great Northern Timber Wood Chipping and Shipping
Sheet Harbour Quarry
Gaetz Brook Wind Farm



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Atlantic Gold

FIGURE 8.5-6E

Beaver Dam Mine Project

Cumulative Effects Assessment: Access to Crown Land within the Mi'kmaq Regional Assessment Area Western

- Projects
- Crown Land
- Project
- Mi'kmaq Regional Assessment Area

Note: Forestry operations occur throughout the RAA and are not displayed on this figure

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 4.25 8.5 17 km

1:326,852 Scale when printed @ 11" x 17"

Drawn By: EP
Reviewed By: KR

Date: 2/25/2021

McCallum Environmental Ltd.

Document Name: BD_EIS_Figure8-4-X_CEA_Mikmaq_Polygons_West

Table 8.5-8: Analysis of Cumulative Effect on the Mi'kmaq of Nova Scotia

Valued Component	Cumulative Effects Residual Effect Summary	Projects (by Category) within RAA and interaction with VC cumulative effects conclusions	Impact to the Mi'kmaq of Nova Scotia			Residual Effect
			Health/Socio	Physical/ Cultural	Traditional Use	
Noise	Additive periods of potential effects from the Project and forestry operations are likely to be limited in frequency. Additive cumulative effects may occur when forestry operations occasionally coincide with Project activities, and hauling ore from Beaver Dam, and FMS and Cochrane Hill concentrate to Touquoy for processing. Cumulative effects to baseline noise levels from the use of the Beaver Dam Haul Road by Beaver Dam, FMS and Cochrane Hill Gold Projects will occur regularly throughout the operational phase of the Project.	Within the noise RAA, forestry operations were considered in the cumulative effects assessment, and cumulative noise impacts along the BD Haul Road from truck traffic from the Project, Cochrane Hill Gold Project, the Beaver Dam Mine Project, and forestry activity. The NSSA AMP lies within the Noise RAA, but is not expected to produce noise on any consistent or substantial basis aside from occasional (annual) helicopter activity. There is no further cumulative impact from noise to the Mi'kmaq within the broader RAA. Individual projects as described in Section 8.5.7.2.2. contribute spatially isolated noise impacts within the RAA, but do not overlap with the Project.	Limited to cumulative effects described within Noise sub-section of Section 8. Specific to BD Haul Road and potential for additive (sporadic) Project + Forestry activities within the Beaver Dam Mine Site	No impact from noise to physical and cultural including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance	Limited to cumulative effects described within Noise sub-section of Section 8. Noise impacts from other projects would be felt in isolation of the Project and its cumulative effects	No additional residual effect beyond that defined in the subsection of Section 8 dedicated to the Noise VC.
Air	Additive periods of potential effects from the Project and forestry operations are likely to be limited in frequency. Elevated dust levels are possible when forestry operations coincide with hauling ore from the Beaver Dam Mine Site to the Touquoy Processing Facility along with concentrate from Fifteen Mile Stream and Cochrane Hill Projects. Cumulative effects to ambient dust levels from the use of the Beaver Dam Haul Road by the Project and Fifteen Mile Stream and Cochrane Hill Gold Project will occur regularly throughout the operational phase of the Project. These cumulative effects are not considered significant, and the Proponent has committed to 80% dust suppression along the Beaver Dam Haul Road to reduce dust levels.	Within the air RAA, fifteen projects were considered in the cumulative effects assessment. These projects were determined to have spatial and temporal overlap with the Project interactions, and were carried through the evaluation of cumulative effects. There is no further cumulative impact from air to the Mi'kmaq within the broader RAA. Individual projects as described in Section 8.5.7.2.2. contribute spatially isolated air impacts within the RAA, but do not overlap with the Project.	Limited to cumulative effects described within Air sub-section of Section 8. Specific to BD Haul Road and potential for additive (sporadic) Project + Forestry activities within the Beaver Dam Mine Site	No impact from air to physical and cultural including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance	Limited to cumulative effects described within Air sub-section of Section 8. Air impacts from other projects would be felt in isolation of the Project and its cumulative effects	No additional residual effect beyond that defined in the subsection of Section 8 dedicated to the Air VC.
Light	Additive periods of potential effects from the Project and forestry operations are likely to be limited in frequency. However, cumulative effects to ambient light levels from the use of the Beaver Dam Haul Road Use by Fifteen Mile Stream, Cochrane Hill Gold Projects and forestry activities will occur regularly throughout the operational phase of the Project, although maximum light levels are limited by two trucks passing by at a single occurrence in space and time.	Within the light RAA, only forestry operations were considered in the cumulative effects assessment, and cumulative light impacts along the BD Haul Road from truck traffic from the Project, Cochrane Hill Gold Project, the Beaver Dam Mine Project, and forestry activity. The NSSA AMP lies within the Light RAA, however light production is not involved in the acid mitigation project, so it was not carried through the evaluation of cumulative effects to light. There is no further cumulative impact from light to the Mi'kmaq within the broader RAA. Individual projects as described in Section 8.5.7.2.2. contribute spatially isolated light impacts within the RAA, but do not overlap with the Project.	Limited to cumulative effects described within Light sub-section of Section 8. Specific to BD Haul Road and potential for additive (sporadic) Project + Forestry activities within the Beaver Dam Mine Site	No impact from light to physical and cultural including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance	Limited to cumulative effects described within Light sub-section of Section 8. Light impacts from other projects would be felt in isolation of the Project and its cumulative effects	No additional residual effect beyond that defined in the subsection of Section 8 dedicated to the Light VC.
Surface Water	Additive periods of potential effects from the Project and forestry operations are likely to be limited in frequency and limited in scale, assuming forestry activities are well managed. The Beaver Dam Mine Project and the Fifteen Mile Stream Gold Project and Cochrane Hill Gold Project interaction cumulatively at the Touquoy Mine Site with the deposition of tailings into the exhausted pit and the resulting effect to the Moose River. With water treatment, this residual effect is considered low magnitude. The presence of historical tailings at Beaver Dam Mine Site has an additive effect with the Project, resulting in a positive residual effect through improvement of water quality with property management and disposal of historical tailings during Project development.	Within the surface water RAA, forestry operations and the NSSA AMP were considered in the cumulative effects assessment; along with the Touquoy Mine Project. There is no further cumulative impact of surface water to the Mi'kmaq within the broader RAA. Individual projects as described in Section 8.5.7.2.2. contribute spatially isolated surface water impacts within the RAA, but do not overlap with the Project.	Limited to cumulative effects described within Surface Water sub-section of Section 8. Recreational swimming within Cameron Flowage has been evaluated from Project water quality. Adverse health effects from recreational water use (swimming) are not anticipated. Swimming in Moose River has been discounted due to low water levels.	No impact from surface water to physical and cultural including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance	Limited to cumulative effects described within Surface Water sub-section of Section 8.	No additional residual effect beyond that defined in the subsection of Section 8 dedicated to the Surface Water VC.

Valued Component	Cumulative Effects Residual Effect Summary	Projects (by Category) within RAA and interaction with VC cumulative effects conclusions	Impact to the Mi'kmaq of Nova Scotia			Residual Effect
			Health/Socio	Physical/ Cultural	Traditional Use	
Fish and Fish Habitat	Additive periods of potential effects from the Project and forestry operations are likely to be limited in frequency and limited in scale, assuming forestry activities are well managed. The NSSA AMP is expected to provide a positive residual impact to fish and fish habitat. Water quality will meet CCME Freshwater Aquatic Guidelines with necessary water treatment and thus will not impact fish and fish habitat in the receiving environment (Anti-Dam Flowage) The Fifteen Mile Stream Project and the Project interaction cumulatively at the Touquoy Mine Site with the deposition of tailings into the exhausted pit and the resulting effect to the Moose River. With water treatment, this residual effect is considered low magnitude and the effect to Mi'kmaq consumption of country foods (fish) has been concluded to be low.	Within the fish RAA, forestry operations and the NSSA AMP were considered in the cumulative effects assessment; along with the Touquoy Mine Project. There is no further cumulative impact of surface water to the Mi'kmaq within the broader RAA. Individual projects as described in Section 8.5.7.2.2. contribute spatially isolated surface water impacts within the RAA, but do not overlap with the Project.	Limited to cumulative effects described within Surface Water sub-section of Section 8. It is unlikely that effluent releases will result in levels of metals in country foods (fish) that would be harmful to human health.	No impact from fish to physical and cultural including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance	Limited to cumulative effects described within Fish sub-section of Section 8. Fishing activities to support Mi'kmaq traditional uses and commercial fisheries are not expected to be affected by the Project or its cumulative impact with identified projects as described in the Fish sub-section of Section 8.	No additional residual effect beyond that defined in the subsection of Section 8 dedicated to the Fish VC.

The cumulative effect of all projects within the RAA combined result in a loss of potential access to lands for traditional or spiritual purposes. The total area of the identified projects in the RAA was calculated in order to quantify the area of land (for the purposes of this exercise, limited to crown land only) which may be lost for traditional purposes. The total estimated project footprint was calculated for each individual project, using publicly available study area boundaries where available, property boundaries, and aerial photo interpretation of project infrastructure if a study area boundary was not publicly available. As the calculations were based on each project's study area or property boundary rather than actual infrastructure, this method is considered an overestimate of land lost to traditional purposes. Furthermore, all projects were considered, regardless of the temporal nature of a project's implementation (past, present or future). As such, this exercise presents a worst-case scenario, assuming all projects overlap temporally to limit access for the Mi'kmaq for their traditional practices.

Two projects have been excluded from this spatial land use exercise. The Nova Scotia Salmon Association's Acid Mitigation Project in the West River Sheet Harbour was not considered as removing land available for traditional or spiritual purposes. These habitats are still available, but work has been completed to mitigate the effects of acid rain on the watercourses. Secondly, timber harvesting was not considered as a loss of access to land for traditional purposes. Reliable, accurate data quantifying the area of timber harvesting which occurs on private land and crown land is not available. Timber harvesting changes the habitat type for some time, but it does not result in permanent change in the capacity of the forest to support habitats and species (i.e., natural succession will, in time, allow forest habitat to regenerate), and it does not result in loss of access to the land on any time frame, with the exception of during active cutting periods. As such, these two projects were not quantified for this cumulative effects assessment.

The total area of projects within the RAA, and the proportion of crown land is presented in Table 8.5-9 and 8.5-10. All projects quantified within the RAA account for 6,282 ha of total area, 3,148 ha of which is crown land. The loss of access to a maximum area of 3,148 ha from all identified projects in the RAA accounts for 0.32% of all land within the RAA, and 0.88% of available crown land within the RAA. The maximum project footprints used for this calculation are presented on Figure 8.5-6A to 8.5-6E. Figure 8.5-7 shows the proportion of industrial development in the RAA, which accounts for less than 1% of the region (0.6%). The proposed Beaver Dam Mine Project, as well as all other AMNS projects, account for only 0.4% of the RAA (Figure 8.5-7).

Table 8.5-9: Cumulative Projects in the Regional Assessment Area

	Development Type	Industrial Developments	Area (ha)
Existing			
1	Mine	Touquoy Mine	219.99
2	Mine	Dufferin Gold Mine	46.41
3	Mine	Tangier Gold Mine	29.90
4	Mine	ScoZinc Ltd Mine	236.14
5	Quarry	Chedabucto Aggregates	22.55
6	Quarry	Black Point Quarry	371.53
7	Quarry	Porcupine Mountain Quarry	278.36
8	Quarry	Mosher Lake Limestone	3.44
9	Quarry	Murchyville Gypsum Mine	11.61
10	Quarry	Cook's Brook Sand Gravel	13.80
11	Quarry	National Gypsum Quarry	475.94
12	Quarry	Goff's Quarry Expansion	69.16
13	Quarry	Loch Katrine Quarry	47.51

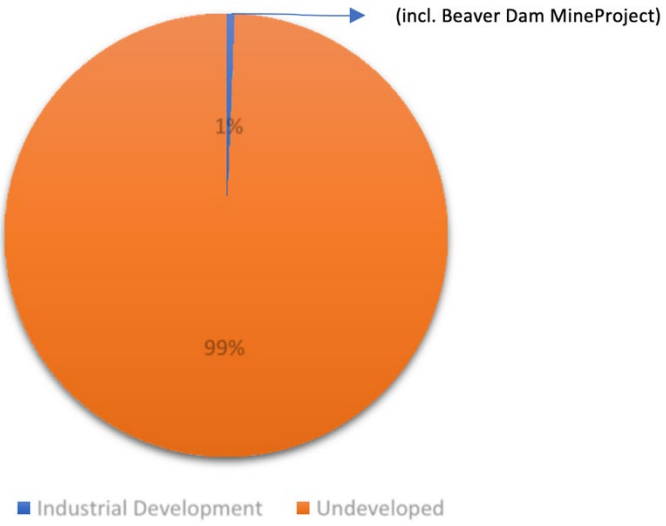
Table 8.5-9: Cumulative Projects in the Regional Assessment Area (continued)

	Development Type	Industrial Developments	Area (ha)
14	Wind	Chebucto Terence Bay Wind	1.39
15	Wind	Gaetz Brook Wind Farm	1.21
16	Wind	Chebucto Pockwock Wind	9.54
17	Wind	Sable Wind Power	5.91
18	Wind	Mulgrave Wind Power	3.80
19	Hydro	Lake Major Dam Replace	0.09
20	Timber Mill	Great Northern Timber (Sheet Harbour)	42.80
21	Timber Mill	Great Northern Timber (Musquodoboit)	37.83
22	Timber Mill	Taylor Lumber Co. Mill	7.42
23	Infrastructure	Port of Sheet Harbour	25.70
24	Infrastructure	Highway 107	110.68
25	Infrastructure	Liquid Asphalt Storage	1.13
26	Infrastructure	Waste Dangerous and Non Dangerous Goods	3.94
		Subtotal	*2,077.78*
Approved			
27	Quarry	Sheet Harbour Quarry	156.54
28	Oil and Gas	Goldboro LNG Facility	136.31
29	Oil and Gas	Goldboro Gas Plant	36.11
30	Infrastructure	Canso Spaceport Facility	21.82
		Subtotal	*350.78*
Proposed			
31	Mine	Beaver Dam Mine	470.65
32	Mine	Haul Road Study Area (including existing Mooseland Road Corridor)	295.97
33	Mine	Fifteen Mile Stream Study Area	1,139.60
34	Mine	Cochrane Hill Gold	1,410.22
35	Mine	Anaconda Gold Mine	283.54
36	Oil and Gas	Bearpaw Pipeline Project	183.06
37	Infrastructure	Aerotech Connector	70.66
		Subtotal	*3,853.70*
		Total	**6,282.22**

Table 8.5-10: Analysis of Cumulative Effect on Access to Crown Land within the Mi'kmaq of Nova Scotia Regional Assessment Area

	Total Area (ha)	Total Area of Crown Land
Regional Assessment Area	974,571	357,647
CEA Projects within Regional Assessment Area	6,282	3,148

Figure 8.5-7: Percent Regional Industrial Development in Regional Assessment Area



8.5.7.3 Mitigation

In part to mitigate the adverse effects on the use of surface waters and the fish that inhabit them for traditional purposes, the Proponent has committed to water treatment during operations and during post closure as required, at the Beaver Dam Mine Site. In order to mitigate the adverse effects of dust dispersion onto plants and berries for traditional purposes that inhabit the forests surrounding the Beaver Dam Mine Site and Haul Road, the Proponent has committed to the use of chemical dust suppressants as required to reduce dust by 80% on the Haul Road.

The Beaver Dam Mine Site and Haul Road will limit access to Millbrook First Nation and other Mi'kmaq of Nova Scotia for a period of eight years. The proposed property extents of the Beaver Dam Mine Site and Haul Road encompasses a 727-ha area, of which 123 ha is Crown land.

The Proponent has committed to the development of a multi-use bypass road parallel to the Haul Road. This bypass road will allow continued access for the Mi'kmaq of Nova Scotia and specifically, Millbrook First Nation community members, to lands and lakes used for traditional purposes to the south and north of the Beaver Dam Haul Road between Highway 224 and the Mooseland Road, to the east and west of the Beaver Dam Haul Road between Highway 224 and the Beaver Dam Mine Site, as well as access to the lands north of the Beaver Dam Mine Site.

Tracts of crown land are present in close proximity to the Project (Figure 6.14-7). These tracts of land are adjacent to the Project Area and, in most cases, overlap with areas with documented traditional use (MFC 2019 – Under Confidential Cover). These areas of land are publicly owned, not limited by provincial or federal parks and protected areas, are all accessible and available with consideration of the mitigation measures described in CEAA 2-48. These areas are presented as potential suitable alternative areas for traditional practices to continue, during the eight-year temporal scale of the Project.

The Proponent is committed to engaging in fisheries offsetting plans, and wetland compensation activities for the fish habitat and wetland loss associated with the Project as required by the Fisheries Act Authorization Process and provincial wetland alteration process for the Project.

The mitigation of the effects on land use and resources for traditional purposes originating from regional forestry and land management practices falls outside the scope of the project Proponent's authority and responsibility.

8.5.7.4 Residual Cumulative Effects and Significance Assessment

A significant cumulative adverse residual effect on the Mi'kmaq of Nova Scotia is defined as an environmental effect that results in one or more of the following outcomes:

Long-term (greater than 20 years) or permanent loss of the availability of, or access to, land and resources currently relied on for traditional use practices; or if long-term or permanent loss is expected, no allowance for agreed-upon compensation with the affected Mi'kmaq community(s). A twenty-year temporal scale was chosen to represent a generational loss of access to an area.

Human health risk assessments are inherently conservative, and hence, development of a threshold of significance for human health is complicated, since risk estimates tend to be biased high, based on the degree of conservatism included in any given risk assessment. The threshold for a significant residual effect has been defined as a potential adverse effect to health, identified through the conclusions presented in the HHRA.

An unmitigated loss of a physical or cultural structure, site or thing that is of historical, archaeological, paleontological or architectural significance to the Mi'kmaq.

Short-term (less than 20 years) loss of availability of land and resources caused by displacement due to Project activities are not considered to be significant.

The significance of potential effects on potential or established Aboriginal or treaty rights is a matter of consideration by the Crown and Mi'kmaq representatives (Assembly of Nova Scotia Chiefs and the Governments of Canada and Nova Scotia).

Assuming that the proposed mitigation and compensation measures are applied for the Project, and that they achieve their objectives, the predicted residual cumulative effects on the Mi'kmaq of Nova Scotia are assessed to be adverse, but not significant (Table 8.5-11).

Historical and current land use with the region has affected the local habitats in ways that have affected the local distribution and abundance of several species of flora and fauna. However, the total area of crown land that has been limited by all projects identified within the RAA is only 0.88% of available crown land present within the RAA.

Table 8.5-11: Residual Cumulative Environmental Effects on the Mi'kmaq of Nova Scotia

Residual Adverse Cumulative Effects (After Mitigation and Compensation if required)	Significance Levels						Overall Significance of Residual Adverse Effects (and Rationale)
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	
Effects to Mi'kmaq of Nova Scotia and their traditional land use as a result from impacts to air quality, noise, light, surface water, fish habitat, and human health, and cumulative limitations to land use for traditional purposes from multiple projects within the RAA.	L Mitigation and best management strategies reduce magnitude of impact. The loss of access to a maximum area of 6,282 ha from all identified projects in the RAA accounts for 0.64% of all land within the RAA, and 0.88% of available crown land within the RAA.	LAA Direct cumulative effects within PA, indirect cumulative effects within LAA. BD Haul Road cumulative effects within LAA for BD Haul Road.	A Seasonal windows applicable. Air dispersion affected by season and wind direction, noise and light effects will be limited by foliage when present on trees, effects to fish and fish habitat are more sensitive during spawning windows (spring and fall).	LT Effects will extend beyond 8+ years – will extend to eight years of limited access to the Beaver Dam Mine Site, less than the defined 20 years in the context of the Mi'kmaq of Nova Scotia VC significant threshold.	R VC interaction will occur regularly.	R VC interaction will recover to baseline after Project activities are completed.	Moderate Adverse Effect (Not Significant) Assuming that the proposed compensation measures are applied for the Project and that they achieve their objectives, the predicted residual cumulative effects on the Mi'kmaq of Nova Scotia with regards to impacts to air quality, noise, light, surface water, fish habitat, and human health, are assessed to be adverse, but not significant. Loss of access is limited to 0.88% of available crown land within the RAA.

Notes: Notes: Specific characterization criteria listed below for Mi'kmaq of Nova Scotia are defined in Section 6.14.6.2. Standard characterization criteria listed below are defined in Section 5.11, Table 5.11-1.

Magnitude		Geographic Extent		Timing		Duration		Frequency		Reversibility	
N	Negligible	PA	Project Area	N/A	Not Applicable	ST	Short-Term	O	Once	R	Reversible
L	Low	LAA	Local Assessment Area	A	Applicable	MT	Medium-Term	S	Sporadic	IR	Irreversible
M	Moderate	RAA	Regional Assessment Area			LT	Long-Term	R	Regular		
H	High					P	Permanent	C	Continuous		

8.5.7.5 Follow-up and Monitoring Programs

No additional monitoring is recommended, beyond that provided in each VC section and associated cumulative effects section. The monitoring and follow-up of the residual cumulative effects, primarily caused by past and ongoing forestry practices, falls outside the scope of the project Proponent's authority and responsibility.

Follow-up and monitoring of the site reclamation for the Beaver Dam Mine Site will be required. In addition, it is expected that the development of benefit agreement(s) and implementation of the overall Mi'kmaq engagement strategy with regards to the Project will include regular review of compliance and effects monitoring programs associated with other VCs, as well as monitoring of Project benefits to the Mi'kmaq of Nova Scotia.

8.6 Cumulative Effects Summary

A Cumulative Effects Assessment was carried out to meet the general requirements of the CEAA 2012, as well as the specific requirements laid out in the *Guidelines for the Preparation of an* Environmental *Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012* and *Nova Scotia Registration Document pursuant to the Nova Scotia Environment Act – Beaver Dam Mine Project – Atlantic Gold Corporation*.

The VCs included in the Cumulative Effects Assessment into consideration were the following:

- Physical Environment:
  - Noise;
  - Air;
  - Light; and
  - Surface Water Quality and Quantity.
- Biophysical Environment:
  - Fish and Fish Habitat; and
  - Species of Conservation Interest and Species at Risk.
- Socio-Economic Environment:
  - Mi'kmaq of Nova Scotia.

Major industrial projects that have or are taking place within each VCs respective RAA were identified. Figure 8.5-6A to 8.5-6E identifies the complete suite of Projects which were considered in the Cumulative Effects Assessment.

The main conclusions of the Cumulative Effects Assessments are as follows:

- The cumulative effects to Noise, Air and Light are considered to be adverse but not significant. The primary pathway for cumulative effects for these VCs is through increased traffic along the Beaver Dam Haul Road. Logging trucks, and traffic from both the FMS and Cochrane Hill Projects will account for approximately 11.6% of the total proposed traffic rates. This is not expected to result in a significant cumulative effect to any of these three VCs, as described in Sections 8.5.1 to 8.5.3.
- The primary pathway for cumulative effects regarding surface water quantity and quality is through the addition of the Project, the proposed expansion of the Touquoy pit and subsequent disposal of Touquoy tailings in the exhausted pit, the Fifteen

Mile Stream Gold Project and Cochrane Hill Gold Project to the processing and waste disposal facilities at the Touquoy Mine Site. The cumulative effects of these combined projects on the receiving environments are adverse, but not significant, provided all mitigation measures are implemented.

- Cumulative effects to fish and fish habitat can occur directly (through direct loss of fish habitat, for instance), or indirectly through effects of projects on water quantity and quality. No significant cumulative effects to surface water quantity and quality is expected. Timber harvesting is a predominant land use within the fish and fish habitat RAA. It is expected that timber harvesting be carried out under the Wildlife and Watercourse Protection Regulations, reducing the potential cumulative effect on fish and fish habitat. Therefore, the primary pathway for cumulative effects to fish and fish habitat is through direct fish habitat loss. The Beaver Dam Project will result in approximately 4.18 ha of direct loss of fish habitat to allow for construction of the Open Pit and associated infrastructure. The Project is expected to result in an additional 322 m^2 of indirect impact to fish habitat based on flow reduction in local catchment areas. There is spatial and temporal overlap between the Project and terrestrial liming work being completed by the NSSA, however the NSSA AMP work is expected to result in a positive residual effect to fish and fish habitat, and will not lead to an adverse residual effect to fish and fish habitat when combined with the proposed Beaver Dam Project.
- Overall, the generalized disturbance of the landscape by forestry activities, past, present and future are the main source of cumulative effects of habitats, flora, terrestrial fauna and birds throughout the area. These cumulative effects also lead to effects on current use of land and resources for traditional purposes by the Mi'kmaq of Nova Scotia and to effects to priority species (SOCI and SAR). The maximum Project edge effect will affect 237 ha of interior forest habitat, which accounts for 0.3% of predicted interior forest in the RAA. There is limited additional development pressures from other projects in the RAA, as demonstrated by the few projects identified within this evaluation with small footprints of disturbance.
- The main pathways for cumulative effects to the Mi'kmaq of Nova Scotia are described as any adverse effect to the health and socioeconomic conditions, physical and cultural heritage, and current use of lands and resources for traditional purposes, as described in detail in Section 8.5.7. Cumulative effects of the Project on the Mi'kmaq of Nova Scotia, considering these three primary pathways, has been assessed as adverse, but not significant. The loss of access to a maximum area of 6,282 ha from all identified projects in the RAA accounts for 0.64% of all land within the RAA, and 0.88% of available crown land within the RAA. The largest regional impact to the landscape appears to be from regional forestry activities based only on aerial photography review. This impact could not be quantified herein due to a lack of publicly available data to support quantitative analysis.

Once the mitigation measures are taken into account, there are no significant residual cumulative effects anticipated for the VCs evaluated herein. The predicted residual cumulative effects on the Mi'kmaq of Nova Scotia with regards to indirect effects from impacts to water quality, wetland habitats, and road safety, are assessed to be adverse, but not significant.

Historical and current land use within the region has undeniably affected the local habitats in ways that have affected the local distribution and abundance of several species of flora terrestrial fauna and birds, including SOCI and SAR. However, the mitigation of the effects originating from regional forestry and land management practices falls outside the scope of the Project Proponent's authority and responsibility.