Beaver Dam Mine Project
Responses to the Information Request, Round 2
October 2021

Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment

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October 29, 2021

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Bridget Tutty, Environmental Assessment Officer
Environmental Assessment Branch
Nova Scotia Environment
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Dear Ms. MacCarthy and Ms. Tutty,

Atlantic Mining NS Inc, a wholly owned subsidiary of St Barbara Limited, is pleased submit the Responses to the Information Request, Round 2, for the Beaver Dam Mine Project. An Updated 2021 Environmental Impact Statement (EIS) as per the *Canadian Environmental Assessment Act, 2012* and the Environmental Assessment Registration Document (EARD) as per Nova Scotia *Environmental Assessment Regulations* will be submitted concurrently to support the Responses to Information Requests.

As per our July 20, 2021 meeting, it was agreed upon that the Non-Conforming Information Requirements from the letter dated July 15, 2021 (Annex 1) are not stated in the requirements outlined in each Information Request.

As per discussions with the Impact Assessment Agency of Canada on October 18, 2021, the Health Canada request of providing modeling results without mitigation will be provided as an attachment for the Information Request CEAA-2-31 at a later date.

The undersigned has signing authority and submits the documents as per the federal and provincial environmental assessment processes.

Any correspondence regarding the Environmental Assessment should be directed to the undersigned.

C Hudson

Craig Hudson
Head of Permitting and Projects
Atlantic Mining NS Inc

cc: Mike Atkinson, Impact Assessment Agency of Canada

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Round 2 Information Request Number:	CEAA-2-01
Regulatory Agency/Indigenous Community:	CEAA, Indigenous Groups
Topic/Discipline:	Project Overview
EIS Guideline Reference:	*5 (1)(c)(iii) Current Use of Lands and Resources for Traditional Purposes* *5 (1)(c)(ii) Aboriginal Physical and Cultural Heritage* *5 (1)(c)(iv) Any Structure, Site or Thing of Historical, Archaeological, Paleontological or Architectural Significance*
Revised EIS (February 28, 2019) Reference:	Section 2, Project Description, Section 6.14 Indigenous People

Context and Rationale

During consultation, Indigenous groups requested a visual representation of the Project that would clearly show landscape changes throughout all phases. The revised EIS states that the project area and its vicinity are used intensively by the Mi'kmaq of Nova Scotia - Revised EIS, p752

In the revised EIS, the proponent provided discussion and topographic mapping outlining the visual impacts of the Project (all phases) from three positions (in a canoe in Lower Beaver Lake at 0.8 m height; standing on a rooftop; and at 5 m above ground) in or near Beaver Dam IR 17.

However, the proponent has not provided a virtual representation or model that provides Indigenous groups or the Agency with an understanding of the visual impacts of the Project. The required virtual representation or model should be 2D or 3D and, based on the significant current and traditional use in the project area, employ additional viewpoints beyond Beaver Dam IR 17. The rationale of viewpoint selection is to be provided.

The Proponent is Required to …

Provide a 2D or 3D model or virtual representation of the project area (before construction, and during operation, decommissioning and post-reclamation) to facilitate a clearer understanding of the visual impact of the Project.

Viewpoints of the model or representation should be based on nearest residences and proximal areas of close land users.

Provide a rationale as to why these viewpoints were selected and how they adequately depict landscape change over time during all phases of the Project.

Response

Nortek Resource Solutions Inc. (Nortek) has completed a viewshed analysis of the Project to support a 2D visual representative of where the Project will be visible from surrounding vantage points (Appendix M.2 of the Updated 2021 EIS [AMNS 2021]). This was completed to respond, in part, to this Information Request, Round 2 (IR2; CEAA 2-01). This viewshed analysis is a 2D virtual representation of the Beaver Dam Mine site before construction (baseline), during operations, and during closure. Viewpoints of the virtual representation were selected based on nearest residences and/or proximal areas of close land users, where a viewshed was determined to be possible.

The Zone of Visual Influence (ZVI) provides a spatial overview of where the proposed Project stockpiles will be visible across a 20 km radius. This ZVI informed viewpoints for the virtual 2D representations. The Beaver Dam Mine Site is predominantly forested and therefore the existing forest stand data was included in the analysis. The analysis consisted of preparing a Digital Surface

Model (DSM) which included the proposed stockpiles. Once the model was prepared, a visibility analysis was completed to determine all areas on the DSM in which the stockpiles are visible. This analysis focused on stockpile locations as they are the highest infrastructure proposed at the Beaver Dam Mine Site.

This ZVI was prepared to provide a general overview of where the Project will be visible from, and also to demonstrate a visual representation of what the mine will look like from specific locations. As shown in Appendix M.2 of the Updated 2021 EIS (AMNS 2021) the Project stockpile(s) will be visible from the east and west of the Beaver Dam Mine Site including from West Lake, from the north of the Beaver Dam Mine Site in Como Lake, directly south of the Beaver Dam Mine Site, and to the west of Beaver Lake IR along the north and south side of Highway 224. Commercial and recreational activities (boating, fishing, swimming) along Cameron Flowage will observe an adjusted viewplane with visible stockpile(s). The ZVI also demonstrates as a user moves farther away from the Beaver Dam Mine Site, the mine infrastructure will be visible from higher elevation points on the landscape, including several high points northwest of the Beaver Dam Mine Site and south of the mine including near Lake Alma. The user will not observe the infrastructure from most lakes surrounding the Beaver Dam Mine Site, with the exception of those described above.

Through a review of the ZVI results, several photos were then taken from various vantage points to demonstrate a 2D virtual representation of the Project Area under baseline conditions, during operations and during closure. Visual Simulations 1 to 4 in Appendix M.2 of the Updated 2021 EIS (AMNS 2021) show these four vantage points and what will be visual during operations and closure phases of the Project.

Visual Simulation 1 illustrates the view from the north side of the Beaver Dam Mine Site just north of Cameron Flowage, looking southwest towards the Project. The NAG stockpile will be visible during operations and closure phases, as shown on this Figure. Visual Simulation 2 illustrates a similar view from the north side of the Beaver Dam Mine Site but looking farther southwest/west. The full extent of the NAG stockpile will be visible during operations and closure phases from this location, as shown on Visual Simulation 2. Visual Simulation 3 illustrates the view from west of the Beaver Lake IR on Highway 224 where the ZVI also predicted a visual change from the Project. The PAG, NAG and LGO stockpiles will be visible from this vantage point during the operation phase, as shown on Visual Simulation 3. During reclamation, only the PAG and NAG piles will remain. Finally, Visual Simulation 4 illustrates the view from a forestry road near Cope Brook, south of the NAG pile. From this location, the NAG stockpile will be visible during both the operations and closure phases. These four vantage points were selected to be representative of expected maximum change in viewscape, while also working to choose locations where the Project team anticipated human activities to be taking place (near access trails, lakes and other access points) (Appendix M.2 of the Updated 2021 EIS [AMNS 2021]).

References

AMNS (Atlantic Mining NS Inc.). 2021. Updated Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. October 2021. Middle Musquodoboit, NS.

Round 2 Information Request Number:	CEAA-2-02
Regulatory Agency/Indigenous Community:	All
Topic/Discipline:	Environmental Assessment Methodology
EIS Guideline Reference:	Part 2, Section 6.6 Significance of Residual Effects
Revised EIS (February 28, 2019) Reference:	Section 5.10 Residual Effects and Determination of Significance

Context and Rationale

The revised EIS provides an updated and improved methodology for the environmental assessment. However, as required in CEAA 1-11, CEAA 1-14 and CEAA 1-17, the EIS does not present adequate definitions of valued component-specific criteria and it does not provide sufficient rationale within significance conclusions for direct and cumulative effects.

The significance determination criteria in Table 5.10-1 have been more clearly defined (e.g., magnitude, duration, timing, etc.) and describe the criteria rankings (e.g. low, medium, high). Where possible, quantitative information should be used (specifically for magnitude and timing). This information and clarity will allow reviewers to better follow and understand the proponent's assessment of individual valued components and the subsequent significance conclusions.

The determination of significance for each valued component, (specifically noise, air, wetlands, fish and fish habitat, and Indigenous peoples) should be presented in a rational, defensible way that discusses the key criteria and provides a rationale if a particular criterion is deemed not relevant. The proponent may consider a decision tree or matrix which describes the combination of factors (magnitude, reversibility, frequency, duration, etc.) that would produce a significant effect.

Furthermore, several of the valued components (e.g. noise, air, wetlands, fish and fish habitat, Indigenous peoples, etc.) throughout the EIS exceed thresholds and provide limited justification in concluding non-significance, or have an outcome of many maximum criteria rankings, and provide limited justification in concluding non-significance. For example, in the assessment of wetlands in section 6.8.9, the proponent concludes that effects will be high in magnitude, permanent and irreversible. The proponent offers little justification for the conclusions of non-significance.

Additionally, in section 6.1, the predicted residual environmental effects of Project development and production on noise are assessed as adverse, but not significant. However, Table 6.1-9 notes that there is an exceedance of guidelines/threshold at the property lines. They extend beyond the PA, they extend beyond 3 years and they occur regularly during operations. A defensible rationale is required to justify the non-significance conclusion.

The same comments apply for the cumulative effects assessments provided in section 8.

The Proponent is Required to …

Expand upon the revised valued component-specific criteria within the individual effects assessment chapters of the EIS, with a focus on quantitative definitions, specifically for magnitude and timing. If a quantitative criterion is not possible, provide a rationale as to why quantitative definitions are not appropriate.

Provide an expanded analysis to support each significance determination in the direct and cumulative effects assessments (specifically noise, air, wetlands, fish and fish habitat, and Indigenous peoples) so that the reviewer understands how the conclusions were made in the revised EIS.

Response

Revised significance determination and expanded analysis of valued component-specific criteria are listed in the table below (Table CEAA-2-02-1). Quantitative definitions specifically for magnitude and timing, is provided within each assessment chapter in the Updated 2021 EIS for each Valued Component (VC). Section 5.11, Table 5.11-1, page 5-19 in the Updated 2021 EIS (AMNS 2021), and presented below in Table CEAA 2-02-1, provides reference to the VC-specific Definition Sections where the expanded definitions can be found.

The cumulative effects assessment (AMNS 2021, Section 8, page 8-1) provides an expanded assessment of significance determination (i.e., specifically for noise, air, surface water quality and quantity, fish and fish habitat, and Mi'kmaq of Nova Scotia) and reference to those sections is provided in Table CEAA 2-02-1 below.

Table CEAA 2-02-1: Characterization Criteria for Residual Environmental Effects

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories	Valued Component Specific Definitions (Effects Assessment)	Valued Component Specific Definitions (Cumulative Effects Assessment)
Significance Threshold	The definition of a significant adverse effect based on Project interactions with each Valued Component.	Determinations of Significance based on characterization criteria as defined for each VC.	Noise – 6.1.6.2 Air – 6.2.6.2 Light – 6.3.6.3 Greenhouse Gases – 6.4.6.2 Geology, Soils and Sediment – 6.5.6.2 Groundwater Quality and Quantity – 6.6.6.4 Surface Water Quality and Quantity – 6.7.7.2 Wetlands – 6.8.6.3 Fish and Fish Habitat – 6.9.6.2 Habitat and Flora – 6.10.6.2 Terrestrial Fauna – 6.11.6.2 Avifauna – 6.12.7.2 SOCI and SAR – 6.13.6.2 Mi'kmaq of Nova Scotia – 6.14.6.2 Physical and Cultural Heritage – 6.15.6.2 Socioeconomic Conditions – 6.16.12 Accidents and Malfunctions – 6.18.6.1.1, 6.18.6.2.3, 6.18.6.3.3, 6.18.6.4.1, 6.18.7.1.4, 6.18.7.2.1, 6.18.7.3.1, 6.18.4.1, 6.18.7.4.2, and 6.18.8.1.1	Noise – 8.5.1.4 Air – 8.5.2.4 Light – 8.5.3.3 Surface Water Quantity and Quality – 8.5.4.4 Fish and Fish Habitat – 8.5.5.4 SOCI and SAR – 8.5.6.4 Mi'kmaq of Nova Scotia – 8.5.7.4
Magnitude	The size or degree of the effects compared against baseline conditions or reference levels, and other applicable measurement parameters (i.e., standards, guidelines, objectives)	Negligible (N) – Differing from the average value for the existing environment/baseline conditions to a small degree, but within the range of natural variation and below a threshold value Low (L) – Differing from the average value for the existing environment/baseline conditions, outside the range of natural variation, and less than or equal to appropriate guideline or threshold value Moderate (M) – Differing from the existing environment/ baseline conditions and natural variation, and marginally exceeding a guideline or threshold value	Noise – 6.1.6.2 Air – 6.2.6.2 Light – 6.3.6.3 Greenhouse Gases – 6.4.6.2 Geology, Soils and Sediment – 6.5.6.2 Groundwater Quality and Quantity – 6.6.6.4 Surface Water Quality and Quantity – 6.7.7.2 Wetlands – 6.8.6.3 Fish and Fish Habitat – 6.9.6.2 Habitat and Flora – 6.10.6.2 Terrestrial Fauna – 6.11.6.2 Avifauna – 6.12.7.2	Noise – 8.5.1.4 Air – 8.5.2.4 Light – 8.5.3.3 Surface Water Quantity and Quality – 8.5.4.4 Fish and Fish Habitat – 8.5.5.4 SOCI and SAR – 8.5.6.4 Mi'kmaq of Nova Scotia – 8.5.7.4

Table CEAA 2-02-1: Characterization Criteria for Residual Environmental Effects (continued)

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories	Valued Component Specific Definitions (Effects Assessment)	Valued Component Specific Definitions (Cumulative Effects Assessment)
		High (H) – Differing from the existing environment/ baseline conditions and natural variation, and exceeding a guideline or threshold value	SOCI and SAR – 6.13.6.2 Mi'kmaq of Nova Scotia – 6.14.6.2 Physical and Cultural Heritage – 6.15.6.2 Socioeconomic Conditions – 6.16.12 Accidents and Malfunctions – 6.18.4	
Geographic Extent	The geographic area over or throughout which the effects are likely to be measurable	Project Area (PA) – the residual environmental direct and indirect Local Assessment Area (LAA) – Occurs beyond the PA and LAA and within the RAA Regional Assessment Area (RAA) – Occurs beyond the PA and LAA and within the RAA	Noise – 6.1.6.1 Air – 6.2.6.1 Light – 6.3.6.1.1 Greenhouse Gases – 6.4.6.1 Geology, Soils and Sediment – 6.5.6.1 Groundwater Quality and Quantity – 6.6.6.1 Surface Water Quality and Quantity – 6.7.7.1 Wetlands – 6.8.6.1.1 Fish and Fish Habitat – 6.9. 6.1.1/6.9.6.2 Habitat and Flora – 6.10.6.1.1 Terrestrial Fauna – 6.11.6.1.1 Avifauna – 6.12.7.1.1 SOCI and SAR – 6.13.6.1.1 Mi'kmaq of Nova Scotia – 6.14.6.1.1 Physical and Cultural Heritage – 6.15.6.1.1 Socioeconomic Conditions – 6.16.9.1 Accidents and Malfunctions – 6.18.4	Noise – 8.5.1.4 Air – 8.5.2.4 Light – 8.5.3.3 Surface Water Quantity and Quality – 8.5.4.4 Fish and Fish Habitat – 8.5.5.4 SOCI and SAR – 8.5.6.4 Mi'kmaq of Nova Scotia – 8.5.7.4
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant.	Not Applicable (N/A) — seasonal aspects are unlikely to affect VC's (i.e., fisheries productivity). Applicable — seasonal aspects may affect VC's (i.e., fisheries productivity)	Light – 6.3.6.3 Groundwater Quality and Quantity – 6.6.6.4 Surface Water Quality and Quantity – 6.7.7.2 Fish and Fish Habitat – 6.9.6.2 No specific definitions for other VCs	Light – 8.5.3.3 Surface Water Quantity and Quality – 8.5.4.4 Fish and Fish Habitat – 8.5.5.4
Duration	The time period over which the effects are likely to last	Short-term (ST) – effects are limited to occur from as little as 1 day to 24 months Medium-term (ML) – effects can occur beyond 24 months and up to 4 years	Groundwater Quality and Quantity – 6.6.6.4 Surface Water Quality and Quantity – 6.7.7.2 Fish and Fish Habitat – 6.9.6.2	Surface Water Quantity and Quality – 8.5.4.4 Fish and Fish Habitat – 8.5.5.4

Table CEAA 2-02-1: Characterization Criteria for Residual Environmental Effects (continued)

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories	Valued Component Specific Definitions (Effects Assessment)	Valued Component Specific Definitions (Cumulative Effects Assessment)
		Long-term (LM) – effects extend beyond 4 years Permanent (P) – valued component unlikely to recover to baseline conditions	No specific definitions for other VCs	
Frequency	The rate of recurrence of the effects (or conditions causing the effect)	Once (O) – effects occur once Sporadic (S) – effects occur at irregular intervals throughout the Project Regular (R) – effects occur at regular intervals throughout the Project Continuous (C) – effects occur continuously throughout the Project	No specific definitions for other VCs	
Reversibility	The degree to which the effects can or will be reversed (typically measured by the time it will take to restore the environmental attribute or feature)	Reversible (R) – VCs will recover to baseline conditions before or after Project activities have been completed. Partially Reversible (PR) – mitigation cannot guarantee a return to baseline conditions Irreversible (IR) – effects to VCs are permanent and will not recover to baseline conditions	No specific definitions for other VCs	

Source: AMNS 2021, Section 5.11, Table 5.11-1, page 5-19 and Section 8.5.1.4, page 8-39, Section 8.5.2.4, page 8-50, Section 8.5.3.3, page 8-56, Section 8.5.4.4, page 8-71, Section 8.5.5.4, page 8-79, Section 8.5.6.4, page 8-99, Section 8.5.7.4, page 8-118.

Table CEAA-2-02-2 presents **an example of the characterization criteria for residual effects for fish and fish habitat**. Updates are provided in each VC chapter in the sections noted in Table CEAA 2-02-1 above.

The effects assessment for fish and fish habitat fully considers the potential interactions with related VCs, including with the potential to influence fish and fish habitat, including conclusions of the effects assessment for surface water quality, surface water quantity (hydrology) and groundwater quality and quantity (hydrogeology) (Section 6.7.12, page 6-315 and Section 6.6.7.4, page 6-207 of the Updated 2021 EIS [AMNS 2021]). In particular the magnitude threshold refers to applicable water quality guidelines, accessed in the surface water effects assessment (Section 6.7.7.1.4, Table 6.7-18, page 6-258 [AMNS 2021]). Specifically, water quality guidelines accessed as thresholds to support the assessment of effects to surface water quality, and by extension fish and fish habitat, include Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic life (CCME FAL) and NSE Tier 1 (ESQ) water quality guidelines. Additionally, a site-specific water quality objective was developed for arsenic in the receiving environment, following CCME (2007) protocols, using a species sensitivity distribution (SSD) approach. The resultant Site-Specific Water Quality Objective (SSWQO) for arsenic accessed in the assessment can be found in Section 3.4, Table 3-2, PDF page 6 of Appendix G.2 of the Updated 2021 EIS (AMNS 2021).

Further, the effects assessment for fish and fish habitat was developed to be consistent with Fish and Fish Habitat Protection Policy (DFO 2019), which states "*the Department interprets "harmful alteration, disruption or destruction" as any temporary or permanent change to fish habitat that directly or indirectly impairs the habitat's capacity to support one or more life processes of fish.*" However, it is recognized that the total impacts determined within this assessment will be further reviewed and determination of the amount of HADD will be made by DFO during the authorization application process. Residual potential HADD at the Beaver Dam Mine Site are provided in Section 6.9.9, Table 6.9-31, page 6-556, Table 6.9-32, page 6-557 and Table 6.9-33, page 6-557 (Updated 2021 EIS [AMNS 2021]).

Overall, 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 residual effects of the Project on the Fish and Fish Habitat VC is characterized using standard criteria, including magnitude, geographical extent, duration, frequency, reversibility, and context of the effect (Table CEAA-2-02-2). The residual effects assessment concludes with a determination of significance. 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 Project Area (PA) or near-field receiving environment, are of sporadic or short-term duration, occur at any frequency and are reversible to partially reversible.

Table CEAA-2-02-2: Example of Definitions of Characterization Criteria for Residual Effects on Fish and Fish Habitat

Criteria	Description of Ratings

Magnitude	• **Negligible:** no measurable change in fish and fish habitat quantity or quality described as one or more of the following (and/or):
	  ○ Less than one percent change in surface flow volumes[(a)].
	  ○ No direct loss of fish habitat; and
	  ○ predicted change of surface water quality indicator is less than 10% of background conditions[(b)], (i.e., no measurable change of state of indicator from background conditions).
	• **Low:** a measurable change in fish habitat area or quality, but within the range of natural variation described as one or more of the following (and/or):
	  ○ Less than 10% flow reduction and not affecting the ability of documented fish species to use the habitat to carry out one or more life processes[(a)];
	  ○ Direct loss of to up to 20 m^2 of fish habitat in any individual fish-bearing wetland or watercourse[(a)]; and
	  ○ water quality in the receiving environment is 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 (defined as 25th to 75th percentile baseline water quality)[(b)].
	• **Moderate:** a measurable change in fish habitat area or quality, above the range of natural variation, which partially limits the ability of fish to use the habitat to carry out one or more life processes described as one or more of the following (and/or):
	  ○ Less than 10% flow reduction but greater than a 10% net increase in the duration (number) of days below the 30% MAD (based on daily flows), which partially limits the ability of fish to use the habitat to carry out one or more life processes[(c)];
	  ○ Direct loss of fish habitat, greater than 20 m^2, up to 100 m^2 in any individual fish bearing wetland or watercourse [(a)]; and
	  ○ Water quality in the receiving environment is predicted to be greater than guidelines and differ substantially from baseline levels and approaches upper observed limits of natural variation (defined as percentile baseline water quality)[(b)].
	• **High:** a measurable change in fish habitat area or quality to an extent which limits the ability of fish to use the habitat to carry out one or more life processes described as one or more of the following (and/or):
	  ○ Greater than a 10% flow reduction and a greater than 10% increase in number of days below the 30% MAD (based on daily flows), which limits the ability of fish to use the habitat to carry out one or more life processes[(c)];
	  ○ Direct loss of fish habitat greater than 100 m^2 in any individual fish-bearing wetland or watercourse[(a)]; and
	  ○ Water quality in the receiving environment is predicted to be greater than guidelines and differ substantially from baseline water quality (outside of 75th to 95th baseline water quality), resulting in a detectable change beyond the range of natural variation[(a)].

Geographical Extent	• **Discrete:** effect is limited to receiving environments in the immediate footprint or Project Area (PA). • **Local:** effect is limited to the FFHA/LAA. • **Potential Regional**: effect persists to the RAA.
Timing	• Timing represents seasonal occurrence of the effect (e.g., spring vs winter; high flows vs. low flows) and represents effect criteria for designated water users (aquatic resources, human health). The characterization of effect of changes to fish and fish habitat is based on life cycles and is considered in the assessment.
Duration	• **Short term:** effect is restricted to Construction Phase and/or EOM modelling. • **Medium term:** effect occurs in Construction Phase and EOM Phase. • **Long term:** Effect occurs in Construction Phase and EOM Phase and/or persists in PC.

Table CEAA-2-02-2: Example of Definitions of Characterization Criteria for Residual Effects on Fish and Fish Habitat (continued)

Criteria	Description of Ratings
Frequency	• **Sporadic:** VC interaction or effect will occur at irregular intervals throughout any Project Phase. • **Regular:** effect occurs on a regular basis but not continuous basis. • **Continuous:** effect occurs constantly (e.g., every model timestep in a given Project Phase).
Reversibility	• **Reversible:** effect can be reversed. • **Partially reversible:** effect can be partially reversed. • **Irreversible:** effect cannot be reversed, is of permanent duration.

Notes: [a] Thresholds developed to consistent with Fish and Fish Habitat Protection Policy (DFO 2019).

[b] Water quality guidelines accessed as thresholds to support the assessment of effects to surface water quality, and by extension fish and fish habitat (CCME 2007 and NSE Tier 1 EQS water quality guidelines).

[a] MAD flow thresholds are derived from the DFO guidance from the Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada (DFO, 2013a).

m^2 = squared metres; % = percent; MAD = mean annual discharge; DFO = Fisheries and Oceans Canada; PA = Project Area; EOM = End-of-Mine; PC = Post-closure; FFHA = Fish and Fish Habitat Assessment Area; LAA = Local Assessment Area

A significant adverse environmental effect for fish and fish habitat has not been predicted for the Project for the following reasons, with consideration of the ecological and social context of the LAA surrounding the Project:

- During construction:
  - Direct impacts to fish and fish habitat will occur. However, the current Project infrastructure layout has allowed AMNS to achieve complete avoidance of first order tributaries to Crusher Lake and Mud Lake, and a more equalized site-wide water balance which reduces indirect impacts to downgradient fish habitat.
  - Direct loss of habitat within the Beaver Dam Mine Site will be required to allow for development of the Pit and pit perimeter berm primarily, with small direct impacts related to internal haul roads and loss of upstream flow (i.e., WC5, WC13, WC14). The majority of direct habitat loss within the Beaver Dam Mine Site is within WL59, which is an open water wetland constructed to support historic mine activities.
  - Direct impacts to fish habitat along the Haul Road are minimal in scale, and are required to allow for upgrades to the existing forestry road. This involves installation of 29 watercourse crossings; 12 of which are expected to improve fish passage through upgrading culverts which are currently either crushed, buried, blocked or hung.
  - The water collection and treatment system will be constructed, and collection of contact water will commence near the end of the construction phase of the project.
  - Strict adherence to the Erosion and Sediment Control plan will limit the potential of indirect effects to fish and fish habitat commencing in the construction phase, and continuing throughout the operational life of the Project.
  - The death of fish by means other than fishing will be limited by the completion of fish rescue wherever direct impact is required.

- During operations:
  - All direct impacts to fish habitat will have been completed, and no new direct impacts are expected.
  - Water collection, treatment and effluent release will occur, resulting in indirect effects to four watercourses through reduction of both daily and monthly average flows. Mud Lake is also predicted to experience a small reduction in water level (maximum 5 cm). Where flow reduction is of a magnitude that it is predicted to result in alteration of fish habitat; the impact area has been incorporated into the draft Fish Habitat Offset Plan (Appendix J.3 of the Updated 2021 EIS [AMNS 2021].
  - With appropriate treatment of effluent discharge, the magnitude of the residual effect to the Killag River at the Beaver Dam Mine Site is considered negligible (within established criteria or background concentrations at the 100 m compliance point).
  - Effluent is predicted to be of neutral pH, limiting potential impact to Killag River.
  - Changes in flow to the Killag River and resultant changes to fish habitat quality from pit operations and dewatering have been predicted to be low.
- During closure:
  - With appropriate treatment of effluent discharge, the magnitude of the residual effect to the Killag River at the Beaver Dam Mine Site is considered negligible (within established criteria or background concentrations at the 100 m compliance point).
  - Effluent is predicted to be of neutral pH, limiting potential impact to Killag River, a low pH river with current efforts to increase pH to support salmon restoration.
  - During pit filling, flows in the Killag River are expected to decrease by 2.2% MAD flows; however, the duration of low flow period based on daily flows is expected to decrease (fewer low-flow days compared to baseline). Following pit filling, the Killag River is expected to observe a surplus in surface water on the order of 2.2%. These interactions are low in magnitude and not expected to result in any harmful alteration of fish habitat within the Killag River.

References

AMNS (Atlantic Mining NS Inc.). 2021. Updated Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. October 2021. Middle Musquodoboit, NS.

CCME (Canadian Council of Ministers of the Environment). 2007. CCME Water Quality Guidelines for the Protection of Freshwater Aquatic life (CCME FAL). https://ccme.ca/en/resources#

DFO (Fisheries and Oceans Canada). 2013. Framework for Assessing the Ecological Flow Requirements to support Fisheries in Canada. National Capital Region. Canadian Science Advisory Secretariat. Science Advisory Report 2013/017.

DFO. 2019. Fish and Fish Habitat Protection Policy Statement. August 2019. https://www.dfo-mpo.gc.ca/pnw-ppe/policy-politique-eng.html

NSE (Nova Scotia Environment). 2014. Nova Scotia Environment: Environmental Quality Standards for Contaminated Sites – Rational and Guidance Document. Appendix A: Reference Tables for Nova Scotia Pathway-Specific Standards, Table A2 Reference Tables for Surface Water (ug/L). Final—Ver.1.0- April 2014. https://novascotia.ca/nse/contaminatedsites/docs/EQS-Contaminated Sites-Rationale-and-Guidance-NSE-2014.pdf

Round 2 Information Request Number:	CEAA-2-03
Regulatory Agency/Indigenous Community:	CEAA
Topic/Discipline:	Environmental Assessment Methodology
EIS Guideline Reference:	Section 6.1.4; 6.2.2
Revised EIS (February 28, 2019) Reference:	Section 6.6.6.3 Appendix F.6

Context and Rationale

In order to provide reviewers with a comprehensive understanding of what is being proposed, the proponent is required to compile a list of all mitigation, monitoring and follow-up programs related to the Project.

The Proponent is Required to …

Provide a summary table or document of all proposed mitigation measure, monitoring and follow-up programs.

Response

Summary tables of proposed Mitigation measures, monitoring and follow-up programs are provided in Section 9, Table 9.1-1, page 9-2 and Section 10, Table 10.1-1, page 10-3 of the Updated 2021 EIS (AMNS 2021).

References

AMNS (Atlantic Mining NS Inc.). 2021. *Updated* Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. October 2021. Middle Musquodoboit, NS.

Round 2 Information Request Number:	CEAA-2-04
Regulatory Agency/Indigenous Community:	CEAA
Topic/Discipline:	Light
EIS Guideline Reference:	Part 2, Section 6.6 Significance of Residual Effects
Revised EIS (February 28, 2019) Reference:	Section 6.3.5.2 Thresholds for Determination of Significance

Context and Rationale

In the revised EIS, the proponent states that a significant impact for light is defined as "direct light trespass that according to the affected resident regularly interferes with the use and enjoyment of nearby residential properties on a permanent basis and/or evidence of unacceptable levels of bird mortality associated with Project lighting".

The Proponent is Required to …

Provide a quantitative definition of significance for light that can be used for the purpose of the environmental assessment. If this is not feasible, provide a reasoned rationale for the proposed definition of significance for light.

Response

Section 6.3.6.3, page 6-101 of the Updated 2021 EIS has been updated to address this request and is restated herein. 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 Site.

For light, the following logic was applied to assess the magnitude of a predicted change in light levels:

- Negligible – background light levels (0.1 lux) are met at the property boundary.
- Low – increased light trespass above background levels beyond property boundaries, however, comply with relevant guidelines for light trespass into windows at the residential receptors.
- Moderate – increased light trespass above background levels beyond property boundaries, however, exceed relevant guidelines for light trespass (1 lux) into windows at the residential receptors up to 5 lux.
- High – increased light trespass above background levels beyond property boundaries, however, exceed guidelines for light trespass (1 lux) into windows at a residential receptor above 5 lux.

For light, the following logic was applied to assess the timing of a predicted change in light levels. Timing has been determined to not be applicable because the modelling was completed assuming that 50% of the light would not reach receptors due to directionality and line of sight obstructions. In reality the amount of light blocked by the surrounding woodland and topographic changes will likely be much greater than this (>90%) especially during seasons when trees are in full bloom, and thus results are conservatively high. Light trespass during daylight hours would be negligible and thus, this assessment focusses on dark or nighttime conditions.

References

AMNS (Atlantic Mining NS Inc.). 2021. Updated Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. May 2021. Middle Musquodoboit, NS.

Round 2 Information Request Number:	CEAA-2-05
Regulatory Agency/Indigenous Community:	CEAA, KMKNO, ESFW, Save Caribou
Topic/Discipline:	Light
EIS Guideline Reference:	Part 2, Section 6.6.10 Aboriginal Peoples
Revised EIS (February 28, 2019) Reference:	Map Book - Figure 6.3-2 Light Impact Analysis

Context and Rationale

In accordance with the EIS Guidelines and the Agency's Reference Guide: Determining Whether a Project Is Likely to Cause Significant Adverse Environmental Effects, the definitions of significance and the criteria used to determine a significant effect must be quantifiable, to the extent possible, for each VC.

The revised EIS indicates that there is significant use of the Beaver Dam Mine site and its vicinity. Throughout consultation, Indigenous groups have expressed concern regarding light: specifically, how it may impact upon current use practices or may result in disturbance to wildlife, including species utilized by Mi'kmaq hunters.

The revised EIS states that "the lighting effects from Beaver Dam would have a lower impact although it could be more widely experienced, especially if moisture or particulate matter are present in the atmosphere. The resulting halo of light above the mine might be seen from many locations." The Agency understands that Figure 6.3-2 provided in response to CEAA 1-43 does not represent the extent to which project light can be seen. For the Agency and Indigenous groups to understand potential effects from light, a better understanding of the extent of light effects is required.

Furthermore, in consideration of the Haul Road, the proponent indicated that trucking will occur "mainly under daytime and pre-curfew conditions and thus light impacts from trucks along the Haul Road are expected to be insignificant when compared to baseline daylight illuminance and screening provided by trees along the Road". However, the proponent does not provide sufficient information on how Haul Road or mine operations may affect wildlife or specify how species utilized by Mi'kmaq hunters may be affected.

Lastly, Table 6.11-6 states that "Project infrastructure and roads will have lights which are operational at all times." Clarification is required because it is the Agency's understanding that lighting will not be installed along the Haul Roads.

The Proponent is Required to …

Provide a light shed map in consideration of Beaver Dam IR 17 and areas identified for current use practices. The model should use a conservative value in estimating moisture or particulate matter in the atmosphere.

Provide additional consideration of potential fauna behaviour and distribution effects in relation to project lighting – specifically on species utilized by Mi'kmaq hunters.

Indicate how predicted changes to fauna behavior/distribution may affect local hunting practices in the project area and its vicinity.

Confirm whether lighting will be installed along the Haul Roads.

Update the direct and cumulative effects assessment of related valued components as appropriate.

Response

A light shed map has been provided as Section 6.3.7, Figure 6.3-2, page 6-104 of the Updated 2021 EIS (AMNS 2021) and provided as Figure CEAA 2-05-1 in response to this Information Request (CEAA 2-05).

Project effects of light to wildlife (Section 6.11.7.4.2 Sensory Disturbance – Light, page 6-633) has been added to the Updated 2021 EIS and summarized in this Information Request, Round 2 (IR2) response, in consideration of the revised Project Description (Section 2, page 2-1 of the Updated 2021 EIS [AMNS 2021]) and updated effects assessment. Section 6.14.7.1 Project Interactions with Mi'kmaq Traditional Use/Rights, page 6-813 of the Updated 2021 EIS (AMNS 2021) includes discussion of predicted impacts to Mi'kmaq traditional use and rights including hunting practices from changes in wildlife behaviour and distribution. The Traditional Land and Resource Use Study (TLRUS) (MFC 2019 – Under Confidential Cover) indicates that local residents of the Beaver Lake Indian Reserve (IR) 17, Sheet Harbour IR 36 and Millbrook IR, which are part of the Millbrook First Nation frequently use the area (i.e., range of use from weekly to yearly, and depending on availability of species) for hunting and rely on the wild harvest as an important food and dietary source. Species noted to be harvested by Mi'kmaq hunters in the TLRUS (MFC 2019 – Under Confidential Cover) include deer, bear, rabbit, grouse, and porcupine. 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.

Due to the proximity of the Beaver Dam Mine Site and Haul Road to traditional harvesting areas as described int the TLRUS (MFC 2019 – Under Confidential Cover) and Mi'kmaq Ecological Knowledge Study (MEKS) (Appendix M.1), there will potentially be an area outside of the Beaver Dam Mine Site and Haul Road where Millbrook community members and other Mi'kmaq hunters may observe a changed pattern of wildlife movement. This area has been identified as a potential Wildlife Indirect Environmental Effects Zone (Section 6.14.7.1 Project Interactions with Mi'kmaq Traditional Use/Rights, Figure 6.14-5, page 6-814 of the Updated 2021 EIS [AMNS 2021]). Within close proximity to the proposed property boundaries of the Beaver Dam Mine Site and Haul Road, there is the potential for sensory disturbance to wildlife and birds from noise and light above background conditions resulting in potential changes to wildlife patterns and by extension, hunting practices for the Mi'kmaq of Nova Scotia. There are limited Project effects expected on hunting, gathering and trapping activities beyond the potential Wildlife Indirect Environmental Effects Zone.

As described in Section 6.11.7.4.2 Sensory Disturbance – Light, page 6-633, light effects on terrestrial fauna include changes circadian patterns, seasonal patterns, movement, and community interactions and composition (Pauwels, 2018). These impacts can change distribution through disorientation, attraction or avoidance, and behavioral changes that can affect the success of foraging, reproduction, and communication (Longcore and Rich, 2004).

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. Much of the research surrounding the impacts of light on wildlife focus on small mammals, rodents and avifauna (e.g., Schirmer et al., 2019; Schroer et al, 2016; Gauthreux and Belser, 2006). As a result, the discussed impacts of light are directly relevant to Mi'kmaq species of concern, such as rabbit, porcupine and grouse. Nocturnal and corpuscular wildlife, such as porcupine, are particularly susceptible to the effects of light, notably the type of light (i.e., short, high energy UV/violet/blue wavelengths [DEE, 2020; Pauwels, 2018]). Schirmer et al. (2019) found that increased artificial lighting, delayed, compressed active period of nocturnal species.

There is more limited data on the impacts of artificial light on larger mammalian species, including those used by the Mi'kmaq (e.g., ungulates and bear). However, studies have found that increased human activity and resultant artificial light may attract these species. Ditmer et al. (2021) observed that artificial lighting in cities attracted deer, as it mimicked their preferred grazing times (dawn and dusk). Bear are adaptable and commonly use anthropogenically disturbed environments and as a result may benefit from artificial lighting through altered predator-prey dynamics. Harder (2002) notes increased illumination may facilitate hunting, particularly along waterways.

Light levels from the Project have been modelled in the Light Impact Assessment (Appendix D.1 of the Updated 2021 EIS [AMNS 2021]) and discussed in Section 6.3.6.2 Light Assessment Modelling Methodology, page 6-98. While the calculated light levels at the sensitive receptors are below the guidelines recommended by the Institution of Lighting Professionals (ILP) guidelines (ILP 2020), evening (Haul Road) and nighttime (Beaver Dam Mine Site) light propagation from the Project may still cause sensory disturbance to fauna. Project activities are likely to result in localized avoidance of the Beaver Dam Mine Site and Haul Road and directly surrounding areas by some species, while it may attract others. This potential avoidance would be due to changes in ambient light levels. The impact distance will also be dependent on the type of lighting used (e.g., LEDs, metal halides), which has been considered as a potential mitigation opportunity (Section 6.11.8 Terrestrial Fauna – Mitigation, page 6-635).

As stated in Section 6.3.6.2.1 Light Assessment Modelling Methodology – Beaver Dam Mine Site and Haul Road Methodology, page 6-98 of the Updated 2021 EIS, lighting will not be installed along the Haul Road (AMNS 2021). Table 6.11--6 (Section 6.11.7, page 6-628 of the Updated 2021 EIS [AMNS 2021]) was referring to haul roads within the mine site itself, which will be lit where needed for safety and use downward-facing lights to reduce light impacts to wildlife and birds. EIS mitigation tables that mention this have been updated to clarify that it is site infrastructure and mine site haul roads, not the Haul Road.

The Cumulative Effects Assessment (CEA), Section 8 of the Updated 2021 EIS (AMNS 2021), has been revised for all appropriate Valued Components (VCs), to ensure consistency with the Cumulative Effects Assessment Methodology Interim Technical Guidance document (version 2), prepared by CEAA (2018). Through the scoping of VCs for inclusion in the CEA, where adverse residual effects were identified, it was determined that further evaluation was warranted to assess cumulative effects of Light, specifically on fauna, avifauna, Species of Conservation Interest and Species at Risk (SOCI/SAR) and Mi'kmaq of Nova Scotia. Light intrusion into the forest along the Beaver Dam Haul Road is noted as a concern for the Millbrook First Nation and local residents. The CEA has been updated to include an expanded assessment of Project overlap with other projects located within the Light specific Regional Assessment Area (RAA) (Section 8.5.3.1.3 Light Cumulative Effects Assessment – Effects of Other Projects in the Area, Figure 8.5-3, page 8-54 [AMNS 2021]) and the potential cumulative impacts of these projects.

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. 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 for gold concentrate transportation 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). A Light Impact Assessment (Appendix D.1 of the Updated 2021 EIS [AMNS 2021]) was completed for the Beaver Dam Mine Project using a 'worst-case' scenario when two trucks are closest to each receptor and shining light towards the receptor. Given the limitations of traffic on the Beaver Dam Haul Road (2 lanes, only 2 trucks can be in one place at one time), the increase in volume of traffic from these additional projects will not result in a cumulative impact on light levels, particularly related to light levels at reception points.

References

AMNS (Atlantic Mining NS Inc.). 2021. Updated Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. May 2021. Middle Musquodoboit, NS.

CEAA (Canadian Environmental Assessment Agency). 2018. Technical Guidance Assessing Cumulative Environmental Effects under the *Canadian Environmental Assessment Act*. Version 2. March 2018. Available at: https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/assessing-cumulative-environmental-effects-ceaa2012.html

DEE (Department of the Environment and Energy). 2020. National Light Pollution Guidelines Australian Guidelines (Version 1). Commonwealth of Australia.

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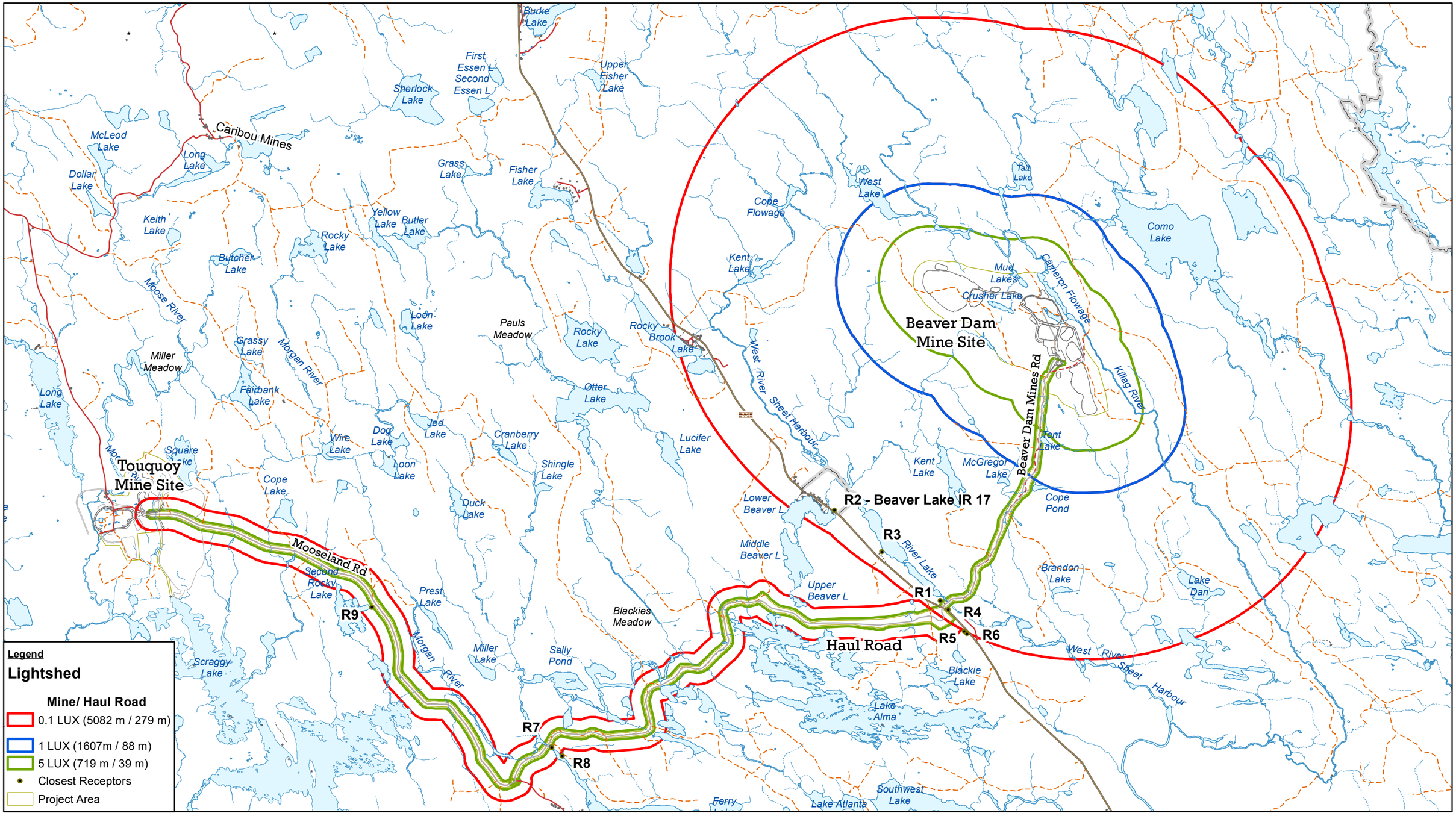
Pauwels, J. 2018. Light pollution & biodiversity: What are the levers of action to limit the impact of artificial lighting on nocturnal fauna?. PhD Thesis. Biodiversity and Ecology. Museum national d'histoire naturelle - MNHN PARIS, 2018. English.

Schirmer A., Gallemore C., Liu T., Magle S., DiNello E., Ahmed H and Gilday T. 2019. Mapping behaviorally relevant light pollution levels to improve urban habitat planning. Scientific Reports. Nature. 9:11925.

Schroer, S. and Hölker, F. 2016. Impact of lighting on flora and fauna. Handbook of Advanced Lighting Technology. pp 1-33.



Source: Service Nova Scotia, GHD

0 750 1,500 2,250
Meters

Coordinate System:
NAD 1983 CSRS UTM Zone 20N

Map shows light trespass from Beaver Dam Mine and Haul Road traffic only. Light trespass from (existing) Touquoy Mine is not presented.

ATLANTIC GOLD CORPORATION
MARINETTE, HALIFAX CO., NOVA SCOTIA
ENVIRONMENTAL IMPACT STATEMENT - BEAVER DAM MINE

LIGHT IMPACT FROM BEAVER DAM MINE AND HAUL ROAD

088664 (014)
Dec 3, 2020

FIGURE CEAA 2-05-1

GIS File: N:\CA\Halifax\Projects\661\088664\GIS\Maps\Deliverables\088664-REPORT\088664-RPT(017)\088664(017)GIS-HX011.mxd

Round 2 Information Request Number:	CEAA-2-06
Regulatory Agency/Indigenous Community:	DFO, KMKNO
Topic/Discipline:	Fish and Fish Habitat
EIS Guideline Reference:	Part 2, Section 6.3.1 Fish and Fish Habitat
Revised EIS (February 28, 2019) Reference:	Section 6.9.3.1 Fish Habitat Assessment, Table 6.9-4; 6.9.6.2 Fish and Fish Habitat Impact Extent, Table 6.9-27

Context and Rationale

Section 6.3.1 of the EIS Guidelines requires "the identification of any potential harmful alteration, disruption or destruction of fish habitat, including the calculations of any potential habitat loss (temporary or permanent) in terms of surface areas". The information is necessary for the Agency to properly understand potential effects to fish and fish habitat.

Section 6.9.6.2 of the revised EIS does not provide an estimate of the surface area of all potential fish habitat alteration and destruction likely to result from the Project. Although Table 6.9-27 provides affected watercourse length, it does not provide an estimate of the total affected area.

Section 6.9.6.2.2 of the revised EIS describes indirect impacts to fish and fish habitat within the Beaver Dam Mine site; however, Table 6.9-27 does not provide an estimate of the surface area of indirect impacts to fish habitat that are likely to result from the Project (e.g., substantial changes in hydrology to the section of WC-5 downstream of the waste rock storage site, as well as Crusher Lake, Mud Lake and associated wetlands). Table 6.8-1 indicates that the total size of Wetland-17 surrounding Mud Lake has not been calculated; however, the hydrological alterations upstream of this wetland are likely to result in a harmful alteration. The area of potential alteration and disruption should be provided.

Table 6.9-4 describes fish habitat present within each wetland and its associated watercourse in the Beaver Dam Mine site. All wetlands are identified as fish habitat. Table 6.9-27 is not consistent with Table 6.9-4 because it indicates that a number of wetlands listed in Table 6.9-4 have low potential to be fish habitat. A detailed rationale for the low potential characterization has not been provided.

In reference to Table 6.9-37 of the revised EIS, the proponent indicates that impacts to fish habitat will be quantified and confirmed through monitoring to determine if serious harm to fish is likely. Section 8.5.6.2.3.1 of the revised EIS indicates that there is uncertainty as to Project effects on fish and fish habitat. The proposed approach to reduce this uncertainty is to implement monitoring programs and follow-up programs. Impacts to fish and fish habitat must be characterized and quantified during the environmental assessment so that appropriate avoidance, mitigation and offsetting measures, as well as follow-up monitoring programs, are considered during the environmental assessment.

The Proponent is Required to …

Provide an estimate of the surface area (in square metres) of the potential serious harm to fish (i.e., destruction and permanent alteration of fish habitat) that may result from the Project for each affected waterbody, watercourse and wetland. The proponent should assume any waterbody, watercourse or wetland that has been identified as potential fish habitat, but not confirmed, is fish habitat for the purposes of the estimate.

Update Tables 6.9-4 and 6.9-27, as appropriate, indicating which wetlands, or portions of wetlands, are considered to be fish habitat. Provide a detailed rationale for any waterbodies, watercourses or wetlands that are characterized as having a low potential to be fish habitat along with supporting technical and scientific information.

Response

CEAA-2-06 A)

A summary of potential direct and indirect impacts to fish habitat are provided in the Updated 2021 EIS Section 6.9.7.5, page 6-522 and summarized below in Tables CEAA 2-06-1 and CEAA 2-06-2. Table CEAA 2-06-1 includes all watercourses and waterbodies including wetlands that have the potential to be impacted prior to mitigation and the determination of whether the potential impacts are harmful. Waterbodies considered likely Harmful Alteration, Disruption and Destruction (HADD) in the final column of Table CEAA 2-06-1 are carried forward into Round 2, Information Request (IR2) response for CEAA-2-07. Cameron Flowage, Mud Lake and Crusher Lake are included as lakes potentially impacted by the Project, but the detailed assessment of impacts in Section 6.9.7.2, page 6-488 determined that the potential impacts would be minor and not likely to result in HADD of fish habitat.

Table CEAA 2-06-1: Potential Habitat Destruction or Permanent Alteration within the Proposed Beaver Dam Mine Site Footprint (Based on Updated 2021 EIS Section 6.9.7.5.2, Table 6.9-24, page 6-524 and Appendix J.3, Section 4.3.3, Table 3, PDF page 34)

Watercourse / Waterbody	Potential Impact	Potentially Impacted Area (m^2)	Considered HADD based on Mitigation or Analysis of Effects
Cameron Flowage	**Permanent Alteration**: Loss of flow, thermal impact	106,778.00	no
Mud Lake	**Permanent Alteration**: Loss of flow	33,599.00	no
Crusher Lake	**Permanent Alteration**: Loss of flow	43,585.00	no
WC-5	**Habitat Destruction**: Due to overprinting Internal Haul Road	154.00	yes
WC-12	**Habitat Destruction**: Due to overprinting Pit	93.00	yes
WL56	**Habitat Destruction**: Due to overprinting Pit	1,454.27	yes
WC-13[(b)]	**Habitat Destruction**: Loss of upstream flow	279.45	yes
WL59	**Habitat Destruction**: Due to overprinting Pit, Internal Haul Road	37,162.70	yes
WC-14[(b)]	**Habitat Destruction**: Due to overprinting Internal Haul Road, loss of upstream flow	108.80	yes
WC-25[(b)]	**Habitat Destruction**: Loss of upstream flow	17.55	yes
WL61	**Habitat Destruction**: Due to overprinting Pit Perimeter Road	173.67	yes
WC-23[(a)]	**Permanent Alteration**: Loss of flow	4,487.64	yes
WC-26[(a)]	**Permanent Alteration**: Loss of flow	1,927.05	yes
WC-5[(a)]	**Permanent Alteration**: Loss of flow	2,075.04	yes
WC-27[(a)]	**Permanent Alteration**: Loss of flow	1,146.74	yes
Total		**233,041.91**	

Source: Based on AMNS 2021, Section 6.9.7.5.2, Table 6.9-24, page 6-524 and Appendix J.3, Section 4.3.3, Table 3, PDF page 34.
Notes: [(a)] Watercourses 23, 26, 5, and 27 will be potentially impacted by flow reductions but the channels are expected to remain suitable to support fish life functions. Potentially impacted area is the total surface area.
[(b)] Portions of watercourses 13, 14 and 25 may be destroyed due to complete loss of upstream flow.

Table CEAA 2-06-2 includes all watercourses and waterbodies including wetlands that have the potential to be impacted by the Haul Road prior to mitigation and the determination of whether the potential impacts are harmful. A summary of the waterbodies and their predicted interaction with the Project is provided in Section 6.9.7.3.1, Table 6.9-19, page 6-511 of the Updated 2021 EIS (AMNS 2021). The value shown in the potential impact column is the entire surface area of the waterbody where potential impacts could occur. The direct footprint impact column quantifies what potentially is HADD after mitigation measures associated with the plan for upgraded haul road.

Table CEAA 2-06-2: Potential Habitat Destruction or Permanent Alteration along the Haul Road (Based on Updated 2021 EIS Section 6.9.7.3.1, Table 6.9-19, page 6-511)

Watercourse Location / ID	Current Crossing (Condition)	Plan for Upgraded Haul Road[a]	Potentially Impacted Area[b] (m^2)	Direct Footprint Impact (m^2) Considering Site Specific Impact Assessment	Considered HADD based on Mitigation or Analysis of Effects
WC-1	Culvert (functioning)	Proposed upgraded road alignment perpendicular to WC. Extend existing culvert, following standard mitigation measures.	9.5	0	no
WC-A	Culvert (buried)	Proposed upgraded road alignment perpendicular to WC. Replace buried culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of buried culvert.	12.0	0	no
WC-B	Culvert (crushed)	Proposed upgraded road alignment perpendicular to WC. Replace crushed culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of crushed culvert.	16.8	0	no
WC-C	Culvert (functioning)	Proposed upgraded road alignment perpendicular to WC on eastern side of road. Replace functioning culvert. On western side of road, alignment expected to have direct impact on WC through ditching. Standard mitigation will apply to limit impact to fish habitat.	23.4	7.4	yes
WC-D	None	Proposed upgraded road alignment perpendicular to WC. Install new culvert at crossing location. Standard mitigation will apply to limit impact to fish habitat.	11.5	10.5	yes
WC-E	Culvert (blocked)	Proposed upgraded road alignment perpendicular to WC, east of existing road. Remove blocked culvert on existing road and install new culvert downstream at new crossing location. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of blocked culvert.	40.7	0	no
WC-F	Culvert (crushed)	Proposed upgraded road alignment perpendicular to WC, west of existing road. Remove blocked culvert on existing road and install new culvert downstream at new crossing location. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of crushed culvert.	43.2	0	no
WC-G	Culvert (crushed)	Proposed upgraded road alignment perpendicular to WC. Replace crushed culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through replacement of crushed culvert.	122	0	no

Table CEAA 2-06-2: Potential Habitat Destruction or Permanent Alteration along the Haul Road (Based on Updated 2021 EIS Section 6.9.7.3.1, Table 6.9-19, page 6-511) (continued)

Watercourse Location / ID	Current Crossing (Condition)	Plan for Upgraded Haul Road[a]	Potentially Impacted Area[b] (m^2)	Direct Footprint Impact (m^2) Considering Site Specific Impact Assessment	Considered HADD based on Mitigation or Analysis of Effects
WC-H	Bridge (functioning)	Proposed upgraded road alignment perpendicular to WC. Existing bridge to be expanded to facilitate multi-use bypass road, and parallel new bridge for Haul Road. Standard mitigation will apply to limit impact to fish habitat.	145.7	0	no
WC-I	Culvert (buried)	Proposed upgraded road alignment perpendicular to WC. Replace buried culvert. Standard mitigation will apply to limit impact to fish habitat.	16.2	0	no
WC-J	Culvert (buried)	Proposed upgraded road alignment perpendicular to WC on eastern side of road. Replace buried culvert. On western side of existing road, alignment overlaps approximately 19 m of parallel stream that flows into western ditch. Proposed road upgrade will funnel the WC directly across the road to the eastern side and away from the ditch network associated with the road. Standard mitigation will apply to limit impact to fish habitat.	55.9	21.6	yes
WC-K	Culvert (buried)	Proposed upgraded road alignment perpendicular to WC. Install new culvert. Replace buried culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through installation of culvert.	9.6	0	no
WC-L	Culvert (functioning)	WC runs parallel to current road in western roadside ditch. Proposed road upgrade will require the functioning culvert to be replaced to funnel the WC directly across the road to the eastern side and away from ditch network associated with the road. Proposed road alignment overlaps approximately 53 m of parallel ditched stream. Standard mitigation will apply to limit impact to fish habitat.	35.0	15.9	yes
WC-M	Culvert (functioning, North), None (South)	Proposed upgraded road alignment is perpendicular to WC at two locations (north and south). Northern crossing will require an extension to existing culvert which is functioning. Southern crossing will require installation of a new culvert. Standard mitigation will apply to limit impact to fish habitat.	46.8	10.9	yes
WC-N- West River	Bridge (functioning)	Proposed upgraded road alignment perpendicular to WC. Existing bridge to be expanded to facilitate multi-use bypass road, and parallel new bridge for Haul Road. Standard mitigation will apply to limit impact to fish habitat.	480	0	no
WC-O	None	Proposed new road designed perpendicular to WC. Requires culvert installation. Standard mitigation will apply to limit impact to fish habitat.	90.0	29.3	yes
WC-P	None	Proposed new road designed perpendicular to WC. Requires culvert installation. Standard mitigation will apply to limit impact to fish habitat.	30.6	10.2	yes
WC-T	Culvert (buried)	Proposed upgraded road alignment perpendicular to WC. Replace buried culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of buried culvert.	81.0	0	no

Table CEAA 2-06-2: Potential Habitat Destruction or Permanent Alteration along the Haul Road (Based on Updated 2021 EIS Section 6.9.7.3.1, Table 6.9-19, page 6-511) (continued)

Watercourse Location / ID	Current Crossing (Condition)	Plan for Upgraded Haul Road[a]	Potentially Impacted Area[b] (m^2)	Direct Footprint Impact (m^2) Considering Site Specific Impact Assessment	Considered HADD based on Mitigation or Analysis of Effects
WC-U	Culvert (functioning)	Proposed upgraded road alignment perpendicular to WC. Replace functioning culvert. Standard mitigation will apply to limit impact to fish habitat.	24.8	0	no
WC-V	Culvert (buried)	Proposed upgraded road alignment perpendicular to WC. Replace buried culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of buried culvert.	51.8	0	no
WC-W	Culvert (hung)	Proposed upgraded road alignment perpendicular to WC. Replace hung culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through replacement of hung culvert.	40.7.	0	no
WC-X	None	Proposed upgraded road alignment is perpendicular to WC and will require a new culvert installation. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through providing fish access to upstream aquatic resources.	16.1	12.1	yes
WC-Y	Culvert (buried)	Proposed upgraded road alignment is perpendicular to WC. Replace buried culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through replacement of buried culvert.	25.9	0	no
WC-AA	Culvert (hung)	Proposed upgraded road alignment perpendicular to WC. Replace hung culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through removal of hung culvert.	96.0	0	no
WC-AC	None	Proposed upgraded road alignment overlaps with the top end of this watercourse (3.7 m). This area may be altered to support road upgrades. Standard mitigation will apply to limit impact to fish habitat.	85.8	8.3	yes
WC-AD-Morgan River	Bridge (functioning)	Proposed upgraded road alignment perpendicular to WC. Existing bridge to be expanded to facilitate multi-use bypass road, and parallel new bridge for Haul Road. Standard mitigation will apply to limit impact to fish habitat.	540.0	0	no
WC-AE	Culvert (buried)	Proposed upgraded road alignment perpendicular to WC. Replace buried culvert. Standard mitigation will apply to limit impact to fish habitat and overall improve fish habitat through replacement of buried culvert.	37.0	0	no
WC-AF	None	Proposed upgraded road alignment overlaps with the bottom end of this watercourse (40.2 m), at which point the watercourse currently empties into the southern ditch along the existing road. Current ditch drains east towards culvert at WC-AE. Proponent will consider installation of a culvert to funnel the watercourse directly across the road north towards WC-AH, away from the ditch network associated with the road. Standard mitigation will apply to limit impact to fish habitat.	51.6	46.3	yes

Table CEAA 2-06-2: Potential Habitat Destruction or Permanent Alteration along the Haul Road (Based on Updated 2021 EIS Section 6.9.7.3.1, Table 6.9-19, page 6-511) (continued)

Watercourse Location / ID	Current Crossing (Condition)	Plan for Upgraded Haul Road[a]	Potentially Impacted Area[b] (m^2)	Direct Footprint Impact (m^2) Considering Site Specific Impact Assessment	Considered HADD based on Mitigation or Analysis of Effects
WC-AG	None	Proposed upgraded road alignment overlaps with the bottom end of this watercourse (18.4 m), at which point the watercourse currently empties into the southern ditch along the existing road. Current ditch drains east towards culvert at WC-AE. Proponent will consider installation of a culvert to funnel the watercourse directly across the road north towards WC-AH, away from the ditch network associated with the road. Standard mitigation will apply to limit impact to fish habitat.	16.0	12.0	yes
WL64	Culvert (buried) – see WC-A	Buried culvert associated with WC-A located at wetland crossing. Proposed upgraded road alignment overlaps surface water features (presumed fish habitat) both sides of road. Replacement of buried culvert likely to improve fish access into wetland.	2192.2	48.7	yes
WL66	Culvert (crushed) at northern crossing – see WC-B	Proposed upgraded road alignment overlaps wetland complex at two locations – a northern crossing (associated with WC-B) and a southern crossing. At northern crossing, proposed upgraded road alignment overlaps surface water features (presumed fish habitat) on both sides of road. Replacement of crushed culvert on WC-B likely to improve fish access into wetland. No culvert/bridge currently exists at southern crossing. Proposed upgraded road alignment overlaps surface water features (presumed fish habitat) on west side of road. Proponent will consider installation of a culvert to re-establish natural wetland hydrology which may provide fish access into previously inaccessible fish habitat.	2,020.3	487.0	yes
WL73	None	No culvert is present at current wetland crossing. Proposed upgraded road alignment overlaps surface water features (presumed fish habitat) currently exist on both sides of road, likely caused by road impoundment. Proponent will consider installation of a culvert to re-establish natural wetland hydrology which may provide fish access into previously inaccessible fish habitat.	483.9	185.2	yes
WL76	Culvert (crushed) – see WC-G	Crushed culvert associated with WC-G located at wetland crossing. Proposed upgraded road alignment overlaps surface water features (presumed fish habitat) both sides of road. Replacement of crushed culvert likely to improve fish access into wetland.	895.7	398.6	yes
WL146	None	No culvert is present at wetland crossing. Proposed upgraded road alignment overlaps surface water feature (presumed fish habitat) on both sides of road – extensive flooding on west side likely caused by road impoundment. Proponent will consider installation of a culvert to re-establish natural wetland hydrology which may provide fish access into previously inaccessible fish habitat from WC-Z.	378.7	106.4	yes

Table CEAA 2-06-2: Potential Habitat Destruction or Permanent Alteration along the Haul Road (Based on Updated 2021 EIS Section 6.9.7.3.1, Table 6.9-19, page 6-511) (continued)

Watercourse Location / ID	Current Crossing (Condition)	Plan for Upgraded Haul Road[a]	Potentially Impacted Area[b] (m^2)	Direct Footprint Impact (m^2) Considering Site Specific Impact Assessment	Considered HADD based on Mitigation or Analysis of Effects
WL154	None	Headwater wetland confined to west side of road. Proposed upgraded road alignment overlaps surface water feature (presumed fish habitat). No culvert proposed.	440.6	176.9	Yes
WL159	Culvert (hung) – see WC-AA	Hung culvert associated with WC-AA located at wetland crossing. Proposed upgraded road alignment overlaps surface water feature (confirmed fish habitat). Replacement of hung culvert likely to improve fish access upstream to WL160.	285.3	6.5	yes
WL160	Culvert (hung) – see WC-AA	Hung culvert associated with WC-AA located at wetland crossing. Proposed upgraded road alignment overlaps surface water feature (confirmed fish habitat). Flooding observed in wetland likely caused by improper culvert sizing. Replacement of crushed culvert likely to improve fish access and re-establish natural wetland hydrology.	897.2	836.5	yes
WL168	None		30.7	0	no
Total			**9,880.14**	**2,430.3**	

Source: Based on AMNS 2021, Section 6.9.7.3.1, Table 6.9-19, page 6-511.

Notes: [a] For all reaches requiring fish rescue prior to culvert installation, fish will be released within the same watercourse or waterbody, typically in an area downstream of the proposed impact unless site conditions necessitate otherwise.

[b] Potential Impacted Area includes the length of the crossing plus 10 m on both the upstream and downstream for installation and end treatments multiplied by the mean wetted width of the watercourse.

CEAA-2-06 B)

To address IR2 (CEAA 2-06), part B, all watercourses and wetlands along the Haul Road identified as potential fish habitat are considered fish habitat for the purposes of the potential and direct impact estimates (wetlands with contiguous and/or open water areas). The methods used to describe watercourses and fish habitat along the Haul Road are provided in the Baseline Fish and Fish Habitat: 2015-2017 Technical Report (Appendix H, Section 2.0, PDF page 289), which is appended to the Baseline Fish and Fish Habitat 2019-2020 Technical Report (Appendix J.2) of the Updated 2021 EIS (AMNS 2021).

Wetlands

To address IR2 (CEAA 2-06), part B, fish habitat descriptions for each wetland in in the Beaver Dam Mine Site and Haul Road have been revised, with details presented in Appendix H, Section 3.4, PDF page 313 of the Baseline Fish and Fish Habitat 2019-2020 Technical Report (Appendix J.2 of the Updated 2021 EIS [AMNS 2021]). Wetlands that were assessed as isolated with no surface water connectivity to fish-bearing systems and/or open water features are considered non-fish bearing and do not provide fish habitat.

Quantification of fish habitat within wetlands was determined using the same methods for quantifying fish habitat in watercourses. Often, wetlands with throughflow watercourses which are highly entrenched are discussed in terms of the watercourse itself for provision of fish habitat. Wetlands which are contiguous with watercourses without strong entrenchment were determined to provide fish habitat in the portion of the wetland with standing water, in a conservatively inclusive way.

Information provided in Table 6.9-4 of the Revised 2019 EIS (AMNS 2019) has been updated and is provided in Appendix J.2 (2019-2020 Fish Baseline Report), Appendix H, Section 3.4.3, Table 3-14, PDF page 323 in the Baseline Fish and Fish Habitat 2015-2017 Technical Report (AMNS 2021) and presented below as Table CEAA 2-06-3.

Table 6.9-27 of the Revised 2019 EIS (AMNS 2019) provided potential direct impacts to fish habitat in all aquatic habitats. This was completed based on now outdated methods for fish habitat quantification, and a previous version of the *Fisheries Act* focused on identifying serious harm to fish. As such, wetland impact areas in this table outlines the entire area of the wetland; not the portion of that wetland that provides fish habitat. Information provided in Table 6.9-27 of the Revised 2019 EIS (AMNS 2019) has been updated in Section 6.9.7.2, as Table 6.9-13, page 6-491 Table 6.9-14, page 6-493, and Table 6.9-15, page 6-494 of the Updated 2021 EIS (AMNS 2021). A summary of fish habitat in wetlands and impacts to wetland fish habitat is presented below in Table CEAA-2-06-4. The last two columns of this table indicate whether fish habitat is present (and in which numbered wetland or watercourse), and identifies whether fish habitat quantification has been completed based on predicted direct or indirect impacts.

Table CEAA-2-06-3: Wetlands Fish Habitat within the Project Area

Wetlands ID	Hydrological Regime	Associated Watercourse/ Waterbody	Fish Habitat Description
Beaver Dam Mine Site			
4	Throughflow	WC2 and WC3	Fish habitat within standing and open water in wetland. Shallow contiguous surface water in wetland may provide shelter and food sources for small forage species. However, no fish were captured in WC3 through electrofishing surveys. No fish collection was conducted in WC2.
8	Bi-directional non- tidal / Throughflow	WC4, WC5, and Crusher Lake	Open water observed in wetland and WC5 throughflow through wetland habitat. Along the southern shore of Crusher Lake. Deeper contiguous surface water may provide rearing, shelter and food for generalist species. Potential spawning habitat for generalist species confirmed in Crusher Lake (banded killifish, brown bullhead, golden shiner) observed along submerged vegetated wetland edge.
10	Lentic – bi- directional - non-tidal	Crusher Lake	Open water and vegetated habitat along lake edge. Deeper contiguous surface water may provide rearing, shelter and food for generalist species. Potential spawning habitat for generalist species confirmed in Crusher Lake (banded killifish, brown bullhead, golden shiner) observed along submerged vegetated wetland edge.
11	Throughflow	WC4	Fish habitat within standing and open water in wetland. Shallow contiguous surface water in wetland may provide shelter and food sources for small forage species confirmed in WC4 (ninespine stickleback, one unconfirmed species).
13	Throughflow	WC4	Currently small beaver dam at watercourse outlet causing localized flooding within the wetland. Shallow contiguous surface water in wetland may provide shelter and food sources for small forage species confirmed in WC4 (ninespine stickleback, one unconfirmed species).
15	Headwater - outflow	WC8	Open water observed in wetland with potential seasonal surface water connections to downstream resources. Shallow contiguous surface water in wetland may provide seasonal shelter and food sources for small forage species. No fish surveys conducted in WC8 as part of 2015 and 2016 field programs.
17	Lentic – bi- directional - non-tidal/throughflow	WC5 and Mud Lake	Open water observed in wetland and unconfined WC5 throughflow. Along the shores of Mud Lake. Inundated wetland habitat with deeper contiguous surface water may provide rearing, shelter and food for generalist species. Potential spawning habitat for generalist species observed along submerged vegetated wetland edge. No fish surveys conducted in Mud Lake as part of 2015 and 2016 field programs.
20	Throughflow	WC3	Open water observed in wetland with intermittent surface water connections to downstream resources. Shallow contiguous surface water in wetland may provide seasonal shelter and food sources for small forage species. However, no fish were captured in WC3 through electrofishing surveys.
29	Headwater - outflow (northern extent) Throughflow (southeastern extent)	WC10 and WC11	Open water and vegetated habitat along lake edge. Deeper contiguous surface water may provide rearing, shelter and food for generalist species. Potential spawning habitat for generalist species also likely along submerged vegetated wetland edge. No fish surveys conducted in system as part of 2015 and 2016 field programs.

Table CEAA-2-06-3: Wetlands Fish Habitat within the Project Area (continued)

Wetlands ID	Hydrological Regime	Associated Watercourse/ Waterbody	Fish Habitat Description
44	Throughflow	WC5	Open water observed in wetland with confirmed surface water connections to downstream resources. Currently beaver dam at outlet causing extensive flooding within the wetland. Deeper contiguous surface water may provide rearing, shelter and food for generalist species. Beaver pond may provide shelter and food source for older brook trout. However, no fish captured in WC5 south of Crusher Lake. Brook trout confirmed south of Crusher Lake.
56[(a)]	Throughflow	WC12	Fish habitat present where standing water is present – drain system present. Shallow contiguous surface water in wetland may provide seasonal shelter and food sources for small forage species confirmed in wetland (banded killifish, northern redbelly dace). Potential spawning areas also available along inundated wetland edge. Seasonal, high flow access to brook trout possible through WC12.
59[(a)]	Throughflow	WC12, WC13, WC14	Open water observed in wetland with confirmed surface water connections to downstream resources. Inundated wetland habitat with deeper contiguous surface water may provide rearing, shelter and food for generalist species, particularly small forage fish. Potential spawning habitat for generalist species within inundated wetland vegetation. No fish species identified through electrofishing surveys but fish visually observed in deeper, open water areas.
61[(a)]	Throughflow/bi- directional non- tidal	WC13, WC25, and Cameron Flowage	Open water observed in wetland with confirmed surface water connection to downstream resources. Along the southeastern shore of Cameron Flowage. Deeper contiguous surface water may provide rearing, shelter and food for generalist species confirmed in Cameron Flowage and WC13 (banded killifish, brown bullhead, golden shiner, white sucker, northern redbelly dace, yellow perch). Potential spawning habitat for generalist species confirmed in Cameron Flowage and (brown bullhead, golden shiner, yellow perch) observed along submerged vegetated wetland edge.
62	Bi-directional non- tidal	Cameron Flowage	Open water observed in wetland with confirmed surface water connection to downstream resources. Along the mid-southern shore of Cameron Flowage. Deeper contiguous surface water may provide rearing, shelter and food for generalist species confirmed in Cameron Flowage and (brown bullhead, golden shiner, white sucker, yellow perch). Potential spawning habitat for generalist species confirmed in Cameron Flowage (brown bullhead, golden shiner, yellow perch) observed along submerged vegetated wetland edge.
Haul Road			
64	Throughflow	A	Open water observed in wetland. Deeper contiguous surface water may provide rearing, shelter and food for generalist species. Potential spawning habitat for generalist species observed within submerged vegetated wetland. No fish surveys conducted as part of 2015 and 2016 field programs.
66	Throughflow	B	Open water observed in wetland. Deeper contiguous surface water may provide rearing, shelter and food for generalist species. Potential spawning habitat for generalist species observed within submerged vegetated wetland (edge). No fish captured in throughflow watercourse (WC-B) through electrofishing efforts.

Table CEAA-2-06-3: Wetlands Fish Habitat within the Project Area (continued)

Wetlands ID	Hydrological Regime	Associated Watercourse/ Waterbody	Fish Habitat Description
68	Throughflow	B and C	Shallow open water sections observed within wetland habitat. Shallow contiguous surface water in wetland may provide seasonal shelter and food sources for small forage species. Inundated wetland area falls outside SA. No fish captured in throughflow watercourse (WC-B) through electrofishing efforts.
69	Lentic/Throughflow	D	Fish habitat present in connected open water – riparian wetland. Inundated wetland habitat with deeper contiguous surface water may provide rearing, shelter and food for generalist species. Potential spawning habitat for generalist species observed along submerged vegetated wetland edge. No fish surveys conducted in waterbody or WC-D as part of 2015 and 2016 field programs.
73	Throughflow	n/a (Cope Pond)	Open water observed on west and east side of forestry road. No culvert, west side of road is currently impounded/inaccessible. Inundated wetland habitat on east side of road with deeper contiguous surface water may provide rearing, shelter and food for generalist species. Outlet stream falls outside of SA. No fish surveys conducted as part of 2015 and 2016 field programs.
74	Throughflow	F	Fish habitat potential in open water marsh habitat located east of exiting forestry road only. Inundated wetland habitat with deeper contiguous surface water may provide rearing, shelter and food for generalist species. Potential spawning habitat for generalist species also present within inundated wetland vegetation. No fish surveys conducted as part of 2015 and 2016 field programs.
76	Throughflow	G	Open water observed in wetland. Inundated wetland habitat with deeper contiguous surface water may provide rearing, shelter and food for generalist species. Potential spawning habitat for generalist species observed along submerged vegetated wetland edge. No fish surveys conducted as part of 2015 and 2016 field programs.
146	Headwater - outflow	Z	Open water behind blocked culvert within wetland habitat. Inundated wetland habitat with deeper contiguous surface water may provide rearing, shelter and food for generalist species. Potential spawning habitat for generalist species observed within submerged vegetated wetland. No fish surveys conducted as part of 2015 and 2016 field programs.
157	Lentic	Upper Kidney Lake/Big Pond	Fish habitat limited to inundated wetland immediately adjacent to Upper Kidney Lake located south of the forestry road, and Big Pond located north of the forestry road. No throughflow hydrological connection identified in wetland connecting the northern and southern lobes – no culvert. No fish surveys conducted as part of 2015 and 2016 field programs.
159	Throughflow	AA	Inundation caused by beaver activity has extended potential fish habitat throughout wetland. Inundated wetland habitat with deeper contiguous surface water may provide rearing, shelter and food for species confirmed within WC-AA (banded killifish, golden shiner, lake chub, and white sucker). Potential spawning habitat for generalist species observed along submerged vegetated wetland edge (golden shiner, banded killifish).

Table CEAA-2-06-3: Wetlands Fish Habitat within the Project Area (continued)

Wetlands ID	Hydrological Regime	Associated Watercourse/ Waterbody	Fish Habitat Description
160	Throughflow	AA	Open water observed in wetland. Inundated wetland habitat with deeper contiguous surface water may provide rearing, shelter and food for species confirmed within WC-AA (banded killifish, golden shiner, lake chub, and white sucker). Potential spawning habitat for generalist species observed within submerged vegetated wetland (golden shiner, banded killifish).
168	Lentic/Throughflow	n/a (Johns Pond)	Culvert at forestry road collects ditch drainage and directs it north through wetland, surface water disappears underground. Channel forms towards Johns Pond, outside/north of SA. Fish habitat restricted to channel and inundated wetland immediately adjacent to Johns Pond. No fish surveys conducted as part of 2015 and 2016 field programs.

Source: AMNS 2021 (Appendix J.2: Baseline Fish and Fish Habitat, Section 3.4, Table 3-9, PDF page 48 and Appendix H, Section 3.4.3, Table 3-14, PDF page 323).

Note: [a] Wetlands reassessed through detailed fish habitat assessments during 2019-2020 field program (Appendix J.2, Section 3.4, Table 3-9, PDF page 48 of the Updated 2021 EIS [AMNS 2021]).

Table CEAA-2-06-4: Summary of Fish Habitat in Wetlands Delineated within the Beaver Dam Mine Project Area

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Hydrologic Flow Path	Watercourse Association	Standing Water % Cover in Wetland	Watercourse or Open Water	Quantification of Fish Habitat
1	complex: Mixed wood treed bog, tall shrub bog, open low shrub bog	37,188	Terrene	Outflow-Headwater	Stream	<5%	WC3 and WC5	No - No impacts expected in fish habitat within wetland
2	coniferous treed bog, graminoid bog, shrub bog	196,857	Terrene	Outflow-Headwater	Stream	0%	WC1	Yes – WC1
3	shrub bog	4,658	Terrene	Isolated	No	50%	None	N/A
4	complex: Treed swamp/ treed fen, mixed wood treed swamp	13,139	Terrene	Throughflow	Stream	20%	WC2 and WC3	No - No impacts expected
5	mixed wood treed swamp	6,202	Terrene	Outflow-Headwater	No	5%	WC2	No - No impacts expected
6	mixed wood treed swamp	262	Terrene	Isolated	No	0%	None	N/A
7	cut treed swamp	306	Terrene	Isolated	No	<5%	None	N/A
8	complex: Coniferous treed swamp, graminoid fen, low shrub fen, shrub swamp	16,603	Lentic lake	Bidirectional-non-tidal /Throughflow	Lake	30%	WC4, WC5, Crusher Lake	Yes - in WC5 downstream of Crusher Lake only
9	open bog	307	Terrene	Isolated	No	5%	None	N/A
10	low shrub fen	18,817	Lentic lake	Bidirectional-non-tidal	Lake	50%	Crusher Lake	No - No impacts expected in fish habitat within wetland
11	complex: low shrub bog, mixed wood treed swamp	2,955	Lotic Stream (ephemeral)	Throughflow	No	5%	WC4	No - No impact expected

Table CEAA-2-06-4: Summary of Fish Habitat in Wetlands Delineated within the Beaver Dam Mine Project Area (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Hydrologic Flow Path	Watercourse Association	Standing Water % Cover in Wetland	Watercourse or Open Water	Quantification of Fish Habitat
12	complex: Open mixed wood treed swamp, coniferous treed swamp	4,475	Terrene	Isolated	No	0%	None	N/A
13	complex: Treed swamp, coniferous treed swamp	4,816	Terrene	Throughflow	No	20%	WC4	No - No impact expected
14	complex: Shrub bog, Mixed wood treed swamp, low shrub fen	31,655	Terrene/Lotic Stream	Throughflow	Streams	8%	WC3 and WC5	Yes - WC5. no impact expected in WC3
15	graminoid fen	1,249	Lentic Pond	Outflow	Stream/ Pond	20%	WC8	No - No impact expected
16	open shrub swamp	3,670	Terrene	Outflow-Headwater (inferred)	No	<5%	WC6	No - No impact expected
17	complex: Tall shrub swamp, coniferous treed bog	76,341	Lentic lake	Bidirectional-non-tidal/throughflow	Stream/ Lake	40%	WC5, WC27, Mud Lake	Yes - WC5, WC27, Mud Lake
18	coniferous treed swamp	1,864	Terrene	Isolated	No	0%	None	N/A
19	shrub bog	11,428	Terrene	Isolated	No	1%	None	N/A
20	mixed wood treed fen	10,106	Terrene/Lotic Stream	Throughflow	Stream	25%	WC3	No - No impact expected
21	mixed wood treed swamp	202	Terrene	Isolated	No	0%	None	N/A
22	mixed wood treed swamp	274	Terrene	Isolated	No	0%	None	N/A
23	coniferous treed swamp	419	Terrene	Isolated	No	0%	None	N/A
24	coniferous treed swamp	328	Terrene	Isolated	No	0%	None	N/A
25	coniferous treed swamp	1,416	Terrene	Isolated	No	1-2%	None	N/A
26	coniferous treed swamp	658	Terrene	Isolated	No	100%	None	N/A
27	mixed wood treed swamp	493	Terrene	Outflow-Headwater	Stream	5%	WC10	No - No impact expected

Table CEAA-2-06-4: Summary of Fish Habitat in Wetlands Delineated within the Beaver Dam Mine Project Area (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Hydrologic Flow Path	Watercourse Association	Standing Water % Cover in Wetland	Watercourse or Open Water	Quantification of Fish Habitat
28	coniferous treed swamp	222	Terrene	Isolated	No	0%	None	N/A
29	complex: Mixed wood treed swamp, low shrub fen, open bog, coniferous treed swamp, coniferous raised bog, graminoid fen	112,835	Lentic lake	Outflow-Headwater (northern extent), Throughflow (southeastern extent)	Lake/ Stream	25%	WC11	No - No impact expected
30	coniferous treed swamp	964	Terrene	Isolated	No	0%	None	N/A
31	coniferous treed swamp	10,473	Terrene	Isolated	No	0%	None	N/A
32	coniferous treed swamp	120	Terrene	Isolated	No	0%	None	N/A
33	coniferous treed swamp	1,900	Lotic Stream	Throughflow	No	5%	WC11	No - No impact expected
34	mixed wood treed swamp	1,382	Terrene	Isolated	No	0%	None	N/A
35	coniferous treed swamp	3,376	Terrene	Isolated	No	0%	None	N/A
36	coniferous treed swamp	916	Terrene	Isolated	No	0%	None	N/A
37	deciduous treed swamp	253	Terrene	Isolated	No	0%	None	N/A
38	coniferous treed swamp	388	Terrene	Isolated	No	0%	None	N/A
39	coniferous treed swamp	1,857	Terrene	Isolated	No	0%	None	N/A
40	coniferous treed swamp	8,091	Terrene	Isolated	No	0%	None	N/A
41	graminoid marsh	910	Terrene	Isolated	No	0%	None	N/A
42	coniferous treed swamp	1,879	Terrene	Isolated	No	0%	None	N/A
43	mixed wood treed swamp	81	Terrene	Isolated	No	0%	None	N/A
44	coniferous treed bog	10,611	Terrene	Throughflow	Stream	90%	WC5	No - No impact expected upstream of Crusher Lake
45	coniferous treed swamp	295	Terrene	Isolated	No	<5%	None	N/A

Table CEAA-2-06-4: Summary of Fish Habitat in Wetlands Delineated within the Beaver Dam Mine Project Area (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Hydrologic Flow Path	Watercourse Association	Standing Water % Cover in Wetland	Watercourse or Open Water	Quantification of Fish Habitat
46	coniferous treed riverine swamp	754	Lotic Stream	Throughflow	Stream	0%	WC5	No - No impact expected upstream of Crusher Lake
47	fresh water marsh	1,029	Terrene	Isolated	No	80%	None	N/A
48	coniferous treed swamp	2,876	Terrene	Throughflow	Stream	0%	WC4	No - no impact expected
49	coniferous treed swamp	117	Terrene	Isolated	No	5%	None	N/A
50	coniferous tall shrub swamp	117	Terrene	Isolated	No	0%	None	N/A
51	mixed wood treed swamp	898	Terrene	Isolated	No	0%	None	N/A
52	coniferous treed swamp	1,620	Terrene	Throughflow	Stream	0%	WC-5	No - No impact expected upstream of Crusher Lake
53	low shrub swamp	824	Terrene	Outflow-Headwater	Stream	<5%	WC-5	No - No impact expected upstream of Crusher Lake
54	coniferous treed bog	416	Lotic	Isolated	No	0%	None	N/A
55	mixed wood treed swamp	616	Terrene	Isolated	No	0%	None	N/A
56	complex: Coniferous treed swamp, tall shrub swamp, low shrub bog, open water	16,276	Terrene	Throughflow	Streams	5%	WC12 and open water	Yes - WC12, WL56
57	complex: Coniferous treed swamp, deciduous treed swamp	88,717	Terrene	Outflow-Headwater	Stream	0%	WC14, (WC18)	Yes - WC14. WC18 is a regulated WC, not fish habitat
58	deciduous treed swamp	581	Terrene	Isolated	No	0%	None	N/A
59	complex: coniferous treed swamp, emergent marsh, open water	65,304	Terrene	Throughflow	Streams	70%	WC12, open water, WC13	Yes - WC12, WC13, WL59.

Table CEAA-2-06-4: Summary of Fish Habitat in Wetlands Delineated within the Beaver Dam Mine Project Area (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Hydrologic Flow Path	Watercourse Association	Standing Water % Cover in Wetland	Watercourse or Open Water	Quantification of Fish Habitat
60	coniferous treed swamp	2,963	Terrene	Isolated	No	0%	None	N/A
61	complex: Deciduous treed swamp, tall shrub swamp, open low shrub fen	25,982	Lentic lake	Throughflow/Bidirectional- non-tidal	Lake	20%	WC25, Cameron Flowage	Yes - WC25, WL61
62	coniferous treed swamp	832	Lentic lake	Bidirectional- non - tidal	Lake	0%	Cameron Flowage	No impact proposed to fish habitat within WL62
63	coniferous treed swamp	486	Terrene	Isolated	No	0%	None	N/A
64	complex: low shrub bog, mixed wood treed swamp	42,047	Terrene	Throughflow	No	40%	WC1, WCA	Yes - WC1, WCA, and standing water in WL64
66	complex: graminoid fen, mixed wood treed swamp, high shrub fen	55,419.49	Terrene	Throughflow	Stream	65%	WCB	Yes, WCB, and standing water in WL66
200	coniferous treed swamp	1,677	Terrene	Isolated	No	0%	None	N/A
201	mixed wood swamp	284	Terrene	Isolated	No	0%	None	N/A
202	coniferous treed swamp	571	Terrene	Isolated	No	0%	None	N/A
203	open bog	3,925	Terrene	Isolated	No	0%	None	N/A
204	coniferous treed swamp	8,295	Terrene	Isolated	No	0%	None	N/A
205	mixed wood swamp	45,975	Terrene	Throughflow	No	0%	(WC20, WC21, WC22)	Yes - quantified, but confirmed by ECCC to not be fish habitat.
206	shrub swamp	3,298	Lotic Stream	Throughflow	Stream	2%	WC17	No - No impacts expected
207	complex: mixed wood treed swamp, bog	86,450	Terrene	Outflow	Stream	4%	WC16, WC26	Yes - WC26. WC16 is not contiguous with any fish bearing system
208	coniferous bog	6,478	Terrene	Isolated	No	3%	None	N/A

Table CEAA-2-06-4: Summary of Fish Habitat in Wetlands Delineated within the Beaver Dam Mine Project Area (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Hydrologic Flow Path	Watercourse Association	Standing Water % Cover in Wetland	Watercourse or Open Water	Quantification of Fish Habitat
209	shrub bog	11,514	Terrene	Isolated	No	0%	None	N/A
210	coniferous bog	11,058	Lotic Stream	Inflow - Stream, Drainage	Stream	10%	(WC15)	No - WC15 is not contiguous with any fish bearing system.
211	coniferous treed swamp	10,474	Terrene	Isolated	No	0%	None	N/A
212	shrub swamp	13,987	Terrene	Isolated	No	0%	None	N/A
213	shrub swamp	992	Terrene	Isolated	No	0%	None	N/A
214	mixed wood swamp	6,041	Terrene	Isolated	No	0%	None	N/A
215	shrub swamp	16,447	Lotic Stream	Outflow	Stream	0%	(WC15)	No - WC15 is not contiguous with any fish bearing system.
216	shrub swamp	1,397	Terrene	Isolated	No	0%	None	N/A
217	coniferous treed swamp	5,230	Lotic Stream	Throughflow	Stream	1%	(WC18)	No - WC18 is a non-fish bearing regulated watercourse. No fish habitat within the wetland adjacent to Cameron Flowage.
218	open bog	115	Terrene	Isolated	No	40%	None	N/A
219	complex: fen, mixed wood treed swamp	90,880	Stream Floodplain	Outflow	Stream	0%	(WC19)	No - WC19 is a non-fish bearing regulated watercourse - not contiguous with downstream fish-bearing systems.

Table CEAA-2-06-4: Summary of Fish Habitat in Wetlands Delineated within the Beaver Dam Mine Project Area (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Hydrologic Flow Path	Watercourse Association	Standing Water % Cover in Wetland	Watercourse or Open Water	Quantification of Fish Habitat
220	coniferous treed fen	15,691	Terrene	Outflow	Stream	0%	(WC21)	Yes - habitat is quantified by homogeneous section, however it was confirmed by ECCC that this habitat is not considered waters frequented by fish.
221	mixed wood treed swamp	4,082	Terrene	Isolated	No	0%	None	N/A
222	coniferous treed swamp	7,788	Terrene	Isolated	no	0%	None	N/A
223	coniferous treed swamp	475	Terrene	Isolated	no	10%	None	N/A
224	coniferous treed swamp	1,693	Terrene	Isolated	no	0%	None	N/A
225	coniferous treed swamp	235	Terrene	Isolated	no	0%	None	N/A
226	complex: coniferous swamp, bog	15,039	Terrene	Isolated	no	0%	None	N/A
227	mixed wood treed swamp	365	Terrene	Isolated	no	0%	None	N/A
228	coniferous treed bog	11,835	Terrene	Isolated	no	0%	None	N/A
229	coniferous treed swamp	4,644	Terrene	Isolated	no	0%	None	N/A
230	coniferous treed swamp	1,812	Terrene	Isolated	no	0%	None	N/A
231	coniferous treed swamp	4,808	Terrene	Inflow (via drainage)	no	0%	None	N/A
232	mixed wood treed swamp	875	Terrene	Isolated	no	0%	None	N/A
233	mixed wood treed swamp	8,025	Terrene	Isolated	no	0%	None	N/A
234	coniferous treed swamp	3,328	Terrene	Isolated	no	0%	None	N/A
235	mixed wood treed swamp	619	Terrene	Isolated	no	0%	None	N/A
236	complex: swamp, bog	37,699	Terrene	Isolated	No	0%	None	N/A

Table CEAA-2-06-4: Summary of Fish Habitat in Wetlands Delineated within the Beaver Dam Mine Project Area (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Hydrologic Flow Path	Watercourse Association	Standing Water % Cover in Wetland	Watercourse or Open Water	Quantification of Fish Habitat
237	coniferous treed swamp	429	Terrene	Throughflow (via drainage)	no	0%	None	N/A
238	deciduous treed swamp	4,685	Terrene	Isolated	no	0%	None	N/A
239	open bog	1,004	Terrene	Isolated	no	0%	None	N/A
240	mixed wood treed swamp	21,799	Terrene	Isolated	no	0%	None	N/A
241	mixed wood treed swamp	821	Terrene	Isolated	no	0%	None	N/A
242	mixed wood treed swamp	2,366	Terrene	Isolated	no	0%	None	N/A
243	mixed wood treed swamp	1,104	Terrene	Isolated	no	0%	None	N/A
244	coniferous treed swamp	131	Terrene	Isolated	no	0%	None	N/A
245	mixed wood treed swamp	1,864	Terrene	Isolated	no	5%	None	N/A
246	mixed wood treed swamp	8,871	Terrene	Isolated	no	5%	None	N/A
247	mixed wood treed swamp	9,371	Terrene	Isolated	no	0%	None	N/A
248	mixed wood treed swamp	401	Terrene	Isolated	no	0%	None	N/A
249	mixed wood treed swamp	2,322	Terrene	Isolated	no	0%	None	N/A
257	shrub swamp	230	Terrene	Isolated	no	10%	None	N/A
258	shrub swamp	954	Terrene	Isolated	no	0%	None	N/A
64	complex: low shrub bog, mixed wood treed swamp	6,306	Terrene	Throughflow	No	40%	WC1, WC-A	Yes - WC1, WC-A, and standing water in WL64
65	open bog	65	Terrene	Isolated	No	0%	None	N/A
66	complex: graminoid fen, mixed wood treed swamp, high shrub fen	15,578	Terrene	Throughflow	Stream	65%	WC-B	Yes, WC-B, and standing water in WL66
67	complex: low shrub fen, tall shrub fen	1,535	Terrene	Outflow	No	20%	WC-C	Yes - WC-C

Table CEAA-2-06-4: Summary of Fish Habitat in Wetlands Delineated within the Beaver Dam Mine Project Area (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Hydrologic Flow Path	Watercourse Association	Standing Water % Cover in Wetland	Watercourse or Open Water	Quantification of Fish Habitat
68	complex: shrub fen, graminoid fen and mixed wood treed swamp	5,568	Terrene	Throughflow	No	10%	WC-C	Yes - WC-C
69	complex: Shrub fen, graminoid fen and mixed wood treed swamp	3,899	Lentic	Throughflow (inferred from wet areas mapping)	Stream	5%	WC-D	Yes - WC-D. No impact to WL69
70	tall shrub swamp	613	Terrene	Isolated (inferred)	No	20%	None	N/A
71	deciduous treed swamp	425	Terrene	Isolated	No	0%	None	N/A
72	deciduous treed swamp	1,471	Terrene	Outflow	No	0%	WC-E	Yes - WC-D. No impact to WL72.
73	Complex: tall shrub swamp, tall shrub fen	27,091	Terrene	Throughflow	No	10%	Open Water - tributary to Cope Pond	Yes - WL73 open water
74	Complex: Mixed wood treed swamp, fresh water marsh	12,339	Terrene	Throughflow	Stream	15%	WC-F	Yes - WC-F.
75	mixed wood treed swamp	144	Terrene	Isolated	No	1%	None	N/A
76	Complex: mixed wood treed swamp, open graminoid fen	10,406	Lotic	Throughflow	Stream	2%	WC-G and flooded wetland	Yes - WC-G and flooded wetland
77	mixed wood treed swamp	1,688	Terrene	Throughflow (inferred)	No	0%	WC-J	Yes - WC-J. No impact to WL77.
78	mixed wood treed swamp	194	Terrene	Isolated	No	0%	None	N/A
79	coniferous treed swamp	3,294	Terrene	Throughflow	Stream	0%	WC-H, WC-I, WC-J	No impacts predicted within WL79
80	coniferous bog	978	Terrene	Isolated	No	0%	None	N/A
81	tall shrub swamp	154	Terrene	Isolated	No	20%	None	N/A

Table CEAA-2-06-4: Summary of Fish Habitat in Wetlands Delineated within the Beaver Dam Mine Project Area (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Hydrologic Flow Path	Watercourse Association	Standing Water % Cover in Wetland	Watercourse or Open Water	Quantification of Fish Habitat
82	mixed wood treed swamp	616	Terrene	Isolated	No	1%	None	N/A
83	mixed wood treed swamp	529	Terrene	Isolated (inferred)	No	0%	None	N/A
84	low shrub swamp	695	Terrene	Isolated (inferred)	No	0%	None	N/A
85	low shrub swamp	322	Terrene	Isolated (inferred)	No	0%	None	N/A
86	mixed wood swamp	4,607	Terrene	Isolated (inferred)	No	0%	None	N/A
87	open bog	362	Terrene	Isolated (inferred)	No	5%	None	N/A
88	tall shrub swamp	409	Terrene	Isolated	No	0%	None	N/A
89	treed swamp	6,170	Terrene	Isolated (inferred)	No	0%	None	N/A
90	mixed wood treed swamp	4,495	Terrene	Outflow (inferred)	No	1%	WC-K	Yes - WC-K. No Impact to fish habitat within WL90
91	mixed wood treed swamp	1,060	Terrene	Isolated (inferred)	No	1%	None	N/A
92	mixed wood treed swamp	1,943	Terrene	Throughflow	No	1%	WC-L	Yes - WC-L. No impact to fish habitat within WL92.
93	graminoid marsh	166	Terrene	Isolated	No	90%	None	N/A
94	mixed wood treed swamp	1,693	Lotic	Throughflow	Stream	20%	WC-M	Yes - WC-M. No impact to fish habitat within WL94.
95	mixed wood treed swamp	263	Terrene	Isolated	No	2%	None	N/A
96	mixed wood treed swamp	861	Terrene	Isolated (inferred)	No	0%	None	N/A
97	mixed wood treed swamp	107	Terrene	Isolated	No	30%	None	N/A
98	mixed wood treed swamp	1,540	Terrene	Throughflow	Stream	20%	WC-N	No impact to WL98
99	mixed wood treed swamp	694	Terrene	Isolated	No	3%	None	N/A
100	shrub swamp	1,582	Terrene	Isolated	No	0%	None	N/A

Table CEAA-2-06-4: Summary of Fish Habitat in Wetlands Delineated within the Beaver Dam Mine Project Area (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Hydrologic Flow Path	Watercourse Association	Standing Water % Cover in Wetland	Watercourse or Open Water	Quantification of Fish Habitat
101	clear cut swamp	219	Terrene	Isolated	No	0%	None	N/A
102	Complex; mixed wood treed bog, mixed wood treed swamp	5,439	Terrene	Isolated	No	15%	None	N/A
103	low shrub bog	455	Terrene	Isolated	No	0%	None	N/A
104	low shrub swamp	102	Hillslope	Isolated	No	0%	None	N/A
105	low shrub bog	284	Terrene	Isolated	No	0%	None	N/A
106	low shrub bog	1,701	Terrene	Isolated (inferred)	No	0%	None	N/A
107	coniferous treed swamp	186	Terrene	Isolated	No	0%	None	N/A
108	tall shrub swamp	183	Terrene	Isolated	No	0%	None	N/A
109	coniferous treed swamp	1,606	Terrene	Isolated	No	1%	None	N/A
110	shrub bog	912	Terrene	Isolated	No	1%	None	N/A
111	mixed wood swamp	1,060	Lotic	Throughflow	Stream	5%	WC-O	No impact to WL111
112	mixed wood swamp	3,595	Terrene	Outflow-Headwater	Stream	8%	WC-O	No impact to WL112
113	mixed wood treed swamp	1,940	Terrene	Isolated (inferred)	No	3%	None	N/A
114	coniferous swamp	242	Terrene	Isolated	No	<5%	None	N/A
115	mixed wood treed swamp	582	Terrene	Isolated (inferred)	No	2%	None	N/A
116	coniferous swamp	892	Terrene	Isolated	No	0%	None	N/A
117	coniferous swamp	147	Terrene	Isolated	No	4%	None	N/A
118	coniferous swamp	428	Terrene	Isolated	No	2%	None	N/A
119	coniferous treed swamp	328	Terrene	Isolated	No	0%	None	N/A
120	low shrub swamp	115	Terrene	Isolated	No	0%	None	N/A
121	coniferous swamp	466	Terrene	Isolated	No	0%	None	N/A

Table CEAA-2-06-4: Summary of Fish Habitat in Wetlands Delineated within the Beaver Dam Mine Project Area (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Hydrologic Flow Path	Watercourse Association	Standing Water % Cover in Wetland	Watercourse or Open Water	Quantification of Fish Habitat
122	coniferous treed swamp	200	Terrene	Isolated	No	0%	None	N/A
123	mixed wood treed swamp	818	Terrene	Isolated	No	2%	None	N/A
124	mixed wood treed swamp	528	Terrene	Isolated	No	0%	None	N/A
125	mixed wood treed swamp	344	Terrene	Isolated	No	0%	None	N/A
126	mixed wood treed swamp	63	Terrene	Isolated	No	0%	None	N/A
127	treed bog	185	Terrene	Outflow (inferred)	No	5%	None	N/A
128	tall shrub bog	409	Terrene	Isolated	No	0%	None	N/A
129	treed bog	2,006	Terrene	Isolated	No	2%	None	N/A
133	low shrub bog	102	Terrene	Isolated	No	5%	None	N/A
134	treed swamp	398	Terrene	Isolated	No	5%	None	N/A
135	shrub fen	1,227	Terrene	Throughflow	Stream	0%	WC-Q	No impacts to WL135.
136	mixed wood treed swamp	522	Terrene	Isolated	No	0%	None	N/A
137	mixed wood treed swamp	2,404	Terrene	Throughflow	Stream	5%	WC-R	No impacts to WL137.
138	shrub bog	1,521	Terrene	Isolated	No	20%	None	N/A
139	tall shrub bog	106	Terrene	Isolated	No	28%	None	N/A
140	treed bog	230	Terrene	Isolated	No	0%	None	N/A
141	tall shrub bog	60	Terrene	Isolated	No	40%	None	N/A
142	low shrub bog	342	Lotic	Throughflow	Stream	2%	WC-W	Yes - WC-W.
143	Complex: graminoid bog, deciduous treed swamp	527	Lotic	Throughflow	Stream	45%	WC-X	Yes - WC-X.
144	tall shrub fen	2,034	Terrene	Throughflow	Stream	10%	WC-Y	Yes - WC-Y. No Impacts to fish habitat within WL144
145	low shrub bog	1,462	Terrene	Isolated (inferred)	No	0%	None	N/A

Table CEAA-2-06-4: Summary of Fish Habitat in Wetlands Delineated within the Beaver Dam Mine Project Area (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Hydrologic Flow Path	Watercourse Association	Standing Water % Cover in Wetland	Watercourse or Open Water	Quantification of Fish Habitat
146	Complex: graminoid fen, mixed wood treed swamp	2,265	Terrene	Outflow	Stream/ Pond	75%	WC-Z and slooded wetland in WL146	Yes - Flooded wetland in WL146
147	Complex: low shrub bog, mixed wood treed swamp	2,708	Terrene	Outflow (inferred)	No	5%	None	N/A
148	low shrub bog	9,221	Terrene	Throughflow (inferred)	No	5%	None	N/A
149	low shrub bog	1,835	Terrene	Isolated (inferred)	No	6%	None	N/A
150	marsh	145	Terrene	Isolated	No	95%	None	N/A
151	tall shrub bog	2,827	Terrene	Isolated	No	2%	None	N/A
152	clear cut mixed wood swamp	2,275	Terrene	Isolated	No	0%	None	N/A
153	shrub swamp	2,416	Terrene	Outflow (inferred)	No	5%	None	N/A
154	open bog	1,927	Terrene	Outflow (inferred)	No	30%	None; flooded wetland habitat.	Yes - Flooded wetland in WL154
155	mixed wood treed swamp	540	Terrene	Isolated	No	20%	None	N/A
156	shrub bog	14,745	Terrene	Outflow/headwater (inferred)	No	1%	None	N/A
157	Complex: shrub fen, shrub swamp	7,006	Lentic	Throughflow (inferred from wet areas mapping)	No	1%	None	N/A
158	shrub swamp	575	Terrene	Isolated	No	15%	None	N/A
159	mixed wood treed swamp	1,995	Lotic Stream	Throughflow	Stream	15%	WC-AA and flooded wetland	Yes - WC-AA
160	freshwater marsh	1,237	Lotic Stream	Throughflow	Stream	60%	WC-AA and flooded wetland	Yes - WC-AA and flooded wetland in WL160.

Table CEAA-2-06-4: Summary of Fish Habitat in Wetlands Delineated within the Beaver Dam Mine Project Area (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Hydrologic Flow Path	Watercourse Association	Standing Water % Cover in Wetland	Watercourse or Open Water	Quantification of Fish Habitat
161	mixed wood swamp	1,618	Terrene	Isolated	No	0%	None	N/A
162	mixed wood treed swamp	1,756	Terrene	Isolated	No	5%	None	N/A
163	clear cut swamp	1,107	Terrene	Isolated	No	10%	None	N/A
164	mixed wood treed swamp	3,320	Terrene	Isolated (inferred)	No	1%	None	N/A
165	mixed wood treed swamp	1,623	Lotic	Throughflow	Stream	10%	WC-AC	Yes - WC-AC
166	shrub swamp	68	Terrene	Isolated	No	0%	None	N/A
167	mixed wood treed swamp	875	Terrene	Isolated	No	3%	None	N/A
168	Open bog	664	Terrene	Bidirectional-non-tidal	Pond	75%	Johns Pond	No - no impact proposed to WL168
169	mixed wood treed swamp	607	Terrene	Isolated (inferred)	No	2%	None	N/A
170	mixed wood treed swamp	1,893	Terrene	Isolated (inferred)	No	0%	None	N/A
171	mixed wood treed swamp	4,329	Riverine	Throughflow	Stream and River (inferred)	10%	WC-AE	Yes - WC-AE, no impact proposed to WL171.
172	mixed wood treed swamp	229	Terrene	Isolated	No	5%	None	N/A
173	mixed wood treed swamp	4,814	Lotic	Throughflow	Stream	10%	WC-AE, WC-AF	Yes - WC-AE and WC-AF. No impact to fish habitat proposed in WL173.
174	mixed wood treed swamp	2,649	Terrene	Outflow	Stream	5%	WC-AG	No impact proposed to WL174.
175	shrub swamp	632	Terrene	Outflow (inferred)	No	5%	None	N/A
176	mixed wood treed swamp	446	Terrene	Isolated (inferred)	No	0%	None	N/A
177	shrub swamp	808	Terrene	Isolated (inferred)	No	70%	None	N/A
178	mixed wood treed swamp	4,385	Terrene	Isolated (inferred)	No	40%	None	N/A
179	mixed wood treed swamp	3,376	Terrene	Isolated	No	5%	None	N/A

Table CEAA-2-06-4: Summary of Fish Habitat in Wetlands Delineated within the Beaver Dam Mine Project Area (continued)

Wetland ID	Wetland Type	Wetland Size (m^2)	Landscape Position	Hydrologic Flow Path	Watercourse Association	Standing Water % Cover in Wetland	Watercourse or Open Water	Quantification of Fish Habitat
250	coniferous treed swamp	404	Terrene	Outflow	No	0%	None	N/A
251	mixed wood treed swamp	104	Stream Entrenched	Outflow	Stream	1%	WC-AI	No impact proposed to WL251 or WC-AI
252	coniferous treed fen	716	Stream Entrenched	Throughflow	Stream	5%	WC-AI	No impact proposed to WL252 or WC-AI
253	coniferous treed fen	205	Terrene	Outflow (inferred)	No	2%	None	N/A
254	coniferous treed swamp	6,644	Terrene	Isolated	No	0%	None	N/A
255	shrub swamp	65	Terrene	Isolated	No	0%	None	N/A
256	coniferous treed swamp	15,423	Terrene	Isolated	No	0%	None	N/A
259	coniferous treed swamp	162	Terrene	Isolated	No	0%	None	N/A

References

AMNS (Atlantic Mining NS Inc.). 2019. Revised Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. February 28, 2019. Middle Musquodoboit, NS.

AMNS. 2021. Updated Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. October 2021. Middle Musquodoboit, NS.

Round 2 Information Request Number:	CEAA-2-07
Regulatory Agency/Indigenous Community:	DFO, KMKNO
Topic/Discipline:	Fish and Fish Habitat
EIS Guideline Reference:	6.5 Mitigation; 6.6 Significance of Residual Effects
Revised EIS (February 28, 2019) Reference:	Section 6.9.5.2 Thresholds for Determination of Significance; Section 6.9.9 Residual Effects and Significance

Context and Rationale

Section 6.9.5.2 of the revised EIS defines a significant adverse effect from the Project on fish and fish habitat as "an effect that is likely to cause serious harm to fish … an adverse effect that does cause a permanent loss to fish habitat may be mitigated by replacement of lost habitat and removal/rescue of fish present prior to commencement of the activity. This may also allow for an adverse effect to be considered not significant".

Section 35 of the Fisheries Act prohibits serious harm to fish which is defined in the Act as "the death of fish or any permanent alteration to, or destruction of, fish habitat".

Project infrastructure and/or activities that result in the direct destruction of fish habitat are considered serious harm to fish. Substantial alterations to hydrological conditions in fish habitats over the long term that limit or diminish the ability of fish to use these habitats to carry out life processes are also considered to be serious harm to fish.

DFO does not agree with the proponent's prediction that direct and indirect impacts to fish and fish habitat from the Project will not result in serious harm to fish. Based on the information presented in the revised EIS, DFO has determined that the Project is likely to result in serious harm to fish and that a Fisheries Act Authorization is required. Based on the significance threshold for fish and fish habitat provided in section 6.9.5.2 of the revised EIS, additional information is needed about fish habitat offsetting measures to determine whether the Project is likely to result in a significant adverse effect to fish and fish habitat. The Agency requires that the proponent demonstrate that measures and standards have been fully applied to first avoid, then mitigate, residual harm to fish, as set out in DFO's Fisheries Protection Policy Statement (http://www.dfo-mpo.gc.ca/pnw-ppe/pol/index- eng.html#ch84).

The Proponent is Required to …

Following the application of additional measures to avoid and mitigate impacts to fish and fish habitat (see DFO IR-3), provide an estimate of the total surface area of residual serious harm to fish (in square metres) that is likely to result from the Project. This estimate must include fish habitats that will be directly destroyed by Project components, and fish habitats that will be permanently altered as a result of hydrological alterations from Project components.

Provide a draft fish habitat offsetting plan that identifies specific measures that will be implemented to offset the likely residual serious harm to fish from the Project. The draft fish habitat offsetting plan should be developed in accordance with available guidance: DFO's Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting (http://www.dfo-mpo.gc.ca/pnw-ppe/offsetting-guide-compensation/index-eng.html). Note that a final fish habitat offsetting plan and associated letter of credit is required to apply for a Fisheries Act Authorization.

Update the direct and cumulative effects assessment of related valued components as appropriate.

Response

CEAA-2-07 A

AMNS has updated the effects assessment related to fish and fish habitat to reflect the current, modernized *Fisheries Act*; which requires quantification of all direct and indirect Harmful Alteration, Disruption or Destruction (HADD) of fish habitat; rather than the previous threshold of Serious Harm to Fish. Methods to identify impact areas to fish habitat are described in the Updated 2021 EIS Section 6.9.3.3, page 6-438. Direct and indirect impacts are defined and quantified in Section 6.9.7.2, page 6-488 and Section 6.9.7.3, page 6-508, respectively. Measures to avoid, minimize and offset for impacts to fish habitat are described in Section 6.9.8.1, page 6-543 (AMNS 2021). For convenience, we have provided a summary of the potential residual effects (HADD) below from the more detailed descriptions in Section 6.9.7.2, page 6-488, Section 6.9.7.3, page 6-508 and Appendix J.3 (draft Fish Habitat Offset Plan), Section 5.0, PDF page 60 of the Updated 2021 EIS (AMNS 2021).

Residual potential HADD at the Beaver Dam site are provided in Table CEAA 2-07-1 below. Habitats directly destroyed are considered to be permanently lost over the entire area identified. Habitats permanently altered due to flow reductions have been quantified as the entire surface area at 30% MAD as it is below this threshold where there is greater potential to impact the habitats' ability to sustain the resident fish species life cycle.

Table CEAA 2-07-2 quantifies the residual impacts associated with wetlands and watercourses along the haul road after consideration of mitigations such as improving degraded culvert crossings. Lastly an estimate of the total surface area of residual serious harm to fish (in square metres) for the Project Site and Haul Road combined is provided in Table CEAA 2-07-3. It is recognized that these are best estimates of residual impacts and that ongoing discussions with DFO may require future adjustments to the values.

Table CEAA 2-07-1: Residual Habitat Destruction or Permanent Alteration within the Proposed Beaver Dam Mine Site Footprint (Based on Updated 2021 EIS Section 6.9.9, Table 6.9-31, page 6-555, Appendix J.3, Section 4.3.3, Table 3, PDF page 34 and table carried forward from CEAA-2-06)

Watercourse / Waterbody	Infrastructure	Residually Impacted Area (m^2)
WC-5	**Habitat Destruction**: Due to overprinting Internal Haul Road	154.00
WC-12	**Habitat Destruction**: Due to overprinting Pit	93.00
WL56	**Habitat Destruction**: Due to overprinting Pit	1,454.27
WC-13[(b)]	**Habitat Destruction**: Loss of upstream flow	279.45
WL59	**Habitat Destruction**: Due to overprinting Pit, Internal Haul Road	37,162.70
WC-14[(b)]	**Habitat Destruction**: Due to overprinting Internal Haul Road, loss of upstream flow	108.80
WC-25[(b)]	**Habitat Destruction**: Loss of upstream flow	17.55
WL61	**Habitat Destruction**: Due to overprinting Pit Perimeter Road	173.67
WC-23[(a)]	**Permanent Alteration**: Loss of upstream flow	3,541.36
WC-26[(a)]	**Permanent Alteration**: Loss of upstream flow	15,54.50
WC-5[(a)]	**Permanent Alteration**: Loss of upstream flow	1,700.19
WC-27[(a)]	**Permanent Alteration**: Loss of upstream flow	932.83
Total		**47,172.3**

Source: Based on AMNS 2021, Section 6.9.9, Table 6.9-31, page 6-555, Appendix J.3, Section 4.3.3, Table 3, PDF page 34 and Table CEAA 2-06-1.
Notes: [(a)] Watercourses 23, 26, 5, and 27 will be potentially impacted by flow reductions but the channels are expected to remain suitable to support fish life functions. Potentially impacted area is the total surface area.
[(b)] Portions of watercourses 13, 14 and 25 may be destroyed due to complete loss of upstream flow.

Table CEAA 2-07-2: Residual Habitat Destruction or Permanent Alteration along the Haul Road (Based on Updated 2021 EIS Section 6.9.9, Table 6.9-32, page 6-556 and Table carried forward from CEAA-2-06)

Watercourse Location	Current Crossing (Condition)	Plan for Upgraded Haul Road	Residual Impact (m^2)
WC-C	Culvert (functioning)	**Permanent Alteration**: Road Crossing	7.4
WC-J	Culvert (buried)	**Permanent Alteration**: Road Crossing	21.6
WC-L	Culvert (functioning)	**Permanent Alteration**: Road Crossing	15.9
WC-M	Culvert (functioning, North), None (South)	**Permanent Alteration**: Road Crossing	10.9
WC-O	None	**Permanent Alteration**: Road Crossing	29.3
WC-P	None	**Permanent Alteration**: Road Crossing	10.2
WC-X	None	**Permanent Alteration**: Road Crossing	12.1
WC-AC	None	**Permanent Alteration**: Road Crossing	8.3
WC-AD- Morgan River	Bridge (functioning)	**Permanent Alteration**: Road Crossing	None
WC-AF	None	**Permanent Alteration**: Road Crossing	46.3
WC-AG	None	**Permanent Alteration**: Road Crossing	12.0
WL64	Culvert (buried) – see WC-A	**Permanent Alteration**: Road Crossing	48.7
WL66	Culvert (crushed) at northern crossing – see WC-B, None at southern crossing	**Permanent Alteration**: Road Crossing	487.0
WL73	None	**Permanent Alteration**: Road Crossing	185.2
WL76	Culvert (crushed) – see WC-G	**Permanent Alteration**: Road Crossing	398.6
WL146	None	**Permanent Alteration**: Road Crossing	106.4
WL154	None	**Permanent Alteration**: Road Crossing	176.9
WL159	Culvert (hung) – see WC-AA	**Permanent Alteration**: Road Crossing	6.5
WL160	Culvert (hung) – see WC-AA	**Permanent Alteration**: Road Crossing	836.5
Total			**2,430.3**

Source: Based on AMNS 2021, Section 6.9.9, Table 6.9-32, page 6-556 and Table CEAA 2-06-2.

Table CEAA 2-07-3: Residual Habitat Destruction or Permanent Alteration Beaver Dam Mine Project Footprint Combined

Infrastructure	Residually Impacted Area (m^2)
Beaver Dam Mine Project Site	47,172.3
Haul Road	2,430.3
Total	**49,602.6**

Response CEAA-2-07 B

AMNS has developed a draft Fish Habitat Offset Plan as Appendix J.3 of the Updated 2021 EIS (AMNS 2021). Within the draft Fish Habitat Offset Plan (Appendix J.3, Section 6.1, Table 13, PDF page 81 and Sections 6.2 through 6.6, PDF pages 84 through 106 of the Updated 2021 EIS [AMNS 2021]), a number of candidate offsetting measures have been described as a viable but conceptual level in order to invite and consider regulator and public comment prior to finalizing the offset plan and measures. However, we understand and appreciate that the Federal Review team requires sufficient information and detail to be able to make a determination that the predicted residual HADD (CEAA 2-07 Part A) can be sufficiently offset such that an overall determination that the project will not result in a significant effect to fish can be made. It remains our understanding that detailed engineering and design for the proposed offset measures can be completed during a final revision of the fish habitat offset plan and the application for an Authorization, following an EA decision.

Although we would like to retain flexibility in the final offset plan to incorporate future comments, we have selected the Musquodoboit River offsetting measures (Appendix J.3, Section 6.3, PDF page 84) as a proposed base measure that is intended to be implemented to offset the potential HADD predicted for the Beaver Dam Mine Project. The measure consists of both habitat enhancement in the main river, as well as a large off channel pond complex adjacent to the main channel. This measure was selected because 1) a portion of the measure is directed at enhancing existing Atlantic salmon habitat in the main river, and 2) the adjacent off channel pond complex and channel enhancements will provide a significant aerial extent (approximately 6.5 ha) of new fish habitat with a high degree of construction certainty and overall success.

The Musquodoboit River Valley is located approximately 14 km west of the Beaver Dam Mine Site and generally comprises floodplain land adjacent to the Musquodoboit River and has been subject to intense farming practices. Land to the east and west of the lower lying floodplain areas rise in elevation and is dominated by undeveloped forested land that has been subject to infrequent tree harvesting activities. Many headwater streams originate from these higher lands and drain through the lower lying agricultural areas via a combination of undisturbed streams and ditching networks into the Musquodoboit River. It has been identified as a river system (e.g., Kent Brook) where efforts to increase the abundance of Atlantic Salmon may be a worthwhile investment (Montgomery et al. 2020).

The Musquodoboit River measures would include a large off channel pond complex (West Block), a Tributary channel / riparian habitat enhancement (East Block) and potential habitat enhancements in the main river itself. Of the three components of the Musquodoboit offset measure, the West Block pond complex and East Block channel enhancement has been assessed to a level where a confident area in square metres can be provided. Recent investigation and data review at the proposed location have included the following:

- Assessment of groundwater elevations to verify water level predictions for the pond.
- Assessment of soil depth through the West block to ensure excavation of the pond complex can be completed without encountering bedrock or refusal.
- Ground survey to confirm suitability topography of the offset area for construction of the pond complex
- Fish sampling to determine species that may benefit from the offset measure.

The groundwater level in the west block is just under 1 m below grade (0.94 m based on 5 monitoring wells) which correlates well with survey results of the adjacent Musquodoboit River banks which are in the order of 1 m in elevation. Soil probing through the proposed pond complex area to 3 m depth was completed to confirm that the pond complex can be excavated without encountering bedrock or refusal.

Originally, a pond complex of approximately 4 ha was considered for the west block. Based on the recent data collected at site, we have a high confidence that an excavated pond complex can be developed in the West Block having a permanent open water area of 60,000 m^2, (6 ha). The species utilizing the pond complex would be similar to the general fish community found in the affected waterbodies at the Beaver Dam site and ongoing sampling is underway to confirm the species complex.

The pond complex will be excavated to include shallow littoral habitats as well as deeper refuge areas more than 2.5 m in depth. The pond basin morphology and the shoreline will be designed with a holistic ecological approach to include diverse substrates and habitat structure, as well as treed and herbaceous riparian features to support other aquatic and terrestrial wildlife.

In addition to the larger pond complex in the West Block, an adjacent East Block parcel is proposed for the restoration and enhancement of an existing channelized watercourse. The current channel is degraded by historic agricultural practices and cattle grazing. Recent field surveys noted extensive habitat degradation and poor water quality. We propose to implement restoration measures including cattle fencing, riparian establishment, and instream substrate and morphology enhancements. We estimate the development of 500 m^2 of higher quality stream habitat due to the proposed restoration efforts.

The proposed pond complex and channel enhancements proposed for implementation are expected to provide comparable habitat and support similar species as the wetland and stream habitats impacted by the Beaver Dam Mine Project. Table CEAA 2-07-4 summarizes the observed fish species captured within the Project study area (listed in the general order of abundance at the project site) and the observed or inferred presence at the proposed offset measure location.

Table CEAA 2-07-4: Observed and Inferred Fish Communities at the Beaver Dam Mine Project Site and the Proposed Musquodoboit River Offset Location

Species	Species Presence		
	Beaver Dam Project Site Study Area	Musquodoboit River: East and West Block Drainages	Musquodoboit River: Main River
Alewife (Gaspereau)	-	-	Inf.
American Eel	Obs.	-	Obs.
Atlantic Salmon	Obs.	-	Obs.[(a)]
Banded Killifish	Obs.	-	Inf.
Brook Trout	Obs.	-	Inf.
Brown Bullhead	Obs.	-	Obs.
Common Shiner	-	Obs.	Obs.
Creek Chub	Obs.	Obs.	Obs.
Golden Shiner	Obs.	-	-
Lake Chub	Obs.	-	Inf.
Ninespine Stickleback	Obs.	Obs.	-
Northern Redbelly Dace	-	Obs.	Obs.
Pearl Dace	-	Obs.	Obs.
Sea Lamprey	-	-	Obs.[(a)]
Smallmouth Bass	-	-	Inf.
Threespine Stickleback	-	Obs.	Inf.
White Perch	-	-	Inf.
White Sucker	Obs.	-	Obs.
Yellow Perch	Obs.	-	Obs.
Species Richness	**11**	**6**	**17**

Notes: [(a)] Observed in main river downstream of the offsetting location.

Obs. = Observed during recent sampling efforts (September 2021); Inf. = Inferred based on historic records for the Musquodoboit River watershed and habitat conditions.

Additional details regarding the West and East Block measures including photos of similar projects are provided in Section 6.3, PDF page 84 of the draft Fish Habitat Offset Plan (Appendix J.3 in the Updated 2021 EIS [AMNS 2021]).

Significant additional opportunities along the Musquodoboit River exist within the mainstem and other land block. These additional areas represent sufficient contingency offsetting opportunities in the event that additional offsetting is required to address greater than anticipated impacts, or deficiencies in success of the approved offsets.

A summary of the proposed measures to be implemented (West and East Block Measures) is shown in Table CEAA 2-07-5 below, along with the currently estimated HADD area for comparison. The proposed offset measure will provide a net increase in habitat area to support a similar fish community as those impacted by the Project. As shown in the table additional contingence offset areas are available and can be added to increase the ratio of offset to impact if needed. The proposed measures are to be implemented either in advance of or concurrently with the impacts associated with site development to ensure minimal time lag

between site impacts and offset measures. AMNS proposes to revise the current draft Fish Habitat Offset Plan (Appendix J.3) in parallel with ongoing review of the EIS documentation and discussions with DFO. The revised document will provide plan and section views of the offset measures and additional details of the habitat features.

Table CEAA 2-07-5: Offset Area Accounting and Balance Summary

Impact Location / Offset Measure Description	Habitat Description	Potential Residual HADD Area (m^2)	Proposed Offset Area (m^2)
Beaver Dam Mine Project Site	General baitfish and sportfish, small creek and pond / lake and wetland	47,172.3	
Haul Road	General baitfish and sportfish, small creeks	2,430.3	
Musquodoboit River – Main Channel	Baitfish and sportfish including Atlantic Salmon		TBD
Musquodoboit River – West Block	General baitfish and sportfish, pond/lake and wetland		60,000
Musquodoboit River – East Block	General baitfish and sportfish, small creek		500
Musquodoboit River – Other Block	General baitfish and sportfish, pond/lake and wetland		TBD contingency
Summary		49,602.6	65,000
Net Difference			15,397
Net Ratio (offset to impact)			1.3:1

Notes: 1) Values for the Musquodoboit River offset measure reflect the minimum area of fish habitat to be implemented. Additional contingency area is available.

2) The proposed net gain and ratio of offset to impacted habitat will require discussion and confirmation with DFO to ensure it is sufficient for the Project to offset the Project impacts. Additional areas may be added based on discussions with DFO and comments received.

CEAA 2-07-C

The Cumulative Affects Assessment for the Beaver Dam Mine Project is provided in Section 8, page 8-1 of the Updated 2021 EIS (AMNS 2021). The updated cumulative effects of the Project on fish and fish habitat are summarized in Section 8.5.5.2, page 8-75 of the Updated 2021 EIS. The evaluation of cumulative environmental effects is based upon the updates to the fish and fish habitat baseline work, updated Project layout, updated effects assessment and updates to cumulative effects assessment methodology including inclusion of the proposed and current Nova Scotia Salmon Association Acid Mitigation Projects in this analysis.

References

AMNS (Atlantic Mining NS Inc.). 2021. Updated Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. October 2021. Middle Musquodoboit, NS.

Montgomery, F., R. Rutherford and E. Halfyard. 2020. Characterizing water chemistry and the distribution of Atlantic Salmon on Nova Scotia's eastern shore based on environmental DNA (eDNA). Nova Scotia Salmon Association. https://www.asf.ca/assets/files/ns-eastern-shore-eDNA.pdf

Round 2 Information Request Number:	CEAA-2-08
Regulatory Agency/Indigenous Community:	DFO, KMKNO
Topic/Discipline:	Fish and Fish Habitat
EIS Guideline Reference:	Part 2, Section 2.2 Alternative Means of Carrying out the Project; Part 2, Section 6.5 Mitigation
Revised EIS (February 28, 2019) Reference:	Section 6.9.6.2 Fish and Fish Habitat Impact Extent

Context and Rationale

Part 2, Section 2.2 of the EIS Guidelines requires the proponent to identify and consider the effects of alternative means of carrying out the Project that are technically and economically feasible. Part 2, Section 6.5 of the EIS Guidelines requires the proponent to identify technically and economically feasible mitigation measures for each environmental effect identified.

As set out in DFO's Fisheries Protection Policy Statement (https://www.dfo-mpo.gc.ca/pnw-ppe/policy-politique-eng.html), proponents are required to demonstrate that measures and standards have been fully applied to first avoid, then mitigate, residual serious harm to fish before DFO will consider offsetting measures.

Page 488 of the revised EIS states that there are "opportunities to further redesign the project to avoid/minimize the impacts" to fish and fish habitat. Table 6.9-36 on page 509 of the revised EIS includes a commitment from the proponent to "Maintain pre-construction hydrological flows into and out of down-stream surface water habitats, to the extent practicable, to limit indirect impacts to fish habitat."

Section 6.9.6.2 of the revised EIS describes a large area of residual serious harm to fish at the Beaver Dam Mine site from the Project. It is important to understand what technically and economically feasible measures may be available to avoid and mitigate impacts to fish and fish habitat from project infrastructure and activities, including opportunities to redesign the Project, as well as the potential environmental effects of any project redesign on fish and fish habitat and other valued components. The Agency requires the proponent to identify opportunities to further avoid and mitigate serious harm to fish. DFO will then evaluate the adequacy of the offsetting measures proposed in the preliminary fish habitat offsetting plan.

The Proponent is Required to …

Provide a description of any technically and economically feasible opportunities to redesign the Project in a manner that would avoid and mitigate impacts to fish and fish habitat.

Provide a description of any additional technically and economically feasible measures that could be implemented to mitigate impacts to fish and fish habitat, including any site-specific measures that can be implemented to maintain pre-construction hydrological flows into and out of downstream surface water habitats.

Indicate whether the proponent intends to implement any of the project redesigns and/or mitigation measures.

Update the direct and cumulative effects assessment of related valued components as appropriate.

Responses

The Beaver Dam Mine Project has undergone a number of iterations or redesigns that included mitigations to avoid and mitigate impacts to fish habitat, which are described in Section 6.9.8, page 6-543 of the Updated 2021 EIS (AMNS 2021). These include technically and economically feasible opportunities to reduce impacts to fish.

Minimizing the Project footprint while avoiding critical lichen and wetland habitat is one example that has been applied to reduce impacts to maintain pre-construction hydrology and associated impacts to fish and fish habitat. Through the process or avoiding direct impact to fish habitat in watercourses contiguous with Mud Lake and Crusher Lake, AMNS sought alternative locations for deposition of waste rock. Critical Habitat for Boreal Felt Lichen is present within and surrounding WL29; which presents a substantial constraint for Project development. As a result, AMNS expanded the Fish Habitat Assessment Area (FHAA) to search for an alternative location further northwest. Parallel to the re-location of the waste rock storage area; it was determined that the potentially acid generating (PAG) component of waste rock requires segregation from the non-acid generating (NAG) component. Due to relocating the pile, and segregating those two waste streams, the total footprint of the waste rock piles has increased based on previous iterations of the site layout. This expanded study area allowed AMNS to identify a location for waste rock deposition that avoids direct impact to fish habitat, reduces indirect impact (hydrological interactions) to Crusher Lake and Mud Lake, while avoiding lichen Critical Habitat. The resultant indirect effects from flow reduction to receiving catchment areas have been fully assessed, quantified, and included in the fish and fish habitat effects assessment (Section 6.9.7.2, page 6-488 of the Updated 2021 EIS [AMNS 2021]) and in Appendix J.3 Draft Fish Habitat Offset Plan of the Updated 2021 EIS (AMNS 2021). On-going site engineering and design was completed in conjunction with the AMNS environmental team to reduce impacts to fish and fish habitat, including, but not limited to, adjustment in locations of till and organic stockpiles, drainage ditches, interior roads and other infrastructure. Efforts were made to minimize direct and indirect impacts to fish and fish habitat from the project design. Through the permitting stage of the Beaver Dam Mine Project, additional opportunities for minimization of impact to fish and fish habitat will be evaluated, as detailed engineering designs are completed to support the Beaver Dam Mine Site and the Haul Road.

The placement of Project components was optimized to reduce impacts to fish and fish habitat through detailed delineation of fish habitat in the expanded Fish Habitat Assessment Area (FHAA). Additional potentially economic and technically feasible measures to mitigate impacts to fish and fish habitat that were considered primarily included a review of options to supplement operational flow within affected catchment areas. To support this evaluation AMNS screened nearby watercourses and waterbodies to identify a source for supplemental flow during operations. Como Lake was identified as the most suitable option for supplemental flow due to its size, proximity to the Project, and location within an adjacent watershed. This option to supplement flow with water from Como Lake was deemed economically and technically unfeasible due to the length of piping that would be required to supplement flow into the Cope Brook system (greater than 4 km), power requirements (step up and step down transformers and electrical switch gears at Como Lake), a 2.5 km overhead power line from generators at Beaver Dam to the transformer at Como Lake, costing for pump power and overhead line brush cleared, and required updates to landowner agreements and lease arrangements (Crown land and Northern Timber).

The direct effects to fish and fish habitat have been updated and are summarized in Section 6.9.7.2.1, Table 6.9-15, page 6-494 and Section 6.9.7.3.1, Table 6.9-19, page 6-511 of the Updated 2021 EIS (AMNS 2021). The updated cumulative effects of the Project on fish and fish habitat are summarized in Section 8.5.5.2.1, page 8-75 of the Updated 2021 EIS (AMNS 2021). The evaluation of cumulative environmental effects is based upon the updates to the fish and fish habitat baseline work, updated Project layout, updated effects assessment and updates to cumulative effects assessment methodology including inclusion of the Nova Scotia Salmon Association proposed and current Acid Mitigation Projects.

References

AMNS (Atlantic Mining NS Inc.). 2021. *Updated* Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. October 2021. Middle Musquodoboit, NS.

Round 2 Information Request Number:	CEAA-2-09
Regulatory Agency/Indigenous Community:	DFO, KMKNO
Topic/Discipline:	Fish and Fish Habitat
EIS Guideline Reference:	Part 2, Section 6.3.1 Fish and Fish Habitat
Revised EIS (February 28, 2019) Reference:	Section 6.7.3.3 Surface Water Quantity; Section 6.9.6.2 Fish and Fish Habitat Impact Extent

Context and Rationale

As indicated in section 6.7.5.5 of the revised EIS, the Mud Lake catchment area will be altered during site development. These alterations will affect runoff volume discharging into Mud Lake on an annual basis. The results of the surface water quantity modelling described in section 6.7.6.1.2 indicate that the Mud Lake catchment area will be reduced by approximately 43%.

Furthermore, the catchment area of Crusher Lake will be reduced by 52%. Crusher Lake and Mud Lake are directly connected by Watercourse-5 (WC-5), which is the sole watercourse in the Beaver Dam Mine site that drains directly into Mud Lake. Flow rates within WC-5 are expected to decrease. The presumed reduction of flow is predicted to impact upon the ecological maintenance flow within WC-5.

Mud Lake is a shallow body of water with a depth not exceeding approximately 2 m to 3 m and is bordered by Wetland-17. During certain months of the year, Mud Lake experiences natural reductions in water volume due to warmer temperatures and low- flow periods. The reduction in the catchment area is expected to further reduce the volume of water in Mud Lake.

Mud Lake, WC-5 and Wetland-17 all provide fish habitat. These habitats may be used for overwintering, rearing, feeding, refuge and passage, and are directly connected to Cameron Flowage (Killag River) via the outflow of Mud Lake.

Section 6.9.6.2.2 of the revised EIS indicates that mine infrastructure will directly affect the drainage area of Mud Lake and several watercourses that eventually empty into Mud Lake. DFO requires additional information regarding the Project's potential to result in the permanent alteration of fish habitat in Mud Lake and Wetland-17.

The Proponent is Required to …

Provide a description of how the reduction of water in Mud Lake will affect fish habitat in Mud Lake and the adjacent Wetland-17. The description should include, but is not limited to additional information on whether:

- The quality or type of fish habitat in Mud Lake will be altered by predicted changes in water volume or changes in lake characteristics associated with water quantity (e.g., water temperature, dissolved oxygen, nutrient concentrations).
- The availability or type of fish habitat in Wetland-17 will be altered by the predicted changes in water quantity in Mud Lake or the potential changes in the environmental characteristics of Mud Lake.
- A vertical drop in water levels will exacerbate Mud Lake's sensitivity to thermal stress during summer months.
- Provide rationale for the conclusion provided in Table 6.9-37 that refers to the determination that the residual effects to Mud Lake will not be significant.

Update the direct and cumulative effects assessment of related valued components as appropriate.

Response

Fish habitat within Mud Lake and WC27 has been described and summarized in Sections 6.9.4.2.1, page 6-449 of the Updated 2021 EIS (AMNS 2021) based on assessments completed during fish collection (June 15, July 7 and August 26, 2020) and detailed habitat evaluations (July 22, 2020). An additional habitat evaluation was completed on Mud Lake on August 18, 2021; the results of all habitat evaluations are provided herein.

Mud Lake, located in the northern portion of the Beaver Dam Mine Project Area, is a main receptor of water within the Project Area. Its primary source is WC5, which directs water from Crusher Lake north to WL17, emptying into a strip of wetland which separates the eastern and western lobes of the lake.

Mud Lake exists as an open waterbody within WL17. The entire shoreline of the lake is composed of this peat wetland, predominantly in the form of a low shrub fen. Adjacent to open water, the wetland consists of low ericaceous shrubs and graminoids. The littoral zone is gently sloped and unshaded by any forest canopy cover, but some shade is provided along the wetland edges by emergent and floating wetland vegetation when water levels are high. Substrate through the lake is composed of deep muck and decaying organic material.

Within Mud Lake, the substrate is dominated by mud, with emergent vegetation along the edges when the water level is high. On August 17, 2021, a habitat evaluation was completed throughout Mud Lake; where depth was measured along 11 transects spaced throughout the lake (between three and five measurements per transects, depending on the length of the transect). Depth was measured to the top of soft substrate; depth probes extended more than 40 cm into the substrate in most locations. Water quality was measured once on each transect, along with a description of substrate and cover. Secchi depth measurements were attempted at each transect; however, the depth was too shallow to record secchi disk measurements (meaning light penetration is greater than the depth of the water column). Mud and detritus characterized substrate throughout the lake, and vegetation cover was present through approximately 35% of the surface area (*Nymphaea odorata* and *Pontederia cordata).* Water quality measurements, recorded with a calibrated YSI multi-parameter probe are provided in Table CEAA-2-09-1. During summer low flow, water depths ranged between 0.13 m and 0.88 m, with relatively high temperatures ranging between 23.6 and 29.1°C.

Table CEAA-2-09-1: In-situ Water Quality Measurements Recorded throughout Mud Lake, September 2021

Transect	Depth (m)	Water Quality						
		Temp (°C)	pH[a]	CON (µS/cm)	SPC (µS/cm)	TDS (mg/L)	DO (%)[a]	DO (mg/L)
1	0.42	24	5.26	279.8	287.8	196.55	78.4	6.4
2	0.38	23.6	4.94	277.5	285.4	135.85	66.9	5.57
3	0.49	23.6	4.94	274	281.6	183.55	75.9	6.42
4	0.39	24.2	5.06	276.2	281.4	182.65	83	6.81
5	0.38	25.1	5.21	283.2	317.8	185.55	85	6.94
6	0.34	25.4	5.13	280.8	277.9	180.7	84.6	7.01
7	0.45	23.7	4.59	265	265.5	172.25	56.1	4.7
8	0.51	26.2	4.87	277.3	265.7	172.9	79.2	6.12
9	0.3	25.4	4.42	332.5	331.6	216.8	79.7	6.52
10	0.77	26.5	4.83	346.6	329.9	215.8	82.8	6.26
11	0.31	29.1	4.95	355.5	333.4	217.5	78.8	6.01

[a] Values in bold indicate parameters recorded as below CCME guidelines for the protection of aquatic life, including: DO levels not suitable for any life stage of warm or cold-water fish species (<5.5 mg/L) (1999), and pH levels below 5.0 (CCREM 1987).

The outlet of Mud Lake, WC27, directs water northwest to the Killag River. Like Mud Lake, the riparian area of WC27 is composed of wetland habitat in the form of a low shrub fen. In the spring, the riparian wetland floods which significantly extends the wetted perimeter of the outlet. In the summer, channelized flow narrows into multiple braids which meander through wetland vegetation. The characteristics of WC27 are quite similar to Mud Lake – it is more accurately described as a narrowed extension of the lentic habitat observed in Mud Lake than a true lotic watercourse. Still, a detailed habitat assessment was performed on the outlet via boat based on the methodology described in the Baseline Fish and Fish Habitat 2019-2020 Technical Report (Appendix J.2, Section 3.4, PDF page 45 of the Updated 2021 EIS [AMNS 2021]).

WC27 has been delineated into a single homogeneous reach of a low-gradient flat which extends for 228 m before emptying into the Killag River. The main channel ranges from 3.4 to 9 m wide, velocity is sluggish to visibly stagnant, and the average water depth is 58 cm. Substrate is 100% deep, organic muck - consistent with the substrate in Mud Lake. In-stream cover is abundant, primarily in the form of emergent and submergent vegetation (pickerelweed and various graminoids).

Trapping efforts in Mud Lake and WC27 resulted in the highest species diversity of all lentic sites. The majority of fish captured within this system are considered habitat generalists: golden shiner, banded killifish, white sucker, ninespine stickleback, yellow perch, and brown bullhead. Mud Lake and WC27 support these species' spawning stage by providing abundant in-stream vegetation and soft substrate in a low velocity environment. In addition, the deep muck and vegetation provide usable habitat for juvenile American eel. Although no spawning habitat for lake chub was identified, the system may support young of the year through adult life stages which have been documented over a wider variety of substrates. The system may also provide refuge and feeding opportunities for adult brook trout, but lacks the substrate, flows, and cover diversity to support spawning through juvenile life stages. Water quality within the system is described as generally acidic with areas of low DO but is not considered limiting to overall fish production. Three of the four temperature readings recorded within the Mud Lake/WC27 system over the summer of 2020 were below 20°C, falling within the optimal temperature range for cold-water fishes. Water temperatures were observed to surpass 20°C in late July, at which point cold-water fishes such as brook trout would likely disperse to areas of thermal refuge.

Through revisions in Beaver Dam Mine Site layout, the predicted effects to the Mud Lake catchment have been reduced, leading to a maximum predicted decrease in water level of 5 cm at End-of-Mine (EOM) and 4 cm at post closure (PC). This has been achieved primarily by relocating the Waste Rock Storage Area (WRSA) to its current proposed location. Fish habitat within Mud Lake is described in Section 6.9.4.2, page 6-449 of the Updated 2021 EIS (AMNS 2021), and the current predicted impacts to this system (including methods for evaluating the indirect impacts) are described in Section 6.9.7.4, page 6-517 of the Updated 2021 EIS and presented in Tables CEAA-2-09-1 and CEAA-2-09-2. The reduction in water level within Mud Lake (maximum of 0.05 m) is not anticipated to result in a reduction in the habitats' capacity to support the current fish community as it represents a maximum potential water level change of less than 10% of the modelled natural baseline range (Section 6.9.7.4.4, Table 6.9-23, page 6-522 and Appendix A, Section 5.2.3, PDF pages 74 to 79 of Appendix P.4 [Mine Water Management Plan] of the Updated 2021 EIS [AMNS 2021]). The maximum reduction in water level during summer months (June, July, August) is 0.04 m as indicated in Table CEAA-2-09-2 and CEAA-2-09-3.

Table CEAA-2-09-2: Flow Depth Comparison at the WC27 Upstream Assessment Point (Mud Lake)

Flow Depth Statistic	Baseline Conditions	EOM Conditions		PC Conditions	
	Flow Depth (m)	Flow Depth (m)	Change in Depth from Baseline (m)	Flow Depth (m)	Change in Depth from Baseline (m)
Minimum	0.00	0.00	0.00	0.00	0.00
10th Percentile	0.07	0.05	-0.02	0.06	-0.01
25th Percentile	0.10	0.09	-0.01	0.09	-0.01
50th Percentile	0.16	0.15	-0.01	0.15	-0.01
75th Percentile	0.24	0.22	-0.02	0.22	-0.02
90th Percentile	0.32	0.28	-0.04	0.29	-0.03
Maximum	0.59	0.54	-0.05	0.55	-0.04
Mean	0.20	0.18	-0.02	0.19	-0.01

Source: AMNS 2021, Section 6.9.7.4.4, Table 6.9-23, page 6-522 and Appendix A, Section 5.2.3, PDF pages 74 to 79 of Appendix P.4 (Mine Water Management Plan).

Table CEAA-2-09-3: Flow Depth Comparison at the WC27 Upstream Assessment Point (Mud Lake) during Summer Months (June, July, August)

Flow Depth Statistic	Baseline Conditions	EOM Conditions		PC Conditions	
	Flow Depth (m)	Flow Depth (m)	Δ Depth (m)	Flow Depth (m)	Δ Depth (m)
Minimum	0.00	0.00	0.00	0.00	0.00
10th Percentile	0.04	0.03	-0.01	0.03	-0.01
25th Percentile	0.07	0.05	-0.02	0.06	-0.01
50th Percentile	0.10	0.09	-0.01	0.09	-0.01
75th Percentile	0.15	0.13	-0.02	0.14	-0.01
90th Percentile	0.21	0.19	-0.02	0.2	-0.01
Maximum	0.56	0.52	-0.04	0.53	-0.03
Mean	0.14	0.12	-0.02	0.12	-0.02

Source: AMNS 2021, Appendix A, Section 5.2.3, PDF pages 74 to 79 of Appendix P.4 (Mine Water Management Plan).

Based on the above analysis, the predicted changes to water depth in Mud Lake are well withing the natural variability of the seasonal baseline conditions and represent a less than 10% change in the natural lake levels. In the context of our definition of magnitude in IR2 response CEAA 2-02 this would represent a low magnitude of change. The fish community present in Mud Lake and WL17 is considered resilient to the observed range baseline water level fluctuations and the water quality conditions inherent to the fluctuations, and it is expected that the predicted conditions will continue to support the current habitat use, Proposed monitoring of water levels, water quality and fish communities at site will confirm these predictions during follow up monitoring.

The direct effects to fish and fish habitat have been updated and are summarized in Section 6.9.7.2.1, Tables 6.9-15, page 6-494 and Section 6.9.7.3.1, Table 6.9-19, page 6-511 of the Updated 2021 EIS (AMNS 2021). The updated cumulative effects of the

Project on fish and fish habitat are summarized in Section 8.5.5.2.1, page 8-75 of the Updated 2021 EIS (AMNS 2021). The evaluation of cumulative environmental effects is based upon the updates to the fish and fish habitat baseline work, updated Project layout, updated effects assessment and updates to cumulative effects assessment methodology including inclusion of the Nova Scotia Salmon Association proposed and current Acid Mitigation Projects.

References

AMNS (Atlantic Mining NS Inc.). 2021. Updated Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. October 2021. Middle Musquodoboit, NS.

CCME (Canadian Environmental Quality Guidelines). 1999. Water Quality Guidelines for the Protection of Freshwater Aquatic Life. Retrieved from: http://ceqg-rcqe.ccme.ca/en/index.html#void.

CCREM. 1987. *Canadian Water Quality Guidelines*. Prepared by the Task Force on Water Quality Guidelines. Retrieved from: https://www.ccme.ca/files/Resources/supporting_scientific_documents/cwqg_pn_1040.pdf.

DFO (Fisheries and Oceans Canada). 2013. Framework for Assessing the Ecological Flow Requirements to support Fisheries in Canada. National Capital Region. Canadian Science Advisory Secretariat. Science Advisory Report 2013/017.

Round 2 Information Request Number:	CEAA-2-10
Regulatory Agency/Indigenous Community:	DFO
Topic/Discipline:	Fish and Fish Habitat
EIS Guideline Reference:	Part 2, Section 6.3.1 Fish and Fish Habitat
Revised EIS (February 28, 2019) Reference:	Section 6.7.6.1.2 Surface Water Quantity Modelling Results; Section 6.9.6.2 Fish and Fish Habitat Impact Extent

Context and Rationale

As indicated in section 6.7.6.1.2 of the revised EIS, the catchment area to Crusher Lake is expected to be reduced by approximately 52%. Crusher Lake is bordered by Wetland-8 and Wetland-10, which are lacustrine wetlands that are permanently saturated.

As referred to on page 408 of the revised EIS, runoff that would naturally flow through WC-5 from Crusher Lake will be diverted to Cameron Flowage (Killag River) via the North Settling Pond. Water levels in Crusher Lake are expected to experience less fluctuation than normal. The reduced water levels in Crusher Lake may impact upon WC-5 by reducing the flow below the ecological maintenance level.

Flows in WC-5 may experience a reduction of approximately 43%. WC-5 flows through multiple wetlands, including Wetland-8, Wetland-14 and Wetland-17. WC-5 also has connectivity to other watercourses (e.g. WC-3) and wetlands (e.g. Wetland-20) north of Crusher Lake.

The development of the waste rock stockpiles and low-grade ore stockpiles within the contributing area to Crusher Lake is expected to directly reduce the overall size of the drainage area and directly affect several watercourses that empty into Crusher Lake.

As indicated on page 495 of the revised EIS, Crusher Lake is approximately 4 hectares in area and is known to support a variety of fish species.

The Proponent is Required to …

Provide rationale to support the determination on page 339, which informs Table 6.7-24, that reductions in flow into and out of Crusher Lake will result in minor changes (i.e. not significant) to fish and fish habitat.

Provide additional information regarding the fish habitat in WC-5 and whether the reduction of Crusher Lake's catchment area may result in the permanent alteration of fish habitat present in Crusher Lake and WC-5 (e.g. alteration of habitat used for passage).

Provide additional information and rationale to explain why any permanent alterations to Crusher Lake and WC-5 from the reduction of flow, reduction of Crusher Lake catchment area, diversion of runoff, development of mine infrastructure, etc. will not result in subsequent permanent alterations to watercourses or wetland habitat connected to WC-5 and Crusher Lake.

Update the direct and cumulative effects assessment of related valued components as appropriate

Response

Section 6.9.7.4, page 6-517 of the Updated 2021 EIS (AMNS 2021) provided additional detail regarding the reduction in flows in and out of Crusher Lake and indirect impacts to fish and fish habitat.

Estimates of daily flows within WC5 are predicted to decrease by 4.7% of mean annual discharge (MAD) flow. This flow reduction is of moderate magnitude; however, a more detailed evaluation of daily flows indicates that this represents a 12.2% increase in the number of days where flow remains below the 30% MAD. The Project is anticipated to exacerbate the natural low flow period by extending it from 113 days per year below 30% MAD at baseline to 129 days below 30% MAD at EOM (Section 6.9.7.4.1, Table 6.9-20, page 6-519 and Table 6.9-21, page 6-519). During post-closure, the predicted number of low flow days decreases to 115, which is only a 1.8% increase in number of days below 30% mad (representing a low magnitude of change). Using the WPM to calculate loss of habitat due to flow reduction, WC5 is predicted to have aerial reduction of 17.40 m^2 during end-of-mine, and only 4.26 m^2 at PC; however, as discussed with DFO we have quantified the total potentially altered habitat as the entire 30% MAD wetted width or 1,700.19 m^2. Based on the limited magnitude, duration and spatial extent of flow reduction, it is expected that the remaining habitat within WC5 will maintain capacity to support life history phases of fish (e.g., remaining habitat quantity, temperature regime).

Crusher is part of the Mud Lake catchment; and WC5 is the main inlet and outlet to Crusher Lake. Impacts to Crusher Lake have been modelled with consideration of changes in baseflow, and changes in daily and monthly flows. Furthermore, during operations, water will be extracted from the lake at a rate of 3 m^3/hr to support domestic and truck wash water demands. The mine impacts to lake water levels were assessed by converting instantaneous (average daily) flow rates to the historical record to flow depths within WC5 upstream assessment point using Manning's equation Table CEAA 2-10-1 (Section 6.9.7.4.1, Table 6.9-22, page 6-520 of the Updated 2021 EIS [AMNS 2021]). The change in flow depths at the lake outlet assessment points were then used to estimate the change in water levels. Flow depths were computed for various flow statistics and compared between the mine development stages. These results provided in the table below show that the water levels within Crusher Lake are not anticipated to change as a result of the Project. Details of this analysis are presented in the Water Balance Analysis (Appendix A, PDF page 44 of Appendix P.4 Mine Water Management Plan [AMNS 2021]).

Table CEAA 2-10-1: Flow Depth Comparison at the WC5 Assessment Point (Crusher Lake)

Flow Depth Statistic	Flow Depth (m)		
	Baseline Conditions	EOM Conditions	PC Conditions
Minimum	0.00	0.00	0.00
10th Percentile	0.04	0.00	0.04
25th Percentile	0.04	0.00	0.04
50th Percentile	0.06	0.06	0.06
75th Percentile	0.10	0.09	0.10
90th Percentile	0.14	0.14	0.14
Maximum	0.43	0.43	0.43
Mean	0.11	0.11	0.11

Source: AMNS 2021.

References

AMNS (Atlantic Mining NS Inc.). 2021. Updated Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. October 2021. Middle Musquodoboit, NS.

Round 2 Information Request Number:	CEAA-2-11
Regulatory Agency/Indigenous Community:	DFO
Topic/Discipline:	Fish and Fish Habitat
EIS Guideline Reference:	Part 2, Section 6.3.1 Fish and Fish Habitat
Revised EIS (February 28, 2019) Reference:	Section 6.9.6.2 Fish and Fish Habitat Impact Extent

Context and Rationale

Part 2, section 6.3.1 of the EIS Guidelines requires estimates of fish mortality for various species and life stage (e.g. egg, larvae, juvenile, adult).

Page 492, section 6.9.6.2 of the revised EIS states: "Mortality to fish is expected to be low, once mitigation measures are implemented including fish rescue of adult fish prior to commencement of construction activities in confirmed fish habitat and adherence to approved timing windows for construction to minimize impact to eggs, larvae, and juvenile fish."

Fish rescue activities vary in effectiveness depending on how they are carried out. The revised EIS does not provide information on planned fish rescue (i.e. collection or release sites; fish handling, transport and release methods). The Agency therefore cannot assess the potential effectiveness of this proposed mitigation. Additionally, the planned movement of live aquatic organisms is regulated by DFO through the National Code on Introductions and Transfers of Aquatic Organisms under the Fishery (General) Regulations to ensure that environmental impacts of planned movements are limited. An introduction and transfer licence may be required for fish rescue activities. DFO evaluates the ecological and genetic risks of planned transfers and determines whether a licence can be issued.

The Proponent is Required to …

Provide a description of planned fish rescue measures. For example, detail capture, handling, transport, release methods, capture and release locations and timing.

Predict the effectiveness of the planned fish rescue, including an estimate of fish mortality for various species and life stages from the Project in the event that fish rescue is ineffective or that an introduction and transfer licence cannot be obtained.

Response

Updates to the fish rescue plan is provided in Section 6.9.8.2.2, page 6-547 of the Updated 2021 EIS (AMNS 2021) and is summarized below.

A fish rescue plan will be provided to Fisheries and Oceans Canada (DFO) for approval at the permitting phase of the Beaver Dam Mine Project and prior to any fish rescue activities.

The fish rescue will be completed by a team of aquatic ecologists, experienced in the collection, handling and transfer of fish. The team will obtain a scientific research license which allows for collection of fish, including collection for fish rescue purposes. A fish transfer license will only be required if fish are to be transferred from one watershed to another, which is not being considered. Therefore, a fish transfer licence is not expected to be required. Release locations within the same watercourse, or those

watercourses where natural connectivity exists will be used. The team will adhere to all specific terms and conditions of the Scientific Licence.

All fish collection methods were selected based on inherent low mortality (i.e., gill nets and other lethal fish collection methods will not be used). The rescue will be completed to minimize handling and stress to fish, particularly if completed during warmer months. Measures such as oxygen supplementation and water cooling will be used as needed. A sub-sample of individuals per species will be sampled (physical measurements recorded), with the remaining to be identified and enumerated only. To reduce handling and stress to fishes, measurements of length, weight and age class, will not be recorded, unless requested by DFO (in consideration of Atlantic salmon, if caught). Fish will be released into the natural environment as soon as possible, and the rescue team will closely monitor fish for signs of stress.

AMNS commits to implementing all practicable methods and a reasonable level of effort to rescue all fish from habitat that will be dewatered, diverted, and/or infilled. During the completion of each rescue reach, personnel will remain on site during all de-watering to dip-net any fish remaining in the reach, wherever safely practicable. This will allow an estimate of mortalities to be provided to DFO in a summary report outlining results of the fish rescue. Fish release locations for each individual fish habitat within the Mine Site are identified in Section 6.9.7.2.1, Table 6.9-15, page 6-494 of the Updated 2021 EIS (AMNS 2021). Along the Haul Road, wherever fish rescues are required, the release point will be within the same watercourse, typically downstream of the rescue reach.

Fish captured in WL59 will be released primarily into Cameron Flowage, as it is the nearest contiguous watercourse. Based on the catch results, the team will consider releasing some fish into Crusher Lake and/or Mud Lake, to reduce competition for resources in a single release location. Due to the physical parameters of this habitat, a moderate to high level of effectiveness is predicted for fish rescue efforts, and some mortalities may be inevitable.

Fish release locations for each individual fish habitat within the Mine Site are identified in Section 6.9.7.2.1, Table 6.9-15, page 6-494 of the Updated EIS (AMNS 2021). Along the Haul Road, wherever fish rescues are required, the release point will be within the same watercourse, typically downstream of the rescue reach.

References

AMNS (Atlantic Mining NS Inc.). 2021. Updated Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. October 2021. Middle Musquodoboit, NS.

Round 2 Information Request Number:	CEAA-2-12
Regulatory Agency/Indigenous Community:	DFO
Topic/Discipline:	Fish and Fish Habitat
EIS Guideline Reference:	Part 2, Section 6.3.1 Fish and Fish Habitat
Revised EIS (February 28, 2019) Reference:	Section 6.9.6.2 Fish and Fish Habitat Impact Extent, Table 6.9-27

Context and Rationale

Section 6.9.6.2 of the revised EIS describes potential effects to fish from blasting activities near watercourses, including death, injury and behavioural disturbance. Section 2.3.2.1 indicates that blasting will occur two or three times a week at the open pit. The eastern border of the open pit is located approximately 100 m or less from Cameron Flowage.

The revised EIS does not provide a detailed analysis or assessment of the potential magnitude and extent of death, injury or behavioural disturbance to fish in Cameron Flowage that could result from blasting in the open pit.

Table 6.9-36 of the revised EIS includes a commitment to follow DFO's measures to avoid causing harm to fish and fish habitat pertaining to blasting. These measures include avoiding the use of ammonium nitrate-based explosives in or near water due to the production of toxic by-products. However, section 2.4.2.2 of the revised EIS states that the construction and operation phases will use ammonium nitrate as a blasting agent. The Agency is unclear as to whether the proponent intends to implement DFO's measures to avoid causing harm to fish and fish habitat pertaining to blasting.

The Proponent is Required to …

Clarify which of DFO's measures to avoid causing harm to fish and fish habitat pertaining to blasting are applicable to the Project and which measures the proponent intends to follow. Provide a detailed analysis and assessment of the potential magnitude and spatial extent of death, injury and behavioural disturbance to fish in Cameron Flowage that could result from blasting activities in the open pit, along with supporting scientific and technical information.

Update section 6.9.6.2 of the revised EIS as appropriate.

Response

The updates to effects of blasting on fish including mitigations is described in Section 6.9.7.2.2, page 6-495 of the Updated 2021 EIS (AMNS 2021) and summarized below.

<u>Effects of Blasting on Fish</u>

Indirect impacts to fish and fish behavior, spawning grounds and migration patterns are possible from blasting activities associated with mine development. The detonation of explosives near watercourses within the Project Area can produce post-detonation shock waves which involves a rise to a high peak pressure and then a subsequent fall to below ambient hydrostatic pressure. This pressure deficit can cause impacts in fish (Wright and Hopky, 1998). An overpressure in excess of 100 kPa can result in effects in fish including damage to the swim bladder in finfish, and potential rupture and hemorrhage to the kidney, liver, spleen and sinus venous. It is also possible that fish eggs and larvae can be damaged (Wright and Hopky, 1998). The degree of damage is related

to the type of explosive, size and pattern of the charges and the distance to the watercourse, depth of water within the watercourse, and species, size and life stage of the fish.

Wright and Hopky (1998) provide guidelines on methods and practices for blasting which are "intended to prevent or avoid the destruction of fish, or any potentially harmful effects to fish habitat that could result from the use of explosives". Included in these guidelines are recommended setback distances from the land-water interface to ensure explosive charges do not result in an instantaneous pressure change greater than 100 kPa, the pressure at which damage to fish is likely to occur (Wright, 1982). Wright and Hopky (1998) provide additional blasting setback recommendations to avoid impacts to spawning beds (peak particle velocities >13 mm/s) during periods of egg incubation (Table CEAA 2-12-1).

Table CEAA 2-12-1: Fisheries and Oceans Canada Guidelines Limits

Assessment Type	Assessment Metric	Limit
Water-Overpressure	Peak Pressure (P_{peak})	≤ 100 kPa
Vibration[a]	Peak Particle Velocity (PPV)	≤ 13 mm/s

Source: Wright and Hopky (1998).

Notes: [a] The vibration limit applies with a maximum PPV level of 13 mm/s in a spawning bed during the period of egg incubation.

≤ = less than or equal to, kPa = kilopascals; mm/s = millimetres per second.

AMNS has completed a site-specific blasting assessment for the Beaver Dam Mine Project using the calculations provided in the DFO guidance document Wright and Hopky (1998) and has attached it to this submission as Attachment CEAA 2-12-A following this response. The assessment calculated the allowable explosive loading per delay based on the closest distance between the maximum pit outline and the nearest waterbodies including Cameron Flowage, Mud Lake and Crusher Lake (Table CEAA 2-12-2). These values will be used by the Project team to develop a blasting plan that meet the DFO criteria in Table CEAA 2-12-1. It should be clearly noted that values presented in Table CEAA 2-12-2 for blasting loads per delay are to guide the basting plan and are not to be considered a fixed limit. Rather AMNS is committed to proceed with the blasting on site in full compliance with the DFO Guidelines (Wright and Hopky 1998). Taking into consideration the nature and variability of blasting and associated vibration levels and water overpressure, AMNS will conduct on-site specific monitoring to establish site constants that can be used in blasting design to ensure compliance with the DFO Limits for vibration levels and water overpressure.

Table CEAA 2-12-2: Blast Impact Summary

Source Point	Shoreline Location	Shoreline Location Relative to Pit	Distance to Shorelines (m)	Allowable Explosive Loading W (kg TNTe / delay)[a]	
				Non-Spawning Period	Spawning Period
A	Cameron Flowage	E	55	122	13
B	Cameron Flowage	SE	82	271	30
C	Mud Lake	N	198	1,581	172
D	Crusher Lake	NW	262	2,768	301

Notes: [a] The allowable explosive loading in kg TNTe per delay may be converted into the kg of site-specific explosive per delay by dividing by the actual explosive manufacturer's published relative effectiveness factor (R.E. factor) in units of kg TNTe/kg.

W (kg TNTe / delay) = explosive loading per delay in terms of kilograms of equivalent weight of Trinitrotoluene explosive; m = metre; E = east; SE = south east; N = north; NW north west.

It is also important to recognise that the values shown in Table CEAA 2-12-2 are the worst-case scenario or closest point to the waterbodies at the maximum extent of the pit. As the pit is progressed, the setbacks and allowable loadings will increase. In addition to the site-specific calculations for the closest waterbodies, the assessment provides quick reference charts to be used by the site and its contractors to determine explosive loading per delay for other locations in the pit based on distance to the adjacent waterbody.

A detailed Explosives Management Plan will be developed by AMNS during the permitting process to ensure adherence to Table CEAA 2-12-1 criteria outlined within Wright and Hopky (1998) and the attached Blasting Assessment (Attachment CEAA 2-12-A). The following Best Management Practices are considered to further minimize potential impacts to waters frequented by fish including the Cameron Flowage/Killag River and will be included in the Explosives Management Plan, where applicable:

- Use of line drilling will be considered.
- Use of electronic detonators for more accurate detonator timing to reduce the potential for fragmentation and minimize vibrations.
- Blast parameters such as hole size, drilling pattern, use of decked loads will be evaluated on a regular basis.
- Monitoring program will include a combination of seismograph with geophones microphones, and hydrophones will be implemented and blasting practices will be adaptively managed based on outcomes.
- Use of blast mats should be considered to limit any flyrock being thrown into the river.

By adhering to the criteria in Table CEAA 2-12-1 and informing the explosives management plan with the blasting assessment as well as other best management practices described will ensure compliance and consistency with the DFO Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters and prevent impacts to fish and fish habitat (Wright and Hopky 1998). As such no residual death, injury and behavioural disturbance to fish in Cameron Flowage or other identified waterbodies is anticipated.

Section 6.9.7.2.2 Indirect Effects – *Effects of Blasting on Fish*, page 6-506, has been updated in the Updated 2021 EIS (AMNS 2021).

References

AMNS (Atlantic Mining NS Inc.). 2021. *Updated* Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. October 2021. Middle Musquodoboit, NS.

Wright, D.G. 1982. A discussion paper on the effects of explosives on fish and marine mammals in the waters of the Northwest Territories. Can. Tech. Rep. Fish. Aquat. Sci. 1052: v + 16 p.

Wright D.G. and Hopky, G.E. 1998. Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters. Can. Tech. Rep. Fish. Aquat. Sci. 2107: iv + 34p.

ATTACHMENT CEAA 2-12-A:

DFO BLASTING IMPACT ASSESSMENT, MEMO – SEPTEMBER 22, 2021

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Memo

To: Danielle Finlayson-Bourque, Atlantic Mining NS Inc. **Date:** September 22, 2021

From: Amir Saghaeian, B.Sc., E.I.T. - Wood

CC: Alfredo Rodrigues, P.Eng - Wood
Mark C Ruthven - Wood

Ref: Beaver Dam - Blasting Information for CEAA 2-12

Re: DFO Blasting Impact Assessment

1. INTRODUCTION

Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited ("Wood"), at the request of Atlantic Mining NS Inc, has completed this blasting impact assessment for an open pit operation at the Beaver Dam Project site (the Site). The blasting activity will progress within the open pit mine area as shown in Figure 1, provided in Appendix A.

The applicable guidelines used for the blasting impact assessment include the Canadian Department of Fisheries and Oceans (DFO) Guidelines for the Use of Explosives In or near Canadian Fisheries Waters [1].

2. APPLICABLE GUIDELINES

The Canadian Department of Fisheries and Oceans (DFO) *Guidelines for the Use of Explosives In or near Canadian Fisheries Waters* [1] provides guideline limits for blasting water-overpressure and ground-borne vibration when in proximity to Canadian Fisheries Waters. These limits are applicable at the land-water interface (shoreline). The applicable water-overpressure and vibration limits for blasting from the DFO guideline are outlined in Table 1.

Table 1: DFO Limits

Assessment Type	Assessment Metric	Limit
Water-Overpressure	Peak Pressure (P_{peak})	≤ 100 kPa
Vibration [1]	Peak Particle Velocity (PPV)	≤ 13 mm/s

Notes:

1. The vibration limit applies with a maximum PPV level of 13 mm/s in a spawning bed during the period of egg incubation.

3. IMPACT ASSESSMENT APPROACH

Predictive overpressure and vibration models typically use the equivalent weight of Trinitrotoluene explosive (TNTe) as the input variable. Utilizing receptor setback data, water overpressure criteria and vibration criteria the predictive models can be used to establish the upper limit for explosive loading per delay in terms of kilograms (kg) of TNTe. The allowable explosive loading in kg TNTe per delay may be converted into the kg of site specific explosive per delay using the actual explosive manufacturer's published relative effectiveness factor (R.E. factor) in units of kg TNTe/kg. This will provide the blasting contractor with generalized guidance which can be utilized to determine the limiting kg/delay explosive loading for any explosive compound.

4. BLAST IMPACT ASSESSMENT

The blasting impact calculations were completed using conservative assumptions to model the predictable worst-case scenario in all cases. The Blast Impact Summary Table 2 shows the maximum explosive loading allowable in units of kg TNTe/delay at the closest distance from the boundary of the open pit to the shorelines located at the East (E), Southeast (SE), North (N) and Northwest (NW) of the open pit (see Figure 1 for locations) in order to meet the applicable DFO criteria. The supporting calculations are also provided in Appendix B.

Table 2: Blast Impact Summary

Source Point	Shoreline Location	Shoreline Location Relative to Pit	Distance to Shorelines (m)	Allowable Explosive Loading W (kg TNTe / delay)[1]	
				Non-Spawning Period	Spawning Period
A	Cameron Flowage	E	55	122	13
B	Cameron Flowage	SE	82	271	30
C	Mud Lake	N	198	1,581	172
D	Crusher Lake	NW	262	2,768	301

Notes:

1. The allowable explosive loading in kg TNTe per delay may be converted into the kg of site-specific explosive per delay by dividing by the actual explosive manufacturer's published relative effectiveness factor (R.E. factor) in units of kg TNTe/kg.

Due to proximity of the open pit area to surrounding waterbody, additional results have been provided in this report in the form of quick reference charts (provided in Appendix C), which shows the upper limit for explosive loading per delay in terms of kg of TNTe in order to meet the applicable criteria for water overpressure and vibration outlined in the DFO guideline. This chart can be utilized as a general guide to determine the limiting kg/delay explosive loading for different distances from the source locations within the blast site to the lake shores, however it does not replace the needed assessment of the specific blast design to ensure compliance.

The values presented in Table 2 for blasting loads per delay are not to be considered a fixed commitment. Rather Atlantic Mining is committed to proceed with the blasting on site in full compliance with the DFO Guidelines. Taking into consideration the nature and variability of blasting and associated vibration levels and water overpressure, Atlantic Mining will conduct on-site specific monitoring to establish site constants that can be used in blasting design to ensure compliance with the DFO Limits for vibration levels and water overpressure.

5. CLOSING

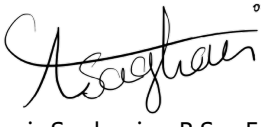
This DFO Blasting Impact Assessment Report was prepared for Atlantic Mining NS Inc. by Wood. The quality of information and conclusions contained herein is consistent with the level of effort involved in Wood's services and based on: i) information available at the time of preparation; ii) data supplied by outside sources; and iii) the assumptions, conditions and qualifications set forth in this report.

Should you have any questions regarding this memorandum, please do not hesitate to contact the undersigned.

Sincerely,

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited

Prepared by:



Amir Saghaeian B.Sc., E.I.T.
Specialist - Acoustics & Vibration

Reviewed by:

Alfredo Rodrigues, P.Eng.
Senior Engineer, Acoustics & Vibration

6. REFERENCES

[1] D. G. Wright and G. E. Hopky, "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters," Can. Tech. Rep. Fish. Aquat. Sci. 2107: iv + 34p., 1998.

Appendix A

Figures

LEGEND

- Reference Source Points
- Proposed Open Pit
- Roads
- Other Infrastructure

0 100 200 300 400 Metres

Datum & Projection: NAD83 / UTM zone 20N

wood.

BEAVER DAM MINE PROJECT

BLASTING IMPACT ASSESSMENT

PROJECT NO: TE211047	FIGURE 1
SCALE: 1:3810	DATE: September 2021

Appendix B

Blasting Impact Calculation Sheets

DFO Limit Assessment Calculation Sheet

Project Name:	Beaver Dam Mine Project		
Scope of Work:	Open Pit Mine Development		
Project Number:	TE211047	**Date:**	September 22, 2021
Calculation Identifier	D.Calc - A		

Criteria

DFO Guidelines

Water overpressure	100	kPa
Peak Particle Velocity - Spawning Area	13	mm/s

Inputs

Water Specific Constants:	**Cw**	146300	cm/s	**Dw**	1 g/cm3
Substrate Specific Constants:	**Type**	Rock			
	Cr	457200	cm/s	**Dr**	2.64 g/cm3
DFO Blasting Constant (default):	**k-value**	100		**β**	-1.6
Distance from Blast to Reception Point:	**R**	55	m		

Results

Zw/Zr	0.1212	**Pr**	462.5 kPa
Vr	1.3 cm/s	**Pw**	100 kPa

Assessment of Results

Weight Per Delay (PPV)	**13** kg	***Spawning Periods***
Weight Per Delay (Water Overpressure)	**122** kg	***Non-Spawning Periods***

General Notes

1. Calculations done in accordance to DFO's Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters.
2. Caculation variations: none considered-
3. Limit variations: none considered -

References

D. G. Wright and G. E. Hopky, "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters," Can. Tech. Rep. Fish. Aquat. Sci. 2107: iv + 34p., 1998.

DFO Limit Assessment Calculation Sheet

Project Name:	Beaver Dam Mine Project		
Scope of Work:	Open Pit Mine Development		
Project Number:	TE211047	**Date:**	September 22, 2021
Calculation Identifier	D.Calc - B		

Criteria

DFO Guidelines

Water overpressure	100	kPa
Peak Particle Velocity - Spawning Area	13	mm/s

Inputs

Water Specific Constants:	**Cw**	146300	cm/s	**Dw**	1 g/cm3
Substrate Specific Constants:	**Type**	Rock			
	Cr	457200	cm/s	**Dr**	2.64 g/cm3
DFO Blasting Constant (default):	**k-value**	100		**β**	-1.6
Distance from Blast to Reception Point:	**R**	82	m		

Results

Zw/Zr	0.1212	**Pr**	462.5 kPa
Vr	1.3 cm/s	**Pw**	100 kPa

Assessment of Results

Weight Per Delay (PPV)	**30** kg	***Spawning Periods***
Weight Per Delay (Water Overpressure)	**271** kg	***Non-Spawning Periods***

General Notes

1. Calculations done in accordance to DFO's Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters.
2. Caculation variations: none considered-
3. Limit variations: none considered -

References

D. G. Wright and G. E. Hopky, "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters," Can. Tech. Rep. Fish. Aquat. Sci. 2107: iv + 34p., 1998.

DFO Limit Assessment Calculation Sheet

Project Name:	Beaver Dam Mine Project		
Scope of Work:	Open Pit Mine Development		
Project Number:	TE211047	**Date:**	September 22, 2021
Calculation Identifier	D.Calc - C		

Criteria

DFO Guidelines

Water overpressure	100	kPa
Peak Particle Velocity - Spawning Area	13	mm/s

Inputs

Water Specific Constants:	**Cw**	146300	cm/s	**Dw**	1 g/cm3
Substrate Specific Constants:	**Type**	Rock			
	Cr	457200	cm/s	**Dr**	2.64 g/cm3
DFO Blasting Constant (default):	**k-value**	100		**β**	-1.6
Distance from Blast to Reception Point:	**R**	198	m		

Results

Zw/Zr	0.1212	**Pr**	462.5 kPa
Vr	1.3 cm/s	**Pw**	100 kPa

Assessment of Results

Weight Per Delay (PPV)	**172** kg	***Spawning Periods***
Weight Per Delay (Water Overpressure)	**1,581** kg	***Non-Spawning Periods***

General Notes

1. Calculations done in accordance to DFO's Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters.
2. Caculation variations: none considered-
3. Limit variations: none considered -

References

D. G. Wright and G. E. Hopky, "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters," Can. Tech. Rep. Fish. Aquat. Sci. 2107: iv + 34p., 1998.

DFO Limit Assessment Calculation Sheet

Project Name:	Beaver Dam Mine Project		
Scope of Work:	Open Pit Mine Development		
Project Number:	TE211047	**Date:**	September 22, 2021
Calculation Identifier	D.Calc - D		

Criteria

DFO Guidelines

Water overpressure	100	kPa
Peak Particle Velocity - Spawning Area	13	mm/s

Inputs

Water Specific Constants:	**Cw**	146300	cm/s	**Dw**	1 g/cm3
Substrate Specific Constants:	**Type**	Rock			
	Cr	457200	cm/s	**Dr**	2.64 g/cm3
DFO Blasting Constant (default):	**k-value**	100		**β**	-1.6
Distance from Blast to Reception Point:	**R**	262	m		

Results

Zw/Zr	0.1212	**Pr**	462.5 kPa
Vr	1.3 cm/s	**Pw**	100 kPa

Assessment of Results

Weight Per Delay (PPV)	**301** kg	***Spawning Periods***
Weight Per Delay (Water Overpressure)	**2,768** kg	***Non-Spawning Periods***

General Notes

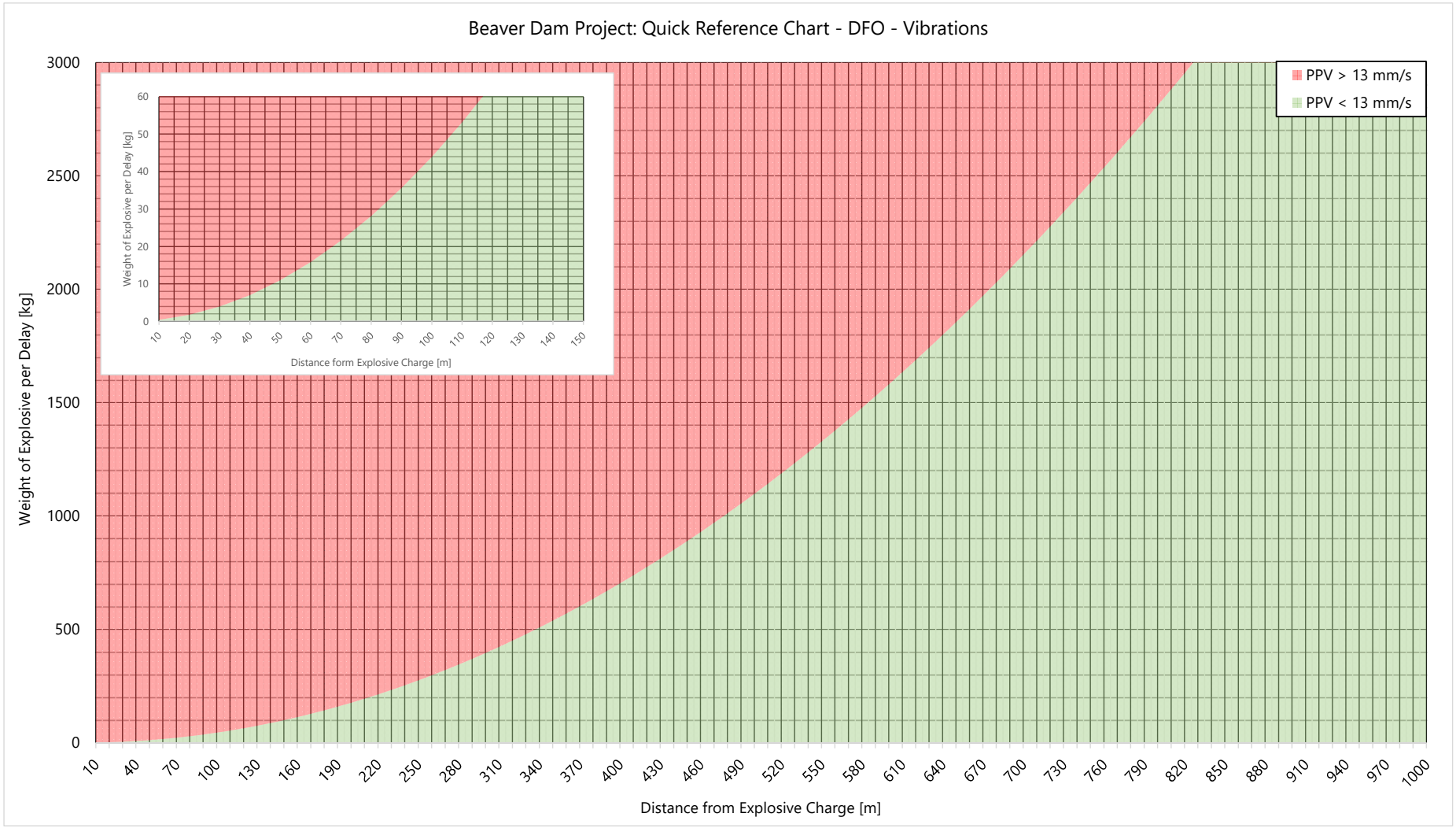
1. Calculations done in accordance to DFO's Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters.
2. Caculation variations: none considered-
3. Limit variations: none considered -

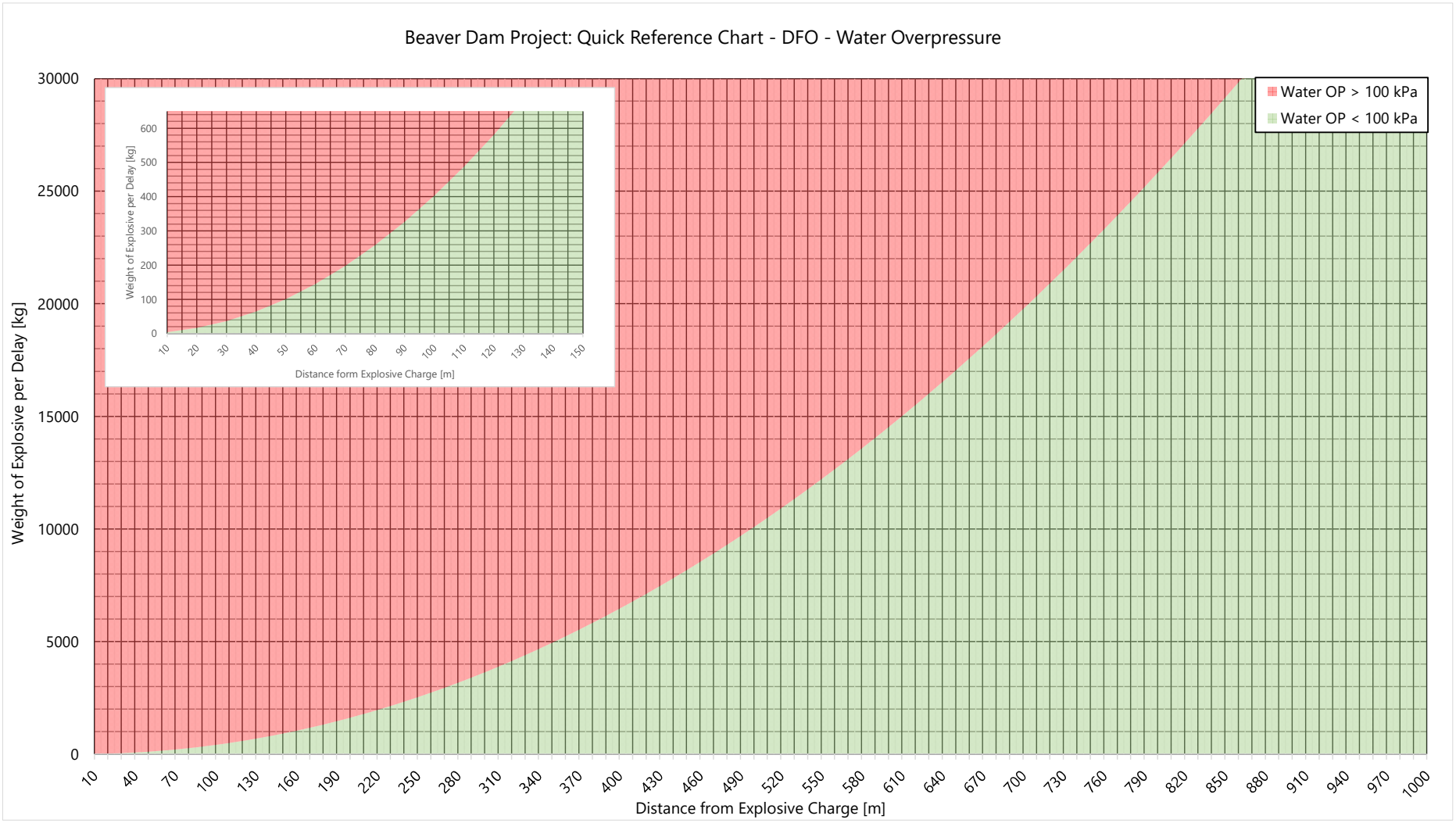
References

D. G. Wright and G. E. Hopky, "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters," Can. Tech. Rep. Fish. Aquat. Sci. 2107: iv + 34p., 1998.

Appendix C

Quick Reference Chart


Beaver Dam Project: Quick Reference Chart - DFO - Vibrations
PPV > 13 mm/s
PPV < 13 mm/s
Weight of Explosive per Delay [kg]
Distance from Explosive Charge [m]
Weight of Explosive per Delay [kg]
Distance form Explosive Charge [m]


Beaver Dam Project: Quick Reference Chart - DFO - Water Overpressure
Water OP > 100 kPa
Water OP < 100 kPa
Weight of Explosive per Delay [kg]
Distance from Explosive Charge [m]
Weight of Explosive per Delay [kg]
Distance form Explosive Charge [m]

Appendix D

Limitations

Limitations

1. The work performed in the preparation of this report and the conclusions presented herein are subject to the following:
    a. The contract between Wood and the Client, including any subsequent written amendment or Change Order dully signed by the parties (hereinafter together referred as the "Contract");
    b. Any and all time, budgetary, access and/or site disturbance, risk management preferences, constraints or restrictions as described in the contract, in this report, or in any subsequent communication sent by Wood to the Client in connection to the Contract; and
    c. The limitations stated herein.

2. **Standard of care:** Wood has prepared this report in a manner consistent with the level of skill and care ordinarily exercised by reputable members of Wood's profession, practicing in the same or similar locality at the time of performance, and subject to the time limits and physical constraints applicable to the scope of work, and terms and conditions for this assignment. No other warranty, guaranty, or representation, expressed or implied, is made or intended in this report, or in any other communication (oral or written) related to this project. The same are specifically disclaimed, including the implied warranties of merchantability and fitness for a particular purpose.
3. **Limited locations:** The information contained in this report is restricted to the site and structures evaluated by Wood and to the topics specifically discussed in it, and is not applicable to any other aspects, areas or locations.
4. **Information utilized:** The information, conclusions and estimates contained in this report are based exclusively on: i) information available at the time of preparation, ii) the accuracy and completeness of data supplied by the Client or by third parties as instructed by the Client, and iii) the assumptions, conditions and qualifications/limitations set forth in this report.
5. **Accuracy of information:** No attempt has been made to verify the accuracy of any information provided by the Client or third parties, except as specifically stated in this report (hereinafter "Supplied Data"). Wood cannot be held responsible for any loss or damage, of either contractual or extra-contractual nature, resulting from conclusions that are based upon Wood's use of the Supplied Data.
6. **Report interpretation:** This report must be read and interpreted in its entirety, as some sections could be inaccurately interpreted when taken individually or out-of-context. The contents of this report are based upon the conditions known and information provided as of the date of preparation. The text of the final version of this report supersedes any other previous versions produced by Wood.
7. **No legal representations:** Wood makes no representations whatsoever concerning the legal significance of its findings, or as to other legal matters touched on in this report, including but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and change. Such interpretations and regulatory changes should be reviewed with legal counsel.
8. **No third-party reliance:** This report is for the sole use of the party to whom it is addressed unless expressly stated otherwise in the report or Contract. Any use or reproduction which any third party makes of the report, in whole or in part, or any reliance thereon or decisions made based on any information or conclusions in the report is the sole responsibility of such third party. Wood does not represent or warrant the accuracy, completeness, merchantability, fitness for purpose or usefulness of this document, or any information contained in this document, for use or consideration by any third party. Wood accepts no responsibility whatsoever for damages or loss of any nature or kind suffered by any such third party as a result of actions taken or not taken or decisions made in reliance on this report, or anything set out therein. including without limitation, any indirect, special, incidental, punitive or consequential loss, liability or damage of any kind.

Round 2 Information Request Number:	CEAA-2-13
Regulatory Agency/Indigenous Community:	DFO, KMKNO, ESFW
Topic/Discipline:	Fish and Fish Habitat
EIS Guideline Reference:	Part 2, Section 6.3.1 Fish and Fish Habitat
Revised EIS (February 28, 2019) Reference:	Section 2.3.3.2 Conceptual Reclamation Plan, page 59; Section 6.9.6.2 Fish and Fish Habitat Impact Extent

Context and Rationale

The Killag River provides habitat for all life stages of salmonids, including the Southern Upland population of Atlantic salmon. This population has been designated by COSEWIC as Endangered and is currently under consideration for listing under Schedule 1 of SARA.

The Killag River has been identified as important habitat for all life stages of Atlantic salmon in the West River Sheet Harbour system. The river also provides habitat for American eel which is designated by COSEWIC as Threatened and is currently under consideration for listing under SARA.

Section 6.3.1 of the EIS Guidelines requires "the identification of any potential harmful alteration, disruption or destruction of fish habitat, including the calculations of any potential habitat loss (temporary or permanent) in terms of surface areas."

Section 2.3.3.2 of the revised EIS states that during decommissioning, the pit will be filled with water, creating a lake, with the re-establishment of a connection between the filled open pit and Cameron Flowage.

The release of suspended sediment into Cameron Flowage is a potential harmful alteration, disruption or destruction of fish habitat. Elevated levels of suspended sediments can harm fish and sedimentation can damage or destroy spawning habitat, bury and smother eggs, and affect survival and emergence. Additional information is needed to determine whether suspended sediments released into Cameron Flowage from the open pit post-mine closure will adversely affect fish and fish habitat in the Killag River.

The Proponent is Required to …

Provide an assessment of the potential effects of suspended sediment released into Cameron Flowage from the open pit post-mine closure on fish and fish habitat within the Killag River.

Update the direct and cumulative effects assessment of related valued components as appropriate.

Response

Atlantic Mining NS Inc. (AMNS) has developed a draft Erosion and Sediment Control Plan (Appendix C, PDF page 159 of the Mine Water Management Plan [Appendix P.4] in the Updated 2021 EIS [AMNS 2021]) that includes mitigation and best management practice to control and manage sediment throughout the life of mine.

The amount of sediment that will be released from the open pit post-mine closure is projected to be negligible as a result of mine reclamation and revegetation as part of mine closure planning and regulatory requirements. Once reclamation is complete, any

suspended sediment would only be the result of extreme flows and natural erosion of shorelines due to high water and velocities throughout the system. However, a settling calculation was performed to determine the pool (pit lake) length required to settle out a sediment particle during the 100-year storm event, following Equation 4.5 from the Ontario Ministry of the Environment Stormwater Management Planning and Design Manual (2003). The calculation was performed for a sediment particle with a 0.01 mm diameter and corresponding settling velocity of 0.00005 m/s, which is representative of a fine silt (Table G.1 of the 2011 Erosion and Sediment Control Manual by the Government of Alberta [2011]). The results indicate that the required pool length is approximately 710 m. The flow path from the inlet to outlet of the pit lake will be approximately 800 m. As a result, the pit lake will provide more than enough distance to settle out suspended sediments from the site runoff post-mine closure. Furthermore, all applicable water quality guidelines and objectives will be adhered to, and all standard mitigation measures will be followed through post-closure (i.e., exposed soil will be stabilized and revegetated) to reduce potential for sediment release.

The direct effects to fish and fish habitat have been updated and are summarized in Section 6.9.7.2.1, Table 6.9-15, page 6-494 and Section 6.9.7.3.1, Table 6.9-19, page 6-511 of the Updated 2021 EIS (AMNS 2021). The updated effects of the Project on fish and fish habitat are summarized in Section 8.5.5.2.1, page 8-75 of the Updated 2021 EIS (AMNS 2021). The updated evaluation of cumulative environmental effects is based upon the updates to the fish and fish habitat baseline work, updated Project layout, updated effects assessment and updates to cumulative effects assessment methodology (Section 8, page 8-1 of the Updated 2021 EIS [AMNS 2021]).

References

AMNS (Atlantic Mining NS Inc.). 2021. *Updated* Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. October 2021. Middle Musquodoboit, NS.

Government of Alberta. 2011. Erosion and Sediment Control Manual. Prepared by Government of Alberta – Transportation. June 2011. Available at: https://www.alberta.ca/erosion-and-sediment-control-manual-june-2011.aspx

Ontario Ministry of the Environment. 2003. Stormwater Management Planning and Design Manual. Retrieved from: https://www.ontario.ca/document/stormwater-management-planning-and-design-manual-0. Updated March 29, 2019.

Round 2 Information Request Number:	CEAA-2-14
Regulatory Agency/Indigenous Community:	DFO, KMKNO, ESFW
Topic/Discipline:	Fish and Fish Habitat
EIS Guideline Reference:	Part 2, Section 6.3.1 Fish and Fish Habitat
Revised EIS (February 28, 2019) Reference:	Section 6.9.6.2 Fish and Fish Habitat Impact Extent; Section 6.6.6 Project Activities and Groundwater Quality and Quantity Interactions and Effects

Context and Rationale

The Beaver Dam Mine site is located immediately adjacent to the Killag River, the main tributary to West River Sheet Harbour, which provides important habitat for all life stages of salmonids, including Southern Upland Atlantic salmon. Given the current status of Southern Upland Atlantic salmon and the importance of the Killag River to the survival and recovery of this species in the West River Sheet Harbour system, adverse effects from the Project on salmon habitat extending beyond the project area into the Killag River have potential to be significant.

As such, the Agency requires the proponent to provide a thorough assessment of potential effects and to take all measures to avoid and mitigate adverse effects to fish and fish habitat within the Killag River.

Groundwater inflow in rivers and streams serves an important function in sustaining aquatic ecosystems and salmonid habitat by providing stable water temperatures year-round and augmenting stream flows during periods of low flow. For these reasons, fish often seek areas of groundwater upwelling for spawning and egg incubation, overwintering, and refuge from warm water during summer.

Section 6.6.6.1 of the revised EIS predicts base-flow reductions to Cameron Flowage and the Killag River and states that "Effects will range from locally significant to insignificant. No adverse groundwater impacts from the Beaver Dam Mine Site are predicted beyond the boundary of the RAA, and in general, the majority of impacts do no extend beyond the LAA."

Page 246 of the revised EIS states that the simulated change in base flow throughout the Cameron Flowage watershed is presented in Table 7.4 of Appendix F.1 (Beaver Dam Model Report); however, there is no Table 7.4 in Appendix F.1 and there is no report titled Beaver Dam Model Report in the list of Appendices. Page 246 of the revised EIS also states that further analysis of the potential effects of this base-flow reduction to Cameron Flowage is discussed in Section 6.7 (Surface Water Section); however, it is not clear where there is a discussion of the potential effects of this base-flow reduction in Section 6.7.

Section 6.9.6.2.2, page 497 of the revised EIS states that "There is a predicted increase in runoff volume discharged to the Killag River of 0.91% and 0.03% during EOM and PC, respectively. Additionally, a 5 to 7% reduction in baseflow is predicted for the Killag River (Appendix G.5). Together, the impact to fish and fish habitat within the Killag River was deemed negligible." The revised EIS does not include a detailed assessment of the potential effects of the reduction in base flows to fish habitat due to changes in groundwater, nor does it include an explanation of how the impacts to fish and fish habitat were deemed negligible.

The Agency is of the view that impacts to salmonid habitat in the Killag River have potential to be a significant adverse environmental effect. Additional information is needed to understand the potential effects of groundwater reductions on fish and fish habitat within the Killag River.

The Proponent is Required to …

Provide an assessment, with supporting scientific and technical information, of the potential effects of reductions in groundwater inflows on fish and fish habitat within the Killag River, including the potential effects to salmonid habitat.

Update the direct and cumulative effects assessment of related valued components as appropriate.

Provide the specific location in the revised EIS (e.g. document title, page number) where additional information about the simulated change in base flow throughout the Cameron Flowage watershed has been presented.

Provide the specific location in the revised EIS where the predicted reduction in base flows to Cameron Flowage are discussed in section 6.7.

Response

A)
The project layout/infrastructure changed significantly between the 2019 and 2021 EIS. Furthermore, the Revised 2019 EIS (AMNS 2019) only included a few months of groundwater and surface water elevation data. A significant amount of additional data baseline groundwater and surface water data (up to a complete year to assess seasonal variations) was incorporated into the Updated 2021 EIS (AMNS 2021). To incorporate the additional groundwater and surface water data, the groundwater flow model was updated and recalibrated as requested in the Information Requests, Round 2 (IR2s) (CEAA-2-41, CEAA-2-42, NSE-2-33, NSE-2-149, and NSE-2-150). Given the additional baseline data, the update to the groundwater flow model, and changes in the Site layout/infrastructure the defined baseline conditions are expected to change (due to additional data to define baseline conditions/simulations) as are model predictions (due to model updates and infrastructure changes). Therefore, inconsistencies between the 2019 and 2021 EIS are expected because 2021 EIS and includes additional baseline and an updated infrastructure layout which dictates extent and magnitude the predicted groundwater impacts. The 2021 EIS supersedes the 2019 EIS.

The additional groundwater and surface water data, and changes to site infrastructure, as they pertain to groundwater are presented in Appendix F.5: Hydrogeologic Modelling Report, Section 2.3, PDF page 18, Section 6, PDF page 33, Section 7, PDF page 40, Appendix A, PDF page 177, and Appendix B, PDF page 195 in the Updated 2021 EIS (AMNS 2021). Appendix F.5, Section 2.3, PDF page 18 describes the hydrogeologic conditions, Section 6, PDF page 33 discusses the selection of and calibration to groundwater elevation targets that consider the additional groundwater elevation data, and Appendix A, PDF page 177 and Appendix B, PDF page 195 present groundwater and surface water hydrographs, respectively, that include the additional collected data. Section 7, PDF page 40 discusses the implementation of model boundary conditions to represent the proposed infrastructure and the proposed infrastructure is shown on all Section 7 figures (PDF pages 92 to 150). Specific changes include:

- Incorporation of up to a year of surface water elevations monitoring data. Where possible, specified surface water elevations in model boundary conditions representing rivers, stream, and lakes (including Cameron Flowage) were updated to reflect observed average annual, dry and wet conditions. For example, the average annual surface water elevation in Cameron Flowage was updated from to 126.7 m above mean sea level (AMSL) for average baseline conditions in the 2021 EIS compared 127.7 m AMSL in the 2019 EIS (AMNS 2019). The surface water elevation specified in the 2021 EIS incorporated updated survey information and approximately eight months of additional surface water monitoring data (Updated 2021 EIS [AMNS 2021]). Therefore, the calculated average, dry, and wet conditions changed due to the inclusion of additional data to

calculate the averages. The updated/change to the surface water elevations specified for the groundwater flow model boundary conditions representing rivers, streams, and lakes has a direct impact on the predicted baseflow under baseline, end of mine (EOM) and post-closure (PC) conditions, thus the predicted impacts in the 2021 EIS are expected to differ from the 2019 EIS.

- Incorporation of up to a year of groundwater elevation monitoring. To incorporate the additional groundwater elevation monitoring data, GHD calculated average annual, dry and wet groundwater elevations at monitoring well location and applied those groundwater elevations as model calibration targets. GHD then updated the model calibration (i.e., adjusted model parameters such as recharge and incorporated the updated surface water elevations corresponding to the average annual, dry, and wet conditions) to reflect observed average annual, wet, and dry conditions. The update to the model calibration (i.e., update of model parameters to represented observed conditions) directedly impacts the predicted baseline, EOM, and PC conditions, therefore the predicted baseline, EOM, and PC conditions are expected to differ between the 2021 and 2019 EIS.
- Incorporated the revised project layout. For the Updated 2021 EIS (AMNS 2021), the project layout was updated to reduce the extent and significant of potential impacts related to the development of the project. The update in the project layout as it pertains to groundwater included:
  - Separation of non-acid generating (NAG) and potentially acid generating (PAG) material into separate waste rock piles;
  - Specification of an impermeable engineered cover over the PAG waste rock pile to reduce seepage of precipitation through the PAG waste rock pile to groundwater;
  - Revision to the layout of the till, topsoil, and low grade ore (LGO) stockpiles; and
  - Revision to the layout of surface water ditches and treatment ponds to reflect the changes to the project layout.
- The project layout has a direct impact on the location and extend of simulated/predicted impacts. Therefore, the update to project layout changed the predicted impact to groundwater quantity (i.e., baseflow) and quality and the predicted impacts are expected to differ between the 2021 and 2019 EIS.

In summary, the groundwater flow model was revised to incorporate up to year of additional monitoring data. The update to the groundwater flow model involved revising surface water elevation to reflect the new data, and updating the model calibration (i.e., changing model parameters such as recharge and updating specified surface water elevations to reflect observed conditions) to reflect the complete year of groundwater elevation monitoring data. The updates to the groundwater flow model in combination with the significant changes to the project layout resulted in a change to both the baseline conditions and the predicted impact under EOM and PC conditions. The groundwater and surface water elevation data, and the revised project layout as it pertains to groundwater that are incorporated into the Updated 2021 EIS (AMNS 2021) are described in the Appendix F.5: Hydrogeologic Modelling Report Section 2.3, PDF page 18, Section 6, PDF page 33, Section 7, PDF page 40, Appendix A, PDF page 177, and Appendix B, PDF page 195 (AMNS 2021). The inclusion of additional data improved the predictive capacity of the groundwater flow model and the update to the groundwater flow model in combination with the change to project layout resulted in the prediction of an annual reduction of 2 to 3% of baseflow to Cameron Flowage in Section 6.6.7.1, page 6-188 of the Updated 2021 EIS (AMNS 2021) versus 5 to 7% as predicted in the Revised 2019 EIS.

Both the 2019 EIS and the 2021 EIS state that “Groundwater flow in the till overburden typically follows topographic relief, and is expected to mirror the topographic surface, with recharge occurring on the basin boundaries and uplands and discharge occurring

to low-lying areas containing wetland areas and tributaries of the Killag River Watershed." in Section 6.6.3.3, page 236 (AMNS 2019) and Section 6.6.4.2.1, page 6-171 of the Updated 2021 EIS (AMNS 2021), respectively. Within the same respective sections, both the 2019 EIS and the 2021 EIS also state that "PCA (2015) further states that groundwater occurs at shallow depths at the Beaver Dam Mine Site and that Cameron Flowage is a likely area of groundwater discharge." There is no inconsistency between the 2019 and 2021 EIS regarding the statement that Cameron Flowage is likely an area of groundwater discharge. However, with respect to Cameron Flowage, Section 6.9.7.2.2 (Beaver Dam Mine Site, Fish and Fish Habitat – Indirect Effects, page 6-495 of the Updated 2021 EIS [AMNS 2021]) introduces the discussion of diffuse upwelling (i.e., groundwater discharge that does not provide groundwater refugia) versus concentrated upwelling areas (i.e., groundwater discharge that has the potential to provide groundwater refugia). Section 6.9.7.2.2 (Beaver Dam Mine Site, Fish and Fish Habitat – Indirect Effects, page 6-495 of the Updated 2021 EIS [AMNS 2021]) states that "The thermal regime of a river or reach is tied to its landscape geomorphology, geology, and vegetation (O'Sullivan et al. 2019); however, studies on the spatial distribution of thermal refuges have found greater occurrences of them to be significantly associated with areas of higher channel curvature, close proximity of incoming tributaries, and channel confinement (ratio of valley width to channel width) (Dugdale et al. 2015; Larken and Sharp 1992; van Balen et al. 2008; Winter et al. 1998). While the Cameron Flowage can be described as a semi-confined river channel section, given the general topography (i.e., low river valley relief, lack of river channel curvature, and limited inflow tributaries near the Open Pit area) concentrated groundwater upwelling locations are not likely. While the overall change in water temperature is not predicted to increase more than 0.5°C, over baseline, if groundwater upwelling(s) are confirmed, a portion of the west shoreline would be altered and therefore a portion of the estimated total area may be included in the fish habitat affected (Appendix J.3 of the Updated 2021 EIS [AMNS 2021])." In summary, the 2021 EIS introduces a new discussion regarding diffusive groundwater discharge to Cameron Flowage versus concentrated groundwater upwelling. As discussed, and supported above, the 2021 EIS states that concentrated areas of groundwater upwelling are not likely, thus groundwater discharge to Cameron Flowage is expected to be more diffusive in nature. Therefore, both the 2019 and 2021 EIS are consistent in their respective/identical statements that Cameron Flowage is expected to be an area of groundwater discharge and there are no inconsistencies in this respect. It should also be noted that the thermal imagery study conducted in August 17, 2021 (Attachment CEAA-2-14-A) did not identify areas of concentrated groundwater upwelling. This study further supports that groundwater discharge to Cameron Flowage is expected to be diffusive in nature and that concentrated areas of groundwater upwelling are not likely.

It is predicted the baseflow reduction throughout the Cameron Flowage watershed is predicted to range from 677 to 754 m^3/d at EOM and from 446 to 620 m^3/d at PC, with the majority of baseflow reduction occurring within the Beaver Dam Mine Site Property Boundary (50 to 60%). The remainder of the baseflow reduction occurs between the Property Boundary and the Local Assessment Area (LAA), indicating the Beaver Dam Mine Site operations will not impact the baseflow contribution to Cameron Flowage beyond the LAA. The range in baseflow reduction represents 2 to 3% of the total baseflow in the Cameron Flowage and less than 1% of the total average annual flow in Cameron Flowage, Section 6.6.7.1, page 6-189. Predicted reduction in base flows to Cameron Flowage are discussed in greater detail in Section 6.9.7.2.2, page 6-502 of the Updated 2021 EIS (AMNS 2021). Refer to Section 6.9.7.2.2, page 6-501 for further details on calculation of the reduction in base flows to Cameron Flowage.

B)
The direct effects to fish and fish habitat have been updated and are summarized in Section 6.9.7.2.1, Table 6.9-15, page 6-494, Table 6.9-19, page 6-511 of the Updated 2021 EIS (AMNS 2021). The updated cumulative effects of the Project on fish and fish habitat are summarized in Section 8.5.5.2.3, page 8-77 of the Updated 2021 EIS (AMNS 2021). The evaluation of cumulative environmental effects is based upon the updates to the fish and fish habitat baseline work, updated Project layout, updated effects assessment and updates to cumulative effects assessment methodology.

C)
Refer to the Hydrogeological Modelling Report (Section 7.4.4, PDF page 46 and 47 of Appendix F.5) and Section 2, PDF page 665 and Section 3, PDF page 667 of the Baseflow Mitigation Assessment (Appendix H, PDF page 664 of Appendix P.4 – Mine Water Management Plan) for further details on calculation of the simulated baseflow throughout the Cameron Flowage watershed (Updated 2021 EIS [AMNS 2021]).

D)
Predicted reduction in base flows to Cameron Flowage are discussed in Section 6.9.7.2.2, page 6-495 of the Updated 2021 EIS (AMNS 2021). Refer to Section 6.9.7.2.2, page 6-495 for further details on calculation of the reduction in base flows to Cameron Flowage (Updated 2021 EIS [AMNS 2021]).

References

AMNS (Atlantic Mining NS Inc.). 2019. Revised Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. February 28, 2019. Middle Musquodoboit, NS.

AMNS. 2021. Updated Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. October 2021. Middle Musquodoboit, NS.

ATTACHMENT CEAA 2-14-A:

CAMERON FLOWAGE THERMAL IMAGING STUDY – AUGUST 2021

Technical Memorandum

October 12, 2021

To	Danielle Finlayson-Bourque	**Tel**	902.384.2772
Copy to	Andrew Betts (GHD) Craig Hudson (AMNS)	**Email**	Danielle.Finlayson-Bourque@atlanticgold.ca
From	Dylan Wyles, Alex Mutton and Josee Courtemanche	**Ref. No.**	088664-70
Subject	Cameron Flowage Thermal Imaging Study – August 2021 Beaver Dam Road, Marinette, Nova Scotia		

1. Introduction

GHD is pleased to provide the results of the thermal imaging program completed in August 2021 at Cameron Flowage, located near Beaver Dam Road, in Marinette, Nova Scotia (Site). This memorandum is to be read in conjunction with the following video: https://vimeo.com/user9670035/review/592335066/9b5c64c73f (Section 3.1). The Site is located approximately 6.5 kilometres north of Highway 224, along Beaver Dam Road and includes a portion of Killag River, approximately 1.75 kilometres long and ranges from 130 metres wide to less than 10 metres wide in some areas. GHD was retained by Atlantic Mining NS Inc. (AMNS), a wholly owned subsidiary of St Barbara Limited to perform a thermal investigation of the Cameron Flowage surficial river system to identify and locate thermal anomalies on Site which could indicate potential groundwater influence.

2. Thermal Investigation Program

The thermal investigation program in Cameron Flowage was conducted to identify thermal anomalies to assist AMNS with identifying areas indicative of groundwater diffusion. This study was performed utilizing a DJI Matrice 210 unmanned aerial vehicle (UAV), equipped with an Zunmuse XT 2 infrared (IR) camera and completed by a qualified drone pilot and flight observer. To accurately identify thermal anomalies, GHD performed the investigative UAV flight late in the evening, after sunset, to allow the surroundings to cool for several hours to ambient temperature (reducing solar loading) and prevent solar reflection from interfering with the investigation. Any direct or indirect solar radiation may create thermal reflectivity and distort the IR data.

GHD arrived on Site on August 10, 2021, to perform a reconnaissance flight and collect daylight imagery for comparison with thermal imagery. When GHD arrived on Site early in the morning on August 11 to collect thermal imagery, heavy fog had settled in the area which prevented the UAV from being able to perform, and the mission was terminated. GHD returned to Site in the late evening on August 17, 2021, to conduct UAV infrared investigative flights over Cameron Flowage during low light conditions. Investigative infrared video footage was collected along the shoreline of the water body to inspect for thermal anomalies. A total of twelve (12) unique thermal anomalies were identified along the shoreline of Cameron Flowage, the positions of which have been identified in Figure 3.1.1, with discussion of each in Section 3. GHD uses the term "anomalies" to

denote any infrared characteristic that is unique and/or cannot be explained by normal thermal conditions (e.g., reflections, solar loading, solar shadows, etc.). Thermal anomalies may warrant further investigation to determine the nature and cause of the anomaly. The captured thermal imagery colour palette is a qualitative representation of temperature differences at the surface and is not intended to represent accurate temperature measurements or indicate subsurface conditions. Examples of thermal anomalies include but are not limited to: surficial runoff; groundwater diffusion; groundwater springs; water channels; and animal influence.

3. Analysis

Analysis of the UAV infrared imagery is provided in this section, with a discussion in Section 4, a further baseline comparison in Section 5, and pertinent recommendations in Section 6. Section 3 is to be read in conjunction with the Cameron Flowage Thermal Study Video (Section 3.1.1). This was a secondary UAV inspection with the data captured and analyzed here used for comparing results with the baseline inspection from April 2021. As previously mentioned, this comparison can be found in Section 4. During this thermal investigation, conducted on August 17, 2021, the average surface water temperature in Cameron Flowage was noted to be approximately 19.8 ºC and the air temperature on Site was noted to be 13 ºC.

Twelve (12) thermal anomalies were observed during thermal investigation of Cameron Flowage in Beaver Dam, Nova Scotia. The location of each thermal anomaly is noted in Figure 3.1.1. All twelve (12) of the thermal anomalies include colder water diffusing into the main water body coming from the shoreline. The anomalies are separated into three areas of the Cameron Flowage, with six (6) anomalies near the west end of the waterbody on the north and south shorelines, four (4) anomalies in the central portion of the waterbody on the north and south shorelines, and two (2) anomalies in the eastern portion of the waterbody. Eight (8) of twelve (12) anomalies are found along the south shoreline, with three (3) on the north shoreline and one (1) in the middle of the waterway near the eastern end of the waterbody.

3.1 Cameron Flowage Thermal Study Video

The Cameron Flowage Thermal Study Video reviews both infrared and non-infrared footage of Cameron Flowage side-by-side. A map is included to note the location of the UAV at the time of recording and a thermal legend is provided. A short pause in the video is included while viewing each thermal anomaly to allow for review with Section 3. The video can be viewed and downloaded at the following link: https://vimeo.com/user9670035/review/592335066/9b5c64c73f.

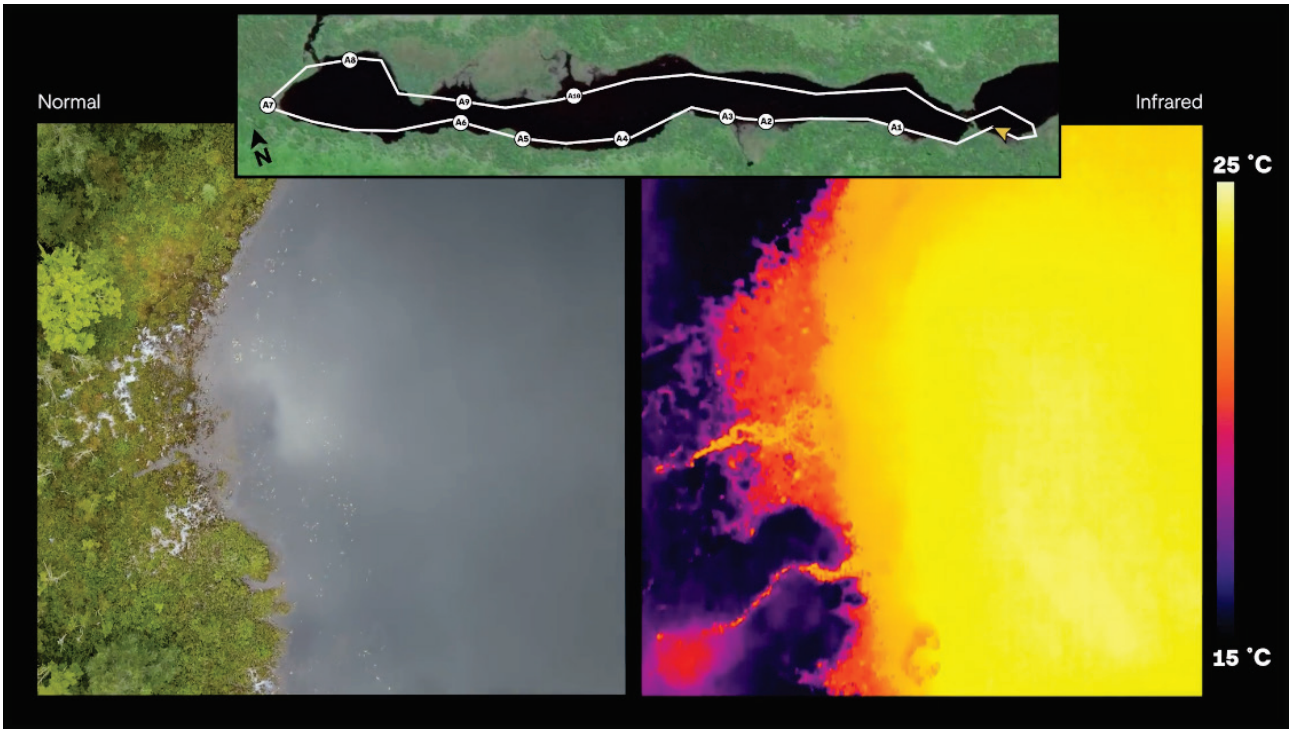


*Figure 3.1 Cameron Flowage Thermal Study Video (**https://vimeo.com/user9670035/review/592335066/9b5c64c73f**)*

3.2 Thermal Anomaly 1

Thermal Anomaly A1 is located in the central area of Site along the southern shoreline at approximately 0.94 River Kilometers (RKM) (Figure 1). A1 was observed to be colder than the average temperature of Cameron Flowage. The temperature difference between the anomaly and main body of water is approximately 4 ºC – 5 ºC.

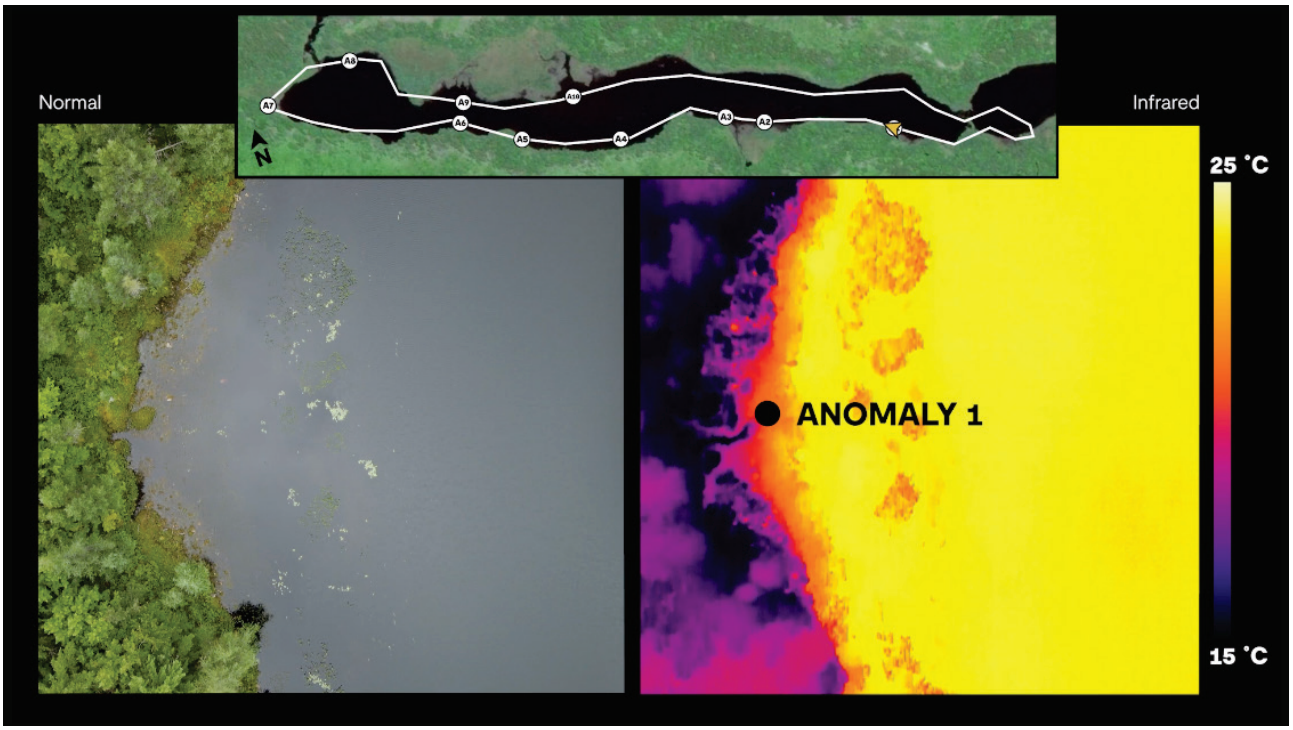


Figure 3.2 Thermograph and photograph of A1 (August 17, 2021)

3.3 Thermal Anomaly 2

Thermal Anomaly A2 is located in the central area of Site along the southern shoreline, west of A1, at approximately 0.73 RKM (Figure 1). Thermal anomaly A2 indicates colder water diffusing into Cameron Flowage from the south shoreline. The temperature difference between A2 and Cameron Flowage is approximately 7 ºC – 8 ºC.

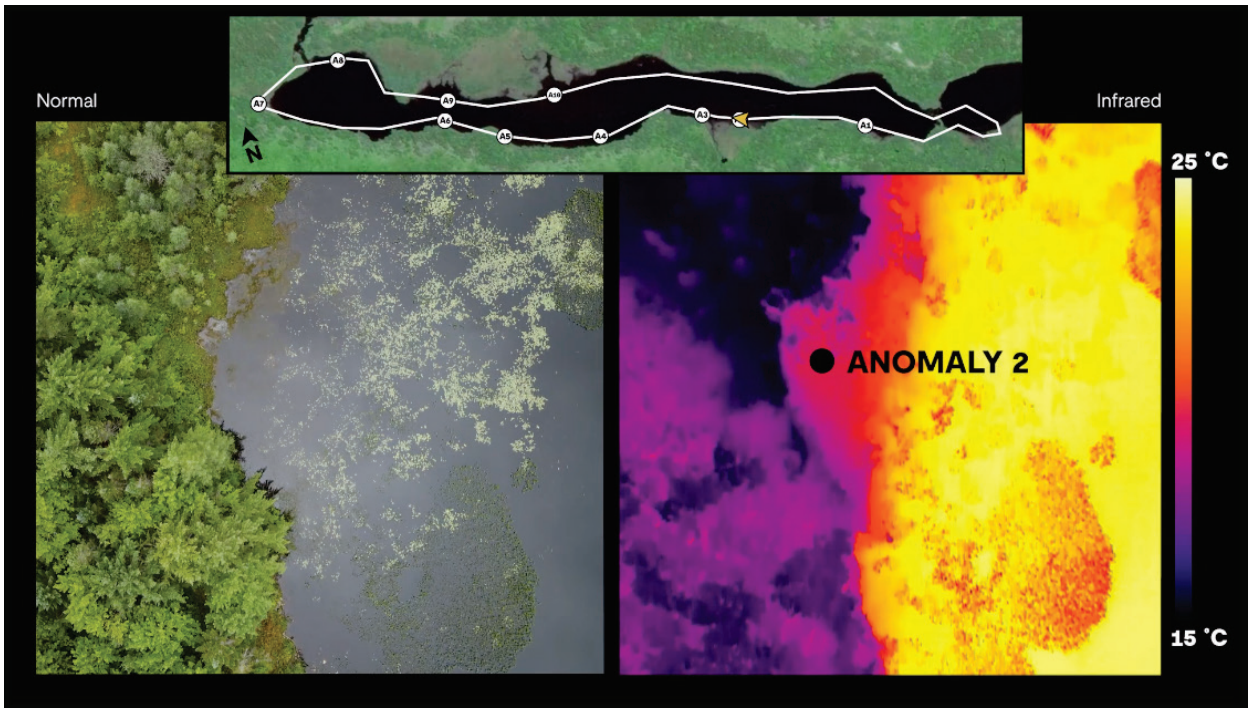


Figure 3.3 Thermograph and photograph of A2 (August 17, 2021)

3.4 Thermal Anomaly 3

Thermal Anomaly A3 is located in the central area of Site along the southern shoreline, slightly west of A2, at approximately 0.67 RKM (Figure 1). Thermal anomaly A3 indicates colder water diffusing into Cameron Flowage from the south shoreline from various locations. The temperature difference between A3 and Cameron Flowage is approximately 6 ºC – 8 ºC.

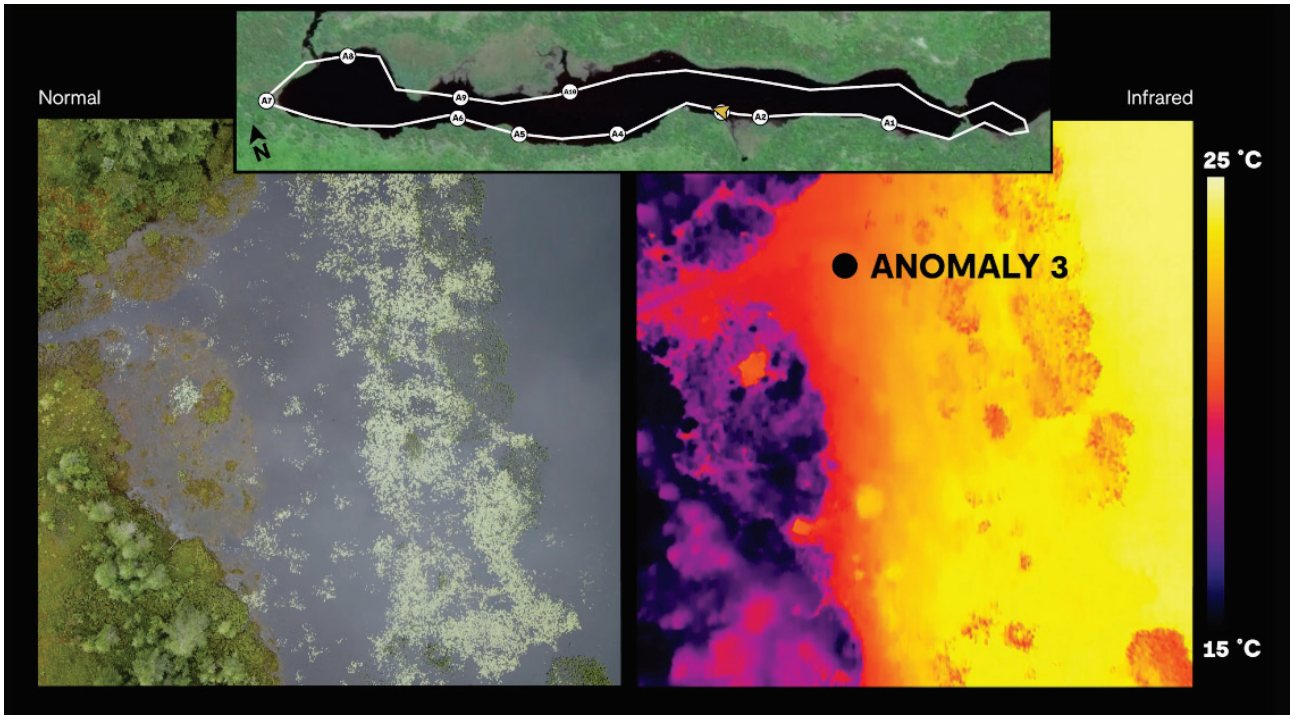


Figure 3.4 Thermograph and photograph of A3 (August 17, 2021)

3.5 Thermal Anomaly 4

Thermal Anomaly A4 is located in the western-central area of Site along the southern shoreline at approximately 0.55 RKM (Figure 1). Thermal anomaly A4 indicates colder water diffusing into Cameron Flowage from the south shore. The temperature difference between A4 and Cameron Flowage is approximately 3 ºC – 4 ºC.

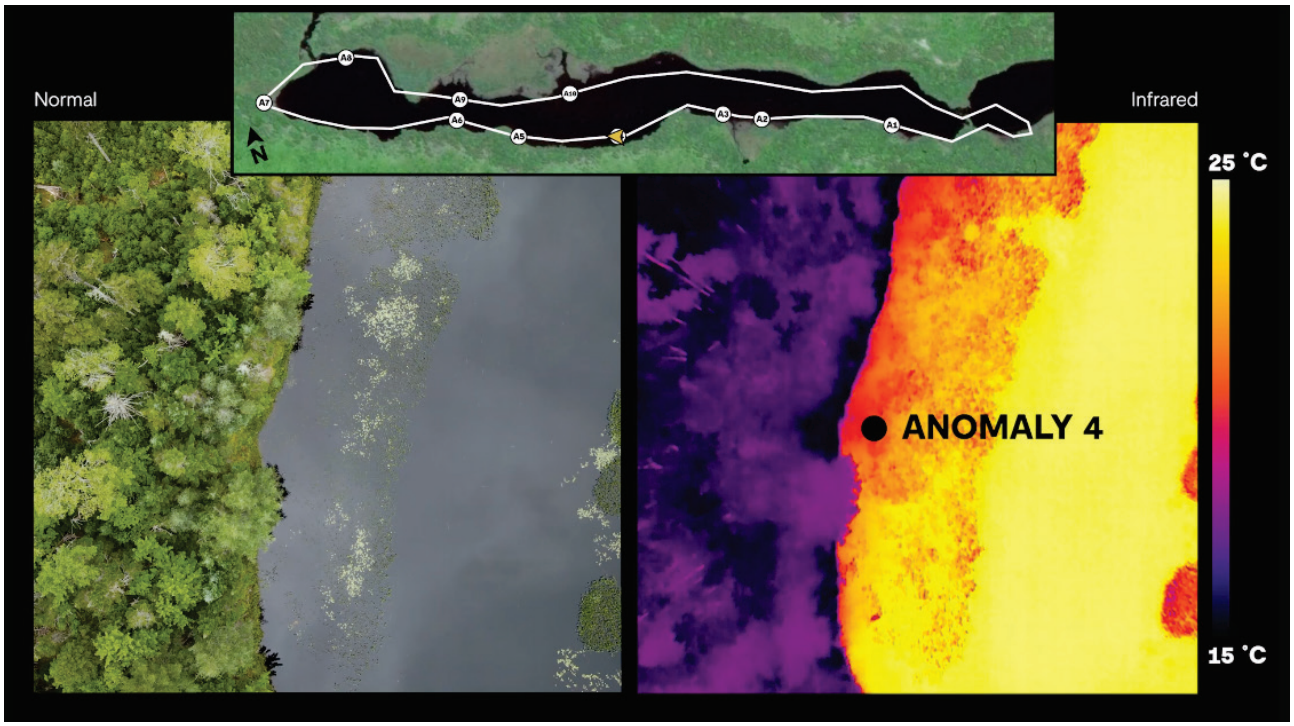


Figure 3.5 Thermograph and photograph of A4 (August 17, 2021)

3.6 Thermal Anomaly 5

Thermal Anomaly A5 is located in the central area of Site along the southern shoreline, west of A4, at approximately 0.38 RKM (Figure 1). Thermal anomaly A5 indicates colder water diffusing into Cameron Flowage from the south shore. The temperature difference between A5 and Cameron Flowage is approximately 6 ºC – 7 ºC.

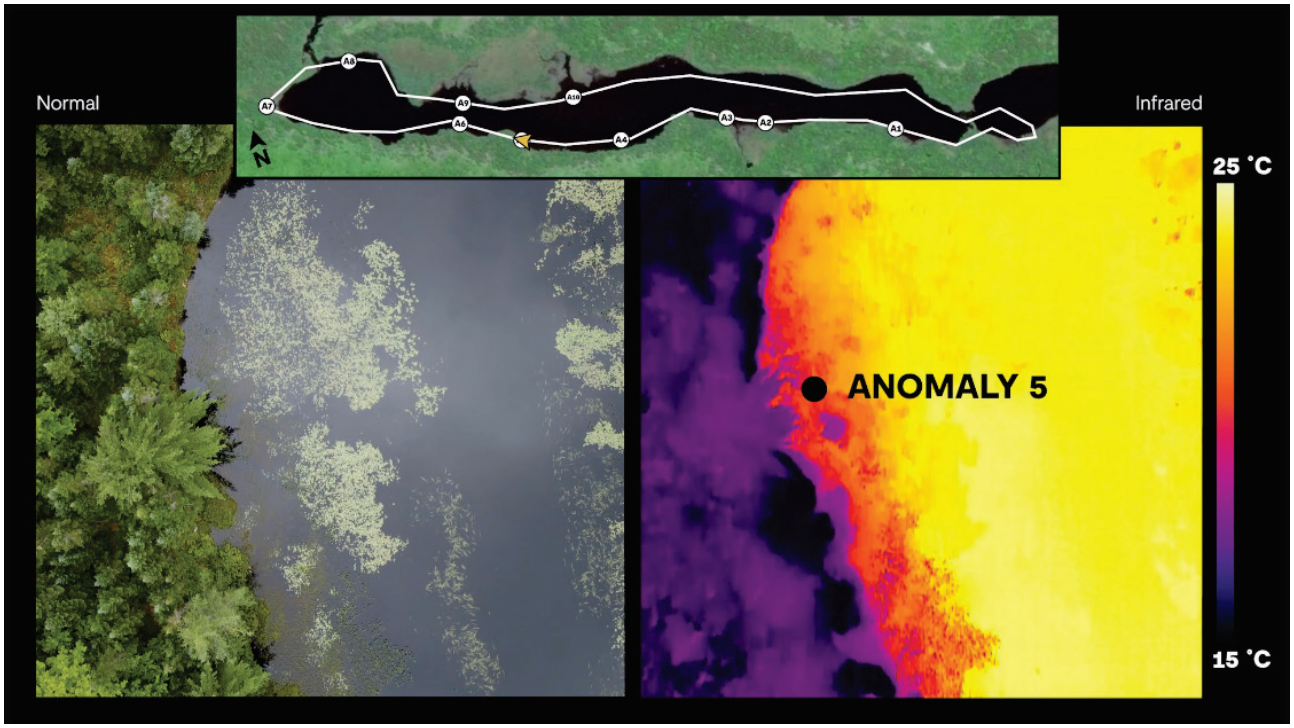


Figure 3.6 Thermograph and photograph of A5 (August 17, 2021)

3.7 Thermal Anomaly 6

Anomaly A6 is located toward the western end of Site along the southern shoreline, slightly west of A5 at approximately 0.29 RKM (Figure 1). A6 indicates colder water diffusing from the shoreline into the warmer waters of Cameron Flowage. The temperature difference between A6 and Cameron Flowage is approximately 3 ºC – 5 ºC.

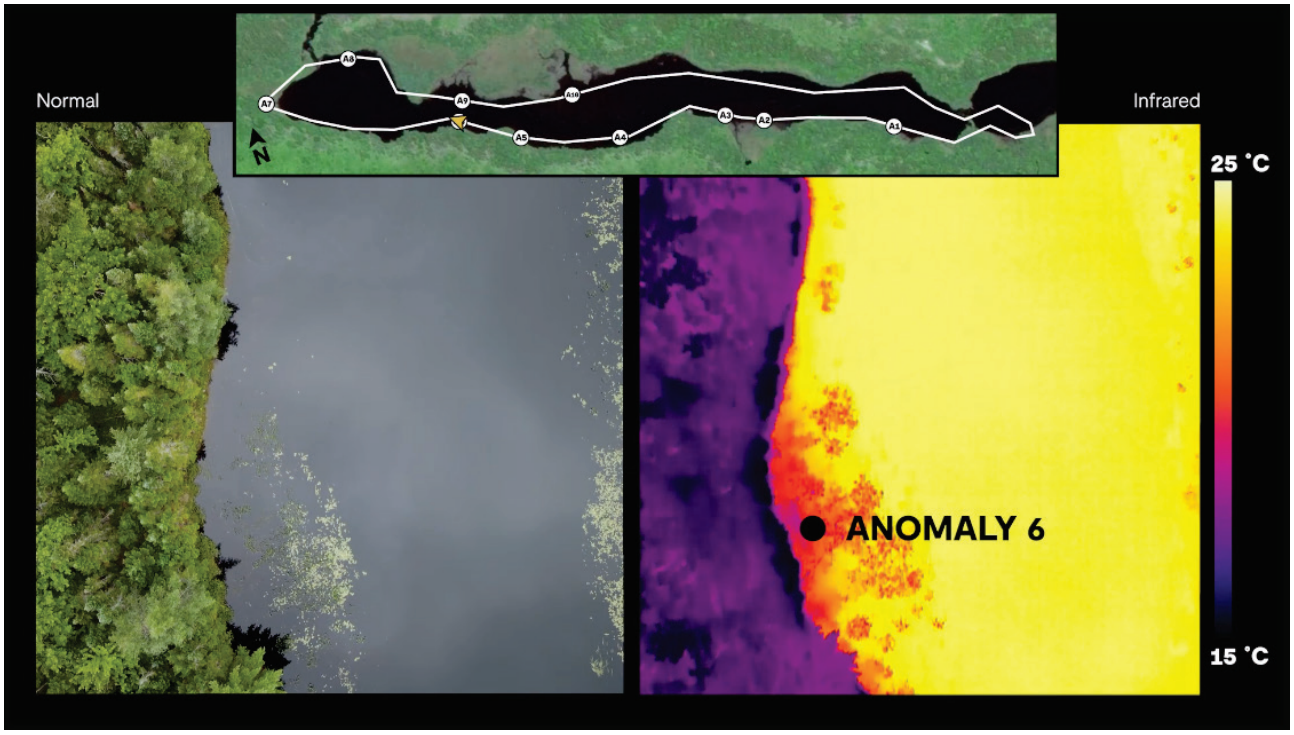


Figure 3.7 Thermograph and photograph of A6 (August 17, 2021)

3.8 Thermal Anomaly 7

Thermal Anomaly A7 is located at the western end of Site along the west shoreline, at approximately 0 RKM (Figure 1). Thermal anomaly A7 indicates colder water diffusing into Cameron Flowage from the west shore. The temperature difference between A7 and Cameron Flowage is approximately 3 ºC – 4 ºC.

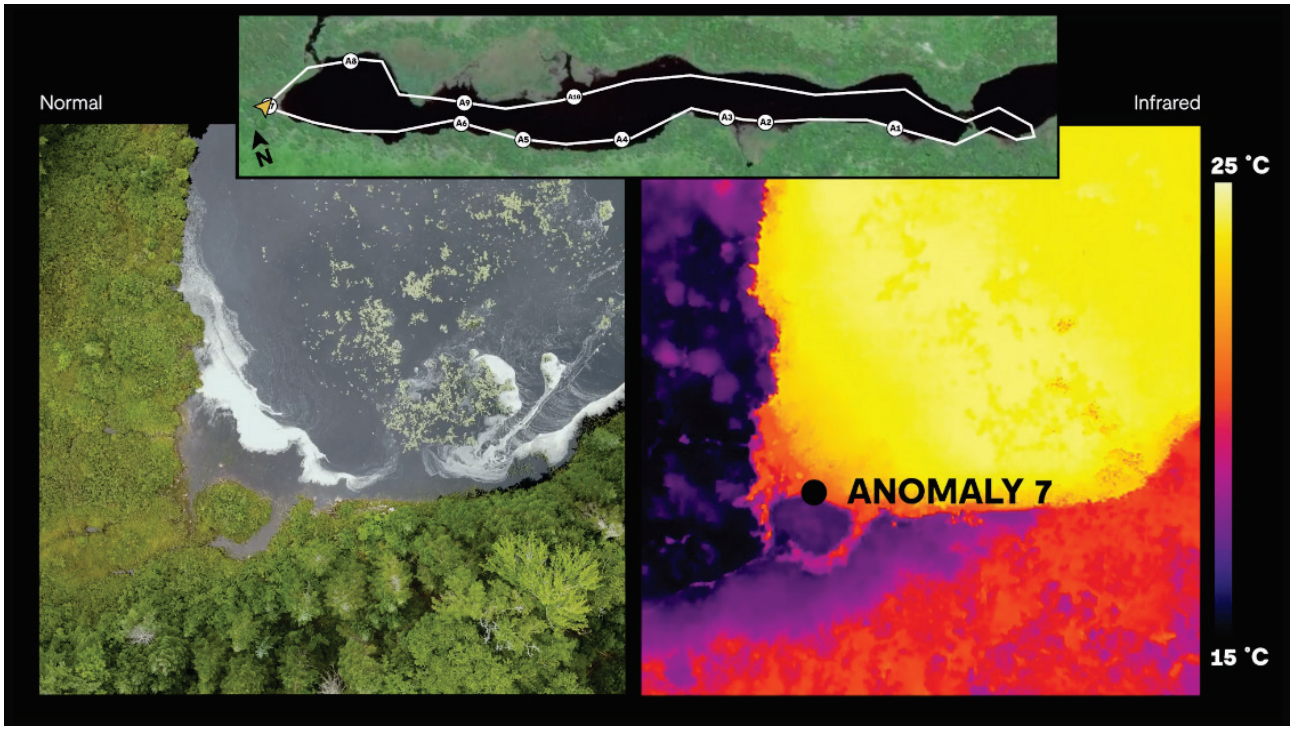


Figure 3.8 Thermograph and photograph of A7 (August 17, 2021)

3.9 Thermal Anomaly 8

Thermal Anomaly A8 is located near the western end of Site along the northern shoreline, east of A7, at approximately 0.12 RKM (Figure 1). Thermal anomaly A8 indicates colder water diffusing into Cameron Flowage from the north shore. The temperature difference between A8 and Cameron Flowage is approximately 3 ºC – 5 ºC.

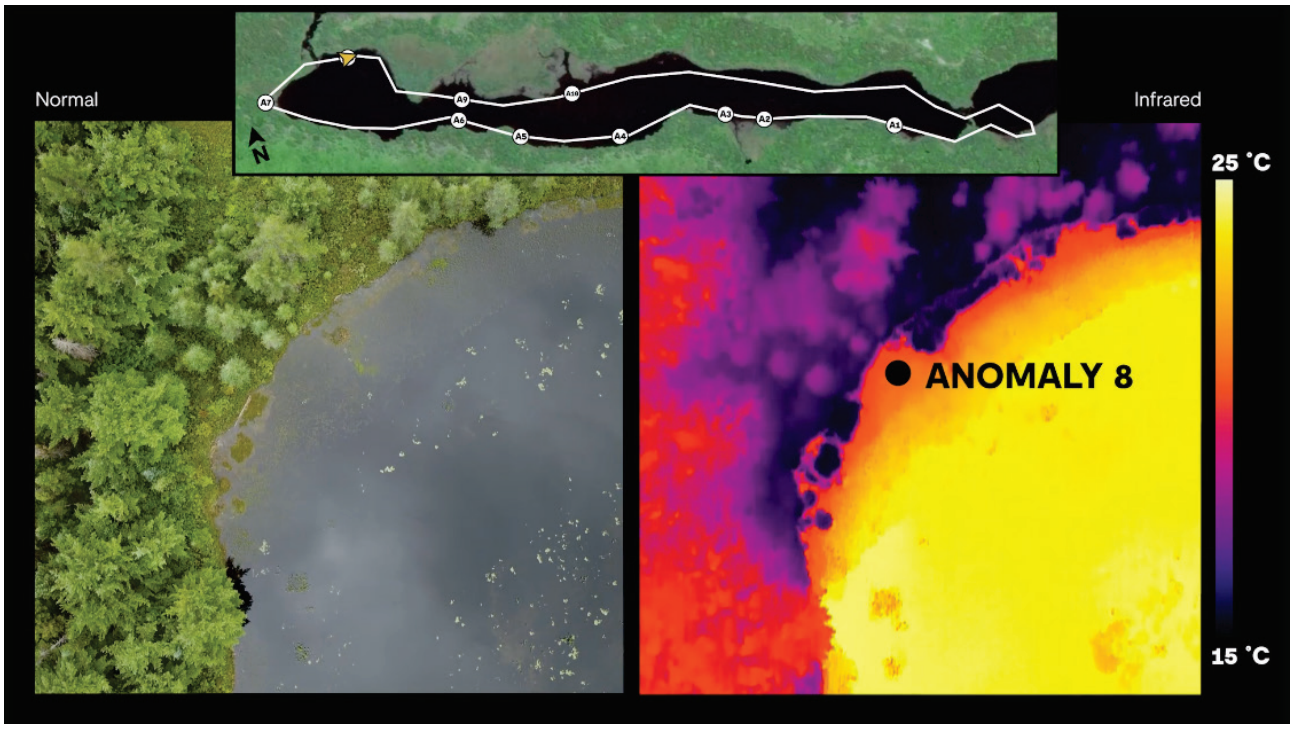


Figure 3.9 Thermograph and photograph of A8 (August 17, 2021)

3.10 Thermal Anomaly 9

Thermal Anomaly A9 is located near the western end of Site along the northern shoreline, east of A8, at approximately 0.3 RKM (Figure 1). Thermal anomaly A9 indicates colder water diffusing into Cameron Flowage from the north shore. The temperature difference between A9 and Cameron Flowage is approximately 4 ºC – 6-ºC.

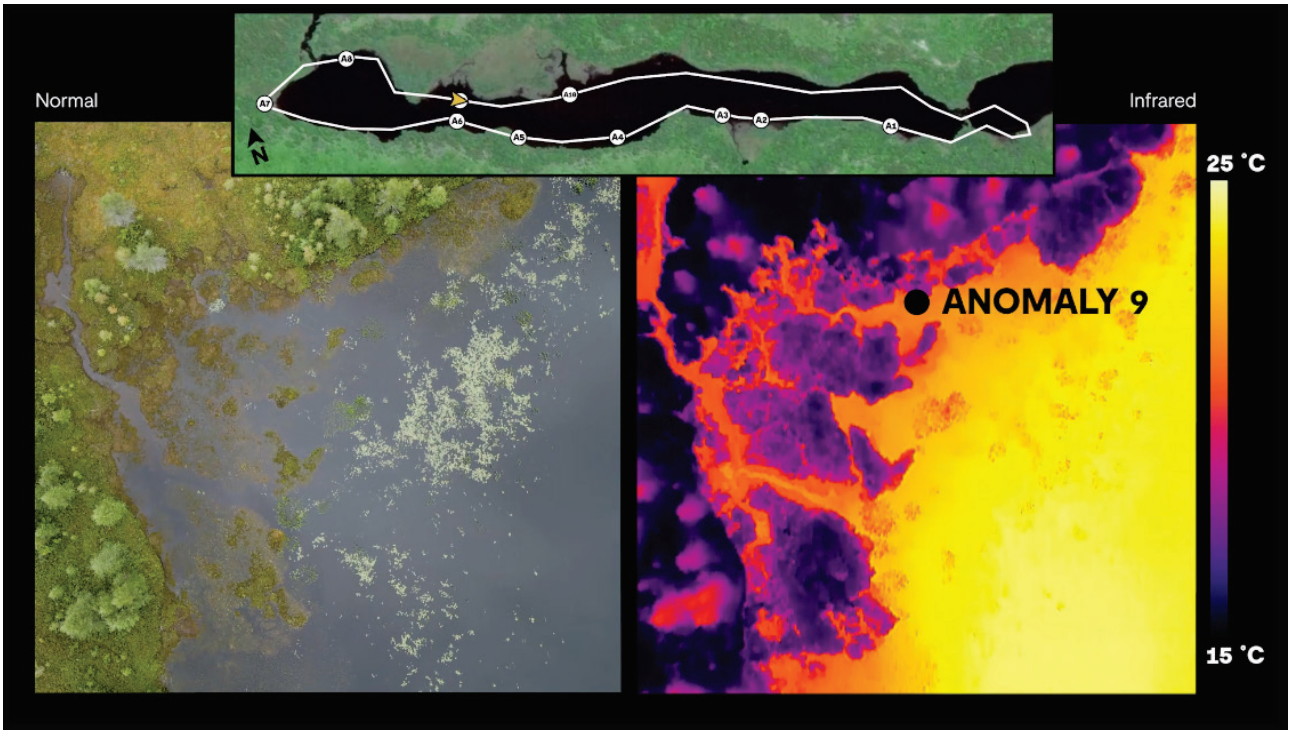


Figure 3.10 Thermograph and photograph of A9 (August 17, 2021)

3.11 Thermal Anomaly 10

Thermal Anomaly A10 is located at the western-central end of Site along the northern shoreline at approximately 0.45 RKM (Figure 1). Thermal anomaly A10 indicates colder water diffusing into Cameron Flowage from the north shore. The temperature difference between A10 and Cameron Flowage is approximately 6 ºC – 8 ºC.

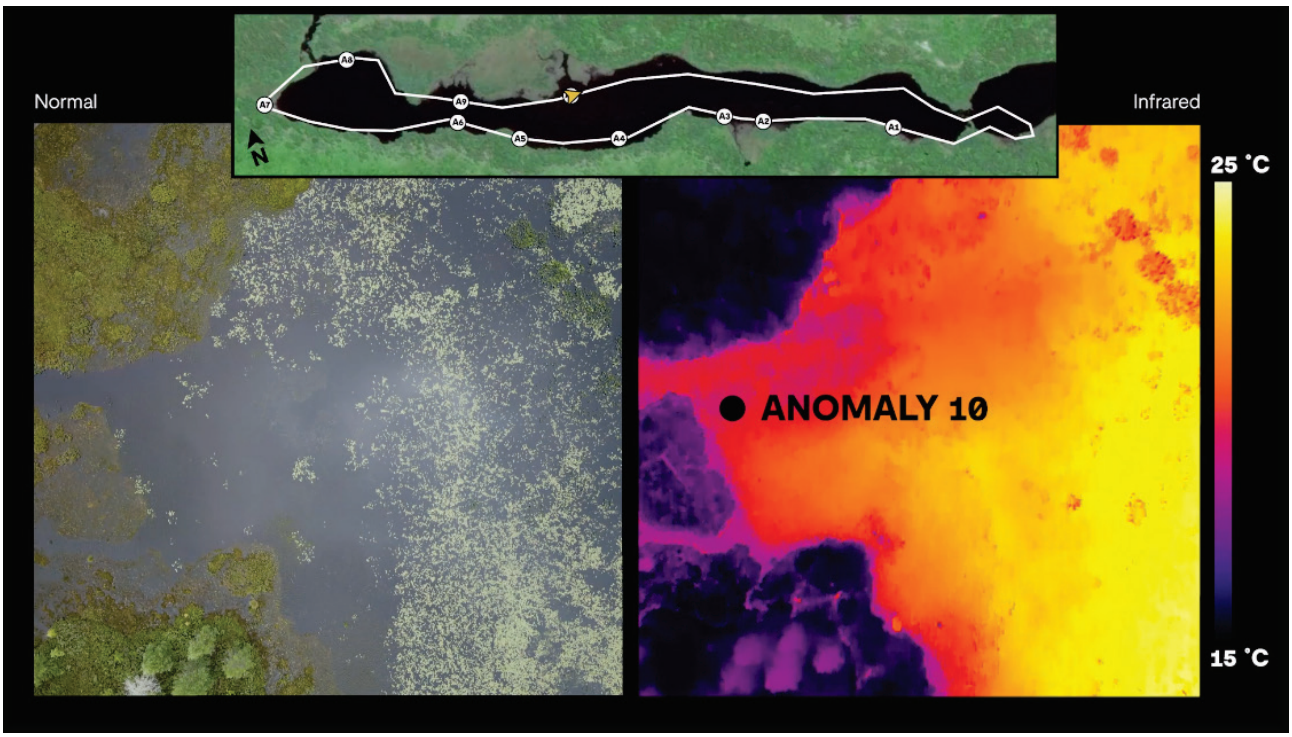


Figure 3.11 Thermograph and photograph of A10 (August 17, 2021)

3.12 Thermal Anomaly 11

Thermal Anomaly A11 is located at the eastern end of Site at approximately 1.48 RKM (Figure 2). Thermal anomaly A11 indicates colder water meeting warmer water in the river channel west of Beaver Dam Road. The temperature difference is approximately 1 ºC – 2 ºC.

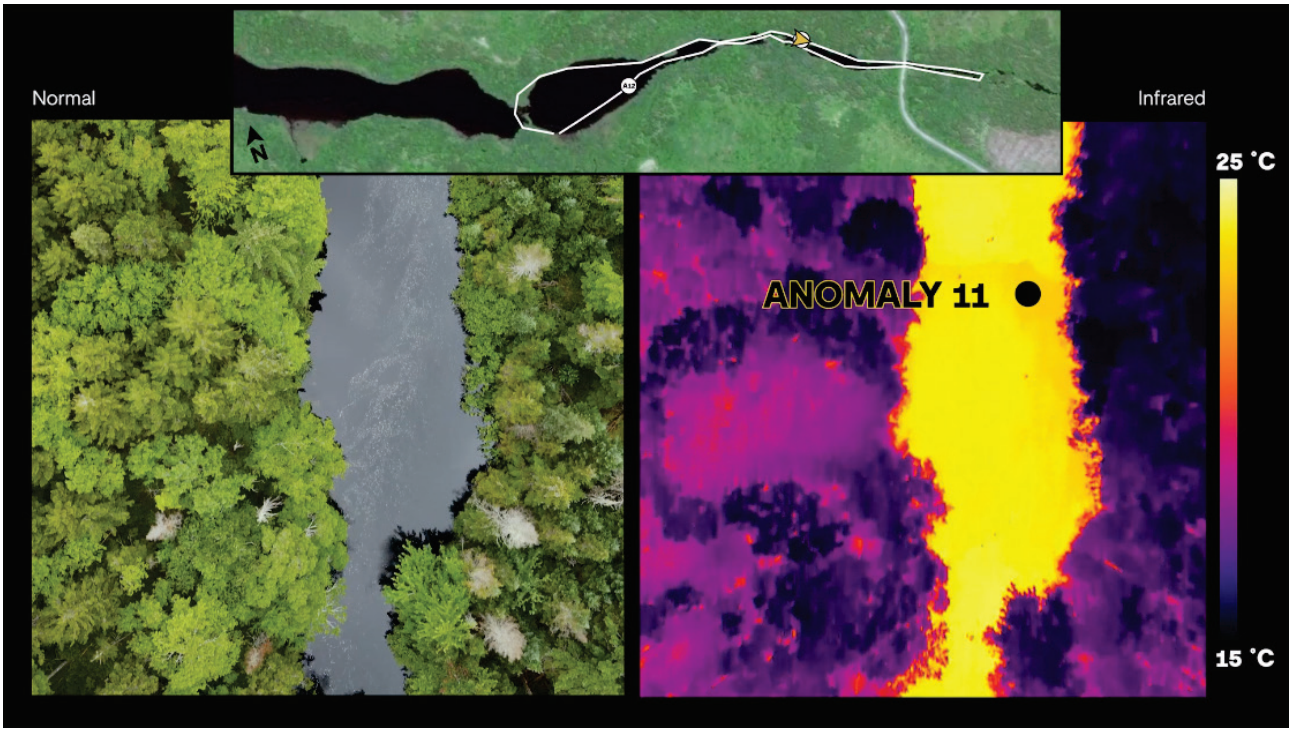


Figure 3.12 Thermograph and photograph of A11 (August 17, 2021)

3.13 Thermal Anomaly 12

Thermal Anomaly A12 is located near the eastern end of Site along the southern shoreline in the southern section, at approximately 1.23 RKM (Figure 2). Thermal anomaly A12 indicates colder water diffusing into Cameron Flowage from the south shore. The temperature difference between A12 and Cameron Flowage is approximately 4 ºC – 6 ºC.

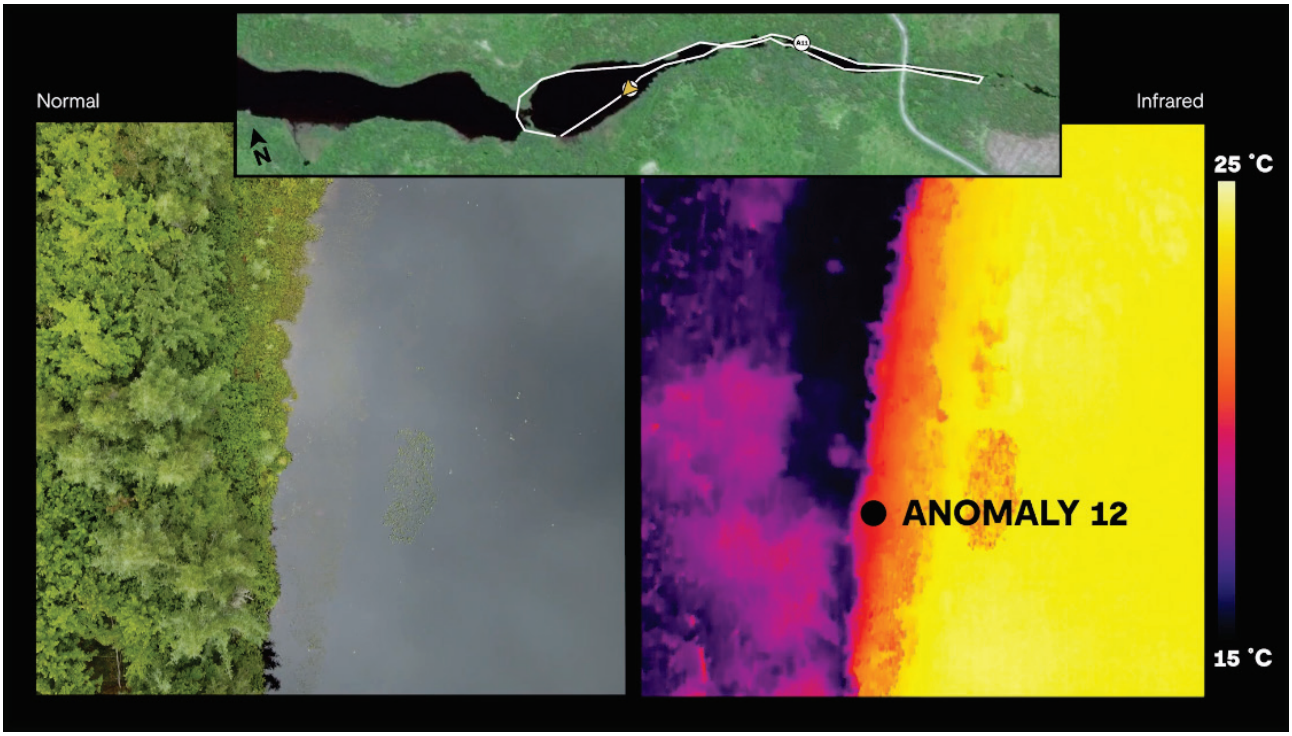


Figure 3.13 Thermograph and photograph of A12 (August 17, 2021)

4. Discussion

Thermal anomalies observed within Cameron Flowage presented variations in water temperatures that ranged from 1 ºC to 8 ºC below the average temperature of the waterbody. The observed anomalies were mostly concentrated around the western and central portions of the waterbody, with a couple anomalies observed in the eastern portion. All thermal anomalies were typically observed within 10 metres of the shoreline and presented temperatures below the average measured temperature in the waterbody.

As atmospheric temperatures on Site were measured to be approximately 7 ºC below the average measured waterbody temperature, shallower areas in Cameron Flowage may have been more susceptible to cooling during the colder night temperatures. Daily recorded high atmospheric temperatures on days leading up to the site visit were 20 ºC (August 14), 22 ºC (August 15), and 19 ºC (August 16).

Through a groundwater monitoring program that has been conducted by GHD at the Site, it was determined that average groundwater temperatures range between 9.3 ºC and 10.2 ºC for the late summer months (July - September), which coincide with the warmest measured groundwater temperatures of the year[1]. With the secondary inspection completed in August the thermal survey sufficiently represents the difference between areas in a dynamic waterbody, making it more effective to observe areas of groundwater diffusion. This means the difference between surface water temperature and average groundwater of approximately 9 ºC – 10 ºC allows for the areas of groundwater fusion to be more recognizable.

[1] GHD (2021). Compilation and Review of Water Temperature Data and Evaluation of Potential Impacts of Baseflow Reduction on Surface Water Temperature in Cameron Flowage Beaver Dam Mine Project, Marinette, Nova Scotia

5. Comparison of Secondary Flight with Baseline Flight

A secondary UAV inspection was conducted on August 17, 2021 and compared to the baseline UAV data collected on April 16, 2021. The UAV flight paths for the baseline and secondary inspections are identical with different anomalies located along the flight paths, as shown in Figure 5.1 and 5.2.

Figure 5.1 Baseline Cameron Flowage UAV Flight Path (April 16, 2021)

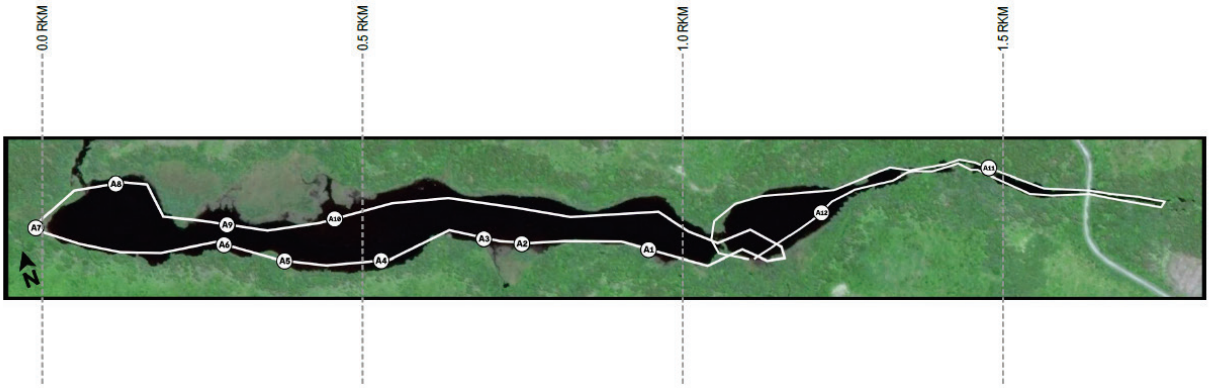


Figure 5.2 Secondary Cameron Flowage UAV Flight Path (August 17, 2021)

Comparing the two UAV flight paths identified anomalies that show similarities between both inspections. These anomalies include A4 from the baseline inspection coinciding with A12 from the secondary inspection, A10 from the baseline inspection coinciding with A8 from the secondary inspection, A13 from the baseline inspection coinciding with A9 from the secondary inspection, and A16 from the baseline inspection coinciding with A10 from the secondary inspection. With this comparison GHD is able to confirm consistent anomalies at these four (4) locations.

5.1 Baseline Inspection A4 compared with Secondary Inspection A12

Thermal anomaly A4 from the baseline inspection indicated a temperature difference of approximately 2ºC – 3 ºC through colder water diffusing into Cameron Flowage from the south shore. In comparison, thermal anomaly A12 from the secondary inspection indicated a temperature difference of 4 ºC – 6 ºC also through colder water diffusing into Cameron Flowage from the south shore.

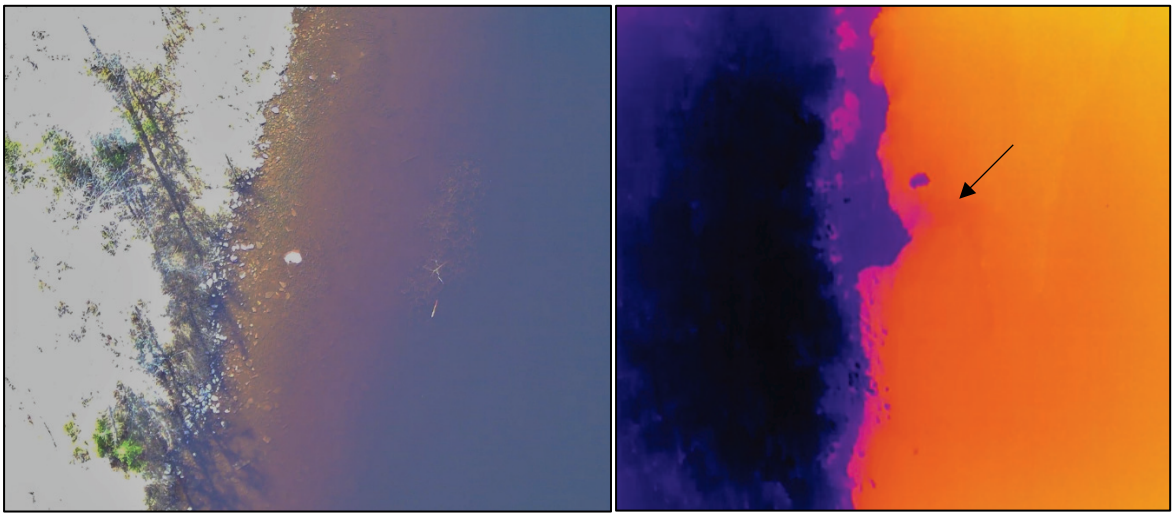


Figure 5.1.1 Thermograph and photograph of A4 (April 16, 2021)

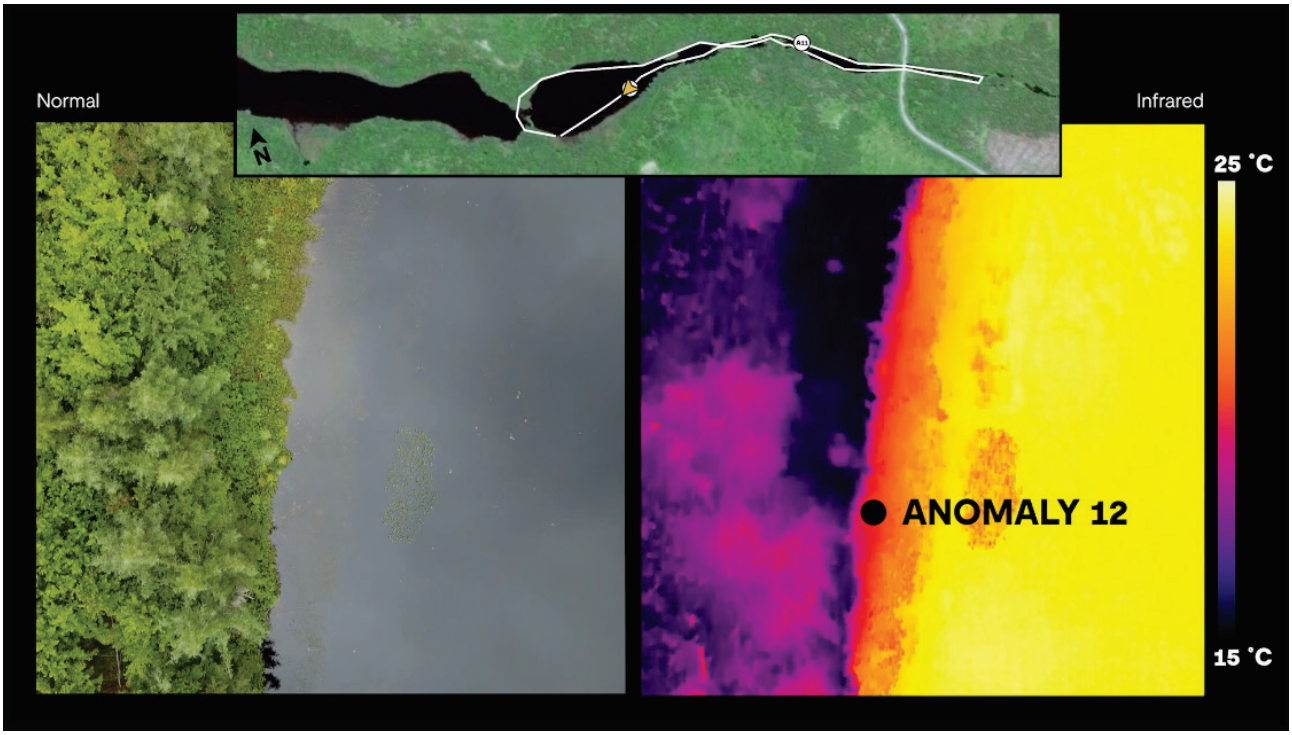


Figure 5.1.2 Thermograph and photograph of A12 (August 17, 2021)

5.2 Baseline Inspection A10 compared with Secondary Inspection A8

Thermal anomaly A10 from the baseline inspection indicated a temperature difference of approximately 2 ºC – 4 ºC through colder water diffusing into Cameron Flowage from the north shore. In comparison, thermal anomaly A8 from the secondary inspection indicated a temperature difference of 3 ºC – 4 ºC also through colder water diffusing into Cameron Flowage from the north shore.

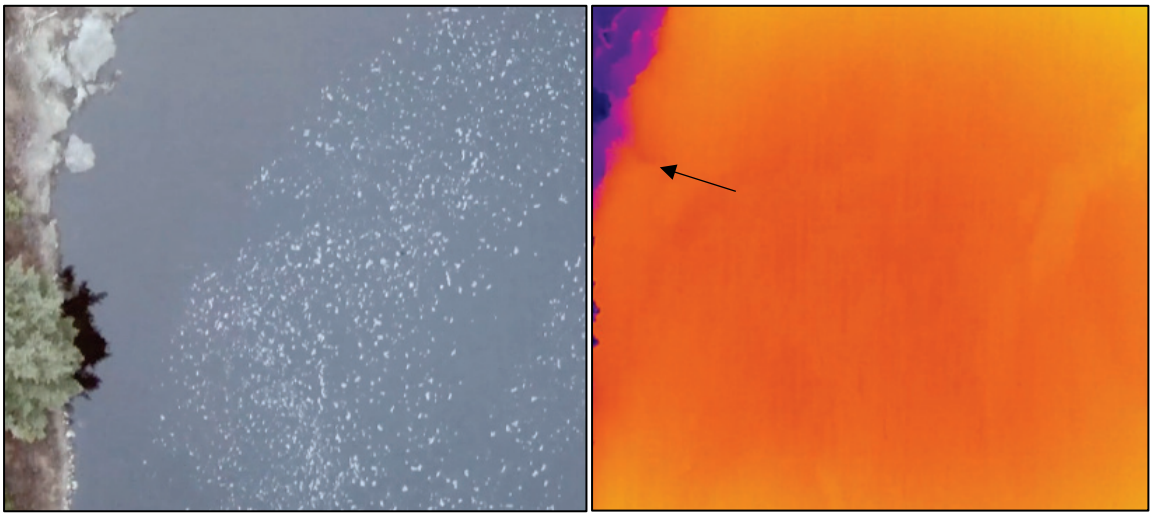


Figure 5.2.1 Thermograph and photograph of A10 (April 16, 2021)

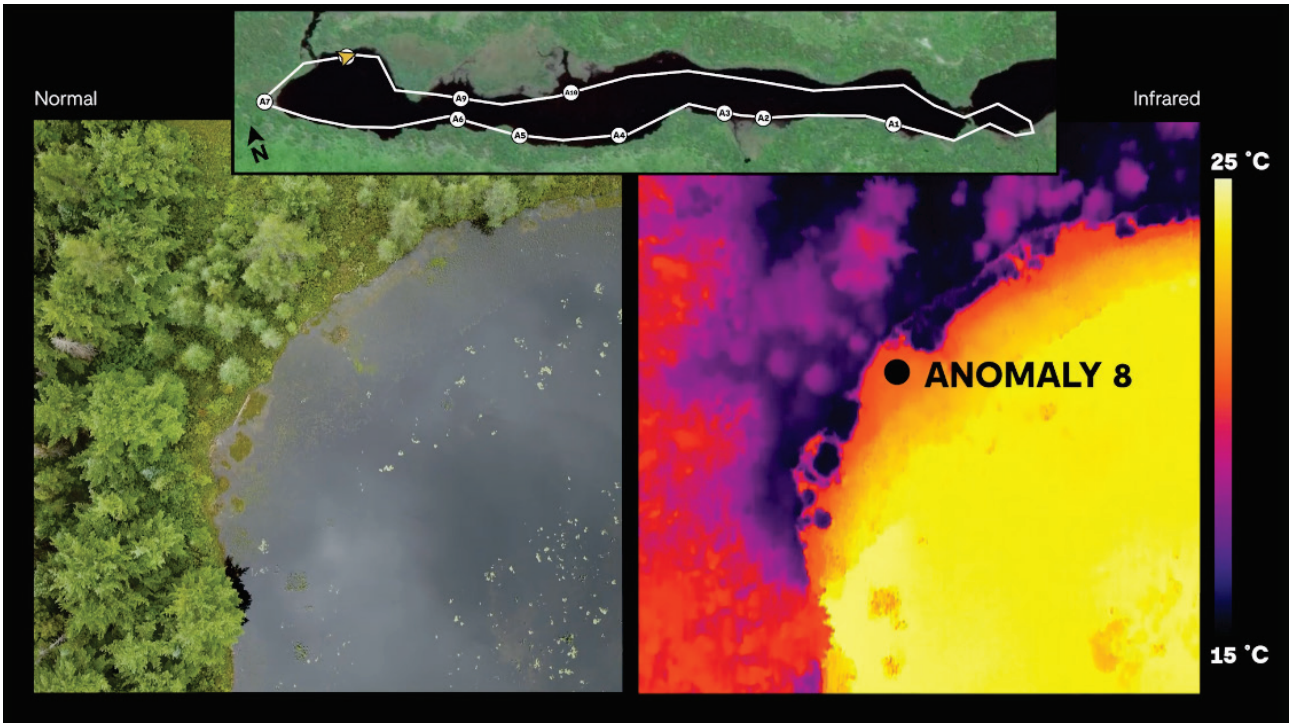


Figure 5.2.2 Thermograph and photograph of A8 (August 17, 2021)

5.3 Baseline Inspection A13 compared with Secondary Inspection A9

Thermal anomaly A13 from the baseline inspection indicated a temperature difference of approximately 2ºC – 4 ºC through colder water diffusing into Cameron Flowage from the north shore. In comparison, thermal anomaly A9 from the secondary inspection indicated a temperature difference of 5 ºC – 6 ºC through colder water diffusing into Cameron Flowage from the north shore.

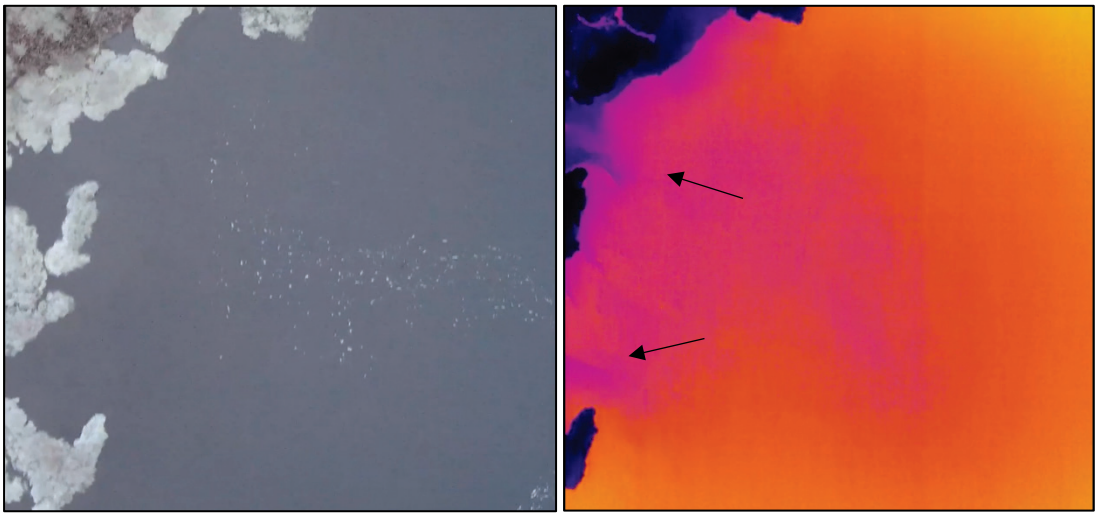


Figure 5.3.1 Thermograph and photograph of A13 (April 16, 2021)

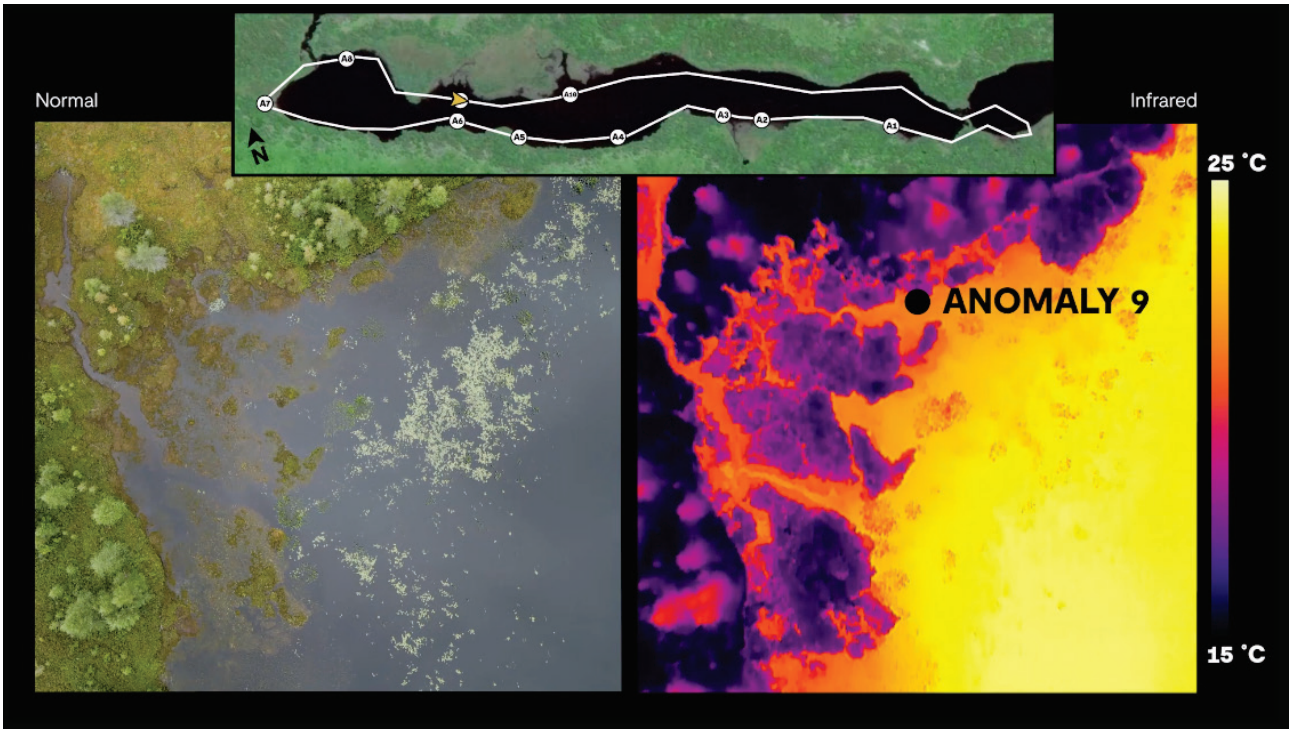


Figure 5.3.2 Thermograph and photograph of A9 (August 17, 2021)

5.4 Baseline Inspection A16 compared with Secondary Inspection A10

Thermal anomaly A16 from the baseline inspection indicated a temperature difference of approximately 4ºC – 8ºC through a larger area of colder water diffusing into Cameron Flowage from the north shore. In comparison, thermal anomaly A10 from the secondary inspection indicated a temperature difference of 5 ºC – 6 ºC also through colder water diffusing into Cameron Flowage from the north shore.

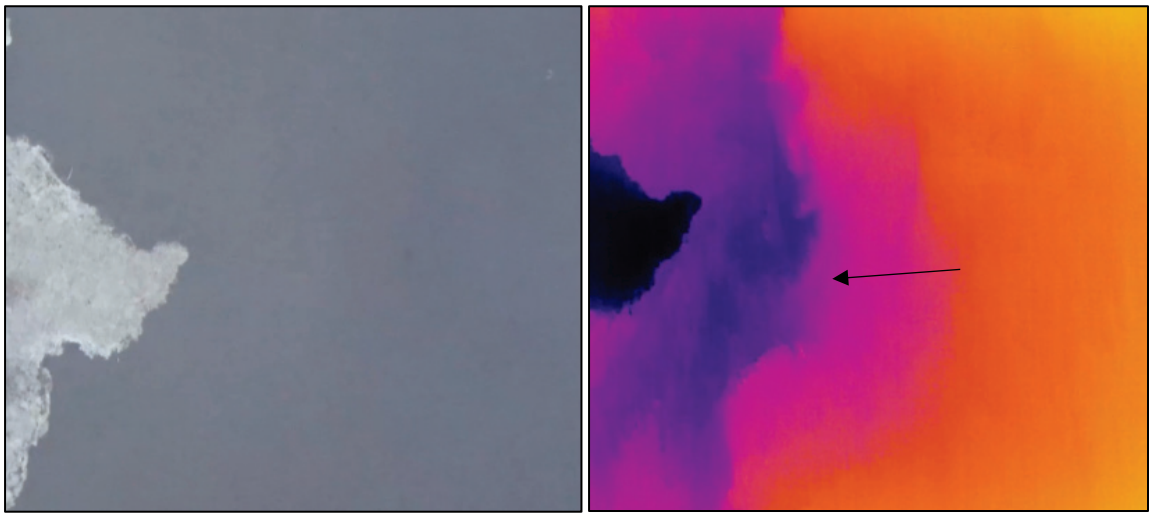


Figure 5.4.1 Thermograph and photograph of A16 (April 16, 2021)

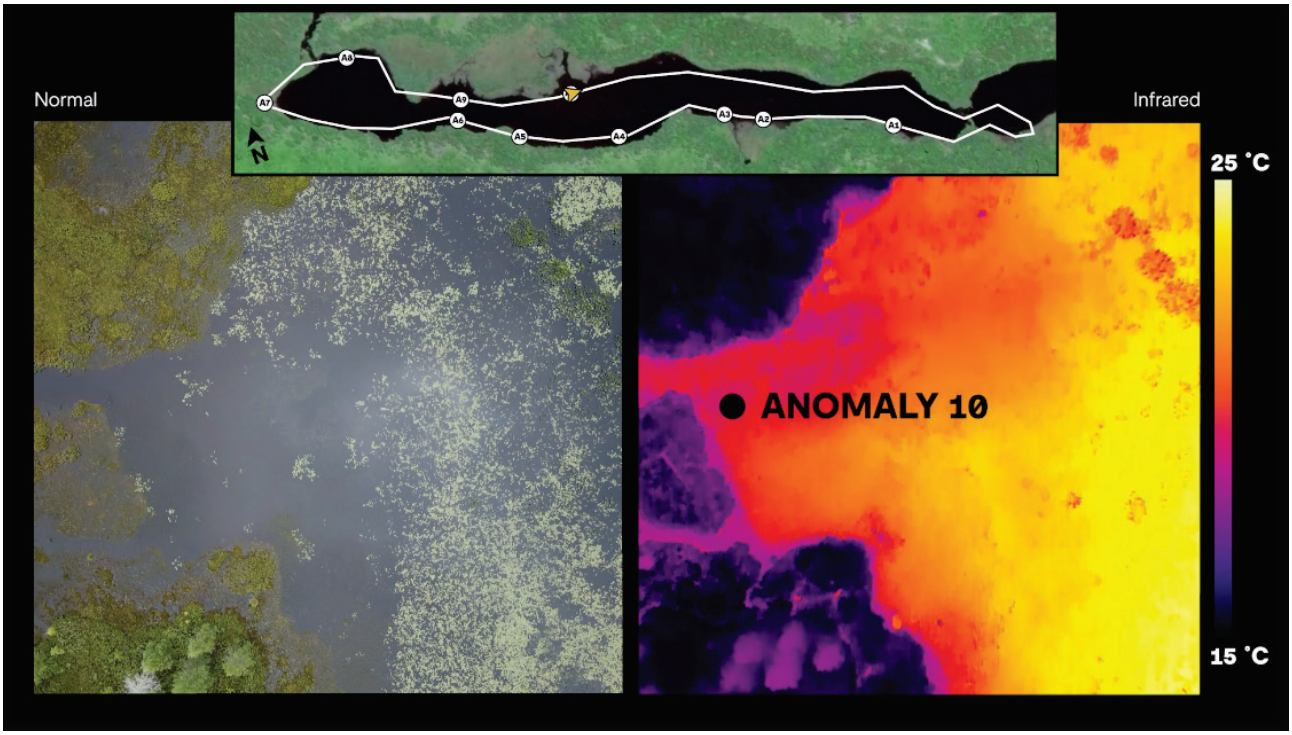


Figure 5.4.2 Thermograph and photograph of A10 (August 17, 2021)

6. Conclusion and Recommendations

A total of 12 thermal anomalies were observed during the investigation at Cameron Flowage. Thermal anomalies include any infrared characteristic that is unique and/or cannot be explained by expected thermal influences (e.g., reflections, solar loading, solar shadows, etc.). All of the thermal anomalies observed were colder than the average measured waterbody temperature. The anomalies are separated into three areas of Cameron Flowage, with six (6) anomalies near the west end of the waterbody on the north and south shorelines, four (4) anomalies in the central portion of the waterbody on the north and south shorelines, and two (2) anomalies in the eastern portion of the waterbody. Eight (8) of twelve (12) anomalies are found along the south shoreline, with three (3) on the north shoreline and one (1) in the middle of the waterway near the eastern end of the waterbody. The Cameron Flowage Thermal Study Video can be viewed at the following link: https://vimeo.com/user9670035/review/592335066/9b5c64c73f (Section 3.1).

Based on local groundwater monitoring results, GHD determined that groundwater temperatures at the Site should be expected to range between 9.3 ºC and 10.2 ºC, which is approximately 9 ºC – 10 ºC colder than the measured averaged temperature of the waterbody at the time of the thermal survey. This temperature difference allows for the thermal anomalies to be effectively identified. Thermal anomalies observed within Cameron Flowage presented variations in water temperatures that ranged from 1 ºC to 9 ºC below the average temperature of the waterbody. Among the thermal anomalies, four (4) were found to be comparable from both investigations (April and August 2021), with colder water diffusing into Cameron Flowage from the respective shoreline. GHD recommends the installation of thermal loggers to better understand the extent and permanency of select thermal anomaly locations in Cameron Flowage as well as monitor any thermal fluctuations related to flows and/or weather (e.g., rainfall, air temperature).

Regards,

Dylan Wyles, B.Sc.
Environmental Technician

Jeff Parks
Senior Project Manager

Encl.

LEGEND:

UAV FLIGHT PATH

A1 THERMAL ANOMALIES

RKM RIVER KILOMETER

0 30 60 90m

1:3000

GHD

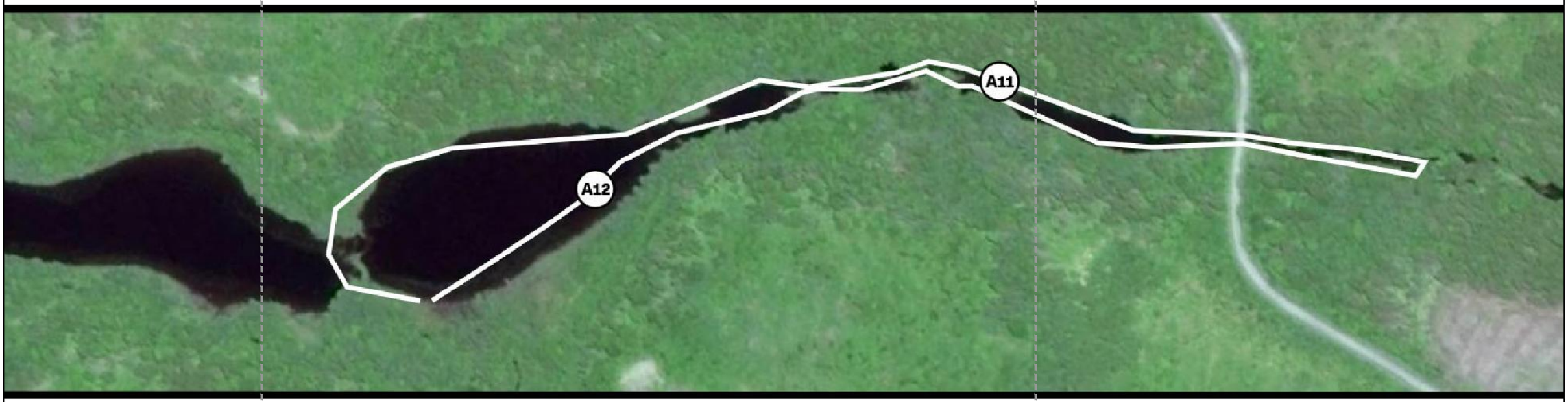
ATLANTIC GOLD CORPORATION
MARINETTE, HALIFAX COUNTY, NOVA SCOTIA
BEAVER DAM MINE PROJECT

CAMERON FLOWAGE UAV FLIGHT PATH
NORTHERN SECTION

Project No. **88664**
Date **September 2021**

FIGURE 1

Filename: N:\CA\Halifax\Projects\661\088664\Digital_Design\ACAD\Figures\MEMO-13\088664-GHD-0000-MEM-EN-0101_HX-013.dwg
Plot Date: 01 September 2021 2:19 PM



LEGEND:

UAV FLIGHT PATH

A1 THERMAL ANOMALIES

RKM RIVER KILOMETER

0 25 50 75m

1:2500

GHD

ATLANTIC GOLD CORPORATION
MARINETTE, HALIFAX COUNTY, NOVA SCOTIA
BEAVER DAM MINE PROJECT

CAMERON FLOWAGE UAV FLIGHT PATH
SOUTHERN SECTION

Project No. **88664**
Date **September 2021**

FIGURE 2

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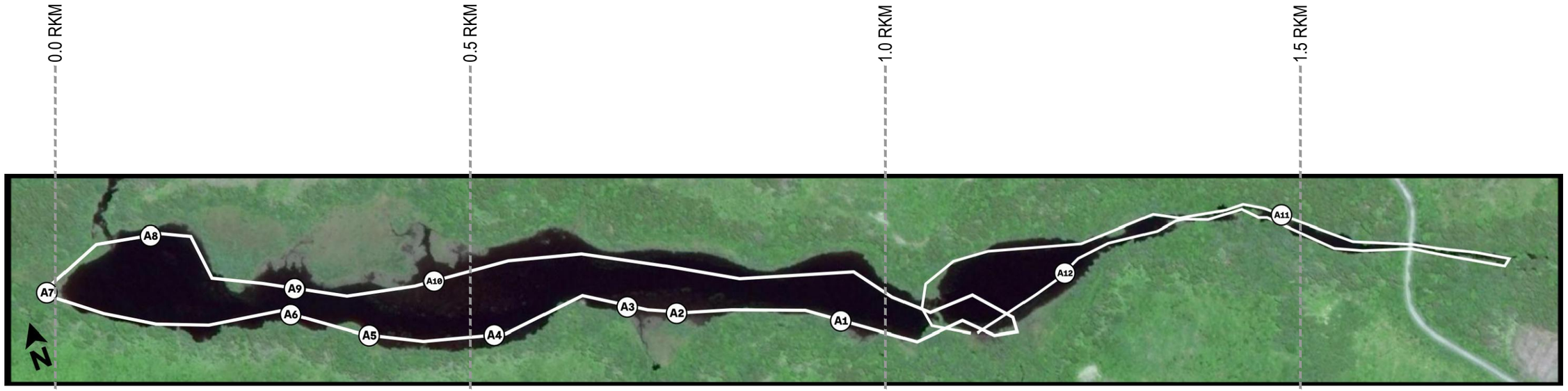

LEGEND:

UAV FLIGHT PATH

A1 THERMAL ANOMALIES

RKM RIVER KILOMETER

0 50 100 150m

1:5000

ATLANTIC GOLD CORPORATION
MARINETTE, HALIFAX COUNTY, NOVA SCOTIA
BEAVER DAM MINE PROJECT

CAMERON FLOWAGE UAV FLIGHT PATH

Project No. **88664**
Date **September 2021**

FIGURE 3

Filename: N:\CA\Halifax\Projects\66\088664\Digital_Design\ACAD\Figures\MEMO-13\088664-GHD-0000-MEM-EN-0103_HX-013.dwg
Plot Date: 01 September 2021 2:17 PM

Round 2 Information Request Number:	CEAA-2-15
Regulatory Agency/Indigenous Community:	DFO
Topic/Discipline:	Fish and Fish Habitat
EIS Guideline Reference:	Part 6, Section 6.7.1 Effects of Potential Accidents or Malfunctions
Revised EIS (February 28, 2019) Reference:	Section 6.18.3.2 Stockpile Slope Failure, Table 6.18-3 Fish and Fish Habitat

Context and Rationale

Section 6.7.1 of the EIS Guidelines states: "The proponent will therefore conduct an analysis of the risks of accidents and malfunctions, determine their effects, and present a preliminary emergency measures."

Section 6.18.3.2 of the revised EIS indicates that a "Worst-case scenario resulting from stockpile slope failure would be disturbance to surrounding area, including the potential for mine rock and low-grade ore to enter nearby watercourses, damage to infrastructure, and worker safety."

Table 6.18-3 also states that the potential for adverse effects to fish and fish habitat is low, although the worst-case scenario of the disturbance of a watercourse or waterbody from a stockpile slope failure has not been carried forward into the Potential Interactions and Effects section of 6.18.3.2.

It is unclear why the worst-case scenario of mine rock and low- grade ore entering a nearby watercourse has been excluded from the definition of a significant event. The Agency requires a reasoned explanation as to why it has also been excluded from Table 6.18-3 and the Potential Interactions and Effects section.

Given the proximity of soil and till stockpiles to Cameron Flowage and the Killag River, a slope failure of mine rock, low-grade ore, and/or soil stockpiles could potentially result in materials entering this watercourse. Due to the importance of Cameron Flowage and the Killag River to salmonid species, principally the Southern Upland population of Atlantic salmon, any such disturbance could result in significant adverse effects to fish and fish habitat as defined in section 6.9.5.2 of the revised EIS.

The Proponent is Required to …

Provide an effects assessment for potential stockpile slope failure on fish and fish habitat given the importance of fish habitat within and adjacent to the project area, after mitigation has been applied.

Response

The accident and malfunctions section is updated and included in the Updated 2021 EIS (AMNS 2021, Section 6.18, page 6-934).

Slope failures from stockpiles including waste rock, ore and till stockpiles have been considered and assessed. The stockpiles are situated at least 30 m away from the Cameron Flowage. The stockpiles have been designed to consider climate changes and seismic conditions and are engineered to a recognized industry standard. A geotechnical stability assessment has been undertaken (Appendix A.2a [Mine Waste Stockpile Geotechnical Design] included in the Updated 2021 EIS [AMNS 2021]) to confirm the design criteria is within safety factor requirements to maintain stability and will not result in slope failures. The stockpiles will be inspected regularly to ensure conformity with stability factors.

Design and Operation Environmental Protections

A number of design and operation environment protection have been considered to prevent a slope failure these include but not limited to the following:

- Waste rock and stockpile slopes are designed to meet a safety factor of at least 1.5;
- Internal roads will be designed to provide internal drainage and help dissipate construction induced pore pressure within the pile;
- If appropriate during final design, instrumentation may be installed to record pore pressures and deformation of the underlying ground and mineral waste in order to provide an early warning of potential failure;
- Daily inspections, at a minimum, will be undertaken to check for slumping and instability; and
- The perimeter runoff collection ditches and sedimentation ponds will allow runoff management by capturing stockpile runoff in ditches and allowing it to settle in ponds prior to discharge to the environment.

Contingency and Emergency Response Procedures

In the unlikely event of a slope failure, an emergency response action plan will be implemented. Once the failure area is secured, and depending on the scale of the failure, the stockpile slope will be recontoured in place. If any material migrated as far as the perimeter ditch, it would be excavated and returned to the stockpile and if required the drainage ditches repaired. If the slope failure caused effluent in the perimeter ditching to spill, silt fencing could be deployed downstream of the spill to prevent sediment laden waters from entering a watercourse.

A draft Erosion and Sediment Control Management Plan is in Appendix C, PDF page 159 of the Mine Water Management Plan [Appendix P.4] of the Updated 2021 EIS (AMNS 2021h).

References

AMNS (Atlantic Mining NS Inc.). 2021. Updated Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. October 2021. Middle Musquodoboit, NS.

Round 2 Information Request Number:	CEAA-2-16
Regulatory Agency/Indigenous Community:	DFO
Topic/Discipline:	Fish and Fish Habitat
EIS Guideline Reference:	Part 6, Section 6.7.1 Effects of Potential Accidents or Malfunctions
Revised EIS (February 28, 2019) Reference:	Section 6.18.3.3 Settling Pond Failure, Table 6.18-4 Fish and Fish Habitat

Context and Rationale

Section 6.7.1 of the EIS Guidelines states: "The proponent will therefore conduct an analysis of the risks of accidents and malfunctions, determine their effects, and present a preliminary emergency measures."

The Agency notes that in section 6.18.3.3 of the revised EIS, a worst-case scenario "would be complete failure of the settling pond, resulting in uncontrolled discharge of sediment laden water into the surrounding environment." The revised EIS further states that "Should a settling pond failure result in an uncontrolled discharge of sediment laden water to Cameron Flowage the event will be considered significant" and that the potential for adverse effects to fish and fish habitat is high (Table 6.18-4).

The Agency also notes that in section 6.18.3.3, Potential Interactions and Effects, "Inadequate settling pond capacity and water level monitoring, combined with a significant precipitation event may cause a settling pond failure and thus, pose a risk to surface water quality, wetlands, fish and fish habitat, and SOCI/SAR through all phases of the Project." Furthermore, in section 6.18.3.3, Mitigation and Emergency Response, the statement is made: "In the event of a 1 in 100 year precipitation event that creates volumes in excess of the capacity available in ponds and ditching, or infrastructure failure, a spillway into the water diversion structure will be used for overflow. In the case of a storm event or infrastructure failure, settling ponds will be monitored regularly … Generally, settling pond failure emergency response includes raising the alarm and evacuation of all equipment and personnel from the area."

Given the potential effects to Southern Upland Atlantic salmon in the Killag River, further assessment of a settling pond failure is warranted. The potential effects of a settling pond failure and the impacts of sediment-laden water on fish and fish habitat are not fully discussed.

The Proponent is Required to …

Provide a detailed assessment of the potential effects of siltation and increased total suspended solids (TSS) on fish and fish habitat from a settling pond failure with reference to relevant and recent scientific literature.

Provide clarification on monitoring versus evacuation procedures. The proponent indicates that in the event of a storm event which creates volumes in excess of the capacity of the settling ponds or infrastructure failure, the spillway into the water diversion structure will be used for overflow and the settling ponds will be monitored regularly. In the event of settling pond failure, emergency response plans indicate that all personnel will be evacuated from the area. Portions of these mitigation and emergency response plans contradict one another and do not give a sense of confidence in mitigation procedures (i.e. the commitment to monitor and evacuate simultaneously).

Clarify the capacity of the settling pond. It is inferred in the revised EIS that in the event of a 1 in 100-year storm, the settling pond will reach capacity and over flow into the spillway.

The capacity of the spillway is unclear. Clarify whether the spillway is capable of negating potential effects to Cameron Flowage (i.e. sediment-laden water entering fish habitat) in the event of a settling pond failure or overflow. Confirm the total volume (i.e. 1 in 100-year, 1 in 200-year storm events) that the entire system can hold prior to release into Cameron Flowage. Given the effects of climate change and the potential for high volume rain events to occur more frequently than in the past, and the potential effects on fish and fish habitat in the Killag River should a failure occur, provide additional information about settling pond design considerations. I think this information request was missing text in the word document?

Conduct an effects assessment on residual effects in the event of a settling pond failure after mitigation measures have been implemented, and provide a significance determination.

Update the direct and cumulative effects assessment of related valued components as appropriate.

Response

In response to this Round 2, Information Request (CEAA-2-16) information from the updated Beaver Dam Mine Project Mine Water Management Plan (Appendix P.4 of the Updated 2021 EIS (AMSN 2021) has been summarized below. Additional detail is presented in Appendix P.4 (Mine Water Management Plan) and Appendix C, PDF page 159 (draft Erosion and Sediment Control Plan) of Appendix P.4 of the Updated 2021 EIS (AMNS 2021).

The Beaver Dam Mine Site has a network of drainage ditches and ponds supporting onsite water management including:

- North Settling Pond;
- East Settling Pond;
- South Settling Pond;
- West Settling Pond; and
- Evaporation Pond.

Potential Concern

Environmental concerns relate to failure of settling ponds may contain elevated levels of water quality parameters (e.g., total suspended solids [TSS]) can be toxic to aquatic life and could harm local fish, amphibian and benthic invertebrate populations. Suspended solids can interfere with aquatic life, particularly during periods of egg incubation. Sediments can damage fish gills, smother eggs and interfere with behaviors such as feeding as well as degrade habitat through increase embedment of substrates and infilling of pools (DFO 2000; Bash et al. 2001).

Designs and Environmental Protections

A: The likelihood of failure of the North Settling Pond is expected to be negligible. There are two potential pathways for pond failure: overtopping and piping.

With respect to overtopping failure, the pond will be designed to control site runoff up to and including the 100-year storm event, with a minimum freeboard of 0.3 m above the 100-year water level. Larger flow events will be controlled through one of two

emergency spillways (two-way pump and overflow spillway weir) that will be directed to the sump within the open pit. The overflow spillway weir is designed to control site runoff up to and including storm events as large as Hurricane Beth (i.e., largest recorded rainfall event in Nova Scotia with approximately 296 mm of rainfall [Government of Canada 2013]). The spillway will be designed to provide sufficient erosion protection to mitigate against scouring and erosion, and as such provides mitigation against the release of TSS. Water collected in the pit will be pumped back into the pond after the storm event, as storage becomes available. Furthermore, discharge from the North Settling Pond enters the aeration treatment lagoon, which provides additional holding capacity in the event of overtopping. As a result, pond failure by overtopping will not impact fish or fish habitat in the Killag River from the North Pond.

The North Settling Pond will be designed to mitigate failure of the containment berm by piping through two mechanisms. First, the North Settling Pond will be lined with an impermeable geosynthetic liner to prevent seepage through the pond berms and minimizing the potential for piping failure. The operating water level (permanent pool) of the pond will be below the ground elevation on the downstream side of the berm. Only the active storage portion of the pond has potential for piping failure. Further, due to the temporary nature of water storage in this part of the settling pond (only after a storm event and for approximately 24 to 36 hours afterwards) there is low risk for piping failure to form.

The East Settling Pond will be designed to control site runoff generated from up to and including the 100-year storm event, similar to the North Settling Pond, with the 0.3 m freeboard above the 100-year water level. In addition, the East Settling Pond will also be lined with an impermeable geosynthetic liner to prevent seepage through the pond berms and minimizing the potential for piping failure. Larger events will be controlled through the emergency spillway. The overflow spillway weir is designed to control Site runoff up to and including storm events as large as Hurricane Beth (i.e., approximately 296 mm depth of rainfall [Government of Canada 2013]). The spillway will be designed to provide sufficient erosion protection to mitigate against scouring and erosion, and as such provides mitigation against the release of TSS. If a hurricane-sized rainfall event were to be predicted, pumps from across the Site would be re-purposed to the East Settling Pond to pump water to the open pit in order to provide further protection against overtopping failure and prevent an uncontrolled release of water into Cameron Flowage. Given the design of the East Settling Pond and contingency measures put in place, there is low likelihood of overtopping failure and piping failure. With planned site erosion and sediment controls in place, discharge via the emergency spillway is anticipated to have diluted TSS concentrations.

The evaporation pond and the West and South Settling ponds will also be designed to control site runoff generated from the 100-year storm event, with the 0.3 m freeboard above the 100-year water level. Larger events will be controlled through the emergency spillways. The overflow spillway weirs are designed to control Site runoff up to and including storm events as large as Hurricane Beth (i.e., approximately 296 mm depth of rainfall [Government of Canada 2013]). No further failure analysis was performed on the evaporation pond or the West Settling Pond as these ponds drain towards the North Settling Pond, resulting in no additional risk to fish habitat within Cameron Flowage. The South Settling Pond drains towards the Tent Lake watershed. The South Settling Pond will be lined with an impermeable geosynthetic liner to prevent seepage through the pond berms and minimize the potential for piping failure. If a hurricane-sized rainfall event were to be predicted, pumps from across the Site would be re-purposed to pump water to the open pit in order to provide further protection against overtopping failure. With planned site erosion and sediment controls in place, discharge via the emergency spillway is anticipated to have diluted TSS concentrations. No further failure analysis was performed on the South Settling Pond due to the low risk of failure and additional contingencies put in place to direct Site runoff towards the open pit if a hurricane-sized rainfall event were to be predicted.

All pond berms and outlet structures will be monitored regularly to detect any deficiencies that may result in failure. In addition, all ponds will have short service lives as they will be decommissioned during post-closure. As a result, all discharge from the Beaver Dam Mine Site Settling Ponds to Cameron Flowage will be treated and overflow will not negatively impact fish or fish habitat in Cameron Flowage.

Settling Pond Failure Analysis

A failure of the settling pond is defined as a breach of the banks through overflow or bank structure failure resulting in the release of sediment laden water to the environment. A worst-case scenario would be complete failure of the settling pond, resulting in uncontrolled discharge of sediment laden water into the surrounding environment. The likelihood of failure of the North Settling Pond and East Settling Pond is expected to be negligible. However, a worst-case scenario without applying mitigation measures was modeled, as requested in this IR, to assess the potential effect of siltation and increased total suspended solids (TSS) on fish and fish habitat from a settling pond failure

The impacts of a failure of the pond berms were assessed for the North Settling Pond and East Settling Pond through the development of a GIS-based Revised Universal Soil Loss Equation (RUSLE) calculation, two-dimensional (2D) Hydrologic Engineering Center River Analysis System (HEC-RAS) model and subsequent velocity analysis. Due to uncertainty (e.g., berm failure mechanism, weather conditions, sediment grain size distribution) conservatism was built into the models in several different aspects. Conservative assumptions include:

- Analysis of multiple different grain-size distributions for within each pond including 100% Fine Sand (diameter of 0.13 mm) and a worst-case scenario of 100% Fine Silt (diameter of 0.01 mm). The sediment within the pond will include a wide range of grain-size sediment. Assuming 100% of sediment in the pond is either Fine Sand or Fine Silt is conservative as there will likely be some larger particles present in the pond.
- Assumption that during the 100% Fine Silt analysis, the entire volume of sediment within the pond would mobilize due to the low incipient velocity of fine silt.
- Analysis of multiple different weather conditions during pond breach including dry weather conditions (receiving watercourse with flows equal to flows during 25 mm storm event) and wet weather conditions (receiving watercourse with flows equal to flows during 100-year storm event).
- 0.5 m depth of sediment within the pond with vertical side slopes for erosion of sediment instead of the more realistic convex curve on the erosion face.

The 2D model developed in HEC-RAS was used to determine the velocity profile within each pond during the pond breach. The maximum predicted velocity measurements for the North Settling Pond and East Settling Pond are shown on Figure CEAA-2-16-1 and CEAA-2-16-2, respectively. A detail view of the East Settling Pond breach is shown on Figure CEAA-2-16-3. As mentioned previously, it was assumed the entire bed of each settling pond would be mobilized assuming the bed consisted of Fine Silt. If the bed consisted of Fine Sand, only the areas which experience a velocity of greater than 0.46 m/s (approximate incipient velocity of Fine Sand [https://plainwater.com/water/shear-stress-permissible-velocity/, last accessed September 23, 2021]) would result in mobility of the sediment. A summary of the predicted volume of sediment loss under each condition (Fine Sand or Fine Silt) for the North Settling Pond and East Settling Pond are shown in Table CEAA-2-16-1 and CEAA-2-16-2.

Figure CEAA 2-16-1: North Settling Pond Failure Maximum Velocity Profile

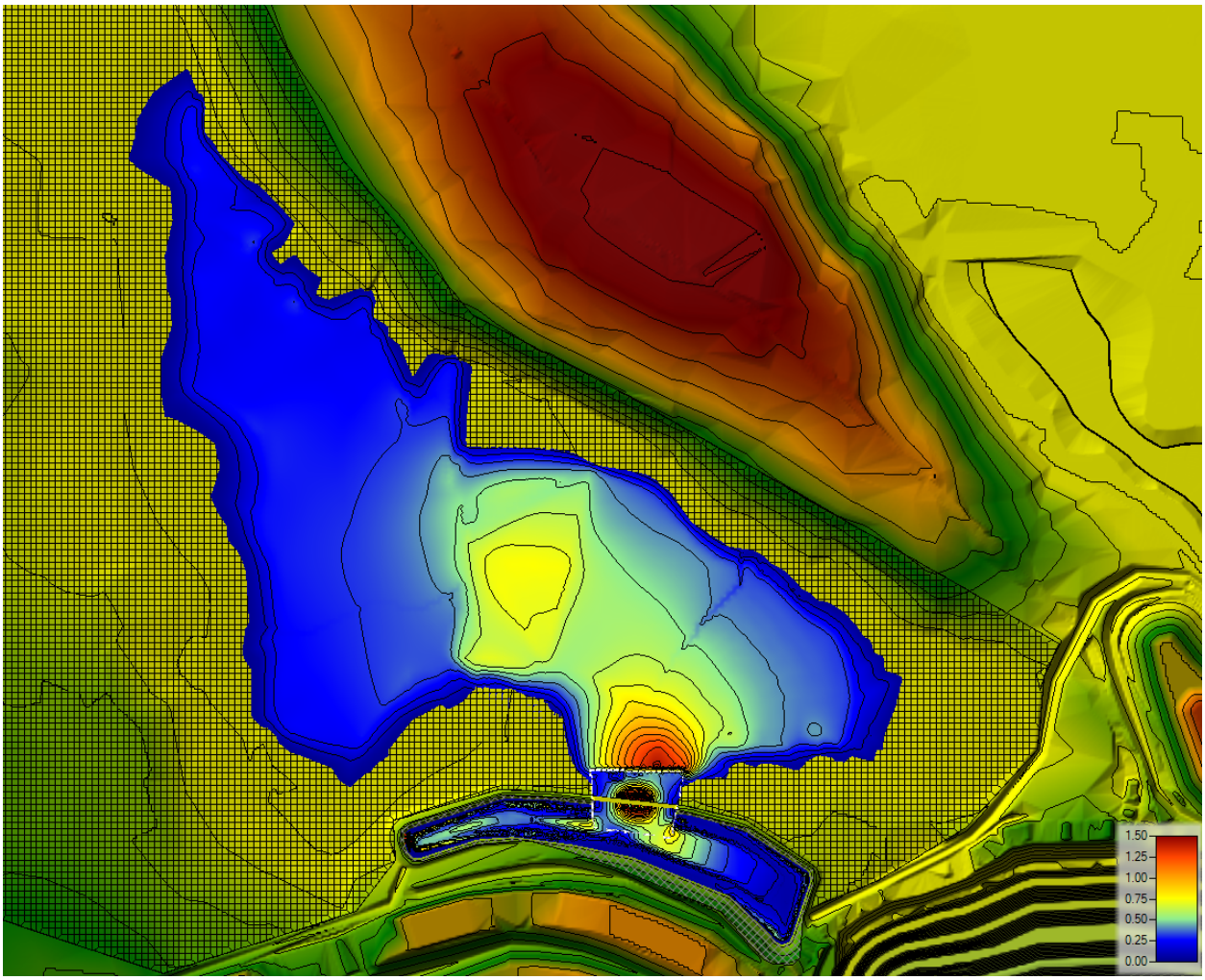

Figure CEAA 2-16-2: East Settling Pond Failure Maximum Velocity Profile

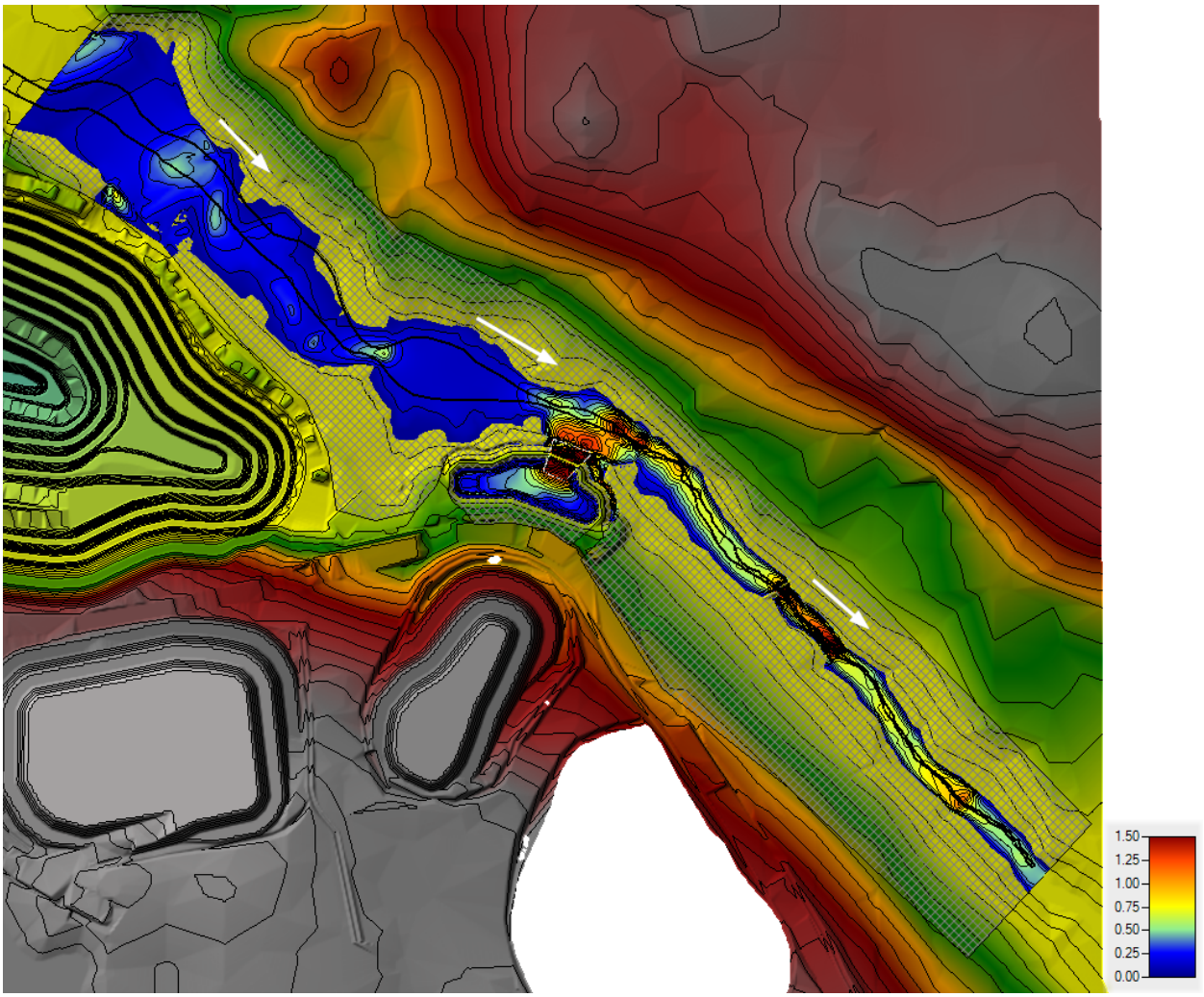

Figure CEAA 2-16-3: East Settling Pond Failure Maximum Velocity Profile - Detail View

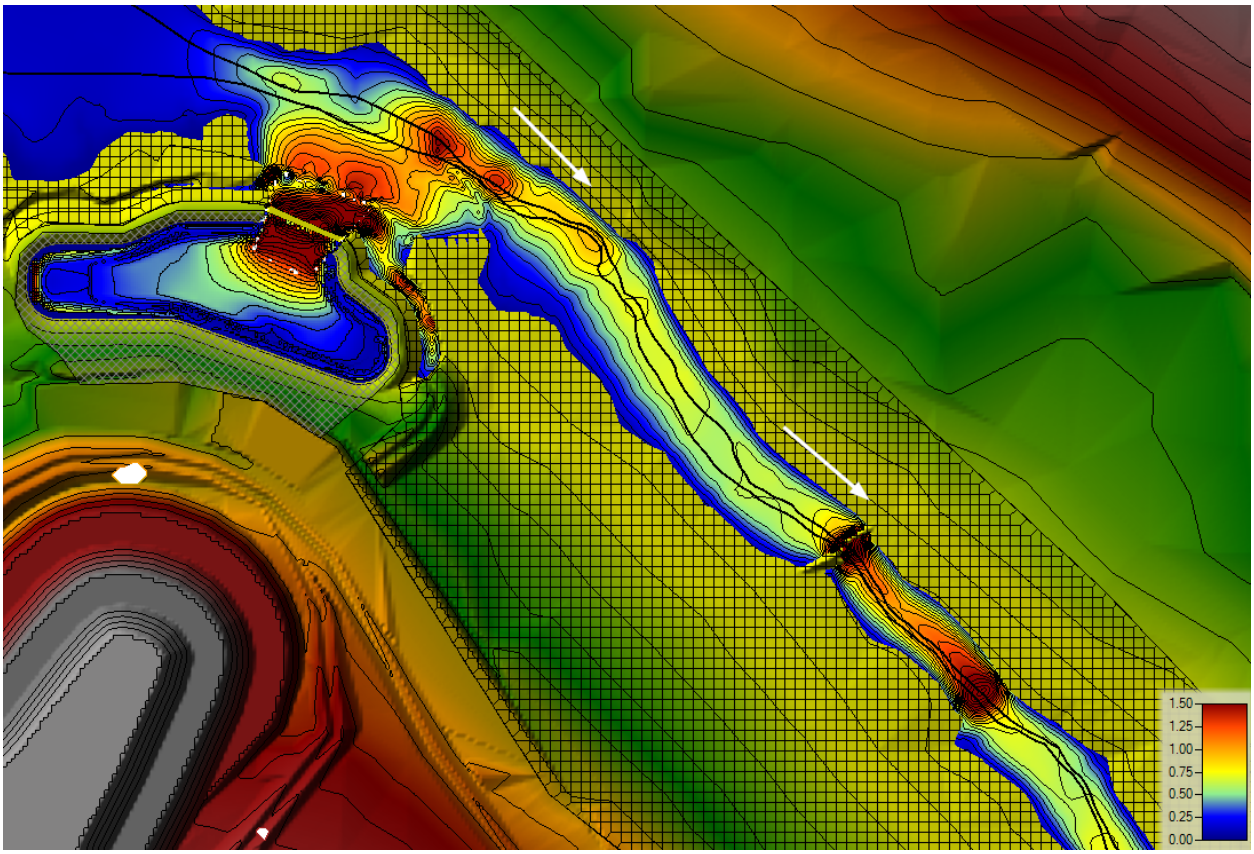

Table CEAA 2-16-1: North Settling Pond Failure - Sediment Loss Summary

	Sediment Transport Calculations - North Pond	
	Fine Sand	**Fine Silt**
Maximum Particle Size (m)	0.00013	0.00001
Incipient Velocity (m/s)	0.4572	Any Velocity
Depth of Sediment (m)	0.5	0.5
Mobilized Area (m^2)	3,500	7,500
Angle of erosion	Vertical	Vertical
Volume of sediment loss (m^3)	1,900	3,750

Table CEAA 2-16-2: East Settling Pond Failure – Sediment Loss Summary

	Sediment Transport Calculations - East Pond	
	Fine Sand	**Fine Silt**
Maximum Particle Size (m)	0.00013	0.00001
Incipient Velocity (m/s)	0.4572	Any Velocity
Depth of Sediment (m)	0.5	0.5
Mobilized Area (m^2)	3,750	7,500
Angle of erosion	Vertical	Vertical
Volume of sediment loss (m^3)	2,000	5,500

To determine the magnitude of the sediment loss as it relates to the receiving water body, a RUSLE calculation was performed on a watershed-scale to determine the annual soil loss expected for the contributing drainage area to the Killag River. The RUSLE calculation was performed in a GIS-based environment, calculating the Annual soil loss in tons/year at each dam bread discharge point to the Killag River. A breach from the North Settling Pond will enter Mud Lake initially before discharging to the Killag River while a breach from the East Settling Pond will enter the Killag River directly. The volume of sediment loss shown in Tables CEAA 2-16-1 and CEAA-2-16-2 were compared to the total annual soil loss for each contributing drainage area. The results are presented in Tables CEAA-2-16-3 and CEAA-2-16- 4.

Table CEAA 2-16-3: North Settling Pond Failure – Sediment Loss Percentage

	Sediment Transport Calculations - North Pond	
	Fine Sand	Fine Silt
Volume of sediment loss (m^3)	1,900	3,750
Soil Loss (kg)	2,737,900	6,607,500
Soil Loss (tons)	2,738	6,608
Predicted Yearly Soil Loss (tons)	218,874	218,874
Percent of Total Yearly Soil Loss (%)	1.25%	3.02%

Table CEAA 2-16-4: East Settling Pond Failure – Sediment Loss Percentage

	Sediment Transport Calculations - East Pond	
	Fine Sand	Fine Silt
Volume of sediment loss (m^3)	2,000	5,500
Soil Loss (kg)	2,882,000	9,691,000
Soil Loss (tons)	2,882	9,691
Predicted Yearly Soil Loss (tons)	276,591	276,591
Percent of Total Yearly Soil Loss (%)	1.04%	3.50%

The total suspended soil discharge concentrations were calculated based on the total sediment loss experienced from each pond and the total volume of water the sediment will be mixed with. For the North Settling Pond this included the volume of water exiting the pond during the breach and the volume of Mud Lake. For the East Settling Pond this included the volume of water exiting the pond during the breach and the flow within the Killag River (assuming a flow equivalent to the predicted flow as a result of a 25 mm 4-hour storm event). The predicted concentrations of sediment in the North Settling Pond were 4,037 ppm for Fine Sand and 9,743 ppm for Fine Silt. The predicted concentrations of sediment in the East Settling Pond were 15,625 ppm for Fine Sand and 52,539 ppm for Fine Silt.

To determine the extent of the sediment plume within the receiving water body, two scenarios were considered: dry weather and wet weather. The 2D HEC-RAS model predicts it will take 20 minutes for the North Settling Pond to empty in the event of a breach. For both dry weather and wet weather conditions, the sediment discharge from a failure of the North Settling Pond would be captured within Mud Lake as this is a stagnant water body. The settling velocities of Fine Sand and Fine Silt indicate the sediment would settle within 1 hour and 14 hours respectively.

The 2D HEC-RAS model predicts it will take 13 minutes for the East Settling Pond to empty in the event of a breach. For dry weather conditions, the velocity of flow within the Killag River is below the settling velocity of Fine Sand and Fine Silt. As such, during dry weather conditions, the sediment plume would settle into the forested area between the pond and the Killag River, or

near the discharge point of the Killag River. For wet weather conditions, the flow velocities within the Killag River exceed the settling velocity of Fine Sand and Fine Silt. As such, the particles will continue to be mobilized downstream of the breach entrance to the Killag River. Based on the velocity profile for a 2D model of the Killag River, it is predicted the Fine Sand will travel approximately 800 m downstream of the discharge point before settling out. Fine Silt has a very low settling velocity. Due to the turbulent nature of the Killag River, the Fine Silt would likely remain in suspension, travelling in a plume down the Killag until it reaches a stagnant waterbody downstream of the discharge point. The nearest stagnant waterbody is Sheet Harbour.

Assessment of the Potential Effects on Fish and Fish Habitat

The effects of elevated suspended solids to fish range from an immediate lethal effect to a longer-term chronic effect including habitat degradation. The immediate effect of suspended solids on fish depends on a number of factors in addition to concentration and duration including the size and angularity of the particles. The lethal concentration of TSS can be measured in the hundreds to hundreds of thousands of milligrams per litre (mg/L) of sediment, and as such the results of the 96-h LC50 test have limited value for predicting effects in the wild and at best they are but a coarse indicator of the short-term effects of a contaminant (DFO, 2000; Newcombe and Macdonald, 1991). Studies listed by (Newcombe and Macdonald, 1991) show that effects on fish from TSS concentrations ranging from tens of mg/L to >200,000 mg/L range considerably from negligible effects to 100% mortality, and that concentrations alone are a poor predictor of TSS effects. Most of the studies in the cited literature refer to studies where elevated TSS durations were 24 hour or greater.

Sublethal effects can manifest over time due to small increases in TSS and as such most TSS guidelines including the CCME particulate guidelines limit longer term increases (e.g., greater than 24 hours) to small increases such as 10% (Bash et al. 2001; CCME 2002).

The analysis conducted for the Beaver Dam project has considered a number of conservative and worst-case assumption and has calculated a predicted peak TSS concentration in Mud Lake of 4,037 ppm for Fine Sand and 9,743 ppm for Fine Silt and peak concentrations in the Killag River of 15,625 ppm for Fine Sand and 52,539 ppm for Fine Silt.

In the case of Mud Lake, the plume is expected to stay within a portion of the waterbody itself, and not extend into the Killag River. The duration of the elevated TSS is predicted at 1 hour for the fine sand particles and 14 hrs for the fine silt fraction. Under these conditions, portions of Mud Lake are expected to be beyond the plume of sediment outwash. As such there would be localized sedimentation of the lake substrate, but with a material relatively consistent with existing (fine particulate) substrates. Some mortality of fish in the immediate vicinity of the outwash can be expected, but large areas of Mud Lake will be relatively unaffected and the existing fish community; and aquatic biota are expected to recover. Elevated TSS and sedimentation is not predicted to extend to the Killag River from Mud Lake as a result of a breach of the North Settling Pond.

For the East Settling Pond and run out to the Killag River, the estimated extent of sedimentation is predicted to be 800 m downstream the for the fine sand scenario, and to Sheet Harbour for the fine silt assessment. In both cases the peak TSS concentrations are expected to be short lived in any given area (<24 hrs), with fine silt solids mobilized downstream in a pulse until it precipitates out in Sheet Harbour. This condition would likely result in some mortality of fish and other biota as the peak TSS plume moves through the channel, but given the short duration of the peak concentration it is expected that the communities will recover. Longer term habitat impacts could range from significant sedimentation of substrates (including spawning and refuge areas) under the fine sand scenario (800 m of sedimentation) to negligible long-term effects in the case of fine sediments where

the entire plume is expected to move through the system to Sheet Harbour where the mobilized solids are expected to have a negligible effect on the harbour's sediments).

Overall, the total volume of additional sediment contribution to the Killag River is low (1 to 3.5%) compared to the estimated annual soil loss of the watershed at the Project site. In the event of an unlikely malfunction and breach of the north or east ponds, an assessment of the sedimentation of habitats would be completed, and if necessary localized remediation of lake and stream habitats could be undertaken to remove the deposited solids. Although short term impacts to biota and habitats are expected, recovery of the system would be expected.

B: The settling pond systems will be monitored regularly during mine operations to ensure the water levels are within the operational range, and the active and passive flood control infrastructure is in good working order, so that they perform as intended during major storm events. The North Settling Pond will be designed with a multi-level approach to flood control. A two-way pump will be installed to pump water between the pond and the pit. If a large storm event is anticipated, pond water can be pumped to the pit in advance of a storm event to increase the active storage volume of the pond. The pumps will run over the duration of the storm event. The pond will also include an emergency spillway, which will be designed to passively control larger than the 100-year storm event (designed to the Hurricane Beth historical storm) the North Settling Pond will discharge toward the open pit, in the event the pumps become overwhelmed or inoperable. During a large storm event, the pond will be actively monitored until the emergency spillway is activated, directing Site runoff towards the open pit. If the rainfall event is predicted to trigger the emergency spillway, the Site emergency response plan will be implemented to evacuate all personnel from the open pit and surrounding areas. Monitoring of the pond will cease once the emergency response plan is implemented. The draft Emergency Response Plan (Appendix P.1 of the Updated 2021 EIS [AMNS 2021]) will be updated to include evacuation of all equipment and site personnel downstream of the settling ponds and within the pit in anticipation of a major storm event.

C: The North, East, West and South Settling Ponds will be designed to control site runoff generated up to and including the 100-year storm event through passively controlled primary outlet structures. Each pond will be equipped with an emergency spillway, sized to control site runoff up to and including storm events as large as Hurricane Beth (i.e., largest recorded rainfall event in Nova Scotia with approximately 296 mm of rainfall [Government of Canada 2013]). The North Settling Pond emergency spillway will be directed into the open pit, which will be dewatered back into the North Settling Pond when storage becomes available. The emergency spillway will include erosion protection within the spillway and at the connection point to Cameron Flowage to prevent any potential negative impacts to Cameron Flowage.

D: The North, East, West, South Settling Ponds and Evaporation Pond will be designed to control site runoff generated up to and including the 100-year storm event through passively controlled primary outlet structures. Each pond will be equipped with an emergency spillway, which will be activated during events in exceedance of the 100-year storm. The emergency spillways will be sized to control site runoff up to and including storm events as large as Hurricane Beth (i.e., largest recorded rainfall event on record in Nova Scotia with approximately 296 mm of rainfall [Government of Canada 2013]). The emergency spillway will include erosion protection within the spillway and at the connection point to Cameron Flowage to prevent any potential negative impacts to Cameron Flowage. Climate change impacts were incorporated (approximately 5% increase in IDF 100-year 24-hour rainfall depths) into the pond design based on NSE climate change projections as the ponds will only be in service short-term considering the mine will be in operations approximately 5 years. The ponds will be decommissioned during active closure phase.

E:

Settling Pond Failure

A failure of the settling pond is defined as a breach of the banks through overflow or bank structure failure resulting in the release of sediment laden water to the environment. A worst-case scenario would be complete failure of the settling pond, resulting in uncontrolled discharge of sediment laden water into the surrounding environment. The capacity demand of the settling pond will increase as open pit depth increases and more infiltrated groundwater is pumped out of the mine.

Likelihood

There are two potential pathways for settling pond failure: overtopping and piping. With respect to overtopping failure, the pond will be designed to control site runoff up to and including the 100-year storm event, with a minimum freeboard of 0.3 m above the 100-year water level. Larger flow events will be controlled through one of two emergency spillways (two-way pump and overflow spillway weir) that will be directed to the sump within the open pit. The overflow spillway weir is designed to control site runoff up to and including storm events as large as Hurricane Beth (i.e., largest recorded rainfall event in Nova Scotia with approximately 296 mm of rainfall [Government of Canada 2013]). The spillway will be designed to provide sufficient erosion protection to mitigate against scouring and erosion, and as such provides mitigation against the release of TSS. Water collected in the pit will be pumped back into the pond after the storm event, as storage becomes available. Furthermore, discharge from the North Settling Pond enters the aeration treatment lagoon, which provides additional holding capacity in the event of overtopping. As a result, pond failure by overtopping will not impact fish or fish habitat in the Killag River from the North Pond.

The North Settling Pond will be designed to mitigate failure of the containment berm by piping through two mechanisms. First, the North Settling Pond will be lined with an impermeable geosynthetic liner to prevent seepage through the pond berms and minimizing the potential for piping failure. The operating water level (permanent pool) of the pond will be below the ground elevation on the downstream side of the berm. Only the active storage portion of the pond has potential for piping failure. Further, due to the temporary nature of water storage in this part of the settling pond (only after a storm event and for approximately 24 to 36 hours afterwards) there is low risk for piping failure to occur.

The East Settling Pond will be designed to control site runoff generated from up to and including the 100-year storm event, similar to the North Settling Pond, with the 0.3 m freeboard above the 100-year water level. In addition, the East Settling Pond will also be lined with an impermeable geosynthetic liner to prevent seepage through the pond berms and minimizing the potential for piping failure. Larger events will be controlled through the emergency spillway. The overflow spillway weir is designed to control Site runoff up to and including storm events as large as Hurricane Beth (i.e., approximately 296 mm depth of rainfall [Government of Canada 2013]). The spillway will be designed to provide sufficient erosion protection to mitigate against scouring and erosion, and as such provides mitigation against the release of TSS. If a hurricane-sized rainfall event were to be predicted, pumps from across the Site would be re-purposed to the East Settling Pond to pump water to the open pit in order to provide further protection against overtopping failure and prevent an uncontrolled release of water into Cameron Flowage. Given the design of the East Settling Pond and contingency measures put in place, there is low likelihood of overtopping failure and piping failure. With planned site erosion and sediment controls in place, discharge via the emergency spillway is anticipated to have diluted TSS concentrations.

The evaporation pond and the West and South Settling ponds will also be designed to control site runoff generated from the 100-year storm event, with the 0.3 m freeboard above the 100-year water level. Larger events will be controlled through the emergency

spillways. The overflow spillway weirs are designed to control Site runoff up to and including storm events as large as Hurricane Beth (i.e., approximately 296 mm depth of rainfall [Government of Canada 2013]). No further failure analysis was performed on the evaporation pond or the West Settling Pond as these ponds drain towards the North Settling Pond, resulting in no additional risk to fish habitat within Cameron Flowage. The South Settling Pond drains towards the Tent Lake watershed. The South Settling Pond will be lined with an impermeable geosynthetic liner to prevent seepage through the pond berms and minimize the potential for piping failure. If a hurricane-sized rainfall event were to be predicted, pumps from across the Site would be re-purposed to pump water to the open pit in order to provide further protection against overtopping failure. With planned site erosion and sediment controls in place, discharge via the emergency spillway is anticipated to have diluted TSS concentrations. No further failure analysis was performed on the South Settling Pond due to the low risk of failure and additional contingencies put in place to direct Site runoff towards the open pit if a hurricane-sized rainfall event were to be predicted.

All settling pond berms and outlet structures will be monitored regularly to detect any deficiencies that may result in failure. In addition, all ponds will have short service lives as they will be decommissioned during post-closure. As a result, all discharge from the Beaver Dam Mine Site Settling Ponds to Cameron Flowage will be treated and overflow will not negatively impact fish or fish habitat in Cameron Flowage.

Based on these factors, the likelihood of settling pond failure is determined to be negligible.

Magnitude

The criteria that would determine a significant effect should a settling pond fail, is based primarily on environmental protection. The maximum effect of a settling pond failure as it relates to VCs (i.e., soil and sediment quality, surface water quality and quantity, wetlands, fish and fish habitat, and species of conservation interest and species at risk), would be heavy siltation of wetlands and waterbodies and subsequent stresses on fish and other aquatic species. Adverse effects to the sediment quality portion of the geology, soil, and sediment quality VC are considered low.

The effects of elevated suspended solids to fish range from an immediate lethal effect to a longer-term chronic effect including habitat degradation. The immediate effect of suspended solids on fish depends on a number of factors in addition to concentration and duration including the size and angularity of the particles. The lethal concentration of TSS can be measured in the hundreds to hundreds of thousands of mg/L of sediment, and as such the results of the 96-h LC50 test have limited value for predicting effects in the wild and at best they are but a coarse indicator of the short-term effects of a contaminant (DFO, 2000; Newcombe and Macdonald, 1991). Studies listed by (Newcombe and Macdonald, 1991) show that effects on fish from TSS concentrations ranging from tens of mg/L to >200,000 mg/L range considerably from negligible effects to 100% mortality, and that concentrations alone are a poor predictor of TSS effects. Most of the studies in the cited literature refer to studies where elevated TSS durations were 24-hour or greater.

Sublethal effects can manifest over time due to small increases in TSS and as such most TSS guidelines including the CCME particulate guidelines limit longer term increases (e.g., greater than 24 hours) to small increases such as 10% (Bash et al. 2001; CCME 2002).

In the event of an unlikely malfunction and/or breach of the north or east settling ponds, some mortality of fish in the immediate vicinity of the outwash can be expected. An assessment of the sedimentation of habitats would be completed, and if necessary

localized remediation of lake and stream habitats could be undertaken to remove the deposited solids. Although short term impacts to biota and habitats are expected, recovery of the system would be expected.

Comparison of surface water samples to CCME FWAL TSS guidelines and MDMER TSS guidelines will be utilized to determine if sediment laden water will have an impact on surface water quality in Cameron Flowage and subsequently on fish and fish habitat.

The environmental concerns relating to sediment laden water discharging to Cameron Flowage result in the magnitude of settling pond failure is determined to be high.

Risk Rating

With a negligible likelihood and a high level of magnitude/consequence the risk rating is determined to be a 7 (e.g., 1 (highest risk rating) to 9 (lowest risk rating) (Section 6.18.4, Figure 6.18-1, page 6-938 of the Updated 2021 EIS [AMNS 2021]).

F: Potential impacts to fish and fish habitat which could occur as a result of an uncontrolled release of sediments from a settling pond failure are addressed in the Accidents and Malfunctions (Section 6.18.7.1, page 6-953 of the Updated 2021 EIS [AMNS 2021]), as a settling pond failure is not expected as part of normal mine operations. Potential direct and indirect impacts to fish and fish habitat are not specifically quantified within the effects assessment to Fish and Fish Habitat (Section 6.9, page 6-431) or the Cumulative Effects Assessment (Section 8, page 8-1) of the Updated 2021 EIS (AMNS).

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Newcombe C. P. and D. D. Macdonald. 1991. Effects of Suspended Sediments on Aquatic Ecosystems, North American Journal of Fisheries Management, 11:1, 72-82, DOI: 10.1577/1548-8675(1991)011<0072:EOSSOA>2.3.CO;2

Round 2 Information Request Number:	CEAA-2-17
Regulatory Agency/Indigenous Community:	DFO
Topic/Discipline:	Fish and Fish Habitat
EIS Guideline Reference:	Part 6, Section 6.7.1 Effects of Potential Accidents or Malfunctions
Revised EIS (February 28, 2019) Reference:	Section 6.18.4.2 Fuel Spills, Table 6.18-6 Fish and Fish Habitat

Context and Rationale

Section 6.7.1 of the EIS Guidelines requires the proponent to "conduct an analysis of the risks of accidents and malfunctions, determine their effects, and present preliminary emergency measures".

Section 6.18.4.2 of the revised EIS states that a "Worst-case scenario would be a transportation collision causing the entire amount of material being transported to be spilled into a water body. The effects of the spill would vary depending on the material spilled; diesel fuel and gasoline are toxic to aquatic life and would have the greatest impact to the environment." Table 6.18-6 also states that the potential for adverse effects to fish and fish habitat is high.

The effects of a fuel spill scenario in which fuel either from a vehicle accident or fuel delivery truck accident entering a waterbody has not been sufficiently assessed. There is potential for this scenario to occur along the Haul Road and thus impact watercourses which provide habitat for salmonids, principally Southern Upland Atlantic salmon in West River Sheet Harbour. Given the potential effects to fish and fish habitat, the Agency requires further assessment of potential fuel spills.

The Proponent is Required to …

Conduct an assessment on the effects of hydrocarbon spills on fish and fish habitat.

Assess the potential for a large fuel spill to enter the West River system and disperse to the Eastern Shore Islands Area of Interest. Investigate impacts to fish and fish habitat within this Area of Interest.

Update the direct and cumulative effects assessment of related valued components as appropriate.

Based on the updated assessment, provide mitigation measures that will mitigate adverse effects to fish and fish habitat.

Response

Accidents and Malfunctions (Section 6.18, page 6-934) of the Updated 2021 EIS (AMNS 2021) has been updated to include an assessment of a potential worst-case scenario fuel spill which is outlined in Section 6.18.7.1, page 6-953. Mitigation and emergency response for potential fuel and other spills are discussed in Section 6.18.7.1.6, page 6-960 of the Updated 2021 EIS (AMNS 2021).

<u>Assessment of Large Fuel Release</u>

All phases of the Project have the potential for fuel and/or other spills to occur. As requested, modeling was completed to support this IR2 response to assess a worst-case scenario fuel spill and the effects on fish and fish habitat. To select the worst-case scenario for the modelling, there are ultimately three potential locations a large fuel spill could take place. The first occurrence could occur during the delivery of fuels to the Beaver Dam Mine site. The second could occur from a spill from the on-site storage

tanks and the third potential location would be along the Haul Road from the trucks transporting ore from the Beaver Dam Mine to the Touquoy processing facility.

The delivery of hydrocarbons to the Beaver Dam Mine will be completed by a third party using licenced and trained drivers along a regional road network. Any potential spill and containment/remediation would fall under the third party's responsibility, therefore the following assessment does not cover this type of spill.

A spill occurring from a holding tank on-site has a potential to reach the receiving environment and would be the responsibility of AMNS to contain and remediate. Therefore, this type of spill has been investigated further. Within the design of the storage tanks a secondary containment berm is included to capture any unforeseen spill from entering the receiving environment. Furthermore, should a spill breach the secondary containment berm the hydrocarbons would be captured in the surface water collection ditches. The surface water collection ditches in the area of the tanks all drain north through the east side potentially acid generating (PAG) ditches to a sump pit (approximately 500 m in length) where the water gets pumped west to a collection ditch that ultimately discharges to the North Settling Pond (approximately 1,125 m in length). The North Settling Pond has a 24-hour detention time and has been designed to include an emergency shutoff valve. If a spill event were to occur from the storage tanks on-site and breach the secondary containment berms, the fuel can be captured in the sump pit located in the northeast corner of the PAG pile collection ditch as well as the ultimate discharge location of the North Pond. Through this multi-tiered containment system (secondary containment berms, PAG ditch sump pit, and North Settling Pond with shutoff valve) there is negligible risk of a spill entering the receiving environment.

The highest potential risk of a fuel spill entering the receiving environment would occur along the Haul Road between Beaver Dam Mine and Touquoy Mine sites. Therefore, the following detailed assessment was focused on the Haul Road, which would represent a worst-case scenario. The most likely cause of a spill event would result from a collision of two "C" train transport trucks carrying ore, assuming all saddle tanks are full of diesel holding an approximate maximum volume of 1,100 litres per truck.

This assessment was completed in multiple steps. The first step consisted of identifying the locations along the Haul Road that have the highest risk potential for impact should a spill occur. The second step required a planning distance calculation, which was used to simulate a spill and determine the potential downstream travel distance before a spill response team can be deployed and have the spill containment equipment put in place. The last step was to determine, based on the extent of the spill, what the potential impacts could be to fish and fish habitat.

High risk areas along the Haul Road were determined based on proximity to water crossings. A total of 38 water crossings were identified along the entire length of the Haul Road. The majority of the water crossings are pipe culverts, total of 35, with the remaining three water crossings being bridges. A total of 27 of the culverts crossings and all three bridges are currently part of the Haul Road improvement works and will be new culverts and bridges designed by WSP. The design velocities calculated by WSP for each of the water crossings was used for planning distance calculation in step 2 of this analysis. The remaining culvert crossings are all along public roads that are not slated for redesign and therefore outside of WSP's scope of work. For these culvert crossings an alternative method, drainage-area ratio method, was used to estimate these flow velocities. The formula used to perform the planning distance calculation was for diesel transport on moving navigable water based on the velocity of the waterbody and the time interval to reach final storage (large waterbody) or ability for a spill response team to contain the spill during adverse weather conditions (worst-case scenario). The travel distance/planning distance of a spill is then equal to the velocity multiplied by the deployment time of a spill containment team from either Beaver Dam Mine or Touquoy Mine sites.

The planning distance calculation included the calculation of both the potential downstream travel distance and the response time of the spill containment crew. As mentioned above, the velocities for the majority of the culvert crossings and all bridge crossings were provided by WSP. The velocities for remaining culvert crossings (8) were calculated based on a drainage-area ratio method. The response times were calculated based on the combination of three response criteria:

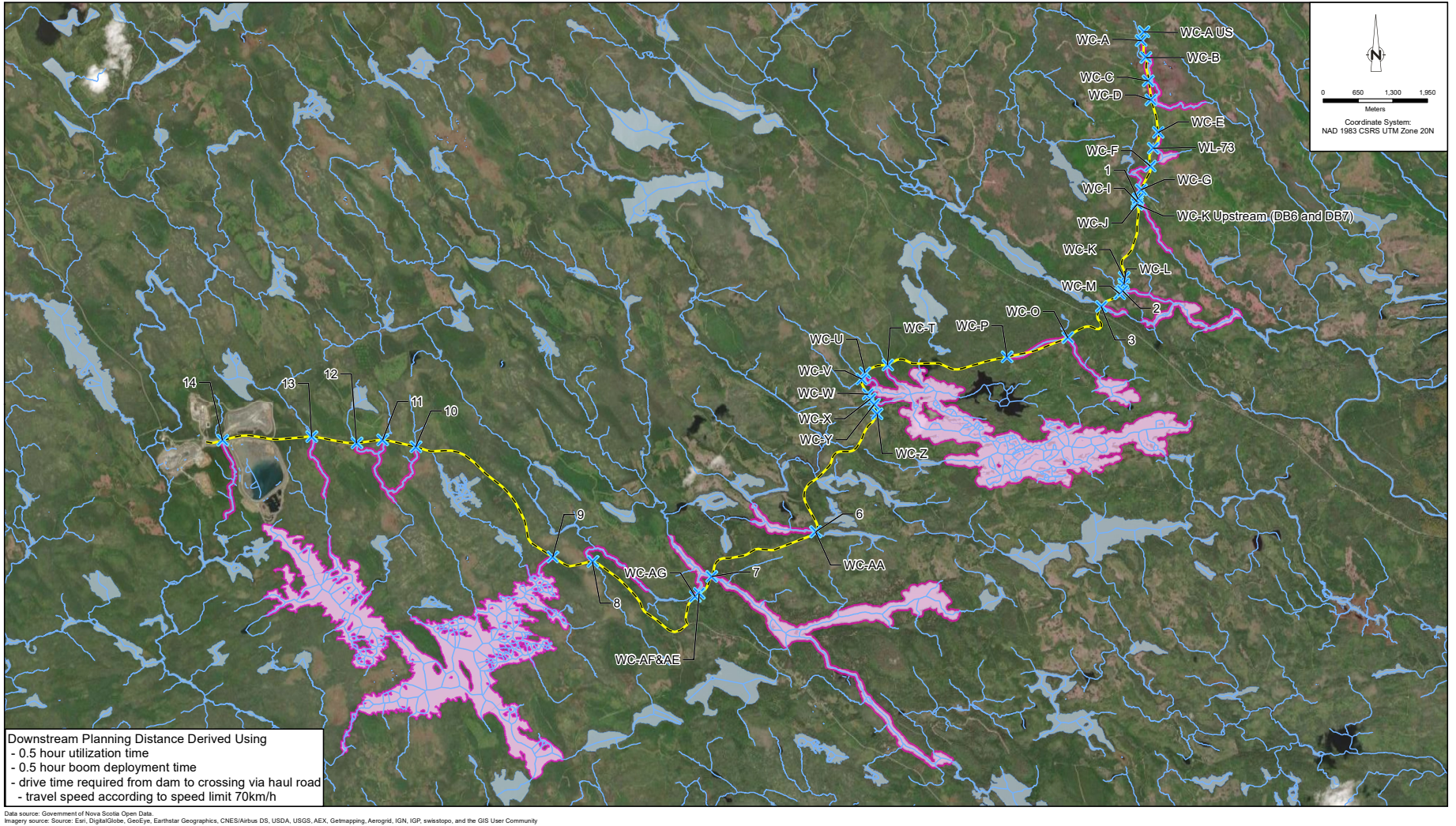
1. An initial 30-minute activation time from the moment the spill occurred until the spill containment crew were mobilized from either Touquoy or Beaver Dam Site (depending on location of the spill);

2. The time to travel from Touquoy or Beaver Dam to the spill location (assuming an average speed of 70 km/hr); and

3. An average time of 30 minutes deployment time of spill containment equipment once at the site of the spill location.

Calculation results have been plotted on Figure CEAA 2-17-1 and the potential area covered by a spill event at each of the 38 water crossings is highlighted. It must be noted that if a water crossing enters a large body of water (>2,000 m^2) a default five-kilometer buffer is created following the waterbody shoreline. This is a conservative approach based on the anticipated reduction in velocities in a waterbody and dispersion of spill throughout the waterbody; and it resulted in inclusion of Scraggy Lake, Grassy/Ferry Lake and Lake Alma in the modelled potential affected area for a fuel release; all of which are well upstream of the Eastern Shore Wild Islands. These results are further used to identify potential impacts to fish and fish habitat. The selection of a 5 km buffer was used for spills entering a large waterbody as this size represents a conservative estimate on the time for a spill response team to deploy a containment kit at the downstream end of the waterbody. They could then work their way back upstream to identify the true extent of the spill and deploy further containment/remediation equipment.

As shown on Figure CEAA 2-17-1, if a spill were to occur at the intersection of the Haul Road with the West River Sheet Harbour, the greatest spatial extent predicted to be impacted is a maximum of approximately 3 km downstream (using design criteria listed in the previous paragraph). Given the velocity of the river and the response time to mobilize to site and deploy spill containment equipment, it is not anticipated that a large fuel spill in the West River Sheet Harbour would reach the Eastern Shore Wild Islands area of interest, which is located more than 30 km downstream of the proposed Haul Road Crossing (this area is shown on Figure CEAA 2-17-2). The spatial extent of each additional water crossing does not extend farther than the 3 km predicted for the West River Sheet Harbour crossing, as shown in Figure CEAA 2-17-2. A fuel oil spill at any water crossing will not reach the Eastern Shore Wild Islands area of interest, based on modelling completed to support this IR response.



Data source: Government of Nova Scotia Open Data.
Imagery source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- Haul Road
- Down Stream Planning Distances
- Water Crossing Locations
- Nova Scotia Watecourse

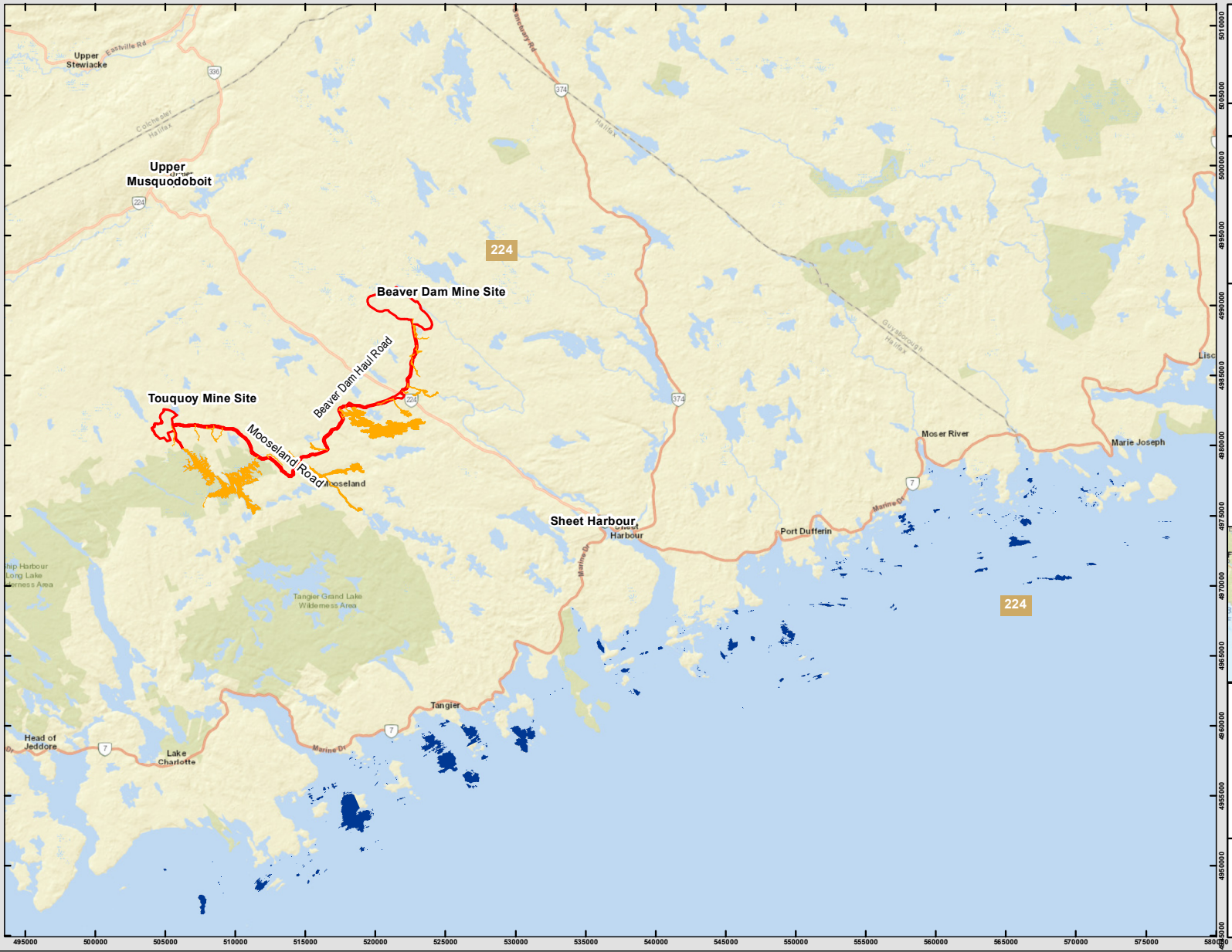
ATLANTIC MINING NOVA SCOTIA
BEAVER DAM MINE

088664
Sep 27, 2021

WATER CROSSING DOWN STREAM PLANNING DISTANCES

FIGURE CEAA 2-17-1

GIS File: Q:\GIS\PROJECTS\88000s\88664\Layouts\20210825_DownstreamPlanning\088664_20210825_DownstreamPlanning_GIS002.mxd



Prepared For:

Atlantic Gold

FIGURE CEAA 2-17-2

Beaver Dam Mine Project

- Eastern Shore Wild Islands
- Downstream Planning Distances
- Project Area

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

0 2.5 5 10 km

1:250,000

Scale when printed @ 11" x 17"

Drawn By: MMD
Reviewed by: XX

Date: 2021-10-15

McCallum Environmental Ltd.

Potential Environmental Concerns

If a fuel spill were to occur within close proximity to fish habitat (at each water crossing identified, especially the West River Sheet Harbour), there would be an adverse impact to fish and fish habitat. A fuel spill could result in a degradation to the water quality, resulting in adverse effects to the spawning, rearing, foraging and overwintering habitat functions as well as several biological effects including increased mortality, early-life stage developmental defects, reduced reproductive capacity, genetic damage, impaired immune function and disease resistance, and changes in behaviour (DFO, 2015). Acutely toxic conditions for fish can occur in any area covered with an oil slick, and can last 24 to 48 hours, or until oil weathered significantly or is removed, unless fresh inputs of oil continue. The size and impacts of a fish kill are difficult to predict however significant fish kills are typically observed following spills of lighter petroleum products which have a higher proportion of acutely toxic LMW compounds (e.g., gasoline, diesel fuel) (Logan et al., 2015). Depending on the location and volume of a release, this could result in a high magnitude of effect to fish and fish habitat (Logan et al., 2015). The geographical extent is expected to be discrete to local in nature (maximum of 5 km downstream of the Haul Road) with short term duration and sporadic frequency. Given the implementation of appropriate containment and recovery (clean-up) measures, the effects to fish habitat are expected to be acute in nature and partially reversible (Logan et al., 2015). As described in Section 6.18.9, Table 6.18-13, page 6-979 of the Updated 2021 EIS (AMNS 2021), the likelihood of a fuel release in an aquatic environment is considered very low.

Potential impacts to fish and fish habitat which could occur as a result of an accident or malfunction such as a large fuel spill are addressed in the Accidents and Malfunctions (Section 6.18.7.1, page 6-953 of the Updated 2021 EIS [AMNS 2021]), as a large fuel spill is not expected as part of normal mine operations. Potential direct and indirect impacts to fish and fish habitat are not specifically quantified within the effects assessment to Fish and Fish Habitat (Section 6.9, page 6-431) or the Cumulative Effects Assessment (Section 8, page 8-1) of the Updated 2021 EIS (AMNS 2021).

Within the Accidents and Malfunctions, Section 6.18.7.1.5, Table 6.18-7, page 6-958 of the Updated 2021 EIS (AMNS 2021) outlines that a fuel release during truck transport has a high potential adverse effect to fish and fish habitat. As described in Section 6.18.9, Table 6.18-13, page 6-979, the likelihood of this event is determined to be very low due to competent, licenced and trained drivers and usage of inspected vehicles. Due to the sensitivity of the receiving aquatic environment, the consequence of a fuel spill is determined to be very high. Considering the very low likelihood and high consequence together, a fuel spill along the haul road has been assigned a risk ranking of 6, which represents an overall moderate risk. Accidents or malfunctions with a low to moderate overall risk are determined to be not significant (Section 6.18.9, page 6-978 of the Updated 2021 EIS [AMNS 2021]).

AMNS intent to address the potential impact of fuel spills through project design and operation performance to ensure a safe and environmentally sound operation. Therefore, in part and described below, is focused on the environmental designs and protections that will be in place to address potential fuel spills before there is an impact to fish and fish habitat, which supports the predictive modelling exercise described above to determine maximum potential spatial extent of a spill.

Design and Operations Environmental Protections

Regular maintenance of fuel trucks can significantly reduce the chance of an equipment failure caused accident. The need for compliance with the *Transportation of Dangerous Goods Act* and associated Regulations will be reinforced in all applicable contracts and vendor agreements.

The potential for environmental impacts associated with malfunction and accidents on the trucking route will be minimized by the following operational procedures which will be incorporated into the environmental management system as possible and into trucking / supply contracts as reasonable:

- Speed limits are to be strictly adhered to;
- Strict adherence to national trucking hour limits and other applicable requirements;
- Drivers will be required to meet all applicable regulatory training requirements, be trained in spill response procedures for the materials they transport, and carry the appropriate Material Safety Data Sheets;
- All vehicles transporting materials to site will be required to maintain a supply of basic emergency response equipment, including communication equipment, first aid materials and a fire extinguisher; and
- Penalties for operational violations.

An Emergency Response Plan, including a Spill Contingency Plan, forms part of the environmental management system that will address the primary hazardous materials on site including procedures for spill response on the trucking route to the site. Materials to be maintained in vehicles will be identified in the draft Emergency Response Plan (Appendix P.1) and Attachment CEAA 2-17-A to this response includes a Spill Abatement Equipment List that will be available on-site for AMNS responders to complete initial containment and confinement of spills.

At the Beaver Dam Mine Site, the following additional controls will be in place to reduce the potential for or the severity of accidents involving hazardous materials:

- Speed limits, to be posted and enforced by security personnel;
- Right of way procedures will be defined and haul trucks and loaded vehicles will be given preference;
- Traffic will be required to yield to wildlife as observed; and
- Where possible, heavy traffic will be limited to site haul roads and other traffic limited to site access roads.

Emergency Response Procedure and Contingency

Emergency response procedures will be established as part of the environmental management system and include the following: medical response, notification, containment of spill, removal of spill, treatment of affected environment, monitoring of environment and learning from the accident.

The primary goal in any collision resulting in a fuel spill, will be to ensure public and worker health and safety. Potential ignition sources will be removed in the event of a spill of flammable or combustible materials, if safely possible, and the spill will be stopped or slowed using available equipment. Appropriate corporate and external personnel will be notified, and an assessment will be conducted to determine the best means to prevent immediate environmental impacts. Spill countermeasures may include the use of absorbent materials, establishment of a collection trench and setting containment booms on water. When fuel is contained by booms, berms or other means, it may be pumped, skimmed or mopped with absorbent matting, and disposed of in an approved facility designed to manage such wastes. If a spill were to directly enter a fast-moving watercourse, it may not be possible to completely contain and remediate the spill.

Clean-up and potentially remediation will ensure long term environmental impacts are reduced to the extent practical. After any major spill, a review will be conducted to ensure that the required design changes, procedures and appropriate monitoring measures are in place to ensure that incident will not be repeated.

Fuel Release from Fuel Storage Facility and Re-Fueling Areas

Diesel fuel and gasoline will be stored at the fuel storage facility in double-walled Enviro tanks, or other equivalent storage for containment such as a bermed facility that will be consistent with Nova Scotia regulatory requirements. The fuel storage facility will include a refuelling area for heavy and support mining equipment, and potentially for small vehicles.

Potential Environmental Concerns

The risk of a major environmental event associated with fuel storage and dispensing areas is less than that from truck transport because of the fixed locations selected to be isolated from water courses and other sensitive environmental features, the presence of collision protection barriers, containment and the proximity to spill response and containment equipment.

Environmental impacts associated with fuel storage and dispensing will depend in part on final fuel storage facility design, but could include:

- A catastrophic failure of a tank and/or a major collision involving an Enviro tank resulting in the failure of both walls of the tank at the fuel storage facility;
- An accident resulting in a catastrophic failure of the tank of the remote fuelling truck; and
- Operator error with refuelling or damage to the dispensing system (such as a ruptured fuel line).

Impacts would likely be limited to the immediate terrestrial environment except in the case of a major spill or a spill during a rainfall event. The fuel storage facility will be located where drainage will be directed to the north settling pond. The spill / impacted runoff would be contained and could be treated prior to any effluent being discharged from the North Settling Pond. Depending on soil and its hydrological characteristics, a significant fuel spill that goes undetected could create a plume in the soil and leach into downstream watercourses resulting in aquatic and riparian impacts.

Design and Operation Environmental Protections

The potential for environmental impacts associated with malfunction and accidents of onsite fuel storage facilities and dispensing areas have been minimized by the following design and construction features:

- Tankage and storage areas will be constructed to recognized industry standards and conform to Technical Standards and Safety Authority leak detection requirements;
- Storage areas are distant from water courses and sensitive habitat;
- Use of bollards (collision protection poles) and other measures to prevent collision;
- Containment berms considerations around all permanent tanks; and

- Enviro tanks will be situated to minimize the risk from collision and puncturing of both walls and protected using bollards or similar.

Operational procedures to minimize the potential of accidents or malfunctions will be identified into the environmental management system, and are expected to include:

- At least daily inspections of all fuel storage locations;
- Formal weekly inspections using a protocol checklist to check for leakage and other operational problems;
- Volumes will be confirmed at all tanks containing petroleum product at least weekly, using a dip check or other method, with the result logged for comparison; any measurements different from anticipated volumes will immediately be investigated;
- Fuel tanks will not be filled above 98% of capacity to allow for expansion due to temperature changes; and
- No smoking in the vicinity of the fuel storage facility or refuelling areas.
- Procedures for fuel storage will be regularly reviewed as part of the environmental management system.

Emergency Response Procedure and Contingency

If fuel has breached containment the Emergency Response Plan that includes a Spill Contingency Plan would be implemented. The primary focus will be on ensuring human health and safety. Once the area is secured the leak or failure will be sealed, if possible. Absorbent materials or a downstream berm (e.g., earthen) could be constructed to contain the spill. A large spill kit will be located at the fuel storage facility and will include absorbent material. Spilled fuel would be collected and hauled off site for disposal or to the on-site oil/water separator. Used absorbent material would be sent offsite to be disposed at a licenced facility. Notification and/or reporting will follow Provincial (Nova Scotia Ministry of Environment) and other applicable requirements.

If the spill migrates to the North Settling Pond, all pumping from the pond will cease. The spill could be contained with a boom and removed with a skimmer.

Soils in the vicinity of the spill will be tested for hydrocarbons and the affected soils delineated. Impacted soil will hauled offsite for treatment and disposal, as required.

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ATTACHMENT CEAA 2-17-A:

SPILL ABATEMENT EQUIPMENT RECOMMENDATIONS, MEMO – AUGUST 23, 2021

455 Phillip Street, Unit 100A
Waterloo, Ontario N2L 3X2
Canada
www.ghd.com

Our ref: 088664-71

August 23, 2021

Ms. Danielle Finlayson-Bourque
Permitting Superintendent
Atlantic Mining NS Corp

Spill abatement equipment recommendations

Dear Ms. Finlayson-Bourque,

Atlantic Mining NS Inc., (AMNS) a wholly owned subsidiary of St. Barbara Limited, retained GHD Limited (GHD) to make recommendations for spill kits to prepare for possible fuel and operating fluid spills originating from transportation vehicles and fuel storage tanks associated with the Beaver Dam Mine project located in Marinette, Nova Scotia (Facility/Site).

1. Background information

The purpose of the assessment is to identify spill kit contents that can be used by AMNS responders to complete initial containment and confinement of spills from diesel storage tanks at the Site and transportation vehicles moving ore to the AMNS Touquoy Mine for processing.

1.1 Fuel storage

GHD understands that fuel will be stored at the Site in three double-walled above-ground storage tanks, the largest containing a maximum volume of 50,000 litres with no additional containment. Spills originating from these tanks will migrate to surface water ditches and travel to a primary holding pond, and then migrate to a secondary holding pond that has an engineered isolation valve on its outfall. The spill kit recommendations include general fuel handling personal protective equipment (PPE) and spill abatement equipment sufficient to contain minor spills during loading and unloading operations. In addition, the recommended spill kit includes equipment to contain a worst-case scenario discharge from the largest tank, planning for containment within the ditches along the migration pathway with considerations for standing water, rain/snow events, and physical damage to the tank.

1.2 Truck fuel and operating fluids

GHD understands ore is being transported in C-Train dump trucks from the Site along an engineered haul road and public infrastructure to the AMNS Touquoy Mine for processing. The total distance of the transportation route is thirty-two-kilometres. The trucks are configured with a dual fuel tank system installed on opposite sides of the power unit, holding an approximate maximum volume of 1,100 litres. The truck configuration allows for equalization between fuel tanks and therefore the recommended spill kit is based on a total loss of both tanks during a motor vehicle accident.

Detailed recommendations on spill kit contents can be found in Table 1 and 2 in section 2.

2. Spill kit recommendations

2.1 Mine site spill kit

Table 1 Mine site spill kit

#	Description	Number of units	Units	Associated tactic
1	Plug'n Dyke sealant	1	1-lb jar	Seal leaking fuel tank
2	Wooden wedges (various sizes)	1	Kit	Containment (tank leak)
3	Oil only 2' x 2' absorbent pads	200	Pads (2 bails)	Absorbing small spills
4	Oil only 2" x 3' socks	8	Socks	Containment (road surface)
5	Oil only 6" x 8' floating boom	8	Booms (2 bails)	Containment (ditches)
6	Sand bags 26" x 14" (empty)	100	Bags (1 bundle)	Containment (dams and underflow weirs)
7	Geotextile fabric 6' x 50'	1	Roll	Containment (underflow weirs)
8	Sewer conduit 6" x 6'	6	Conduit	Containment (underflow weirs)
9	Sand (dry, no salt) tarped or covered	4-6	Yards	Containment (dams and underflow weirs)
10	2" x 2" x 3' wooden stakes	12	Stakes	Secure boom
11	6 ml polypropylene drum liners	20	Drum liners	Waste packaging
12	Waste labels	20	Labels	Waste packaging
13	Polypropylene gloves	8	Pair	PPE
14	Round mouth shovel (4-5' shaft)	2	Shovel	Building berms and dikes
15	Sledgehammer	1	6-lb	Containment (secure wooden stakes)
16	Claw hammer	1	16-oz	Containment (secure wooden wedges)
17	Utility knife (with blades)	1	Knife	Containment (Cutting Geotextile)
18	Skid mounted or rolling tote	2	Totes	Spill kit container
19	Security inspection tags (rip tags)	10	Tags	Inspection
20	Access to yellow iron (one of the following lists of equipment; loader, backhoe, excavator, skid steer)	1	Yellow iron	Containment (dams and underflow weirs)

2.2 Truck spill kit

Table 2 Truck spill kit

#	Description	Number of units	Units	Associated tactic
1	Pop-up containment pool (1100 litre)	1	Pool	Containment (under a leaking tank)
2	Plug'n Dyke sealant	1	1-lb Jar	Seal leaking fuel tank
3	Wooden wedges (sized for fuel and hydraulic lines)	Ukn	Ukn	Containment (fuel and hydraulic lines)
4	Pipe clamps (sized for fuel and hydraulic lines)	Ukn	Ukn	Containment (secure wooden plugs)
5	Oil only 2' x 2' absorbent pads	50	Pads (1/4 bail)	Absorbing small spills
6	Oil only 2" x 3' socks	4	Socks	Containment (road surface)
7	Oil only 6" x 8' floating boom	2	Booms	Containment (creek or culvert outfall)
8	2" x 2" x 3' wooden stakes	4	Stakes	Secure boom
9	6 ml polypropylene drum liners	4	Drum liners	Waste packaging
10	Waste labels	4	Labels	Waste packaging
11	Polypropylene gloves	4	Pair	PPE
12	Round mouth shovel (3' shaft with handle)	1	Shovel	Building berms and dikes
13	Sledgehammer	1	3-lb	Containment (secure wooden takes and plugs)
14	Vice grips	1	Unit	Containment (crimp leaking fuel line)
15	Truck-mounted salvage drum	1	Drum	Spill kit container and waste package
16	Truck mount	1	Mount	Spill kit mount
17	Security inspection tags (rip tags)	10	Tags	Inspection

3. Additional recommendations

This list of additional recommendations may have already been considered or addressed and is not based on deficiencies or known gaps:

– Installation of isolation valves on the fuel equalization line(s) between the fuel tanks on the dump truck power units if they are not already installed.
– Truck spill kits may be installed on each truck (preferred) or strategically positioned on response vehicles or at the Beaver Dam Mine and Touquoy Mine sites.
– Site fuel tank spill kits and dry sand should be covered and protected from the elements to ensure abatement materials are available if an event was to occur.

– Installation of numbered security tabs similar to fire extinguisher tabs should be placed on spill kit openings for easy inspection, monitoring of use, and as a trigger to inventory and re-order supplies.
– AMNS Inc. staff that have responsibility for the use or maintenance of the spill kits should be trained on their contents and the associated tactics for implementation.
– The truck spill kits do not consider downstream containment of fuel if migration was to extend from an accident Site down a surface water crossing with the road. This evaluation will be completed separately.

If there are any questions about the recommendations or you need assistance in the procurement of materials or the implementation of training, please do not hesitate to contact us.

Regards,

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Round 2 Information Request Number:	CEAA-2-18
Regulatory Agency/Indigenous Community:	DFO
Topic/Discipline:	Fish and Fish Habitat
EIS Guideline Reference:	Part 6, Section 6.7.1 Effects of Potential Accidents or Malfunctions
Revised EIS (February 28, 2019) Reference:	Section 6.18.6 Risk Assessment, Table 6.18-12

Context and Rationale

Section 6.7.1 of the EIS Guidelines requires the proponent to "conduct an analysis of the risks of accidents and malfunctions, determine their effects, and present a preliminary emergency measures".

Section 6.18.6 of the revised EIS provides an overview of the risk assessment process in which the proponent assigned a risk rating to each potential accident or malfunction. The section describes the definition of each likelihood of occurrence, as well as the magnitude ratings for accidents and malfunctions. It is unclear how the proponent assigned these values to each accident and malfunction scenario.

Given the fact that the proponent uses these risk ratings to determine significance, the Agency requires a rationale for each value.

The Proponent is Required to …

Provide evidence and/or explanation as to how the proponent concluded the likelihood of each accident or malfunction. It is unclear how values were assigned to likelihood of occurrence or probability for each accident and malfunction.

Provide the same level of evidence and/or explanation for how the proponent reached magnitude ratings for each accident or malfunction.

Provide further evidence or rationale, citing peer-reviewed literature, as to why each accident or malfunction is not considered significant, even if the qualitative risk rating is low or moderate for fish and fish habitat, particularly Southern Upland Atlantic salmon in the Killag River.

Response

<u>Accidents and Malfunctions Risk Assessment Methodology</u>

The accidents and malfunctions section (Section 6.18, page 6-934 of the Updated 2021 EIS [AMNS 2021]) has been updated to consider design (including environmental protections), operations, and safety (i.e., personal, public, and environmental) as well as contingencies, control measures and emergency response planning.

The methodology for the assessment of effects from potential accidents and malfunctions were based on a credible worst-case scenario, which employs a risk-based approach that involves identifying hazards associated with Project infrastructure and activities, as well as the consequences should those hazards create an accident and malfunction. The identification of hazards was completed utilizing the operational expertise, best management practices, and consulting other projects similar to the Project. The identification of worst-case scenarios/consequences were determined using a qualitative risk assessment to determine the

likelihood that hazards would create an accident and malfunction and determining the level of magnitude of those accidents and malfunctions should they occur.

The methods have been adjusted slightly from the Revised 2019 EIS to provide more clarity; however, accidents and malfunctions lends itself to a risk hazard assessment, which is standard practice in assessing potential accidents and malfunctions in mining (Tubis et al. 2020, Asgarian et al. 2017, Bach et al. 2016). The emphasis is on prevention, environmental controls and procedures, and contingency to mitigate the risk

Accidents and malfunctions that are considered either likely to occur, or have a significant effect should they occur, are included in the Updated 2021 EIS assessment for accidents and malfunctions (Section 6.18, page 6-934). For each potential accident and malfunction, the following details will shape the effects assessment:

- a threshold for determination of significance is provided to set a benchmark for significance of an accident and malfunction;
- the interactions between the accident and malfunctions and specific VCs and the resulting effects are discussed in reference to their significance;
- mitigation measures are presented and designed to prevent the likelihood and level of magnitude of occurrence of accidents and malfunctions; and
- preliminary emergency response measures are discussed to lessen the magnitude of accidents and malfunctions should they occur.

Accidents and malfunctions have the potential to occur through every phase of the Project. To decrease the likelihood of occurrence and level of magnitude should these accidents and malfunctions occur, AMNS will implement a preventative system approach to environmental protection and worker health and safety. Contractors will be subject to the same health, safety, and environment policies and procedures, and all personnel will receive site specific training to prevent and mitigate accidents and malfunctions. AMNS has developed an Environmental Management System and Health and Safety Plans at the fully approved and operating Touquoy Mine. These Plans will extend to the activities at the Beaver Dam Mine for all phases of the processing of ore from the Project. These plans will be examined and refined where needed to reflect BMP prior to the time that the Beaver Dam ore is processed at the Touquoy Mine Site. Revised versions of these Plans will also be developed specific to the Beaver Dam Mine Site and operations.

This methodology has also been used for a number of other mining-related undertakings which were subject to a proponent environmental assessment that were reviewed by Federal and Provincial government agencies in other jurisdictions including but not limited to *Ontario Environmental Assessment Act, BC Environmental Assessment Act*, Mackenzie Valley *Resource Management Act* and other stakeholders.

The likelihood of occurrence is given a score of 5 to 1 with an associated rating as defined below:

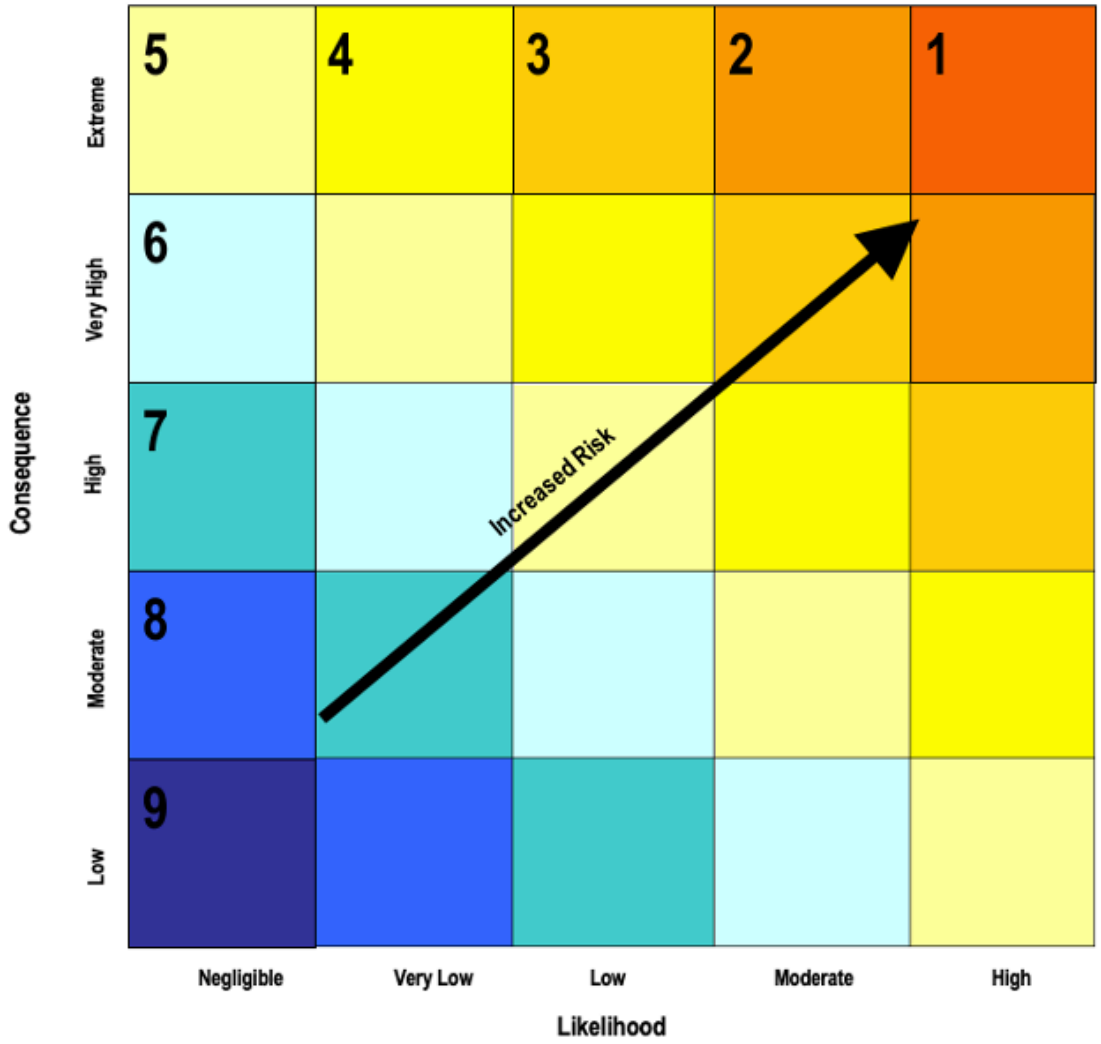
- **Negligible:** Accident or malfunction not likely to occur with a less than 1 in 10,000 probability of occurrence per year.
- **Very Low:** Accident or malfunction unlikely to occur with a less than 1 in 1,000 probability of occurrence per year.
- **Low:** Accident or malfunction has potential to occur with a less than 1 in 100 probability of occurrence per year.
- **Moderate:** Accident or malfunction may occur with a less than 1 in 10 probability of occurrence per year.
- **High:** Accident or malfunction is likely to occur with a greater than 1 in 10 probability of occurrence per year.

The consequences of the occurrence are important from the environmental perspective. The range of malfunctions or accidents that are being considered and the varied sensitivity of the environments involved, do not lend themselves to typical environment-related criteria (such as level of toxicity, surface area affected, duration of impact). As a result, a surrogate measure of environmental consequence has been used, which includes a combination of potential effect and cost of remediation, as a measure of severity. The level of magnitude/consequence should these accidents and malfunctions occur is also given a score of 9 to 5 with an associated rating as defined below:

- **Low:** no long-term effects, readily remediated with a cost in the $10,000's;
- **Moderate:** typically limited or no long-term effects, predictably remediated with a cost in the $100,000's;
- **High**: typically, moderate long-term effects expected, predictably remediated but costly with associated costs in the $1,000,000's;
- **Very high:** significant long-term effects expected, uncertain and costly remediation in the $10,000,000's; and
- **Extreme:** highly significant long-term effects likely, unlikely to be completely remediated and cost in the $100,000,000's.

Each credible potential accident and malfunction discussed was assessed according to likelihood of occurrence and level of magnitude/consequence of occurrence, and given a risk rating of between 1 (highest) and 9 (lowest). Each risk rating refers to a diagonal row of cells within a risk rating matrix shown in the same colour (Section 6.18.4, Figure 6.18-1, page 6-938 of the Updated 2021 EIS [AMNS 2021]) and included below as Figure CEAA 2-18-1. An increased risk is associated with accidents and/or malfunctions having a greater likelihood of occurrence and increased level of magnitude/consequence. The summary breakdown of risk ratings for each accident and malfunction, as well as the key VCs that would likely be affected is provided in Section 6.18.9, Table 6.18-13, page 6-979 (AMNS 2021) and included as Table CEAA 2-18-1 for ease of reference.

Figure CEAA 2-18-1: Risk Rating Matrix



Source: Updated 2021 EIS, Section 6.18.4, page 6-938 (AMNS 2021).

Where a range of risk ratings could occur, a conservative approach whereby only the highest risk ranking associated with a credible occurrence has been used and is listed. Risk ratings of greater than or equal to 4 are considered acceptable if there is a proposed management and mitigation plan. A risk rating of 3 requires further consideration, and risk ratings of less than or equal to 2 are unacceptable.

Each potential accident and malfunction discussed in the following sections was assessed considering the likelihood of occurrence and the level of magnitude/consequence should these accidents and malfunctions occur.

Potential Accidents and Malfunctions

Open Pit Mine Slope Failure

There are two main failures that could occur within the open pit mine slope. The potential slope failures are as follows:

- failure of overburden slopes caused by erosion from vegetation stripping and surface water runoff; and
- failure of bedrock faces caused by improperly designed benches and erosion/fracturing from groundwater inflow.

Likelihood

The likelihood of this failure is heavily influenced by the geotechnical information regarding the materials used during the construction of the slopes and the engineering design. Geotechnical work has been completed at the Touquoy Mine site and the expertise gained from working with these materials will be applied to the final design of the Beaver Dam disturbed areas using actual geotechnical data collected at Beaver Dam Mine site to supplement the abundant public information available. The soil and bedrock at the site are well understood from a geotechnical and construction standpoint including extreme conditions such as drought, freeze-thaw cycles, and weather (high rainfall events or storm events and wind). Regional and site-specific drilling has encountered bedrock materials that consist mainly of metamorphosed sedimentary rocks of the Goldenville Group. These materials are very stable and widely used in Nova Scotia for road materials and situations where erosion resistant materials are needed. Abundant highway construction projects leave these strata at vertical or near vertical with limited issues of stability.

A daily inspection of pit slopes by qualified personnel will be undertaken for any work area within the pit prior to employees or machinery entering. It is proposed to have an independent qualified professional review the slopes on a quarterly basis. Pit slopes are based on recommendations of the qualified professional with appropriate design safety factors applied. Slopes will be monitored throughout the life of the operation.

A berm surrounding the open pit will direct surface water runoff into a water diversion channel that discharges to the settling pond to the west. The berm will be keyed into the bedrock to prevent shallow groundwater flow and/or surface water originating in Cameron Flowage from entering the open pit. An in-mine water diversion ditch will be established along the top bench of the mine to intercept any surface water that infiltrates the berm and flows into the mine. This ditch will direct water to in-mine sumps where it will be pumped out of the mine.

Based on these factors, the likelihood of open pit mine slope failure is determined to be very low.

Magnitude

Surface mines with improperly designed benches, slopes, poor surface water and groundwater management pose a health and safety risk to workers during the site preparation and construction, and operation and maintenance phases, as well as a financial liability risk related to mobile equipment damage or loss.

The maximum effect of an overburden or bedrock face slope failure as it relates to worker health and safety would be a death caused by falling objects. The maximum effect of an overburden or bedrock face slope failure as it relates to financial liability would be a total loss of one or more pieces of mobile equipment.

If slope failure were to occur, emergency procedures would be implemented that will be outlined in the site emergency response plan. Generally, slope failure emergency response includes evacuation of all equipment and personnel from the area and areas up-slope and down-slope from the slope failure area.

Dust generated from the failure of an open pit slope would be temporary and localized to the area directly around the slope failure. In addition, the physical and cultural heritage artifacts in the area of any open pit slope failure are likely to be identified during mine development. As a result, potentially adverse effects to the atmospheric environment and physical and cultural heritage are considered low.

Due to the potential consequences on worker health and safety, the level of magnitude/consequence of open pit mine slope failure is considered very high.

Risk Rating

With a very low likelihood and a very high level of magnitude/consequence the risk rating is determined to be a 5 (e.g., 1 (highest risk rating) to 9 (lowest risk rating) [Figure CEAA 2-18-1]).

Stockpile Slope Failure

Stockpile slope failure (i.e., waste rock, till/organic stockpiles) may be caused by improperly designed lifts, and erosion from surface water runoff.

Worst-case scenario resulting from stockpile slope failure would be disturbance to surrounding area, including the potential for mine rock and low-grade ore to enter nearby watercourses, damage to infrastructure and worker safety.

Likelihood

Stockpile slopes (i.e., waste rock, till/organic stockpiles) will be designed at an angle determined by geotechnical analysis and acceptable safety factors, thereby reducing the likelihood of a slope failure. Placement of materials in the stockpiles would follow a plan developed for the stockpile that would consider thickness of the lift, compaction - if needed, load size, start and stockpile physical limits. Slopes will be monitored throughout the life of the operation with routine inspections by qualified staff and repairs made if warranted.

The stockpiles have also been designed to consider climate changes and seismic conditions and are engineered to a recognized industry standard. A geotechnical stability assessment has been undertaken by Golder (AMNS 2021; included as Appendix A.2a) to evaluate the design criteria for waste rock, till, and organic stockpiles. The results of the assessment indicate that they do not represent a safety risk or stability risk.

Surface water run-off from the non-ore bearing waste rock stockpile, Mine Site roads, and till stockpiles will flow by gravity, with the aid of berms and channels, to a settling pond located west of the open pit. Water will be gradually decanted to Cameron Flowage by gravity via a water diversion structure that runs northeast from the settling pond.

Based on these factors, the likelihood of stockpile slope failure (i.e., waste rock, till/organic stockpiles) is determined to be very low.

Magnitude

The maximum effect of a stockpile slope failure (i.e., waste rock, till/organic stockpiles) as it relates to worker health and safety would be a death caused by falling objects. The maximum effect of a stockpile slope failure as it relates to financial liability would be damage to or a total loss of one or more pieces of mobile equipment.

Dust suspended from the failure of a stockpile slope would be temporary and localized to the area directly around the slope failure. In addition, production and discharge of acid rock drainage to receiving watercourses in the area is unlikely due to all surface water runoff being directed to settling ponds for treatment and monitoring prior to discharge to the environment. As a result, potentially adverse effects to the atmospheric environment, geology, soil, and sediment, surface water quality and quantity, wetlands, and fish and fish habitat are considered low.

Due to the potential consequences on worker health and safety and secondarily on property damage and environmental effects, the level of magnitude/consequence of stockpile slope failure (i.e., waste rock, till/organic stockpiles) is considered very high.

Risk Rating

With a very low likelihood and a very high level of magnitude/consequence the risk rating is determined to be a 5 (e.g., 1 (highest risk rating) to 9 (lowest risk rating) [Figure CEAA 2-18-1]).

Settling Pond Failure

A failure of the settling pond is defined as a breach of the banks through overflow or bank structure failure resulting in the release of sediment laden water to the environment. A worst-case scenario would be complete failure of the settling pond, resulting in uncontrolled discharge of sediment laden water into the surrounding environment. The capacity demand of the settling pond will increase as open pit depth increases and more infiltrated groundwater is pumped out of the mine.

Likelihood

There are two potential pathways for settling pond failure: overtopping and piping. With respect to overtopping failure, the pond will be designed to control site runoff up to and including the 100-year storm event, with a minimum freeboard of 0.3 m above the 100-year water level. Larger flow events will be controlled through one of two emergency spillways (two-way pump and overflow spillway weir) that will be directed to the sump within the open pit. The overflow spillway weir is designed to control site runoff up to and including storm events as large as Hurricane Beth (i.e., largest recorded rainfall event in Nova Scotia with approximately 296 mm of rainfall [Government of Canada 2013]). The spillway will be designed to provide sufficient erosion protection to mitigate against scouring and erosion, and as such provides mitigation against the release of TSS. Water collected in the pit will be pumped back into the pond after the storm event, as storage becomes available. Furthermore, discharge from the North Settling Pond enters the aeration treatment lagoon, which provides additional holding capacity in the event of overtopping. As a result, pond failure by overtopping will not impact fish or fish habitat in the Killag River from the North Pond.

The North Settling Pond will be designed to mitigate failure of the containment berm by piping through two mechanisms. First, the North Settling Pond will be lined with an impermeable geosynthetic liner to prevent seepage through the pond berms and minimizing

the potential for piping failure. The operating water level (permanent pool) of the pond will be below the ground elevation on the downstream side of the berm. Only the active storage portion of the pond has potential for piping failure. Further, due to the temporary nature of water storage in this part of the settling pond (only after a storm event and for approximately 24 to 36 hours afterwards) there is low risk for piping failure to form.

The East Settling Pond will be designed to control site runoff generated from up to and including the 100-year storm event, similar to the North Settling Pond, with the 0.3 m freeboard above the 100-year water level. In addition, the East Settling Pond will also be lined with an impermeable geosynthetic liner to prevent seepage through the pond berms and minimizing the potential for piping failure. Larger events will be controlled through the emergency spillway. The overflow spillway weir is designed to control Site runoff up to and including storm events as large as Hurricane Beth (i.e., approximately 296 mm depth of rainfall [Government of Canada 2013]). The spillway will be designed to provide sufficient erosion protection to mitigate against scouring and erosion, and as such provides mitigation against the release of TSS. If a hurricane-sized rainfall event were to be predicted, pumps from across the Site would be re-purposed to the East Settling Pond to pump water to the open pit in order to provide further protection against overtopping failure and prevent an uncontrolled release of water into Cameron Flowage. Given the design of the East Settling Pond and contingency measures put in place, there is low likelihood of overtopping failure and piping failure. With planned site erosion and sediment controls in place, discharge via the emergency spillway is anticipated to have diluted TSS concentrations.

The evaporation pond and the West and South Settling ponds will also be designed to control site runoff generated from the 100-year storm event, with the 0.3 m freeboard above the 100-year water level. Larger events will be controlled through the emergency spillways. The overflow spillway weirs are designed to control Site runoff up to and including storm events as large as Hurricane Beth (i.e., approximately 296 mm depth of rainfall [Government of Canada 2013]). No further failure analysis was performed on the evaporation pond or the West Settling Pond as these ponds drain towards the North Settling Pond, resulting in no additional risk to fish habitat within Cameron Flowage. The South Settling Pond drains towards the Tent Lake watershed. The South Settling Pond will be lined with an impermeable geosynthetic liner to prevent seepage through the pond berms and minimize the potential for piping failure. If a hurricane-sized rainfall event were to be predicted, pumps from across the Site would be re-purposed to pump water to the open pit in order to provide further protection against overtopping failure. With planned site erosion and sediment controls in place, discharge via the emergency spillway is anticipated to have diluted TSS concentrations. No further failure analysis was performed on the South Settling Pond due to the low risk of failure and additional contingencies put in place to direct Site runoff towards the open pit if a hurricane-sized rainfall event were to be predicted.

All settling pond berms and outlet structures will be monitored regularly to detect any deficiencies that may result in failure. In addition, all ponds will have short service lives as they will be decommissioned during post-closure. As a result, all discharge from the Beaver Dam Mine Site Settling Ponds to Cameron Flowage will be treated and overflow will not negatively impact fish or fish habitat in Cameron Flowage.

Based on these factors, the likelihood of settling pond failure is determined to be negligible.

Magnitude

The criteria that would determine a significant effect should a settling pond fail, is based primarily on environmental protection. The maximum effect of a settling pond failure as it relates to VCs (i.e., soil and sediment quality, surface water quality and quantity, wetlands, fish and fish habitat, and species of conservation interest and species at risk), would be heavy siltation of wetlands and waterbodies and subsequent stresses on fish and other aquatic species. Adverse effects to the sediment quality portion of the geology, soil, and sediment quality VC are considered low.

The effects of elevated suspended solids to fish range from an immediate lethal effect to a longer-term chronic effect including habitat degradation. The immediate effect of suspended solids on fish depends on a number of factors in addition to concentration and duration including the size and angularity of the particles. The lethal concentration of TSS can be measured in the hundreds to hundreds of thousands of mg/L of sediment, and as such the results of the 96-h LC50 test have limited value for predicting effects in the wild and at best they are but a coarse indicator of the short-term effects of a contaminant (DFO, 2000; Newcombe and Macdonald, 1991). Studies listed by (Newcombe and Macdonald, 1991) show that effects on fish from TSS concentrations ranging from tens of mg/L to >200,000 mg/L range considerably from negligible effects to 100% mortality, and that concentrations alone are a poor predictor of TSS effects. Most of the studies in the cited literature refer to studies where elevated TSS durations were 24-hour or greater.

Sublethal effects can manifest over time due to small increases in TSS and as such most TSS guidelines including the CCME particulate guidelines limit longer term increases (e.g., greater than 24 hours) to small increases such as 10% (Bash et al. 2001; CCME 2002).

In the event of an unlikely malfunction and/or breach of the north or east settling ponds, some mortality of fish in the immediate vicinity of the outwash can be expected. An assessment of the sedimentation of habitats would be completed, and if necessary localized remediation of lake and stream habitats could be undertaken to remove the deposited solids. Although short term impacts to biota and habitats are expected, recovery of the system would be expected.

Comparison of surface water samples to CCME FWAL TSS guidelines and MDMER TSS guidelines will be utilized to determine if sediment laden water will have an impact on surface water quality in Cameron Flowage and subsequently on fish and fish habitat.

The environmental concerns relating to sediment laden water discharging to Cameron Flowage result in the magnitude of settling pond failure is determined to be high.

Risk Rating

With a negligible likelihood and a high level of magnitude/consequence the risk rating is determined to be a 7 (e.g., 1 (highest risk rating) to 9 (lowest risk rating) [Figure CEAA 2-18-1]).

Infrastructure Failure

Infrastructure failure may be caused by improper design and construction, or natural causes such as hurricanes or earthquakes. A worst-case scenario would be failure of multiple operational components as a result of a natural cause impacting worker health and safety and the surrounding environment.

Likelihood

Infrastructure at the Beaver Dam Mine Site will be minimal and given the short life of the Project, failure should not occur without being acted upon by extreme natural causes, such as a hurricane or earthquake, or human error.

On-site infrastructure will be informally inspected by site personnel for signs of premature failure through the normal course of the working shift. More rigorous inspection will occur with routine maintenance. Existing legislation is well established and understood by the Proponent personnel through the development and future operation of the Touquoy Mine Site.

A Health and Safety Plan will be developed and implemented for the Beaver Dam Mine Site, which will include evacuation procedures, proper housekeeping procedures for the storage and use of small equipment, and materials.

Based on these factors, the likelihood of infrastructure failure is determined to be negligible.

Magnitude

The maximum effect of an infrastructure failure as it relates to worker health and safety would be a death caused by falling objects or collapsing structures. The maximum effect of an infrastructure failure as it relates to financial liability would be damage to or a total loss of one or more pieces of infrastructure.

The emissions produced through volatilization of fuel oil or through a small fire from an infrastructure failure event would be temporary and localized to the area directly around the failure. In addition, a release of fuel oil, lubricants or other Project related raw materials would be minor in volume and likely contained and cleaned up prior to significantly effecting soil. As a result, potentially adverse effects to the atmospheric environment, and geology, soil, and sediment quality are considered low.

Given infrastructure failure would likely not result in disturbance to a greenfield environment, potential adverse effects to other VCs from an infrastructure failure occurrence are anticipated to be non-existent.

Due to the potential consequences on worker health and safety, environmental impact, and secondarily on property damage, the magnitude of infrastructure failure is considered very high.

Risk Rating

With a negligible likelihood and a very high level of magnitude/consequence the risk rating is determined to be a 6 (e.g., 1 (highest risk rating) to 9 (lowest risk rating) [Figure CEAA 2-18-1]).

Unplanned Explosives Event

An unplanned explosive event is limited to the site preparation and construction, and operation and maintenance phases of the Project. The worst-case scenario would be bodily harm as a result of improperly handling explosives.

Likelihood

Blasting will be undertaken by a qualified contractor and explosives who will be responsible for all licensing and approvals as required by Natural Resources Canada for this Project. Transportation, storage and handling of explosives will be carried out in compliance with the *Explosives Act* and any other relevant legislation. If an unplanned explosive event were to occur, emergency procedures would be implemented that will be outlined in the site emergency response plan. Generally, unplanned explosive event response includes raising the alarm and evacuation of all equipment and personnel from the area. A safe zone around the affected area will be established, the size of which will be determined by on-site staff and possibly external resources (explosive specialists). Barriers and signs to prevent access to the affected area may be required until clean-up is complete.

Based on this information, the likelihood of an explosive's accident is considered negligible.

Magnitude

The maximum effect of an unplanned explosive event as it relates to worker health and safety would be a death caused by direct interaction or from falling objects or collapsing structures damaged from the explosion.

Dust suspended from an unplanned explosive event would be temporary and localized to the area directly around the explosion. In addition, a release of ammonium nitrate or fuel oil to the environment is considered unlikely as the majority of these substances will be consumed should an explosion occur.

Effects to birds, fauna, and SOCI/SAR will likely be minimal due to the Beaver Dam Mine Site being devoid of habitat once blasting commences. Effects to physical and cultural heritage will likely be minimal as well; it is anticipated that anywhere an unplanned explosive event as the potential to occur, the ground will already be disturbed by site preparation and construction activities. As a result, potentially adverse effects to the atmospheric environment, birds, fauna, SOCI/SAR, and physical and cultural heritage are considered low.

Due to the potential consequences on worker health and safety, and secondarily on property damage and environmental effects, the magnitude of an explosive's accident is considered very high.

Risk Rating

With a negligible likelihood and a very high level of magnitude/consequence the risk rating is determined to be a 6 (e.g., 1 (highest risk rating) to 9 (lowest risk rating) [Figure CEAA 2-18-1]).

Fuel Release during Transport (Ore Transport and Fuel Delivery/Transport)

A worst-case scenario would be a transportation collision of two haul trucks along the Haul Road or a fuel transport tanker causing the entire amount of fuel to be spilled into a waterbody and significant injuries to those involved in the collision. The effects of a large fuel spill event would vary depending on the location and proximity to sensitive environments potentially impacting soils (or snow in winter) and/or entering a waterbody if the collision occurred on or near a water crossing.

Likelihood

Fuel will be transported to the proposed Beaver Dam Mine Site by a third party using licenced and trained drivers along a regional road network. The ore will be transported along the Haul Road between Beaver Dam Mine and Touquoy Mine using licenced and trained drivers via "C" train transport trucks. Both types of trucks are generally compartmentalized, such that if there were to be an accident, only a portion of the load will be lost except in a catastrophic incident.

Despite all reasonable safeguards, there is a small potential for spills from tanker/transport trucks due to collisions, accidents related to poor weather conditions, or other mishaps.

Regular maintenance of fuel trucks can significantly reduce the chance of an equipment failure caused accident. The need for compliance with the *Transportation of Dangerous Goods Act* and associated Regulations will be reinforced in all applicable contracts and vendor agreements.

The potential for environmental impacts associated with malfunction and accidents on the trucking route will be minimized by the following operational procedures which will be incorporated into the environmental management system as possible and into trucking / supply contracts as reasonable:

- speed limits are to be strictly adhered to;
- strict adherence to national trucking hour limits and other applicable requirements;
- drivers will be required to meet all applicable regulatory training requirements, be trained in spill response procedures for the materials they transport, and carry the appropriate Material Safety Data Sheets;
- all vehicles transporting materials to site will be required to maintain a supply of basic emergency response equipment, including communication equipment, first aid materials and a fire extinguisher; and
- penalties for operational violations.

An Emergency Response Plan, including a Spill Contingency Plan, forms part of the environmental management system that will address the primary hazardous materials on site including procedures for spill response on the trucking route to the site. Materials to be maintained in vehicles will be identified in the draft Emergency Response Plan (Appendix P.1) and required spill abatement equipment will be available on-site for AMNS responders to complete initial containment and confinement of spills.

At the Beaver Dam Mine Site, the following additional controls will be in place to reduce the potential for or the severity of accidents involving hazardous materials:

- Speed limits, to be posted and enforced by security personnel;
- Right of way procedures will be defined and haul trucks and loaded vehicles will be given preference;
- Traffic will be required to yield to wildlife as observed; and
- Where possible, heavy traffic will be limited to site haul roads and other traffic limited to site access roads.

Emergency response procedures will be established as part of the environmental management system and include the following: medical response, notification, containment of spill, removal of spill, treatment of affected environment, monitoring of environment and learning from the accident.

The primary goal in any collision resulting in a fuel spill, will be to ensure public and worker health and safety. Potential ignition sources will be removed in the event of a spill of flammable or combustible materials, if safely possible, and the spill will be stopped or slowed using available equipment. Appropriate corporate and external personnel will be notified, and an assessment will be conducted to determine the best means to prevent immediate environmental impacts. Spill countermeasures may include the use of absorbent materials, establishment of a collection trench and setting containment booms on water. When fuel is contained by booms, berms or other means, it may be pumped, skimmed or mopped with absorbent matting, and disposed of in an approved facility designed to manage such wastes. If a spill were to directly enter a fast-moving watercourse, it may not be possible to completely contain and remediate the spill.

Clean-up and potentially remediation will ensure long term environmental impacts are reduced to the extent practical. After any major spill, a review will be conducted to ensure that the required design changes, procedures and appropriate monitoring measures are in place to ensure that incident will not be repeated.

Based on this information, the likelihood of fuel release during transport is considered very low.

Magnitude

Diesel fuel and gasoline is toxic to aquatic life when spilled in fresh water. A tanker truck spill would have the greatest environmental impact if the spill reached a major watercourse that supports aquatic life. The diesel slick will move downstream, potentially impacting riverbanks over the length of the watercourse until the spill could be contained or it naturally degrades. A spill on land will be comparatively easy to contain and clean up, particularly under frozen ground conditions.

If a fuel spill were to occur within, or in close proximity to fish habitat, there would be an adverse effect to fish and fish habitat. A fuel spill could result in acute lethality to fish, and a degradation to the water quality, resulting in adverse effects to the spawning, rearing, foraging and overwintering habitat functions. Depending on the location and volume of a release, this could result in a high magnitude of effect to fish and fish habitat. The geographical extent is expected to be discrete to local in nature, with short term duration and sporadic frequency. Given the implementation of appropriate containment and recovery (clean-up) measures, the effects to fish habitat are expected to be partially reversible.

Due to the potential consequences on the environment and worker health and safety, the magnitude of fuel release during transport is considered high.

Risk Rating

With a very low likelihood and a high level of magnitude/consequence the risk rating is determined to be a 6 (e.g., 1 (highest risk rating) to 9 (lowest risk rating) [Figure CEAA 2-18-1]).

Fuel Release from Fuel Storage Facility and Re-Fueling Areas

Diesel fuel and gasoline will be stored at the fuel storage facility in double-walled Enviro tanks, or other equivalent storage for containment such as a bermed facility that will be consistent with Nova Scotia regulatory requirements. The fuel storage facility will include a refuelling area for heavy and support mining equipment, and potentially for small vehicles.

Likelihood

The potential for environmental impacts associated with malfunction and accidents of onsite fuel storage facilities and dispensing areas have been minimized by the following design and construction features:

- Tankage and storage areas will be constructed to recognized industry standards and conform to Technical Standards and Safety Authority leak detection requirements;
- Storage areas are distant from water courses and sensitive habitat;
- Use of bollards (collision protection poles) and other measures to prevent collision;
- Containment berms considerations around all permanent tanks; and
- Enviro tanks will be situated to minimize the risk from collision and puncturing of both walls and protected using bollards or similar.

Operational procedures to minimize the potential of accidents or malfunctions will be identified into the environmental management system, and are expected to include:

- At least daily inspections of all fuel storage locations;
- Formal weekly inspections using a protocol checklist to check for leakage and other operational problems;
- Volumes will be confirmed at all tanks containing petroleum product at least weekly, using a dip check or other method, with the result logged for comparison; any measurements different from anticipated volumes will immediately be investigated;
- Fuel tanks will not be filled above 98% of capacity to allow for expansion due to temperature changes; and
- No smoking in the vicinity of the fuel storage facility or refuelling areas.
- Procedures for fuel storage will be regularly reviewed as part of the environmental management system.

Based on this information, the likelihood of fuel release from fuel storage facilities and re-fuelling areas is considered low.

Magnitude

The risk of a major environmental event associated with fuel storage and dispensing areas is less than that from truck transport because of the fixed locations selected to be isolated from water courses and other sensitive environmental features, the presence of collision protection barriers, containment, and the proximity to spill response and containment equipment.

Depending on soil and its hydrological characteristics, a significant fuel spill that goes undetected could create a plume in the soil and leach into downstream watercourses resulting in aquatic and riparian impacts.

Considering the potential consequences on the environment, the magnitude of fuel release from fuel storage facilities and re-fuelling areas is considered moderate.

Risk Rating

With a low likelihood and a moderate level of magnitude/consequence the risk rating is determined to be a 6 (e.g., 1 (highest risk rating) to 9 (lowest risk rating) [Figure CEAA 2-18-1]).

Transportation Accident – Hazardous Materials (excluding fuel)

A worst-case scenario would be a transportation collision causing the entire amount of material being transported to be spilled into a water body and significant injuries to those involved in the collision. The effects of the spill would vary depending on the material spilled.

Likelihood

Hazardous materials will be transported to the proposed Beaver Dam Mine Site along the regional road network.

Regular maintenance of trucks can significantly reduce the chance of an equipment failure caused accident. The need for compliance with the *Transportation of Dangerous Goods Act* and associated Regulations will be reinforced in all applicable contracts and vendor agreements.

The potential for environmental impacts associated with malfunction and accidents on the trucking route will be minimized by the following operational procedures which will be incorporated into the environmental management system as possible and into trucking / supply contracts as reasonable:

- speed limits are to be strictly adhered to;
- strict adherence to national trucking hour limits and other applicable requirements;
- drivers will be required to meet all applicable regulatory training requirements, be trained in spill response procedures for the materials they transport, and carry the appropriate Material Safety Data Sheets;
- all vehicles transporting materials to site will be required to maintain a supply of basic emergency response equipment, including communication equipment, first aid materials and a fire extinguisher; and

- penalties for operational violations.

Based on this information, the likelihood of a transportation accident (hazardous materials) is considered very low.

Magnitude

The maximum effect of a mobile equipment accident as it relates to worker health and safety would be a death caused by a collision of two pieces of mobile equipment, a single equipment crash, or a direct strike from mobile equipment.

If a spill of hazardous materials were to occur within, or in close proximity to fish habitat, there would be an adverse impact to fish and fish habitat. Depending on the material, a spill could result in acute lethality to fish, and a degradation to the water quality, resulting in adverse effects to the spawning, rearing, foraging and overwintering habitat functions. Depending on the location and volume, this could result in a high magnitude of effect to fish and fish habitat. Given the implementation of appropriate containment and recovery (clean-up) measures, the effects to fish habitat are expected to be partially reversible.

Due to the potential consequences on the environment and worker health and safety, the magnitude of a transportation accident (hazardous materials) is considered very high.

Risk Rating

With a very low likelihood and a very high level of magnitude/consequence the risk rating is determined to be a 5 (e.g., 1 (highest risk rating) to 9 (lowest risk rating) [Figure CEAA 2-18-1]).

Transportation Accident – Non-hazardous Materials

A worst-case scenario would be a transportation collision causing the entire amount of material being transported to be spilled into a water body and significant injuries to those involved in the collision. The effects of the spill would be less significant due to the non-hazardous materials being carried.

Likelihood

Regular maintenance of trucks can significantly reduce the chance of an equipment failure caused accident.

The potential for environmental impacts associated with malfunction and accidents on the trucking route will be minimized by the following operational procedures which will be incorporated into the environmental management system as possible and into trucking / supply contracts as reasonable:

- speed limits are to be strictly adhered to;
- strict adherence to national trucking hour limits and other applicable requirements;
- drivers will be required to meet all applicable regulatory training requirements, be trained in spill response procedures for the materials they transport, and carry the appropriate Material Safety Data Sheets;

- all vehicles transporting materials to site will be required to maintain a supply of basic emergency response equipment, including communication equipment, first aid materials and a fire extinguisher; and
- penalties for operational violations.

Based on this information, the likelihood of a transportation accident (non-hazardous materials) is considered very low.

Magnitude

The maximum effect of a mobile equipment accident as it relates to worker health and safety would be a death caused by a collision of two pieces of mobile equipment, a single equipment crash, or a direct strike from mobile equipment.

If a spill of non-hazardous materials were to occur within, or in close proximity to fish habitat, there would be potential for adverse impacts to fish and fish habitat, however, due to the type of material being carried the potential impacts are significantly reduced from the hazardous material scenario.

Due to the potential consequences on worker health and safety, the magnitude of a transportation accident (non-hazardous materials) is considered very high.

Risk Rating

With a very low likelihood and a very high level of magnitude/consequence the risk rating is determined to be a 5 (e.g., 1 (highest risk rating) to 9 (lowest risk rating) [Figure CEAA 2-18-1]).

Mobile Equipment Accident

All phases of the Project will have the potential for vehicular accidents to occur. A worst-case scenario would be a severe accident-causing injury or death.

Likelihood

The majority of mobile equipment traffic will be limited to the Beaver Dam Mine Site where guided traffic patterns, speed limits, right-of-way signage, and training will minimize the risk of vehicular accidents. The remaining mobile equipment will include haul trucks, which will transport crushed ore 30 km from the Beaver Dam Mine Site to the Touquoy Mine Site. The Haul Road will be dual lane and designed to facilitate the safe passage of two-way truck traffic at 70 km/h. Speed limits will be enforced on the Mine Site and Haul Road.

Speed limit and right-of-way signage will be installed, and all haul truck operators will receive operator training to minimize the risk of haul truck collisions. All intersections will be designed to NSTIR Standards. Communications will be maintained between vehicles using radios so that adverse conditions or collisions may be reported immediately. The operators training will include proper procedures for daily travel to minimize the risk of vehicular accidents, as well as procedures related to emergency response should there be a vehicular accident.

Good maintenance practices for equipment and vehicle maintenance will be undertaken, including regular maintenance as specified by suppliers.

Based on this information, the likelihood of a mobile equipment accident is considered very low.

Magnitude

The maximum effect of a mobile equipment accident as it relates to worker health and safety would be a death caused by a collision of two pieces of mobile equipment, a single equipment crash, or a direct strike from mobile equipment.

The emissions produced from a mobile equipment accident would be temporary and localized to the area directly around the accident. In addition, a release of fuel oil, lubricants or other Project related raw materials would be minor in volume and likely contained and cleaned up prior to significantly effecting soil or sediment quality. Effects to birds, fauna, and SOCI/SAR would be limited to death by direct strike, which would be limited to individuals rather than species populations. As a result, potentially adverse effects to the atmospheric environment, geology, soil, and sediment quality, birds, fauna, and SOCI/SAR are considered low.

Mobile equipment accidents pose an environmental risk to the following VCs:

- surface water quality and quantity;
- wetlands;
- fish and fish habitat; and
- SOCI/SAR.

The magnitude of a release from mobile equipment is dependent on the severity and type of accident that occurs. A large spill can occur if an accident results in the complete destruction of a storage tank, or a small spill can occur if an accident results in a fuel line leak.

The location of the mobile equipment accident will also determine the magnitude of effects. An accident occurring within the Beaver Dam Mine Site boundaries is unlikely to cause significant environmental effects as the area will be largely devoid of ecological receptors and the presence of hundreds of workers will likely lead to quick and efficient containment and cleanup efforts. The primary receiver for spills as a result of accidents in this area is the soil portion of the geology, soil, and sediment quality VC. Spills are unlikely to reach surface water, sediment, groundwater, wetlands, and fish habitat due to anticipated spill response times, as well as containment and cleanup efforts. A spill occurring due to an accident along the Haul Road may have more significant environmental effects if the accident occurs in close proximity to a watercourse or wetland. Should this occur, the effects to surface water quality, wetland health, fish and fish habitat, and SOCI/SAR may be more pronounced.

Due to the potential consequences on worker health and safety and the environment, the magnitude of a mobile equipment accident is considered very high.

Risk Rating

With a very low likelihood and a very high level of magnitude/consequence the risk rating is determined to be a 5 (e.g., 1 (highest risk rating) to 9 (lowest risk rating) [Figure CEAA 2-18-1]).

Tailings and Reclaim Water Pipeline Spills – Touquoy Mine

The criteria that would determine a significant effect should a tailings or reclaim water pipeline fail, is based primarily on environmental protection. Should a pipeline failure result in an uncontrolled discharge of tailings and/or process water to the receiving surface water environment the event will be considered significant.

Likelihood

The sections of the tailings and reclaim pipelines between the plant site and open pit will be double-walled and run in HDPE lined trenches to an adequately sized lined collection pond capable of containing the volume of the pipeline. The catchment pond will be lined with suitable materials, such as clay or a plastic liner.

Process controls will be in place to detect a pipeline leak or spill and initiate shutdown procedures.

The potential for accidents and malfunctions at Touquoy mine will continue to be mitigated through the application of existing environmental management plans, operating procedures and monitoring programs, including the OMS Manual and Emergency and Spill Response Plan.

Based on this information, the likelihood of a tailings and reclaim water pipeline spill is considered negligible.

Magnitude

Given the location of the pipelines, trench and catchment pond within the mine production area and in close proximity to other facilities and personnel, detection and response to any spill would be expected to be rapid and confined to the mine footprint area and not result in significant release to the receiving environment.

If a tailings and/or reclaim water pipelines spill were to occur, emergency procedures would be implemented that will be outlined in the site emergency response plan. Generally, tailings and/or reclaim water pipelines emergency response includes evacuation of all equipment and personnel from the area. If tailings and/or reclaim water encroach on neighbouring properties or public roadways, appropriate authorities will be notified and construction of bunds and/or diversion drains may be required to contain tailings and/or reclaim water on-site. Other immediate responses may include lowering tailing pond levels, stopping the inflow into the tailings pond from the mill, stabilizing unstable slopes, and mitigating downstream consequences.

Due to the potential impact on the environment, the magnitude of a tailings and reclaim water pipeline spill is considered moderate to very high.

Risk Rating

With a negligible likelihood and a moderate to very high level of magnitude/consequence the risk rating is determined to be between 8 to 6 (e.g., 1 (highest risk rating) to 9 (lowest risk rating) [Figure CEAA 2-18-1]).

Cyanide Release – Touquoy Mine

Sodium cyanide (NaCN) is a key reagent used in the Carbon-In-Leach (CIL) process to leach gold from a sold matrix to form a gold cyanide complex that can be extracted from the slurry by adsorption onto activated carbon.

Likelihood

Cyanide handling and use is highly regulated and subject to strict practices and procedures. Cyanide is delivered in dry briquette form is relatively safe from spills and easy to clean up in the event of a transportation or handling incident. Cyanide in solution is restricted to use within the processing facility with an abundance of design and process controls, as well as occupational health and safety practices, to prevent release of cyanide solution or gas within and without the building structure. Cyanide solution is detoxified by a proven and efficient process and tested by an automated in-line sampler prior leaving the processing facility, making the release of a high concentration (i.e., non-detoxified) cyanide solution outside the confines of the process facility a highly unlikely event.

Based on this information, the likelihood of an unplanned cyanide release is considered negligible.

Magnitude

The maximum effect of an unplanned cyanide release as it relates to worker health and safety would be a death caused by inhalation of cyanide. In addition, a release to aquatic environment would result in toxic effects to fish and fish habitat.

Due to the potential consequences on human health and the environment, the magnitude of an unplanned cyanide release is considered moderate to very high.

Risk Rating

With a negligible likelihood and a moderate to very high level of magnitude/consequence the risk rating is determined to be between 8 to 6 (e.g., 1 (highest risk rating) to 9 (lowest risk rating) [Figure CEAA 2-18-1]).

Project Related Fires

All phases of the Project will have the potential for forest and/or site fires to occur. A worst-case scenario is an extreme fire that results in worker injury or death or that causes significant damage to the environment. A forest fire may occur through human or natural causes, while a site fire may occur due to an equipment failure and/or human error.

Likelihood

The topographic profile of the region allows for precipitation to be retained in soil and numerous watercourses and wetlands to form. As a result, large forest and/or site fires are unlikely to occur.

Fire protection for the plant site will be via a "wet system" with hydrants located around the plant site area. The water contained within the lower portion of the raw water tank will be reserved for fire protection. Fire detection systems will be installed in all buildings and in key areas of the Mine Site.

In each area, a combination of heat and smoke detectors will be provided with break-glass units mounted externally to the buildings. The large primary mining fleet including excavators, front end loader, haul truck, dozers and drills will be fitted with fire suppression systems in case of fire.

The water truck will be fitted with a pump and 2.5-inch hydrant hose reel for firefighting. Supplementary hand-held fire extinguishers, each suitable for its specific area, will be mounted in all buildings and vehicles. The site will have fire-fighting and fire-suppression capabilities that will be supplemented by support from the local community.

Fire response training and fire extinguisher training will be provided to all staff. An emergency response plan will be developed for the site, which will include fire response.

The site will be staffed to varying levels 24 hours a day with personnel in all areas of the Beaver Dam Mine Site. Fires, if they occur, would be quickly detected and emergency procedures able to be acted on. The availability of water, equipment and nearby personnel from volunteer fire departments and NSL&F staff with expertise in forest fire control are all benefits to the Project and greatly reduce the possibility of fires that would not be able to be quickly controlled, and damage limited.

Based on this information, the likelihood of a project related fire is considered very low.

Magnitude

In the unlikely event a forest and/or site fire occurs, the following adverse effects to VCs are considered low:

- emissions produced from a forest and/or site fire would be temporary; however, may temporarily adversely affect ambient air quality in the area;
- surface water run-off created from extinguishing the fire may transport sediment and potential contaminants towards watercourses along the Haul Road; thereby affecting surface water quality;

- surface water quantity in watercourses near the Beaver Dam Mine Site may be slightly affected through extraction and use of surface water for extinguishing the fire; however, these watercourses will only be utilized to aid in extinguishing small localized fires;
- effects to wetlands and fish and fish habitat are expected to be minimal due to the presence of water and saturated soils and flora; and
- unless a forest and/site fire extends to the Beaver Lake IR 17, it is unlikely that Indigenous Peoples will be adversely affected by forest and/or site fires.

As a result, potentially adverse effects to the atmospheric environment, surface water quality and quantity, wetlands, fish and fish habitat, and Indigenous Peoples are considered low.

A forest and/or site fire caused by the Project has the potential to modify terrestrial habitat and cause direct mortality to wildlife populations, especially during the breeding season when the mobility of immature individuals is limited. The destruction of habitat may result in the loss of breeding, nesting, rearing, and/or other habitat for birds, fauna, and SOCI/SAR. Habitat fragmentation created by a fire may cause potential adverse effects for species that migrate throughout a landscape based on resources that are seasonally available.

Although a forest and/or site fire caused by the Project is likely to be extinguished before it creates a significant effect to the local area, it is unlikely that terrestrial habitat loss or direct individual mortality would create population viability issues if an uncontrollable fire was allowed to burn. It is likely that mobile terrestrial species will move to adjacent areas and any habitat loss would lead to regrowth within a few generations. In addition, habitat types in the area of the Project are not unique and would be easily supplanted with minor migration efforts by terrestrial species.

Due to the potential consequences on worker health and safety and the environment, the magnitude of a project related fire is considered moderate to very high.

Risk Rating

With a very low likelihood and a moderate to very high level of magnitude/consequence the risk rating is determined to be a 7 to 5 (e.g., 1 (highest risk rating) to 9 (lowest risk rating) [Figure CEAA 2-18-1]).

Risk Assessment Summary

Potential accidents and malfunctions assigned a risk rating of 9 to 7 are considered low risk, those assigned a risk rating of 6 to 4 are considered moderate risk, and those assigned a risk rating of 3 to 1 are considered high risk. If an accident or malfunction is assigned a risk rating of 3 or lower, it is considered significant and requires further consideration during the Project's detailed design phase. All identified accidents and malfunctions have a low or moderate risk rating and are therefore considered not significant.

Table CEAA 2-18-1 summarizes the accident and/or malfunction likelihood, level of magnitude/consequence, risk rating and potentially effected VCs.

Table CEAA-2-18-1: Summary of Accident and Malfunction Characterization Criteria for Risk Rating Matrix for the Beaver Dam Mine Project

Accident / Malfunction	Concerns	Key Valued Components Potentially Affected	Likelihood	Consequence	Risk Rating	Reasoning and Justification
Open Pit Slope Failure	Affects to habitat and limited flooding of open pit	Socio-economic Conditions	Very Low	Very High	5	Very Low likelihood due to Geotechnical studies and ongoing monitoring by qualified professionals (including third parties). Appropriate design safety factors applied. Very High consequences due to presence of operations and potential impact on worker health and safety.
Waste Rock Stockpile Slope Failure	Affects to Terrestrial habitat and aquatic life	Surface Water Quality and Quantity Wetlands Fish and Fish Habitat Socio-economic Conditions	Very Low	Very High	5	Very Low likelihood due to Geotechnical studies and ongoing monitoring by qualified professionals (including third parties). Appropriate design safety factors applied. Designed with a factor of safety. Very High consequences due to presence of operations and surrounding environment and the potential impacts.
Till/Organic Stockpile Slope Failure	Affects to terrestrial habitat and aquatic life	Surface Water Quality and Quantity Wetlands Fish and Fish Habitat Socio-economic Conditions	Very Low	Very High	5	Very Low likelihood due to Geotechnical studies and ongoing monitoring by qualified professionals (including third parties). Appropriate design safety factors applied. Designed with a factor of safety. Very High consequences due to presence of operations and surrounding environment and the potential impacts
Settling Pond Failure	Affects to aquatic life	Surface Water Quality and Quantity Wetlands Fish and Fish Habitat Species of Conservation Interest and Species at Risk	Negligible	High	7	Negligible likelihood due to being designed to mitigate failure and ongoing monitoring and inspections by qualified professionals. Moderate consequences due to surrounding areas and the potential environmental impact on them.

Table CEAA-2-18-1: Summary of Accident and Malfunction Characterization Criteria for Risk Rating Matrix for the Beaver Dam Mine Project (continued)

Accident / Malfunction	Concerns	Key Valued Components Potentially Affected	Likelihood	Consequence	Risk Rating	Reasoning and Justification
Infrastructure Failures	Failure of multiple operational components as a result of a natural cause impacting worker health and safety and surrounding environment	Socio-economic Conditions	Negligible	Very High	6	Negligible likelihood due to engineering design and approval by qualified professionals.. Regular inspections by health and safety team. Very High consequences due to potential impact on worker health and safety.
Unplanned Explosives Event	Affects to aquatic environment and human health	Fish and Fish Habitat Socio-economic Conditions	Negligible	Very High	6	Negligible likelihood due to strict compliance with regulations and certified blasters. Very high consequences due to potential impact on worker health and safety.
Fuel Release during Truck Transport	Affects to aquatic life and downstream human environment	Geology, Soils, and Sediment Quality Surface Water Quality and Quantity Groundwater Quality and Quantity Wetlands Fish and Fish Habitat Species of Conservation Interest/Species at Risk Mi'kmaq of Nova Scotia	Very Low	High	6	Very Low likelihood due competent and trained delivery vendors with inspected vehicles and safe procedures in place. High consequences due to environmental area surrounding delivery routes.

Table CEAA-2-18-1: Summary of Accident and Malfunction Characterization Criteria for Risk Rating Matrix for the Beaver Dam Mine Project (continued)

Accident / Malfunction	Concerns	Key Valued Components Potentially Affected	Likelihood	Consequence	Risk Rating	Reasoning and Justification
Fuel Release from Fuel Storage Facility and Re-Fueling Areas	Affects to habitat	Geology, Soils, and Sediment Quality Surface Water Quality and Quantity Groundwater Quality and Quantity Wetlands Fish and Fish Habitat Species of Conservation Interest/Species at Risk	Low	Moderate	6	Low likelihood to due storage facilities and dispensing area installed as per fuel storage regulations including secondary containment along with site refueling protocols and regular inspections by environment team. Moderate consequences due to the potential environmental impact.
Transportation Accident – Hazardous Materials (excluding fuel)	Affects to habitat, aquatic life and downstream human environment	Surface Water Quality and Quantity Wetlands Fish and Fish Habitat Species of Conservation Interest/Species at Risk Socio-economic Conditions	Very Low	Very High	5	Very Low likelihood due to controlled safety of the site through speed, frequent safety inspections, and ensuring drivers have proper training (TDG). Very High consequences due to potential impact on worker health and safety and the environment.

Table CEAA-2-18-1: Summary of Accident and Malfunction Characterization Criteria for Risk Rating Matrix for the Beaver Dam Mine Project (continued)

Accident / Malfunction	Concerns	Key Valued Components Potentially Affected	Likelihood	Consequence	Risk Rating	Reasoning and Justification
Transportation Accident – Non-hazardous Materials	Affects to local terrestrial environment	Surface Water Quality and Quantity Wetlands Fish and Fish Habitat Species of Conservation Interest/Species at Risk Socio-economic Conditions	Very Low	Very High	5	Very Low likelihood due to controlled safety of the site through speed, frequent safety inspections, and ensuring drivers have proper training. Very High consequences due to potential impact on worker health and safety.
Mobile Equipment Accident	Severe accident-causing injury or death, property damage and environmental impacts	Surface Water Quality and Quantity Wetlands Fish and Fish Habitat Species of Conservation Interest/Species at Risk Socio-economic Conditions	Very Low	Very High	5	Very Low likelihood due to controlled safety of the site through speed, frequent safety inspections, and ensuring drivers have proper training. Very High consequences due to potential impact on personal and worker health and safety and environment.
Tailings/Reclaim Water Pipeline Spill – Touquoy Mine	Uncontrolled discharge of tailings and/or contaminated water into the surrounding environment	Surface Water Quality and Quantity Fish and Fish Habitat	Negligible	Moderate to Very High	8 to 6[(a)]	Negligible likelihood due to engineering design and regular inspections by qualified professionals. Moderate to very high consequences due to potential impact on worker health and safety and the environment.

Table CEAA-2-18-1: Summary of Accident and Malfunction Characterization Criteria for Risk Rating Matrix for the Beaver Dam Mine Project (continued)

Accident / Malfunction	Concerns	Key Valued Components Potentially Affected	Likelihood	Consequence	Risk Rating	Reasoning and Justification
Cyanide Release – Touquoy Mine	Uncontrolled release of cyanide into the workplace and/or surrounding environment resulting in worker injury or death and/or causing significant damage to the environment	Geology, soil, and sediment quality Surface water quality and quantity Groundwater quality and quantity Fish and Fish Habitat Socio-economic Conditions	Negligible	Moderate to Very High	8 to 6[(a)]	Negligible likelihood due to engineering design and regular inspections by qualified professionals. Moderate to very high consequences due to potential impact on worker health and safety and the environment.
Project-related Fires	Affects human environment, local terrestrial habitat loss	Air Greenhouse Gases Habitat and Flora Avifauna Terrestrial Fauna Species of Conservation Interest/Species at Risk Mi'kmaq of Nova Scotia Socio-economic Conditions	Very Low	Moderate to Very High	7 to 5[(a)]	Very Low likelihood due to being designed to mitigate damage, ongoing monitoring, and inspections by qualified professionals to ensure buildings are up to code, and employee training Moderate to very high consequences due to potential impact on infrastructure and people.

Note: Risk rating values are based on a risk rating matrix evaluation (Figure CEAA 2-18-1). Each credible potential accident and malfunction discussed is assessed according to likelihood of occurrence and level of magnitude/consequence of occurrence, and given a risk rating of between 1 (highest) and 9 (lowest). Each risk rating refers to a diagonal row of cells within a risk rating matrix shown in the same colour (Figure CEAA 2-18-1). An increased risk is associated with accidents and/or malfunctions having a greater likelihood of occurrence and increased level of magnitude/consequence.

[(a)] Where a risk rating range is used the largest risk rating is chosen (i.e., lowest number is considered a larger risk).

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Round 2 Information Request Number:	CEAA-2-19
Regulatory Agency/Indigenous Community:	DFO
Topic/Discipline:	Fish and Fish Habitat
EIS Guideline Reference:	Part 6, Section 6.1.6 Effects Assessment: Fish and Fish Habitat
Revised EIS (February 28, 2019) Reference:	Section 6.9 Fish and Fish Habitat; 6.9.2 Baseline Program Methodology; 6.9.3 Baseline Conditions; Tables 6.9-2, 6.9- 3 and 6.9-4

Context and Rationale

Section 6.1.6 of the EIS Guidelines requires that the proponent include the following in the EIS: "a description of the habitat by homogeneous section, including the length of the section, width of the channel from the high water mark (bankful width), water depths, type of substrate (sediments), aquatic and riparian vegetation, and photos".

Section 6.9.2 of the revised EIS provides an overview of the baseline program methodology, with section 6.9.3 indicating baseline habitat results. However, the proponent has not provided detailed results as prescribed in the EIS Guidelines. These results would aid in verifying fish habitat found in each watercourse, as well as confirm fish habitat descriptions/classifications given to each watercourse in Tables 6.9-3 and 6.9-4.

The Proponent is Required to …

Provide a description of the habitat by homogeneous section as described in section 6.1.6 of the EIS Guidelines.

Response

A description of fish habitat by homogeneous section is provided in the Beaver Dam Mine Project Baseline Fish and Fish Habitat 2019-2020 Technical Report (Appendix J.2, Section 3.4, PDF page 45 of the Updated 2021 EIS [AMNS 2021]). The methods used to describe habitats are outlined in Section 6.9.3.3, page 6-438 in the Updated 2021 EIS (AMNS). Detailed habitat descriptions for homogeneous sections of aquatic habitats with anticipated impacts within the Mine Site are described in Section 6.9.4.2.1, Table 6.9-2, page 6-463 and Table 6.9-3, page 6-465 of the Updated 2021 EIS (AMNS 2021). Additional baseline information on aquatic habitats (those with no anticipated impacts) within the Mine Site are provided in Appendix H, Section 3.4, Table 3-11, PDF page 314 of Appendix J.2 of the Updated 2021 EIS (AMNS 2021).

Table CEAA-2-19-1 provides a summary of waypoints for homogeneous sections (reaches) of watercourses were assessed using the detailed habitat description methodology within the Beaver Dam Mine Site (homogeneous sections of watercourses are described in Tables 6.9-2, page 6-463 and 6.9-3, page 6-465 of the Updated 2021 EIS (AMNS 2021), for the Mine Site and Haul Road, respectively). Each watercourse and reach (homogeneous section) are shown graphically on Figures J.4-2A to J.4-2D, PDF pages 7 to 10 of Appendix J.4 in the Updated 2021 EIS (AMNS 2021) and included as part of this response as Figures CEAA 2-19-1A to CEAA-2-19-1D. Coordinates of individual transects within each reach are provided in Appendix G, Table 3, PDF page 272 of the Baseline Fish and Fish Habitat 2019-2020 Technical Report (Appendix J.2 of the Updated 2021 EIS [AMNS 2021]).

Table CEAA-2-19-1: Coordinates Associated with Detailed Habitat Evaluation for Watercourses with Anticipated Impacts: Beaver Dam Mine Site

WC #	Reach #	Upstream Coordinates		Downstream Coordinates	
		Easting	Northing	Easting	Northing
5	1	521565	4990210	521564	4990227
5	2	521564	4990227	521560	4990270
5	3	521560	4990270	521474	4990394
5	4	521474	4990394	521447	4990447
5	5	521447	4990447	521427	4990478
5	6	521427	4990478	521407	4990515
5	7	521407	4990515	521411	4990577
5	8	521411	4990577	521531	4990845
12	1	522148	4990329	522197	4990330
13	1	522688	4990227	522716	4990240
13	2	522716	4990240	522731	4990231
13	3	522731	4990231	522749	4990224
13	4	522750	4990231	522767	4990252
13	5	522767	4990254	522778	4990294
14	1A	522770	4990120	522746	4990135
14	1B	522732	4990026	522746	4990135
14	2	522746	4990135	522736	4990161
20	1	520058	4989895	519983	4989705
21	1	520059	4990173	520069	4990158
21	2	520069	4990158	520092	4990140
22	1	520131	4989803	520043	4989785
23	1	519779	4989575	519674	4989469
23	2	519674	4989469	519697	4989341
23	3	519697	4989341	519481	4988642
25	1	522422	4990526	522428	4990556
26	1	520229	4990824	520094	4990947
26	2	520094	4990947	520000	4991378
27	1	521352	4991027	521228	4991199

All other watercourses were described in a qualitative manner. Within the Mine Site, remaining (numbered) watercourses are not predicted to be affected by the Project. Lettered watercourses are present along the Haul Road; some of which are proposed for alteration to facilitate construction of culvert crossings. These assessed reaches along the Haul Road represent reaches that are very short in length, and qualitative assessment described in Section 6.9.4.2.2, Table 6.9-4, page 6-467 of the Updated 2021 EIS (AMNS 2021) are reflective of homogeneous sections (reaches) of each watercourse assessed. Table CEAA-2-19-2 provides

reference waypoints (upstream end) for all watercourses, which are also shown graphically on Section 6.7.3, Figures 6.7-1 and 6.7-2, pages 6-218 to 6-222 of the Updated 2021 EIS (AMNS 2021).

Table CEAA-2-19-2: Reference Waypoints for Watercourses identified within the Project Area

Watercourse	Tertiary Watershed	UTM Easting	UTM Northing
1	Tent Lake	522631	4989087
2	Cameron Flowage	522050	4990014
3	Cameron Flowage	522024	4989866
4	Cameron Flowage	521450	4990084
5 (top near WL2)	Cameron Flowage	521808	4989574
5 (Lower near WL14)	Cameron Flowage	521555	4990209
6	Cameron Flowage	521379	4990527
7	Cameron Flowage	521438	4990346
8	Cameron Flowage	521343	4990272
9	Cameron Flowage	521536	4990206
10	Kent Lake	521394	1989508
11	Kent Lake	521166	4989752
13	Cameron Flowage	522689	4990224
14	Cameron Flowage	522734	4990027
15	Cameron Flowage	5200961	4990506
16	Cameron Flowage	520825	4990602
17	Cameron Flowage	520938	4990711
18	Cameron Flowage	522896	4989817
19	Tent Lake	523301	4988607
20	Cope Brook	520060	4989901
21	Cope Brook	520059	4990173
22	Cope Brook	520133	4989803
23	Cope Brook	519780	4989577
24	Cope Brook	520219	4989715
25	Cameron Flowage	522421	4990531
26	Cameron Flowage	520003	4991349
27	Cameron Flowage	521351	4991021
A	Tent Lake	522628	4988891
B	Tent Lake	522705	4988568
C	Tent Lake	522752	4988169
D	Tent Lake	522828	4987773
E	Brandon Lake	522907	4987152
F	Brandon Lake	522841	4986566
G	Brandon Lake	522621	4986101

Table CEAA-2-19-2: Reference Waypoints for Watercourses identified within the Project Area (continued)

Watercourse	Tertiary Watershed	UTM Easting	UTM Northing
H	Brandon Lake	522562	4985938
I	Brandon Lake	522547	4985881
J	Brandon Lake	522554	4985838
K	Brandon Lake	522306	4984470
L	Brandon Lake	522312	4984339
M	Brandon Lake	522234	4984150
N- West River Sheet Harbour	Brandon Lake /Rocky Brook Lake	521887	4983922
O	Lake Alma	521193	4983426
O	Lake Alma	521250	4983332
P	Lake Alma	520111	4982977
Q	Lake Alma	518454	4982878
R	Lake Alma	518335	4982893
S	Lake Alma	518117	4983044
T	Lake Alma	517873	4982824
U	Lake Alma	517441	4982674
V	Lake Alma	517395	4982554
W	Lake Alma	517500	4982275
X	Lake Alma	517549	4982187
Y	Lake Alma	517595	4982084
Z	Lake Alma	517675	4981893
AA	Eagles Nest	516527	4979693
AB	Eagles Nest	516303	4979597
AC	Eagles Nest	515091	4979240
AD	Eagles Nest	514588	4978868
AE	Rocky Lake	514402	4978588
AF	Rocky Lake	514346	4978527
AG	Rocky Lake	514286	4978468
AH	Rocky Lake	514249	4978518
AI	Lake Alma	521480	4983395

References

AMNS (Atlantic Mining NS Inc.). 2021. Updated Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. October 2021. Middle Musquodoboit, NS.

Prepared For:

Atlantic Gold

FIGURE CEAA 2-19-1A

Beaver Dam Mine Project Fish Habitat Evaluation Results: Beaver Dam Mine Site

West Brook

Killage River (Upstream)

Killag River

Killag River at WC-26

WC-26

WC26-R2-T10

WC26-R2-T9

R2

WC26-R2-T5

WC-26

WC26-R2-T3

R1

WL231

WL207

WC-16

WL228

WL229

WL209

WL208

WL215

519500

520000

520500

4991500

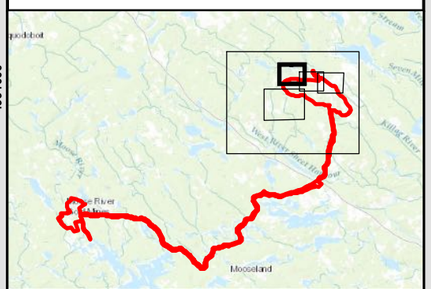
4991000

4990500

Fish Habitat Quantification: Dominant Habitat Type by Reach (R)

- Flat

- Daily Flow Assessment Points
- Transect Locations
- Track
- Topo Contours (5 m)
- Field Delineated Watercourses within PA
- NSTDB Mapped Watercourses outside PA
- Lake
- Field Delineated Wetlands within PA
- NSE Mapped Wetlands outside PA
- Planned Infrastructure
- Fish Habitat Assessment Area (FHAA)



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
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Document Name: BD_EIS_Figure6-9-2FishHabMethods2zoom

Prepared For:

Atlantic Gold

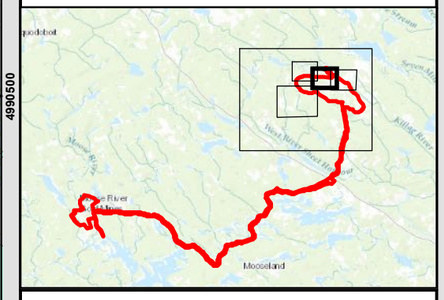
FIGURE CEAA 2-19-1**B**

Beaver Dam Mine Project Fish Habitat Evaluation Results: Beaver Dam Mine Site

Killag River At WC-27
WC-27 (Downstream)
R1
WC-27
WC27-R1-T3
WC27-R1-T2
WC27-R1-T1
WC-27 (Upstream)
WL257
Killag River At Cameron Flowage
Killag - T1
Killag - T2
Killag - T3
Killag River
Mud Lake
WC-5 (Downstream)
R8
WC-5
WL216
WL206
WC-17
WC-16
WL207
WL204
WL60
WL17
WL210
WC-15
WL16
WC-6
R7
R6
R5
R4
R3
WL18
WL208
WL215
WL213
WC-7
WL19
WL59
WL56
WL55
R1
WC-12
WL211
WL214
WL202
WC-8
WL15
WC-9
R2
R1
WC-5
WL20
WL212
WL10
Crusher Lake
Crusher Lake
WC-3
WL203
WL200
WC-4
WL7
WL4
WL31
WL201
WL40
WL11
WL8
WL12
WC-2
WL29
WL32
WL39
WL13
WL5
4991000
4990500
4990000
521000
521500
522000

Fish Habitat Quantification: Dominant Habitat Type by Reach (R)
- Cascade
- Rapid
- Run
- Pool
- Flat
- No Defined Channel
- Seep

- Daily Flow Assessment Points
- Transect Locations
- Local Road
- Dry Weather / Seasonal Road
- Track
- Topo Contours (5 m)
- Field Delineated Watercourses within PA
- NSTDB Mapped Watercourses outside PA
- Open Water
- Lake
- Field Delineated Wetlands within PA
- NSE Mapped Wetlands outside PA
- Planned Infrastructure
- Fish Habitat Assessment Area (FHAA)



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Projection: Transverse Mercator
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Reviewed By: XX

McCallum Environmental Ltd.

Document Name: BD_EIS_Figure6-9-2FishHabMethods2zoom

Prepared For:

Atlantic Gold

FIGURE CEAA 2-19-1**C**

Beaver Dam Mine Project Fish Habitat Evaluation Results: Beaver Dam Mine Site

Killag River

Killag River At Cameron Flowage

Killag - T1

Killag - T2

Killag - T3

Killag - T4

Killag - T5

Killag - T6

Killag - T7

Killag - T8

Killag - T9

Killag River (Far Field)

Cameron Flowage

WL216

WL17

WL60

WL62

WC-25

WL59

WL61

WL56

WL55

R1

WC-12

WC-13

R4

R5

WL20

WC-3

WL7

WL4

WL12

WC-2

WL5

WL2

R1A

R1B

WC-14

WL34

WL57

WL58

WL217

WC-18

4991000

4990500

4990000

522000

522500

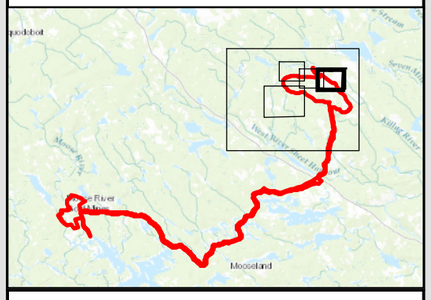
523000

523500

Fish Habitat Quantification: Dominant Habitat Type by Reach (R)

- Step-pool
- Run
- Riffle
- Pool
- Flat
- Seep

- Daily Flow Assessment Points
- Transect Locations
- Lime Doser
- Local Road
- Dry Weather / Seasonal Road
- Track
- Topo Contours (5 m)
- Field Delineated Watercourses within PA
- NSTDB Mapped Watercourses outside PA
- Open Water
- Lake
- Field Delineated Wetlands within PA
- NSE Mapped Wetlands outside PA
- Planned Infrastructure
- Fish Habitat Assessment Area (FHAA)



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Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

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Drawn By: LP Date: 2021-04-14
Reviewed By: XX

McCallum Environmental Ltd.

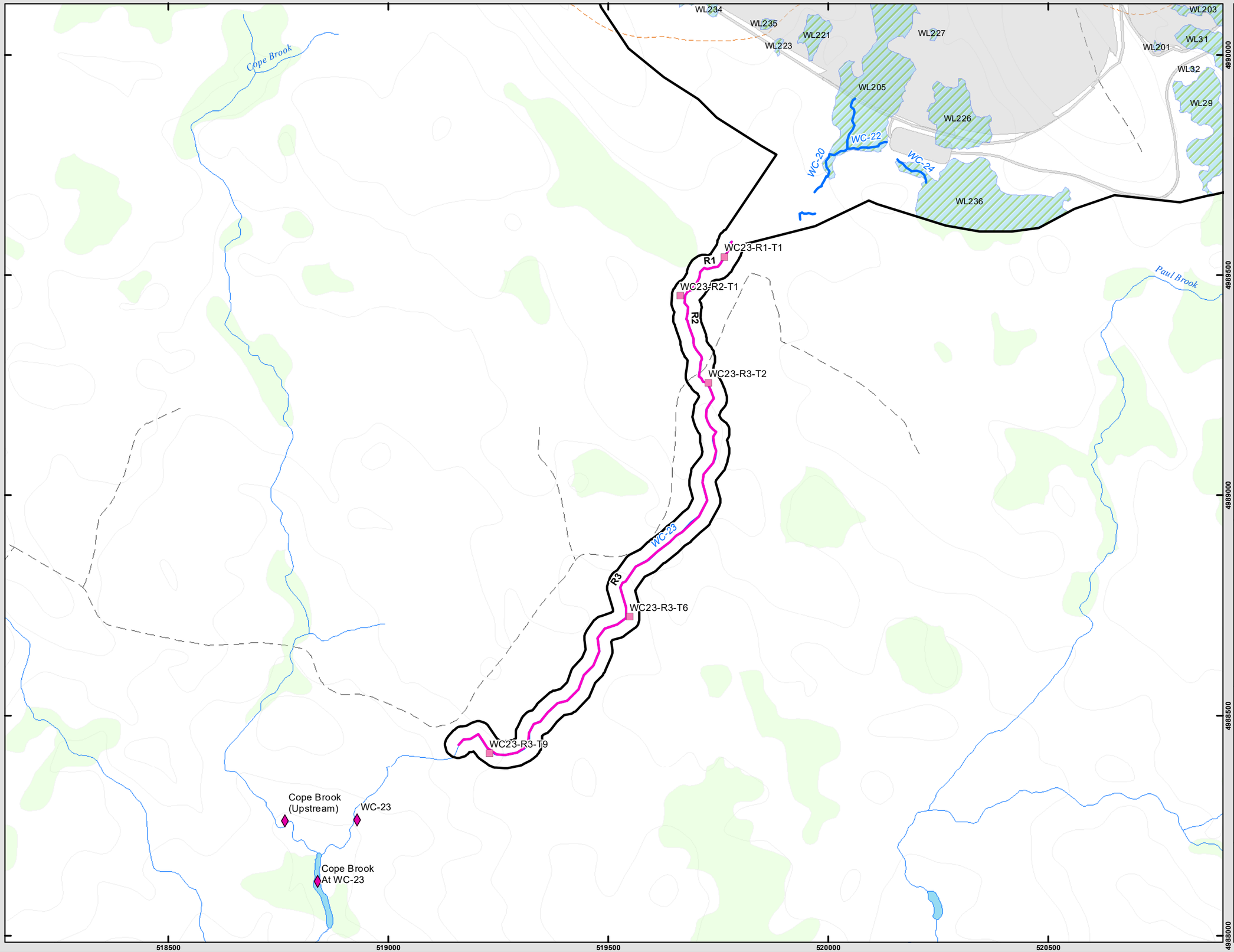
Document Name: BD_EIS_Figure6-9-2FishHabMethods2zoom

Prepared For:

Atlantic Gold

FIGURE CEAA 2-19-1D

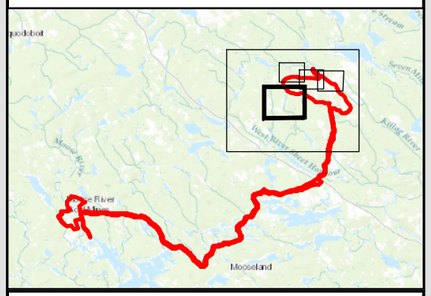
Beaver Dam Mine Project Fish Habitat Evaluation Results: Beaver Dam Mine Site



Fish Habitat Quantification: Dominant Habitat Type by Reach (R)

- Flat

- Daily Flow Assessment Points
- Transect Locations
- Dry Weather / Seasonal Road
- Track
- Topo Contours (5 m)
- Field Delineated Watercourses within PA
- NSTDB Mapped Watercourses outside PA
- Lake
- Field Delineated Wetlands within PA
- NSE Mapped Wetlands outside PA
- Planned Infrastructure
- Fish Habitat Assessment Area (FHAA)



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

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Document Name: BD_EIS_Figure6-9-2FishHabMethods2zoom

Round 2 Information Request Number:	CEAA-2-20
Regulatory Agency/Indigenous Community:	DFO
Topic/Discipline:	Fish and Fish Habitat
EIS Guideline Reference:	Part 6, Section 6.1.6 Effects Assessment: Fish and Fish Habitat
Revised EIS (February 28, 2019) Reference:	Section 6.9.5.2 Section 6.9 Fish and Fish Habitat; 6.9.6 Project Activities and Fish and Fish Habitat Interactions and Effects; Table 6.9- 28, Figures 6.7-3A - 6.7-3Lfor Determination of Significance; Section 6.9.9 Residual Effects and Significance

Context and Rationale

Section 6.9.6.2 of the revised EIS gives an overview of potential direct and indirect impacts within the Haul Road project area. Widening and re-alignment within the Haul Road to support upgrades for the Project will be required. Table 6.9-28 provides an overview of the potential or confirmed impact to fish habitat (m2) within wetlands along the Haul Road. Figures 6.7-3A to 6.7-3L visually depict potential impacts to fish habitat within streams and wetlands along the Haul Road.

It is unclear how the proponent calculated the potential/confirmed impact to fish (m2) in Table 6.9-28. Figures 6.7-3A-6.7-3L show differing areas of wetlands affected around the Haul Road. Some wetlands are only impacted directly within the Haul Road footprint, while others have an equal buffer of impact north and south of the road, and some have an irregular buffering of impact around the road.

The Proponent is Required to …

Clarify the procedures utilized to calculate impacts to fish habitat (m2) in wetlands along the Haul Road. Explain why affected wetland areas in Figures 6.7-3A to 6.7-3L are not consistent on either side of the Haul Road for each wetland.

Response

The procedures used to calculate impacts to fish habitat (m^2) in wetlands along the Haul Road are summarized in Section 6.9.3.3.2, page 6-438 of the Updated 2021 EIS (AMNS 2021) and described in further detail in the 2019-2020 Baseline Report (Appendix J.2 of the Updated 2021 EIS [AMNS 2021]).

Along the Haul Road, wetland boundaries were defined following methods outlined by the Army Corps of Engineers (2012), using indicators of wetland vegetation, hydrology and hydric soil to identify wetland habitats. Fish habitat within wetlands was identified based on presence of contiguous surface water and/or open water areas, based on field observations recorded during wetland and watercourse delineation surveys, and fish habitat and collection surveys along the Haul Road (as described in Section 6.9.4.2.2, page 6-466 of the Updated 2021 EIS [AMNS 2021]). Impacts to wetlands which do not provide fish habitat (i.e., isolated wetlands, wetlands lacking surface water) are fully evaluated in Section 6.8.7.1, page 6-390. Fish habitat within wetlands was described in a conservatively inclusive manner. Since the Haul Road Study Area was relatively narrow and linear in nature; watercourses were not typically assessed beyond the PA to confirm connectivity; as a result, where open water or watercourses were observed, they were presumed to be accessible to fish.

All areas of wetland with confirmed or expected fish habitat (contiguous surface water and/or open water areas) overlapped by the Haul Road re-alignment cut and fill extent (maximum direct impact area of Haul Road) have been calculated using average width

and length measurements recorded during qualitative habitat evaluation (i.e., width of watercourse x length of impacted watercourse = area of directly impacted waterbody). Haul Road impacts are provided in m^2, as requested in IR2 CEAA 2-20, and they include new culvert installations, and replacement of existing culverts to accommodate widening of the road. Impact areas were assessed on a case-by-case basis, considering the context of whether a crossing was new or existing, and considering the condition of existing culverts. In instances where a culvert was present but deemed based on condition to be impassable to fish, the upgraded culvert proposed was determined to be a net benefit to fish and fish habitat; these are identified in Table 6.9-19, page 6-511 of the Updated 2021 EIS (AMNS 2021) as improvements to fish passage, with no direct impact to fish habitat. While the improvement of fish passage is acknowledged; the benefits to fish related to access to new habitats have not been quantified or considered in the Preliminary Fish and Fish Habitat Offset Plan (Appendix J.3 of the Updated 2021 EIS [AMNS 2021]). This impact area also includes an allowance for a multi-use bypass road, which has been added to the Project Description. All expected direct impacts to fish and fish habitat from the Haul Road and bypass road are shown on Figure J.4-6 (Appendix J.4 of the Updated 2021 EIS [AMNS 2021]).

Some wetlands that are expected to provide fish habitat have been excluded from direct impact calculations based on the Haul Road re-alignment where the road will not impact portions of wetlands accessible to fish. For example, WL169 is contiguous with John's Pond; but proposed impacts to this wetland are in a portion of the wetland inaccessible to fish; meaning that portion of the wetland lacks standing water at any time of the year (in this example, the impact is proposed on the south side of the existing forestry road with no hydrologic connectivity between that portion of the wetland and John's Pond. A similar situation would involve impacts to a portion of a wetland complex which lacks standing water at all times of the year, such as a treed swamp component of a wetland complex). In other examples, the presence of the existing forestry road has resulted in a backup of water on one side of the road. In these situations (i.e., Wetlands 64 and 66), the wetland boundaries and flooded waters accessible to fish are different sizes on each side of the existing road, based on installation of inadequate drainage structures at the time of road construction. In these situations, wetland impacts, and impacts to fish habitat in those wetlands, will not be consistent on each side of the road. Wetlands that were assessed as isolated with no surface water connectivity to fish-bearing systems and/or open water features are considered non-fish bearing and do not provide fish habitat (i.e., WL89). In addition, wetlands with throughflow watercourses are not discussed further if fish habitat was determined to the be confined to the watercourse channel (entrenched), and not provided within the wetland itself (i.e., WL74 is contiguous with WCF, which is highly entrenched. Impact to fish habitat here is described in relation to WCF, not WL74).

The proposed cut and fill line for the upgraded haul road and a multi-use bypass road was used to calculate impact areas to fish habitat. Inconsistencies in direct impact areas on each side of the Haul Road, as displayed on Figure J.4-6 of Appendix J.4 (Updated 2021 EIS [AMNS 2021]), should be expected. Wetlands/fish habitat areas (m^2) that overlap the Haul Road re-alignment are based on wetland habitat on either side of the road, with any irregular buffering of impact occurring based on cut and fill extents and local topographic relief (Updated 2021 EIS [AMNS 2021]).

References

AMNS (Atlantic Mining NS Inc.). 2021. Updated Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. October 2021. Middle Musquodoboit, NS.

US Army Corps of Engineers. 2012. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0).

Round 2 Information Request Number:	CEAA-2-21
Regulatory Agency/Indigenous Community:	DFO, KMKNO, ESFW, Save Caribou
Topic/Discipline:	Fish and Fish Habitat
EIS Guideline Reference:	Part 6, Section 6.1.6 Effects Assessment: Fish and Fish Habitat
Revised EIS (February 28, 2019) Reference:	Section 6.9 Fish and Fish Habitat; 6.9.7 Preferred Alternative Haul Road; Table 6.9- 32; Figure 6.8-1

Context and Rationale

Section 6.9.7 of the revised EIS provides an effects assessment of the newly added Preferred Alternative Haul Road route.

Construction of the Preferred Haul Road section will require the alteration of wetlands which provide habitat for fish. Table 6.9-32 gives an overview of the fish habitat within wetlands along the Preferred Alternative Haul Road. Figure 6.8-1 visually depicts watercourses and wetlands along the Preferred Alternative Haul Road.

It does not appear that the proponent calculated the potential/confirmed impact to fish (m2) within wetlands from the Preferred Alternative Haul Road. Figure 6.9-32 also fails to show areas of wetlands affected around the Preferred Alternative Haul Road.

The Proponent is Required to …

Calculate impacts to fish habitat (m2) in wetlands along the Preferred Alternative Haul Road and indicate the methods for their calculations; maintain consistency with section 6.9.6.

Update Figure 6.8-1 to include potential impacts to fish habitat.

Response

The Preferred Alternative Haul Road (PAHR) has been removed from the Beaver Dam Mine Project Description (Updated 2021 EIS [AMNS 2021], Section 2). As noted in Section 6.9.7.3, page 6-508 of the Updated 2021 EIS (AMNS 2021), expected direct impacts to fish and fish habitat that will result in a HADD from the Haul Road and bypass road are presented in Section 6.9.7.3.1, Table 6.9-19, page 6-511 of the Updated 2021 EIS (AMNS 2021).

References

AMNS (Atlantic Mining NS Inc.). 2021. Updated Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. October 2021. Middle Musquodoboit, NS.

Round 2 Information Request Number:	CEAA-2-22
Regulatory Agency/Indigenous Community:	DFO
Topic/Discipline:	Fish and Fish Habitat
EIS Guideline Reference:	Part 6, Section 6.1.6 Effects Assessment: Fish and Fish Habitat
Revised EIS (February 28, 2019) Reference:	Section 6.9 Fish and Fish Habitat; 6.9.7.3.2 Preferred Alternative Haul Road - Electrofishing; Table 6.9-33

Context and Rationale

Section 6.9.7.3.2 of the revised EIS provides an overview of the contiguity between watercourses within the Preferred Alternative Haul Road route and electrofishing results from the original Haul Road surveys. Table 6.9-33 provides an overview of the contiguity between the Preferred Alternative Haul Road watercourses and original Haul Road watercourses. The description of the contiguity between the two routes as described in Table 6.9-33 and the text below are not consistent.

The Proponent is Required to …

Clarify if the text or table is correct with respect to contiguity and make the appropriate corrections to ensure consistency throughout the revised EIS. Base any conclusions on these correlations.

Response

The Preferred Alternative Haul Road (PAHR) route has been removed from the updated Beaver Dam Mine Project Description (Updated 2021 EIS [AMNS 2021], Section 2).

References

AMNS (Atlantic Mining NS Inc.). 2021. Updated Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. October 2021. Middle Musquodoboit, NS.

Round 2 Information Request Number:	CEAA-2-23
Regulatory Agency/Indigenous Community:	DFO, KMKNO, ESFW
Topic/Discipline:	Fish and Fish Habitat
EIS Guideline Reference:	Part 2, 6.3.1 Fish and Fish Habitat
Revised EIS (February 28, 2019) Reference:	Table 6.9-37 Residual Environmental Effects for Fish and Fish Habitat on page 511; Biological Monitoring Studies ii in Appendix O.1

Context and Rationale

In reference to Table 6.9-37, the proponent indicates that impacts to fish habitat will be quantified and confirmed through monitoring to determine if serious harm to fish is likely.

The preliminary Environmental Effects Monitoring Plan (EEMP) was prepared to outline the proposed monitoring to support the Project.

Section 8.5.6.2.3.1, indicates that there is some uncertainty as to Project effects on fish and fish habitat. The proposed approach to reduce this uncertainty is to implement monitoring programs and follow-up programs. It is critical to accurately characterize and quantify the impacts to fish and fish habitat prior to the issue of an Environmental Assessment approval so that the appropriate avoidance, mitigation, monitoring and counterbalancing measures are included as terms and conditions of the approval.

DFO cannot provide an accurate determination of the area of serious harm to fish if the proponent has yet to characterize and quantify the impacts of the Project on fish and fish habitat. If monitoring is required to accurately assess the potential impacts to fish and fish habitat, monitoring should be undertaken prior to the Environmental Assessment.

The Proponent is Required to …

Provide a rationale as to why no monitoring approaches for fish and fish habitat have been provided in the preliminary EEMP.

Response

Detailed baseline data has been collected on fish and fish habitat to inform the effects assessment in Section 6.9.7, page 6-485 and as part of the Environmental Effects Monitoring Program (EEMP), which has been implemented to support Mineral and Diamond Mining Effluent Regulations (MDMER). The EEMP is one component of the broader Aquatic Effects Monitoring Program (AEMP), which will monitor fish and fish habitat, including water and sediment quality, periphyton and benthic invertebrates and hydrology. A draft AEMP has been developed and is provided as Appendix P.5 of the Updated 2021 EIS (AMNS 2021).

Round 2 Information Request Number:	CEAA-2-24
Regulatory Agency/Indigenous Community:	ECCC
Topic/Discipline:	Migratory Birds, Fauna and Species of Concern
EIS Guideline Reference:	Section 6.1.5; Section 6.1.7; Section 6.1.8; Section 6.2; Section 6.3.2; Section 6.3.3; Section 6.4; Section 6.5; Section 8
Revised EIS (February 28, 2019) Reference:	Section 6.10, 6.12, 6.13; Section 8.5: Section 9.2

Context and Rationale

Wetland Habitat for Migratory Landbird Species At Risk (SAR)

Wetland Habitat for Migratory Landbird Species At Risk (SAR) The Project as proposed will result in the loss of wetland function (i.e. habitat for landbird SAR). For those wetlands that cannot be avoided and for those where direct and indirect effects cannot be entirely minimized, conservation allowances should be considered as a compensation. However, it is unclear whether the proponent's proposed wetland compensation would include conservation allowances for affected habitat for wetland function loss (landbird SAR).

Bank Swallow

While it was not detected during surveys of the project area, bank swallow is another migratory bird SAR, which nests in Nova Scotia and may be attracted to un-vegetated stockpiles of soil with faces at 70 – 90° slopes during the months of May to July.

Greater Yellowlegs

The Project as proposed will result in the loss of breeding habitat for greater yellowlegs, and may cause disturbance to migratory birds in areas where habitat is not directly affected by the Project. Pairs establishing territories, nesting birds and chick-rearing birds shall not be disturbed, as per the Migratory Birds Convention Act. For this reason, ECCC generally recommends a minimum setback of 300 m from greater yellowlegs from mid-April until chicks have naturally left the area.

The Proponent is Required to …

Provide details on the conservation allowance for loss of wetland function (habitat for landbird SAR) that will be implemented.

Provide details on a landbird SAR monitoring program that would be implemented that includes adaptive management measures to be implemented in the event that unanticipated effects are detected.

Confirm that measures similar to those proposed for common nighthawk will also be implemented for bank swallows due to potential attraction to the project area as a result of project-related changes in habitat.

Provide details on the measures that will be implemented to avoid effects of habitat loss of greater yellowlegs. Clarify whether buffers would be established if greater yellowlegs nest near, but not within, the project footprint.

Response

Request A: Provide details on the conservation allowance for loss of wetland function (habitat for landbird SAR) that will be implemented.

The residual loss of wetland habitat as a result of Project development reduces local breeding habitat for landbird Species at Risk (SAR). Conservation allowances for loss wetland function have been included in the updated Preliminary Wetland Compensation Plan (Appendix H.3 included in the Updated 2021 EIS [AMNS 2021]), specifically for observed landbird SAR (Canada warbler, olive-sided flycatcher, and rusty blackbird) that utilize these habitats for critical life functions (i.e., breeding).

The wetland restoration project(s) outlined in the Preliminary Wetland Compensation Plan will target wetland restoration and restoration of wetland function (i.e., landbird SAR breeding habitat), as breeding habitat is expected to be lost as a result of wetland alteration, and land conversion of breeding habitat is a primary threat to these species (unknown if this is the cause of decline in olive-sided flycatcher) (Environment Canada 2015a,b, 2016). The breeding habitat requirements for the three migratory landbird SAR and overwintering habitat for snapping turtle are described below:

Canada warbler (SARA Threatened; NSESA Endangered, ACCDC S3B)
The Canada warbler has a wide range of suitable habitats, including deciduous, coniferous, and mixed forests, with a well-developed shrub layer. Their preferred habitat is moist mixed forests (COSEWIC 2008). Primary breeding habitat is the dense shrub understory in wetlands or old-growth forests (Environment Canada 2016).

Rusty blackbird (SARA Special Concern; NSESA Endangered, ACCDC S2B)
Rusty blackbird breeding habitat is forested wetlands, including peat bogs, sedge meadows, marshes, swamp, beaver ponds, slow moving streams, and pasture edges (COSEWIC 2006). Breeding sites typically contain shallow open water with emergent vegetation adjacent to conifer or tall shrub wetlands (Environment Canada 2015a). Powell et al. (2014) found that wetlands with non-fish bearing shallow open water, beaver activity, and >70% coniferous cover along the upland edge were often occupied by breeding rusty blackbird.

Olive-sided flycatcher (SARA Threatened; NSESA; Threatened ACCDC S2B)
Suitable habitat for the olive-sided flycatcher includes open areas with tall trees or snags, forest openings, forest edges near natural openings, or human-made openings. Suitable breeding habitat also includes coniferous or mixed coniferous forests, likely near water or wetlands (Environment Canada 2015b).

The detailed design process will include modelling of specific hydrological conditions and detailing the groundwork activities that are required to be implemented at the site to meet the objectives of the restoration project as it relates to restoration of wetland function (landbird SAR breeding habitat). Specific habitat objectives and restoration activities are outlined in the Preliminary Wetland Compensation Plan and will include the following (Table CEAA-2-24-1):

Table CEAA-2-24-1: Restoration Actions to Provide Habitat for Species at Risk

Common Name	Scientific Name	Action Description
Canada warbler	Cardellina canadensis	Site contouring to create uneven ground.
		Planting and/or natural revegetation of speckled alder (*Alnus incana*) and other deciduous shrubs (2.5 to 3.5 m tall, when fully grown)[a]. Shrub cover should average 79%.
		Planting and/or natural revegetation of ferns (e.g., *Osmundastrum cinnamomea*) in the herbaceous layer[a].
Rusty blackbird	Euphagus carolinus	Shallow open water, at depths to support emergent vegetation (<30 cm).
		Open water situated adjacent shrub swamp (i.e., Canada warbler habitat).
		Site contouring to create depressions able to hold additional small pools/puddles.
		Coniferous upland edge to wetland[b]. Supplemental planting of spruce (*Picea* sp.) and/or balsam fir (*Abies balsamea*) along upland edge of wetland, if planting increases connectivity to intact forest.
Olive-sided flycatcher	Contopus cooperi	Open areas.
		Near water (to provide high densities of insects for foraging).
		Retain snags and tall trees.
		Tall artificial snags erected from wooden poles or logs[c]. Density of snags should meet a minimum of 13/ha[d].

Notes: [a] Availability of certain seeds/spores at time of restoration unknown.

[b] Site dependant on surrounding landscape/forest community.

[c] Artificial snag specifications and installation is described in detail in Eaton et al., 2014. Generally, snags should be installed using the same methods and equipment as those used to install powerline poles. Inverting snags with root balls can provide enhanced perching opportunities.

[d] Robertson et al., 2007; Eaton et al., 2014

While the Preliminary Wetland Compensation Plan targets replacement of lost wetland function (landbird SAR breeding habitat), these species also forage within their breeding habitat, therefore, by creating breeding habitat, foraging habitat is also created. Furthermore, some habitat requirements are similar across the SAR (i.e., riparian and open water features) which will be targeted to meet restoration objectives for multiple species. The exact scope required for the detailed design process will be determined in consultation with NSE, NSLF, and ECCC.

Request B: Provide details on a landbird SAR monitoring program that would be implemented that includes adaptive management measures to be implemented in the event that unanticipated effects are detected.

Baseline surveys conducted for the Updated 2021 EIS (AMNS 2021) demonstrate that Project-related development will occur within know landbird SAR habitat. As a result, a Landbird SAR Mitigation and Monitoring Plan (Appendix A, PDF page 24 in Appendix P.7 [draft Wildlife Mitigation and Monitoring Plan] of the Updated 2021 EIS [AMNS 2021]) was developed to present monitoring protocols for landbird SAR during Project development phases, assess the effectiveness of applied mitigation measures, and provide adaptive management approaches in the event unanticipated effects are detected.

The following landbird SAR species have been documented within the Beaver Dam Mine Site and along the Haul Road during EIS baseline surveys (Updated 2021 EIS [AMNS 2021]) and will be targeted during the landbird SAR mitigation and monitoring program:

- Chimney Swift (*Chaetura pelagica;* COSEWIC & SARA: Threatened; NSESA: Endangered);
- Canada Warbler (*Cardellina canadensis*; COSEWIC & SARA: Threatened; NSESA: Endangered);
- Barn Swallow (*Hirundo rustica*, COSEWIC & SARA: Threatened; NSESA: Endangered);
- Olive-sided Flycatcher (*Contopus cooperi*; COSEWIC Special Concern; SARA & NSESA: Threatened);
- Common Nighthawk (*Chordeiles minor*; COSEWIC: Special Concern; SARA & NSESA: Threatened);
- Eastern Wood-pewee (*Contopus virens*, COSEWIC & SARA: Special Concern; NSESA: Endangered;
- Rusty Black-bird (*Euphagus carolinus*; COSEWIC & SARA: Special Concern; NSESA: Endangered);
- Evening Grosbeak (*Coccothraustes vespertinus*, COSEWIC & SARA: Special Concern; NSESA: Vulnerable); and
- Peregrine Falcon (*Falco peregrinus*; COSEWIC: Not at Risk; SARA: Special Concerned; NSESA: Vulnerable).

The mitigation and monitoring plan has been developed to reassess habitats within the Project Area (PA), specifically the Beaver Dam Mine Site and Haul Road, that are known to support or have the potential to support landbird SAR and develop protocols in the event landbird SAR are observed during Project operations. While the iterative process of Project design has permitted the micro-siting of infrastructure and optimized the proposed site layout to avoid or minimize many impacts to sensitive habitat and known SAR occurrences where practicable, Project interactions with landbird SAR may not be entirely avoidable. The monitoring plan aims to detect, further avoid, and mitigate possible Project related impacts on landbird SAR.

The plan will consist of a focused pre-construction baseline breeding bird survey to confirm landbird SAR usage of the PA. The baseline survey will guide the operational monitoring protocols and proposed adaptive management strategies detailed in the Landbird SAR Mitigation and Monitoring Plan. Continued site monitoring for landbird SAR will be conducted during construction and operations of the Beaver Dam Mine Site and Haul Road. General avifauna management protocols are further outlined in the Wildlife Management Plan (Appendix P.7 of the Updated EIS [AMNS 2021]), which will supplement the landbird SAR monitoring program (Appendix A, PDF page 24 of Appendix P.7 of the Updated EIS [AMNS 2021]).

Request C: Confirm that measures similar to those proposed for common nighthawk will also be implemented for bank swallows due to potential attraction to the project area as a result of project-related changes in habitat.

While some priority species may avoid the PA in favor of undisturbed habitat in the surrounding landscape, others, such as common nighthawk and bank swallow, are anticipated to be attracted to the mine infrastructure and newly created habitat. While bank swallows were not detected during baseline surveys for the Updated 2021 EIS (AMNS 2021), Project activities may increase habitat suitability for this species.

Bank swallows (SAR/COSWIC Threatened, NSESA Endangered) nest in Nova Scotia and have experienced a decline in numbers partially due to loss of nesting habitat or destruction of nest sites (COSEWIC 2013). During their breeding season (mid-April to late

August) this species is particularly drawn to natural and anthropogenic piles of unvegetated soil, sand and gravel pits and sandy banks/berms, specifically with slopes at 70 to 90° and more than 2 m high, even in areas with high activity levels (ECCC 2020). As a result, bank swallows may be attracted to Project infrastructure, such as stockpiles and the open pit, during their breeding season. If a bank swallow nest is observed outside of operational areas, the site will be maintained once chicks have fledged (flagged, buffer removed). The site will be monitored for reuse during the following breading season, as part of the Operational Landbird SAR Monitoring Program. If a nest is found in operational areas (e.g., open pit), AMNS will consult with NSE to remove the nest/nest site. With implementation of mitigation measures, the direct impact to these species is anticipated to be low.

Similar to the mitigations for common nighthawk, the amount of exposed soil and stockpile slope will be limited (<70°) prior to and during nesting season, favoring to cover or revegetate soil, wherever practicable. If nesting is observed, activities in the area will be ceased and a buffer of minimum 50 m will be applied (ECCC 2020). Activities will not be resumed within the buffered area until the birds have left at the end of the breeding season. Monitoring will occur by qualified personnel (e.g., Environmental Technician) to determine if the chicks have fledged and if operations can re-commence. Avian deterrents (e.g., auditory and visual deterrents) that follow best management practices may be used proactively to deter nesting in areas of high activity (i.e., open pit) where activities cannot be suspended, or buffers cannot be maintained. The appropriate regulatory agencies (ECCC and NSLF) will be contacted to determine appropriate mitigation measures in all instances of observed bank swallow breeding or nesting within the PA.

Mitigation, monitoring and adaptive management strategies will be conducted as described in the Landbird SAR Mitigation and Monitoring Plan (Appendix A of Appendix P.7 [draft Wildlife Management Plan] of the Updated EIS [AMNS 2021]).

Request D: Provide details on the measures that will be implemented to avoid effects of habitat loss of greater yellowlegs. Clarify whether buffers would be established if greater yellowlegs nest near, but not within, the project footprint.

Baseline surveys confirm that greater yellowlegs (*Tringa melanoleuca*, ACCDC S3B S3S4M) and their breeding habitat were observed within the PA. Greater yellowleg observations are provided in Section 6.13.4.8.11 – Priority Avifauna Summary, page 6-738 of the Updated 2021 EIS (AMNS 2021). During breeding season, greater yellowlegs prefer graminoid wetlands with open water portions and scattered shrubs and small trees (Cornell University 2019). The current habitat in the proposed mine footprint displays a high level of disturbance and has been fragmented by historical mine operations, forestry operations, and roads. Therefore, much of this area is not high-quality habitat for this species. Suitable nesting habitat for greater yellowlegs is present within the local area surrounding the mine footprint and PA, which will remain unaltered. While some mine related impacts cannot be avoided (i.e., open pit placement dependant on ore location), the iterative Project design process and micro-siting of infrastructure has reduced impacts to possible greater yellowleg breeding habitat where practicable (i.e., Wetlands 8, 44).

Wetland 64 (Haul Road PC 1), the area of highest possible greater yellowlegs nesting evidence within the PA, is located at the north end of the existing Beaver Dam Mine Road, which will be impacted by proposed upgrades and increased traffic. This will occur during the construction and operation phases. The iterative, detailed Project design aims to minimize impact to wetlands which may offer suitable nesting habitat for greater yellowlegs (such as that observed at Haul Road PC3), wherever practicable. As a result of PA and infrastructure modifications, a waterline has been rerouted and will no longer discharge into Wetland 64, avoiding resultant changes in hydrology and greater yellowlegs habitat.

Detailed Haul Road design will consider greater yellowlegs use of Wetland 64, and other locations with observed possible breeding activities and habitat (i.e., Haul Road PC 3 near Wetland 121). However, due to the location of these wetlands and the nature of mine activities (i.e., existing haul road which will be upgraded to provide access to the Beaver Dam Mine Site), it will not be practicable to maintain the recommended setback distance (i.e., 300 m) during the breeding season. Where this distance from Project activities cannot be maintained, the Updated 2021 EIS proposes species-specific mitigation measures for greater yellowlegs within Section 6.13.8 – Mitigation: Priority Avifauna. Adaptive management strategies, such as bird deterrents, have also been proposed to deter greater yellowlegs nesting at known probable nesting sites, where setback distances cannot be maintained. If new breeding evidence or nests are observed within 300 m of Project activities, a site mitigation plan will be developed in consultation with regulators (ECCC and NSLF) to determine alternative and feasible setback distances, mitigation measures, and other adaptive management strategies.

A Landbird SAR Mitigation and Monitoring Plan (Appendix A, PDF page 24 of Appendix P.7 [draft Wildlife Management Plan] of the Updated EIS [AMNS 2021]) has been established to mitigate impacts to landbird SAR during Project construction and operations. While greater yellowlegs are not a SAR, appropriate measures will be taken should this species be incidentally observed during the proposed operational monitoring.

References

AMNS (Atlantic Mining NS Inc.). 2021. Updated Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. October 2021. Middle Musquodoboit, NS.

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COSEWIC. 2013. COSEWIC assessment and status report on the Bank Swallow *Riparia riparia* in Canada. Ottawa. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 48 pp.

Eaton, B.R., Fisher, J.T., McKenna, G.T. and Pollard, J. 2014. An Ecological Framework for Wildlife Habitat Design for Oil Sands

Mine Reclamation. Oil Sands Research and Information Network. University of Alberta, School of Energy and the Environment, Edmonton, Alberta. OSRIN Report No. TR-67. 83 pp.

Environment Canada. 2015a. Management Plan for the Rusty Blackbird (*Euphagus carolinus*) in Canada. *Species at Risk Act* Management Plan Series. Environment Canada, Ottawa. iv + 26 pp

Environment Canada. 2015b. Recovery Strategy for Olive-sided Flycatcher (*Contopus cooperi*) in Canada [Proposed]. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. vi + 51 pp.

Environment Canada. 2016. Recovery Strategy for the Canada Warbler (*Cardellina canadensis*) in Canada. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. vii + 56 pp.

ECCC (Environment and Climate Change Canada). 2020. Bank Swallow (*Riparia riparia*) In Sandpits and Quarries. Ottawa, Environment and Climate Change Canada, Ottawa.

Powell, L. L., T. P. Hodgman, I. J. Fiske, and W. E. Glanz. 2014. Habitat occupancy of Rusty Blackbirds (*Euphagus carolinus*) breeding in northern New England, USA. The Condor 116(1): 122-133.

Robertson, Bruce A. and Hutto, Richard L., 2007. "Is Selectively Harvested Forest an Ecological Trap for Olive Sided Flycatchers?" (2007). Biological Sciences Faculty Publications. 268.

Round 2 Information Request Number:	CEAA-2-25
Regulatory Agency/Indigenous Community:	ECCC
Topic/Discipline:	Migratory Birds, Fauna and Species of Concern
EIS Guideline Reference:	Section 5.0; Section 6.1.1; Section 6.1.10; Section 6.2.1; Section 6.5; Section 8.0
Revised EIS (February 28, 2019) Reference:	Section 6.2.6.2; Appendix C-1, Figure 5

Context and Rationale

The revised EIS (page 165) notes the potential of PM10 criteria being exceeded up to 57% of the time. Even given the conservative estimate of a background concentration, this is still a high frequency in an area with demonstrated Indigenous land and resource issues. The scale of Figure 5 in Appendix C and the limited description of the extent of the exceedances found on page 161 of the revised EIS make it difficult to identify any interactions between the higher ambient concentrations in the vicinity of the Haul Road and the identified sensitive receptors.

The Proponent is Required to …

Provide a more detailed description of the geographical extent of any ambient air quality exceedances and their interaction with any potential sites important for use by Indigenous people.

Response

Air modelling has been updated to support the Updated 2021 EIS (AMNS 2021) and the Round 2 Information Requests (IR2s). The Haul Road between the proposed Beaver Dam Mine 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. Predictive modelling was completed in consideration of 80% dust control along the Haul Road (Section 6.2.7.2, Table 6.2-11, page 6-87 and Appendix C.1, Table 9B, PDF page 45 of the Updated 2021 IES [AMNS 2021]) and included in Table CEAA 2-25-1 below. Based on this updated modelling, there are no exceedances beyond the property boundary of the Haul Road.

Modelling of sources at the Beaver Dam Mine Site and the Touquoy Mine Site showed maximum predicted concentrations at their respective fence lines well below applicable air quality criteria, which are unlikely to cause adverse effects. The results of this modelling are also included below in Tables CEAA 2-25-2 and CEAA 2-25-3.

Maximum predicted TSP, PM_{10}, $PM_{2.5}$ concentrations did not exceed the Canadian Ambient Air Quality Standards (CAAQS) for either the 24-hour or annual averaging periods at any of the sensitive receptor locations, based on Project only (modelled), combined (modelled plus background) or Cumulative traffic with 80% dust control implemented along the Haul Road. 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.

Table CEAA 2-25-1: Maximum Predicted Concentrations due to Haul Road Operations

Parameter	Averaging Period	Assessment Criteria (Ambient Air Quality Standard) (µg/m³)	Maximum Predicted Concentration (µg/m³)	Percentage of Assessment Criteria (%)	Background Concentration (µg/m³)	Combined Effect[a] (µg/m³)	Percentage of Assessment Criteria for Combined Effect (%)
TSP	24-hour	120	54.64	46	17.1	71.04	60
	Annual	70	17.46	25	12.1	29.56	42
PM_{10}	24-hour	50	23.59	47	13.1	36.69	73
$PM_{2.5}$	24-hour	27	2.52	9	9.0	11.52	43
	Annual	8.8	0.98	11	5.7	6.68	76

Source: AMNS 2021, Section 6.2.7, Table 6.2-11, page 6-87 and Appendix C.1, Table 9B, PDF page 45.

Notes: [a] "Combined Effect" equals predicted maximum concentration and background concentration. µg/m³ = micrograms per cubic metre; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; TSP = total suspended particulate.

Table CEAA 2-25-2: Maximum Predicted Concentrations due to Beaver Dam Mine Site Operations

Parameter	Averaging Period	Assessment Criteria (Ambient Air Quality Standard) (µg/m³)	Maximum Predicted Concentration (µg/m³)	Percentage of Assessment Criteria (%)	Background Concentration (µg/m³)	Combined Effect[a] (µg/m³)	Percentage of Assessment Criteria for Cumulative Effect (%)
TSP	24-hour	120	55.3	46	17.1	72.4	60
	Annual	70	21.0	30	12.1	33.1	47
PM_{10}	24-hour	50	25.9	52	13.1	39.0	78
$PM_{2.5}$	24-hour	27	2.9	11	9.0	11.9	44
	Annual	8.8	1.2	14	5.7	6.9	79

Source: AMNS 2021, Section 6.2.7, Table 6.2-8, page 6-85 and Appendix C.1, Table 9B, PDF page 45.

Notes: [a] "Combined Effect" equals predicted maximum concentration and background concentration. µg/m³ = micrograms per cubic metre; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; TSP = total suspended particulate.

Table CEAA 2-25-3: Maximum Predicted Concentrations due to Touquoy Mine Site Operations

Parameter	Averaging Period	Assessment Criteria (Ambient Air Quality Standard) (µg/m³)	Maximum Predicted Concentration (µg/m³)	Percentage of Assessment Criteria (%)	Background Concentration (µg/m³)	Combined Effect[a] (µg/m³)	Percentage of Assessment Criteria for Combined Effect (%)
TSP	24-hour	120	3.1	3	17.1	20.2	17
	Annual	70	1.1	2	12.1	13.2	19
PM_{10}	24-hour	50	3.1	6	13.1	16.2	32
$PM_{2.5}$	24-hour	27	1.3	5	9.0	10.3	38
	Annual	8.8	0.4	5	5.7	6.1	70

Source: AMNS 2021, Section 6.2.7, Table 6.2-14, page 6-88 and Appendix C.1, Table 9B, PDF page 45.
Notes: [a] "Combined Effect" equals predicted maximum concentration and background concentration. µg/m³ = micrograms per cubic metre; PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; TSP = total suspended particulate.

Figure 1, PDF page 22 of Appendix C.1 (Updated 2021 EIS [AMNS 2021]) shows the property boundaries for the Beaver Dam Mine Site and Haul Road. As a result of the updated modelling, there is no interaction between air exceedances and any potential sites important by the Millbrook First Nation and the broader Mi'kmaq of Nova Scotia outside of the property boundaries for the Beaver Dam Mine Site and Haul Road. Table CEAA 2-25-4 below summarizes the project interactions and potential effect for air quality related to Mi'kmaq of Nova Scotia.

Table CEAA 2-25-4: Project Interactions and Summaries for each Valued Components and Potential Effect to Mi'kmaq of Nova Scotia

Valued Component	Summary of Key Mitigation Measures relating to Mi'kmaq of Nova Scotia (refer to individual VC sections for details)	Summary of Residual Effect	Potential Interaction with, and Effect to the Mi'kmaq of Nova Scotia (health and socio-economic conditions, current use, physical and cultural heritage)	Consideration in HHRA

Air	• Apply dust suppressants, when and where practicable, to target 80% effectiveness
	• Speed reduction
	• The crushed ore stockpile at the Touquoy Mine Site will be covered to minimize wind and rain erosion
	• In the event that the monitoring program identifies the need for additional dust mitigation measures for the Haul Road, options exist for further reduction in particulates including:
	  • an enhanced dust suppression application schedule;
	  • use of other suppressants that are biodegradable;
	  • road re-surfacing or treatments to reduce silt content; and
	  • paving portions of the Haul Road.
		Maximum predicted concentrations of parameters (i.e., TSP, PM_{10}, and $PM_{2.5}$) meet the assessment criteria for ambient air quality standards (Government of Nova Scotia 2005 and CCME 2020) at the proposed Beaver Dam Mine Site and the Haul Road property boundaries. At the Haul Road property boundaries, these assessment criteria are met with applied mitigation of 80% chemical dust suppressants.	Elevated particulate levels above background concentrations outside of the Beaver Dam Mine Site and Haul Road property boundaries could be present on vegetation and berries and as a result, affect traditional gathering and food consumption practices and human health by the Mi'kmaq of Nova Scotia.	Yes

Note: PM_{10} = coarse particulate matter; $PM_{2.5}$ = fine particulate matter; TSP = total suspended particulate; NSAQS = Nova Scotia Air Quality Standards; CAAQS = Canadian Ambient Air Quality Standards; HHRA = Human Health Risk Assessment; VC = Valued Component; % = percent.

References

AMNS (Atlantic Mining NS Inc.). 2021. Updated Environmental Impact Statement. Beaver Dam Mine Project. Submitted to the Impact Assessment Agency of Canada and Nova Scotia Environment. October 2021. Middle Musquodoboit, NS.

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Round 2 Information Request Number:	CEAA-2-26
Regulatory Agency/Indigenous Community:	ECCC
Topic/Discipline:	Migratory Birds, Fauna and Species of Concern
EIS Guideline Reference:	Section 6.10
Revised EIS (February 28, 2019) Reference:	Section 6.10, 6.13; Section 8.5; Section 9.2

Context and Rationale

Boreal Felt Lichen

A proposed boreal felt lichen critical habitat polygon may be present in the path of the Preferred Alternative Haul Road, but this is not clear in the revised EIS. Critical habitat includes any occurrence documented between 2005 and 2015, even if individuals are thought to be lost. Young boreal felt lichen are difficult to see, and it is therefore important to leave potential habitat where it is known that the building blocks of these lichens for critical habitat.

In the *Amended Recovery Strategy for the boreal felt lichen (Erioderma pedicellatum), Atlantic population, in Canada (Proposed)*, critical habitat for boreal felt lichen is identified as:

- the substrata/porophyte for growth of boreal felt lichen (i.e. the host tree);
- the wetland in which the substrate/porophyte occurs, or is adjacent to; and
- a critical function zone around the substrate/porophyte (500 m radius) and associated wetland (100 m radius if <100 m2; 50 m radius if >100 m2). The critical function zone is necessary to maintain the hydrology of the wetland, microhabitat characteristics required for the survival of the lichen, and to allow for colonization.

Blue Felt Lichen

Blue felt lichen was observed at 30 locations: Haul Road (1), Beaver Dam Mine site (14), broader LSA (10), adjacent to the Haul Road (3), Preferred Alternative Haul Road (2). Micro-siting of project infrastructure (minus the Preferred Alternative Haul Road) has reduced the number of individuals of blue felt lichen directly affected by the Project from 3 to 1. Micro-siting has not yet been done for the Preferred Alternative Haul Road, and while the proponent expects to avoid priority lichens, this has yet to be confirmed, thus two individuals may be directly affected. Blue felt lichen individuals not directly affected by the Project may be indirectly affected by changes in air quality, or changes in hydrology of the site.

Frosted Glass Whiskers Lichen

Frosted glass whiskers were detected at eight locations at the Beaver Dam Mine site, and micro-siting has resulted in avoidance of all eight locations. Three individuals were identified along the Preferred Alternative Haul Road, but do not fall directly within the road alignment. Frosted glass whiskers not directly affected by the project may be indirectly affected by changes in air quality, or changes in the hydrology of the site. The proponent proposes to reduce effects to frosted glass whiskers by maintaining a 100 m habitat buffer wherever practicable.

Snapping Turtle

The Project will result in the loss of wetland habitat suitable for hibernating snapping turtle.

The Proponent is Required to …

Provide shapefiles for the entire project footprint (i.e. including the Preferred Alternative Haul Road) and Local Assessment Area (LAA) so that the Project can be mapped in relation to boreal felt lichen critical habitat polygons. ECCC can provide the boreal felt lichen proposed map package to the proponent upon request, with the expectation that a copy of the mapped project in relation to the critical habitat polygons would subsequently be provided to ECCC. If there is an overlap, demonstrate how measures have been taken to avoid, minimize or mitigate effects to boreal felt lichen.

Provide details regarding the technical feasibility of transplantation of directly affected blue felt lichen as a proposed mitigation.

Confirm that a 100 m habitat buffer would be maintained for all individuals of blue felt lichens and frosted glass whiskers that would not be directly affected by the Project. For any individuals where a 100 m habitat buffer would not be implemented, identify measures to avoid/minimize the effects.

Provide a lichen species at risk (SAR) monitoring program that would include all sites where lichen SAR have been detected in the Local Assessment Area. Explain how adaptive management measures would be proposed and implemented in a timely manner in the event that adverse effects to lichen SAR are detected.

Provide details on the conservation allowance for the loss of wetland function (habitat for hibernating snapping turtles) that will be implemented.

Update the direct and cumulative effects assessment of related valued components as appropriate.

Response

Request A: Provide shapefiles for the entire project footprint (i.e. including the Preferred Alternative Haul Road) and Local Assessment Area (LAA) so that the Project can be mapped in relation to boreal felt lichen critical habitat polygons. ECCC can provide the boreal felt lichen proposed map package to the proponent upon request, with the expectation that a copy of the mapped project in relation to the critical habitat polygons would subsequently be provided to ECCC. If there is an overlap, demonstrate how measures have been taken to avoid, minimize or mitigate effects to boreal felt lichen.

AMNS has received and reviewed the boreal felt lichen critical habitat layer received from Environment and Climate Change Canada (ECCC) on June 2, 2019, in relation to the Beaver Dam Mine Project infrastructure. Figure CEAA-2-26-1 shows the Project layout in relation to adjacent ECCC boreal felt lichen critical habitat polygons and will be included in the Updated 2021 EIS (AMNS 2021). The roads and trails observed in the satellite imagery (e.g., forestry tracks) are not associated with and pre-date the Project. As shown in Figure CEAA-2-26-1, while two polygons overlap with the Project Area (PA), Project infrastructure does not interact with these areas and the appropriate setbacks as required by the Recovery Strategy and Action Plan will be maintained. Where infrastructure abuts against the boreal felt lichen critical habitat area, to the west of the Crusher/potentially acid generating (PAG) waste rock stockpile and non-acid generating (NAG) waste rock stockpile, care will be taken during final Project planning and construction to keep Project related infrastructure out of these areas. As a result, Project related direct and indirect impacts to boreal felt lichen occurrences within the critical habitat areas is not expected. Nevertheless, AMNS has included the three observed occurrences in their Preliminary Lichen Mitigation and Monitoring Plan (Appendix P.6 of the Updated 2021 EIS [AMNS 2021]). Avoidance and mitigation measures for lichen SAR are outlined in Section 6.13.8.2, page 6-754 and Appendix P.6, Section 5.4, PDF page 21 (Preliminary Lichen Mitigation and Monitoring Plan) of the Updated 2021 EIS (AMNS 2021).

AMNS will provide the shapefiles for the entire Project footprint and Local Assessment Area to ECCC if that request is still applicable. The **Preferred Alternative Haul Road** is no longer part of the Project Description in the Updated 2021 EIS (AMNS 2021).