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Fifteen Mile Stream Gold Project

Environmental Impact Statement Summary

Highway 374

Trafalgar, Nova Scotia

February 2021

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1.0 Introduction and Environmental Assessment Context

The "Fifteen Mile Stream Gold Project" (the Project) is located at the eastern boundary of Halifax County, central Nova Scotia, approximately 95 km northeast of Halifax and 17 km to the northeast of the Proponent's Beaver Dam Mine Project. The property covers the historic Fifteen Mile Stream Gold District located on NTS sheets 11E01/C and 11E02/D and is centered at approximately 538584 E and 4999404 N (UTM Zone 20 NAD 83 CSRS). The Touquoy Mine Site, which forms part of the project description, is located on the NTS sheet 11D15 and is centered at 504599 E and 4981255 N (UTM Zone 20 NAD 83 CSRS).

The Project is proposed to be developed in association with the currently operating Touquoy Mine. The Project is planned to be permitted and operated as a separate satellite surface mine operating at a rate of approximately two million tonnes (Mt) of gold-bearing ore per year. FMS ore will be crushed and concentrated through processing on site to produce a gold concentrate which will be hauled by on-road highway trucks to the Touquoy Mine Site carbon-in-leach (CIL) processing facility for final processing into gold doré bars, a distance of just over 76 km on existing public roads. This will eliminate the need for a separate CIL cyanide leach circuit at the FMS Mine Site to support the Project. The FMS concentrate will be processed at the Touquoy Mine Site in conjunction with ore supply from Touquoy, Beaver Dam and Cochrane Hill surface mines.

The mine will operate for 6.75 years and will employ up to 200 persons including both salaried and hourly personnel. At the cessation of mining activities, the site will be reclaimed in accordance with federal and provincial requirements.

The Project is subject to both federal and provincial environmental assessment processes. This document presents both the Environmental Impact Statement (EIS) and the EA registration Document (EARD) to satisfy requirements of the federal and provincial processes, respectively.

The EIS/EARD for the Project has been prepared to facilitate the approval of the Project in accordance with the *Canadian Environmental Assessment Act, 2012* (*CEAA 2012*) and Environmental Assessment Regulations made under the *Nova Scotia Environment Act*. The EIS Guidelines (CEAA 2018) prepared by Canadian Environmental Assessment Agency (CEAA / Impact Assessment Agency of Canada [IAAC, agency name change as of August 2019]) have provided a framework for the organization of the EIS. No public money is being sought to undertake the Project.

1.1 Proposed Project

The Project Area (PA) includes the FMS Study Area and the necessary components of the Touquoy Mine Site to process the gold concentrate and manage the associated additional tailings. This PA is shown at a regional scale along with proposed transportation routes on Figure 1-1. The two options for transportation of gold concentrate include an initial route and a second route once the Beaver Dam Gold Project becomes operational. The initial route is on public roads (Highway 374, Highway 7 and the Mooseland Road); the second route includes the use of Highway 224 and the Beaver Dam constructed interior haul road from Highway 224 to Mooseland Road.

The total proposed FMS Mine Site infrastructure footprint is approximately 400 hectares (ha). The FMS Study Area for the purpose of the environmental assessment is the infrastructure footprint plus an associated buffer and is also shown on Figure 1-2.

Operations at the FMS Mine Site will include mining, crushing, ore processing and concentration, and operation of a waste rock storage area (WRSA), ore stockpiles and a tailings management facility (TMF). Two streams of gold concentrate will be produced at site and transported to the Touquoy Mine Site processing facility for final processing into gold doré bars. Tailings will be generated from mill processing and deposited into the exhausted Touquoy pit. Infrastructure at the FMS Mine Site will include crushing facilities, fine ore stockpile and reclaim, concentrator facilities, maintenance facilities, fuel storage, office infrastructure and site haul roads.

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FIGURE 1-1

Fifteen Mile Stream Project Area and Proposed Transportation Routes

Halifax County, NS

FMS Study Area

Upper Musquodoboit

Touquoy Mine Site

Beaver Dam Haul Road

Mooseland Road

Sheet Harbour

Port Dufferin

Mooseland

Tangier

Como Lake

Tangier Grand Lake

224

374

7

Legend

- Concentrate haul route (following completion of Beaver Dam Haul Road)
- Initial concentrate haul route
- Project Area

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

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Scale when printed @ 11" x 17"

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Date: 2020-08-26

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FIGURE 1-2

Fifteen Mile Stream Study Area

Trafalgar, NS

Seloam Lake
Existing Access Road
Fifteen Mile Stream
Seloam Brook
Moser Lake
Local Traffic Bypass Road
Organic Material Stockpile
Seloam Brook Realignment
Seloam Lake Water Intake Pipe
Existing Access Road
Open Pit
Till Stockpile
Low Grade Ore Stockpile
Topsoil Pile
Local Traffic Bypass Road
Tailings Management Facility
WRSA (PAG Material)
WRSA (NAG Material)
Plant Facilities
Truck Shop
ROM Pad
East Lake
Surplus Water Discharge Pipe
Powerline
Fifteen Mile Stream
Anti Dam Flowage
374

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FMS Planned Infrastructure
- Realignment Channel
- Water Control Structure
- Pit
- Plant
- Truck Shop
- Crusher Pad
- ROM Pad
- Water Treatment
- Plant and Admin Building Footprint
- Seloam Diversion Berm
- Tailings Management Facility
- TMF pond
- Topsoil Stockpile
- Organics Pile
- Till Stockpile
- Low Grade Stockpile
- WRSA (NAG)
- WRSA (PAG)
- Access Road
- Haul Road
- Contractor Laydown Area
- Outflow Channel
- Water Management Pump
- Water Management Pond
- Water Management Ditch
- Water Intake/Discharge Pipe
- Powerline Tie In
- Powerline Tie in Option 2
- Potential Borrow Pit

NSTDB Roads
- Collector
- Local
- Dry Weather / Seasonal
- Track
- Transmission Line
- FMS Study Area

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

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McCallum Environmental Ltd.

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An existing 69 kV, north-south hydroelectric transmission line is located west of Highway 374 and this line will supply power to the site via a small spur line (approximately 5.3 km) and sub-station to step the voltage down to 25 kV.

Development of the Project will require the realignment of Seloam Brook to accommodate development of the open pit. A realignment channel and a diversion berm will be constructed to convey Seloam Brook flow around the north of the proposed open pit and planned diversion berm. The Seloam Brook Realignment will isolate the mine site from the watercourse while maintaining fish connectivity through the Seloam Brook system. The realignment channel will have a defined flow path to improve fish passage through the reach and mitigate the braided configuration of the existing habitat, caused by past mining activities, and will utilize the consolidated flow to maximize habitat stability and suitability. In addition to the defined flow path, the realignment channel will incorporate an integrated floodplain and highly suitable fish habitat.

Two processing concentrate streams will be produced at the Project; a gravity concentrate and a float concentrate. Both will be transported from the Project to the Touquoy Mine Site using existing highways in conjunction with the Beaver Dam Haul Road thus requiring minimal upgrades to existing road infrastructure. To start, gold concentrate will be hauled south along Highway 374 (31 km) to Highway 7, through Sheet Harbour (27 km) and onto Mooseland Road to the Touquoy Mine Site (35 km). Once the Beaver Dam Mine Project becomes operational, and the Beaver Dam Haul Road has been upgraded as part of that project, haul trucks from the Project are expected to take Highway 224 from Sheet Harbour to the Beaver Dam Cross Road (21 km) and the Beaver Dam Haul Road will be used for the remainder of the haul to the Touquoy Mine Site (24 km).

Changes to the Touquoy Mine Site as a result of the Project are anticipated to be minimal. Only minor changes to the existing processing facility at the Touquoy Mine Site will be required, including the addition of concentrate storage and the addition of a second gravity concentrate leach reactor and a gravity electrowinning cell. These changes can be accommodated within the existing facility footprint. There will be a small volume of tailings deposition into the mined out Touquoy pit as a result of concentrate from the Project. All other aspects of the Touquoy Mine Site will remain the same as previously assessed including the disturbed footprint, tailings management aspects and the size and locations of stockpiles.

The approved reclamation plan for the Touquoy Mine Site calls for the mined-out pit to be allowed to fill with water. At the end of processing at the Touquoy Mine Site, the remaining volume within the open pit would naturally fill with water and the deposited tailings will be stored under a water cap, creating a lake as per the approved plan for the reclaimed Touquoy pit, albeit slightly shallower. “Wet” disposal is accepted internationally as a superior method of permanent tailings management as opposed to “dry” storage.

Following the production period for the Project, reclamation would occur at the FMS Mine Site and all associated facilities, as outlined in the reclamation plan. Any changes to the current reclamation plan for the Touquoy Mine Site as a result of the Project would require approval by the province of Nova Scotia.

1.2 Proponent Information

Atlantic Mining NS Inc. (the Proponent), a wholly owned subsidiary of St. Barbara Limited, is a well-financed, growth-oriented gold development group with a long-term strategy to create a mid-tier gold production group focused on manageable, executable projects in mining-friendly jurisdictions. Its board and management team, with extensive experience in geology, mining and mine development, process and metallurgy and project financing, are currently focused on the development of its project portfolio of advanced gold development properties located in Nova Scotia, Canada.

Currently, the Proponent holds four gold development projects in Nova Scotia: the Touquoy Gold Project, the Beaver Dam gold deposit, the Cochrane Hill gold deposit; and the Fifteen Mile Stream gold deposit. The Touquoy Gold Project has been in operation since October 2017. The Beaver Dam Mine Project Environmental Impact Statement has been submitted to IAAC (previously CEAA) and is in the information request phase. The Fifteen Mile Stream Gold Project is presented herein.

A corporate office in Melbourne, Victoria, Australia and a local office in Mooseland, Nova Scotia, Canada are maintained in support of the Proponent's projects. Key management and technical staff will be located in both locations for the duration of the Project. The addresses for both office locations are provided in Table 1.2-1.

Table 1.2-1: Office Locations

Corporate Office	Local Office
Level 10, 432 St Kilda Road, Melbourne, VIC 3004 Locked Bag 9, Collins Street East, VIC 8003 Tel: +61 (3) 8660 1900 Fax: +61 (3) 8660 1999	409 Billybell Way, Mooseland Middle Musquodoboit, Nova Scotia B0N 1X0 Tel: +902.384.2772 Fax: +902.384.2259

All communications regarding the EIS for the Project should be sent to the Manager of Environment and Community or as directed by the Head of External Affairs and Business Continuity. The contact information for these two roles is outlined in Table 1.2-2.

Table 1.2-2: Proponent Contacts

Position	Proponent
Head of External Affairs and Business Continuity	Laird Brownlie Middle Musquodoboit, Nova Scotia Phone: +902.384.2772 Email: Laird.Brownlie@atlanticgold.ca
Manager of Environment and Community	James Millard Middle Musquodoboit, Nova Scotia Phone: +902 384.2772 Email: James.Millard@atlanticgold.ca

1.3 Environmental Assessment Context

At its foundation, EA is a planning tool used to ensure that projects are carefully planned to avoid or mitigate possible negative environmental effects and to maximize potential benefits. Use of the EA process early in a project's planning phase can be used to encourage proponents to develop their projects in the most sustainable manner.

The EIS has been prepared to facilitate the approval of the Project in accordance with the *Canadian Environmental Assessment Act, 2012 (CEAA 2012)* and Environmental Assessment Regulations made under the *Nova Scotia Environment Act* and project-specific guidelines provided in the Guidelines for the Preparation of an Environmental Impact Statement (EIS Guidelines) issued by the Canadian Environmental Assessment Agency (CEAA) in August 2018. The use of the EIS Guidelines required the Proponent to carefully review and consider the Project, including its alternatives, and the potential effects on valued components.

The following Valued Components (VC) were selected to facilitate a focused and effective EA:

Physical VCs

- Noise;
- Air;
- Light;
- Geology, Soils and Sediment;
- Surface Water; and
- Groundwater.

Biophysical VCs

- Wetlands;
- Fish and fish habitat;
- Habitat and flora;
- Terrestrial fauna;
- Avifauna; and
- Species of Conservation Interest and Species at Risk.

Socio-economic VCs

- Mi'kmaq of Nova Scotia;
- Physical and cultural heritage; and
- Socio-economic conditions.

Criteria or established thresholds for determining the significance of residual effects from Project activities are described for each VC in their corresponding subsection within Section 6.0 of the EIS. These criteria or threshold were developed through the following avenues:

- consultation with appropriate regulatory agency responsible for each VC;
- using information obtained in stakeholder and right holder consultation;
- using available information on the status and characteristic of each VC;
- using applicable regulatory documents, environmental standards, guidelines, and/or objectives; and
- using professional judgement of the EA Study Team.

These criteria or thresholds establish a level beyond which a residual effect would be considered significant. Thresholds may be based on regulations, standards, resource management objectives, scientific literature, and/or ecological processes. Significance criteria has been defined quantitatively where practicable, and qualitatively with supporting justifications where no standards exist.

The EIS Guidelines require that the Proponent demonstrate how all aspects of the Project have been examined and planned in a precautionary manner to avoid serious or irreversible environmental effects. The EIS applies the precautionary approach through the following assessment methodologies:

- provides extensive detail about the existing environment and develops mitigation measures to eliminate, reduce, or control the effect Project activities have on the environment;
- considers project design that will minimize disturbance to the existing environment;
- outlines contingency plans that address worst-case accidents and malfunctions;
- outlines follow-up and monitoring programs to verify project activity related impact predictions; and
- anticipates other projects in the area in an effort to eliminate, reduce, or control cumulative effects.

The application of a precautionary approach in developing the EIS will allow it to act as a planning tool which will be used to ensure the Project avoids or mitigates potential environment effects and promotes sustainable development.

Methodology used to conduct the EA and predict the effects of the Project was developed to meet the requirements of the EIS Guidelines. This methodology was developed to incorporate:

- Input from the Mi'kmaq of Nova Scotia and the public throughout the duration of the Project;
- Environmental and social points of interest to the scientific and regulatory communities; and
- Other federal, provincial, and municipal legislative and regulatory requirements that may apply to the Project.

The EIS was prepared by a consulting team led by McCallum Environmental Limited (MEL) under contract to the Proponent.

1.4 Spatial Boundaries

The spatial boundaries represent anticipated geographic limits that will aid in defining the scale and range of interactions between Project activities and VCs. The following spatial boundaries will be used for the EIS.

1.4.1 Project Area (PA)

The PA encompasses the immediate area in which Project activities may occur and are likely to cause direct and indirect effects to VCs. The Project Area (PA) encompasses two primary components: the FMS Study Area and the Touquoy Mine Site [processing facility, TMF and exhausted pit (to be used to process FMS concentrate and dispose of concentrate tailings)]. Figure 1-1 outlines the PA.

1.4.2 Local Assessment Area (LAA)

The LAA encompasses adjacent areas outside of the PA where Project-related effects to VCs are reasonably expected to occur. Generally, the LAA is limited to the area in which Project activities are likely to have indirect effects on VCs; however, the size of the LAA can vary depending on the VC being considered, and the biological and physical variables present.

1.4.3 Regional Assessment Area (RAA)

The RAA encompasses all Project and VC interactions including diffuse or longer-range effects such as those from Project activities on socio-economic conditions. The RAA may vary in size depending on the VC being considered, and the biological and physical variables present, and is generally larger than direct and indirect effects are expected for each VC. The RAA is used to support cumulative effects assessment (CEA).

Spatial boundaries will vary for each VC. All VCs were evaluated at the LAA level with the exception of Cultural and Physical Heritage (PA level) and Socioeconomic Conditions (RAA level). Detailed descriptions and justification for the LAA and/or RAA are provided within the corresponding subsection within Section 6.0 of the EIS.

2.0 Project Overview

2.1 Project Phases

The Project phases have been defined as follows:

- Construction Phase/Pre-Production Phase (commencing in 2023);
    - Twelve month pre-production period ;
- Operations (commencing in 2024);
    - 6.75 years of production, includes 1.5 years of processing low grade stockpile;
- Closure (commencing in 2030);
    - Reclamation Stage (2 to 3 years); and
    - Post Closure (PC) Stage.

2.2 Primary Project Components

The primary components associated with the Project include the following:

- FMS Mine Site
    - open pit for extracting ore and waste rock;
    - mine site haul roads;
    - local traffic bypass roads;
    - powerline;
    - waste rock storage area (WRSA);
    - overburden till piles;
    - topsoil and organics storage piles;
    - separate run of mine (ROM) stockpile and low grade ore (LGO) stockpile;
    - Seloam Brook realignment channel and diversion berm around open pit;
    - crusher and concentrator facilities;
    - tailings management facility (TMF); and,
    - water management system including water discharge.
- the existing Touquoy Mine Site
    - concentrate storage;

- gravity concentrate leach reactor;
- Gravity electrowinning cell; and,
- exhausted pit for remaining FMS concentrate tailings storage.

Figures 1-2 and 1-3 display the location of the components at the FMS Mine Site, and the location of the relevant components of the Touquoy Mine Site related to the Project.

2.3 Construction Phase/Pre-Production Phase (Year 1)

2.3.1 FMS Mine Site

Site preparation at the FMS Mine Site will begin one year prior to operations commencing, with construction of key infrastructure following shortly thereafter. The following activities will be undertaken to prepare the FMS Mine Site for construction activities:

- clearing, grubbing, and grading;
- drilling and rock blasting;
- establishment of topsoil, organic material (saturated topsoil/peat), till, and waste rock stockpiles; and
- Seloam Brook realignment and pit site dewatering.

Once site preparation activities have been completed, construction will commence and involve the following activities:

- watercourse and wetland alteration;
- mine site road construction;
- local bypass rod construction;
- surface infrastructure installation and construction;
- powerline construction;
- pit pre-stripping;
- TMF embankment construction; and
- collection ditch and settling pond construction.

The FMS Mine Site will have a total disturbed area of approximately 400 ha, consisting of the pit (27 ha); WRSA (53 ha); TMF (123 ha); low grade ore stockpile (15 ha); till stockpile (12 ha); topsoil stockpiles (5 ha); organic material stockpile (19 ha); operational facilities (40 ha); Seloam Brook diversion berm (6 ha); settling ponds and water management structures (16 ha); potential borrow pit areas (30 ha); access road (6 ha); local road bypasses (5 ha); powerline (2 ha) and mine site roads (16 ha). Ore, till, topsoil, and organic material stockpiles will comprise approximately 51 ha during operations but are not anticipated to remain at the completion of the Project.

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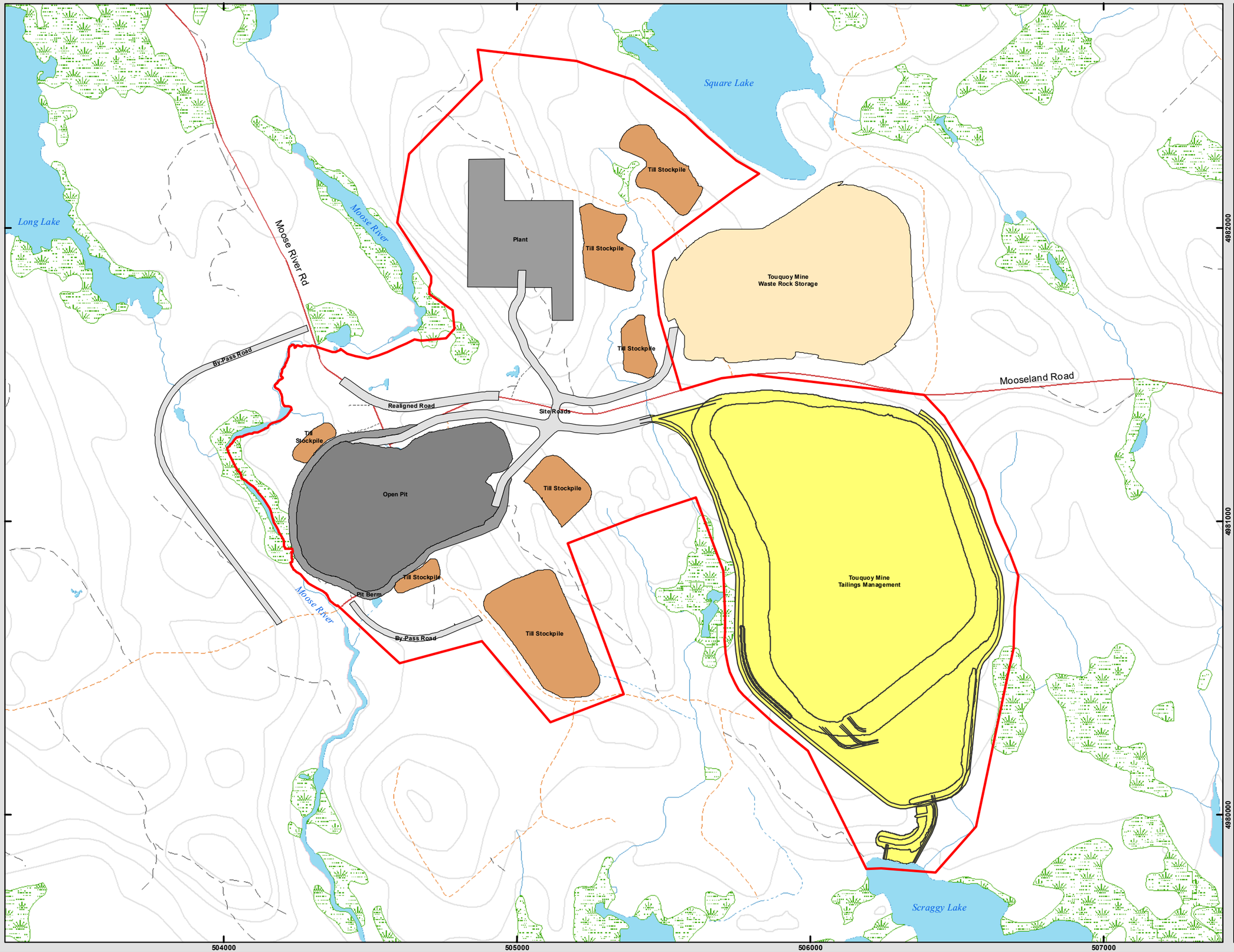
FIGURE 1-3

Touquoy Mine Site

Mooseland, NS



Touquoy Mine Infrastructure
- Site Roads
- Tailings Management
- Waste Rock Storage
- Pit
- Plant
- Till Stockpile
- Pit Berm
- Realigned Road
- By-Pass Road

- Touquoy Mine Site
- NSTDB Lakes
- NSE Wetlands
- NSE Mapped watercourses

NSTDB Roads
- Local
- Dry Weather / Seasonal
- Diveways (>300 m)
- Track

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

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Scale when printed @ 11" x 17"
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Pre-construction and construction activities will be staged in accordance with the status of various permitting initiatives. For example, in the event there is a delay to the required fisheries authorizations, pre-construction and construction activities will be focused during that period on areas that will not have a direct impact on area of fish habitat. Impacts during this and other phases of the development will be managed and limited by means of an Erosion Prevention and Sediment Control Plan and Surface Water and Groundwater Management and Contingency Plans.

2.3.1.1 Site Preparation and Pre-Production

A twelve-month pre-production period is anticipated to supply material for construction including internal haul roads, water collection ponds and TMF starter dams. The planned mine mobile equipment fleet will be procured and utilized for pre-production operations.

Topsoil will be excavated beneath the entire TMF embankment and upstream TMF basin liner footprint to a depth of approximately 0.5 m. Topsoil will be stockpiled for use in reclamation. Loose or unsuitable overburden materials (i.e., wetland material) will be excavated completely in wetland areas beneath the embankment footprint and either stockpiled in the organic material stockpile or disposed of within the TMF basin. Any suitable construction materials for the starter embankment that are encountered during sub-excavation will be stockpiled separately.

The open pit footprint, mine infrastructure and waste rock storage areas will be cleared and grubbed in advance of operations with the timing informed by Environment and Climate Change Canada (ECCC) directives, wherever practicable, relative to migratory bird nesting. Topsoil will be salvaged to a nearby stockpile for later use in reclamation activities. Glacial till overburden within the open pit footprint will be salvaged to a till stockpile storage area for later use to support reclamation activities. The Seloam Brook Realignment and construction of associated downstream water control structures will be completed during the construction phase prior to commencement of mining.

Once vegetation, topsoil, and till have been removed, drilling and blasting will be used to mine ore and non-ore bearing waste rock. Holes will be drilled into the host rock to receive explosives used for blasting. The pit will be mined down to the -50 bench (bench floor elevation in metres above sea level), approximately 165 m in depth.

2.3.1.2 Management of historic waste rock and tailings

The Proponent is committed to responsibly managing historical tailings and waste rock that are encountered during the construction of the Project. Historical tailings and waste rock that are outside the planning disturbance footprint will be left undisturbed. With respect to the management of existing waste rock and historic tailings, four options have been examined by Stantec (2019a) on behalf of the Proponent:

- Reprocessing followed by residuals storage within the FMS TMF;
- Short term storage if the material does not exceed industrial Tier 1 EQS or other environmental criteria followed by reuse during reclamation;
- Long term storage within the TMF; and
- Offsite transport and disposal.

The Proponent is currently evaluating these options with respect to waste rock and tailings chemistry, potential environmental impacts of each option, the risk to human and ecological health, cost and feasibility. In their 2019 Historical Tailings and Waste Rock Management Plan for the FMS Mine Site, Stantec proposed a series of mitigation measures to ensure these materials are managed appropriately during excavation. These measures include additional sampling, stormwater management, monitoring, remedial verification, documentation and reporting.

During construction, the first step will be to build berms to complete the Seloam Brook Realignment project and re-route water around the proposed pit development area. This will allow for an "in the dry" working area for the pit. However, based on topography and delineated wetlands and open water sections within the proposed pit area, water management is expected to be required during pit development. There is elevated arsenic and potentially mercury within this development area documented in baseline surface water and sediment condition. Settling ponds (lined with clay geosynthetic liner) will be built for the proposed WRSA first and will be used to manage construction water from the pit development area. A modular effluent treatment plant for water will be available during construction if required to manage water quality issues should they arise.

During operations, runoff from the waste rock, till and low grade ore stockpiles will be directed to water management ponds. Water collected in the water management ponds will be pumped to the TMF supernatant pond, unless discharge to the receiving environment is appropriate based on water quality analysis and regulatory approval. The TMF will act both as containment for tailings and site contact water unsuitable for discharge. Initial water balance calculations indicate the TMF will operate under surplus water conditions and require a discharge. Further work will be undertaken to determine the need for, and design of, any treatment works to ensure such discharge meets environmental requirements. Water quality modelling conclusions indicate that water treatment during operations will not be necessary. There will be a modular effluent treatment plant present on site during the construction phase and this system can be adapted and utilized throughout the life of mine, as required based on site effluent quality.

2.3.1.3 Seloam Brook Realignment

Seloam Brook will be permanently realigned through the construction of a raised perimeter berm along the east, north and west of the open pit, which will divert flows from Seloam Brook, and its main tributary, Watercourse 12, around the open pit to the north of the pit. This stream channel will be the primary fish habitat and will contain the anticipated principle flows while the floodplain will allow high-flow events such as spring freshets and extreme storm events to pass, similar to a natural wetland/floodplain ecosystem. Development of a detailed Erosion Prevention and Sediment Control Plan, and Seloam Brook Realignment Construction Plan will be completed in advance of commencement of this stream diversion. A Fisheries Act Authorization will be required, with associated fisheries off-setting, to allow for the re-route of Seloam Brook to facilitate pit development.

2.3.1.4 Site Construction

Mine site haul roads will be constructed to enable the mining fleet (loaders, dozers, haul trucks) to access various site locations including the open pit, stockpiles and primary crusher ROM pad area. A haulage road will be constructed connecting the pit exit with the topsoil, till, and non-ore bearing waste rock stockpiles. Another haulage road will be constructed connecting the pit exit and ROM stockpile. The roads will be dual lane and approximately 25 m wide, including berms and drainage, with a maximum speed limit of 40 km/h.

The mine access road will be constructed to connect the property exit with the operational facility area. The road will be dual lane and will have a gravel base and be approximately 16 m wide, including berms and drainage, with a maximum speed limit of 40 km/h.

Two local traffic bypass roads will be constructed in order to allow for continued public access around the site. Traffic flow will be diverted from the current Seloam Lake Road approximately 800 m from its intersection with Highway 374. The two bypass roads will be dual lane and will have a gravel base and be approximately 16 m wide, including berms and drainage. A bridge will be required to cross the Seloam Brook. These local traffic bypass roads will be designed and developed in consultation with Nova Scotia Lands & Forestry (NSL&F) as they are mainly on Crown land.

A temporary prefabricated facility equipped with office space, washroom facilities, a mine dry room, and a first aid facility will be provided. In addition, workshop facilities for general maintenance of the mining fleet and ore haulage trucks will be constructed.

The geochemical source term results indicate that there will be adequate non-Acid Generating (NAG) waste rock to construct the required site infrastructure, including the TMF berm, drainage structures, roads, and other site facilities.

Borrow and quarry materials for the construction will be sourced from the pit during initial development and the processing areas, wherever practicable. Extra borrow material will be sourced from drumlins on site identified as potential borrow sites on Figure 1-2. Suitable clay material extracted from these areas will be used for the TMF berm and apron liner. During start-up, prior to the availability of quarry materials from the pit, some material may be transported to the site from other quarry sites, external to the Project.

The TMF embankments will be constructed as zoned earthfill-rockfill structures. The embankments will include an upstream liner system consisting of a low-permeability till layer and geotextile material. The maximum Stage 1 embankment height was estimated to be approximately 16 m. The liner will extend from the upstream toe of the embankment into the TMF basin for a length of approximately three times the height of the Stage 1 embankment to control seepage gradients prior to the development of the tailings beaches. The embankment height will be raised over the life of the mine in three additional stages (of approximately 4 m each) to a maximum height of approximately 28 m at Stage 4.

The embankment will be constructed with a crest width of approximately 15 m to allow for single lane haul truck traffic within safety berms and pipeline routes. The embankments will be primarily constructed with NAG pit run waste rock. Filter and Transition Zones consisting of filter sand and drain gravel will be placed on the upstream face of the embankment. A liner material consisting of compacted, low-permeability till will be constructed on top of the filter zone material. A second layer of NAG waste rock will be constructed to complete the upstream face of the embankment, with a geotextile layer separating the till and the waste rock and will function as ice and erosion protection for the embankment.

Collection ditches along the perimeter road around the toe of the TMF embankment will be established to collect runoff from the TMF embankments and seepage through the TMF embankments and foundations. The collection ditches will convey these flows to the two seepage collection ponds. Flows collected in the ponds (including precipitation on the surface of the pond) will be pumped back to the TMF supernatant pond. The north seepage collection pond has a maximum volume of approximately 20,000 m^3 and the east seepage collection pond has a maximum volume of approximately 15,000 m^3.

Non-contact water will be diverted around site facilities to the maximum practicable extent to minimize the impact to local water courses and the unnecessary collection of fresh water. Diversion channels will collect and divert runoff from undisturbed catchment areas for precipitation events up to a 1-in-200-year precipitation event.

Water required for mill operations will be sourced from the plant site collection pond, reclaim from the TMF supernatant pond, water in ore, and freshwater makeup from Seloam Lake. Freshwater make-up requirements are for clean (i.e., non-contact) water required for various components in the mill process.

Three water management ponds are designed to collect runoff from the stockpiles and open pit (Figure 1-2). The ponds were designed to store catchment runoff for the 1 in 10-year 24-hour storm event (116 mm) plus direct precipitation for the 1 in 200-year 24-hour storm event (184 mm). The ore stockpile and open pit collection pond collect runoff from the ore stockpile and dewatering flows from the open pit and have a maximum design volume of approximately 23,000 m^3. The till stockpile collection pond collects runoff from the till stockpile and has a maximum design volume of approximately 22,000 m^3. The NAG collection pond collect runoff from the NAG stockpiles. The NAG stockpile collection pond has a maximum design volume of approximately 35,000 m^3 respectively. These water management ponds will be built prior to initial pit development and lined with a geosynthetic or clay liner in order to manage any potential contaminated water during construction from excavation of historic tails. Water collected in the water management ponds will be pumped to the TMF supernatant pond, unless discharge to the receiving environment is appropriate based on water quality analysis and regulatory approval.

The final design of the collection and settling ponds will be submitted as part of the IA application and process.

A berm will be constructed surrounding the pit to prevent shallow groundwater flow and/or surface water from entering the pit. A water diversion ditch will be established around the perimeter of the open pit to intercept any surface water that infiltrates the berm and flows into the mine. This ditch will direct water to in-pit sumps where it will be directed to collection ponds located to the east and west of the open pit.

Development of the FMS Mine Site will cause direct and in-direct impacts to wetlands and fish habitat mostly within the construction phase of the Project and mostly associated with pit development and the realignment of Seloam Brook. Direct impacts will be associated with clearing, grubbing, infilling and development of the mine and its associated infrastructure. Wetlands located within the FMS Study Area are discussed further in Section 6.7 and Fish and Fish Habitat is discussed in Section 6.8.

During construction, settling pond(s) with impermeable till (clay) or geosynthetic liners, will be constructed near the location of the WRSA in order to manage construction water during pit development. A modular treatment plant will be available to treat water during the construction phase, if required. Increased environmental disturbance is anticipated during initial site preparation, when drilling and blasting is being undertaken in the surface mine and clearing is being undertaken, and during the construction of stockpiles, berms, and roads.

2.3.2 Touquoy Mine Site

2.3.2.1 General

Final processing of gold concentrate will take place at the existing Touquoy processing facility currently operating at the Touquoy Mine. The Touquoy plant has the capacity and is designed to be able to treat the concentrate with some modifications required including:

For FMS Flotation Concentrate (new Flotation Concentrate building):

- Float concentrate stockpile area;
- No-hold up hopper with static grizzly;
- Screw conveyor feeder;
- Intensive mixing tank (repulping);
- Pre-aeration tank, Leach tank, pump and pumpbox (new);

For Gravity Gold Concentrate (new goldroom expansion building):

- Intensive leach reactor (new) –ILR 6000 or equivalent;
- Barren Solution tank (new);
- Gravity electrolyte tank (new);
- Electrowinning cell with sludge hopper (new), and
- Goldroom expansion building enclosure with ventilation ducting (new).

The Touquoy process plant is located east of Moose River, north east of the Touquoy open pit and north-west of the tailings storage facility. The approach by road to the plant will be from the east via the Mooseland Road. The main plant building houses the grinding, classifying cyclones, gravity recovery and ILR intensive leaching, reagent, elution and refinery sections. The crushing, leach, CIL and cyanide detoxification sections are located outdoors.

The Touquoy plant will handle the FMS concentrate with installation of two new buildings: Flotation Concentrate building located south of the current Touquoy plant and goldroom expansion building located adjacent to the existing goldroom. Consequently, the Touquoy process flowsheets will remain fundamentally unchanged with the processing of FMS concentrate.

2.3.2.2 Upgrades to the Touquoy Process Plant

Flotation Concentrate Handling/CIL Circuit

The FMS flotation concentrate will be introduced to the Touquoy process plant via CIL Circuit. Prior to combining the feed slurry to the CIL circuit, the flotation concentrate will be slurried, pre-aerated and leached where about 92% of the gold extraction will occur. In order to introduce the FMS concentrate to the Touquoy process plant, a new Flotation Concentrate building will be installed at the south of the current mill. The FMS flotation concentrate will be transferred to this new building using 40 tons trucks during day shifts only. This building will consist of mainly a stockpile area allowing for 24 hours storage of concentrate, a pre-aeration tank and a leach tank.

Rehandling of the FMS concentrate will be by front-end loader, which will discharge the concentrate into a fairly small no-holdup hopper with capacity of 3 to 5 m^3 located above a screw conveyor feeder. The feeder head chute will discharge into a conical intensive mixing tank, where the adequate process water will be added for slurrying the concentrate. The feed slurry will be pumped to a new pre-aeration tank and subsequently to a new flotation concentrate leaching tank on a continuous basis operation. The residence time in the leach tank will be about 30 hours. The pre-aeration tank will act as a surge tank during the night shift where no FMS flotation concentrate will be trucked. The pre-aeration tank will provide 18 hours of pre-aeration and 12 hours of surge capacity. The concentrate leached slurry will be sampled and overflowed to a launder and a pumpbox prior transferring to CIL circuit via.

Gravity Concentration Feed

No mechanical changes are expected to the existing Touquoy process plant gravity circuit. Given the increase in gravity gold concentrate, it is proposed to install a new parallel intensive leach reactor (ILR 6000 or equivalent) and electrowinning circuit to increase the capacity for gravity gold recovery in a new gold room expansion building adjacent to the existing gold room building The FMS gravity concentrate will be transported to Touquoy plant via a skid-mounted transportable concentrate hopper on a daily basis, which will be positioned adjacent to the new intensive leach reactor unit using a forklift. The intensive leach reactor skids will combine the gravity concentrate with cyanide, caustic soda and hydrogen peroxide to extract the gold from the concentrate. Upon completion of a gravity gold intensive leach cycle which takes about 20 hours including the transfer, reagent addition, and leaching time, the pregnant solution will be pumped to a gravity electrolyte tank and will be circulated through a new electrowinning cell that will plate the extracted gold onto the electrowinning cathodes. Periodically, the electrowinning sludge will be high-pressure washed into a sludge hopper which will transfer the sludge to the existing sludge press feed hopper for dewatering ahead of smelting. The barren solution from the electrowinning cell will be pumped either to the CIL circuit or it will be transferred to the new Barren Solution tank for bleeding to either the Flotation Concentrate Leach or to the existing or new Intensive Leach reactors. The ILR residue will be transferred to the grinding circuit upon completion of leaching circuit.

Leaching

No changes are required to both intensive leach reactor and electrowinning cell. Much smaller carbon adsorption tanks are required to handle the significantly reduced volumetric flow of FMS flotation concentrate. Adsorption of gold still requires six stages of carbon movement to capture the gold, just on a smaller scale.

Other Changes

No changes are required for the elution detoxification, and reagent plant with the exception of adding new cyanide pump, sodium hydroxide pump, hydrogen peroxide dosing pump and flocculant dosing pump for the new ILR system.

The minor works necessary to modify the Touquoy Mine Site for FMS concentrate, as described above, will begin before initiation of operation of the FMS Mine Site. No other changes will be made to the remainder of the processing facility and no additional land disturbances are anticipated to prepare the Touquoy Mine Site to receive FMS concentrate. This transition phase will likely not exceed four to six months.

2.4 Operations (Years 2 to 9)

2.4.1 FMS Mine Site

During operation and maintenance of the Project, the following activities will be undertaken:

- surface mine operation and maintenance;
    - drilling and rock blasting;
    - surface mine dewatering;
- ore management;
- milling operations;
    - crushing;
    - grinding;
    - gravity concentration;
    - conventional flotation circuit;
    - concentrate thickening, filtration and storage;
- concentrate loading and haulage;
- waste rock management;
- tailings management;
- water management;
- dust and noise management;

- petroleum products management; and
- site maintenance and repairs.

2.4.1.1 Mine Operation

In the active mining area, in-situ rock is drilled and blasted on 5 m to 10 m bench heights. Diesel powered down-the-hole hammer drills will be used for production drilling and will also be used for horizontal highwall depressurization drilling on the ultimate pit walls. Blasting will typically occur two to three times per week.

Additional grade control drilling is carried out to better delineate the ore and waste rock in advance of mining. Ore and waste rock will be defined in the blasted rock material with a grade control system based on dedicated reverse circulation (RC) grade control drilling and sampling, and a fleet management system will keep track of each load.

A contract explosives supplier will provide the blasting supplies and materials for the mine. Emulsion will be the primary blasting agent as the majority of holes will be wet. Explosives and all accessories will be supplied on an as needed basis from the contractor's base location off-site and delivered to the contractor's explosive storage facilities or directly to the blast holes typically using the contractor's equipment. All on and off-site permitting requirements will be the responsibility of the contractor through Natural Resources Canada (NRCAN) for this Project. An operational blast material sampling program will be implemented to conduct confirmatory testing of open pit blast hole drill cuttings to confirm geochemical predictions of mine rock at a frequency to be determined by the Project geochemists, geologist and with consideration of available NRCAN and comparable guidance.

Diesel powered hydraulic excavators will load both ore and waste rock into haul trucks. These loading units will also function to re-handle low grade ore material from stockpile and load overburden and topsoil for transport to stockpile.

Ore will be loaded into off-highway rigid frame haul trucks and hauled to the ROM pad and primary crusher. All waste rock will be loaded into off-highway rigid frame haul trucks and hauled to the WRSA. If dust is generated from hauling in the warmer months of the year, it will be controlled by applying dust suppression measures that may include water and/or chemical dust suppressants to the haul roads utilizing specialized water trucks.

At the ROM pad, haul trucks will dump ore material directly into the primary crusher or place it in an active stockpile on the pad, to be re-handled as crusher feed later on. Crusher loading of the stockpiled ore will be accomplished with a diesel-powered wheeled loader.

A small support fleet will be used for mine operations support services. These services will include:

- Haul road maintenance;
- Pit floor and ramp maintenance;
- Ditching;
- Reclamation;
- Open pit dewatering;
- Open pit lighting;
- Mine safety and rescue;
- Transportation of personnel and operating supplies; and

- Snow removal.

A fleet of diesel-powered mobile equipment is specified to handle the above pit support activities and include a hydraulic excavator, wheeled loader, track dozers and motor grader.

Maintenance activities on the mine mobile fleet will be performed in a mine maintenance facility located near the primary crusher, as well as in the field. Fuel, lube and field maintenance will be performed with a mobile maintenance fleet of equipment by qualified and trained staff.

Diesel fuel and lubricant storage will be located near the primary crusher, and a dedicated fuel and lube truck will deliver these materials to the mine and maintenance mobile fleet. Diesel will be supplied from local sources by road tankers and stored in approved, above ground double walled tanks. From here, fuel will be distributed to equipment consumers by means of a dedicated fuel truck or cardlock system located at the storage facility.

The workforce at the Project will be approximately 200 persons working two shifts per day or approximately 50 persons per shift (personnel will work four days on and four days off), similar to that at the operating Touquoy Mine.

In addition, the trucking operation hauling concentrate from the Project to the Touquoy Mine will create approximately 20 jobs that will be contract positions to drive the highway trucks and conduct vehicle maintenance.

2.4.1.2 Waste Rock Management

All waste rock removed from the open pit will be placed in the WRSA, shown on Figure 1-2. On behalf of the Proponent, Lorax (2019) analyzed mine ore, waste rock and tailings to determine the metal leaching/acid rock drainage (ML/ARD) properties of these materials. ML/ARD is a natural process that results from the weathering, primarily through oxidation, of sulphide-bearing rocks and overburden. When these materials are exposed to oxygen and water, metal sulphide minerals oxidize which results in the release of acidity and dissolved metals into contact water. If not neutralized, this process can lead to low pH conditions and elevated metal concentrations in mine drainage. The waste rock will be segregated based on NAG and PAG characteristics and placed into separate stockpiles to allow for appropriate management of waste rock materials. See Section 6.4 for further details on the results of waste rock geochemical analyses and further details on the management of those materials.

These piles will range in height from 20 m to 45 m above the existing ground surface and will contain waste rock excavated from the pit. This height generally conforms with local topographic variations. Total capacity of the PAG rock stockpile will be approximately 3.6 Mt. Total capacity of the NAG rock stockpile will be approximately 13.2 Mt. A haul road along the north-eastern limit of the WRSA will provide access ramps to the lift elevations.

The WRSA will typically be built bottom-up in lifts. Haul trucks will deliver the waste rock to the WRSA. Once the lifts reach 10 m in height, the face of the lift will be re-sloped as required to an overall slope of 3:1 for reclamation. Re-sloping, as required, will be completed by track type dozers and small hydraulic excavators.

The waste rock will be placed according to standard practices and will ensure compliance with provincial regulations with respect to slopes, potentially acid generating material (if any), and surface water run-off.

2.4.1.3 Low Grade Ore Stockpile

To ensure continuity of mill feed and allow initial processing of higher grade material, an LGO will be developed to the north of the plant (Figure 1-2). The northern edge of the LGO will have a maximum height of 40 m while the southern edge will have a maximum height of 10 m. Total capacity of the LGO will be 5.0 Mt.

As with the WRSA, the LGO will be built bottom-up in lifts. The LGO will be placed according to standard practices and will ensure compliance with provincial regulations with respect to slopes, potentially acid generating material (if any), and surface water run-off.

2.4.1.4 Milling Operations

The mill is located south-east of the proposed pit area and southwest of the TMF. The approach by road to the plant will be from the west off of Highway 374.

The main plant building houses the grinding, gravity recovery, flotation, concentrate dewatering and reagent sections. The concentrate storage will be located in a separate building. The single-stage crushing circuit is based on modular mobile crushing equipment and will be located to the south of the main plant building. The fine ore stockpile is covered for snow protection and dust control.

Process water will be reclaimed from the TMF for re-use in the milling operations. Initial start-up water and ongoing make-up water is expected to be sourced from nearby Seloam Lake through application for a surface water withdrawal approval (NSE).

Figure 1-2 shows the plant location in relation to the overall Project site. Figure 1-4 outlines the process flow at the Project.

2.4.1.4.1 *Crushing*

The crushing facility will be a single-stage crushing circuit that will process the ROM ore at an average rate of 326 t/h. The major equipment and facilities at the ROM receiving and crushing areas include:

- ROM hopper;
- Rock breaker;
- Vibrating grizzly feeder;
- Jaw crusher;
- Covered coarse ore stockpile;
- Stockpile reclaim belt feeders; and
- Stockpile transfer and feed conveyors.

ROM ore will be trucked in from the open pits and dumped directly into the ROM hopper or stockpiled on the ROM storage pad from which it can be reclaimed by a front-end loader for continuous feed to the plant. Any oversized pieces of ore will be retained on the static grizzly above the ROM hopper and broken down by a rock breaker.

ROM ore will be fed from the bin onto the vibrating grizzly feeder and grizzly oversized material will be fed directly into a single toggle jaw crusher. Ore will be crushed and discharged onto the jaw crusher discharge conveyor, which will also receive the vibrating grizzly undersize material. The jaw crusher discharge conveyor will be equipped with a magnet and a metal detector to detect and remove tramp metal pieces. Crushed ore and grizzly undersize streams will be combined and transferred to the coarse ore stockpile by the stockpile feed conveyor.

Coarse ore storage will consist of a covered conical stockpile with 12 hours live capacity.

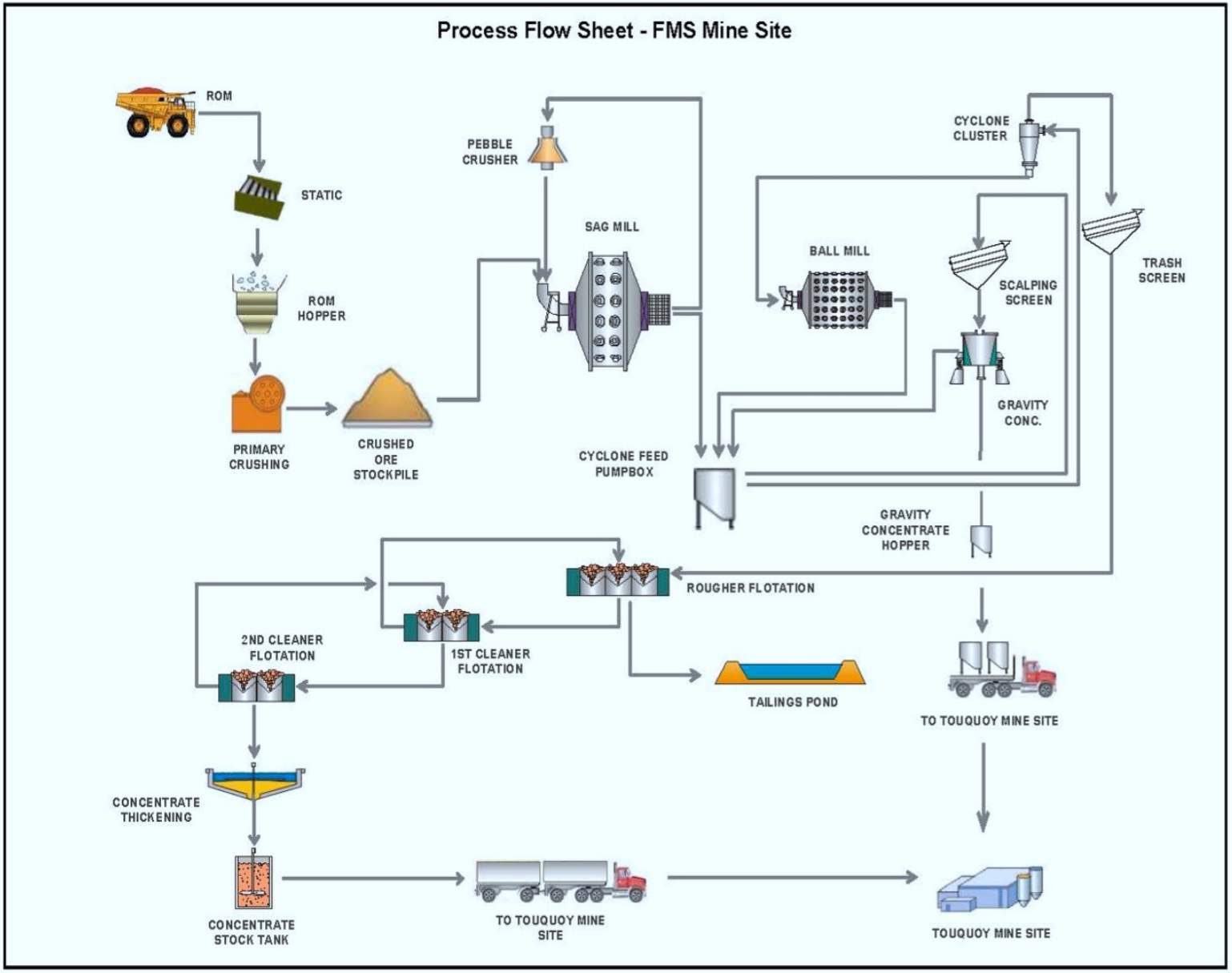

Figure 1-4: Process Flow Sheet – Fifteen Mile Stream Mine Site

Ore from the coarse ore stockpile will be reclaimed by one of two variable speed stockpile reclaim belt feeders at a nominal rate of 248 t/h. The belt feeder will transfer ore onto the SAG mill feed conveyor. Coarse ore from the SAG mill feed conveyor will discharge directly into the SAG mill. The SAG mill feed conveyor will be equipped with a belt scale to provide feed rate data for feed control to the grinding circuit.

2.4.1.4.2 *Grinding*

Crushed ore from the coarse ore stockpile will be reclaimed and fed into the SAG mill for grinding. A SAG mill in closed circuit with a pebble crusher and ball milling (SABC) grinding circuit is proposed. The primary grinding circuit will consist of a SAG mill and pebble recycle crusher treating 25% of the SAG mill feed. The secondary grinding circuit will consist of a ball mill in a closed circuit with primary classifying cyclones. SAG and ball mill discharge is collected in a common cyclone feed pump box. The proposed circulation load for the closed circuit is 300% of new feed.

SAG mill trommel screen oversize is collected on the SAG mill oversize conveyor and transferred onto the pebble crusher feed conveyor. These conveyors will be equipped with a magnet and a metal detector respectively to detect and remove tramp metal pieces ahead of the pebble crusher. A bypass chute will divert pebble crusher feed directly onto the pebble crusher discharge conveyor if metal is detected. The surge bin ahead of the pebble crusher ensures that the crusher is choke fed.

The comminution circuit will be equipped with two gravity concentrators to recover gravity recoverable gold (GRG). The gravity concentrators are fed simultaneously from the cyclone feed pump box by a dedicated pump at a rate equivalent to 50% of the ball mill discharge.

The grinding circuit will grind the crushed product to a P_{80} of 150 µm. The major equipment in the grinding circuit will include:

- One 7.3 m diameter by 3.8 m effective grinding length SAG mill driven by one 3,500 kW motor;
- One 220 kW cone crusher with an 11 mm closed side setting;
- Pebble crusher feed and product conveyors;
- One 4.27 m diameter by 6.7 m effective grinding length ball mill driven by one 2,000 kW motor; and
- One primary cyclone cluster, consisting four 650 mm diameter cyclones (three operating, one standby).

As required, steel balls will be added into the ball mill using a manual kibble system to maintain grinding efficiency. The SAG mill will be equipped with an automated rotary ball feeder and ball counter.

The primary cyclone overflow will be gravity flowed to the flotation circuit.

2.4.1.4.3 *Gravity Concentration*

A portion of the combined mill discharge will be split and fed into two 50% duty parallel gravity concentrator trains. The gold concentrate solids recovered will be stored in a mobile hopper.

The equipment is arranged to provide a gravity cascade under the gravity circuit scalping screen. Two outlets from the screen underpan provide the feed slurry to two gravity concentrator trains. The two gravity concentrators in parallel are sized for 168 t/h solids feed rate each.

The oversize from the scalping screen will gravitate to the ball mill feed chute, while the undersize will feed the concentrators. The tailings from the concentrators will be transferred back to the cyclone feed pump box and the gold-containing gravity concentrate will

be stored in a secure hopper. Once a hopper is full, the water will be decanted, and the hopper will be changed out via forklift and put onto a flatbed truck for transportation to the Touquoy Mine for final processing. The expected mass of gravity concentrate to be produced is 4.4 tpd.

2.4.1.4.4 *Flotation Circuit*

The slurry from the cyclone overflow will gravity flow to a trash screen ahead of the flotation circuit while the cyclone underflow will recirculate back to the grinding circuit. The flotation circuit consists of:

- 7 x 30 m^3 Rougher flotation tank cells;
- 6 x 10 m^3 First stage cleaner flotation tank cells; and
- 4 x 5 m^3 Second stage cleaner flotation tank cells.

Rougher Flotation

Primary cyclone overflow will flow by gravity to the rougher flotation cell feed box. In the rougher flotation cells, potassium amyl xanthate (PAX) collector and methyl isobutyl carbinol (MIBC) frother will be added to enhance the flotation performance.

Concentrates from the rougher circuit are collected via a series of launders and directed into the cleaner feed pump box for transfer to the cleaner circuit. Rougher tailings will be pumped to the TMF.

Cleaner Flotation

The cleaner flotation circuit is configured in two stages, with first cleaner tails returning to rougher feed and the first cleaner concentrate advancing as feed to the second cleaner circuit. Second cleaner tails are returned to the first cleaner feed and second cleaner concentrate is the final concentrate which is pumped to the concentrate thickener.

The cleaner circuit reduces the mass of concentrate produced while maintaining high gold recovery. Overall flotation circuit mass pull is approximately 2.8%.

2.4.1.4.5 *Concentrate Thickening, Filtration and Storage*

The concentrate thickening, filtration, storage and loadout facilities for flotation concentrate consist of:

- One 7 m diameter high-rate thickener.

Concentrate Thickener

Second stage cleaner flotation concentrate will be thickened to a target of 56% solids in a 7 m diameter high-rate thickener. The concentrate will be mixed with diluted flocculant solution at the thickener feed well. Flocculated solids settle towards the thickener discharge cone and will be pumped to the concentrate surge tank, while the supernatant water will overflow to the concentrate thickener overflow tank. Thickener overflow water will be pumped to the process water tank for use as process water in the plant.

Concentrate Filtration & Storage

Thickened concentrate, at 56% solids, will be pumped to concentrate surge tank, and in turn pumped into a B-Train tanker truck. Concentrate is transported by truck for further processing at Touquoy plant. Flotation concentrate production is expected to be approximately 150 tpd.

2.4.1.5 Tailings Disposal and Reclaim Water

The flotation tailings from the rougher/scavenger flotation tank cells will flow will be pumped to the TMF for storage and disposal. The supernatant from the tailings pond will be reclaimed by the reclaim water pumps and recirculated via pumping to the process water tank and re-used as process water.

2.4.1.6 Reagents

The reagents will be prepared and stored in a separate, self-contained area within the process plant and delivered by individual metering pumps or centrifugal pumps to the required addition points. All reagents will be prepared using raw water.

Potassium Amyl Xanthate (Collector)

Potassium Amyl Xanthate (PAX) is used as a collector in the flotation circuit and is supplied in 25 kg bags in the form of pellets. The pellets are mixed with raw water to produce 15% solution strength. The PAX mixing system is a skid package provided by the vendor. The PAX solution will be distributed to the flotation circuit by three reagent metering pumps. Preparation of the PAX will require a bulk handling system, mixing and holding tanks, and metering pumps.

Methyl Isobutyl Carbinol (Frother)

Methyl Isobutyl Carbinol (MIBC) is used as a frother in the fines rougher/scavenger and cleaner flotation circuit and is supplied in bulk tote containers in liquid form. MIBC will be pumped directly from the tote by two reagent metering pumps and is used as 100% solution strength.

Flocculant

The flocculant will be supplied in 25 kg bulk bags as a dry powder. The flocculant is mixed with raw water and diluted to 0.50% mix concentration. The flocculant mixing system is a skid package provided by the vendor. The mixed solution is supplied to the thickeners by two flocculant metering pumps.

As a result of the concentrate being transported and processed at the Touquoy Mine Site, cyanide is not currently planned for use at the FMS Mine Site.

2.4.1.7 Air Services

Blower Air

The flotation blowers will supply air to the rougher/scavenger tank cells and cleaner tank cells. The installed blowers will be multiple-stage, centrifugal type blowers and will be used with a “blow-off” arrangement to adapt to fluctuations in flotation air demand.

Plant & Instrument Air

Rotary screw air compressors will provide high pressure compressed air operating in lead-lag mode, to meet the demand for plant and instrument air requirements.

Pressure filter will use the wet high-pressure air produced from the rotary screw air compressors. There will be a dedicated air receiver to store necessary compressed air required for pressure filter operation.

Wet Plant air will be stored in the plant air receivers to account for variations in demand prior to being distributed throughout the plant. Instrument air will be dried in an Instrument Air Dryer before distributed throughout the plant.

2.4.1.8 Water Services

Raw Water

Raw water will be pumped from Seloam Lake to the raw and fire water tank to feed the plant. Raw water in the tank is used to supply the following services:

- Primary crushing circuit dust suppression water;
- Reagent preparation water;
- Slurry pumps gland seal water;
- Cooling water systems;
- Make-up water for the process water system; and
- Fire water.

Raw water is supplied to the plant by two raw water pumps in a duty-standby configuration.

Potable Water

Potable water will be sourced from the raw water tank and treated in the potable water treatment skid. The treated water will be stored in the potable water storage tank for use by two potable water pumps in a duty–standby configuration.

This services safety showers, eye washes and all tap water on site and is not drinkable, so drinking water will be brought in for consumption.

Gland Water

Gland water is supplied from the raw water and distributed to the plant by two gland seal water pumps in a duty-standby configuration.

Process Water

Process water is comprised mainly of concentrate thickener overflow water and tailings pond reclaim water. Process water is stored in the process water storage tank and distributed by the two process water pumps, in a duty-standby configuration.

2.4.1.9 Other Services

To facilitate successful mining operations, the following in situ support services will be available:

- mine site road maintenance;
- mine floor and ramp maintenance;
- ditching;
- reclamation and environmental controls;
- surface mine dewatering;
- surface mine lighting;

- mine safety and rescue;
- transportation of personnel and operating supplies; and
- snow removal.

2.4.1.10 Ore Management

On average, approximately 21,800 t of rock will be extracted from the open pit per day. Of that, approximately 8,200 t will be ore-bearing and approximately 13,600 t will be waste rock. Ore and waste rock will be loaded into off-highway haul trucks for transport out of the open pit. From there, ore will be separated into low and ROM stockpiles prior to entering the crusher, while non-ore bearing waste rock will be stockpiled for final disposal.

The ore stockpiles will include low grade stockpile, located north of the crusher and operational facilities pad, and a ROM stockpile at the crusher. Acid rock drainage potential was analyzed and is discussed further in the of the EIS. Results indicated that the majority of the ore deposit is net acid consuming over the life of the operating period.

The LGO stockpile will temporarily store ore which will be re-handled through the crusher once the mine has been exhausted. Re-handling of the stockpiled ore will take place during Years 6 and 7 of operations.

2.4.1.11 Surface Water Management

Surface water collected will be directed to the TMF. The TMF will act both as containment for tailings and site contact water unsuitable for discharge. Initial water balance calculations indicate the TMF will operate under surplus water conditions and require a discharge. Further work will be undertaken to determine the need for, and design of, any treatment works to ensure such discharge meets environmental requirements. Water quality modelling conclusions indicate that water treatment during operations will not be necessary, but water treatment will be available if needed.

Water suitable for discharge will flow via HDPE discharge pipe to Anti Dam Flowage and the downstream receiving environment.

2.4.1.12 Power Supply and Reticulation

The incoming 69 kV feed will be stepped down to 25 kV. Power will be distributed throughout the site to supply the gatehouse, mine office, truck workshop, warehouse, mining office, change room buildings and TMF. The power distribution will be via overhead power lines and buried conduits wherever required. The 25 kV will be stepped down to each of these buildings with small transformers typically 100 kVa and less will be pole mounted and larger transformers will be placed on the ground.

A black-start diesel generator will provide emergency power. In the event of a total power black-out the generator will be started by an operator. The emergency generator will only supply back-up power to select equipment in the process plant area.

2.4.1.13 Fuel Supply, Storage and Distribution

A diesel storage and distribution facility (50,000 to 75,000 L) will be located adjacent to the workshop/warehouse. Diesel will be delivered to site in tanker trucks and will be available for use by vehicles using a bowser arrangement with cardlock. There may be a smaller diesel tank (5,000 L) at the TMF for use by contractors during construction. Gasoline usage is expected to be minor, as required for light vehicles use only, and will be satisfied by one gasoline tank (5,000 L) located in the ancillary building area. The road trucks required to transport FMS concentrate to the Touquoy Mine Site will be refueled at FMS Mine Site or Touquoy Mine Site as needed. A propane storage facility will be located near the process building. The major propane use will be for space heating.

The delivery of diesel fuel, gasoline, and propane will be conducted by tanker trucks from suppliers who routinely transport and distribute petroleum products. Transfer of these products from the tanker truck to double-walled tanks with bollards will be constantly supervised by the delivery person to ensure constant observation and immediate response should a spill occur. Based on anticipated equipment, associated efficiency ratings, and hours of operation, diesel fuel consumption by operational equipment and haul trucks has been estimated to be approximately six million litres of diesel fuel per year during full scale operations. Final fuel storage configuration will be determined based on final equipment selection.

2.4.1.14 Concentrate Transport

The concentrate will be transported to the Touquoy process plant along a combination of existing public roads and private road. The initial route proposed is along Highway 374 south to Highway 7, west along Highway 7 through Sheet Harbour to Mooseland Road at Tangier, and then north-west along Mooseland Road to the Touquoy Mine. Once the Beaver Dam Mine comes online (proposed in 2022 or 2023), FMS haul trucks are expected to travel along Highway 374 south to Highway 7, west along Highway 7 through Sheet Harbour to Highway 224 and then north-west along Highway 224 connecting with the upgraded Beaver Dam Haul Road to Mooseland Road.

Assuming a 38 t payload, approximately four highway trucks will be required to transport the concentrate from the FMS Mine Site to the Touquoy Mine Site. The exact number will depend on final payloads and the hauling schedules, which will likely be a single 12-hour shift, or two 8-hour shifts per day operating between the hours of 7:00am to 11:00pm. The number of return truck trips per day will be an annual average of approximately 8 to 11 for 350 days per year (contingency of 15 bad weather days) for the anticipated duration of the Project operations. The exact number trucks will depend on final payloads and the hauling schedules.

2.4.2 Touquoy Mine Site

During operation and maintenance of the Touquoy Mine Site the following activities will be undertaken:

- ore processing; and
- tailings management.

2.4.2.1 Ore Processing

Final processing of gold concentrate will take place at the existing Touquoy facility currently operating at the Touquoy Mine Site. The Touquoy plant has the capacity and is designed to be able to treat the concentrate with only minor modifications required including:

- Concentrate storage;
- Gravity concentrate leach reactor; and
- Gravity electrowinning cell.

This can be accommodated in the existing process building footprint. Figure 1-5 outlines the process flow at the Touquoy Mine Site for final processing of FMS concentrate.

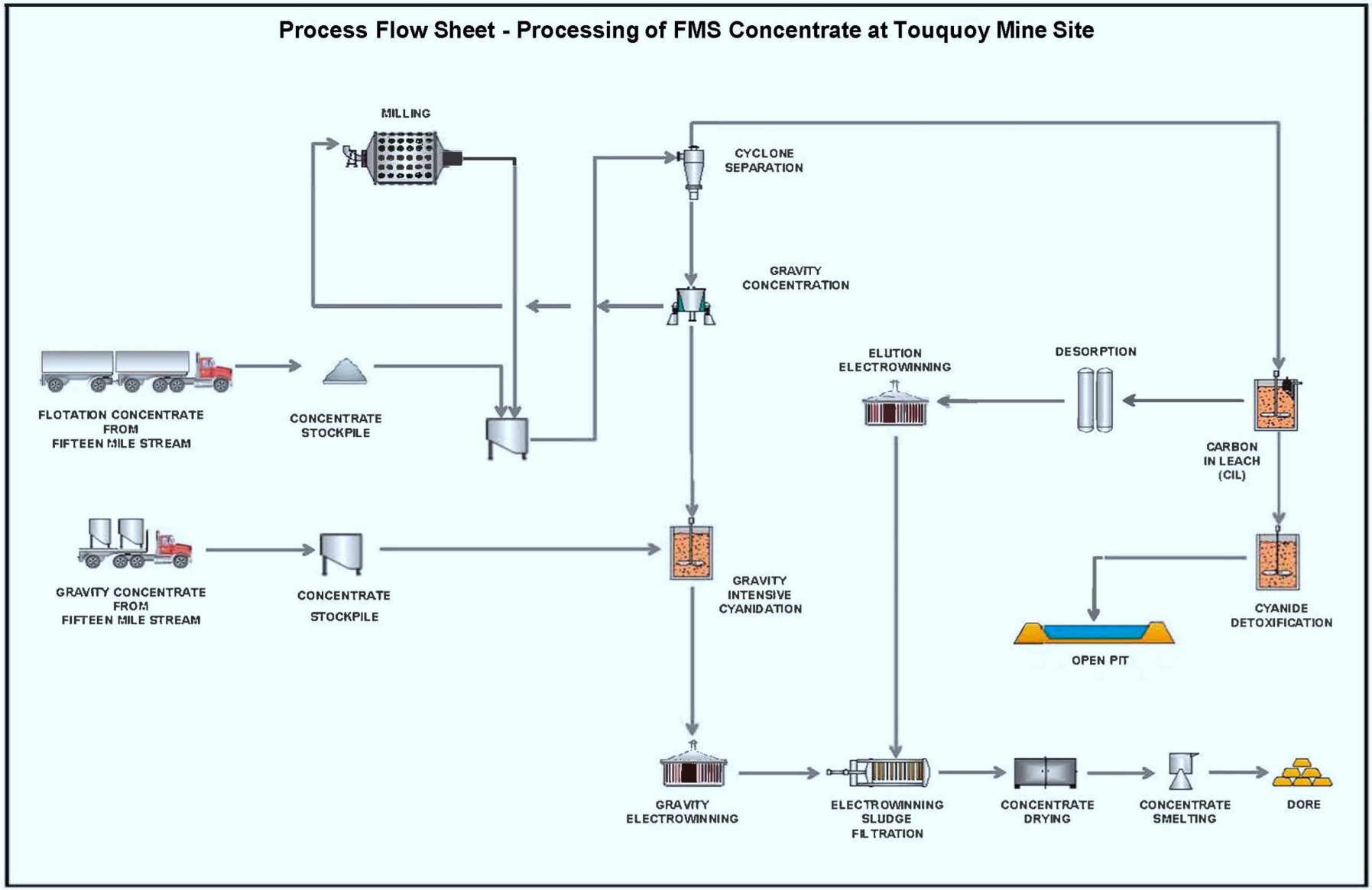

Figure 1-5: Process Flow Sheet - Processing FMS Concentrate at the Touquoy Mine Site

2.4.2.2 Intensive Cyanidation

Gravity gold concentrate will be transported to the Touquoy Mine Site within a mobile hopper. The hopper will be designed to connect directly with the intensive batch leach system, thus avoiding re-handling of concentrate. The intensive batch leach circuit will receive the periodic gold concentrate for treatment in an intensive leach reactor. The gold-containing pregnant solution will pump periodically to a dedicated eluate tank in the gold room.

2.4.2.3 Carbon-in-Leach (CIL)

Flotation gold concentrate will be transferred into the leach feed box for slurry conditioning prior to leaching. The leach feed slurry will be mixed with lime slurry in the leach feed box to raise the slurry pH for cyanide gold extraction. The feed box will gravitate to the leach tank and optionally can feed directly to CIL Tank 1.

The circuit is a hybrid CIL type and consist of one leach tank and six adsorption tanks in series, each having a live volume of 1,169 m^3. The design allows for a 250 t/h solids feed rate at 50% solids for an average 24-hour residence time. Each tank will be interconnected with launders to allow slurry to flow sequentially by gravity to each tank in the train.

Barren carbon will enter the adsorption circuit at CIL Tank 6. The carbon will advance countercurrent to the main slurry flow during periodic transfers of slurry and carbon using air lift movement from a downstream to upstream tank. Carbon concentrations of 10 to 15 g/L are required in all tanks. Carbon will be retained in the upstream tank by an intertank screen. The countercurrent process will be repeated until the carbon becomes loaded and reaches CIL Tank 1. Then a recessed impeller pump will be used to transfer slurry and carbon to a loaded carbon recovery screen. The loaded carbon will be washed with water and released to the acid wash column located inside the main plant, in the desorption area. The slurry will be returned to CIL Tank 1.

Following elution of the loaded carbon and thermal regeneration, the barren carbon will be screened and report to CIL Tank 6. Fine carbon will be discarded to the CIL tailings hopper.

Tailings slurry from CIL Tank 6 will flow by gravity to the vibrating carbon safety screen to recover any carbon in the event of damage, wear or other issues with the CIL Tank 6 interstage screen. Recovered carbon will be collected in a bin that can be manually transferred for re-use or disposal. Tailings discharging from the safety screen will gravitate to the cyanide detox Tank 1 in the cyanide detoxification circuit.

2.4.2.4 Desorption and Regeneration

The following operations are carried out in the desorption and regeneration areas:

- Acid washing of carbon;
- Stripping of gold from loaded carbon; and
- Regeneration of carbon.

This circuit comprises a fibre reinforced plastic column located within the process building. A separate acid-proofed concrete bund is provided under the acid wash column area to ensure that all spillage is captured and kept separate from other process streams. Transfer and fill operations of the acid wash column are controlled manually. All other aspects of the acid wash and the pumping sequence are automated.

A pressure Zadra elution comprising an elution column, strip solution tank, strip solution pump and a strip solution heater package operates in a closed loop with the electro-winning cells located inside the Gold room.

The elution column is a pressure vessel with a live volume equivalent to 6 t of carbon. The elution column is constructed from carbon steel and includes insulation of all hot surfaces. The column is located next to the acid wash column and shares a bund and a sump pump with the strip solution and transfer water tanks.

The strip solution heater package is located inside the process building, near the elution column, but separately bunded. Within this package there is a recovery heat exchanger, trim heat exchanger, direct-fired heater, control panel, all interconnecting electrics and pipework. The heater is a direct-fired type with a propane fuel modulating burner. The heater is designed for a heat output to maintain the strip solution at 145 °C during the stripping cycle. Both heat exchangers are plate and frame type and ensure that the nominal temperature of solution entering the electro-winning cells is <100°C.

After completion of the elution process barren carbon is transferred from the elution column to the kiln dewatering screen and into the carbon regeneration kiln feed hopper. In the kiln feed hopper, any residual and interstitial water is drained from the carbon before it enters the kiln. The kiln is a horizontal rotary unit sized for a feed rate of 330 kg/h at 75% utilization and is propane-fired.

The kiln operates at 650 to 750°C and has a nominal retention time of 15 minutes to allow reactivation to occur. Regenerated carbon discharges from the kiln to a quench tank and is then pumped using a recessed impeller pump to the carbon sizing screen. The screen oversize returns to CIL Tank 6, while the quench water and fine carbon report to the tailings hopper via the carbon safety screen for disposal in the TMF. Fumes from the kiln pass through a wet scrubber to remove entrained minute carbon particles and then to atmosphere via an exhaust stack.

2.4.2.5 Gold Room

Three electrowinning sludging cells are used; one cell will be dedicated to the intensive cyanidation circuit and the other two to the elution circuit.

The electrowinning cell dedicated to the intensive cyanidation circuit is fed leach solution via a fixed speed centrifugal pump from the gravity leach liquor storage tank. Solution is pumped to the electrowinning cell and then gravitates back into the gravity leach solution storage tank in a closed loop until suitable gold recovery is achieved. The duration of this cycle varies with the quantity of gold recovered by gravity but is typically less than 24 hours.

The two electrowinning cells dedicated to the elution circuit operate in a closed loop with the elution column and associated equipment. Eluate flows directly from the top of the elution column to the electrowinning cells after cooling through heat exchangers. The eluate flows through the electrowinning cells and then gravitates back to the strip solution tank and then to the elution column in a continuous closed loop. The duration of this cycle is about 16 hours.

2.4.2.6 Cyanide Handling and Detoxification

2.4.2.6.1 *Cyanide*

Sodium cyanide (NaCN) is a key reagent used 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.

NaCN is delivered in the form of in dry briquettes from an approved supplier as per the International Cyanide Management Code (ICMC) standards. NaCN deliveries are made by truck in one tonne secured (strapped) wooden crates. Within the crates the NaCN is double and sealed close. At site the sodium cyanide is stored in a locked fenced area within the secure reagent building and kept under camera surveillance.

Prior to use, NaCN is mixed with water and sodium hydroxide (NaOH) for dilution and pH control within a mixing tank. Prior to mixing, operators will suit up in full personnel protective equipment (PPE) including Tyvek suits and powdered air purifying respirators

(PAPR). Water and NaOH are added to the cyanide mix tank. The wooden crates are opened, and a gantry crane lifts the bags out and transports them to the mix tank. The bags are lifted by crane into the bag cutter on top of the mix tank and the door is shut to enclose the bag. The bag is slowly lowered onto the bag cutter and the dry solids are emptied into the mix tank. The bag cutter has water sprays to clean the cyanide bags prior to removing from the enclosure. This process is repeated for 4 cyanide (NaCN) bags to achieve a mix concentration of approximately 22%. Once the NaCN storage tank level is below 20% the mix tank is then transferred to the storage tank for distribution throughout the plant.

Cyanide is added into three areas; Leach tank #1, intensive leach reactor (ILR) and barren eluate tank #12. Leach tank #1 is a continuous addition whenever the leach circuit is being fed with ore. It is controlled based on constant cyanide titrations throughout the leach/CIL circuit. The ILR and barren eluate tank are dosed based on a batch process. When a batch is ready, the dosage is controlled based on a flowmeter to a targeted concentration. All these addition points have pH control reagents (NaOH or Lime) with automated interlocks that will not permit NaCN addition until a suitable pH is achieved to avoid the formation of hydrogen cyanide (HCN) gas.

Cyanide target concentrations are as follows:

- Leach tank #1 = 50 ppm (0.005%). By the end of the CIL circuit (CIL tank #6), the remaining cyanide is about 30 ppm (0.003%);
- ILR = 14, 000 ppm (1.4%). Once the process is complete, this small volume (5.2 m^3) is transferred and diluted in the much larger Leach/CIL circuit (9,100 m^3) for consumption; and
- Barren Eluate Tank #12 = 1000 ppm (0.1%). Once the process is complete, the remaining cyanide stays in the tank to be re-used during the next batch. Each new batch, the cyanide is just topped up to the target concentration.

2.4.2.6.2 *Cyanide Destruction*

Cyanide destruction occurs within the cyanide destruction circuit. Slurry passing through the carbon safety screen gravitates to two 300 m^3 cyanide detoxification tanks which are designed on the conventional air-SO_2 process and can operate in series or parallel for operational flexibility. The average slurry residence time at 250 t/h is 1.5 hours.

The tanks utilize high shear agitators and air injection to enhance high oxygen dissolution in the slurry to meet the high oxygen demand of the cyanide destruction process. Sodium metabisulphite and copper sulphate solutions are dosed into either tank providing the oxidizing agent and catalyst respectively for the cyanide destruction. Acid generation is neutralized by the addition of lime slurry to the detox tanks via a ring main.

The detoxified slurry stream gravitates to the tailings hopper from where it is pumped through a single pipeline to the TMF by variable speed tailings pumps (1 duty/1 standby). The tailings slurry is then discharged at selected outlet points around the periphery of the facility. Pipe runs are designed to be self-draining to avoid dead legs.

Contingency measures for cyanide detoxification include primary linear and secondary rotary vezin tailings samplers taking representative tailings samples after the slurry has been detoxified and prior to entering the tailings hopper. The cyanide destruction and tailings hopper area has a dedicated bunded concrete area for collecting spillage. A local sump pump returns any spillage to the carbon safety screen. The area is enclosed for cold weather protection. A CNWAD analyzer automatically monitors slurry levels and an HCN detector provides monitoring for airborne gas.

Shutdown procedures are in place in the event of process upsets including cyanide detoxification.

2.4.2.7 Tailings Disposal

Following the completion of Touquoy mining, a tailings line will be routed to the exhausted Touquoy pit in preparation to receive FMS concentrate tailings. Tailings will be discharged to the open pit via double walled HDPE pipe. Initially, reclaim water will be withdrawn from the supernatant pond in the existing TMF to supply processing water needs for the FMS concentrate. A reclaim water pump and barge, with a new pipeline to the process water tank, will be installed when process water accumulation from the tailings slurry deposited in the pit is adequate. The transition from the TMF to the open pit reclaim water system is expected to be smooth requiring minimal downtime. Additional fresh water requirements beyond what is currently permitted from Scraggy Lake under the Touquoy water withdrawal approvals may be required.

Supernatant water collected in the open pit will be pumped to the process water tank located next to the pre-leach thickener. The sections of the tailings and reclaim pipelines between the plant site and open pit will run in engineered, clay lined trenches with adequately sized emergency dual-lined collection ponds capable of containing the volume of the pipeline, in the event of piping failure. Automated monitoring systems will be installed for pipeline leak detection and shutdown procedures.

The Touquoy Mine currently employs an Operation, Maintenance and Surveillance (OMS) Manual for the existing TMF. This manual will be updated in advance of using the open pit for storage of FMS concentrate tailings in order to reflect changes in operating conditions and environmental factors. As well, the Touquoy Mine also currently employs an Emergency Response Plan and Spill Contingency Plan which will also be updated. Environmental monitoring will continue as prescribed under the Touquoy IA, which will be amended as necessary to reflect the changes in processing of FMS concentrate and storage of FMS concentrate tailings.

2.4.2.8 Existing Environmental Mitigation and Monitoring Requirements Associated with Operations

There is an existing IA for the Touquoy Gold Project which has specific environmental mitigation and monitoring requirements. This is relevant to the Project in two ways:

- Monitoring data is being collected since 2016 and will continue to be collected through to the start of the Project as part of requirements under the existing IA. This provides much background data to support the follow-up programs anticipated at the Touquoy Mine Site for the Project.
- Mitigation measures required as part of the IA and other associated Touquoy Mine environmental management plans will continue to be implemented as part of the Project.

2.5 Closure (Years 9 to 11 and Beyond)

The Closure Phase consists of two stages: Reclamation and Decommissioning, and Post-Closure.

During the reclamation stage, all infrastructure will be removed. Site water will be re-directed towards the open pit to facilitate pit flooding creating a lake. Re-contouring of the WRSA will be carried out progressively throughout the Project life where practical. Water quality modelling has indicated that because of the potentially acid-generating nature of the PAG stockpile, a clay cover will be installed on the PAG stockpile before it is capped and reseeded. A clay cover with an assumed infiltration rate of 15% has been used for post-closure water quality modelling. Berm crests will be re-sloped to permit covering with soil and re-seeding. This approach will minimize the amount of exposed waste rock at any given time and reduce the potential for erosion and acid rock drainage (ARD).

The mine site infrastructure footprint will be capped with soil, where required, or otherwise the surface will be ripped or scarified, sloped, re-contoured to a stable angle and hydroseeded to match the local topography where practicable. Waste rock storage areas will be graded to 3:1 slopes and tailings dam embankment slopes will be graded to 2.5:1 so that they are structurally stable. The final slopes will be based on site specific geotechnical stability studies.

The long-term post-closure stage commences once active reclamation is complete. This post closure stage encompasses pit filling, water treatment as required, and all monitoring programs. This stage is complete once the pit lake has filled and monitoring has been completed to confirm structural and environmental stability for the long term (steady state) for the pit and across the site.

2.5.1 Preamble on Reclamation/Decommissioning Stage

The purpose of site reclamation is to improve aesthetics and allow the site to return to its pre-development state or to a stable future planned use, while decreasing the potential for environmental risk.

The Proponent will establish lease agreements with the province and private landowners for the life of the open pit mine. Land leased for the FMS Mine Site and Touquoy Mine Site will be returned to the province and private owners (if applicable) following the completion of operations, equipment decommissioning and removal, and the acceptance of decommissioning and reclamation activities by Nova Scotia Environment.

The Proponent recognizes the requirements for reclamation through the NS *Environment Act* and *Mineral Resources Act* and the role that NSE and NSL&F have in determining reclamation activities, bonds and plans. The Proponent is well familiar with these requirements and agencies through the development of the Touquoy Mine and the development of the accepted reclamation plan and bond values for that mine. This knowledge and history are advantageous for the successful development of the reclamation plan for the FMS Mine Site that would be required at the Industrial Approval stage of the Project development.

2.5.2 FMS Reclamation Stage: Objectives and Goals

The objective of the Final Reclamation and Closure Plan is to return the site to a safe and stable condition, compatible with the surrounding landscape and anticipated final land use. The plan will employ recognized reclamation best practices, acknowledged principles of ecological restoration, and consultation with relevant stakeholders including Mi'kmaq communities. In the past, the site has hosted numerous mining/exploration activities (underground mine workings, exploration declines, roads, camps, settling ponds, and waste piles of rock and overburden), along with successive tree harvesting and silviculture operations. Evidence of recreational land use (hunting and off-road vehicles) and surface water use (fishing and boating) directly within the FMS Study Area is present and suggests these activities could be re-instated once the surface mine ceases operation and reclamation activities have been completed.

The goals of a successful Final Reclamation and Closure Plan include:

- remove all equipment and infrastructure not necessary for future use and care of the site;
- stabilize the terrestrial environment and revegetate the site to encourage regrowth of native species;
- minimize disruption to the aquatic environment; and
- restore land and surface water use potential.

The reclamation goals are designed to enable eventual abandonment of the site in a safe and stable state.

2.5.2.1 Conceptual Reclamation and Closure Plan

Both components affected by the Project will be included in reclamation activities. The Touquoy Mine Site will be reclaimed under a separate approved plan developed for the Touquoy Gold Project.

Reclamation and Closure Plan requirements in Nova Scotia include the need to submit a Conceptual Reclamation and Closure Plan at the EA stage, a Reclamation and Closure Plan as part of the IA stage, and a Final Reclamation and Closure Plan six months prior

to mine closure. The submission of a Conceptual Reclamation and Closure Plan in concurrence with the EA/EIS allows the public, regulators, and the Mi'kmaq of Nova Scotia to provide comments the Proponent can consider in the development of the Reclamation and Closure Plan. The Reclamation and Closure Plan will be used as the basis to determine the bond amounts and requirements at the Industrial Approval stage of the Project. The submission of a Final Reclamation and Closure Plan six months prior to surface mine closure will allow the Proponent to incorporate knowledge of the site gained through site preparation and construction, and operation and maintenance. Public and Mi'kmaq consultation and engagement will also be sought for the development of the Final Reclamation and Closure Plan through the Community Liaison Committee (CLC) or other technical advisory committee as determined through consultation with the Mi'kmaq and local stakeholders, as concerns raised during the development of the Reclamation and Closure Plan at the IA stage may have changed.

2.5.2.2 FMS Reclamation: Site Infrastructure

In order to achieve the goals described above, the Proponent will undertake general decommissioning and reclamation activities. During reclamation, the FMS Mine Site will include the following:

- All mine site facilities will have been removed;
- Site contact water will be re-directed towards the pit, to allow it to fill with water to eventually form a lake with a wetland edge habitat;
- Topsoil piles will be used up in reclamation;
- The NAG waste rock pile will be capped with topsoil and re-seeded and all disturbed areas will be re-vegetated;
- The PAG waste rock pile will likely require an engineered cover system before cap and re-seeding due to the acid-generating nature of the waste rock;
- The till stockpile will be re-vegetated if there are any residual materials following reclamation;
- Mine site roads will remain in place, and ultimately will be returned to the landowners for forestry and recreational use;
- TMF surface water ponds will be removed and tailing waters will be drained. The TMF will be capped using a combination of rock and soil cover;
- Water treatment, as required, at the site prior to discharge to the mined-out pit, and monitoring programs will be on-going; and
- Fences will be removed once the majority of closure activities are completed.

Ultimately the land will be returned to conditions similar to its original state as a natural woodland and wetland habitat used for recreation and forestry in consultation with stakeholders on their future use of the site. The existing conditions at the site have been previously described as being in a disturbed state in many areas and therefore improvements at the site will be realized through the reclamation activities proposed.

2.5.2.2.1 *Vegetation Post Closure*

Vegetation of areas disturbed by mine development will be integral to preventing erosion and encouraging the growth of native flora for a stable post-closure habitat. All disturbed areas will be covered with a layer of overburden material and topsoil and subsequently vegetated. Vegetation will be achieved through a combination of hydroseeding and the use of local topsoil with native seed and plant

mixtures. The Final Reclamation and Closure Plan, submitted at least six months prior to closure for approval, will define the specific soil amendments, seed mixes and plants to be used during vegetation.

2.5.2.2.2 *Open Pit*

At the end of mine operations at the FMS Mine Site, the dewatering pumps from the open pit will be decommissioned, and the pit will be allowed to flood. Based on the water balance report completed for the site (Knight Piesold Ltd, 2020) the filling of the pit will take approximately 3 to 4 years. The Reclamation and Closure Plan submitted as part of an Industrial Approval process will detail information relative to pit security measures for public and wildlife safety during the refilling period. These measures require the input of multiple agencies to meet regulatory and corporate requirements.

Water levels in the FMS Mine Site pit will rise quickly in the initial years following cessation of operations but will slow as water reaches wider areas of the pit and a greater volume is required to increase water level. This will immerse sulphide mineralization in the walls of the pit limiting the potential for acid generation.

Flooding of the pit will create a lake with a shallow water wetland border where practicable.

During post-closure and once the pit is filled and water quality reaches acceptable conditions for discharge, a connection will be re-established between the newly formed lake and Seloam Brook. Until such time that water quality has reached acceptable conditions for discharge, water treatment is planned and discharge will be directed to Anti-Dam Flowage.

2.5.2.2.3 *Mine Site Roads*

The loose-surface, all weather roads established on the site to facilitate operations will remain in place to enable closure activities, monitoring, and provide access for commercial and recreational activities after closure is completed, and ultimately will be returned to the land owner.

2.5.2.2.4 *Waste Rock Stockpiles*

The waste rock stockpiles will be a key location for progressive reclamation during the operational phase of the mine. As construction proceeds the waste rock pile will be contoured to an overall closure slope of 3H:1V, covered with a layer of overburden material and a layer of topsoil and vegetated. The final slopes will be based on site specific geotechnical stability studies. The flat, ultimate top lift of the stockpile will be similarly contoured, capped and vegetated upon final closure of the mine.

Water quality modelling have indicated that because of the potentially acid-generating nature of the PAG stockpile, a clay cover will be installed on the PAG stockpile before it is capped and reseeded. A clay cover with an assumed infiltration rate of 15% has been used for post-closure water quality modelling (Golder 2019b). For reclamation, berm crests will be re-sloped to permit covering with soil and re-seeding. This approach will minimize the amount of exposed waste rock at any given time and reduce the potential for erosion and acid rock drainage (ARD).

Topsoil will be stockpiled during construction and used to facilitate re-vegetation at the end of the mine life and, when practical, during operation. All disturbed areas, most notably the waste rock and till storage piles, will be reclaimed with topsoil and growing medium to a depth matching the native surroundings. Re-vegetation will employ hardy pioneer species and grasses to colonize disturbed areas and stabilize soil. Native species will be planted to hasten a return to a natural ecosystem reflecting the pre-development site. Organic debris (roots, stumps, brush) will also be stockpiled and mulched to provide biomass for reclamation.

2.5.2.2.5 *Ore Stockpiles*

No ore stockpiles are expected to remain at the end of the surface mine life. The cutoff grade is 0.3 g/t and the current production plan calls for all material above cutoff grade to be milled. The Proponent has hedged a portion of its production to ensure that any interim stockpiles that may exist can be processed profitably in the unlikely event that the mine closes early. If economics deem low grade ore to be unprofitable, then any remaining low-grade ore stockpiles will be remediated or returned to the open pit. Remediation would involve three options:

- If the low grade ore is demonstrating NAG, cover with available till/clay and revegetate;
- Alternatively, cover the LGO stockpile with a compacted clay cover and drainage (filter layer) to minimize infiltration of surface water into the stockpile. The clay cover will be covered with topsoil and revegetated; or
- Any remaining low grade ore would be re-handled back into the mined out pit for permanent storage under water.

2.5.2.2.6 *Operational Facilities*

Buildings, equipment, and other infrastructure will be dismantled and salvaged or sold as scrap depending on condition and markets. Concrete foundations will be destroyed and buried. Minor excavations will be filled, or barriers erected to eliminate hazard to the public or wildlife. Ancillary facilities (truck shop, fuel farm, generators) will be used to support reclamation activities for the surface mine and waste rock stockpile before final decommissioning. Fences will be removed once the majority of closure activities are completed.

If soil is encountered that is contaminated with hydrocarbons from the fuel farm and shop areas, it will be disposed of at an approved soil treatment facility. Dismantling procedures for all equipment and facilities will ensure that workers and the public are not exposed to hazardous materials or products used in or resulting from operations.

2.5.2.2.7 *Tailings Management Facility*

TMF closure and rehabilitation activities will be carried out progressively during the Operations Phase (where practicable) and at the end of economically viable mining. Closure and rehabilitation activities will be conducted in accordance with international closure standards. Specifically, measures will be taken to ensure that:

- Dust is not emitted from the facility as a result of moisture loss from the TMF surface;
- Runoff does not affect surface or groundwater;
- The TMF embankments remain stable; and
- The stored tailings remain physically and chemically stable.

The primary objective of the closure and reclamation initiatives will be to return the TMF site to a self- sustaining condition with pre-mining usage and capability. The reclaimed TMF will be required to maintain long-term geochemical and physical stability, protect the downstream environment and shed surface water. Activities that will be carried out during Operation Phase and at closure to achieve these objectives are discussed below.

Surface facilities will be removed in stages and full reclamation of the TMF will be initiated upon mine closure. General aspects of closure will include:

- Selective discharge of tailings around the facility prior to closure to establish a final tailings beach that will facilitate surface water drainage and reclamation;
- Removal of surface water ponds and drainage of tailing waters;
- Dismantling and removal of the tailings and reclaim delivery systems and all pipelines, structures and equipment not required beyond mine closure;
- Capping of the facility using combined rock and soil cover that will shed runoff to a permanent spillway;
- Establishment of a permanent TMF spillway in the TMF embankment;
- Removal of the seepage collection pump-back systems at such time that suitable water quality for direct release is achieved;
- Removal and re-grading of all access roads, ponds, ditches and borrow areas not required beyond mine closure; and
- Long-term stabilization and vegetation of all exposed erodible materials.

Selected groundwater monitoring wells and all other geotechnical instrumentation will be retained for use as long-term dam safety monitoring devices. Post-closure requirements will also include annual inspection of the former TMF and ongoing evaluation of water quality, flow rates and instrumentation records to confirm design assumptions and performance for closure.

Industry standard reclamation methods will be employed to close out the remainder of the Project infrastructure. Hazardous materials will be collected for offsite disposal including hazardous components of vehicles and equipment (i.e., fuel tanks, gear boxes and glycol-based coolant). Buildings and equipment stripped of hazardous components will be demolished and disposed in an approved landfill, offsite.

Once all buildings, facilities and equipment have been removed, the footprints (whether bedrock or pads) will be re-contoured to allow for restoration of natural drainage to the receiving environment.

2.5.2.3 Water Management

All surface water runoff in the vicinity of the open pit will be directed as dispersed flow into the pit to decrease filling time. Runoff from remaining waste rock, till stockpiles, and TMF will be directed to the pit prior to release to the environment. Groundwater and surface water models will be revised periodically in an effort to better predict post closure water quality and to identify the planned extent and duration of potential treatment requirements. Currently, water modelling does not predict the need for water treatment during the Closure Phase.

Increased environmental disturbance is anticipated during initial site decommissioning, when operational facilities are dismantled, and the site surfaces are re-vegetated. Increased environmental disturbances are not anticipated during post-reclamation monitoring.

2.5.2.3.1 *Surface Water Management Post Closure*

The management of surface water runoff at the site, post-closure, will be managed with the following objectives:

- Prevent contamination of surface and groundwater flows;

- Promote filling of the open pit;
- Prevent erosion and sedimentation; and
- Protect natural watercourses and wetlands.

The Proponent commits to develop an Erosion Prevention and Sediment Control Plan for during and after reclamation activities. The plan will be submitted with the Final Reclamation and Closure Plan before closure.

2.5.2.3.2 *Effluent Treatment*

There is a commitment to treat mine contact water collected from site water management ponds during operations (if required), closure, and post closure phases that does not meet effluent quality discharge criteria. During the course of mine operations, geochemical and hydrogeological test data will continue to be collected and geochemical source terms revised as warranted based on ongoing data collection. Groundwater and surface water models will be revised periodically in an effort to better predict post closure water quality and to identify the planned extent and duration of treatment requirements.

2.5.2.3.2.1 Plant Site

The Process Water / Runoff Ponds will be backfilled and reclaimed upon closure. Site grading during closure reclamation will divert drainage such that it disperses from the area following the natural pre-development flow pattern of the site. Ditches will be lined with suitable material to prevent erosion and sedimentation. All slopes will be reduced to 3H:1V in the plant site area to minimize erosion and encourage revegetation.

2.5.2.3.2.2 Open Pit

In the area surrounding the open pit, all surface runoff will be directed towards the pit to accelerate flooding. The proposed closure shoreline geometry will ensure all water draining through the till/bedrock interface is directed to the pit lake. The barrier berms will remain in place to allow the realignment of Seloam Brook to remain intact. This is a permanent feature. The barrier berm will define the perimeter of the flooded pit lake for long-term land use. It will be constructed with closure slopes (3H:1V) and will be vegetated during operations as part of the progressive reclamation plan.

2.5.3 Touquoy Mine Site

The Touquoy Mine Site will be reclaimed under a separate plan developed for the Touquoy Gold Project and already approved by regulatory agencies. As mentioned previously, the currently approved Touquoy Mine Reclamation Plan will be updated to reflect the above changes associated with processing FMS concentrate and re-submitted. Water treatment at discharge location into the Moose River from the pit, as required, will occur, and monitoring programs will be on-going.

2.5.3.1 Tailings Management - Closure

During the closure phase, the objective is for water in the pit lake to meet the reclamation regulatory water quality requirements or site-specific criteria. Based on the water balance model results (Stantec 2019b), no water will be discharged from the exhausted Touquoy pit until the pit reaches the spillway elevation in Year 18 (well into the post closure stage). This allows for many years of water treatment in the pit as a batch reactor with the objective of adjusting the pH to precipitate metals, potentially improving discharge criteria toward MDMER discharge criteria. As an additional benefit of the slow filling of the pit over time, the residence time and exposure to the atmosphere will increase, thus enhancing the natural UV degradation of cyanide and improving water quality in the pit.

2.5.3.2 Reclamation

The Touquoy Mine Site will be reclaimed under the separate plan that was developed for and approved by regulatory agencies for the Touquoy Gold Project. As mentioned previously, changes to the Touquoy Mine Site and reclamation obligations as a result of processing FMS concentrate are expected to be minimal with the only significant change being the subaqueous storage of tailings in the open pit and associated water quality considerations. The currently approved Touquoy Mine Reclamation Plan will be updated to reflect described changes associated with processing FMS concentrate and submitted in accordance with IA requirements and the *Mineral Resources Act.*

The Touquoy Mine Reclamation Plan is developed, updated and finalized as required under the IA and requires approval of NSE in consultation with NSL&F. The reclamation plan for the Touquoy Mine is secured by a bond posted by the Proponent, which is intended to allow the Province to reclaim the site at all phases of the Touquoy Mine. This plan includes allowing the pit to fill with water naturally from inflow of surface and ground waters and precipitation. Also required in the reclamation plan is ongoing monitoring post-closure to demonstrate stability of the site. This monitoring will cease in consultation with NSE once stability has been demonstrated by the monitoring data by comparing with baseline and operational data.

2.5.4 Post Closure Stage (Year 9 and beyond)

2.5.4.1 FMS Mine Site Surface Mine

During the post-closure stage, the pit will be filled with water, creating a lake, with the goal of re-establishment of a connection between the newly formed lake and Seloam Brook once water is acceptable for discharge. Water treatment will continue, as required, with discharge to Anti-Dam Flowage during the post-closure stage, and monitoring programs will be on-going until such time that discharge water quality meets appropriate confirmed criteria at the point of discharge. At this point, discharge will cease into Anti-Dam Flowage and will be re-directed to Seloam Brook. This post closure phase is estimated to be 15 to 20 years in length or longer and is subject to revision with expected refinements to model predictions. Groundwater and surface water models will be revised periodically in an effort to better predict post closure water quality and to identify the planned extent and duration of treatment requirements.

2.5.4.2 Touquoy Mine Site Surface Mine

Based on the water balance model results (Stantec 2021), no water will be discharged from the exhausted Touquoy pit until the pit reaches the spillway elevation in Year 18. The water quality in the Touquoy pit will be monitored during the pit filling and as the pit level approaches the spillway elevation. The water quality will be compared to the MDMER discharge limits and will be treated as required to meet these limits prior to discharge to Moose River. The MDMER discharge limits will decrease from the existing limits to those presented effective June 2, 2021. The discharge from the Touquoy Mine Site is anticipated to occur after this period, and therefore the lower MDMER limits will apply. At this time, assuming acceptable water quality within the pit for discharge, the spillway to Moose River would allow for passive discharge into the Moose River. Water treatment within the pit and/or at the discharge location into the Moose River from the pit, as required, will occur, and monitoring programs will be on-going.

3.0 Alternative Means of Carrying out the Project

In accordance with Section 19(1)(g) of CEAA 2012, environmental assessments for designated projects must consider alternative means of carrying out the Project that are technically and economically feasible, as well as the environmental effects of any such alternatives.

The process for consideration of alternative means is outlined in the CEAA Operational Policy Statement entitled "Addressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012" and includes the following steps:

Step 1 – identify technically and economically feasible alternative means;

Step 2 – list their potential effects on valued components;

Step 3 – select the approach for the analysis of alternative means; and

Step 4 – assess the environmental effects of alternative means.

Alternative means of carrying out the Project are defined as means of similar technical character or methods that are functionally the same. Alternative means differ from alternatives in that they represent the various technical and economically feasible ways that a project can be carried out, and which are within the Proponent's scope and control.

As a minimum, the EIS Guidelines require the Proponent to conduct an alternative means analysis for the following Project components:

- mine type (e.g., open pit, underground);
- material extraction methods;
- processing (process types);
- processing location (e.g., FMS Mine Site versus Touquoy Mine Site);
- energy sources to power the project site (diesel, electricity, renewables);
- location of key project components;
- mine waste disposal (methods and sites considered);
- transportation of concentrate (means and routing considered);
- access to the project site;
- management of water supply and wastewater;
- water management and location of the final effluent discharge points; and
- mine waste disposal and final effluent discharge (methods and sites considered).

A qualitative approach primarily utilizing the professional knowledge and judgment of the EA Study Team has been employed for the assessment of alternative means and considers all four steps outlined above. A multiple accounts analysis (MAA) was completed for the TMF to satisfy the requirements of ECCC for an assessment of alternatives for mine waste disposal, pursuant to a regulatory amendment of Schedule 2 of the *Metal and Diamond Mining Effluent Regulations* (MDMER). A summary of these assessments is presented in Table 3.0-1.

Table 3.0-1: Summary of Alternative Means of Undertaking the Project

Project Component or Activity	Alternative Means	Technical Feasibility	Economic Feasibility	Environmental Effects	Preferred Option
Mine Type	Surface Mine (Open Pit)	Technically Feasible	Economically Feasible	Environmental effects are associated with the surface mine construction and operation; however, no significant residual environmental effects are anticipated	Yes
	Underground Mine	Not Technically Feasible considering the configuration of the gold deposit.	Not Economically Feasible	Not assessed	No
Mineral Extraction Methods	Blasting	Technically Feasible	Economically Feasible	Environmental effects include noise and dust impacts; however, blasting will be intermittent and short duration	Yes
	Rock Breaking	Not Technically Feasible considering the hardness of the ore deposit	Not Economically Feasible based on the hardness of the ore deposit	Environmental effects include continual noise and dust impacts.	No
Ore Processing Methods	Gravity/Flotation CIL/Electrowinning	Technically Feasible This is the preferred processing option in Canada and is used worldwide in almost all major gold mining/processing operations. Well suited to this particular ore	Economically Feasible	Environmental effects associated with processing are minimal as it all takes place within the confines of the process plant.	Yes
	No Alternative	Not Technically Feasible	None Economically Feasible.	Not assessed	No

Table 3.0-1: Summary of Alternative Means of Undertaking the Project (continued)

Project Component or Activity	Alternative Means	Technical Feasibility	Economic Feasibility	Environmental Effects	Preferred Option
Ore Processing Locations	FMS Crushing/Grinding and Gravity/Flotation To produce concentrate	Technically Feasible	Economically Feasible	Construction and operation of a processing plant and associated tailings management facility have the potential to affect all VCs being considered in the EIS.	Yes
	Touquoy CIL/Electrowinning of concentrate To produce Doré from concentrate	Technically Feasible as the Touquoy facility is already designed to treat FMS concentrate with minimal modifications.	Economically Feasible as the infrastructure for processing FMS concentrate is already in place	Potential environmental effects for the existing Touquoy facility have previously been assessed and approved. Processing FMS concentrate at the Touquoy facility will result in an additional six years of processing beyond the current lifespan of the Touquoy Project and greenhouse gas emissions due to transporting concentrate to Touquoy.	Yes
	FMS Gravity/Flotation and CIL/Electrowinning To produce Doré on site	Technically Feasible	Not Economically Feasible as would require additional infrastructure for CIL/Electrowinning and cyanide destruction for a relatively short mine life.	Environmental effects would include the additional provisions for cyanide destruction and storage/handling of cyanide process tailings and reclaim water. Environmental effects for the existing Touquoy facility have previously been assessed and approved.	No
	Touquoy Gravity/Flotation and CIL/Electrowinning To process ore offsite	Technically Feasible, although the existing TMF at Touquoy would require significant expansion resulting in a larger disturbed area due to downstream construction	Not Economically Feasible due to high costs associated with haulage of 10.8 Mt of ore from FMS to Touquoy	Environmental effects of processing all FMS concentrate at Touquoy would include increased disturbance due to TMF expansion and GHG emissions associated with hauling ore from FMS to Touquoy	No

Table 3.0-1: Summary of Alternative Means of Undertaking the Project (continued)

Project Component or Activity	Alternative Means	Technical Feasibility	Economic Feasibility	Environmental Effects	Preferred Option
Energy Source	On-site Generators	Technically Feasible	Economically Feasible	Environmental effects include GHG emissions associated with operating diesel fuel-powered generators as well as haulage of diesel, plus the added potential for spills associated with transport and storage of diesel.	No
	Provincial Grid Tie-in	Technically Feasible	Economically Feasible	Environmental effects to habitat associated with construction of a 5.3 km right-of-way for electrical lines.	Yes
	Renewable Energy Sources	Technically Feasible	Not Economically Feasible due to projected power demand and short duration of Project	Environmental effects would depend on renewable energy technology used.	No
Project Key Component Locations	As shown on Figures 1-2 and 1-3	Technically Feasible	Economically Feasible	Environmental effects will include loss of habitat; however, efforts have been made to microsite and reduce impacts including to fish and fish habitat wherever practicable. Some impacts are unavoidable due to the proximity requirements of components.	Yes
	Alternative Locations	Possibly Technically Feasible depending on locations	Possibly Economically Feasible depending on locations	Alternative locations were evaluated and were ruled out based on greater environmental impacts.	No
Concentrate Transportation	Highway trucks via public roads	Technically Feasible	Economically Feasible	Environmental effects are similar for both alternatives, including GHG emissions, traffic noise and dust.	Yes

Table 3.0-1: Summary of Alternative Means of Undertaking the Project (continued)

Project Component or Activity	Alternative Means	Technical Feasibility	Economic Feasibility	Environmental Effects	Preferred Option
	Highway trucks via public roads and Beaver Dam Haul Road connector	Technically Feasible	Economically Feasible	Environmental effects are similar for both alternatives, including GHG emissions, traffic noise and dust.	Yes
Mine Access	As shown on Figure 1-2	Technically Feasible	Economically Feasible	Potential environmental effects will include loss and alteration of terrestrial habitat and potential impacts to fish and fish habitat associated with construction of a 4 km access road right-of-way, as well as dust and noise impacts associated with operation.	Yes
	Alternative Locations	Technically Feasible	Economically Feasible	Environmental effects would be similar for any alternative although likely greater since the preferred route is the shortest practical and located to minimize impacts to wetlands and aquatic resources	No
Water Supply and Management	Raw water supply from Seloam Lake	Technically Feasible	Economically Feasible	Potential environmental effects include impacts to terrestrial habitat associated with 2 km pipeline/powerline/tote road right of way route	Yes
	Raw water supply from Anti-Dam Flowage	Technically Feasible	Economically Feasible; more costly	Potential environmental effects would be similar for both alternatives, but include increased disturbance associated with longer pipeline/powerline/tote road right of way plus increased power requirements	No

Table 3.0-1: Summary of Alternative Means of Undertaking the Project (continued)

Project Component or Activity	Alternative Means	Technical Feasibility	Economic Feasibility	Environmental Effects	Preferred Option
	Wastewater to septic tanks with leach drains. Sludge pumped out for disposal.	Technically Feasible	Economically Feasible	Potential environmental effects on surface and groundwater	Yes
	Wastewater to RBC plant with discharge to TMF or receiving environment. Sludge pumped out for disposal.	Technically Feasible	Economically Feasible; increased capital and operating costs	Both alternatives have similar potential environmental effects; no substantial benefit to justify additional capital and operating costs	No
Mine Waste Management Facilities	Waste rock stockpiles	Technically Feasible	Economically Feasible	Potential environmental effects will include loss of terrestrial habitat associated with construction. Stockpiles to be recontoured to conform with natural topography and revegetated at closure	Yes
	Waste rock backfill in open pit	Technically Feasible	Not Economically Feasible	Potential environmental effects similar for both alternatives. Stockpile disturbed area footprint, backfilled open pit and excess waste rock require reclamation after backfill. Additional GHG emissions associated with heavy equipment used for backhaul.	No
Tailings Management Facilities	FMS gravity/flotation tailings stored in new TMF at FMS (Alternative B)	Technically Feasible	Economically Feasible	Potential environmental effects on surface and groundwater	Yes
	FMS concentrate CIL processing tailings stored in Touquoy open pit	Technically Feasible	Economically Feasible	Potential environmental effects on surface and groundwater	Yes

Table 3.0-1: Summary of Alternative Means of Undertaking the Project (continued)

Project Component or Activity	Alternative Means	Technical Feasibility	Economic Feasibility	Environmental Effects	Preferred Option
	All tailings gravity/flotation/ CIL stored in TMF at FMS	Technically Feasible	Not Economically Feasible due to need for construction of additional CIL/electrowinning and cyanide destruction facilities at FMS	Additional potential environmental effects on surface and groundwater due to the use of cyanide at FMS;	No
	All tailings gravity/flotation/ CIL stored in TMF and/or open pit at Touquoy	Technically Feasible	Not Economically Feasible due to extremely high cost associated with ore haulage	Touquoy TMF would require significant expansion; additional GHG emissions associated with ore haul.	No
Seloam Brook Realignment	Straight Engineered Channel	Technically Feasible	Economically Feasible	Environmental effects will include loss of fish habitat	No
	Engineered Channel with habitat	Technically Feasible	Economically Feasible	Mitigation of impacts to fish and fish habitat and creation of new habitat	Yes

4.0 Public Engagement

The Proponent is committed to stakeholder and rightsholders consultation and engagement as part of the Project. Using key values of openness, transparency, collaboration and respect, the Proponent has continued to work with the local community, non-governmental organizations (NGOs), regulatory agencies, and interested members of the public for over a decade.

Both federal and provincial EA legislation requires consultation with the public to recognize concerns about adverse effects of the environment and identification of steps taken by the Proponent to address these concerns; therefore, these are specifically identified in the EIS related to the Project. Beyond the regulatory requirements, the Proponent strongly believes that meaningful engagement is crucial to the success of any development. The Proponent is committed to maintaining stakeholder consultation and engagement throughout the life of the Project; these activities extend well beyond the EA process.

A community engagement strategy has been developed by the Proponent for the Project and more generally for all its projects along the Eastern Shore area of Nova Scotia. The strategy sets out the formal engagement activities that the Proponent will undertake throughout all phases of its exploration activities and mining operations in Nova Scotia. This includes the development, operation, and reclamation of the Project, which includes the permitted Touquoy Mine Site and the proposed FMS Mine Site. The Proponent is also active in efforts to provide broader awareness relative to advanced exploration activities.

A successful community engagement strategy provides flexibility to allow adaptation to the needs of the community. In 2016, the Proponent developed its strategy for community engagement to coincide with the start of construction of the permitted Touquoy Gold Project and the development of the EA for the Project. This strategy raised awareness about the Touquoy Gold Project. In 2018, an engagement strategy was developed for the Proponent focused on the Fifteen Mile Stream Gold Project and the proposed Cochrane Hill Gold Project. This strategy is being continually updates and is paired with a broader communications plan for the Proponent to ensure messaging, communication and engagement initiatives are aligned and mutually supportive.

Community engagement is important to the Proponent, and the Community Liaison Committee (CLC) is a key component throughout the Project's permitting, construction operation and close out. The volunteer membership acts as an advisory board to the Proponent. The CLC provides a mechanism for information exchange between communities and the company, as well as a forum to share questions, concerns, and input regarding the Project. The Proponent used the *Guide for the Formation and Operation of a Community Liaison Committee* produced by NSE (2010) to aid in the CLC's formation. The CLC is chaired by an independent consultant, who will act in this role until such time as the Industrial Approval is granted.

The CLC strives to meet quarterly with the potential for additional meetings depending on interest and Project developments. As defined in the Terms of Reference, guests, such as technical consultants or community groups, may be invited to the CLC meetings where topics of interest are planned.

There have been two open houses held in advance of the submission of the EIS. The first occurred on March 27th, 2018 and the second on March 14th, 2019. The first Open House was held at the Royal Canadian Legion Branch 28 in Sheet Harbour on March 27th, 2018. At this Open House, eight information panels provided an overview of the CEAA process, the location of the proposed Project, a very high-level overview of the Project, a list of VCs, general information about reclamation and a bullet list of potential impacts. The goal of this Open House was to introduce the Project and the environmental assessment process to the local community, introduce the team members to community members and begin to log questions and issues that would need to be addressed during the EA process.

The second open house was held on March 14th, 2019 at the Eastern Shore Wildlife Association building in Sheet Harbour. The goal of this Open House was to provide detailed information on important technical aspects and conclusions of the Project in advance of the submission of the EIS, and to receive feedback from the public. The Proponent's team included groundwater and surface water experts, biologists, geotechnical engineers, wetland specialists, metallurgist, human resource specialist, and a community engagement practitioner and land use planner.

The Proponent has also made presentations to many organizations, community groups and educational institutions on its exploration and mine development activities in Nova Scotia. Depending on the interest of community groups, the Proponent will continue to make presentations to share information about its operations in Nova Scotia. The Proponent actively searches for opportunities to speak with community groups in order to answer questions and promote partnerships where appropriate.

Other engagement initiatives include:

- Starting in May of 2018, the Proponent launched a community bulletin.
- The Proponent posts, and will post, signs at their Project sites with contact details and other general information. For example, in the instance of the Touquoy Gold Project, the blasting schedule is posted for public information.
- The Proponent has established an organizational website. The website continues to be populated with new information and the Proponent intends for the website to be a hub of information for reference by the community.
- The Proponent has established an email address - communityrelations@atlanticgold.ca – specifically as a point of contact for the public, and it is monitored regularly.
- The Proponent established a community phone line (902-391-4653) in March 2018 where the public can call with questions or concerns, or to request a meeting with a representative. This phone line is answered during business hours.
- A formal complaints response procedure has been developed in relation to the Touquoy Gold Project and is implemented by the Proponent when a complaint is received from the public. This information is shared with the CLC and NSE.

4.1 Key Issued Raised and Proponent Responses

Table 4.1-1 provides a summary of key issues raised during public consultation and engagement activities relative to the EA of the Project. For each key issue identified, a summary of the Proponent's response is provided along with reference(s) to sections in the EIS which more fully addresses the issue.

In terms of the development of the EIS, there were no additional VCs included other than those identified in the CEAA Guidelines (CEAA 2018); however, many specific monitoring commitments have been made by the Proponent to address concerns. The Proponent has made strong commitments to ongoing community engagement, including local community organizations.

As per the Proponent's engagement strategy, there are many tools to engage stakeholders, including members of the local community, government regulators, NGOs, landowners, and members of the public. As part of submitting the EIS to respective government authorities, the engagement to date associated with the Project was documented, including a summary of issues raised and Proponent responses. The Proponent has a broad objective to continue to engage the community and will continue to implement its strategy. Relative to the Project, specific commitments are made by the Proponent in terms of engagement during the next steps in the EA processes, including:

- Sharing key aspects of the EIS with interested NGOs and/or CLC members;
- Holding meetings with interested NGOs, including Eastern Shore Forestry Watch Association and Nova Scotia Salmon Association;
- Aligning in data collection and mitigation measures with local organizations; and
- Answering specific questions posed directly to the company by providing additional information where feasible.

As part of the understanding that engagement plans need to be flexible, the Proponent will address and respond to additional stakeholders identified or issues noted as the EA moves forward and into Project development, operation and reclamation.

Table 4.1-1: Summary of Key Issues Raised During Stakeholder Engagement

Key Issue	Summary of Proponent Response	Primary Summary Reference
Request to be informed on the Project activities	The Proponent is committed to maintaining its CLC for the life of the Project. Other aspects of community engagement will continue as per the community engagement strategy.	Section 4.0 Public Engagement Section 6.15 Socio-economic Conditions
Concern about volumes of truck traffic in context of safety on public roadways and recreational vehicles	The Proponent explained that there will be approximately 11 additional truck trips required during operation and that the road system can accommodate this increase.	Section 6.15 Socio-economic Conditions
Questions about contingency planning for accidents and malfunctions	Hazards have been identified and assessed based on risk with mitigations and contingency planning in place. Future detailed planning and implementation of the Project will further address potential accidents and malfunctions.	Section 6.17 Accidents and Malfunctions*
Questions about recreational access to Seloam Lake and the impact on the existing access to Seloam Lake.	The Proponent committed to creating a new bypass access road to Seloam Lake.	Section 2.0 Project Description Section 6.15 Socio-economic Conditions
Concerns about the impact on the Liscomb Game Sanctuary	The Proponent provided information on the history of game sanctuaries, the portion of the sanctuary covered by the Project and land use regulations inside the game sanctuary.	Section 6.15 Socio-economic Conditions
Impacts of Project on Wildlife	The Proponent provided details of wildlife species identified during baseline studies and provided information relating to the magnitude of disturbance to wildlife especially Species at Risk necessary to support Project development, mitigation strategies to reduce interactions with wildlife, and discussions relating to reclamation planning to support closure planning and re-establishment of wildlife habitat once mining activities are completed.	Section 6.10 Terrestrial Fauna Section 6.12 Species of Conservation Interest and Species at Risk
Managing water quality and water monitoring/water seepage	The Proponent provided a summary of all predictive water quality modelling work completed to support the EA and summarized for the Public that, if required during operations, water treatment will be completed. During the post-closure stage of Closure Phase, a water treatment system may be required, based on current modelling predictions. Aquatic effects assessment in Anti-Dam Flowage has demonstrated low risk to aquatic organisms as a result of Project discharge.	Section 6.6 Surface Water
Questions about TMF capacity at Touquoy Mine	The Proponent confirmed that the TMF at the Touquoy Mine Site has sufficient capacity to accept tailings from the concentrate from the Project for six months to one year.	Section 2.0 Project Description Section 6.6 Surface Water

Table 4.1-1: Summary of Key Issues Raised During Stakeholder Engagement (continued)

Key Issue	Summary of Proponent Response	Primary Summary Reference
Concerns about archeological resources not being found and protected	The Proponent provided information relating to the baseline program completed to identify archaeological features at the FMS Mine Site, avoidance and mitigation measures taken to reduce potential impacts to these features from Project development and resulting residual impact from the Project.	Section 6.14 Physical and Cultural Heritage
Questions about FMS water, fish and impact on Seloam Brook.	The Proponent provided information on baseline conditions of Seloam Brook and other surface water bodies, watercourses and wetlands within the Project footprint. Direct and indirect potential impacts to fish and fish habitat from Project development were described. The Seloam Brook proposed re-route was described to facilitate pit development along with proposed mitigation and offsetting measures (through a *Fisheries Act* Authorization process) to reduce residual effect to fish.	Section 6.8 Fish and Fish Habitat

***** Accidents and Malfunctions can be found in Section 6.17 in the full version of Environmental Impact Statement.

5.0 Indigenous Peoples Engagement

Within the provincial and federal EA processes and as part of the Made-in-Nova Scotia Process, there are distinct consultation processes completed by the Crown. To maximize engagement of Indigenous Peoples in the EA process, proponents are required to engage Indigenous Peoples directly and early on in the EA process.

The Proponent is committed to meaningful engagement of the Mi'kmaq of Nova Scotia as part of the Project. Engagement began as part of planning and environmental assessment of the Touquoy Gold Project over a decade ago. Specific engagement activities related to the Project commenced in February 2018, including participation in the One Window meetings, many presentations and meetings with different Mi'kmaq groups. This engagement has focused on the Assembly of Nova Scotia Mi'kmaq Chiefs and staff of the KMKNO, Millbrook and Sipekne'katik First Nations, as well as the community members, staff and Chief and Council of nearby Mi'kmaq communities, Paqtnkek and Pictou Landing First Nations.

The Proponent engaged with the Mi'kmaq of Nova Scotia to obtain views on:

- Effects of changes to the environment on the Mi'kmaq of Nova Scotia, specifically: health and socio-economic conditions; physical and cultural heritage, including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; and current use of lands and resources for traditional purposes; and
- Potential adverse impacts of the Project on potential or established Aboriginal or Treaty rights, title and related interests, in respect of the Crown's duty to consult, and where appropriate, accommodate the Mi'kmaq of Nova Scotia.

The information gathered by the Proponent during its engagement with the Mi'kmaq helps to contribute to the Crown's understanding of any potential adverse impacts of the Project on potential or established Aboriginal or treaty rights, title and related interests, and the effectiveness of measures proposed to avoid or minimize those impacts.

The Proponent's approach to Mi'kmaq engagement and participation in the development of the EIS has respected the current framework for engaging with the Mi'kmaq in Nova Scotia – providing project information, draft summary of effects and impacts, and proposed mitigations measures to the KMKNO, Millbrook and Sipekne'katik First Nations. At the request of the KMKNO, the Pictou Landing First Nation and Paqtnkek First Nation were also contacted by the Proponent.

The Proponent has used a similar approach to the discussion of potential benefits and opportunities related to the project – focusing on discussions with the ANSMC/KMKNO, Millbrook and Sipekne'katik First Nation communities

The objective of Mi'kmaq engagement relative to the development of the EIS for the Project is to gather views from Mi'kmaq groups with respect to both potential environmental effects of the Project and the potential adverse impacts of the Project on potential or established Aboriginal or treaty rights, title and related interests.

As part of an overall Indigenous Peoples Engagement Plan, the Proponent's approach to Mi'kmaq engagement allows for flexibility to permit adaptation based on discussions and feedback from the Mi'kmaq and ongoing development of the Proponent's projects.

The Proponent uses the following methods, depending on the need, to engage with the Mi'kmaq of Nova Scotia:

- One-window regulatory meetings;
- Face-to-face meetings with Mi'kmaq organizations, Chiefs and Councils and communities;
- One point of contact for the Mi'kmaq of Nova Scotia;
- Phone calls;

- Emails;
- Dropbox and FTP sites for documentation;
- Mi'kmaq community open houses;
- Public open houses and town hall meetings;
- Site visits and tours;
- Newsletters and regular Project Updates;
- Plain Language Project Summaries; and
- Website and other digital and social media.

In addition to the Proponent's engagement program related to the environmental assessment, the following elements are being discussed to further develop the company's decade-long relationship with the Mi'kmaq of Nova Scotia – one that has been built on mutual understanding and transparency, maintaining flexibility and open lines of communication to adjust implementation as the relationship and Project develops:

Engagement to date has been positive and productive; and the relationship was formalized in a 2014 Memorandum of Understanding (since expired) with the ANSMC. The Proponent initiated the engagement program on FMS in early 2018 with "One Window" regulatory meetings with all potential regulatory agencies, and the Mi'kmaq of Nova Scotia have representation at the "One Window" meetings. Public open houses followed the regulatory meetings to provide general information on the proposed Project to all interested community members. The public open houses were followed by a series of face-to-face meetings with Millbrook and Sipekne'katik First Nations, and the KMKNO through to the end of 2018. All information regarding the EIS and the EA process was shared and discussed during these meetings, including archaeological reports, a summary of potential impacts, and other key details of the Project. The Proponent also arranged a tour of the area and invited both Millbrook and Sipekne'katik First Nations to participate in the Community Liaison Committee (CLC).

In 2019, the Proponent held community open houses, and continued to exchange information with the KMKNO, and Millbrook and Sipekne'katik First Nations, and attempted to organize meetings to discuss Project information, traditional and current use of the area by the Mi'kmaq of Nova Scotia, and potential impacts and mitigations. In late 2019, meetings were held to discuss the ongoing engagement process.

The Proponent met with the ANSMC/KMKNO in early 2020, prior to the global pandemic that was declared on March 11, 2020. Since that time, the Proponent continued internal work to further understand any potential impacts of the proposed project on Mi'kmaq rights, such as ensuring all Indigenous perspectives that have already been shared with the Proponent were considered, and any additional opportunities to understand specific impacts on current and traditional practices and perspectives identified. It is anticipated that these discussions will continue during the environmental impact statement review process.

The Proponent suspended all Project-related engagement activities in early March as everyone began to contend with protection and prevention in communities, and the associated uncertainties and risks. The Proponent kept in contact with communities during Nova Scotia's "lockdown" period from March to June 2020 and moved any engagement activity online. An online/virtual meeting was held with Millbrook First Nation's Chief and Council in early May 2020 to provide an overview of the FMS and other Proponent projects to new council members. In July 2020, the Proponent met with the KMKNO to discuss potential impacts and mitigations and sought meetings with the Pictou Landing and Paqtnkek First Nations.

It is anticipated, both by the Proponent and those representing the Mi'kmaq of Nova Scotia that engagement will continue throughout and beyond the current environmental assessment process. This will require ongoing dialogue regarding potential impacts on Mi'kmaq communities, and the Proponent is committed to continuing those discussions.

5.1 Key Issues Raised and Proponent Responses

As part of submitting the EIS and EARD to respective government authorities, the Mi'kmaq engagement to date associated with the Project was documented, including a summary of key issues raised and proponent responses at the time of EIS submission. For each key issue identified in Table 5.1-1, a summary of proponent response is provided along with reference(s) to sections in the EIS which address the issue. This summary also includes general and specific feedback received from the Mi'kmaq of Nova Scotia. Note that Project adaptation will continue, as needed and practicable, through engagement with the Mi'kmaq.

The issues raised during Mi'kmaq engagement activities were incorporated into the design of the Project where practicable, and the development of the EIS. Commitments identified in the table above have been reviewed with the Mi'kmaq of Nova Scotia and support an overall reduction of Project impact. These commitments allow for opportunities for the Mi'kmaq to continue providing more detail on their traditional use of the area as the project progresses; participate in planning and implementation of key aspects of the Project, including fish habitat offsetting, wetland restoration, reclamation planning, and the design and implementation of monitoring programs, among others.

As part of the Proponent's engagement of the Mi'kmaq completed to date on the Project, the potential effects and the proposed mitigation measures and monitoring programs were generally presented and discussed. The objective was to provide information on the Project to the Mi'kmaq and for the Proponent to better understand the views of the Mi'kmaq on the potential effects and proposed mitigation measures and monitoring programs; this supported the development of the EIS. Specifically, alongside on-going meetings with the KMKNO and Mi'kmaq communities, documents have been shared, with requests for feedback and input from the Mi'kmaq communities, to support communication of EIS conclusions, summary of technical VC impacts, summary of Mi'kmaq impacts, mitigation measures and proposed monitoring plans. Exchange has also taken place to support Proponent knowledge and learning relating to specificity of traditional use of the land in the area surrounding the Project, and also to support broader understanding of potential effects of the Project on the economic, social and mental well-being of the Mi'kmaq of Nova Scotia.

Information that has been shared directly with the KMKNO, PLFN, Paqtnkek First Nation, Millbrook First Nation and Sipekne'katik First Nation (for review and feedback), includes, but is not limited to:

- EIS Technical Poster Boards;
- Draft EIS document submitted to IAAC [subject to conformity review] including MEKS and Archaeological Reports;
- EIS Summary document;
- Questionnaire to support understanding of traditional use of the land, and a broader understanding of potential impacts to the economic, mental and social well-being of the Mi'kmaq of Nova Scotia;
- Summary of Mi'kmaq Effects;
- FMS Plain Language Summary; and
- Potential Impacts and Summary of Mi'kmaq Effects.

Table 5.1-1: Summary of Key Issues Raised During Mi'kmaq Engagement

Key Issue	Summary of Proponent Response	Primary Summary Reference
Dust from the FMS Mine Site Infrastructure and potential impacts to traditional practices including ingestion of dust by plants and animals	• Minimization of air emissions with mitigation measures. Monitoring for air quality, including total suspended particulates, will be completed. • Commitment to dust suppression (water and chemical treatment if required) to reduce impact. • Completion of human health risk assessments to assure the communities that plants and animals are safe to eat and that water is safe for swimming.	Section 6.2 Air
Elevated noise and light levels impacting hunting practices near the mines	• The Proponent has worked with communities to understand where they hunt and whether elevated light and noise levels in close proximity to the mines is a concern based on hunting patterns. • Implementation of measures to reduce noise and light during operations and from trucks to minimize impact.	Section 6.1 Noise Section 6.2 Air Section 6.13 Mi'kmaq of Nova Scotia
Quality of water being discharged into streams, rivers and lakes and potential effect on fish and other aquatic species	• Managing site water to a single point of discharge wherever practicable. • Committed to water treatment when needed, prior to discharge. • Committed to a robust monitoring program to confirm water quality. • Committed to Indigenous participation in monitoring programs including Environmental Effects Monitoring in receiving waters.	Section 6.6 Surface Water
Impacts to fish and fish habitat	• Planning to reduce direct and indirect impact. Moving infrastructure to avoid fish habitat – example, waste rock storage area and tailings management facility options at FMS. • Predictive modelling to understand how the mine operations may indirectly impact fish habitat so that monitoring can be planned to confirm these predictions and adapt as required. • Commitment to Offsetting plans to compensate for lost fish habitat, and Indigenous participation in plan development and implementation.	Section 6.8 Fish and Fish Habitat

Table 5.1-1: Summary of Key Issues Raised During Mi'kmaq Engagement (continued)

Key Issue	Summary of Proponent Response	Primary Summary Reference
Reclamation planning and concerns regarding timing for renewed access to the site after active mining is completed.	• The FMS facilities will be removed, the pit will fill with water and disturbed surfaces covered/capped, as required, and then reclaimed with stockpiled topsoil and re-vegetated. The site will be returned to landowner for forestry and recreational use. • Access can be regained once active reclamation has been completed (2 years after mining is completed). The landscape at this time will not be equivalent to baseline conditions, as the forested habitat will not have had time to re-establish, but it is expected that traditional practices can resume on the landscape. This conclusion has been shared with the Mi'kmaq, however, to date, no specific feedback has been shared with the Proponent. Dialogue related to this item will continue throughout the EA review process.	Section 2.0 Project Description
Contingency planning for accidents and malfunctions. For example, the Mi'kmaq have shared their concerns regarding dam integrity and safety at the Tailings Management Facility (TMF). The Proponent has developed a pilot Emergency Response Communication Plan with the Mi'kmaq of Nova Scotia	• Hazards have been identified and assessed based on risk. Mitigation measures and contingency planning will be in place to address potential accidents and malfunctions. • Regarding dam integrity, the EIS evaluates the potential for an accident of this nature and identified a dam breach as a High hazard classification. The TMF has been situated in a position that limits impact to people, wetlands and streams to the maximum practical extent. There are also no residents within 5 km of the TMF. • The EIS indicates that should a total breach of the TMF occur, the impacts to the surrounding environment would be high and have a regional geographic extent. • Based on the High dam hazard consequence classification and the applied design criteria, the design incorporates increased conservatism to reduce the likelihood of failure. • The TMF will be designed by a Design Engineer/Engineer of Record with specific and extensive experience in designing, constructing, operating and monitoring/maintaining such structures. • Completion of a Dam Breach Inundation Study for incorporation into an Emergency Response Plan. • Development of an Operation, Monitoring and Surveillance Manual (OMS) which provides a documented framework for actions, and a basis for measuring performance and demonstrating due diligence during the operational phase of the Project.	Section 2.0 Project Description Section 6.17 Accidents and Malfunctions*

Table 5.1-1: Summary of Key Issues Raised During Mi'kmaq Engagement (continued)

Key Issue	Summary of Proponent Response	Primary Summary Reference
	• Completion of Independent Dam Safety Reviews (DSR), to further monitor operation, maintenance, surveillance, and performance of the dams during Operations and Closure. • The TMF dams have been designed to meet Canadian Dam Association (CDA) Dam Safety Guidelines (CDA, 2013 & 2014).	
Habitat loss from Project development, including forest, wetlands, flora and fauna	• There is historical disturbance at the FMS Study Area from forestry activities, and historical mining. • The FMS Mine Site will be reclaimed at end of operation. Existing facilities will be used for processing and tailings management at the Touquoy Mine Site, minimizing new disturbed footprint at the FMS Mine Site. • The Proponent will prepare a Wetland Compensation Plan, with participation from Mi'kmaq organizations, to offset wetland losses as a result of Project development. • Habitat loss is limited to the temporal scale of the Project (eleven years) and reclamation will take place to revegetate stockpiles, TMF and reclaimed areas.	Section 6.9 Habitat and Flora Section 6.12 Species of Conservation Interest and Species at Risk
Impacts to Fish Habitat from the rerouting of Seloam Brook.	• Disturbance of Seloam Brook and options for rerouting. Seloam Brook is a disturbed system impacted by historical mining activities. • Commitment to fish habitat provisions within the proposed diversion channel to mimic or improve habitat lost as a result of pit development. • The Proponent has shared conceptual plans relating to the proposed Seloam Brook Diversion with Mi'kmaq communities. To date, no specific concerns have been communicated relating to this aspect of the Project, beyond the broader question relating to impacts to fish and fish habitat described above. Dialogue on this topic will continue throughout the EA process.	Section 2.0 Project Description Section 6.8 Fish and Fish Habitat

Table 5.1-1: Summary of Key Issues Raised During Mi'kmaq Engagement (continued)

Key Issue	Summary of Proponent Response	Primary Summary Reference
Legacy contamination issues. Long term storage and safety of tailings and other contamination	• Containment and management of historical tailings within approved on-site storage facilities at the mine sites • Reclamation bonding to ensure long-term monitoring and remediation of mine sites	Section 2.0 Project Description Section 6.4 Geology, Soils and Sediment
Loss of habitat and access to mine sites to undertake traditional practices, such as hunting, harvesting, fishing.	• The loss of access within the FMS Mine Site is for an eleven-year timeframe and has been communicated to the Mi'kmaq. • Reduce mine site footprints through infrastructure placement and planning. • Seloam Lake is important for fishing and is used by the Mi'kmaq. The Proponent has planned bypass roads to allow for continued access to Seloam Lake and lands farther east of the FMS Mine Site. • Wetland and fish habitat restoration will be completed to compensate for lost wetland habitat. • Commitment to reclamation with Mi'kmaq participation in planning and implementation to restore habitats and allow traditional practices to resume within the Mine Site. • Re-vegetation with a native mix of plants determined in consultation with Mi'kmaq communities. • The Proponent has documented large tracts of available crown land adjacent to the FMS Mine Site that has similar habitat characteristics and access routes to that of the FMS Mine Site. The Proponent has indicated to the Mi'kmaq of Nova Scotia that these tracts of crown land may form suitable alternative lands for the continuation of traditional practices during the temporal window when the lands within the FMS Mine Site are not available. To date, no specific feedback on this proposed mitigation measure has been provided by the Mi'kmaq of Nova Scotia. Dialogue will continue throughout the EA process and the Proponent is committed to on-going adjustments in proposed mitigation measures as requested by the Mi'kmaq of Nova Scotia relating to loss of access.	Section 6.13 Mi'kmaq of Nova Scotia

Table 5.1-1: Summary of Key Issues Raised During Mi'kmaq Engagement (continued)

Key Issue	Summary of Proponent Response	Primary Summary Reference
Cumulative loss of area for traditional practices from industrial development along the Eastern Shore. Changing landscape within Eskikewa'kik	• Project design to complete processing at existing Touquoy Mine to reduce waste and mine footprints at FMS and BD. • Reduce mine site footprints through infrastructure placement and planning. • Use of existing transportation routes wherever possible to avoid additional fragmentation of habitats. • Evaluation of Crown land loss in Eskikewa'kik from known and planned projects to support project analysis.	Section 8.0 Cumulative Effects Assessment
Request ongoing engagement of the Mi'kmaq of Nova Scotia	• The Proponent is committed to ongoing Mi'kmaq engagement for the life the Project – prior to, during and post environmental assessment. This includes communication and information sharing, face-to-face meetings, discussion of impacts and mitigations, and any other issues that may arise as the Project develops.	Section 5.0 Indigenous Peoples Engagement Section 9.0 Follow-up and Monitoring Programs Proposed

* Accidents and Malfunctions can be found in Section 6.17 in the full version of Environmental Impact Statement

It is the opinion of the Proponent that Mi'kmaq groups engaged were open to the Project as presented with its mitigation measures and monitoring programs; however, we have heard directly from the Mi'kmaq that their views on Project conclusions will be further developed as part of the detailed review of the EIS once released, as part of their participation in the federal and provincial EA processes.

In response to the interest of the Mi'kmaq, the Proponent has made strong commitments to ongoing Mi'kmaq engagement, including specific activities to further support the participation of the Mi'kmaq in this EA process. The ongoing engagement ensures that the potential effects of the Project and the proposed mitigation measures and monitoring programs are understood by the Mi'kmaq of Nova Scotia in order to evaluate the effects on their communities and potential or established Aboriginal or treaty rights, title and related interests. It is anticipated the outcomes of ongoing engagement throughout the EA process and beyond will support the Project detailed design in all phases from pre-construction data collection to final reclamation.

As mentioned above, the Proponent is committed to ongoing engagement with the Mi'kmaq of Nova Scotia throughout the lifecycle of all of its projects. As part of submitting the EIS and EARD to respective government authorities, the engagement to date associated with the Project was documented, including a summary of issues raised and proponent responses and adjustments to the Project. The Proponent has a broad objective to continue to engage the community and will continue to meet with KMKNO, Millbrook and Sipekne'katik First Nations to continue dialogue on the Project, review proponent conclusions, proposed mitigation measures, and opportunities for Mi'kmaq participation in the EIS. We have heard from the Mi'kmaq that the majority of specific and detailed commentary on EIS summary of impacts and mitigation measures will be provided during EIS review and information request (IR) processes, post submission to IAAC.

Ongoing engagement with the Mi'kmaq of Nova Scotia will include the following:

- Request and support the gathering of more detailed information on Mi'kmaq traditional use of the area;
- Request feedback on EIS conclusions;
- Meet with any other interested Indigenous organizations and Mi'kmaq communities in Nova Scotia; and
- Develop potential partnerships with Mi'kmaq environmental groups on specific ecological monitoring and restoration projects.

Engagement planning needs to be flexible. The Proponent will continue to address and respond to additional questions or concerns identified or issues noted as the EA moves forward into Project development, operation and reclamation. The Proponent is strongly committed to continue its engagement with the Mi'kmaq of Nova Scotia in the ongoing spirit of cooperation and with mutual benefit and respect.

6.0 Summary of Environmental Effects Assessment for each Valued Component

6.1 Noise

6.1.1 Baseline Conditions

6.1.1.1 FMS Study Area

Noise data was collected at two sample locations over a 24-hour period between November 20 to 22, 2017. The locations of the noise monitoring stations are provided in Table 6.1-1.

Table 6.1-1: Baseline Noise Monitoring Locations

Sample Location	UTM Coordinates (Zone 20T)		General Area	Rationale
	Easting	Northing		
Station A	539995	4998537	Approximately 2.5 km east of the FMS pit	Representative area near the eastern extent of the FMS Study Area
Station B	535431	5001152	Approximately 3 km northwest of the FMS pit	Representative area 2 km north of the FMS Study Area and 1 km east of Hwy 374

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

Noise level measurements for both sample locations near the FMS Study Area were collected and are presented in Table 6.1-2.

Table 6.1-2: Baseline Ambient Noise Levels in the vicinity of the FMS Study Area

Location	Time	Sound Pressure Level (dBA)						NSE Criteria
		Leq	L10	L50	L90	Lmax	Lmin	
Station A	Day	36.3	39.7	34.5	27.3	45.3	21.5	65
	Evening	31.3	34.8	28.3	22.6	41.9	19.7	60
	Night	34.7	37.9	31.7	27.8	50.7	23.9	55
Station B	Day	33.8	38.1	29.3	23.4	47.8	19.7	65
	Evening	30.6	32.0	29.5	25.8	42.4	24.1	60
	Night	27.9	29.1	27.0	24.9	45.0	23.4	55
Average	Day	35.2	39.0	32.6	25.8	--	--	65
	Evening	31.0	33.6	29.0	24.5	--	--	60

Table 6.2-1: Baseline Ambient Noise Levels in the vicinity of the FMS Study Area (continued)

Location	Time	Sound Pressure Level (dBA)						NSE Criteria
		Leq	L10	L50	L90	Lmax	Lmin	
	Night	32.5	35.4	30.0	26.6	--	--	55
	24 - Hour	33.9	37.4	31.4	25.9	--	--	--

The L_{90} is defined as the noise level which is exceeded 90% of the time and is commonly referred to as the residual or background noise when anthropogenic sources of noise are not present. The L_{90} recorded at both monitoring locations met NSE Pit and Quarry Guideline (NSDEL 1999) criteria for all time intervals. The overall (24hr) L_{90} average for the FMS Study Area was 25.9 dBA and has been used in the noise model as the representative background noise level.

6.1.1.2 Touquoy Mine Site

A baseline acoustic assessment was conducted as part of the 2007 Focus Report (CRA 2007) for the Touquoy Mine Site. A single location at the Touquoy Mine Site was monitored to understand the noise levels directly around the Touquoy Mine Site and proposed open pit. The results of the 2007 Focus Report of baseline noise levels at the Touquoy Mine Site are presented in Table 6.1-3.

Table 6.1-3: Average Baseline Sound Equivalent Levels (L_{eq}) Recorded at Touquoy Mine Site in 2007

Monitoring Location	Date	Time	Average Leq Value (dBA)	NSE Criteria (dBA)
Location 1	Jan 9, 2007	19:00 – 22:59	44.8	<60
	Jan 10, 2007	07:00 – 14:59	44.9	<65
		15:00 – 23:59	40.9	<60
	Jan 11, 2007	0:00 – 06:59	40.2	<55
		07:00 – 18:59	42.9	<65
		19:00 – 22:59	41.4	<60
	Jan 11 to 12, 2007	23:00 – 06:59	40.7	<55

Baseline sound level measurements recorded at the Touquoy Mine Site in 2007 were notably above those recorded near the FMS Study Area yet met the NSE Pit and Quarry Guideline (NSDEL 1999) criteria for all time intervals.

6.1.2 Anticipated Effects and Changes to the Environment

6.1.2.1 FMS Study Area

The noise prediction model SPM9613 developed by Power Acoustics Inc was used to provide an order of magnitude estimation of the predicted operational noise within the property boundaries of the FMS Mine Site. The prediction model SPM6913 incorporated two subroutines.

- ISO 9613-1 specifically addressing atmospheric attenuation; and
- ISO 9613-2 that specifies an engineering method for calculating environmental noise from a variety of sources.

The model included meteorological parameters, ground attenuation, pit geometry, along with octave sound power levels, proposed locations and 3D dimensions of over 20 significant noise sources. Proposed location and octave sound power levels used in the model of each significant noise source are described in further detail in the Noise Baseline and Predictive Modelling Report (Wood, 2019a). The significant noise sources were modelled to conservatively reflect the worst-case scenario, predicted to be during construction and Year 7 of operations when the largest amount of material (20 Mt) will be mined requiring the most equipment.

A review of the noise modelling results using the most conservative temporal inputs (during construction and Year 7 operations) was compared to established guidelines at the property boundary and nearest sensitive receptors was completed with the following results:

- The predicted sound levels at the FMS Mine Site property boundary will be at or below the most restrictive noise goals (nighttime hours of 55 dBA) during all construction and operational hours (day, evening and night) at the property boundary.
- Sensitive receptors include seasonal camps and residences were identified in the surrounding area with the nearest being 4.9 km and 8.7 km south of the FMS Study Area respectively. The predicted sound levels resulting from activities in the FMS Study Area will attenuate to background levels (25.9 dBA) over an approximate distance of 4 to 5 km at or before the nearest seasonal or permanent residence.
- During the decommissioning and reclamation phase, less equipment will be active on site resulting in an anticipated lower level of sound propagation than during operations. Therefore, the conclusions relating to operational phase are considered to the reasonable worst-case scenario.
- Blasting events may provide a slight spike in the sound levels at distance for a brief period. The 128-dBA threshold is not predicted to be exceeded at the nearest structure form the FMS Study Area (approximately 5 km to the south), using standard blasting methods employed by mining operations. Predicted blasting noise will meet the Nova Scotia Pit and Quarry Guidelines (NSDEL 1999) criteria of 128 dBA at approximately 100 m from the blast location.

6.1.2.2 Touquoy Mine Site

The Datakustik's CadnaA Acoustical Modelling Software was used for an acoustic assessment as part of the 2018 Noise Impact Study (GHD, 2018) in support of the Beaver Dam EIS. The 2018 Noise Impact Study focused on sound emissions from noise sources identified at the facility and determining effects on sensitive receptors, including Camp Kidston (3 km to the north), the Scraggy Lake area (2 km to the south) and the nearest residence (5 km to the northwest). Sound level impacts were compared to the Nova Scotia Guidelines for Environmental Noise Measurement and Assessment which are the same as those listed in the Nova Scotia Pit and Quarry Guidelines (NSDEL 1999). A predicted worst-case facility sound level measurement for a 1-hour period was estimated for the property boundary and at each receptor near the Touquoy Mine Site.

The predicted total sound level range at the Touquoy Mine Site property boundary presented in the 2018 Noise Impact Study is 39.2 to 53.9 dBA (GHD, 2018), which are below the most conservative threshold (nighttime hours of 55 dBA) set in the Pit and Quarry

Guidelines (NSDEL 1999). Additionally, ambient baseline sound levels at the Touquoy Mine Site are reached at approximately 5 km from the PA. Noise from the Project will be considerably less than that predicted from the Beaver Dam Mine Project, which included crushing and processing of all Beaver Dam ore at the Touquoy Mine Site. Thus, noise generated at the Touquoy Mine Site associated with the Project is estimated to be considerably lower than results presented above for the Beaver Dam Mine Project, which already met compliance at the Touquoy Mine Site property boundaries.

There are no new or additional effects from noise anticipated to be caused by the processing of FMS concentrate and the management of concentrate tailings. To date, no noise complaints for the operating Touquoy Mine have been received or are anticipated.

6.1.3 Mitigation Measures

The majority of mining operations will occur in the pit well below ground surface thereby providing excellent noise shielding, and blasting will be restricted to daytime hours, per the NSE Pit and Quarry Guidelines. The forest cover surrounding the mine will also provide a dampening effect to any noise generated. Topography and distance from receptors will also contribute to a reduction of Project-generated sound at a distance.

Mitigation measures for the FMS Study Area are described in Table 6.1-4 and will be implemented by the Proponent.

Table 6.1-4: Mitigation for Noise

Project Activity	Mitigation Measures
C	Consider placement of stockpiles and infrastructure to mitigate noise migration from processing equipment
C	Consider the use of natural landforms when available as noise barriers when designing final site details and when placing fixed equipment
C	Noise-reduction as criteria in equipment selection
C,O	Restrict blasting to a specific and regular daytime schedule during weekdays
C,O	Communicate general blasting schedule to the local community
C,O	Regular check by site supervisor for excessive noise on site and in relation to sensitive receptors so that resolution can be timely
C,O	Use equipment that meets appropriate noise emission standards for off-road diesel equipment
C,O	Speed reduction
C,O	Subcontractor agreements will include an obligation to comply with environmental protection including noise reduction
C,O	Site design to minimize the need for reversing and vehicle reversing alarms
C,O	A procedure will be developed that will allow the public to register complaints regarding noise concerns and will require the Proponent to respond in a timely and effective manner
C,O,CL	Implement preventative maintenance plans for all mobile and stationary equipment

Note: C = Construction Phase, O = Operation Phase, CL= Closure Phase.

Mitigation measures will be confirmed through the permitting stage through the Industrial Approval. Detailed mitigation measures are provided in the Noise Baseline and Predictive Modelling Report (Wood, 2019a).

Mitigation measures at the Touquoy Mine Site are already in place and will continue for the additional time required for the processing of FMS concentrate and management of FMS concentrate tailings.

6.1.4 Significance of Residual Effects

A significant adverse effect for noise has not been predicted for the Project for the following reasons, with consideration of the ecological and social context within the LAA of the Project:

- During Construction: Noise will be elevated above baseline conditions for limited periods but for short duration (<1 year), extending into the RAA. However, noise levels are expected to remain within established guidelines at the property boundaries and thus the guidelines are also met within the LAA. Given the remote location of the Project, the likelihood of mobile receptors being regularly in close proximity to the FMS Mine Site is low.
- During Operations: Noise will be elevated above baseline conditions extending into the RAA. However, noise levels will remain within established guidelines at the property boundaries of the FMS Mine Site. The likelihood of mobile receptors being regularly in close proximity to noise generation sites is low.
- During Operations: Predicted blasting noise will meet the *Nova Scotia Pit and Quarry Guidelines (NSDEL 1999)* criteria of 128 dBA at approximately 100 metres from the blast location.
- During Closure: Noise generation during closure will be less than predicted levels during construction and operation but are expected to still be elevated above baseline conditions potentially extending into the LAA or RAA during decommissioning activities, then drop to baseline conditions for the post closure period.
- Noise effects from the Project are reversible and will dissipate to background concentrations once operations and active reclamation phases are complete.

6.2 Air

6.2.1 Baseline Conditions

6.2.1.1 FMS Study Area

Background airborne concentrations of total suspended particulates (TSP), particulate matter with an aerodynamic diameter of 10 µm or less (PM_{10}), arsenic, and mercury were collected at two locations near the FMS Study Area on November 21, 2017. Additional data was also collected in November 2017 in support of the proposed Cochrane Hill Mine Site (40 km east of the FMS Study Area) and is included in this assessment to augment the baseline data set for TSP, PM_{10}, arsenic, and mercury.

As part of the ExxonMobil project in Goldboro, Nova Scotia, data on concentration levels of NO_2 and SO_2 were collected from June 10 to August 10, 2004 in Seal Harbour (70 km east of the FMS Study Area). Similarly, concentrations of particulate matter with an aerodynamic diameter of 2.5 µm or less ($PM_{2.5}$) were collected over three 24-hour periods at Seal Harbour in each of July, August and September 2004. This data was used as the closest rural representative background for $PM_{2.5}$, NO_2 and SO_2 concentration levels. Additionally, data collected in 2016 by the National Air Pollution Surveillance Network (NAPS) in Aylesford, NS was consulted for annual concentration levels of $PM_{2.5}$. The Aylesford station was selected as it is located in the most rural setting of the National Air Pollution Surveillance Network (NAPS) stations found in Nova Scotia.

Air concentrations of NO_2, SO_2, and $PM_{2.5}$ collected in Seal Harbour as part of the ExxonMobil program in 2004, the annual average concentrations of $PM_{2.5}$ collected at the Aylesford NAPS station collected in 2016, and concentrations of TSP, PM_{10}, arsenic, and mercury collected in 2017 near the FMS Study Area are provided in Table 6.2-1.

Table 6.2-1: Baseline Air Pollutant Concentration Levels in/near the FMS Study Area

Pollutant	Seal Harbour 24-hour Concentration Levels (µg/m³)	NAPS Aylesford Station Annual Concentration Levels (µg/m³)	FMS Study Area 24-hour Concentration Levels (µg/m³)***
NO_2 *	3.76	---	---
SO_2 *	10.48	---	---
$PM_{2.5}$	4.0	6.0	---
PM_{10}	---	---	9.2 – 9.5
TSP	---	---	9.6 – 14
Arsenic**	---	---	Not detected
Mercury**	---	---	Not detected

* NO_2 and SO_2 results were available in parts per billion (ppb) and converted to µg/m³ .

** Detection limits used in the analysis of Arsenic and Mercury are <0.00071 to <0.0013 µg/m³ and <0.000035 to < 0.000067 µg/m³ respectively.

*** one 24-hour sampling event; two locations.

Ambient air concentration levels collected in 2004 in Seal Harbour (NO_2, SO_2 and $PM_{2.5}$), in 2016 at the NAPS Aylesford station ($PM_{2.5}$), and ambient air concentration levels collected onsite (arsenic, mercury, TSP and PM_{10}) were all found to be below the established regulations and objectives. Additional baseline levels of other metals or organic compounds, such as PAHs and VOCs, were not available.

6.2.1.2 Touquoy Mine Site

Data collected through the National Air Pollution Surveillance Network (NAPS) was used to represent baseline concentrations of NO_2, SO_2, Ozone and $PM_{2.5}$. The closest monitoring station (Station #030118) was selected and is located at 1657 Barrington Street, Halifax, NS. This station is located in an urban environment and is considered to have ambient air quality concentration levels above those expected in the rural environment of the Touquoy Mine Site.

Background airborne concentration levels of TSP and PM_{10} were collected at the Touquoy Mine Site in support of the 2007 Focus Report (CRA 2007). TSP measurements were collected onsite from five locations in January 2007. PM_{10} measurements were collected at two locations (referred to in this report as Air 1 TQ and Air 2 TQ) using a Beta Attenuation Monitor in September 2007. Air 1 TQ was located 300 m north of the Touquoy pit and Air 2 TQ was located 18 km south of the Touquoy Mine Site, along Hwy 7. Elevated particulate readings were observed at Air 2 TQ due to a paving project occurring during the monitoring period. As such only the data collected from September 9 to 11, 2017 (post paving activities) is presented as a representative of ambient baseline conditions.

Data collected by the NAPS in 1996 for particulate matter (TSP and $PM_{2.5}$), 2004 (NO_2 and SO_2) and 2005 (Ozone) were available for the 2007 Focus Report. The mean annual concentration levels of NO_2, SO_2, Ozone, TSP and $PM_{2.5}$ from the Halifax monitoring station (Station #030118) and range of 24-hour (PM_{10}) averages for Air 1 TQ and Air 2 TQ are presented in Table 6.2-2.

Table 6.2-2: Ambient Air Concentration Levels at Touquoy Mine Site

Parameter	Station #030118 (µg/m³)	Air 1 TQ (µg/m³)	Air 2 TQ (µg/m³)
Nitrogen Dioxide	32.9	---	---
Ozone	25.5	---	---
Sulfur Dioxide	18.3	---	---
Total Suspended Particulates	11	10.5 – 16.1*	---
$PM_{2.5}$	6	---	---
PM_{10}	---	5 – 17	8 – 11

* Range of total suspended particulate concentration levels as recorded at five locations throughout the Touquoy Mine Site in proximity to Air 1 TQ.

Ambient air concentration levels collected by the NAPS at the nearest location (Halifax) and ambient air concentration levels collected onsite (TSP and PM_{10}) were all found to be below the established regulations and objectives.

6.2.2 Anticipated Effects and Changes to the Environment

6.2.2.1 FMS Study Area

6.2.2.1.1 *Air Pollutants Methodology*

The dispersion model AERMOD adopted by the USEPA was used to predict the dispersion of the Criteria Air Contaminants generated by the Project operating under normal conditions. The model included meteorological parameters, terrain, building inputs and various source emissions data (Wood, 2019b). The primary source emissions were modelled to conservatively reflect the worst-case one-year contribution of air pollutants.

Benzene and benz(a)pyrene were chosen as surrogate parameters to assess volatile organic compounds (VOCs) and polyaromatic compounds (PAHs) in diesel exhaust. These parameters were chosen since the ambient criteria are the typically the most stringent compared other VOCs and PAHs present in diesel exhaust.

6.2.2.1.2 *Metals in Fugitive Dust Methodology*

For metals bound to particulate matter, the maximum predicted ground level air concentrations for $PM_{2.5}$ and PM_{10} outside the Property boundary from the AERMOD model were used as a basis of the metals' inhalation assessment. Both short term (24 hour) and long term (annual average) assessments were conducted. To estimate the potential metals concentrations on dust, the geochemistry of the predominant source of dustfall from the FMS Mine Site was used. Specific geochemistry fractions were developed based on the available data. These geochemistry fractions were applied to the baseline and predicted future PM_{10} and $PM_{2.5}$ data, to estimate metals-specific ground level air concentrations (Intrinsik, 2019).

6.2.2.1.3 *FMS Mine Site Results*

A review of the ground concentration levels (GCL) predicted through dispersion modelling to occur at the FMS Mine Site property boundary without any mitigation measures are summarized and compared to the previously established regulatory maximum concentration levels in Table 6.2-3. Benzene and benz(a)pyrene were chosen as surrogate parameter in the assessment of VOCs and polyaromatic compounds (PAHs) in diesel exhaust. These parameters were chosen as they are typically under a more stringent ambient criteria compared to other VOCs and PAHs potentially present in diesel exhaust.

Table 6.2-3: Dispersion Modelling Results for Mine Operations – Maximum Ground Level Concentrations

Pollutant	Averaging Time Period	Normal Operating Conditions Location with the Highest Predicted GLC Site Boundary Locations		Normal Operating Conditions – with Mitigation Controls Location with the Highest Predicted GLC Offsite Exceedances	Nova Scotia Objectives
		Prediction	(X coordinates, Y coordinates)		
NO_2 ($\mu g/m^3$)	1 hour	334	(536741,4999377)	none	400
	Annual	1.6	(537350,4999594)	none	100
SO_2 ($\mu g/m^3$)	1 hour	0.56	(536741,4999377)	none	900
	24 hour	0.04	(536937,4999429)	none	300
	Annual	0.002	(536937,4999429)	none	60
TSP ($\mu g/m^3$)	24 hour	**335**	(537907,4997509)	none(1)	120
	Annual	24	(537907,4997509)	none	70
PM_{10} ($\mu g/m^3$)	24 hour	**98.8**	(537907,4997509)	none(1)	50(2)
$PM_{2.5}$ ($\mu g/m^3$)	24 hour	10.1	(536937,4999429)	none	27(3)
	Annual	0.59	(536937,4999429)	none	8.8
Arsenic ($\mu g/m^3$)	24 hour	0.05	(537907,4997509)	none	0.3(2)
CO ($\mu g/m^3$)	1 hour	133	(536741,4999377)	none	34, 600
	8 hour	14.5	(536937,4999429)	none	12,700

(1) Highest GLC for TSP at site boundary is 100.9 $\mu g/m^3$; highest GLC for PM_{10} at site boundary is 32.6 $\mu g/m^3$.

(2) OMECP AAQC.

(3) Canadian Wide Standard.

A comparison of maximum ground level concentrations (GLCs) results with Nova Scotia objectives indicates that, with the exception of one area for TSP and PM_{10} to the south of the site, all results are well within the objectives for NO_2, SO_2, CO and TSP, OMECP AAQCs for arsenic, CWS for $PM_{2.5}$.

The off-site particulate exceedances to the south of the FMS Mine Site are located within 500 m of the site boundary in a wooded area. The TSP exceedance (334 µg/m^3) is above the Nova Scotia 24-hour objective of 120 µg/m^3; the $PM_{2.5}$ exceedance (98.8 µg/m^3) is above the OMECP criterion of 50 µg/m^3 for a 24-hour averaging period. It should be noted the above-mentioned results represent conditions without dust control mitigation measures applied. A review of the modelling data determined the estimated total number of exceedances per year to the 24-hour TSP objective and 24-hour PM_{10} criterion is 3 days and 2 days, respectively.

The model was run a second time with a 75% reduction in road emissions for the 3.65 km section of road from the plant to Highway 375; 75% reduction for the 1.3 km road from the open pit to the plant and a 55% reduction on the remainder of the site roads. There were no off-site exceedances with these reductions applied. As previously mentioned, the need to control emissions on onsite roads will be required an estimated 3 times per year when weather and onsite operations are unfavourable and may cause offsite exceedances. Based on a literature review, Environment Canada states if an unpaved road is watered twice a day a 55% reduction in particulate emissions can be achieved (as cited in Wood, 2019b). Further reductions (to 75%) in particulate emissions can be achieved using magnesium chloride or other equivalent dust suppressant. These mitigation measures will reduce offsite impacts to below the Nova Scotia 24-hour objective for TSP and OMECP for PM_{10}. The use of mitigation measures will also further reduce impacts from other similar particulate emission parameters, such as arsenic, that are associated with dust generation from the site.

With respect to possible exposures to metals on particulate matter through inhalation, predicted concentrations of metals on PM_{10} and $PM_{2.5}$ at the Property boundary were compared to regulatory ambient air quality guidelines from Ontario (24-hour exposure durations), due to a lack of metals guidelines in Nova Scotia. All predicted concentrations were below the guidelines, and hence, predicted exposure levels are not considered to represent a risk for people spending time near the FMS Mine Site property boundary (see Table 6-2 and 6-3; Intrinsik, 2019). Similarly, when assessed on a long-term basis, predicted metals levels on annual $PM_{2.5}$ were within regulatory guidelines, and hence, risks are considered to be within acceptable levels (see Table 6-4; Intrinsik, 2019).

Table 6.2-4 provides a summary of predicted air dispersion modelling results compared to the Ontario MECP criteria for benzene and benzo(a)pyrene for 24 hour averaging periods. The benzene and benzo(a)pyrene were chosen as surrogate parameters to assess volatile organic compounds (VOCs) and polyaromatic compounds (PAHs) in diesel exhaust. These parameters were chosen since the ambient criteria are the typically the most stringent compared other VOCs and PAHs present in diesel exhaust. These results represent impacts from the Project alone and do not include baseline information.

Table 6.2-4: Dispersion Modelling Results for Diesel Emissions – Maximum Ground Level Concentrations

Pollutant	Averaging Time Period	Normal Operating Conditions Location with the Highest Predicted GLC Offsite Exceedance	Normal Operating Conditions Location with the Highest Predicted GLC Site Boundary Locations	Normal Operating Conditions – 50% Mitigation Controls Location with the Highest Predicted GLC Offsite Exceedance	Ontario MECP AAQC (µg/m^3)
Benzene[(1)] (µg/m^3)	24 hours	none	0.02 (536937,4999429)	none	0.23[(2)]
Benzo(a)pyrene[(1)] (µg/m^3)	24 hours	none	0[(3)] (536937,4999429)	none	0.00005[(2)]

(1) Emission rates were calculated based on emission factors provided in Table 3.3-2 Speciated Organic Compound Emission Factors for Uncontrolled Diesel Engines. Section 3.3 Gasoline and Diesel Industrial Engines, USEPA, AP-42.
(2) OMECP AAQC.
(3) Concentration provided by AERMOD is calculated so low it is displayed as 0 in the model results.

Table 6.2-5 provides a summary of predicted air dispersion modelling deposition results, and an estimate of the monthly and annual particulate and metals deposition.

Table 6.2-5: Deposition Modelling Results for Mine Operations

Pollutant	Averaging Time Period	Predicted Typical Deposition Levels at Site Boundary	Predicted Typical Deposition Levels at 1 km from Site Boundary	Ontario MECP AAQC (g/m^2)
TSP (g/m^2)	Monthly	0.1	0.02	7
	Annual	1.4	0.35	4.6
Arsenic (g/m^2)	Annual	$2x10^{-4}$	$4x10^{-5}$	-(2)

(1) OMECP AAQC.

(2) « denotes not available.

Table 6.2-6 provides the cumulative deposition results for the life of the mine operation.

Table 6.2-6: Cumulative Deposition Results for the Life of the Mine Operation

	Year										Total
	1	2	3	4	5	6	7	8	9	10	
Estimated Annual % Production	0	3.75	95	100	100	100	100	100	70.4	0	
Annual Deposition Contribution TSP (g/m^2)	0	0.05	1.3	1.4	1.4	1.4	1.4	1.4	0.99	0	9.34
Annual Deposition Contribution As (g/m^2)	0	0	$8x10^{-6}$	$1.8x10^{-4}$	$2x10^{-4}$	$2x10^{-4}$	$2x10^{-4}$	$2x10^{-4}$	$1.4x10^{-4}$	0	$1.1x10^{-3}$

Table 6.2-6 also provides an estimate of the total deposition of metals for the life of the Project at the FMS Mine Site property boundary. This estimate is considered worst case and deposition amount will decrease further from the site; the deposition amount will decrease by an estimated 75% one km from the site boundary.

The dispersion modelling provided a worst case one-year estimate for deposition. Information from the FMS Mine Site production schedule was used to estimate the amount of material handled in each year of operation. Table 6.2-6 provides the estimated total metals deposition based on the estimated production rates. The total estimated metals deposition for the life of the Project is 1.1×10^{-3} g/m^2 for arsenic.

Potential risks to people in areas near the FMS Mine Site property boundary were further assessed in a human health risk assessment study (Intrinsik, 2019b). Methods used to conduct the risk assessment followed Health Canada (2012; 2016a; 2016b; 2018) as

referenced in Intrinsik (2019b). Metals adhered to dusts released by the Project could deposit on soils, vegetation and berries in the area, and be taken up by plants, or wildlife in their foraging activities. People spending time in the area conducting activities such as harvesting, hunting, swimming or camping could be exposed through a number of different pathways. Total human exposure to metals adhered to dusts (identified as Chemicals Of Potential Concern, or COPCs) was calculated by summing the estimated daily intakes from the following potential exposure pathways, based on maximum predicted dust deposition rates at the Property boundary, as well as 1 km from the Property boundary:

- Exposure from the ingestion of berries;
- Exposure from the ingestion of leafy vegetation;
- Exposure from the ingestion of game meats;
- Exposure from the ingestion of fish;
- Exposure from the incidental ingestion of soils;
- Exposure from the inhalation of dust; and
- Exposure from the ingestion and contact with surface water through recreational water use (swimming).

Intrinsik (2019b) concluded that adverse health effects from COPCs, either non-carcinogens or carcinogens, are not anticipated and considered negligible respectively. This is based on the COPC composition of the dust and particulate source material, worst-case dust deposition rates throughout the lifetime on the Project and estimated daily intake by humans.

6.2.2.2 Touquoy Mine Site

The effects of fugitive dust production and deposition throughout the operational period of the Project at the Touquoy Mine Site is considered to be insignificant for the following reasons:

- The FMS concentrate has limited exposure to the open atmospheric environment upon arrival at the Touquoy Mine Site;
- Generated dust from site maintenance activities at Touquoy Mine Site is expected to be negligible; and
- The produced FMS concentrate tailings will be a wet slurry solution and not prone to being dispersed through the surrounding atmospheric environment.

Fugitive dust production, deposition and GHGs at the Touquoy Mine Site is considered to be insignificant during the FMS Mine Site operational period, and therefore, the potential effects of reduced air quality at the Touquoy Mine Site are not further discussed in this assessment. Also, for the same reasons as described above, no evaluation of effects of dust deposition on human exposure (metal concentrations in soils and vegetation and potential exposures related to harvesting) was completed for the Touquoy Mine Site for the Project.

6.2.2.3 Greenhouse Gas Emissions

The Project is predicted to generate a total of 35 kt of carbon dioxide annually as described in Table 6.2-7.

Table 6.2-7: Estimated Annual Greenhouse Gas Emissions – Proposed FMS Mine Operations (Tonnes/Year)

Activity	Equipment	CO_{2e}
Production Drilling	Two 110 mm DTH Drills	3,385.3
Bench Scale Exploration	Two 135 mm RC Drills	5,376.7
Production Loading	Three Hydraulic Excavators	3,436.9
Production Loading Stockpile Re-handle	One Wheel Loader	498.8
Production Hauling	Nine Haul Trucks	17,241.4
Trucking	Eleven Trucks per day from FMS Mine Site to Touquoy Mine Site	3,352.2
Articulated Haul Trucks	Two Articulated Haul Trucks	1,724.1
TOTAL CO_{2e}		**35,015.4**

In 2015 the estimated GHG emissions generated in Nova Scotia was 16,200 kt CO_2e. The project is expected to generate an estimated 35 kt of carbon dioxide, which would result in an increase in carbon dioxide emissions of approximately 0.2% to the Provincial levels. Therefore, the contribution of GHG emission from the Project does not threaten the currently achieved 2020 GHG reduction goal set by the province of Nova Scotia.

6.2.3 Mitigation Measures

Mitigation measures used to reduce and control air pollutants during construction, operation, and closure phases are outlined in Table 6.2-8 and will be implemented by the Proponent. Mitigation measures will be confirmed through the permitting stage through the Industrial Approval.

Mitigation measures at the Touquoy Mine Site (as required by the IA) are anticipated to continue throughout the operations phase of the Project.

A complaint from the public and/or First Nations will be a trigger to evaluate mitigation options. The Site Manager will be responsible for consideration of preventative mitigative actions listed in Table 6.2-8.

Table 6.2-8: Mitigation for Air

Project Phase	Mitigation Measure
O	Implement Fugitive Dust Management Plan, which is included in the EMS Framework Document
C, O	Utilize paved surfaces where available
C, O	Speed reduction
C, O	Apply dust suppressants, when and where practicable, to target 55% effectiveness (twice daily watering of roads during dusty periods) and 75% effectiveness (chemical dust suppressants) on main site road from pit to plant and from plant to Highway 374
C, O	Use mechanical sweeper on paved surfaces to prevent dust from remobilizing
C, O, CL	A procedure will be developed that will allow the public to register complaints regarding dust concerns and will require the Proponent to respond in a timely and effective manner
O	Apply stabilized covers on, where necessary
O	Size and select haul vehicles appropriately to minimize trip frequency
O	Implement appropriate dust suppression measures for crusher trains and associated activities/stockpiles
O	Minimize dust during transportation through use of specialized hoppers (fully contained) for concentrate between the FMS and the Touquoy Mine Sites
CL	Stabilize slopes on inactive stockpiles to a safe and long-term angle of repose
CL	Use soil and organics stockpiles for final capping and stabilization. Hydroseed as required

Note: C = Construction Phase, O = Operation Phase, CL= Closure Phase.

6.2.4 Significance of Residual Effects

The predicted residual environmental effects of Project development and production on air quality are assessed to be adverse, but not significant. The overall residual effect of the Project on air quality is assessed as not likely to have significant adverse effects after mitigation measures have been implemented. A significant adverse effect for air has not been predicted for the Project for the following reasons, with consideration of the ecological and social context within the LAA of the Project:

- During Construction and Closure: Air concentrations will be elevated above baseline conditions for limited periods but for short duration (<1 year for construction and 2 to 3 years for the reclamation stage of the Closure Phase), extending into the LAA. However, air concentrations will remain within established guidelines at the property boundaries and thus the guidelines are also met within the LAA. Air effects are reversible once mining operations and active reclamation activities are completed.
- During Operations: Air concentrations will be elevated above baseline conditions extending into the LAA. However, air concentrations levels will remain within established guidelines at the property boundaries with appropriate mitigation and thus the guidelines are also met within the LAA. Air effects are reversible once mining operations and active reclamation activities are completed.

- During Operations: Human Exposure to COPC from Dust Deposition for the FMS Mine Site are predicted to meet guidelines within the LAA. Adverse health effects from COPCs, either non-carcinogens or carcinogens, are not anticipated and considered negligible respectively. Air effects are reversible once mining operations and active reclamation activities are completed.

6.3 Light

6.3.1 Baseline Conditions

6.3.1.1 FMS Study Area Baseline Conditions

Ambient light data was collected at four representative sample locations on the night of September 9th, 2018 in or in proximity to the FMS Study Area. At all sample locations, ambient light measurements were under exposed, indicating ambient light levels were too low to be measured (<0.01 lux).

Sky brightness ranged across the monitoring sites from 21.5 to 21.7 mag/arcsec^2 indicative of a low-light rural environment. The baseline sky brightness results for each monitoring location are provided in Table 6.3-1.

Table 6.3-1: Baseline Sky Brightness surrounding the FMS Study Area

Monitoring Location	UTM Coordinates (Zone 20 T)		General Location Description	Brightness (mag/arcsec^2)	CIE Classification
	Easting	Northing			
Light 1	535910	4998952	Within the FMS Study Area ~ 1.5 km west of the proposed pit.	21.7	E1 (Intrinsically Dark)
Light 2	539562	4998399	Within the FMS Study Area ~ 2 km east of the proposed pit.	21.6	E1 (Intrinsically Dark)
Light 3	538085	4999935	Within the FMS Study Area ~ 1 km northeast of the proposed pit.	21.5	E1 (Intrinsically Dark)
Light 4	534814	5001866	Outside of the FMS Study Area ~ 4 km northwest of the proposed pit.	21.5	E1 (Intrinsically Dark)

The FMS Study Area consists of intrinsically dark night skies which are characteristic and similarly found in wilderness or park sites.

6.3.1.2 Touquoy Mine Site Baseline Conditions

At all locations where baseline measurements were taken at the Touquoy Mine Site, ambient light measurements were under exposed, indicating ambient light levels were too low (<0.01 lux) to be measured (CRA, 2007). No data was collected to support determination of CIE Classification for Sky Brightness.

6.3.2 Anticipated Effects and Changes to the Environment

6.3.2.1 FMS Study Area

Predictive effects of light spill are determined by "line of sight" methodology and use elevation contours for impact limits. This is used to represent the 0.1 lux light level which is otherwise considered the limit of possible impact. The possible impact from light extent was also evaluated through a light attenuation assessment through the use of the inverse-square law to determine potential effects at the nearest receptors (Wood, 2019c).

The effects of light impact from the FMS Study Area were assessed for impacts from light spill by two methodologies and sky glow. Light spill is defined as the extent which light will travel before being obscured by a barrier. Sky glow is the observable brightness of the night sky caused by light spill above the horizontal plane or reflected into the night sky.

The predicted extent of light propagation extends between 0 and 2 km from the FMS Mine Site property boundary. A significant removal of trees or significant elevation change at the receptor or source would be needed for light spill to be noticeable at the residential receptors.

Utilizing the inverse square methodology, for each source at the site, the total wattage of lighting was summed based on estimations or manufacturer specifications where available. The wattage of each source was converted to lumens utilizing the luminous efficacy from published sources (US DOE, 2017) for comparable lighting types. Luminous efficacy considers the sensitivity of the human eye to the wavelength of light produced. All sources were conservatively treated as a single source at the point of infrastructure closest to the closest residence.

On the south side of the site, nearest the receptors, the typical extent of light spill (< 0.1 lux) is expected to be approximately 500 m from the south edge of infrastructure. A total light output of 6,527,000 lumens was used as an assumption for the whole site emitting from the nearest point of infrastructure to the nearest receptor. The calculation of 0.10 lux at 500 me takes into account the physical obstacles such as trees, berms, or local topography, between the Project and the light receptors by using a 99.6% attenuation factor.

While an approximation, the effect is that even a few stands of trees or a hill of sufficient height can substantially reduce light spill, which is supported by roadside observations carried out near the FMS Mine Site. With 1.35 lux for light vehicles added to the lux for all other light sources gives a resultant illuminance at Receptor 1 (located 4.9 km south of the FMS Mine Site) of 0.001 lux. Receptors 2, 3 and 4 are further from the sources and would have, therefore, notably lower illuminance. All residences identified are expected to have CIE-acceptable "E1" illuminance levels during construction and operation phases.

Additionally, site infrastructure and equipment will be sources of light that are not anticipated to produce a significant area of illumination (sky glow). Therefore, the effects of sky glow are anticipated to be limited to within 2 km of the FMS Study Area and not likely noticeable at the nearest receptor.

Effects to wildlife, birds and the Mi'kmaq of Nova Scotia from predicted light are further discussed in Sections 6.10, 6.11, and 6.13.

6.3.2.2 Touquoy Mine Site

In the 2007 Focus Report the impacts of the proposed lighting installations at the Touquoy Mine Site were quantified and compared with guidelines published by the Institution of Lighting Engineers (ILE) in the document entitled "Guidance Notes for the Reduction of Obtrusive Light" (ILE 2005). A threshold of 1 lux was determined to be the limit of noticeable impact from light. 1 lux is equivalent to the light provided by a full moon on a clear night. The extent of the 1 lux threshold was compared to nearby sensitive receptors to determine potential effects. Sensitive receptors included Camp Kidston (3 km to the north), the Scraggy Lake Area (2 km to the south) and the nearest residence (5 km to the northwest).

The predicted light spill anticipated to occur at the identified points of reception (Camp Kidston, Scraggy Lake Area and the nearest residence) ranges between 0.0587 and 0.294 lux, well below the established 1 lux threshold used at the Touquoy Mine Site.

The primary effect of the continued use of the Touquoy Mine Site is the continued lighting of facilities and vehicular traffic during the processing of FMS concentrate. There are no new or additional effects from light anticipated to be caused by the processing of concentrate and the management of tailings from the Project.

6.3.3 Mitigation Measures

Mitigation measures for the Project are described in Table 6.3-2 and will be implemented by the Proponent.

Table 6.3-2: Mitigation for Light

Project Phase	Mitigation Measure
C, O, CL	Temporary lighting will be directly focused on work areas and shielded where practicable to avoid light trespass
C, O, CL	Use of only downward-facing lights on site infrastructure and Mine Site roads
C, O, CL	Install motion-sensing lights, where practicable
C, O, CL	All floodlights will employ full horizontal cut-off, as appropriate
C, O, CL	Only use direct and focused light when needed for worker safety
C, O, CL	Lighting not in use will be turned off, whenever practicable
C, O, CL	Site perimeter lighting will be directed to minimize offsite light trespass
C, O, CL	A procedure will be developed that will allow the public to register complaints regarding light concerns and will require the Proponent to respond in a timely and effective manner
C, O, CL	Utilize efficient sources of light, such as LED, to reduce overall magnitude of light, wherever practicable

Note: C = Construction Phase, O = Operation Phase, CL= Closure Phase.

6.3.4 Significance of Residual Effects

The overall residual effect of the Project on light is assessed as not likely to have significant adverse effects after mitigation measures have been implemented.

A significant adverse effect for light has not been predicted for the Project for the following reasons, with consideration of the ecological and social context within the LAA of the Project:

- During Construction: Light will be elevated above baseline conditions potentially extending into the LAA. However, light spill will be limited by surrounding topography prior to reaching the nearest receptors. Given the remote location of the Project the likelihood of receptors being regularly in close proximity to light generation sites is very low. Light trespass has been qualitatively assessed during construction and is predicted to be lower than during operations, which was modelled and is described below.

- During Operations: Light spill is predicted to extend 2 km from the FMS Mine Site into the LAA for the Project. However, light levels will be limited by surrounding topography prior to reaching the nearest receptors and given the remote location of the Project the likelihood of mobile receptors being regularly in close proximity to light generation sites is very low.
- During Closure: Light levels will be elevated above baseline conditions potentially extending into the LAA during decommissioning activities, then drop to baseline conditions for the post closure period. Light trespass has been qualitatively assessed during Closure and is predicted to be lower than during operations, which was modelled and is described above.

6.4 Geology, Soils and Sediment

6.4.1 Baseline Conditions

6.4.1.1 FMS Study Area

The Project is located within the Eastern Ecoregion of the Acadian Ecozone. The Eastern Ecoregion is underlain primarily by quartzite and slate of the Meguma Supergroup, the geological name for this assemblage of ancient metamorphosed sedimentary rocks. Throughout this region, Meguma rocks are intruded by younger granites and related igneous rocks. A variety of landforms are found in this ecoregion, including forest-covered rolling glacial till plains, drumlin fields, extensive exposed bedrock, and wetlands.

Background soil quality across the Maritimes was assessed by Friske et al (2014a, 2014b). Of the dozens of samples collected, eight samples nearest the FMS Study Area were reviewed for the EIS. The average background arsenic concentrations in offsite forest soils surrounding the FMS Study Area are at or exceed federal soil quality guidelines (12 mg/kg) but do not exceed provincial Tier 1 Environmental Quality Standards (EQS) for an industrial site with non-potable groundwater use and coarse-grained soil (31 mg/kg).

6.4.1.1.1 *Historic Waste Rock and Tailings*

Current soil and sediment quality throughout the FMS Study Area is affected by the presence of historic waste rock and tailings, which are prevalent in the FMS Study Area and overprint 'natural' soil and sediment chemistry. To map, characterize and eventually manage historic waste rock and tailings, Stantec (2019a) completed a comprehensive historical review of past mine workings through a series of Phase I and Phase II Environmental Site Assessments and issued management options and recommendations to further delineate and control waste rock and tailings.

In late 2018, Stantec (2019c) sampled historic tailings and waste rock from 21 test pits excavated within the FMS Study Area. Possible tailings were visually observed at 9 of the 21 test pits. The report concludes that elevated arsenic concentrations are expected to be present across the FMS Study Area since the gold is associated with the mineral arsenopyrite. Concentrations of arsenic detected in soil samples collected from certain test pits only marginally exceeded the Tier 1 EQS and are potentially indicative of background (pre-mining) soil concentrations (i.e., 40 – 200 mg/kg). Soils near an ore body would be expected to be mineral-enriched relative to the soils described in the previous section that are more distant from the mineralized zone.

Unprocessed waste rock is much more widespread within the FMS Study Area than tailings; more than a dozen distinct waste rock piles have been mapped. Waste rock is associated with elevated concentrations of common heavy metals such as arsenic, iron and lead, since these elements are found in minerals associated with gold deposits.

6.4.1.1.2 *Sediment Sampling*

A total of 12 sediment grab samples were collected on October 5, 2018 along Seloam Brook and within a tributary to East Lake located in the southeast corner of the FMS Study Area. Six additional sediment samples were collected later in October 2018 from Anti-Dam Flowage, a two-kilometer-long lake located immediately downstream of the FMS Study Area. The samples were analyzed

for metals, grain size distribution and organic matter content to obtain baseline sediment quality data prior to site preparation and construction.

The 2018 baseline sediment sampling program identified elevated concentrations of certain heavy metals in sediments from the FMS Study Area, in particular, arsenic and mercury. The concentration range of each metal significantly exceeds metal concentrations in background soils, suggesting the FMS Study Area sediments have been negatively affected by past mining activities.

On-going exploratory work is being completed by Stantec Consulting to support Phase I and Phase II Environmental Site Assessments. Additional sediment quality results obtained by Stantec as part of this on-going work are provided to support the analysis of project effects on fish and fish habitat.

6.4.1.1.3 *Metal Leaching and Acid Rock Drainage*

On behalf of the Proponent, Lorax (2019) analyzed mine ore, waste rock and tailings to determine the metal leaching and acid rock drainage (ML/ARD) properties of these materials. ML/ARD is a natural process that results from the weathering, primarily through oxidation of sulphide-bearing rocks and overburden. When these materials are exposed to oxygen and water, metal sulphide minerals oxidize, which results in the release of acidity and dissolved metals into contact water. If not neutralized, this process can lead to low pH conditions and elevated metal concentrations in mine drainage.

A total of 60 Project drill core samples were subjected to geochemical assessment. Static tests, including acid base accounting (ABA) and solid phase element analyses, were carried out on all samples, and based on these results, a subset of samples was selected for kinetic tests (humidity cells).

Selected Summary of Results

- Samples from the greywacke (GW) unit are generally non-potentially acid generating but samples from the other three lithologies and from the ore samples include PAG rock. There is a clear relationship of PAG% with the relative amount of argillite contained within the rock type: the argillite unit (<5% greywacke interbeds) shows the highest PAG proportion of 88%, while none of the greywacke samples are classified as PAG.

- Elements of potential concern based on the solid phase elemental analysis include Ag, As, Cu, Pb, Sb, and Zn. These elements, excluding Cu and Zn, are enriched by a factor greater than 10x above the average upper continental crust abundance (AUCCA) in one or more samples. Arsenic is elevated above 10x the AUCCA in all lithologies.

- The shake flask extraction (SFE) results indicate that As and Al are potential parameters of concern in runoff from the mine rock. Other parameters highlighted in the solid phase analyses were not above the federal water quality guidelines in the SFE leachate.

- Modelling results suggest that the neutralization potential (NP) will be depleted from the FMS mine rock between approximately 6 and 15 years. A conservative estimate for time to NP depletion for the static test samples indicates that approximately 50% of the PAG samples will become acidic within 10 years. This estimate does not consider the slower sulphide oxidation rates in colder temperatures, which would be expected to delay the onset of acid generation.

- Arsenic is the main parameter of concern in the tailings due to elevated concentrations in both the solid phase elemental analysis and in the SFE leachate. Arsenic concentrations increased over 18-week saturated column leachate test. The maximum As concentrations reached (0.35 mg/L) are 7x the CCME guideline.

6.4.1.1.4 *Geochemical Characterization*

The prediction of both the elemental concentrations in contact water from the WRSA, overburden and ore stockpiles, pit walls, and the TMF was completed by Lorax Environmental Services Ltd. (Lorax 2019) using a combination of kinetic test results as well as site monitoring and analogue data from the operational Touquoy Mine.

Source terms were generated for:

- PAG and NAG portions of the WRSA;
- Low-grade ore stockpile;
- Pit wall run-off;
- Nitrogen concentrations predicted for drainage from the WRSA, pit walls, and the TMF embankment at EOM (The PC scenario involves an annual nitrogen depletion rate rather than absolute concentrations);
- Base Case FMS tailings process water (supernatant);
- TMF beach run-off;
- Long-term TMF pore water; and
- Till and topsoil stockpiles.

Source terms are used as inputs into surface and groundwater quality modelling (Sections 6.5 and 6.6).

6.4.1.2 Touquoy Mine Site

Sediment quality at the Touquoy Mine Site will not be affected by activities associated with the Project and so no assessment of the potential effects on sediment quality at the Touquoy Mine Site was conducted. Construction of the spillway at Touquoy Mine Site will not result in any interactions with sediment quality in the Moose River.

6.4.2 Anticipated Effects and Changes to the Environment

Construction will require the removal and storage of overburden, topsoil, existing mine waste and historical tailings, as well as the diversion of Seloam Brook away from the future open pit through the proposed Seloam Brook realignment. During construction, settling pond(s) with geosynthetic liners, will be constructed near the location of the WRSA in order to manage construction water during pit development. A modular treatment plant will be available to treat water during the construction phase, if required. Mine site haul roads and drainage ditches will be constructed, culverts installed, and buildings erected. Construction will require blasting for quarrying onsite in multiple locations, and site preparation. The tailings management facility (TMF) will also be constructed. These construction activities will occur over a 12 month period and have the potential to release sediments via surface runoff to Seloam Brook as well as nearby unnamed watercourses and wetlands. Sediments that exhibit elevated metal concentrations and/or sediments as suspended solids within the water column may be generated during construction activities.

Operations including mining, crushing, transporting and the stockpiling of low grade ore and waste rock also have the potential to generate particulates that may become sediments if they are transported to nearby watercourses and wetlands. In addition, tailings stored in the above-ground TMF may become sediments in the event of a breach or overtopping of the TMF during operation or post closure.

Sediments may be generated during site closure and reclamation as buildings are dismantled, infrastructure is removed, and topsoil replaced in preparation for revegetation.

Historical waste rock and tailings will be managed as described in Section 2.1.2.1.2.

6.4.3 Mitigation Measures

Mitigation measures provided in Table 6.4-1 will be implemented by the Proponent where potential indirect impacts to sediment quality are possible. A preliminary Erosion Prevention and Sediment Control Plan has been developed and will be updated in collaboration with environmental regulators as part of the company's Environmental Management System and Industrial Approval application for the Project.

Historical waste rock and tailings will be managed. The quality of potentially contaminated sediments in Seloam Brook, and the volume of contaminated sediments, will be further assessed through additional sampling prior to beginning the Seloam Brook realignment. This will be completed during the final engineering design phase of this realignment.

Table 6.4-1: Mitigation for Geology, Soil, and Sediment

Project Phase	Mitigation Measure
C, O, CL	Implement Erosion Prevention and Sediment Control Plan, which will be developed to support the EMS Framework Document
C, O, CL	Complete pre-construction site meetings for all relevant staff/contractors related to working around wetlands and watercourses and communicate the importance of implementing the Erosion Prevention and Sediment Control Plan
C	Construct settling pond(s) with geosynthetic liners at appropriate locations around the site that will facilitate the management of contact water during pit and other infrastructure development
C	A modular effluent treatment plant for contact water will be available during construction if required
C, O, CL	Construct site management ponds, and direct all site contact water into these ponds and to the TMF during operations, and to the pit during closure
C	Complete the Seloam Brook Realignment "in the dry" to, in part, reduce likelihood of erosion and sediment releases. Certain areas along the diversion berm may require additional bank protection from erosion, which will be considered when final designs for the Realignment are submitted to NSE as part of the IA application process
C	Monitor stormwater pond discharges on a regular schedule, as stipulated in the provincial permit, prior to discharge (where practicable based on water quality)
C, O	Direct runoff through natural vegetation, wherever practicable
C, O	Conduct vegetation management (cutting and clearing) in or near wetlands and watercourses in accordance with applicable guidelines
C, O, CL	Re-vegetate slopes adjacent to wetlands and watercourses to limit erosion and sediment release

Note: C= Construction Phase O= Operation Phase CL= Closure Phase

6.4.4 Significance of Residual Effects

Significant residual effects on sediment quality are not anticipated since erosion and sediment control, along with stormwater management best practices, are standard, proven techniques that have long been used in mining and construction contexts. The soils and sediments of the site are already disturbed through past mining activity. Moreover, historic tailings and waste rock that are currently situated near watercourses will be managed and moved to more appropriate storage facilities, reducing their current effects on water and sediment quality. Monitoring programs will be developed in collaboration with environmental regulators to ensure mitigation measures are implemented and functioning as designed.

A significant adverse environmental effect for geology soil and sediment 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 sediment quality in the PA and LAA are not expected, with appropriate mitigation including the use of settling ponds and other standard erosion and sediment control practices.
- During Operations, potential for indirect impacts to sediment quality in the PA and LAA will be managed through erosion and sediment control measures and dust mitigation.
- During Closure, reclamation will allow for site restoration of a native assemblage of plant communities which will reduce the likelihood of long-term impacts to sediment quality within the PA and LAA from the Project.

6.5 Groundwater

6.5.1 Baseline Conditions

6.5.1.1 FMS Study Area

Locally, groundwater flow likely parallels surface topography, particularly adjacent to major river valleys. Groundwater discharge likely provides baseflow to streams and rivers and some wetland features within the vicinity of the FMS Study Area. Recharge of the shallow overburden and bedrock aquifers in the groundwater is likely from precipitation and surface streams or rivers. Recharge would also occur through areas of fractured and jointed exposed bedrock.

Site specific field programs were conducted to gather geologic and hydrogeologic information. Borehole locations were selected to provide broad coverage of the proposed Project infrastructure including the open pit, TMF, processing facility locations and existing surface water features.

In 2017, angled geotechnical boreholes were drilled in the FMS Study Area with select boreholes targeting the Egerton-MacLean (Golder, 2019a). These holes also underwent packer testing to understand the hydraulic conductivity of the open pit area.

A 2018 shallow borehole drilling campaign was carried out at 14 drilling locations over the FMS Study Area with the exception of one borehole located approximately 1.75 km to the northwest of the FMS Study Area. At each drilling location, up to two monitoring wells were installed within individual offset boreholes (Golder 2019a). Packer and single well response tests were completed on all boreholes in order to understand the shallow hydraulic conductivity. These shallow vertical boreholes were installed with monitoring wells which were used to record water levels and collect water quality samples. There were six well nest locations installed with pressure transducer dataloggers. Manual water levels were recorded at all wells on a monthly basis initially for three months and then quarterly thereafter. In addition, grain size analysis was conducted at 12 locations and was used to determine the hydraulic conductivity of the overburden in the vicinity of the FMS Study Area.

Groundwater samples were collected from each monitoring well in September 2018, December 2018, March 2019 and June 2019.

6.5.1.1.1 *Groundwater Quantity Conceptual Model*

Based on the baseline data collected, the following section presents the groundwater quantity conceptual model. Due to the relatively shallow depth to bedrock, and the low hydraulic conductivity of the bedrock unit, groundwater flow within the FMS Study Area is conceptualized as occurring mainly within the till, and upper (contact) portion of the bedrock. Site specific groundwater levels indicate that the water table is generally within the till or the upper few meters of the bedrock, supporting this conceptualization. Given the prevalence of wetlands and surface drainage features throughout the area, and the excess of the annual rainfall relative to evaporation, groundwater is likely to follow short localized flow paths, discharging to surface water features within proximity to areas of groundwater recharge. Detailed discussion of the hydrostratigraphy of the FMS Study Area is included in the groundwater modelling report (Golder, 2019b).

Based on this study and previous studies of the hydrogeology of this deposit and others in the area, the degree of hydraulic connection amongst the smaller bedrock fracture systems is likely poor to moderate. Based upon the current drilling records it is our understanding that there are no large regional fault systems in the vicinity of the Project, and the Seigel and Serpent faults are smaller and do not appear to be capable of transmitting or storing large amounts of water based on the limited testing to date.

Groundwater can be expected to seep into the open pit developed at the FMS Mine Site through the surficial deposits and the upper (contact) bedrock unit. Within the deeper and less conductive bedrock units, groundwater flow to the open pit is through fractures and structures in the bedrock (which are not represented explicitly in the numerical model). As dewatering progresses and groundwater levels in the vicinity of the open pit are lowered, some surface water bodies which are currently groundwater discharge areas may become areas of groundwater recharge.

6.5.1.1.2 *Groundwater Quality Results*

The following section provides the analytical results for the groundwater quality sampling conducted quarterly at FMS Study Area from September 2018 to June 2019.

All groundwater quality results were compared to the Guidelines for Canadian Drinking Water Quality (CDWQ) and the Nova Scotia Environment Pathway Specific Standards for Groundwater (NSE PSS) for groundwater discharging to surface water (0 to 10 m from a freshwater body).

The results of the laboratory analysis are summarized as follows:

- PHC/BTEX, and total and free cyanide were not detected in any of the samples collected.
- Total mercury exceeded the NSE PSS in two wells in September 2018, and total and dissolved mercury exceeded the NSE PSS in a different well in November 2018. Total and dissolved mercury did not exceed the CDWQ in any samples collected in September 2018, November 2018, March 2019, or June 2019.
- Radium-226 did not exceed the health-related maximum acceptable concentration (MAC) provided in the CDWQ in any of the sampling events.
- A summary of the groundwater exceedances of the CDWQ MAC for the September 2018, November 2018, March 2019, and June 2019 sampling events is as follows:
    - Dissolved arsenic exceeded the CDWQ in seven wells in September 2018.
    - Dissolved arsenic exceeded the CDWQ in six wells in November 2018, all of which also exceeded in September 2018.

- Dissolved arsenic exceeded the CDWQ in 5 wells in March 2019, all of which exceeded in the 2018 sampling with the exception of one.
- Dissolved arsenic exceeded CDWQ in 6 wells in June 2019, all of which exceeded in the previous sampling.
- Dissolved manganese exceeded the CDWQ in 13 wells in June 2019. Health Canada established a guideline for manganese in May 2019. Previous sampling events were not compared to the new Health Canada CDWQ guideline, however, concentrations reported for the June 2019 sampling event are consistent with manganese concentrations from previous sampling events.
- No other metals parameters exceeded CDWQ MAC.
- Aluminum, iron and zinc exceeded aesthetic objectives/operational guidance value in multiple wells during all monitoring events.

Parameters exceeding the NSE PSS in groundwater for the September 2018, November 2018, March 2019, and June 2019 sampling events included total mercury and dissolved aluminum, arsenic, cadmium, cobalt, copper, iron, manganese, mercury, selenium, silver, and zinc.

Based upon the local geology and fairly shallow water table, exceedances of these metals are expected due to groundwater interaction with the overburden and bedrock.

6.5.1.2 Touquoy Mine Site

Peter Clifton & Associates (PCA) (2007) completed a hydrogeological assessment of the Touquoy Mine Site. The report provides an assessment of potential groundwater inflows to the proposed Touquoy pit at the Touquoy Mine Site. This assessment used a series of geotechnical/hydrogeological drill holes that were also sampled for groundwater quality. Samples were analyzed for general chemistry and metals. Test pits were also excavated in June 2006 to evaluate groundwater flow in the till between the Touquoy pit and Moose River. Additional assessment work completed in September 2006 included a temperature survey of surface water to determine possible areas of upwelling groundwater.

Jacques Whitford (2008) prepared a Groundwater Monitoring Plan as part of the Industrial Approval application for the Touquoy Mine Site. The series of 32 multi-level well pairs, proposed in the plan were installed by GHD Limited at the Touquoy Mine Site (GHD Limited 2016a,b), and groundwater monitoring has been ongoing at the Touquoy Mine Site to characterize the groundwater conditions in the overburden and bedrock (water levels and chemistry).

The historic and recent data from the Touquoy Mine Site provided a thorough picture of the physical hydrogeology of the Touquoy Mine Site as well as possible interactions that were examined as part of the groundwater VC. Based on the observed hydrogeologic conditions at the site, a hydrogeologic conceptual site model (CSM) was developed to describe groundwater and surface water interactions at the site.

A three-dimensional groundwater flow model was developed based on the CSM in accordance with the BC Guidelines for Groundwater Modelling to Assess Impacts of Proposed Resource Development Activities (Wels et al. 2012). The Touquoy Mine Site numerical groundwater flow model (Touquoy Model) was applied to simulate baseline groundwater quantity conditions for the disposal of the FMS concentrate tailings and the blended FMS concentrate and Beaver Dam tailings into the Touquoy pit. Baseline conditions correspond to the fully dewatered conditions at the end of mine life, which provide a basis of comparison for predicted groundwater quantity conditions during closure (i.e., as the Touquoy pit is filling) and post closure (i.e., after the groundwater conditions have stabilized following the filling of the Touquoy pit). The Touquoy Model is also applied to improve understanding of hydrogeologic interactions and to simulate transport of constituents of concern at the Touquoy Mine Site.

Baseline groundwater quality monitoring at the Touquoy Mine Site has been conducted at 33 well nests since 2016. As presented in Stantec (2019d), the groundwater at the Touquoy Mine Site is slightly basic (pH range 7.02 to 8.08) and an elevated hardness (45 to 160 mg/L). The background groundwater quality generally meets the NSE Tier 2 Pathway Specific Standards (PSS) for groundwater greater for wells located more than 10 m from surface water (NSE 2014).

Groundwater quality exceedances of the NSE PSS were noted in 2017 for aluminum, arsenic, cadmium, copper, iron, mercury, silver, and organics that were common in the 2016 baseline period, and therefore were not attributed to the operation of the mine. In particular, historical (non-Project-related) mining operations at the Touquoy Mine appear to have resulted in elevated concentrations of some parameters, including arsenic., mercury, and cyanide species.

Arsenic was noted to consistently exceed the NSE PSS at OPM-1A/B in both 2016 and 2017. These elevated arsenic concentrations are not attributed to operation and may be from historical tailing piles and/or the Touquoy ore body itself. A remedial action plan is currently underway by the Proponent that involves the delineation, removal, and management of these historical tailings piles around the Touquoy pit area.

Cyanide species were reported in the OPM-series wells at concentrations near the detection limits. These are attributed to historical mining activities or laboratory error as no discharges of cyanide have occurred near the open pit as the result of the Touquoy project.

6.5.2 Anticipated Effects and Changes to the Environment

6.5.2.1 FMS Study Area

6.5.2.1.1 *Groundwater Quantity*

Groundwater quantity changes may be caused by:

- **Hardening of surfaces therefore reducing recharge:** during earth works such as construction of access roads, buildings and stockpiles. These activities will lead to hardening of surfaces through compaction of subsurface soils. This will reduce the area in the LAA that is available for groundwater recharge and cause a temporary lowering of the groundwater table relative to the baseline water levels (while taking seasonal fluctuations into account).

- **Increased recharge thereby potentially increasing groundwater table levels:** Vegetation clearing will take place for construction. Mechanical clearing of vegetation may temporarily increase recharge to shallow groundwater tables in higher permeability areas, thereby potentially causing a slight increase in local groundwater levels. This rise in water table will eventually re-equilibrate to the baseline water level as the increase in recharge area is limited (less than 7% of LAA). A negligible effect on groundwater quantity is anticipated due to vegetation clearing, and no effect on maintenance of existing groundwater quantity (including recharge and flow) is expected.

- **Open pit dewatering** will cause a lowering of the groundwater table and therefore reducing groundwater contribution to water wells and surface water resources (such as wetlands and streams) that are within the modelled potential groundwater radius of influence.

- **Blasting** of the open pit bedrock may increase the fracture frequency around the blast hole.

Effects from the Project on groundwater quantity are evaluated based on the results of hydrogeological modelling. The hydrogeological modelling was completed for operations and post-closure to estimate:

- The rate of groundwater inflow to the open pit;
- Changes in groundwater elevations associated with the open pit, TMF, and WRSA;
- The groundwater flow pathways from the TMF and WRSA; and
- The rates of groundwater flow from the TMF and WRSA to downstream receptors.

FEFLOW (Finite-Element Simulation System for Subsurface Flow and Transport Processes) (Diersch, 2014) Version 7.1 (October 2017) was used to complete the simulations. Details of the conceptual model are reported in Golder, 2019b.

The operations phase of the Project was evaluated with the model as follows:

- The EOM Pit was fully extracted at the start of the simulation to a base elevation of -50 m (CGVD28); and
- The TMF was fully developed to the final TMF Pond/tailings elevation of 158 m (CGVD28) at the start of the simulation.

For the operations simulation the infiltration rate over the footprint of the WRSA, and low-grade ore and overburden stockpiles was unchanged from the calibrated conditions. It is assumed that any surplus infiltration in these areas would be collected by the perimeter drainage system, and not report to groundwater in operations.

The post-closure phase of the project was evaluated with the model as follows:

- The pit was flooded to a natural spill elevation of 109 m ASL;
- The TMF boundaries were unchanged from operations conditions, under the assumption that the tailings may remain saturated for an extended period in post-closure; and
- The PAG portion of the WRSA was assumed to be covered. The infiltration rate through the cover was assumed to be 15% of the total annual water surplus.

The EOM groundwater levels from the operations models were applied as the initial condition for the post closure model. The simulation was run transiently until groundwater inflow to the open pit, and groundwater seepage from the TMF reached steady-state (within the first year following the completion of flooding of the open pit). The effects assessment is based on the steady-state groundwater flow conditions in post-closure.

6.5.2.1.2 *Groundwater Quality*

Quality changes may be caused by:

- **Incomplete combustion of blast materials:** Use of explosives during construction and pre-production has the potential to affect groundwater quality. Specifically, ammonium nitrate type explosives to remove bedrock has the potential to leave nitrogen residual substances (e.g., nitrogen) that can leach into groundwater. This residual is often due to incomplete combustion of the explosive.
- **Existing contaminated soils:** The extent of the existing mine tailings in the FMS Study Area has been delineated by Stantec (December 2018). The Proponent has committed to removing the tailings that may be disturbed as a part of site construction and operation. This tailings removal will be conducted during the construction phase. Therefore, a change in

groundwater quality due to the inadvertent disturbance of existing mine tailings is not anticipated and therefore not assessed as a potential impact to groundwater quality.

- **Rock-water interaction:** precipitation falling onto waste rock or tailings may affect run off water quality that may infiltrate the ground and affect groundwater quality for shallow aquifers.

Based on the results of the groundwater flow model, groundwater will report to surface water features in the receiving environment (i.e., East Lake, Seloam Brook, and the Open Pit). Waste rock and tailings source chemistry and material properties have not yet been characterized to the extent needed to quantify changes in seepage volume or quality through post-closure. As a conservative approach, surface water quality modelling of the receiving environment applied the source-term concentrations for each facility to the groundwater seepage flow in both operations and post-closure (i.e., no attenuation in the groundwater flow pathway was applied). Residual effects from the Project on groundwater quality are also evaluated based on this conservative approach.

6.5.2.2 Touquoy Mine Site

A groundwater flow and solute transport model has been developed for the Touquoy Mine Site to evaluate:

- the dewatering rate from the Touquoy pit and changes in groundwater flow conditions and discharges as the initial condition for the deposition of tailings from processing the FMS concentrate at the Touquoy Mine Site.
- the groundwater seepage rates to the Touquoy pit as it is filled with FMS concentrate tailings (i.e., during FMS Operations at the Touquoy Mine site) until the Touquoy pit is full (i.e., end of Closure).
- the identification of areas where water in contact with the FMS tailings disposed in the Touquoy pit are discharged to the receiving environment, and the potential for surface and groundwater interactions (i.e., the Post-Closure period).

The groundwater flow model was based on site-specific and available regional data including surface water features, topography, water well records and geologic information. The scope of work completed by Stantec to develop the groundwater flow model and apply the model to evaluate potential impacts to groundwater and surface water flow regimes included the following:

- Compilation, review, and interpretation of the geologic, groundwater flow, and surface water flow data available for the Touquoy Mine Site and surrounding area.
- Development of a conceptual site model and steady-state 3D groundwater flow model of the Touquoy Mine Site and surrounding area. The groundwater flow model was calibrated under steady-state conditions and the sensitivity of the model calibration was evaluated with reference to model input parameters such as measured groundwater elevations, groundwater flow directions, and estimated baseflow.
- Application of the calibrated groundwater flow model to evaluate potential changes in groundwater quality and quantity with respect to groundwater flow and groundwater interactions with surface water at the Touquoy Mine Site under Baseline (conditions prior to the deposition of FMS tailings at the Touquoy Mine Site), end of Operations (conditions at the end of deposition of FMS tailings at the Touquoy Mine Site), and Post-Closure conditions.

6.5.3 Mitigation Measures

6.5.3.1 Groundwater Quantity

The groundwater quantity effects assessment was completed taking into account several mitigation measures that will be included in the design of the Project, specifically:

- During operations and closure at the FMS Mine Site, the TMF water management includes a toe drain or equivalent, which collects seepage and gravity drains to seepage collection ponds.
- During operations and closure at the FMS Mine Site, water management system collects stockpile and WRSA runoff and infiltrated water that is in excess of the baseline via a perimeter ditch system.
- During operations at the FMS Mine Site, the open pit water is collected via sumps and is directed to the TMF.
- During operations at the FMS Mine Site, the groundwater flow from bedrock overburden contact is managed via a cut off trench located below top of rock. This groundwater flow from bedrock overburden contact gets directed to the TMF with the pit water.
- During closure at the FMS Mine Site, a cover system over the PAG portion of the WRSA will be implemented to reduce infiltration and thereby by reducing groundwater seepage quantity.
- During closure at the FMS Mine Site, the size of the TMF pond will be minimized which reduces the seepage through the tailings.
- No specific mitigation is required at the Touquoy Mine Site to support the Project relating to groundwater quantity.

6.5.3.2 Groundwater Quality

The groundwater quality effects assessment was completed taking into account several mitigation measures that will be included in the design of the Project, specifically:

- During closure at the FMS Mine Site, a cover system will be implemented over the PAG portion of the WRSA to reduce infiltration and also reducing oxygen thereby reducing acid generation potential.
- During closure at the FMS Mine Site, the size of the TMF pond will be minimized which in turn minimizes tailings water interaction.
- No specific mitigation is required at the Touquoy Mine Site to support the Project relating to groundwater quality.

The actions provided in Table 6.5-1 will be implemented by the Proponent where potential direct and indirect impacts to groundwater quality are possible.

Table 6.5-1: Mitigation for Groundwater

Project Phase	Mitigation Measure
C, O, CL	Implement a Surface Water and Groundwater Management and Contingency Plans, which is included in the EMS Framework Document
C, O, CL	Construct the TMF water management to include a toe drain or equivalent, which collects seepage and gravity drains to seepage collection ponds
C, O, CL	Construct a water management system to collect stockpile and WRSA runoff and infiltrated water that is in excess of the baseline via a perimeter ditch system
O	Collect open pit water via sumps and direct to the TMF
O	Manage groundwater flow from bedrock -overburden contact via a cut off trench up-gradient of the pit located below top of rock. Direct this groundwater flow from bedrock -overburden contact to the TMF with the pit water
CL	Implement a cover system over the PAG portion of the WRSA to reduce infiltration and thereby by reducing groundwater seepage quantity, also reducing oxygen thereby reducing acid generation potential
CL	Minimize the size of the TMF pond to reduce seepage through the tailings and minimizing tailings water interaction

Note: C= Construction Phase O= Operations Phase CL = Closure Phase

6.5.4 Significance of Residual Effects

6.5.4.1 FMS Mine Site Operations Phase

Model results estimate a steady state groundwater seepage rate into the fully mined FMS pit of 655 m^3/day. These values influence the site water model, overall site discharge and overall site water quality. Drainage of rock exposed at the pit perimeter will release a significant volume of water (described as storage), during early mining primarily because of the higher volume of water stored in the upper fractured rock relative to the less fractured rock at greater depth. Groundwater inflows of greater than 655 m^3/d could be experienced during early mining.

The steady-state extent of drawdown due to dewatering of the open pit (based on the 1 m drawdown contour) extended a maximum of 830 m from the open pit. Increases in groundwater elevations associated with the TMF extended to a maximum of 100 m from the centerline of the berm, and 240 m to the south of the pond (in the area where the berm terminates) at steady state.

The rate of groundwater seepage from the TMF that may bypass this seepage collection system was predicted to be 6 m^3/day in the direction of the East Lake Catchment and 75 m^3/day to the catchment to the north of the TMF. Seepage from the WRSA and other stockpiles is not expected to bypass the water management system during the operations phase, but any seepage that did bypass would report to the open pit.

The NSE well database shows that the nearest private well is 15 km northward and southward, and field surveys have identified the nearest seasonal dwelling with a potable well (dug) (Structure ID #3) 8.7 km south of the FMS Study Area, while the predicted groundwater ROI is only 830 m from the edge of the FMS pit. Therefore, no effect on groundwater users is anticipated. There are no confirmed Mi'kmaq uses of groundwater within or directly surrounding the FMS Study Area.

Drilling and blasting of holes in bedrock may create and extend fractures in the bedrock around each blast hole. The permeability of the rock may increase if new open discontinuities are formed in the rock, existing discontinuities are extended or dilated, and these link to provide new flow paths from a water source. It is anticipated that there will be a negligible effect on the permeability of the rock mass surrounding the blast.

In the open pit, groundwater seeps directly into the open pit and also receives precipitation into the open footprint. Therefore, the groundwater receptor is the open pit sump collecting all water that reports to the pit. The concentration of this groundwater seepage is used in the surface water mixing model therefore the effect of the groundwater is assessed as a part of the Surface Water assessment.

Groundwater seepage from TMF into East Lake and Watercourse 12 north of TMF is considered in the surface water mixing model. Therefore, the effect of this identified groundwater seepage is assessed as a part of the Surface Water assessment.

Use of explosives during construction and pre-production and operations has the potential to affect groundwater quality. Specifically, ammonium nitrate type explosives to remove bedrock has the potential to leave nitrogen residual substances that can leach into groundwater. This residual is often due to incomplete combustion of the explosive. Blasting will be conducted using ammonium nitrate and fuel oil (ANFO) when blast holes are dry. A mixed emulsion type of explosive will be used when the blast holes are wet. These nitrogen residuals may be present on the pit walls, the waste rock located in the WRSA pile and in the TMF embankments which are made from the waste rock. This groundwater will be collected and ultimately discharge to surface water. This change in surface water quality due to groundwater contribution is assessment in the Surface Water assessment.

6.5.4.2 FMS Mine Site Post-Closure Stage of Closure Phase

Post-closure activities are defined as a fully flooded pit with the water from the TMF pond and the WRSA being pumped or fed into the open pit. During post-closure, the PAG portion of the WRSA will be covered.

Post-closure model results show that beyond 140 m of pit wall groundwater table anticipated to recover to within 1 m of baseline water level which is expected to be within seasonal variation.

During post-closure an increase in groundwater table due to placement of saturated tailings on surface during operations are now anticipated to drain over a long period of time. The numerical modelling shows 85% of TMF seepage will be collected via gravity drain however the 15% will be allowed to enter the groundwater flow system (i.e., bypass the collections system) and will discharge to East Lake and/or Watercourse 12 (tributary to Seloam Brook) north of the TMF. A water level rise of about 16 m is expected to be confined to within approximately 100 m from the centerline of the TMF berm and 240 m from the southern extent of the tailings which is adjacent to berm termination. Water levels are anticipated to be lowered from the rise of 16 m above baseline water table level during operations to a drop to near baseline groundwater level. The lowering of this water table may take more than 100 years and the groundwater level is anticipated to remain above baseline water levels. The rate of groundwater seepage from the TMF was 6 m^3/day to the East Lake Catchment and 75 m^3/day to the catchment to the north of the TMF. The rate of groundwater seepage from the WRSA to the flooded open pit was 175 m^3/day (of which 90 m^3/day originates from the PAG portion of the WRSA).

Waste rock infiltration through the pile that reports to groundwater table directly below the pile is anticipated to reach the groundwater table during post-closure with a cover as the source term is constant. This groundwater will discharge to the open pit as groundwater seepage. The concentration of this groundwater seepage is used in the surface water mixing model therefore the effect of the groundwater is assessed as a part of the surface water assessment.

Groundwater seepage from TMF into East Lake and Watercourse 12 north of TMF is in the surface water mixing model. Therefore, the effect of this identified groundwater seepage is assessed as a part of the Surface Water assessment.

Use of explosives during construction and pre-production and operations has the potential to affect groundwater quality. Specifically, ammonium nitrate type explosives to remove bedrock has the potential to leave nitrogen residual substances that can leach into groundwater. This residual is often due to incomplete combustion of the explosive. These nitrogen residuals may be present on the pit walls, the waste rock located in the WRSA and in the TMF embankments which are made from the waste rock. During post-closure this groundwater will ultimately discharge to surface water (i.e., the open pit, East Lake, and Watercourse 12). This change in surface water quality due to groundwater contribution is assessment in the Surface Water assessment.

6.5.4.3 Touquoy Mine Site

Anticipated effects at Touquoy Mine Site include:

- Water levels in the vicinity of the Touquoy pit will be depressed at the beginning of FMS operations. The Touquoy pit will be dewatered at a rate of approximately 768 m^3/d.
- Water levels in the vicinity of the Touquoy pit will recover slightly at the end of FMS operations, but will continue to be depressed relative to existing conditions as the final water level in the Touquoy pit will be at 108 m CGVD2013. At this stage, there will be both groundwater inflows to and outflows from the filled Touquoy pit, with a net groundwater discharge of 373 m^3/d.
- Groundwater in the filled Touquoy pit will seep to Moose River during Post Closure. The total groundwater seepage rate is simulated to contribute approximately 0.6% of the flow in Moose River, therefore the mass loading of the primary compounds of concern are predicted to be low and are not anticipated to adversely affect the water quality in Moose River. These concentrations are evaluated in Section 6.6 (Surface Water).

6.5.4.4 Residual Effects Summary

With the exception of blasting during operation at the FMS Mine Site, all anticipated changes in groundwater quantity and quality due to the Project operation and closure are not directly affecting any groundwater receptors therefore all indirect effects are assessed in the surface water and wetland sections.

Net effects were described after the implementation of effective impact management measures, and summarized according to magnitude, geographic extent, timing, duration, frequency, and reversibility of the effect occurring following the methods described above.

The predicted net effect of blasting on groundwater quantity is:

- High in magnitude as the increase in permeability is greater than naturally occurring fracture frequency variation;
- The extent of this effect occurs within the FMS Study Area (PA);
- The timing is adverse as the groundwater that is collected in the open pit due to this enhanced permeability is conveyed away via the water management system. This discharge will be managed in accordance with aquatic habitats and reproduction;
- The duration is permanent because, even with the use of appropriate impact management measures, blasting may create and extend fractures in the bedrock around each borehole, thereby increasing permeability and potentially increasing the connectivity of groundwater to the open pit face;
- The change in permeability is continuous; and

- The effect on groundwater quantity is irreversible as the permeability of the rock will not reverse back to what it was before blasting occurred.

This change in groundwater quantity is not significant as the increase in permeability is limited to about 20 m from the open pit face and this increased permeability is within the modeled groundwater ROI where such effects on potential groundwater receptors such as streams and wetlands are being evaluated as part of this environmental assessment.

6.6 Surface Water

6.6.1 Baseline Conditions

6.6.1.1 FMS Study Area

The FMS Study Area lies within the East/West Sheet Harbour primary watershed (1EM), and the East River Sheet Harbour secondary watershed (1EM-1). This primary watershed is bordered by the Liscomb River watershed to the east, St. Mary's River watershed to the north, the Shubenacadie and Musquodoboit watersheds to the northwest, and the Tangier watershed to the west. The secondary watershed sits within the Guysborough Quartzite Barrens and the Granite uplands, underlain by Goldenville and Halifax formation bedrock geology (NSPI, 2009). The FMS Study Area lies within the 1EM-1-B tertiary watershed. At the outlet of this tertiary watershed, Fifteen Mile Stream converges with Twelve Mile Stream at the northern extent of Marshall Flowage.

Forty-two (42) linear watercourses and their associated open water systems, two waterbodies (Anti-Dam Flowage, East Lake), and 274 wetlands were identified and evaluated within the FMS Study Area. Fish habitat potential was determined at each location during field identification/evaluation and collection of physical characteristics of each watercourse/wetland. There are two waterbodies located completely or partially within the FMS Study Area. East Lake is located in the southeast corner of the Study Area, and Anti-Dam Flowage is located within the southwest corner of the Study Area. Seloam Lake, although located just outside the FMS Study Area to the north, has also been included for evaluation due to its contiguity with the major surface water system within the Study Area (Seloam Brook) and the proposed plan to withdraw start up water and process water during operations from this lake. In addition, an extended evaluation of East Brook (the outlet of East Lake Study) was conducted to include reaches of the watercourse that fall outside of the FMS Study Area based on predicted downstream indirect impacts from Project infrastructure.

The FMS Study Area is located between Seloam Lake to the northeast and Fifteen Mile Stream to the west. Seloam Brook connects these two waterbodies, flowing through the FMS Study Area from northeast to southwest. The FMS Study Area is located within the East River Sheet Harbour Watershed (1EM-1), which has been largely inaccessible to anadromous fish since the 1920s due to a series of water storage and hydroelectric dams (O'Neil et al. 1997). Dams are present along Fifteen Mile Stream including upstream of the FMS Study Area at Seloam Lake, and directly downstream of the FMS Study Area at the Anti-Dam Flowage.

Seloam Brook system commences as it flows out of Seloam Lake as WC 20, through an NSPI dam. It is joined by a small tributary (WC15) approximately 285 m downstream of Seloam Lake, and then they continue to flow through Wetland 240. Downstream of Wetland 240, the watercourse continues as a series of braided channels, largely through large wetland complexes with intact riparian buffers. Within these wetland habitats, (i.e., WL's 219, 14, 240 and the upstream extent of WL2), the habitat consists of a mixture of open water, wetland habitat which is accessible to fish during high flow, and additional wetland habitat which provides support for fish habitat but is not directly accessible to fish during any time of the year. Seloam Brook has several main tributaries, including WC5-7 and 12. WC12 originates as drainage from Wetland 27 (WL27), flowing west to Seloam Brook. The upstream reaches of WC12 are intermittent, and only periodically channelized, draining subsurface through boulder fields between wetland habitat. The watercourse channelizes in Wetland 20 (reach 12.5), then flows southwest below a 150 m boulder field between Wetland 20 and 18, eventually re-channelizing in Wetland 18. The watercourse is only contiguous at surface during high flow events.

Boulder fields (i.e., boulder-bed channels) are common throughout the Seloam Brook system. These features are associated with slow gradient streams and characterized by stable relict boulders of glacial origin, planar roughened channel surface, and braided/subsurface flows contingent on catchment area and seasonality. The bed material consists of boulders with limited fine sediments (cobbles, gravels, sand) or evidence of sediment transport and deposition, with boulder surfaces mostly covered by moss.

Continuing through Wetland 2, Seloam Brook diverges and converges into many smaller watercourses including WC 8-11, 13-14 and multiple small ditched anthropogenic channels within the area of historic mine workings. Habitat is variable within this system, ranging from wide open still waters, to watercourses with natural riffle-run-pool sequences, to straightened man-made ditches and channels which provide only passage for fish. This portion of Seloam Brook falls within the proposed diversion to allow for development of the open pit. Fish habitat quality within this area is generally low to medium quality habitat based on physical parameters, presence of historical tailings and waste rock, and water quality measurements previously described. Historic mine workings and the deposition of tailings from historic mine activities result in further degradation of fish habitat quality.

6.6.1.1.1 *Baseline Water Quantity*

To refine the regional hydrology to those in close proximity to the FMS Study Area, local watersheds were delineated based on the upstream areas contributing to each surface water monitoring location. A summary of local watersheds is shown in Table 6.6-1.

Table 6.6-1: Local Watersheds

Watershed ID	Watershed Description	Drainage Area (km^2) [1]
SW2	Seloam Lake Outlet	18.8
SW5	Seloam Brook near confluence with Fifteen Mile Stream	9.5
SW6	Anti Dam Flowage Outlet	48.7
SW14	Fifteen Mile Stream	97.4
SW15	East Lake Outlet	2.8

[1] Note: drainage area excludes upstream areas (e.g., SW6 excludes SW5 and SW2 areas).

Project infrastructure is proposed within the SW5, SW6, and SW15 local watersheds (plus access road and transmission line construction within SW14). Within local watersheds SW5 and SW6, MEL also identified baseline local catchment areas (LCAs) using 1m contour lines and field delineated wetlands and watercourses as described in Table 6.6-2. These local catchment areas were used to identify potential indirect impacts to wetlands, watercourses and fish habitat at the smaller scale, based on construction of Project infrastructure and water management during the operations and closure phases.

Table 6.6-2: FMS Local Catchment Areas

Sub-tertiary Watershed	Local Catchment Area	Drainage Area (ha)
SW6	WC18	41.57
SW5	WC2	57.39
	WC5	13.69
	WC7	85.99
	WC12	293.15

Streamflow measurements were initiated in early 2018 and supplemented with additional stations in summer 2018. Monitoring continues through 2020. Streamflow measurements were intended to gather data on the variability of streamflow in both larger systems (e.g., SW6, Anti Dam Flowage outlet) and small tributaries (e.g. SW15; East Lake outlet).

6.6.1.1.2 *Baseline Water Quality*

The baseline surface water quality at the stations monitored in the FMS Study Area can be generally characterized as having acidic to near-neutral pH, low alkalinity and hardness, and low concentrations of nutrients. Concentrations of most parameters were observed to be consistently below the CCME CWQGs and NSEQSs. However, concentrations of aluminum were observed to be greater than surface water quality guideline criteria in all samples, arsenic was greater than criteria in 35% of samples, iron was greater than criteria in 18% of samples, zinc was greater than criteria in 10% of samples and copper and mercury were greater than criteria in 2% of samples. Background environmental baseline concentrations of some parameters exceeding surface water quality criteria is not uncommon, including within areas that are relatively pristine and not disturbed.

Baseline concentrations of aluminum were consistently observed to be greater than the CCME CWQG and NSEQS (0.005 mg/L), whereas concentrations of iron were observed to be occasionally greater than the CCME CWQG and NSEQS (0.3 mg/L). Naturally occurring concentrations of aluminum and iron that are greater than the CCME CWQGs and NSEQSs be attributed to aluminum and iron being key elements that are associated with common mineral phases in bedrock and overburden.

Baseline concentrations of arsenic were observed to be greater than the CCME CWQG and NSEQS (0.005 mg/L) at locations directly adjacent to or downstream from the ore deposit (SW4, SW5, SW6, SW13 and SW14). Naturally occurring concentrations of arsenic greater than the CCME CWQG and NSEQS can be attributed to naturally occurring processes associated with surface water/groundwater interactions with weathered bedrock containing arsenic-bearing sulphides (e.g., arsenopyrite). The presence of historical mine waste along Seloam Brook may also affect the baseline concentrations at monitoring stations along this watercourse.

6.6.1.2 Touquoy Mine Site

The Touquoy Mine Site is in the Tangier River Primary Watershed (1EL), and the Fish River-Lake Charlotte Secondary Watershed (1EL-5). The primary watershed is bordered by the East/West River Sheet Harbour watershed to the east, and the Musquodoboit River watershed to the north and west. The majority of the Touquoy Mine Site lies within a tertiary watershed which is referred to in the EARD as the Moose River Drainage Basin (1EL-5-P). The topography surrounding the site can be characterized by rolling till plains, drumlin fields, extensive rock land, and numerous freshwater lakes, streams, bogs and wetlands in the headwaters and the relatively low relief, hummocky terrain. This basin ultimately drains to the south via Moose River, into Fish River and Lake Charlotte before flowing into the ocean.

The Touquoy pit is located between Moose River on the west and WC4 on the east that each flow from north to south. Moose River flows south approximately 2.3 km downstream of SW-2 where it joins the Fish River. Watercourse No. 4 flows south between the existing Touquoy pit and TMF to Moose River and eventually to the Fish River.

The existing Touquoy pit is actively dewatered and pumped to the TMF. The approved Touquoy Environmental Assessment stated that the exhausted Touquoy pit would be allowed to fill naturally with water over a period of time through the collection of direct precipitation, surface flow and groundwater inflow. No change to this method is planned for the deposition of FMS concentrate tailings, except that the time frame for refilling will be shorter given the decrease in available volume taken by the tailings.

A water balance model of the Touquoy Mine Site has been prepared available to simulate the quantity of runoff at the Touquoy Mine Site under existing conditions. The water balance model development includes multiple revisions to reflect the changes to the mine site during design, construction, commissioning, and operation of the Touquoy Gold Project that have improved the accuracy of the model. Inputs to the model include groundwater inflows, surface runoff, direct precipitation, and Touquoy pit dewatering for Touquoy ore processing. Moose River is proposed as a second point of final discharge near SW-2 under closure of the exhausted Touquoy pit once the pit has filled with water. At SW-2, Moose River is a third order watercourse with an approximately 12.5 m bankfull width as measured in the 2017 hydrometric program. The substrate was noted in the 2017 report as characteristically muddy consisting predominantly of cobbles and small boulders, silt/sand with gravel.

6.6.1.2.1 *Baseline Water Quantity*

Surface water in Moose River is based the statistical analysis on the regional flow record. Strong linear trends exist between the average monthly flow rates of the selected monitoring stations and drainage area for April, August, and June to August. From these regional relationships, it can be inferred that the average April and August flows for SW-2 in Moose River are estimated to be 2.42 m^3/s and 0.45 m^3/s, respectively. Results of the analysis indicated that generally the peak and low flow events occur in April and August, respectively.

The water balance was refined to simulate the existing conditions (water quantity and water quality) at the start of processing FMS concentrate prior to discharging tailings into the exhausted Touquoy pit.

6.6.1.2.2 *Baseline Water Quality*

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

The baseline water quality in Watercourse No. 4 and Scraggy Lake are not based on the existing conditions, as they will be changed by the Touquoy Gold Project. Therefore, the baseline water quality in these waterbodies is based on predictions presented by Stantec (2016). These predictions assume mixing of effluent from the project with the baseline water quality in these features.

6.6.2 Anticipated Effects and Changes to the Environment

6.6.2.1 FMS Study Area

6.6.2.1.1 *Water Quantity*

A hydrological model was developed using GoldSim Version 12.1, which is a graphical, object-oriented numerical model where input parameters and functions are defined by the user and are built as individual objects or elements linked together by mathematical expressions. The object-based nature of the model is designed to facilitate understanding of the various factors that influence an engineered or natural system, which allows for forecasting potential changes to the hydrological system.

Separate models were constructed for the existing conditions, operations and closure phases, in order to directly compare the predicted change in flows as a result of the Project. A long-term (54-year) climate record was used as input to the hydrology numerical model, and was applied stochastically, where the model randomly selected climate data from a monthly distribution of climate inputs. A total of 1000 realizations of the model were simulated, which provided for a wide range of climate input conditions (wet, dry and typical climates). This stochastic modelling approach provided a framework for the range of probabilistic climate conditions for the FMS Study Area.

The Project Team evaluated the effects of the Project on the water quantity within LCAs based on water balance predictions for the operational Phase and Closure Phase of the Project. The predictions for WC12 were completed by Golder and followed a specific methodology described in Golder, 2019b. The other LCAs predictions were completed through a change in drainage area assessment methodology.

6.6.2.1.2 *Water Quality*

The surface water quality effects predictions were completed qualitatively or using a numerical model to estimate the effluent quality from key site facilities/components and potential changes to the surface water quality of the receiving and downstream environments. The numerical model was developed using GoldSim Version 12.1, which is a graphical, object-oriented mathematical model where all input parameters and functions are defined by the user and are built as individual objects or elements linked together by mathematical expressions. The object-based nature of the model is designed to facilitate understanding of the various factors that influence an engineered or natural system, which allows for forecasting the potential changes to surface water quality.

The objective of the water quality modelling is to predict the combined-net effect that the Project components and activities may have on the quality of the surface water environment. The modelling approach used for the surface water quality predictions is a mass-balance mixing cell model with a number of site-specific components, consisting of both natural components (e.g., natural runoff, rainfall) and site components (e.g., treated effluent discharge, seepage), that are linked together to form a series of mixing cells. Each mixing cell has two or more sources of mass load that are combined to determine a “mixed” or combined water quality. The surface water quality model was constructed by building upon the GoldSim hydrology model, whereby geochemical source-terms and baseline water quality inputs were integrated with flow rates to calculate mass loading rates. The flow logic, which forms the basis of the water balance interconnectivity, is used to configure the model linkages, including determining the direction of mass movement along the flow paths and defining the location of mass mixing points.

As a consequence of the stochastic climate variability, a broad range of resultant flows and water quality through the environment were available for the operations and post-closure phase. With respect to the water quality model receiver predictions, the average model results are assumed to represent typical conditions while the 5th and 95th percentile results are assumed to represent lower and upper end conditions.

During the operations phase, non-contact water (i.e., natural runoff from undisturbed catchments) will be diverted directly to the environment; where required this natural runoff will be directed north of the open pit and west through Seloam Brook. To manage contact water (i.e., drainage that has come into contact with disturbed rock or overburden), a series of water management ponds will be used to collect and control the flow across the Site – these are: ore and open pit pond, NAG waste rock pond, and till pond. The runoff and seepage that enters the open pit will be collected in sumps and then pumped to the ore and open pit pond. The drainage from the LGO stockpile will also report to the ore and open pit pond. Drainage from the NAG and PAG WRSA stockpiles will report to the NAG waste rock pond. Drainage from the till stockpile will report to the till pond. The water from the ore and open pit pond, NAG waste rock pond, and till pond will report to the TMF pond.

During the operations phase, the process water (water associated with the tailings) will be discharged from the plant site to the TMF pond. Tailings beach and TMF embankment runoff will collect in the TMF pond. Water that infiltrates into the subsurface will in part become groundwater and flow toward the perimeter of the TMF. A seepage collection system, comprising the north and east seepage collection ponds, will be constructed that captures seepage and returns the water back into the TMF pond via a pumpback system. The surplus in the TMF pond will be treated, if determined to be required, prior to discharge to the environment. Effluent discharge from the water treatment plant will meet the federal MDMER requirements as per the *Fisheries Act*. The flow of effluent to the environment is based on the Knight Piésold site water management plan. The operations water quality model assumes that the TMF pond effluent flow rate will be actively controlled; in this model, the monthly effluent flow rate from the Knight Piésold site water management plan is applied. TMF seepage that bypasses the seepage collection system will enter the adjacent surface water environment at the SW5 and SW15 catchments.

During the post-closure phase, the tailings beach will be covered with material sourced from the till and topsoil stockpiles. The TMF seepage collection system will remain in place. Contact water from the TMF seepage collection ponds and embankments, the open pit walls and seepage from the covered PAG stockpile will report to the open pit. Non-contact runoff from reclaimed former infrastructure areas (former plant site, former LGO stockpile, former till stockpile), runoff from the covered PAG stockpile, runoff from the NAG stockile, pit catchment runoff, groundwater inflow and precipitation will also report to the open pit. The surplus in the flooded open pit will be discharged to Anti-Dam Flowage. The effluent will be treated, if determined to be required, prior to discharge to the environment. The post-closure water quality model assumed that effluent from the open pit will flow passively to the environment; in this model, the total annual effluent flow from the Knight Piésold site water management plan is allocated monthly in accordance with the seasonal discharge pattern within the receiver.

TMF seepage that bypasses the seepage collection system will enter the adjacent surface water environment at the SW5 and SW15 catchments.

The excavation of mine rock and the development of the open pit results in the rock face of the pit walls being exposed to atmospheric conditions. The blasting of the rock typically results in a “damaged zone” of rock that consists of shallow fractures that extend into the bedrock from the face of the pit wall. The surfaces of the fractures in the damaged zone are also exposed to atmospheric conditions. The exposed rock surfaces are susceptible to weathering processes that can lead to the mobilization of constituents through oxidation and dissolution reactions. Water that comes into contact with the exposed rock surfaces (i.e., direct precipitation, groundwater inflow and runoff from the open pit catchment area) can therefore transport soluble constituents into the pit sump and affect its water quality. Because the ore and open pit pond reports to the TMF pond during operations, and the open pit discharges to the environment during the post-closure stage of the closure phase, weathering of exposed rock surfaces in the open pit can affect the water quality of the discharge to the environment.

The storage of waste rock and LGO in their respective stockpiles results in exposure to atmospheric conditions. The exposed rock surfaces, in particular the fine-grained portions, are susceptible to weathering processes that can lead to the mobilization of constituents through oxidation and dissolution reactions. Water that infiltrates into the WRSA and LGO stockpile can interact with the weathered rock surfaces and mobilize constituents that are by-products of mine rock oxidation. The runoff and seepage water that

is collected at the NAG waste rock pond and the ore and open pit pond will therefore be influenced by the constituents that are mobilized from the mine rock through weathering processes. Because the ore and open pit pond and NAG waste rock pond report to the TMF pond during operations, the weathering of exposed rock surfaces in the WRSA can affect the water quality in the TMF pond discharge to the environment during the operations phase. During the post-closure stage of the closure phase, seepage from the uncovered NAG stockpile and the covered PAG stockpile can affect the water quality in the open pit discharge to the environment.

Explosive agents, including emulsion-based explosives, will be used during mining of the open pit. The detonation of explosives, and the consumption of its agents, is not 100% efficient; this results in the presence of undetonated blasting residues within mine rock, LGO and within the open pit. The explosive residues contain nitrate and ammonia, which are soluble and can be mobilized upon contact with water. As such, the PAG and NAG stockpiles, LGO stockpile and open pit walls are sources of nitrogen species that may have effects on water quality.

Tailings (and associated entrained process water) will be stored in the TMF, which is a subaerial facility. The subaerial deposition of tailings results in exposure to atmospheric conditions, and the tailings are therefore susceptible to weathering processes, such as oxidation and dissolution reactions. Runoff across the surface of the tailings and seepage water that infiltrates through the tailings pore space can mobilize constituents that are by-products of tailings oxidation. During the operations phase, the TMF beach runoff that reports to the TMF pond and the TMF seepage water that is collected at the TMF seepage collection ponds will be influenced by the constituents that are leached from the tailings; this can affect the water quality in the TMF pond discharge to the environment. During the post-closure stage of the closure phase the tailings beach will be covered. Water that is collected at the TMF seepage collection ponds can affect the water quality in the open pit discharge to the environment.

During the operations phase, surplus water from the TMF pond will be discharged to the environment (at Anti-Dam Flowage). During the post-closure stage of the closure phase, surplus water from the flooded open pit will be discharged to the environment at Anti-Dam Flowage with necessary water treatment as/if required. Effluent will be treated at an on-site water treatment plant, if required, such that concentrations meet federal and provincial requirements and regulations. The discharge of treated effluent from the TMF pond and the flooded open pit has the potential to affect water quality of the receiving and downstream surface water bodies.

When water quality is acceptable and treatment is no longer required, the Proponent intends to allow for a direct and passive release of surface water from the pit west into Seloam Brook.

The Project Team evaluated the effects of the Project on the water quality within local catchment areas (LCAs). Groundwater seepage predictions from the TMF and WRSA have been assessed to understand predicted effects of groundwater seepage and potential discharge into surface water systems within LCAs.

6.6.2.1.3 *Additional Analysis*

To complement the watershed modelling efforts, additional analysis was completed on the following finer scale project interactions:

- Seloam Brook Realignment: To assess the potential change in stream flow through the Seloam Brook system (i.e., Seloam Brook and tributaries within the SW5 watershed boundaries), as a result of re-directing flows around the Open Pit, the following was carried out;
    - Analysis of the predicted flooded extent downstream of the realignment and water depth;
    - Optimization of the stream realignment; and
    - Analysis of Q200 flood flow scenario.

- Groundwater - Surface Water Interaction: Through the comparison of contributions to streamflow from groundwater (i.e., the hydrogeological model) and surface water (i.e., the hydrological model) during existing, operations and closure phases.

6.6.2.2 Touquoy Mine Site

6.6.2.2.1 *Water Quantity*

The prediction of surface water quantity effects was completed for the operations and closure phases of the Project at the Touquoy Mine Site using a water balance model to simulate the water and tailings management at the Touquoy Mine Site during and after the processing of the FMS concentrate.

The calibrated water balance model at Touquoy was used to simulate the overall operational water management of the Project at the Touquoy Mine Site by month, as part of a water and tailings management plan. The model was run based on the processing of FMS concentrate and concentrate tailings will deposited in the exhausted pit. Water surplus in the existing Touquoy TMF will be reclaimed from the existing TMF for the remainder of the FMS concentrate processing.

The Touquoy water balance model simulates the water surplus in the exhausted Touquoy pit from both groundwater inflows, surface runoff, direct precipitation and slurry discharge and the estimated time to fill the pit under various climate scenarios. Water quality was assigned to each of the inputs to simulate the monthly water quality and the gradual improvement overtime until effluent discharge from the pit. The main objective of the water balance model is to assess the water quantity changes associated with activities during operation, reclamation, and closure of the Project.

6.6.2.2.2 *Water Quality*

The prediction of surface water quantity effects was completed for the operations and closure phases of the Project at the Touquoy Mine Site using qualitative and numerical modelling to simulate the water and tailings management at the Touquoy Mine Site during and after the processing of the FMS concentrate.

Numerical modelling was conducted to assess the water quality effects in Moose River. A water quality model was prepared from the water balance model. Flow terms in the water balance were assigned water quality source terms to simulate the overall water quality of metal parameters and nitrogen species including cyanide, ammonia, nitrate, and nitrite in the Touquoy pit during operation and post closure. Mixing of the discharge from the Touquoy pit through the spillway at SW-2 at post-closure with Moose River was conducted using an assimilative capacity model.

The objectives of numerical modelling are to predict the period of time that water treatment will be required prior to the pit water effluent discharge to Moose River, and the water quality of effluent discharge to Moose River at biological monitoring stations in place to assess environmental effects.

As full mixing of discharge effluent in Moose River is achieved in less than 30 m downstream of the discharge point, water quality was predicted for only 100 m downstream, assuming 200 m downstream has similar or better water quality. Effluent discharge water quality from the pit was assumed to meet MDMER discharge criteria for an existing mine in 2021 prior to discharge to Moose River.

6.6.3 Mitigation Measures

The surface water quantity and quality effects assessment were completed taking into account several mitigation measures that will be included in the design of the Project – at the FMS Study Area, these include:

- Engineered facilities complying with physical stability requirements will be constructed to store waste rock (PAG and NAG stockpiles in the WRSA), low-grade ore (LGO stockpile), and tailings (TMF).
- A Surface Water and Groundwater Management and Contingency Plans will be developed to support the EMS Framework Document and engineered water management systems will be constructed to collect runoff and seepage from the PAG and NAG stockpiles, LGO stockpile, and TMF during the operations phase and closure phases.
- A Mine Rock Management Plan has been developed by Lorax Environmental Services Ltd. This plan formalizes monitoring procedures as well as provides guidance to the Proponent with respect to best practice mine rock mitigation strategies that may be considered should the results from the monitoring program indicate mitigation is necessary. To that end, this document is intended to serve as a geochemical reference guide for the various different activities at the mine that have a direct or indirect impact on ML/ARD-related processes.
- Erosion and sediment control will be implemented through an Erosion Prevention and Sediment Control Plan, which will be implemented during the construction, operations, and closure phases. The Erosion Prevention and Sediment Control Plan will be based on Best Management Practices (BMPs) to limit erosion, promote settling of sediments, and mitigate the mobilization and migration of suspended solids into nearby surface water features. BMPs for erosion and sediment control may include: the use of earthwork methods to minimize slope length and grade, ditching, sediment ponds/traps, flocculent plant (contingency use only), channel and slope armouring, use of natural vegetation buffers, re-vegetation of disturbed soil, and runoff controls (i.e., sediment fencing and small check dams).
- Explosive use (blasting) BMPs will be implemented to decrease the quantities of water-soluble residual explosives in the open pit, WRSA, and LGO stockpile. Therefore, the BMPs will assist with mitigating the presence of high levels of nitrogen species in effluents from these facilities. The BMPs may include using emulsion-based explosives (rather than ANFO) and blast design optimizations to improve blasting efficiency and reduce the blast waste rate.
- Contact water (effluent) that is comprised of inflows and runoff from the pit walls, runoff and seepage from the PAG and NAG stockpiles, runoff and seepage from the TMF will be collected and treated, if determined to be required, prior to discharge to the environment during the operations and post-closure phases. During the closure and the early years of post-closure, contact water that is collected on site will be pumped to the open pit to assist with reducing the flooding time. Once the open pit is flooded, the surplus water from the open pit will be treated, if determined to be required, prior to discharge to the environment.
- Effluent will meet federal metal mining sector (MDMER) effluent limits (as/if required) and aquatic toxicity requirements prior to being discharged to the environment.
- Treated effluent outfall design needs to follow BMPs to optimize mixing and minimize disturbance to the surface water receiver.
- A TMF seepage collection system will be designed/implemented.
- An Emergency Response Plan and Spill Contingency Plan will be developed and implemented, as required, to provide information on incident prevention, response procedures, training, isolation and disposal of contaminants.

- During the reclamation stage of the closure phase, the PAG stockpile will be covered with an engineered cover.
- During the reclamation stage of the closure phase, the TMF will be covered with material sourced from the till and topsoil stockpiles.
- Realignment of the Seloam Brook will include a routing analysis and water control structures downstream of the realignment channel to balance hydrological and ecological plans, and maintain stability in the upstream and downstream environment.
- A berm will be designed and installed along the eastern end of the organic stockpile to protect it from predicted flood events.

The surface water quantity and quality effects assessment were completed taking into account mitigation measures that will be included in the design of the Project – at the Touquoy Mine Site, these include:

- Effluent will meet federal metal mining sector (MDMER) effluent limits and aquatic toxicity requirements prior to being discharged to the environment.

The actions provided in Table 6.6-3 will be implemented by the Proponent where potential direct and indirect impacts to surface water quality and quantity are possible.

Table 6.6-3: Mitigation for Surface Water

Project Phase	Mitigation Measure
C, O, CL	Develop and implement Surface Water and Groundwater Management and Contingency Plan to support the EMS Framework Document during pre-construction, and construct engineered water management systems to collect run-off and seepage from the PAG and NAG stockpiles, LGO stockpile, and TMF during operations and closure phases
C, O, CL	Development and Implement an Erosion Prevention and Sediment Control Plan, to support the EMS Framework Document
C	Construct engineered facilities complying with all applicable regulatory and technical requirements to store waste rock (PAG and NAG stockpiles), ore stockpiles, and tailings (TMF)
C	Develop a routing analysis and engineering controls to balance hydrological and ecological plans for the Seloam Brook Realignment Project
C	Design and install a berm along the eastern end of the organic stockpile to protect it from predicted flood events
C, O, CL	Implement the Acid Rock Drainage Prediction and Mine Rock Management Plan including best practice mine rock mitigation strategies that may be considered should the results from the monitoring program indicate mitigation is necessary
O	Implement explosive use (blasting) BMPs to decrease the quantities of water-soluble residual explosives in the open pit, PAG and NAG stockpiles, and LGO stockpile
O	Collect and treat (if determined to be required) contact water (effluent) that is comprised of inflows and runoff from the pit walls, runoff and seepage from the PAG and NAG stockpiles, and runoff and seepage from the TMF, prior to discharge to the environment
CL	Treat the runoff from the PAG stockpile (if determined to be required), prior to discharge into pit and subsequent discharge to the environment

Table 6.6-3: Mitigation for Surface Water (continued)

Project Phase	Mitigation Measure
O, CL	Effluent will meet federal metal mining sector (MDMER) effluent limits and aquatic toxicity requirements prior to being discharged to the environment (FMS Mine Site and Touquoy Mine Site)
O, CL	Follow BMPs for effluent outfall design to optimize mixing and minimize disturbance to the surface water receiver
O, CL	Design and implement a TMF seepage collection system
C, O, CL	Develop and implement an Emergency Response Plan (ERP), to support the EMS Framework to provide information on incident prevention, response procedures, training, isolation and disposal of contaminants
CL	Implement an engineered cover system over the PAG stockpile portion of the WRSA
CL	Cover the TMF with material sourced from the till and topsoil stockpiles

Note: C= Construction Phase O= Operation Phase CL= Closure Stage

6.6.4 Significance of Residual Effects

The predicted residual environmental effects of the Project on surface water are assessed to be adverse, but not significant. The determination of significance was based on overall residual effect of the Project following the implementation of appropriate mitigation measures for example water treatment (if/as required), sediment and erosion controls (if/as required) and fisheries offsetting.

6.6.4.1 FMS Study Area

6.6.4.1.1 *Water Quantity*

Water Quantity at the FMS Study Area was assessed through the integration of facility designs, baseline data and the development of a numerical model to simulate the watersheds encompassing the project footprint. The watersheds model was developed to simulate the existing conditions, and to compare those streamflows with that resultant from the Operations and Closure phases of the project. As an overall conclusion, the project footprint and site water management strategies have a low magnitude effect on the macro-scale overall discharge through the receiving watersheds. Similarly, the proportion of groundwater and surface water contributions was assessed as unlikely to be altered over the life cycle of the project.

On a smaller scale, the flow through East Lake will be decreased as a result of the footprint of the TMF; the overall effect of this flow change is an approximate 5 cm decrease in water level within the lake itself. The outflow from East Lake is predicted to see a maximum reduction in flow of 45%. The flow through the WC2 system will also be decreased as a result of the infrastructure footprints, which has a high magnitude effect in the system. The flow through the WC12 system will also be decreased as a result of the infrastructure footprints, which has a low magnitude effect in the system. Finally, the flow through the WC18 system will be decreased as a result of the infrastructure footprints, which has a moderate magnitude effect in the system.

The significant of these changes as it relates to the potential effect on wetlands and fish and fish habitat are described in Sections 6.7 and 6.8.

6.6.4.1.2 *Seloam Brook Realignment*

The Project team worked to further envision the Seloam Brook Realignment from that engineered by KP. This vision included an integrated floodplain and natural channel design principles to develop highly suitable fish habitat with biological features to mitigate a large portion of the habitat losses within Seloam Brook and avoid additional HADD. Habitat design will incorporate features to mimic characteristics within the existing habitat that will be lost but will also include increased species-specific spawning habitat to provide greater productivity potential. The realignment channel will have a defined flow path to improve fish passage through the reach and mitigate the braided configuration of the existing habitat, caused by past mining activities, and will utilize the consolidated flow to maximize habitat stability and suitability.

An estimated flow of around 1.0 m^3/s will remain within the main channel before overtopping into the flood plain. The width of the stream at this flow is estimated at 2.90 m. The model outputs also indicate that a mean water depth within the main stream channel will remain near 0.25 to 0.30 m during the 1:20 Dry Annual flow if the channel is designed similar to existing habitat.

Flows in excess of 1.0 m^3/s are shown to overtop the main stream channel into the flood plain mimicking the function of a natural channel condition. The modelled results show that flows as high as the 200-year event would easily be contained within the conceptual flood plain, and or within a combination of constructed channel and natural topography.

An increase in discharge (and stream velocity), as a result of the Seloam Brook Realignment through tributaries of Seloam Brook, were simulated to be mitigated by the placement of energy dissipation features in the North Channel and South Channel downstream of the realignment. These conceptual features decrease overall simulated stream velocity (energy and sediment transport capability). As a trade off, the flooded extent of the channels may occur, which is predicted to provide additional fish habitat.

6.6.4.1.3 *Water Quality*

6.6.4.1.3.1 Operations

Contact water from the ore and open pit pond, NAG waste rock pond, and till pond, process water from the plant site, runoff from the tailings beach and embankments and collected TMF seepage from the north and east seepage collection ponds will report to the TMF pond, unless suitable for direct release to the receiving environment. Effluent from the TMF pond will be discharged to Anti-Dam Flowage.

The predicted TMF pond effluent quality was derived from the geochemical source terms for the contributing sources (Lorax 2019) and the site water management plan (Knight Piesold Ltd 2020); this quality was used as the model input for the effluent discharge to Anti-Dam Flowage. The predicted TMF pond effluent quality (using both base case and upper case geochemical source terms as model inputs) is compared to the MDMER maximum monthly mean concentrations for new mines. The predicted TMF pond effluent concentrations using base and upper case source terms are predicted to be lower than the MDMER.

The operations phase water quality model conservatively assumes that 14% of seepage that exits from the TMF at perimeter locations will bypass the perimeter seepage collection system and enter the adjacent surface water environment at the SW5 catchment, and 1% will enter the adjacent surface water environment at the SW15 catchment). It should be noted that while the groundwater modelling results indicate that seepage will not report to SW5 and SW15 during the operations phase, the operations phase water quality model conservatively applies the seepage mass load to these receivers. Thus, groundwater seepage has been considered in the predictions generated by the surface water quality modelling effort.

Using the base case source terms, the monthly average and 95th percentile predicted parameter concentrations are below the applicable CCME CWQGs, NSEQSs, FEQG, SSWQO (with the exception of aluminum and iron, which are below the 95th percentile baseline concentration.

Using the upper case source terms, the monthly average and 95th percentile predicted parameter concentrations are below the applicable CCME CWQGs, NSEQSs, FEQG, SSWQO or 95th percentile baseline concentration .The residual effect relevant to the surface water quality VC during the operations (EOM) phase is a change in water quality associated with Project activities. The predicted average and 95th percentile concentrations of modelled parameters are below the applicable CCME CWQGs, NSEQSs, FEQG, SSWQO or 95th percentile baseline concentration on an annual and monthly basis, using both base case and upper case source terms. The magnitude of the effect on surface water quality during the operations phase ranges from Negligible to Low.

In the Operations scenario, all predicted constituent concentrations based on annual average concentrations in the upper case were consistently below selected water quality benchmarks or baseline, with the exception of iron, which marginally exceeds the respective 75th percentile baseline at SW6 and EMZ-2.

Additional modelling was conducted for all parameters to examine the potential for exceedances on a monthly basis. All parameters, when examined on a monthly basis (5th percentile; average and 95th percentile), were less than the receiving environmental quality guidelines (see Golder, 2019b). While the predicted levels slightly exceed the 75th percentile of baseline, they remain within the range of baseline and are unlikely to pose a risk to aquatic life.

Under the Operations scenario (upper case), predicted annual water concentrations for the Baseline + Project scenario were consistently below selected water quality guidelines or benchmarks, with the exception of iron which marginally exceeded the 75th percentile baseline concentrations at SW6 and EMZ-2. Additional modelling was conducted on a monthly basis for the Operations scenario to which there were no exceedances of water quality guidelines for any metal. Iron remains above the 75th percentile of baseline in the monthly predictions, but is within the baseline range which suggest that toxicity is unlikely within the predicted range of concentrations.

The Project activities during the operations phase (EOM) are not likely to cause significant adverse effects to surface water quality.

Water quality for WC12 was evaluated at the same assessment point as hydrology and considered the effect of TMF seepage and of topsoil stockpile area drainage.

The water quality model assumed that 15% of the total seepage that exits from the TMF at perimeter locations will bypass the perimeter seepage collection system and enter the adjacent surface water environment (14% to the north toward the WC12 watershed and 1% to the south toward the SW15 watershed). During the operations and post-closure phases, drainage from the topsoil stockpile area will also report to the WC12 watershed.

The annual and monthly concentrations at WC12 for the operations and post-closure phase, using both the base case and upper case geochemical source terms, are predicted to be lower than the applicable CCME CWQG, NSEQS, FEQG, and SSWQO for all parameters except aluminum; however, the aluminum concentrations are lower than the SW2 95th percentile baseline concentrations (which are already greater than the CCME CWQGs and NSEQS). Based on the threshold for determination of significance of effects presented in the EIS document, the magnitude of the predicted change in surface water quality at WC12 for the operations and post-closure phases ranges from negligible to low, depending on parameter.

Water management (ditching and collection) will reduce the likelihood of localized water quality impact to WC2 and WC18 within the FMS Mine Site during construction and operations phases of the Project. All mine site contact water will be directed to the TMF, reducing the likelihood of surface run off being directed into WC2 or WC18, and potentially causing a reduction in water quality in these streams.

6.6.4.1.3.2 Post-Closure

During the post-closure stage of the Closure Phase, the TMF seepage collection system will remain in place. Contact water from the TMF seepage collection ponds, the TMF beach and embankments, the open pit walls and seepage from the uncovered NAG stockpile and the covered PAG stockpile will report to the flooded open pit. Non-contact runoff from reclaimed former infrastructure areas (former plant site, former LGO stockpile, former till stockpile), runoff shed from the uncovered NAG stockpile and the covered PAG stockpile, pit catchment runoff, groundwater inflow and precipitation will also report to the open pit.

During the post-closure stage of the Closure Phase, the surplus in the flooded open pit will be discharged to Anti-Dam Flowage. Prior to discharge to the environment, the open pit effluent will be treated, if required, to a concentration such that the resultant water quality in the receiver (at EMZ-2) meets the applicable CCME CWQGs, NSEQSs, FEQG or SSWQO.

In the Post Closure scenario, the annual average predictions were all within the selected benchmarks using the base case geochemical source terms. Using upper case geochemical source terms as the model input, the predicted average receiver concentration of the modelled parameters are below the relevant CCME CWQGs, FEQG, NSEQSs and SSWQO on an annual and monthly basis. The 95th percentile concentrations of cadmium are predicted to be greater than the FEQG in May, October and November at EMZ-2. The 95th percentile concentrations of cobalt are predicted to be greater than the CCME CWQG in January, February, April, May, October, November and December at EMZ-2 and October and November at SW6. The 95th percentile concentrations of zinc are predicted to be greater than the CCME CWQG in November at EMZ-2 for zinc. It should be noted that these predictions of Moderate magnitude represent a non-typical condition of upper case geochemical source terms combined with infrequent low flow climate conditions.

Under the Post Closure scenario (upper case), predicted annual water concentrations for the baseline + future scenario were consistently below selected water quality guidelines or benchmarks with the exceptions of cobalt which marginally exceeded the new FEQG guideline at EMZ-2 and iron which marginally exceeded the 75th percentile baseline concentrations at SW6 and EMZ-2. Additional modelling was also conducted on a monthly basis for the Post Closure scenario. Predicted 95th percentile cadmium, cobalt and zinc exceeded their respective guidelines at SW6 and/or EMZ-2 over select months. However, based on further investigation, adverse effects to aquatic life are not anticipated from the predicted concentrations, as these predictions are based on an upper bound scenario, which would only result in the instance that upper bound precipitation events occur in conjunction with upper bound source term conditions, which is unlikely. Note that source terms will continue to be developed and revised, as will water quality modelling, and it is likely that these exceedances predicted in post closure will reduce as refined modelling inputs become available.

These predictions have been formed with consideration of key mitigation measures:

- PAG stockpile is covered during the Closure Phase (with a clay cap layer).
- Tailings beach is covered with a mixture of till and topsoil.

Geochemistry source terms and water quality predictions through modelling will continue to be refined as more data becomes available.

6.6.4.2 Touquoy Mine Site

6.6.4.2.1 *Water Quality*

The use of the exhausted Touquoy pit for tailings storage from the Project will result in degraded water quality in the pit during filling, and that may discharge to the receiving environment (Moose River) through seepage and effluent discharge. The pit water will be managed and treated as required to MDMER limits regulatory closure criteria, and/or site-specific guidelines prior to discharge. Therefore, the magnitude of the effect is expected to be negligible on Moose River quality and downstream tributaries.

- The predicted receiving environment concentration of arsenic is 0.024 mg/L; risks to aquatic life associated with predicted arsenic concentrations are anticipated to be low.
- The aluminum concentration of 0.184 mg/L for aluminum is predicted below the 75th percentile receiver quality in Moose River.
- Elevated concentrations of cobalt, copper and nitrite in groundwater were predicted in the model to meet CCME FAL/NSE EQS after mixing with Moose River 100 m downstream of the discharge point.
- Predicted WAD concentrations in the receiving environment of 0.0024 mg/L are below the NSE Tier 1 guideline of 0.005 mg/L free cyanide, indicating acceptable levels of risk to aquatic life.

6.6.4.2.2 *Water Quantity*

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

- Tailings will be deposited in the Touquoy pit for a total of 88 months reaching an elevation in the pit of 10 m (CGVD 2013). This amounts to approximately 98 m of water cover over the deposited tailings based on a spillway elevation of 108 m (CGVD 2013) and will limit oxygen, reduce metal leaching conditions and further improve water quality.
- No surface water will be discharged from the exhausted Touquoy pit to Moose River until the pit reaches the spillway elevation in Year 14. Water withdrawal from Scraggy Lake will require to be extended for an additional 7 years for processing of FMS concentrate associated with the Project.

6.7 Wetlands

6.7.1 Baseline Conditions

6.7.1.1 FMS Study Area

A desktop review of available topographic maps, provincial databases, and aerial photography was completed to aid in the determination of wetland habitat in the FMS Study Area. Mapped wetland areas were identified from the NSE Wetland Inventory Database. The Nova Scotia Wet Areas Mapping (WAM) database was reviewed to identify potential un-mapped wetlands, along with a provincial flow accumulation data set. The Wetland of Special Significance (WSS) GIS *predictive layer* provided by NSE was consulted for the presence of expected and potential WSS within the FMS Study Area.

Following the initial desktop review, field surveys were completed by McCallum Environmental Ltd. (MEL) biologists, who are trained wetland delineators and evaluators, within the FMS Study Area from November 2016 (in support of a provincial wetland alteration application to support exploratory drilling) through August 2019. Wetland delineation and assessment generally took place within the

growing season (June 1 to September 30). Wetlands that were assessed outside of this period were revisited within the following growing season to confirm functional assessment conclusions and species assemblages.

Wetland delineation was conducted in accordance with the Corps of Engineers Wetland Delineation Manual (Environmental Laboratory 1987) and the Regional Supplement to the United States Army Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (United States Army Corps of Engineers 2011). Wetland types were determined using the Canadian Wetland Classification System (Warner and Rubec 1997).

Further baseline field surveys were conducted throughout the entire FMS Study Area to assess the suitability of wetland habitat for wetland specific species, especially those considered to be Species at Risk (SAR) and/or Species of Conservation Interest (SOCI). All surveys conducted for SAR and SOCI were completed in suitable habitat throughout the FMS Study Area according to species-specific methodologies. This included, for instance, both early and late season botany surveys, and avian migration, breeding and overwintering surveys. Where suitable habitat was observed for a SAR (particularly SAR fish and turtles), it was presumed to potentially be present, even if presence was not confirmed via observation of that species (or evidence thereof).

A total of 274 freshwater wetlands were present within the FMS Study Area, accounting for 210 hectares and representing a land cover of 16.6% of the FMS Study Area. Tree and shrub swamps combined represent the most abundant wetland type in the FMS Study Area, accounting for 70% of all wetlands. Bogs account for 18% of all wetlands within the FMS Study Area, and 15% of the total wetland area. They range in size from 0.027 hectares to 4.825 hectares. Fens and marshes combined account for 3% of wetlands within the FMS Study Area, and 4% of the total wetland area. These wetland types ranged in size from 0.01 to 5.984 hectares.

In general, hydrological flow within wetlands present within the FMS Study Area follow Seloam Brook from Seloam Lake in the northeast, through the proposed open pit, and continue west towards Fifteen Mile Stream. Wetland 2 is the predominant wetland complex that exists along Seloam Brook. This system is fed by tributaries from the east (WC12, which originates in Wetland 27), and from the south (WC 2, from WLs 3 and 1). This system has many side channels and other associated wetlands, including Wetlands 219, 13, 240, 133, 175 and 173. Two main branches of Seloam Brook converge in WL 64 before flowing into Fifteen Mile Stream.

The proposed TMF lies on a watershed divide, where wetlands to the north drain into Seloam Brook, while wetlands present in the southeast portion of the proposed TMF flow east into East Lake (which eventually flows into Anti-Dam Flowage). Toward the southern extent of the FMS Study Area, one drainage basin collects water from Wetlands 47 and 52, converges in Wetland 249, 250 and 251, and continues to drain outside of the FMS Study Area directly into Anti-Dam Flowage. While many wetlands are associated with those main watercourse systems, the vast majority (90.67%, n=243) of wetlands within the FMS Study Area are isolated or are only hydrologically connected to others by drainage instead of regulated watercourses.

6.7.1.2 Touquoy Mine Site

Wetlands were identified within Touquoy Mine Site as part of the EARD process via the NSDNR Wetlands Database and air photo interpretation. These wetlands were assessed in September 2006 and in the spring of 2007 (CRA 2007).

Further wetland surveys were conducted from 2015 to 2018 by MEL biologists, including delineation and functional assessments as part of the wetland permitting process. Wetland delineation was completed in accordance with the Army Corps of Engineers Wetland Delineation Manual (Environmental Laboratory 1987) and the Regional Supplement to the United States Army Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (United States Army Corps of Engineers 2011). Wetland functional assessment was completed for each wetland using the NSE NovaWET 3.0 wetland evaluation technique.

Six wetlands were identified within the Touquoy Mine Site in 2006 as part of the EARD process, five of which were assessed. One of these wetlands was deemed to not be affected from Project development and therefore was not evaluated (CRA 2007).

A total of 52 wetlands were identified within the Touquoy Mine Site (including the western bypass road) during additional field studies by MEL biologists from 2015 to 2017. These wetlands were identified for the wetland permitting process and functional assessments were completed to support permitting for the Touquoy Gold Project. Evaluation for the purposes of the Project will be limited to riparian wetlands along Moose River, downstream of the proposed discharge location from the exhausted Touquoy pit, once tailings deposition is complete, to identify any potential indirect impacts to riparian wetlands from the Project due to a potential change in flow regime in the River.

6.7.2 Anticipated Effects and Changes to the Environment

6.7.2.1 FMS Study Area

Direct and potentially indirect losses of wetlands will occur as the result of Project development. The Seloam Brook Diversion and construction of Project infrastructure will result in direct loss of wetlands which are accessible to fish and provide support for fish habitat. Expected direct impact includes 113 wetlands that are proposed for complete alteration, and 23 wetlands that are expected to be partially altered as a result of Project activities. This proposed direct alteration area to wetlands in the FMS Study Area is 69.08 hectares, representing 32.8% of delineated wetlands in the FMS Study Area, and 5.2% of the wetlands in the LAA. Of all 274 delineated wetlands within the FMS Study Area, 138 (50%) will be completely avoided. The magnitude of this effect is moderate.

Within the FMS Study Area, four wetlands have been identified as Wetlands of Special Significance (WSS) due to the presence of blue felt lichen (SARA Special Concern, NSESA vulnerable). Wetland 240 and the eastern lobe of WL65 (which is the portion of the wetland defined as a WSS) will be avoided completely, while two wetlands are proposed to be partially (WL27) or completely (WL159) altered to support Project infrastructure. Where avoidance of blue felt lichen is determined to be impracticable, the Proponent will implement a Blue Felt Lichen Translocation Plan to mitigate the impact to this species within the WSS.

To support the effects assessment, MEL employed a reasonable worst-case scenario for determining total potential indirect impacts to wetlands. Indirect impact pathways included:

- groundwater drawdown in the 1.0 m ROI surrounding the pit;
- flooding associated with the Seloam Brook Realignment; and
- reduction in flow based on infrastructure construction in the local catchment areas.

The maximum potential indirect impact of the project on wetlands is 10.78 hectares. This represents 5.1% of delineated wetlands within the FMS Study Area, and 0.8% of wetlands within the LAA. The magnitude of this effect is considered low. It is anticipated that the actual indirect impacts to wetlands will be substantially lower, given the suite of mitigation measures proposed. This estimate represents the reasonable worst-case scenario of indirect impacts to wetlands.

These indirect effects are only considered as potential at this point, rather than confirmed alteration areas. During the permitting phase of this Project, a detailed wetland monitoring program will be developed, guided by considerations the impact pathway and the detailed design of the mine infrastructure and water management systems, to verify and confirm the extent of any indirect impacts to wetlands.

The combined expected direct impact and potential indirect wetland impact area is 79.86 hectares which represents 37.9% of delineated wetlands within the FMS Study Area, and 6.0% of wetlands within the LAA. The magnitude of this effect is considered moderate.

Overall, changes in hydrology (i.e., reduced overland flow) due to the placement of Project infrastructure has the potential to affect the functionality of wetlands. More detailed infrastructure design is required to minimize these impacts. This will be completed at the

permitting level. Targeted monitoring for wetlands will also be conducted to verify the accuracy of the predicted environmental effects and the effectiveness of mitigation measures.

All wetland losses will require wetland compensation under the Nova Scotia Wetland Conservation Policy. As is consistent with alteration to all wetlands associated with the Project, protection and viability of connected, unaltered areas of wetland habitat are considered as part of the provincial wetland alteration process. Design of suitable hydrological connectivity structures (e.g., culverts), the implementation of a Project EPP, and ESC methods will be employed to ensure that avoidable indirect impacts to upstream or downstream wetlands will not occur as a result of the activities associated with the Project. In addition, post-construction monitoring will be performed at alteration locations to confirm these commitments. A preliminary wetland monitoring program has been prepared, while a comprehensive wetland monitoring program will be developed to meet the requirements of wetland alteration permits issued for direct and indirect wetland alterations associated with the Project. Wetland area that is accessible to fish will be accounted for in the site-wide Fisheries Authorization for HADD.

6.7.2.1.1 *FMS Wetland Cumulative Effects Modelling*

The Wetland Cumulative Effects Modelling exercise was completed to support the determination of direct wetland effects associated with FMS Mine Site and its associated infrastructure. The modelling has enabled a determination of the following to be made:

- The extent of wetland area loss at the FMS Study Area, LAA, and RAA at Year 0 (i.e., baseline conditions prior to any mine development activities) and Year 8 (i.e., completion of mine development /complete wetland alteration);
- The extent of predicted Mainland Moose, Olive-sided Flycatcher and Rusty Blackbird wetland habitat within the FMS Study Area and LAA at Year 0;
- The extent of predicted Mainland Moose, Canada Warbler, Olive-sided Flycatcher and Rusty Blackbird loss in the FMS Study Area between Year 0 and Year 8; and
- The determination of significance on wetland loss, that is defined as an effect to wetlands likely to cause a permanent loss of >10% wetland habitat for a SAR species identified in the PA within the LAA.

When reviewing the results of the modelling as presented in Table 6.7-1, the reader is reminded of the limitations associated with the modelling completed in the LAA and RAA: i.e., the analysis performed within the LAA and RAA spatial boundaries underrepresent predicted suitable wetland habitat. As such, the predictions are conservative because there is considerable unmapped (under-represented) wetlands within the LAA and RAA that are not accounted for in these calculations.

Table 6.7-1: Wetland Cumulative Effects Modelling Results within the FMS Study Area

Modelling Parameter	Wetland Area Losses	Predicted Moose Wetland Habitat Losses	Predicted Bird Wetland Habitat Losses
A comparison between Year 0 (prior to mine development) within the FMS Study Area, and at completion of mine development within the FMS Study Area.	Loss of 32.8% wetland area.	Loss of 23% Mainland Moose wetland habitat	The loss of 37% Canada Warbler wetland habitat.
			The loss of 29% Olive-sided Flycatcher wetland habitat.
			The loss of 23% Rusty Blackbird wetland habitat

Table 6.7-1: Wetland Cumulative Effects Modelling Results within the FMS Study Area (continued)

Modelling Parameter	Wetland Area Losses	Predicted Moose Wetland Habitat Losses	Predicted Bird Wetland Habitat Losses
A comparison between Year 8 (completion of mine development) within the FMS Study Area, to the LAA at Year 0 (prior to mine development).	Loss of **5.2%** wetland area in comparison to LAA.	Loss of **2.5%** Mainland Moose wetland habitat in comparison to LAA.	Canada Warbler – not assessed
			The loss of **5.5%** Olive-sided Flycatcher wetland habitat in comparison to LAA.
			The loss of **0.3%** Rusty Blackbird wetland habitat in comparison to LAA
A comparison between Year 8 (completion of mine development) within the FMS Study Area, to the RAA at Year 0 (prior to mine development)	Loss of 1.2% wetland area in comparison to RAA.	N/A – not assessed	N/A – not assessed

Note: Values in **Bold** used to deterimine significance, which is defined as a permanent loss of >10% wetland habitat for a SAR species identified in the PA within the LAA.

*RAA only used for wetland area.

Using a combination of field data and desktop resources, the wetland cumulative effects modelling exercise has provided an ability for three wetland function metrics to be predicted within the FMS Study Area, LAA and RAA. The potential loss of the wetland function metrics post Project development has also been evaluated. Development of a predictive future model was beyond the scope and resources available at the time of writing. However, a qualitative approach to assessing the future cumulative effects of the Project on wetland function (by way of evaluating the wetland function metrics) was possible and is discussed below.

The direct and indirect impacts on wetlands within the FMS Study Area will affect the functional abilities of these wetlands (i.e., water quality, water storage capacity, regulation of water temperature, nutrient retention, and provision of wildlife habitat among others) during the Project, and into the future. The loss of wetland area will result in changes to all these wetland functions. For example, loss of wetland area would reduce water storage capacity, and could lead to increased risk of flooding in downstream environments. However, despite the loss of wetland area and thus its function within the FMS Study Area, modeling results suggest that when compared to the LAA and RAA, wetland area being directly lost as a result of the Project is 5.2% of the modelled LAA wetland area, and 1.2% of the modelled RAA area. As a result, the wetland losses will not result in broader wetland and watershed changes within the LAA (Tertiary watershed) and RAA (secondary watershed). Furthermore, there is no significant adverse effect from the Project on wetland area.

Four wildlife species metrics were also evaluated as part of the modelling exercise, the results of which can be used to highlight other potential wetland functional losses, as a result of the Project. The wildlife species metrics evaluated were; Mainland Moose, Canada Warbler, Olive-sided Flycatcher, and Rusty Blackbird wetland habitat.

Within the FMS Study Area, there is the potential for direct and indirect impact to wetlands comprising moose habitat that could provide the thermoregulation characteristics moose require; this analysis was conducted by looking at direct impacts only. While Moose evidence (i.e., footprints and scat) have been observed in and near wetlands within the FMS Study Area, the existing roads extending through the FMS Study Area reduces the extent of suitable moose habitat within the FMS Study Area. Baseline suitable wetland habitat for moose within the FMS Study Area makes up 54% of all wetlands by area. The modeling exercise determined that the loss of potential moose wetland habitat within the FMS Study Area is 23% of all suitable wetlands by area, representing 2.5% of

the predicted suitable moose wetland habitat in the LAA. Furthermore, there is no expected significant adverse effect from the Project on wetland habitat for moose.

Baseline suitable wetland habitat for Canada Warbler, Olive-sided Flycatcher and Rusty Blackbird within the FMS Study Area makes up 33%, 56% and 6% respectively of all wetlands by area. The modelling exercise determined that potential direct habitat loss for the Canada Warbler, Olive-sided Flycatcher and Rusty Blackbird within the FMS Study Area between Year 0 (pre-mine development) and Year 8 (post mine development) was37%, 29% and 23% respectively of all suitable wetlands by area. The modelling also determined that the predicted suitable wetland habitat loss within the FMS Study Area post mine development, in comparison to the predicted habitat within the LAA (pre-mine development) for the Olive-sided Flycatcher and the Rusty Blackbird is 5.5% and 0.3% respectively, demonstrating that large amounts of equivalent habitat is available to these mobile species in close proximity to the Project. Therefore, there is no significant adverse effect from the Project on wetland habitat for the selected bird species.

For the purpose of the modelling exercise, wetland function loss is represented by three wetland function metrics: wetland area, and habitat provision for moose and birds which will be impacted during the construction activities and mine operations. **The modelling exercise has shown that wetland alteration within the FMS Study Area is expected to result in a loss of wetland function metrics ranging between 22 to 37% (when comparing pre- and post-mine development within the FMS Study Area). However, when compared to the LAA, these changes represent smaller percentages of predicted wetland area ranging between 0.3 to 5.5% when comparing wetland loss in the FMS Study Area (post mine development) to the LAA (pre-mine development). Suitable wetland habitat will be available for Mainland Moose and Birds within the LAA, regardless of wetland loss within the FMS Study Area.**

6.7.2.2 Touquoy Mine Site

No indirect impacts to wetlands are expected based on proposed discharge from the pit to the Moose River, as the pre-development and post development catchment areas draining to the discharge location are similar, the Moose River is capable of handling the resultant flows. There are no direct or indirect wetland impacts predicted at the Touquoy Mine Site.

6.7.3 Mitigation Measures

To mitigate and reduce overall loss of function of wetland habitat, the actions provided in Table 6.7-2 will be implemented by the Proponent within wetlands where direct impacts and potential indirect impacts to wetland habitat are expected. Mitigation measures will be confirmed through monitoring requirements, as described at the permitting stage through the Industrial Approval. The Proponent will apply for approval to alter wetlands from NSE and will abide by all site-specific conditions of that approval, which will specify the timing windows in which alterations are permitted.

Mitigation methods are provided for the pre-construction and construction/operation phases to support Project development.

In addition, the Proponent is committed to engaging in wetland compensation activities for the wetland loss associated with the Project as required by the provincial wetland alteration process. A preliminary Wetland Compensation Plan has been developed and will be submitted to NSE at the time of permitting. This plan includes the following options for compensation, prepared in consultation with CWS and NSE:

- On-the-ground wetland restoration opportunities to meet a 2:1 ratio and to be completed within the FMS Mine Site (in conjunction with proposed fisheries off-setting plans associated with the diversion project;
- On-the-ground restoration opportunities to meet a 2:1 ratio and to be completed in a watershed near the Project area to the extent possible;
- Translocation of the blue felt lichen from wetlands if avoidance is not practicable;

- Other secondary forms of compensation that CWS and NSE consider valuable to support the wetland conservation program in Nova Scotia; and
- Collaboration with local community groups and the Mi'kmaq of Nova Scotia to the extent possible.

Table 6.7-2: Mitigation for Wetlands

Project Phase	Mitigation Measure
C, O, CL	Develop and implement an Erosion Prevention and Sediment Control Plan to support the EMS Framework Document
C, O, CL	Complete pre-construction site meetings for all relevant staff/contractors related to working around wetlands and watercourses to minimize unauthorized disturbance, such as the introduction of invasive species
C	Ensure all wetlands are visually delineated (e.g., flagged)
C	Translocation of blue felt lichen from wetlands where avoidance is not practicable
C	Complete detailed design and micrositing of Project Infrastructure to avoid or minimize wetland impact
C	Acquire and adhere to wetland alteration permits
C	Implement construction methods that reduce the potential to drain or flood surrounding wetlands
C, O	Direct runoff through natural vegetation, wherever practicable
C, O	Minimize erosion of wetland soils by limiting flow velocities by means of hydraulic dissipation techniques
C, O	Minimize the rutting of wetland habitat by limiting the use of machinery within wetland habitat and use of swamp mats/corduroy bridges as required
C, O	Conduct vegetation management (cutting and clearing) in or near wetlands and watercourses in accordance with applicable guidelines
C, O, CL	Maintain pre-construction hydrological flows through wetland habitats and partially altered wetlands, wherever practicable
C, O, CL	Re-vegetate slopes adjacent to wetlands to limit erosion and sediment release
CL	Compensate for permanent loss of wetland function through implementation of the site-specific Wetland Compensation Plan, subject to NSE approval

Note: C= Construction Phase O= Operation Phase CL= Closure Phase

6.7.4 Significance of Residual Effects

The predicted residual environmental effects of Project development and production on wetlands are assessed to be adverse, but not significant. The overall residual effect of the Project on wetlands is assessed as not significant after mitigation measures have been implemented.

A significant adverse environmental effect for wetlands 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 wetlands will occur. However, these losses, when considered inside the LAA, represent 5.2% of the total available wetland habitat. One large wetland complex will be altered to support development of the Pit and the Seloam Brook Realignment (WL 2, proposed for direct impact to 51% of the area, plus potential indirect effects of flooding related to the realignment). The portion of the wetland altered by the Pit and berm construction has been altered by historic mining activity. The realignment of this system will incorporate naturalizing the flow regime and riparian wetlands, and replacing lost fish habitat. The majority of wetlands proposed for alteration are common type (swamp habitat), and no loss of wetlands of special significance are proposed. The combined magnitude of effects (proposed direct and estimated indirect impacts) results in a moderate magnitude of effect.
    - Within the LAA there is a predicted cumulative direct loss of wetland habitat for SAR:
        - Mainland moose – 2.5%
        - Olive-sided flycatcher – 5.5%
        - Rusty blackbird – 0.3%
- Impacts are proposed to two WSS, which are designated as WSS due to the presence of a sessile SAR (blue felt lichen). Translocation of the blue felt lichen is proposed. No direct or indirect alteration is proposed within two additional WSS (the eastern lobe of WL65 and WL240).
- During operations, limited impact to wetlands is predicted based on control of surface water flows to mimic baseline hydrologic conditions and implementation of sediment and erosion control measures.
- During Closure, limited impact to wetlands is predicted based on control of surface water flows to mimic baseline hydrologic conditions, water treatment as required, and implementation of sediment and erosion control measures. In addition, there is an opportunity to potentially restore wetland habitat within the PA.
- Wetland compensation will be completed to off-set Project wetland losses. Priority will be given to wetland restoration or creation opportunities within the FMS Mine Site and associated with the proposed fisheries off-setting project (as described in Section 6.8). Additional restoration opportunities will be prioritized within the tertiary watershed or adjacent watersheds wherever practicable.

6.8 Fish and Fish Habitat

6.8.1 Baseline Conditions

6.8.1.1 FMS Study Area

Water temperature affects the metabolic rates and biological activity of aquatic organisms, thus influencing the use of habitat by aquatic biota. There are no CCME guidelines related to temperature and aquatic biota. Temperature preferences of fish vary between species, as well as with size, age, and season.

Trout and salmon are cold-water fish species, meaning they require cold water to live and reproduce. The optimal temperature range for these species (growth of juvenile) is 10 to 20ºC (The Stream Steward n.d.) to 16 to 20ºC (Fisheries and Oceans Canada, 2012) (trout and salmon, respectively). Other species observed or believed to be present in the watershed have higher temperature ranges:

yellow perch 21 to 24ºC (Brown et al. 2009), and white sucker 19 to 26ºC (Kelly 2014). American eel have a broader temperature range and can tolerate temperatures from 4 to 25 ºC (Fuller et al., 2019). Results provide a snapshot of water temperatures within the streams present within the FMS Study Area. Streams with elevated temperatures in June (WC7 for example) would likely demonstrate average temperatures above 19 degrees Celsius and be classified as warm streams (lower quality for trout). Watercourse 43.2 and 38, for example, have high temperatures and low pH indicating they are Class C (warm) streams. Watercourses 16 and 39, for example, have relatively cool temperatures and suitable pH ranges, indicating potential Class A (cool) streams.

Temperatures are elevated above preferred range for salmonids through the entire length of Seloam Brook during the summer months.

The CCME water quality guidelines for the Protection of Aquatic Life establish that a range of pH from 6.5 to 9.0 is suitable within freshwater habitat. Levels of pH that were reported below the suitable range indicate the presence of acidification within watercourses across the FMS Study Area. The pH range for linear watercourses sampled within the FMS Study Area was 3.44 to 6.97, with a median pH of 5.15. Only four sampling sites (WC reaches 12.1, 12.2, 12.4. and FIA 2.1) exhibited pH levels within CCME recommended range for freshwater aquatic life (6.5 to 9.0). Forty-two percent (42%) of linear watercourses sampled *in-situ* during watercourse identification, as well as 58% of fish survey sites, 25% of the twelve benthic sampling sites, and all Anti-Dam Flowage sites (surface and at depth) exhibited pH levels so low (<5.0) as to expect to cause harm to salmonid species.

The CCME guidelines for the Protection of Aquatic Life establish a minimum recommended concentration of DO of 9.5 mg/L for early life stages of cold-water biota and 6.5 mg/L for other life stages (CCME 1999). Eighty-seven percent of DO levels recorded across watercourses within the Study Area were below the minimum CCME recommended concentration of DO for early life stages of cold-water fishes (<9.5 mg/L). Twenty-seven percent (27%) of DO levels recorded for watercourses were below levels suitable for any life stage of warm or cold-water fish species. Low DO concentrations were associated with slow-moving streams whose riparian habitat is dominated by organic wetlands, including watercourse 12, and the inlet and outlet to East Lake (WC43, FIA 4, and East Lake Outflow). The DO concentration range for Anti-Dam Flowage (9.4 to 11.1 mg/L) falls within the recommended CCME lower limit of 9.5 mg/L for early life stages of cold-water species.

CCME Probable Effects Levels are exceeded for Mercury and Arsenic across all sediment samples collected within potential fish impact areas, and elevated lead concentrations were observed at FIA2 above the PELs. This indicates potential effects to aquatic life according to CCME guidelines.

A desktop evaluation for priority fish species revealed two priority species, Atlantic salmon (*Salmo salar)* and brook trout (*Salvelinus fontinalis)*, documented within 5 km of the FMS Study Area. Priority fish species identified as having an elevated potential to be located within the Project Area, based on habitat preferences, and broad geographic range, include American Eel (*Anguilla rostrata*), Atlantic salmon*,* brook trout, and pearl dace (*Margariscus margarita)*. Based on the Nova Scotia Freshwater Fish Species Distribution Records, and fish studies conducted for the East River Sheet Harbour hydro system other fish species expected within the watershed are white perch, yellow perch, American eel, lake chub, golden shiner, ninespine stickleback, and banded killifish.

Sixty-three field-delineated watercourse reaches were categorized into groups of similar qualitative habitat descriptions for Brook Trout and White Sucker. Eight watercourses reaches (3, 19, 39, 41, 48, 49, 50, and 51) were categorized as ‘nil’, and therefore provide no fish habitat. This habitat quality determination was based a complete lack of hydrological connectivity to downstream fish-bearing systems.

One delineated watercourse reach, WC1.4, was classified as ‘nil-low’. This watercourse is in fact a ditched diversion channel that lies just south of Seloam Brook and is present as a result of historic mining activities. Throughout normal to low flow conditions, the channel is predominantly dry; however, during high flow conditions backwater from Seloam Brook has been observed to fill the

channel. As such, the channel has been assessed as accessible to fish during periods of high flow, but provides little natural habitat in terms of flow regime, natural substrate, or vegetative cover, and is not considered to provide quality fish habitat.

Thirty-one watercourse reaches (50%) were categorized as low-quality habitat for both brook trout and white sucker (2, 5, 6, 7, 8, 9, 10, 12.1, 12.2, 12.6, 13, 14, 15, 16, 17, 18, 21, 23, 24.1, 24.3, 26, 27, 38, 42.4, 43.1, 43.2, 44, 45, 47, EB1 and EB5). These reaches, typically 1st order seasonal streams, lacked the morphological, substrate, and in-stream cover complexity of moderate quality watercourse reaches. Low DO and pH levels were also common to these reaches. These watercourse reaches lack stream features that would provide suitable rearing or overwintering habitat for either brook trout or white sucker, with habitat provisioning likely restricted to foraging, refuge, and/or passage for these species and other generalist species expected within the FMS Study Area.

Six watercourse reaches (9%) were categorized as low-quality habitat for brook trout and moderate quality habitat for white sucker (12.3, 12.4, 12.5, 24.2, 30, and 42.2).These watercourse reaches are all low-gradient streams characterized by low to visually imperceptible flow. Deep-water, abundant in-stream vegetation, and fine substrates are available to support white sucker, and other generalist species rearing and foraging. However, brook trout rearing habitat was deemed to be absent due to a lack of substrate complexity, channel morphology and flows.

Twelve watercourse reaches (19%) were categorized as providing moderate quality habitat for both brook trout and white sucker. Moderate habitat quality for both species within the FMS Study Area is exclusively associated with delineated reaches of Fifteen Mile Stream (40), Seloam Brook (1.2, 1.6, 4, 11, 20.2. 22, 25, 42.3, and 42.5), and East Brook (EB3 and EB4). Generally, these habitat quality designations are associated with 2nd-3rd order streams and are described as providing suitable rearing and/or overwintering habitat for both brook trout and white sucker, and other generalist species (i.e., forage fish).

Five watercourse reaches (8%) were categorized as moderate-quality habitat for brook trout and low-quality habitat for white sucker (1.1, 1.3, 1.5, 20.1 and EB2). These reaches within Seloam Brook and East Brook are characterized by moderate gradients, riffle-run habitat types, and moderate-high, stable flow. Substrates are dominated by boulder-sized rock, and in combination with undercut banks provide suitable cover for brook trout rearing. However, the lack of slow and deep pools for velocity refuge, fine substrate, and in-stream vegetation was identified to limit habitat suitability for white sucker and other generalist forage fish.

No high-quality habitat was found within field-delineated watercourses reaches in the FMS Study Area. High quality habitat has been defined as restricted to linear or open water features which would support spawning habitat for either brook trout or white sucker based on suitable substrate, flow rates, channel morphology, water depths, and in-stream habitat features for these species. The only high-quality habitat designations were given to open water features associated with Fifteen Mile Stream along the western boundary of the FMS Study Area.

Thirty-eight open water features have been mapped using aerial photo interpretation during low flow conditions and categorized into high, moderate, low, or 'nil' habitat quality. Two (5%) open water features (II and JJ) were categorized as 'nil', as they are permanently hydrologically isolated and inaccessible to fish.

Fourteen open water features (37%) were categorized as moderate quality habitat. Moderate habitat quality within open water features for fish within the Study Area is exclusively found within the series of wetland complexes along Seloam Brook and the lower reaches of East Brook Generally, these open water features are associated with moderate quality linear watercourses and have areas of deep water, a variety of substrates, and an abundance of cover types.

Eighteen open water features (47%) were categorized as low-quality habitat. These open water features typically lacked depths and substrate complexity associated with moderate quality areas, with habitat provisioning likely restricted to foraging, refuge, and/or passage for brook trout, white sucker, and other generalist species. Many of these open water features along Seloam Brook exist as a result of historic mining activities, DO and pH limitations also limit habitat suitability within these features.

Four open water features (11%) were categorized as high-quality habitat. A high quality habitat has designation has been restricted to open water features which would support brook trout or white sucker spawning habitat based on the presence of suitable substrate, as well as the presence of suitable water quality, flow, well vegetated banks, and an abundance of cover. The only high-quality habitat designation was given to open water features associated with Fifteen Mile Stream along the western boundary of the FMS Study Area.

Historically documented fish species in Anti-Dam Flowage include brook trout, brown bullhead, white sucker, lake chub, nine spine stickleback, while Seloam Lake has supported brook trout, brown bullhead, white sucker, lake chub, golden shiner, nine spine stickleback, banded killifish (NSDFA 2017). Fish collection surveys conducted in East Lake resulted in very low catch records within the waterbody (1 golden shiner) and its inflow and outflow tributaries (1 ninespine stickleback in WC43.2, 1 brook trout in East Brook), and low pH and DO measurements indicate that water quality is likely a limiting a factor to fish habitat quality.

Fifteen wetlands have been evaluated to provide and support potential fish habitat within the FMS Study Area. These wetlands are associated with the following surface water systems:

- East Lake: WL65, WL279;
- Seloam Brook (Watercourse 1, 20, and smaller associated reaches/diversions): WL1, WL2, WL,14, WL64, WL175, WL219, WL240;
- Watercourse 12: WL18, WL20, WL31, WL35;
- Watercourse 17: WL53; and
- Watercourse 42: WL64, WL173.

During assessments completed between July 2017 and July 2018 within the FMS Study Area, a total of 114 individual fish were captured at 11 locations including: Watercourse 20 at the outflow of Seloam Lake, Watercourse 1 within WL2, and Watercourse 1 west of WL2. Two locations fished resulted in no fish captured (WC43 and East Lake outflow). Supplementary fish collection conducted from September 2019 to June 2020 resulted in a total of 7,711 hours and 30 minutes of fish collection survey effort within the East Lake, East Brook and the WC43 system. No fish were captured in the East Lake/WC43 system during the entirety of the Fall 2019 sampling period. During Spring 2020 trapping efforts, a single brook trout was identified in East Brook, and a single ninespine stickleback was identified in WC43 Reach 2.

Fish species known as commercial, aboriginal, or recreational interest under the previous version of the *Fisheries Act* identified within the FMS Study Area include Brook Trout (SOCI) and White Sucker. While not identified within the FMS Study Area, Yellow Perch, White Perch and American Eel (SOCI) are expected to be present within the watershed, based on the NSPI report. Passage of Atlantic Salmon into the FMS Study Area is limited by the presence of downstream dam structures, which have acted as barriers to upstream fish passage since initial dam construction during the 1920s.

Within the FMS Study Area, eight different species of fish were identified through electrofishing and trapping surveys, all of which are known to inhabit the East River Sheet Harbour watershed. White sucker was the most commonly caught species, representing 43.9% of the total catch for all fishing efforts. Lake chub, brook trout, and ninespine stickleback were more frequently represented, while numbers of golden shiner, brown bullhead, banded killifish, and pearl dace were limited. Survey sites within the 3rd order* streams of Seloam Brook showed the highest species diversity, with four species captured at both WC20 (just downstream the Seloam Lake dam) and WC1 reach 1.

Overall, the total number of fish captured within the FMS Study Area is very low (114 individual fish captured within the FMS Study Area in 2017 to 2018, and 2 individuals captured in 2019 to 2020), which is reflected in calculated CPUE for electrofishing and

trapping efforts. Low CPUE is reflective of low fish abundance, which supports the determination that fish habitat quality within the FMS Study Area is predominantly low, and that the presence of hydroelectric dams have limited fish passage within the watershed.

Fish habitat within the FMS Study Area has been substantially degraded by historic mine workings and deposition of tailings. In addition, the presence of multiple hydroelectric dams has limited fish passage within the watershed and accessibility to the FMS Study Area. Fish passage is also limited in certain systems by boulder fields and areas of subterranean flow. Fish habitat quality within the FMS Study Area has been evaluated as predominantly low, which has been supported by the following conclusions.

Overall, the aquatic ecosystem within the FMS Study Area is characterized by acidic conditions as is typical for the watershed in which the FMS Study Area lies. Low pH levels, elevated temperatures and low dissolved oxygens concentrations limit fish habitat quality within select systems. Sediment and water quality are also impacted by the historic deposition of tailings (see Sections 6.4 and 6.6). Aquatic productivity has been evaluated as low-moderate, which is also typical for the watershed and the region in which the watershed lies.

Relative fish abundance throughout the FMS Study Area is low, as supported through electrofishing and fish collection efforts which resulted in low capture numbers.

Habitat complexity within the FMS Study Area is generally lacking, with the majority of linear and open water features assessed as providing low quality habitat for brook trout and white sucker. Only limited amounts of rearing and overwintering habitat, and even more limited amounts of spawning habitat have been identified within the FMS Study Area for these species. Furthermore, it is important to reiterate that the entire site sits within the East River Sheet Harbour Hydro system, which has experienced fish passage limitations for decades, and therefore does not provide a migratory pathway for anadromous or catadromous species.

6.8.1.2 Touquoy Mine Site

Aquatic ecosystem conditions in the Touquoy Mine Site have been affected by historic mining activity. Habitat quality and fishing pressure in Scraggy Lake have resulted in relatively low abundance.

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

Fish habitat within Scraggy Like was described in the EARD for the Touquoy Gold Project. The fish habitat discussion focused on an un-named tributary to Moose River (identified by MEL as WC4, to the west of the TMF), Moose River, Square Lake and Scraggy Lake. Based on surveys completed, it was determined that the un-named tributary to Moose River provided marginal fish habitat quality, primarily based on low flow rates.

Additional baseline fish community and fish habitat assessments were conducted to support design of environmental effects monitoring to address MDMER requirements under the *Fisheries Act*. These baseline aquatic environment surveys were completed by Stantec Consulting Ltd. in 2017 and 2018 and confirmed the following 12 species of fish to be present in Scraggy Lake: alewife, American eel, Atlantic salmon, banded killifish, brown bullhead, brook trout, golden shiner, lake chub, lake trout, white perch, white sucker and yellow perch (internal reports for AMNS 2018, 2019). Fish community surveys were not completed in Scraggy Lake in 2018, but as part of the fish tissue sampling work, bycatch was reported. Incidental capture during fish tissue collection resulted in 143 individual fish, representing 7 species within Scraggy Lake. Further information regarding fish and fish habitat in Scraggy Lake and nearby Long Lake are summarized in the study design for the first EEM program for Touquoy Gold Project (Stantec 2019e).

Moose River is a medium sized watercourse with good riparian habitat. According to the EARD, the portion of Moose River adjacent to the development provided good quality habitat for a variety of fishes including Atlantic Salmon and Brook Trout. These species were observed in the area, along with American Eel, White Sucker and various forage fish species.

6.8.2 Anticipated Effects and Changes to the Environment

6.8.2.1 FMS Study Area

The assessment of potential adverse interactions and effects of the Project on this VC takes into account the potential for the Project to result in:

- Direct and indirect mortality to individual fish;
- Permanent and temporary alteration of habitat that directly or indirectly supports the life processes of fish; and
- Destruction of fish habitat that directly or indirectly supports the life processes of fish.

Direct impact to fish habitat is proposed to allow for construction of site infrastructure. In total, direct impact is proposed for 8.05 ha of fish habitat, in 10 linear watercourses (1.02 ha), 13 open water features (1.91 ha) and one wetland with habitat accessible to fish (5.12 ha). To allow for construction of the open pit, a diversion berm and realignment channel for Seloam Brook are planned.

Each stream reach potentially affected by the Project has been identified using the existing Project infrastructure layout and the existing aquatic habitat mapping. The data was used to determine the overall habitat area within each reach as well as the habitat suitability, based on measured stream substrate, water depths, and water velocities (habitat parameters) for each fish species identified within the Project footprint.

Based on the anticipated direct and indirect impacts to fish and fish habitat, a Fish Habitat Offset Plan: Preliminary Concept Update (Offset Plan) has been developed. The Offset Plan demonstrates the fish habitat offsetting strategy for the FMS Mine Site and serves as the basis for an application for HADD authorization as required by the *Fisheries Act.* The intent of the Offset Plan is to provide DFO with the information necessary to determine if measures to offset unavoidable residual HADD (as defined in the *Fisheries Act*) can be achieved. Final HADD determination and offset requirements will be completed with DFO through the *Fisheries Act* authorization process.

As part of the HADD quantification process, habitat suitability values were calculated for applicable life stages for each species; spawning, young-of-year, juvenile, and adult. The final calculation of a Habitat Utilization Index (HUI) for each species life stage is completed by multiplying the final habitat suitability value and the habitat area for each reach. Total HUI values for all reaches are combined for an overall Species life stage HUI value. To be conservative and to ensure that all species and life stages possibly using the habitat are accounted for, the highest Species life stage HUI calculated is used to represent the largest habitat loss and is therefore used to quantify the HADD for the purpose of offset planning and authorization.

Standard mitigations as well as project-specific avoidances and redesigns have minimized the HADD to only those habitats where avoidance and further mitigation is not possible. It is understood that the final HADD determination will be provided by DFO; however, this preliminary quantification is provided to show that the offset concepts described can be designed to meet HADD quantity expectations, including any offset ratios.

Using the identified fish species currently known to use habitat available within the Project Footprint, Habitat Suitability Index (HSI) values were generated for each species life stage using DFO data for water velocities, water depth, substrate, and where appropriate, emergent vegetation. Using these suitabilities, the final Habitat Equivalent Units (HEUs) for the lost habitat were generated with the highest species life stage HEU value used to conservatively represent the overall HEU and therefore the possible HADD.

Using the overall HEU and therefore the possible HADD, the Project team developed a conceptual offset plan and Seloam Brook Realignment channel design. The realignment channel is required to provide conveyance of flood flows and prevent flooding of the open pit while enabling low flow connectivity around the diversion berm. In the feasibility level engineered design completed by KP, the realignment channel has been designed to provide fish passage during both normal and low flow conditions, and it will incorporate fish habitat enhancement features in an integrated floodplain, as described in the Offset Plan. The channel and floodplain would both be designed to provide substrates, morphology and cover in the high suitability range for the fish species known to exist within the system and to provide ecological function for other species of wildlife that depend on watercourse habitats.

Collection and treatment of site contact water can result in indirect effects to fish and fish habitat through changes to water quality and quantity. The collection of contact water will result in a reduction in flow in some local catchment areas. Flow reduction in local catchment areas range in magnitude from low to high (low magnitude in WC12, moderate magnitude in WC18 and high magnitude in WC2). Aside from the LCA for WC2, the effect of flow reduction in local catchment areas on fish and fish habitat is determined to be low in magnitude, as it is not expected that these reduced flow rates will trigger authorization under the *Fisheries Act*. Collection of contact water within the LCA for WC2 is predicted to result in a maximum 29% reduction in flow, and a moderate magnitude of impact to fish and fish habitat. In addition to predicted flow reductions in LCAs, the reduction in flow rates at SW15 (the outlet of East Lake) is expected to be high in magnitude, based on the construction of the TMF and resulting changes to the watershed. The predicted maximum 45% reduction in flow is expected to require authorization under the Fisheries Act. Indirect effects to fish habitat through reduction in flow and changes to channel morphology through sedimentation and erosion is expected to result in a maximum loss of 1.28 ha of fish habitat.

The predicted indirect habitat alteration areas as a result of flow reduction are accounted for in the HADD quantification very conservatively as 100% of the habitat area being designated as a HADD. In reality the amount of habitat alteration due to a decrease or increase in flow is considerably less than 100%, and we anticipate that this value will be adjusted in future versions of this plan to account for more detailed analysis of area reduction such as the Wetted Perimeter Method which calculates a point where the reduction in flow represents an impairment to the creeks ability to support all habitat functions. Given the implementation of appropriate mitigation measures, receipt of HADD authorization and implementation of the Offset Plan for lost fish habitat, , the magnitude of the effect to fish is determined to be moderate.

HADD Authorization under the *Fisheries Act* will be obtained from DFO prior to the completion of any direct alterations to fish habitat, and the Fisheries Offset Plan will be implemented. Mortality to fish is expected to be low, once mitigation measures are implemented, including development and implementation of a fish rescue plan for adult fish prior to commencement of construction activities in confirmed fish habitat. With authorization and offsetting measures in place, the effects of the project on fish and fish habitat are determined to be moderate and adverse, but not significant.

6.8.2.2 Touquoy Mine Site

None of the potential impacts are expected to require a HADD authorization under the *Fisheries Act* at the Touquoy Mine Site.

6.8.3 Mitigation Measures

To mitigate and reduce overall loss of function of fish and fish habitat, the actions provided in Table 6.8-1 will be implemented by the Proponent within wetlands and watercourses where direct impacts and potential indirect impacts to fish and fish habitat are expected. Mitigation measures will be confirmed through monitoring requirements, as described at the permitting stage through the Industrial Approval.

Table 6.8-1: Mitigation for Fish and Fish Habitat

Project Phase	Mitigation Measure
C, O	Develop and implement Surface Water and Groundwater Management and Contingency Plan to support the EMS Framework Document
C, O, CL	Develop and Implement Erosion Prevention and Sediment Control Plan to support the EMS Framework Document
C, O, CL	Complete pre-construction and periodic site meetings with relevant staff/contractors to educate and confirm policies related to working around fish bearing surface water systems including schedule of construction activities to minimize unauthorized disturbance and limit vegetation clearing
C	Provide signage on fish habitat streams
C	Complete micro siting of mine infrastructure to avoid or minimize fish habitat impact
C	Complete fish rescue within Seloam Brook Realignment footprint prior to commencement of mine development with DFO approval if required
C	Implement water control features along North and South Channels to limit erosion and sedimentation downstream of the Seloam Brook Realignment
C	Implement construction methods that reduce potential interaction with fish habitat and limit vegetation clearing around watercourses
C	Complete culvert installations and upgrades in accordance with the NSE Watercourse Standard (2015b) or as updated at time of construction. Limit vegetation clearing
C, O	Maintain 30 m riparian wetland and watercourse buffer, where practicable
C	Minimize the removal of vegetation upgradient of watercourses and stabilize shorelines or banks disturbed by any activity associated with Project activities
C	Minimize the temporal extent of in-stream works as much as practicable
C, O	Follow DFO-advised *Measures to avoid causing harm to fish and fish habitat including aquatic species at risk* pertaining to blasting (DFO, 2018)
C, O	Select appropriate type of explosive that will minimize nitrogen release to surface water and groundwater
C, O	Use clean, non-ore-bearing, non-watercourse derived and non-toxic materials for erosion control methods
C, O	Incorporate drainage structures, where necessary, to dissipate hydraulic energy and maintain flow velocities sufficiently low to prevent erosion of native soil material
C, O	Limit clearing within confirmed fish habitat outside of approved alteration areas
C, O	Acquire and follow watercourse alteration permits and Fisheries Authorizations
C, O	Adhere to applicable timing windows, as directed by DFO, for construction where infilling has been approved in wetlands and watercourses where fish habitat is present

Table 6.8-1: Mitigation for Fish and Fish Habitat (continued)

Project Phase	Mitigation Measure
C, O	Ensure fueling areas are a minimum of 30 m from waterbodies
C, O	Ensure that machinery arrives on site in a clean condition and is maintained and free of fluid leaks
C, O	Use and maintain properly sized screens on any water intakes or outlet pipes to prevent entrainment or impingement of fish
C, O, CL	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
C, O, CL	Complete offsetting for HADD including for permanent loss of fish habitat through fish habitat restoration activities, subject to DFO approval, based on the *Fisheries Act* current at time of the Project construction

Note: C= Construction Phase O= Operation Phase CL= Closure Phase

For any residual impacts to fish habitat resulting from the proposed Project, the approach to identify appropriate fish habitat offsets has been guided by the following:

- DFO's Fisheries Productivity Investment Policy guidance;
- Provincial fisheries management objectives;
- Technical feasibility;
- Stability and permanence;
- Biological relevance; and
- Cost-effectiveness of options to meet offsetting guiding principles.

The Project will result in the permanent loss of fish habitat and its associated productive capacity. Proven techniques in similar geographic settings for similar fish species provide the greatest likelihood of offsetting lost productive capacity for the long term, are least likely to fail structurally, and require the least amount of maintenance. Low-risk options that are biologically relevant were prioritized during the development of the Offset Plan.

A series of offsetting options were evaluated prior to moving forward with the preliminary Offset Plan. Options were considered using multiple criteria including adherence to DFO's principles for offsetting, and location within the Seloam Brook watershed. To be considered feasible, options had to be self-sustaining, technically feasible, economically viable, and provide similar habitat as an offset.

The Offset Plan provides a list of preliminary information and strategies to offset remaining HADD after measures to avoid and mitigate have been accounted. In addition to works associated with the Seloam Brook Realignment Channel, the evaluation of offsetting options identified options such as creation of onsite open water habitat, complementary measures, and creation of offsite open water habitat. Offsetting, regulatory permitting and monitoring plans will require further consultation with DFO.

6.8.4 Significance of Residual Effects

The predicted residual environmental effects of Project on fish and fish habitat are assessed to be adverse, but not significant. The overall residual effect of the Project on fish and fish habitat is assessed as not significant after mitigation measures have been implemented.

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. Fish habitat quality within the FMS Study Area is limited by low pH levels, historic mining activity, and by limited fish passage through the watershed based on historic and current operation of the East River Sheet Harbour Hydro System. Given these limitations, fish abundance within the FMS Study Area was relatively low. The direct loss of habitat within the FMS Study Area will require authorization under the *Fisheries Act*. An effect to fish and fish habitat is considered high if it results in a change in fish habitat area or quality which limits the ability of fish to use the habitat to carry out one of more life processes. Mitigation is proposed on site with the Seloam Brook Realignment and associated open water habitat creation downstream of the realignment. Offsetting is anticipated to be required for direct impacts to fish habitat (infrastructure construction) and indirect effects related to flow reduction and the Seloam Brook Realignment.

- During operations, adverse, but not significant effects to fish and fish habitat are predicted through withdrawal of water from Seloam Lake and discharge to Anti Dam flowage. The magnitude of these effects to fish and fish habitat is low based on control of surface water flows and discharge to mimic baseline hydrologic conditions and implementation of sediment and erosion control measures. Construction of the TMF is expected to result in a maximum predicted 45% reduction in flow at the outlet of East Lake, and contact water collection is expected to result in a maximum predicted 29% reduction in flow to WC2. These effects will be commence during the construction phase, and be fully expressed on the landscape during operations. This will result in a moderate magnitude of effect to fish and fish habitat, and will be included for authorization under the *Fisheries Act.* Water quality in the receiving environment (Anti-Dam Flowage) has been predicted to result in a negligible magnitude impact to fish.

- During closure, limited impact to fish and fish habitat is predicted based on control of surface water flows to mimic baseline hydrologic conditions, water quality predictions in the receiving environment (Anti-Dam Flowage), and water treatment, as required, and implementation of sediment and erosion control measures.

- Based on the anticipated direct and indirect impacts to fish and fish habitat, a Fish Habitat Offset Plan: Preliminary Concept Update (Offset Plan) has been developed. The Offset Plan will continue to evolve through consultation with DFO and the Mi'kmaq of Nova Scotia.

6.9 Habitat and Flora

6.9.1 Baseline Conditions

6.9.1.1 FMS Study Area

6.9.1.1.1 *Habitat*

Upland forests in the FMS Study Area have experienced relatively high levels of disturbance from timber harvesting and historical mining activities. Twenty-eight percent of the survey locations had evidence of some level of disturbances, typically from timber harvesting, historic mining activities and natural disturbances (i.e., wind). The FMS Study Area has canopies with various maturity ranging from regenerative to mature. Mature, undisturbed habitats are present in the FMS Study Area particularly in large wetland complexes. Canopies typically closer to logging roads and historic mining sites have been disturbed.

In areas affected by natural or anthropogenic disturbance (e.g., wind throw, tree harvesting, and historical mining activities), the habitat types consisted of the spruce-pine, mixed-wood, tolerant hardwood and spruce-hemlock vegetation types (VT) that were often dominated by regenerative canopies. The dominant disturbance regime in the FMS Study Area is timber harvesting followed by mining activities, which is present in patches throughout upland forests. Generally speaking, uplands within the FMS Study Area contain immature or unevenly aged coniferous stands or mixed wood stands. Several pockets of mature coniferous forests are scattered throughout the PA, but over-mature stands were generally uncommon. Pure deciduous stands (including both tolerant and intolerant hardwood forests) are infrequent within the FMS Study Area.

Within the FMS Study Area, habitat survey points fell within eight different ecosites. Ecosites identified within the FMS Study Area were within the dry to wet moisture regime with very poor to rich nutrient regimes. These ecosites generally support a broader variety of vegetation types from the spruce-pine, intolerant and tolerant hardwood, mixed wood, open woodland, spruce-hemlock and intolerant hardwood forest groups. Within the FMS Study Area, the dominant ecosite is AC6 which is characterized by well drained soils and poor nutrient regime which supports conifer species which have a tolerance towards acidic soils. Within the FMS Study Area, 16 VTs were observed during the Habitat Assessments. Collectively, and as a result of the dominance of nutrient poor acidic soils, predominant VTs comprised of conifer species as the dominant canopy layer, often with ericaceous shrubs as the herbaceous layer. The single most dominant VT is MW4 which is dominated by Balsam Fir and Red Maple.

6.9.1.1.2 *Vascular Flora*

A total of 277 species of vascular plants were identified within the FMS Study Area. The diversity of species is moderate to high, especially considering the low fertility of soils within the FMS Study Area. This is attributed to the range of habitat types encountered, from natural aquatic systems, a variety of wetland types, and both intact and disturbed upland habitats. The vegetation species observed are largely native species, with disturbed areas consisting of invasive and exotic species. The species and communities of vascular plants encountered were typical given the eco-regional context, nutrient regimes, moisture regimes, and disturbance regimes. Of the 277 species identified, three are considered Priority Species: Southern Twayblade (*Neottia bifolia* syn. *Listera australis*); Silvery Flowered Sedge (*Carex argyrantha*), and Wiegand's Sedge (*Carex wiegandii*).

6.9.1.1.3 *Lichens*

The lichen community observed within the FMS Study Area consisted of primarily epiphytic species associated with mature conifer and hardwood stands, as well as terricolous and saxicolous lichens usually observed along trails, clearings and open woodlands. Sphagnum dominant swamps with mature Red Maples and Balsam Fir provided suitable habitat for Priority Species such as *Pectenia plumbea* syn. *Degelia plumbea* and *Fuscopannaria cf. ahlneri* as well as other species with an affinity towards mature hardwood and softwood stands.

Mature conifer swamps were present which primarily consisted of an intermixing of Spruce and Balsam Fir surrounded by disturbances (i.e., historical mining and forestry) and lacked BFL indicator species (i.e., *Coccocarpia palmicola* and *Lobaria spp*. on Balsam Fir).

During the field surveys, 59 lichen species were observed. Nine species were determined to be Priority Species including one Species at Risk: Blue Felt Lichen (*Pectenia plumbea* syn. *Degelia plumbea*) and eight SOCI: Eastern Candlewax (*Ahtiana aurescens*), Appressed Jellyskin Lichen (*Scytinium subtile* syn. *Leptogium subtile*), Blistered Tarpaper Lichen (*Collema nigrescens*), Corrugated Shingles Lichen (*Fuscopannaria cf. ahlneri*), a shingle lichen (*Fuscopannaria cf. sorediata*), Crumpled Bat's Wing Lichen (*Collema leptaleum*), Ghost Antler Lichen (*Pseudevernia cladonia*) and Fringe Lichen (*Heterodermia neglecta*). Additional information regarding the Priority Lichen Species observed is provided in Section 6.12.

6.9.1.2 Touquoy Mine Site

6.9.1.2.1 *Habitat*

In the Touquoy Mine Site EARD, habitat was documented to contain coniferous forest, deciduous forest, mixed forest, cutover forest, wetlands, rural residential areas, and areas to be cleared (CRA 2007). Site clearing commenced in the spring of 2016, and the Project operations officially commenced in October 2017. A total of approximately 250 hectares have been developed to support the Project infrastructure. No additional physical disturbance is expected to allow for processing and deposition of FMS concentrate and associated tailings, respectively, at the Touquoy Mine Site.

6.9.1.2.2 *Vascular Flora*

Prior to the construction of site infrastructure, coniferous forest was the most common forest habitat type within the Touquoy Mine Site. These forests were dominated by Red Spruce, Balsam Fir, Bunchberry and Goldthread. No vascular plant SOCI were observed during vascular plant surveys conducted in August 2004, May and June 2005, and September 2006 as part of the EARD process (CRA 2007). One Black Ash was discovered within the Touquoy Mine Site incidentally during wetland surveys in September 2015. It is discussed in further detail within Section 6.12.

6.9.1.2.3 *Lichens*

Lichen surveys conducted in the Touquoy Mine Site in 2004 and 2005 as part of the EARD process documented the presence of Blue Felt Lichen (*Pectenia plumbea* syn. *Degelia plumbea*). An additional lichen survey in 2007 found 20 additional species (CRA 2007). Eight of the 21 species identified in 2007 are priority species, they are discussed in further detail within Section 6.12.

6.9.2 Anticipated Effects and Changes to the Environment

The development of the FMS Mine Site will cause direct impacts to habitat and flora, including upland forested and wetland habitats, resulting in direct loss and fragmented habitat as described in Table 6.9-1. These disturbances are expected to occur primarily during the construction phase of the Project. Habitat within the FMS Study Area and surrounding landscape currently exhibits fragmented conditions as a result of historical mining operations, existing road/trail networks and historical and current forestry activities. The development of Project is likely to result in increased habitat fragmentation and a decrease in habitat quality. A portion of this disturbance is expected to impact interior and mature forested landscapes.

Within the FMS Study Area, the largest patch of interior forests is located in the northeast, with the closest portion of the patch being approximately 200 m west of the collection ditch. This interior forest patch is a contiguous forested habitat within and outside of the FMS Study Area and could provide a means of wildlife movement, migration, breeding bird habitat and flora and fauna habitat. The Project infrastructure will be avoiding this interior forest patch entirely resulting in no changes in contiguity.

Table 6.9-1: Direct and Indirect Impacts on Habitat and Flora

Impact Type	Direct Impact	Project Phase	Indirect Impact	Project Phase
Vegetative and habitat integrity	Direct loss of individual vegetation (vascular and non-vascular) and the habitats which support them. In some cases, whole forest stands (upland and wetland) will be removed.	C	Hydrologically connected upstream wetlands may also be at risk of indirect impacts as a result of downstream alteration activities (e.g., water outflow changes, land elevation changes, blasting, etc. causing dewatering). Inadvertent damming of up-gradient wetlands from construction related infrastructure (e.g., roads with lack of flow through infrastructure).	C, O, CL
	Extensive ground works, including activities such as blasting in and adjacent to wetlands has the potential to destabilize land surfaces and the root zone of vegetative areas, including wetland buffers.	C, CL	Introduction of invasive species can occur indirectly into wetlands when equipment or people move around the PA or via runoff or dust from the roads. Invasive species, such as purple loosestrife (*Lythrum salicaria*), can severely degrade wetland habitat and function.	C, O, CL
			Dust accumulation on vegetation can smother and stress plants and provide minerals and nutrients into the wetland habitat.	C, O, CL

Note: C= Construction Phase O= Operation Phase CL= Closure Phase

Changes to the Touquoy Mine Site as a result of the Project are expected to be minimal. No additional forest clearing or soil stripping is to be expected, therefore, no flora interactions from the Touquoy mine are expected to occur.

6.9.3 Mitigation Measures

To mitigate and reduce overall loss of function of habitat used by flora, the actions provided in Table 6.9-2 will be implemented by the Proponent where direct impacts and potential indirect impacts to flora and habitat are expected. Mitigation measures will be confirmed through monitoring requirements, as described at the permitting stage through the Industrial Approval. The following actions will be implemented where direct loss of habitat is expected to support the development of the FMS Study Area:

- Intact forest stands and wetlands will be avoided wherever practicable during detailed Project planning and design in favor of previously disturbed areas (e.g., stands disturbed by timber harvesting, roads, or other development);
- Topsoil will be salvaged and stored for use in site restoration where practicable. Upland and wetland soils should be stockpiled separately;
- Where natural, intact habitat cannot be avoided, minimization of total Project footprint will be considered during detailed planning;

- Erosion and sediment control planning will be completed to ensure site runoff is not directed towards unaltered habitat where practicable to ensure existing drainage patterns are maintained;
- The effect of dust accumulation on adjacent undisturbed vegetation can be mitigated by monitoring dust conditions and when normal precipitation levels are not enough to suppress fugitive dust, water trucks will be used to suppress dust. This reduces potential impact on fauna and improves safety and visibility for other vehicular traffic as well;
- Winter road maintenance will include conventional snow clearing and deposition of sand for traction control where necessary;
- Site haul trucks will be equipped with spill kits and instructed on their use and spill prevention and appropriate site personnel will be trained in spill isolation, containment, and recovery;
- A wetland alteration application will be submitted during Project planning and design to request an authorization to alter wetland habitat. Loss of function will be addressed in this wetland alteration application; and
- Compensation for permanent loss of wetland habitat will be completed through wetland restoration activities to support no net loss of wetland function, subject to NSE approval.

Project activities will result in direct mortality of vascular and non-vascular flora within the FMS Study Area in both upland and wetland habitat. Compensation, mitigation, and monitoring programs for vegetation related to wetland habitat are described in Section 6.7. The long-term reclamation and remediation will involve re-vegetation of the FMS Study Area at the end of the life of the mine. Revegetation will involve establishment of native vegetation communities. Stockpiled soils will be used in reclamation efforts. This soil will contain a seedbank of native species to increase the establishment of native communities.

Table 6.9-2: Mitigation for Habitat and Flora

Project Phase	Mitigation Measure
C, O	Develop and Implement Erosion Prevention and Sediment Control Plan to support the EMS Framework Document
C, O	Maintain existing vegetation cover whenever practicable and minimize overall areas of disturbance
C, O	Avoid frequent or unnecessary travel over erosion prone areas through communication with personnel and project planning
C, O	Conduct vegetation management by cutting (e.g., no use of herbicides)
C, O	Implement construction methods that reduce the potential to drain or flood surrounding wetlands
C, O	Employ measures to reduce the spread of invasive species (such as cleaning and inspecting vehicles) to maintain the quality of remaining habitat
CL	Hydroseed areas that have erosion potential to return the area to pre-disturbance and stable conditions in a timely fashion upon final reclamation
CL	Implement reclamation program within the FMS Study Area to re-establish native vegetation communities

Note: C= Construction Phase O= Operation Phase CL= Closure Phase

6.9.4 Significance of Residual Effects

The predicted residual environmental effects of Project development and production on habitat and flora are assessed to be adverse, but not significant. The overall residual effect of the Project on habitat and flora is assessed as not significant after mitigation measures have been implemented.

A significant adverse environmental effect for habitat and flora 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 habitat and flora will occur. However, these impacts are limited to the construction phase.
- During Operations, indirect impacts to habitat and flora will be reduced through erosion and sediment control measures and dust mitigation.
- During Closure, reclamation will allow for site restoration of a native assemblage of plant communities.

6.10 Terrestrial Fauna

6.10.1 Baseline Conditions

6.10.1.1 FMS Study Area

The variety of both upland and wetland habitats identified throughout the FMS Study Area support a range of terrestrial fauna. The FMS Study Area is located in a relatively remote, undeveloped landscape. Timber harvesting and associated forestry roads form the dominant land use pattern and disturbance regime within the FMS Study Area and the surrounding landscape. This land use within and surrounding the FMS Study Area has created edge habitats and openings in the canopy coverage to provide foraging opportunities for species such as White-tailed Deer, Black Bears, and Coyote. Evidence of these species, along with Snowshoe Hare and Porcupine, were abundant in disturbed habitats throughout the FMS Study Area. Beavers and evidence thereof have been observed in Seloam Lake and occasionally along Seloam Brook. All of the mammal species identified within the FMS Study Area are presumed to use parts of the site for foraging, breeding, denning, and raising young, at least periodically.

Herpetofauna species were observed throughout the FMS Study Area, generally in association with an aquatic ecosystems, such as wetlands, waterbodies, and watercourses. Open-water wetlands (such as those present along Seloam Brook) and wetlands experiencing hydrological alterations (via existing roads, blocked culverts, old mining activities) provide breeding and foraging habitat for many of Nova Scotia's herpetofauna species within the FMS Study Area.

Incidental sightings of fauna were recorded during all field programs throughout the FMS Study Area during all seasons. Aside from Mainland Moose tracks and pellets, no priority terrestrial fauna species or signs thereof were observed. Given the mobility of fauna species, the absence of observation does not confirm absence of the species within the FMS Study Area. The size of a species and a species' behavior can result in a bias against detection. For instance, very small species, such as the Maritime Shrew (*Sorex maritimensis,* S3) and the Rock Vole (*Microtus chrotorrhinus,* S2) were not observed by the Project Team within the FMS Study Area. As another example, the Fisher (*Pekania pennant*, S3) is a largely nocturnal hunter, with large home ranges and elusive behavior. They prefer dense, mature to over-mature coniferous stands with large hollow snags for den sites. Their preferred habitat and prey items (porcupine, rabbits, squirrels and other small mammals) are present within the FMS Study Area. The lack of observed evidence of fisher does not confirm absence of the species. Furthermore, weather conditions can affect the detectability of species. Rain or snow can wash away or cover animal tracks and scat, while temperature affects the activity levels of herpetofauna and, therefore, their detectability. When there is a thermal advantage to staying under water or immersed in wetland vegetation, herpetofauna can be more difficult to detect, compared with warmer days when they can be found basking in the sun.

Incidental observations of mammal species were documented during all field surveys during 2017 to 2019 across the FMS Study Area. Table 6.10-1 lists those species that were confirmed within the FMS Study Area either visually or by sign (scat, footprints, etc.).

Table 6.10-1: Confirmed Mammalian Species during 2017, 2018 and 2019 Field Surveys

Common Name	Scientific Name	Sign Observed	COSEWIC, SARA, NSESA	S Rank
Mainland Moose	*Alces alces americana*	Tracks, scat	NSESA Endangered	S1
American Black Bear	*Ursus americanus*	observed, tracks, scat, digs	-	S5
American Red Squirrel	*Tamiasciursus hudsonicus*	observed, tracks, middens	-	S5
Beaver	*Castor canadensis*	observed, tracks, dams, lodges, felled trees	-	S5
Bobcat	*Lynx roux*	observed	-	S5
Coyote	*Canis latrans*	Tracks, scat	-	S5
North American Porcupine	*Erethizon dorsatum*	observed, tracks, browse	-	S5
North American River Otter	*Lontra canadensis*	Tracks	-	S5
Red Fox	*Vulpes vulpes*	Tracks		S5
Short-tailed Weasel	*Mustela erminea*	Tracks	-	S5
Snowshoe Hare	*Lepus americanus*	observed, tracks, scat	-	S5
Vole sp.	*Cricetidae sp.*	Tracks/subnivium burrow	-	-
White-tailed Deer	*Odocoileus virginianus*	Tracks, scat, browse	-	S5

Note: The ACCDC works with provincial and federal experts to develop rarity ranks (i.e. S-Ranks) for species in Nvova Scotia, as well as othe rother maritime provinces. See http://www.accdc.com/en/rank-definitions.html for more information. An S-rank of S5 means that the species is Secure – Common, widespread, and abundant in the province.

Herpetofaunal species were inventoried within the FMS Study Area through both targeted searches of appropriate habitats and through incidental observations including specialized survey methods used to identify Wood Turtles and their habitat.

Species that have been observed, either directly or indirectly (through vocalizations, egg masses, cast snake skins, etc.) within the FMS Study Area during the various field programs completed throughout the site, (primarily wetland and watercourse assessments) are provided in Table 6.10-2.

Table 6.10-2: Herpetofauna Species Observed during 2017 to 2018 Field Surveys

Common Name	Scientific Name	S Rank
Common Garternsake	*Thamnophis sirtalis*	S5
Eastern American Toad	*Bufo americanus americanus*	S5
Eastern Smooth Green Snake	*Lichlorophis vernalis vernalis*	S5
Green Frog	*Rana clamitans melanota*	S5
Northern Leopard Frog	*Rana pipiens*	S5
Spring Peeper	*Pseudacris crucifer crucifer*	S5
Wood Frog	*Lithobates sylvaticus*	S5

Though not observed, it is likely that other common herpetile species use habitat within the FMS Study Area, at least periodically. These species include the Mink Frog (*Rana septentrionalis*), Pickerel Frog (*Rana palustris*), Yellow-spotted Salamander (*Ambystoma maculatum*), Northern Red-bellied Snake (*Storeria occipitomaculata occipitomaculata*), and Northern Ring-necked Snake (*Diadophis punctatus edwardsii*).

The Snapping Turtle (*Chelydra serpentina serpentina*, SARA Special Concern, NSESA Vulnerable, S3) was not observed within the FMS Study Area. Although no observations of Snapping Turtle were recorded, suitable habitat was observed, and ACCDC has documented their presence within 17 km of the FMS Study Area.

Observations of odonates and lepidopterans included live adults or larvae, or cast skins observed incidentally during all biophysical surveys, and during focused odonate and lepidopteran surveys completed in 2017. Signs of molluscs included live or dead individuals, or shells. Overall, diversity and abundance of butterfly species observed was relatively low. According to Dr. McKenna, the site lacked the abundance of flowering plants and old field habitat required to support a diversity of butterfly species. No suitable host plant communities for Monarch butterflies were observed during biophysical surveys completed within the FMS Study Area from 2017 to 2019. No incidental observations of freshwater molluscs were recorded during aquatic surveys. During the biophysical surveys within the FMS Study Area, seven additional invertebrates were observed, none of which were priority species.

Incidental sightings of fauna were recorded during all field programs throughout the FMS Study Area during all seasons. Aside from Mainland Moose tracks and pellets, no priority terrestrial fauna species or signs thereof were observed.

6.10.1.2 Touquoy Mine Site

Field surveys for terrestrial fauna were conducted concurrently with vegetation, birds and wetland surveys from 2004 to 2006 (CRA 2007). Refer to the Touquoy Gold Project EARD for detailed methodology. A Mainland Moose monitoring program has been implemented at the Touquoy Mine Site, along with a Wildlife Management Plan. The Mainland Moose program includes post-construction surveys for Mainland Moose, and both plans require any observations of wildlife species (particularly priority species and those which pose a safety concern) to be reported to the site Environmental Technician.

Mainland moose tracks were observed within the Touquoy Mine Site in a bog during field surveys to support the Touquoy Gold Project EA in 2006. Moose are known to the Tangier Grand Lake Wilderness Area, and evidence of moose is reported every year by NSL&F in the Moose River Gold Mines area during deer pellet surveys (CRA 2007).

In addition to the information above, a Post-Construction Moose Monitoring Program for Mainland Moose has been underway in lands surrounding the Touquoy Mine during winter and spring in 2017 and 2018. Surveys are ongoing throughout 2019 and include a combination of winter tracking surveys and spring pellet group inventory surveys. Surveys are completed on foot along transects surrounding the Touquoy Mine throughout a diversity of habitat types. During surveys, moose observations are recorded including a description of moose sign observed, a GPS location and a microhabitat assessment. Three sightings of moose were encountered during 2017, and two sightings of moose were encountered during 2018 surveys. Winter surveys have also been completed in 2019. Annual reports are provided to NSL&F as per the Touquoy Gold Project IA conditions.

According to CRA (2007), NSL&F has extensively surveyed more than 100 AMOs mapped in close proximity to the Touquoy Mine Site (within 500 m of the Moose River Gold Mines Provincial Park). The Touquoy Gold Project EARD determined that these openings are either blocked or filled with water, therefore, suitable habitat for bat hibernacula is not present.

No wood turtle or suitable habitat were observed within the Touquoy Mine Site during wood turtle habitat surveys conducted in 2004 (CRA 2007). No snapping turtles were recorded within the Touquoy Mine Site during the EARD process, however, on June 26, 2016 a snapping turtle was observed within the LAA, north of the Touquoy Mine Site, on Moose River Road. From June 19 to mid-July, 2017 two snapping turtles were observed by MEL staff. One was found along Moose River Road, at the location identified above. The second snapping turtle was observed on Higgins Mines Road west of the PA but within the LAA.

A Wildlife Management Plan was implemented upon commencement of operations of the Touquoy Mine. Under this Plan, wildlife sightings, particularly turtles, were reported to the site Environmental Technicians. Between 19 June 2017 and 27 June 2018, nine observations of Snapping Turtles were recorded by Atlantic Gold staff and contractors at various locations throughout the Touquoy Mine area, typically in close proximity to the Moose River.

6.10.2 Anticipated Effects and Changes to the Environment

The Project is expected to have three main pathways in terms of project interactions with terrestrial fauna pre-mitigation as summarized in Table 6.10-3. Project interactions can be summarized by:

- Direct habitat loss and fragmentation;
- Direct and indirect mortality through vehicular collisions and decreased habitat quality including potential long-term exposure to low concentrations of toxins in the FMS Mine Site and Touquoy open pit; and
- Sensory disturbance through increases in noise, light and vibration above background, particularly during site-preparation and operation phases.

Table 6.10-3: Project Interactions for Fauna

Impact Type	Direct Impact	Project Phase	Indirect Impact	Project Phase
Vegetative and Habitat Integrity	Loss of vegetative cover decreases wildlife habitat availability and also has the potential to reduce natural surface water drainage.	C	Habitat fragmentation may alter habitat suitability for those species which rely on interior forest conditions.	C, O, CL
Sensory Disturbance	Extensive ground works, including activities such as blasting will increase noise levels. Increase in vehicular traffic will add to sensory disturbance through increased noise. This has the potential to reduce habitat for fauna.	C, O, CL	Sensory disturbance (both lights and sounds) may result in further avoidance of the PA by some species.	C, O
	Project infrastructure will have lights which are operational at all times, which can alter habitat quality and sleep/wake cycles within the immediate vicinity of the PA. This may decrease efficiency of nocturnal hunters.	C, O	Some opportunistic wild species may be attracted to the site as a result of increased access and available food sources (natural prey or anthropogenic food sources), potentially increasing interactions between site personnel and wildlife.	C, O
Direct Mortality	Increased traffic and general activity within the PA may result in direct mortality to wild species through vehicular collisions and construction, or through access to the pits prior to completion of pit filling	C, O, CL	Improved access throughout the PA may increase hunting activity of licensed hunters and/or illegal poachers.	C, O, CL
			Potential for long term exposure to low concentrations of concentrations in the TMF.	C, O, CL

Note: C= Construction Phase O= Operation Phase CL= Closure Phase.

6.10.3 Mitigation Measures

In order to mitigate and reduce overall loss of function of habitat used by terrestrial fauna, and reduce direct impacts on fauna, the following actions will be implemented where direct loss of habitat is expected to support development of the Project:

- Intact forest stands and wetlands will be avoided wherever practicable during detailed Project planning and design in favor of previously disturbed areas (e.g., stands disturbed by timber harvesting);
- Where natural, intact habitat cannot be avoided, minimization of total Project footprint will be considered during planning;
- Site infrastructure will be fenced in, where practical, to reduce interactions between Project infrastructure and wildlife;
- A speed limit of 40 km/hr within the FMS Mine Site and Touquoy Mine Site will be implemented to reduce likelihood of collisions with fauna;

- An un-vegetated buffer along roadsides will be maintained, where practicable, to improve visibility along roadsides and reduce the potential for collisions with wildlife;
- Clearing and construction will be limited within wetlands that could support snapping turtles during winter hibernation period;
- Site-specific measures to protect wildlife will be addressed in the WMMP which will be developed to support the EMS Framework Document;
- A wildlife deterrent system will be implemented at the FMS TMF, and continued at Touquoy and should be implemented to the open pits from both sites during post-closure, as is required;
- Waste must be managed to reduce attractants to opportunistic wildlife species;
- Proper handling of hazardous wastes will reduce exposure to contaminants as a result of unplanned incidents;
- Erosion and sediment control planning will be completed to ensure site runoff is not directed towards unaltered habitat;
- For those species reliant on wetland habitat, a wetland alteration application will be submitted during Project planning and designed to request an authorization to alter wetland habitat. Loss of function and habitat, and associated proposed compensation, will be addressed in this wetland alteration application; and
- Mainland Moose monitoring program is to be implemented to determine moose activity surrounding the active FMS Mine Site.

Where direct impacts to habitat are not expected, the FMS Mine Site development and continued operations at the Touquoy Mine Site may be potentially affected by indirect impacts from construction, operation, and decommissioning of the mine. The following actions will be implemented to reduce the potential for indirect impacts to adjacent undisturbed habitat:

- For species which rely on wetland habitat, maintain pre-construction hydrological flows into and out of downstream wetland habitats, to the extent possible (post alteration wetland monitoring may be required as a result of the provincial permitting process);
- In order to protect adjacent habitats from accidental spills, ensure that spill control and contingency planning is in effect, and its procedures fully communicated to staff;
- Vegetation management will be conducted by cutting (i.e., no use of herbicides);
- Ensure all development related activity (construction areas, access roads, etc.) are located within areas where biophysical field evaluations have been completed and approvals/written authorizations are in place as required;
- Erosion control materials shall be clean, non-ore-bearing, non-watercourse derived and non-toxic materials;
- Machinery and personnel will be instructed not to enter the habitats outside of approved Project footprint; and
- Slopes will be re-vegetated to stabilize them and limit erosion and sedimentation into adjacent habitats.

Table 6.10-4: Mitigation for Terrestrial Fauna

Project Phase	Mitigation Measure
C, O, CL	Provide wildlife awareness training to site personnel to reduce interactions between site personnel and wildlife
C	Reduce habitat fragmentation by minimizing new road construction wherever practicable
C	Complete detailed design of mine infrastructure to avoid major faunal habitat
C	Properly install culverts to improve or maintain habitat and connectivity for fauna
C, O	Maintain existing vegetation cover whenever practicable and minimize overall areas of disturbance
C, O, CL	Develop and implement an Erosion Prevention and Sediment Control Plan to support the EMS Framework Document
C, O, CL	Implement Emergency Response Plan and Spill Contingency Plan to protect fauna and their habitat from accidental spills
C, O	Store hazardous and non-hazardous waste in designated locations, in appropriate containers to reduce potential for spills, and to prevent attracting wildlife (e.g., food waste in bear proof containers)
C, O, CL	Vehicles will yield to wildlife on roads
C, O, CL	Implement speed limits within the FMS and Touquoy Mine Sites of 40 km/hr to reduce potential collisions with fauna
C, O, CL	Install signage where specific wildlife concerns have been identified
C, O	Install fencing, where practicable, to prevent wildlife from accessing areas with increased risk of injuries to wildlife
C, O	Monitor in and around site infrastructure for wildlife and if present work to relocate in accordance with the Wildlife Monitoring and Management Plan
C, O	Develop and implement Wildlife Monitoring and Management Plan in accordance with the EMS Framework Document
C, O	Follow the *Pit and Quarry Guidelines* to reduce impact of noise and vibration on wildlife
C, O	Limit use of lights to the amount necessary to ensure safe operation within the FMS Study Area, with the recognition that excessive lighting can be disruptive to wildlife
C, O	Restrict blasting to a specific and regular daytime schedule during weekdays to allow time for wildlife to recover from potential noise disturbance
C, O	Implement bird and wildlife deterrent program at the FMS TMF and the open pits at FMS and Touquoy, and continue bird deterrent programs at Touquoy during post closure
CL	Implement reclamation plans to restore natural habitat and food source re-establishment to support fauna

Note: C= Construction Phase O= Operation Phase CL= Closure Phase

6.10.4 Significance of Residual Effects

The predicted residual environmental effects of Project development and production on terrestrial fauna are assessed to be adverse, but not significant. The overall residual effect of the Project on terrestrial fauna is assessed as not significant after mitigation measures have been implemented.

A significant adverse environmental effect for fauna 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 fauna habitat are expected, however, impacts will be minimized through on-going Project design and micro-sighting of infrastructure footprints wherever practicable.
- The baseline habitat of the FMS Mine Site is a network of existing fragmentation due to historical and present forestry activities.
- Construction work will be considerate of the breeding patterns for fauna, wherever practicable.
- Construction noise and light will be limited to a 12-month window.

During Operations:

- Noise will be elevated above baseline during this period and may cause a displacement of fauna in close proximity to the Mine Sites.

During Closure:

- Noise will be elevated above baseline during reclamation activities (2 to 3 years) involving mobile equipment and then reduce to baseline for the post-closure period.
- Appropriate mitigation such as wildlife deterrents will be implemented to deter wildlife species from entering the TMF and open pits during post closure.

6.11 Avifauna

6.11.1 Baseline Conditions

6.11.1.1 FMS Study Area

Avian baseline monitoring programs were completed by MEL and included the following surveys:

- Breeding Birds: point count surveys (2017 and 2018), and common nighthawk call playback surveys (2017);
- Fall migration: point count surveys (2017 and 2018);
- Winter bird surveys: incidental observations (2018); and
- Spring migration: point count surveys and nocturnal owl playback surveys (2018).

Baseline assessments were completed during multiple seasons to capture an accurate snapshot of avian use of the FMS Study Area. These surveys resulted in the observation of 6,644 individuals, representing 89 species. Of these species 22 are considered priority species. Of the total number of species, 69 (83% of species; 92% of individuals) are protected under the *Migratory Bird Convention Act* (1994). Birds observed that are not protected under the *Act* were from the Accipitridae (e.g., harriers and hawks), Alcedinidae (e.g., kingfisher), Corvidae (e.g., jays, crows and ravens), Phasianidae (e.g., grouse and pheasants), and Strigidae (e.g., owls) families.

Overall, avian diversity and abundance observed was moderate to high based on observer experience in the geographic area. The common species assemblage of forest birds was observed, along with a cohort of species more typically found in intact or interior forests.

6.11.1.2 Touquoy Mine Site

The 2005 breeding bird surveys of the Touquoy Mine Site found 398 birds representing 52 species over 11-point count stations. The most abundant species were the Magnolia Warbler (7.5% of the total) and the Common Grackle (*Quiscalus quiscula*, 7.3%) (CRA 2007). Ten of the 52 species observed were considered priority species at the time of the assessment. They are as follows: Pine Grosbeak (*Pinicola enucleator*), Willow Flycatcher (*Empidonax traillii*), Yellow-bellied Flycatcher, Barn Swallow (*Hirundo rustica*), Boreal Chickadee, Ruby-crowned Kinglet, Rusty Blackbird, Bay-breasted Warbler (*Setophaga castanea*), Swainson's Thrush (*Catharus ustulatus)*, and Pine Siskin (*Spinus pinus)*.

6.11.2 Anticipated Effects and Changes to the Environment

The Project is expected to have three main pathways in terms of project interactions with avifauna pre-mitigation as summarized in Table 6.11-1. Project interactions can be summarized by:

- Direct habitat loss and fragmentation;
- Direct and indirect mortality through vehicular collisions;
- Decreased habitat quality including potential long-term exposure to low concentrations of toxins in the FMS Mine Site and Touquoy TMF and the open pit; and
- Sensory disturbance through increases in noise, light and vibration above background, particularly during construction and operation phases.

Development of the mine infrastructure will cause direct impacts to habitat used by avifauna, including upland forested habitat and wetlands. This will occur mostly within the construction phase of the Project. Habitat within the FMS Study Area and surrounding landscape currently exhibits fragmented conditions based on historic mine operations, existing road and trail networks, and current and historic timber harvesting activity within and adjacent to the FMS Study Area. Project activities are likely to result in increased habitat fragmentation and a decrease in habitat quality for those species that rely on interior forest conditions, where intact interior forest remains. Interior forests are defined as an area within a forest that is sheltered from edge effects.

Table 6.11-1: Impacts of the Project on Avifauna

Impact Type	Direct Impact	Project Phase	Indirect Impact	Project Phase
Vegetative and Habitat Integrity	Loss of vegetative cover through clearing and grubbing decreases bird habitat availability and Project development also has the potential to reduce natural surface water drainage, altering wet areas.	C	Habitat fragmentation may alter habitat suitability for those species that rely on interior forest conditions.	C, O, CL
Sensory Disturbance	Extensive ground works, including activities such as blasting, will increase noise levels. An increase in vehicular traffic will also increase noise levels, and thus sensory disturbance. This has the potential to reduce habitat for avifauna.	C, O, CL	Sensory disturbance (from both sound and light) may result in further avoidance of the PA by some species including birds.	C, O
	Birds may be attracted to or disoriented by open pit lighting at night, particularly during migration periods, leading to mortality	C, O	Artificial lighting at night has been shown to influence the seasonal start of bird vocalizations, which could affect individual fitness	C, O
Direct Mortality	Increased traffic and general activity within the PA may result in direct mortality to wild species, including avifauna, through vehicular and construction collisions.	C, O, CL	Improved access throughout the PA may increase hunting activity of licensed hunters and/or illegal poachers.	C, O, CL
			Potential long-term exposure to low levels of contaminants in TMFs.	O

Note: C = Site Preparation and Construction Phase O = Operation and Maintenance Phase CL= Decommission and Reclamation

Considering the moderate to high levels of bird species and abundance found within the FMS Study Area, the greatest pre-mitigation effect is change in habitat, which will include loss of vegetative cover and/or habitat fragmentation. However, birds are a mobile species and may be able to find new habitat. Supporting this is the fact that all untouched interior forests within the FMS Study Area are connected to tracts of forest beyond this area, therefore, birds that require this specific habitat type will continue to have access to such landscape. Additionally, some species benefit from forest edges and have shown to return in subsequent years after an area is cleared (Tittler et al. 2001). More generally, the area surrounding the FMS Study Area currently has limited development that would cause further disturbances; instead, the area is predominately available habitat for any avian species temporarily displaced by the Project.

6.11.2.1 Touquoy Mine Site

The Project will have no new effects on birds at the Touquoy Mine Site. There will be no changes to interior forest at the Touquoy Mine Site. Sensory disturbance caused by noise and light will occur within the Touquoy Mine Site, however, this is already occurring at this location. However, the addition of material from the Project will extend the life of the Touquoy Mine Site by four years thus extending the sensory disturbance period. At the Touquoy Mine Site noise at 45 dBA is predicted to travel approximately 0 to 850 m outside of this component of the PA. Increased traffic poses a risk to avifauna within the FMS Study Area and in the Touquoy Mine Site. The addition of FMS concentrate tailings at the Touquoy pit will extend the temporal disturbance to birds, particularly related to habitat suitability of the pit. The current bird deterrent program will be continued at Touquoy Mine Site and extended to the Touquoy pit if necessary.

6.11.3 Mitigation Measures

The potential effects to migratory birds associated with the Project phases are outlined in Table 6.11-2.

Table 6.11-2: Mitigation for Avifauna

Project Phase	Mitigation Measure
C, O	Avoid construction on native vegetation during the regional breeding season for migratory birds where practicable (beginning of April to end of August for migratory birds; EC 2015b). Where this is not practicable, a Bird Nest Mitigation Plan will be developed
C, O	If a raptor nest is found within the forested areas to be cleared, a buffer zone appropriate to the species (as determined in consultation with NSL&F) would be placed around the nest
C, O	Limit the amount of exposed soil during nesting season
C, O	Discourage ground-nesting or burrow-nesting species (such as common nighthawk and bank swallows), by limiting large piles or patches of bare soil during the breeding season, wherever practicable
C, O	Communicate regulations related to nesting birds to all site personnel, particularly focused on those priority bird species which may be attracted to Project activities. If nesting behaviour is observed, site personal are to report this activity to the Proponent so appropriate mitigation measures can be implemented as necessary
C, O	Should any ground- or burrow-nesting species initiate breeding activities on stockpiles or exposed areas, the Proponent will work with ECCC and NSE to develop buffer zones that incorporate adaptive management
C, O	Maintain speed limits on mine roads (max. 40 km/hr. within the FMS Study Area) to minimize collisions with birds
C, O	Implement dust suppression mitigation (refer to Air Mitigation)
C, O	Install downward-facing lights on site infrastructure and site roads. Wherever practicable, install motion-sensing lights to ensure lights are not turned on when they are not necessary
C, O	Conduct mobile refueling at least 30 m from any identified breeding locations
C, O	Monitor known nests around stockpiles and exposed areas from a distance with a spotting scope or binoculars to verify the effectiveness of an identified buffer until the nests are inactive
C, O	Conduct routine inspections of the open pit area to remove any trapped or injured birds. If identified, determine a plan for removal in consultation with an avian expert
C, O	Notify ECCC within 24 hours in the event of the mortality or injury of ten or more migratory birds in a single event or in the event of the mortality or injury of a migratory bird SAR
O	Implement bird deterrent program at the FMS TMF if required, and continue current bird deterrent program at the Touquoy (expanding to the exhausted pit if necessary)

Note: C= Construction Phase O= Operation Phase CL= Closure Phase

The mitigation measures outlined above are also applicable to the Touquoy Mine Site for the processing of FMS concentrate. Mitigation measures will be applied to reduce the potential environmental impacts of the Project on migratory birds at the PA as per

existing operational approvals. Due to the success of these audio and visual deterrents, their use will continue at the FMS Study Area, as required.

6.11.4 Significance of Residual Effects

The predicted residual environmental effects of the Project on birds and bird habitat are assessed to be adverse, but not significant. The overall residual effect of the Project on birds and bird habitat is assessed as not significant after mitigation measures have been implemented.

A significant adverse environmental effect for birds 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 bird habitat are expected, however, impacts will be minimized through on-going Project design and micro-sighting of infrastructure footprints wherever practicable. Habitat will be re-established to support avifauna during reclamation.
- The baseline habitat within the LAA consists of a network of existing fragmentation due to historical and present forestry and mining activities. The LAA is rural and undeveloped.
- Micro-siting has reduced the impact to interior forest patches within the FMS Study Area.
- Construction work will be considerate of the breeding bird season wherever practicable.
- Construction noise and light will be limited to a 12-month window.

During Operations:

- Noise and light will be elevated above baseline during this period and may cause a displacement of birds in close proximity to the FMS Study Area. Available similar habitat is present in the LAA.

During Closure:

- Noise and light will be elevated above baseline, but below the predicted operational noise levels, during reclamation activities (2 to 3 years) involving mobile equipment. Noise will then drop to baseline for the post-closure period. Reclamation will include revegetation of the FMS Mine Site with a native mix of vegetation.

The ecological and social context of the VC were included throughout this evaluation. Ecological and social context entails ecosystem health and function as well as the general setting and influence of past and current human activity and its associated disturbance. Ecological factors considered include habitat condition, habitat quality, and avian diversity and abundance. Social factors considered included the impact to indigenous and recreational resources (no commercial considerations were relevant for this particular VC). These factors were qualitatively assessed based on impacts to avifauna.

Ecological context considered in determining the residual environmental impacts include the loss of habitat at the FMS Mine Site during the construction phase, along with sensory disturbance during operations and reclamation within both PA components. Habitat alterations and sensory disturbance may result in a shift in avian usage of the PA. It is important to consider current habitat alterations within the PA and LAA. Furthermore, habitats proposed for direct loss are available in other locations within the LAA.

6.12 Species at Risk and Species of Conservation Interest

6.12.1 Baseline Conditions

6.12.1.1 FMS Study Area

6.12.1.1.1 *Priority Fish*

Although American eel (*Anguilla rostrata* ; COSEWIC Threatened) were not observed within the FMS Study Area, the species has been previously documented and suitable American eel habitat is present, therefore, there is potential for American eel to be present within the FMS Study Area. Migration of American eel and Atlantic salmon into the FMS Study Area is limited due to the presence of multiple downstream hydroelectric dam structures which have acted as barriers to upstream fish passage since initial dam construction during the 1920s.

No fish SAR were observed within the FMS Study Area. Two priority species of fish were identified during field surveys (brook trout, S3, and pearl dace, S3). Quality spawning habitat for brook trout was limited within the Study Area, as described in Section 6.8. No other fish SAR or SOCI were observed and aside from potential for American eel, no other priority species are expected based on habitat, species distribution, and survey effort completed within the FMS Study Area.

6.12.1.1.2 *Priority Vascular Flora*

No vascular flora SAR were identified, however three vascular plant SOCI were identified within the FMS Study Area (*Neottia bifolia,* S3*, Carex wiegandii,* S3, *and Carex argyrantha,* S3S4*)*. Three additional SAR species were identified as having elevated potential to be located within the FMS Study Area based on habitat preference and known distribution. These species are redroot (*Lachnanthes caroliniana*, SARA & COSEWIC special concern, NSESA vulnerable), spotted pondweed (*Potamogeton pulcher*, NSESA vulnerable), and black ash (*Fraxinus nigra*, NSESA threatened). The preferred habitats for each of these species were focused on during all vegetation, habitat, and wetland delineation surveys. None of these species were identified within the FMS Study Area.

6.12.1.1.3 *Priority Lichens*

The FMS Study Area, as mentioned in previous sections, is an area that consists of historic mining and timber harvesting. The FMS Study Area consists of an array of forest types which comprise of regenerative and young forests, cutblocks, fragmented canopies and mature intact hardwood, softwood and mixedwood forested wetlands, uplands and riparian areas. In general, the highest potential for priority lichen species were habitats associated with mature forested wetlands and upland habitats in close proximity to open water and watercourses.

In total, nine priority lichen species were observed during lichen surveys (1 SAR and 8 SOCI). Although Boreal Felt Lichen (*Erioderma pedicellatum*) predictive habitat polygons were present within the FMS Study Area, due to the amount of fragmentation, lack of indicator species and lack of continuous mature balsam fir swamps, Boreal Felt Lichen habitat suitability was determined to be poor. Blue felt lichen (*Pectenia plumbea*) was observed in eleven locations within the FMS Study Area: within wetlands 27, the eastern lobe of 65, 159 and 240 (2 locations), adjacent to wetlands 137, 145, 159 and the western lobe of WL65, and in two locations within upland habitat.

6.12.1.1.4 *Terrestrial Fauna*

Through all targeted surveys and incidental observations, evidence of a single mammalian priority species was observed. Twenty-eight observations of Mainland Moose were documented within, and adjacent to the FMS Study Area through baseline environmental work completed in 2017, 2018 and 2019.

Seventy-seven AMOs were assessed to determine suitability for bat hibernacula. Of the AMOs assessed, all were either blocked with a concrete cap or flooded. No bat hibernacula or bats were observed during the assessments and according to the ACCDC report, no bat hibernacula is present within 5 km of the FMS Study Area.

6.12.1.1.5 *Herpetofauna*

No priority herpetofauna species were identified through field surveys. Targeted surveys for wood turtles within the FMS Study Area did not reveal any sightings, however, several potential suitable habitats for nesting and overwintering were observed within Seloam Brook. No opportunistic observations of wood turtles were documented during any wetland or watercourse surveys throughout the entirety of the FMS Study Area.

No snapping turtles were observed opportunistically during any surveys, including those with considerable field effort in suitable habitat such as wetland and watercourse evaluations. However, areas within Seloam Brook and its' tributaries provide the appropriate water depths (greater than 1 m) and substrate for nesting and over wintering habitat.

6.12.1.1.6 *Priority Invertebrates*

No priority invertebrate species were identified through sampling for benthic invertebrates. Field staff searched for signs of priority aquatic invertebrates, such as freshwater mussels during all wetland and watercourse related programs. None were observed. No observations of odonates were recorded within the vicinity of the FMS Study Area by Odonata Central. No other targeted surveys were completed for invertebrates and no opportunistic observations of priority invertebrate species were recorded. No other priority invertebrate species were identified during the desktop review or field surveys.

6.12.1.1.7 *Priority Avifauna*

Across all survey seasons, a total of 22 priority species were observed either during dedicated survey periods or incidentally within the FMS Study Area. All bird SAR anticipated to be within the FMS Study Area were observed. The presence of wetlands, forested uplands, watercourses, clearings and fragmented habitats (resulting in edge habitats) provided suitable habitat for many of the priority bird species in Nova Scotia.

During all breeding bird surveys, evidence of breeding behavior was recorded for all species, with particular attention towards SAR and SOCI. Breeding evidence was recorded in accordance with guidance provided by Bird Studies Canada (2016), which defines behavior in terms of possible, probable, and confirmed breeders. Any species observed during breeding season singing in suitable habitat is identified as a possible breeder. Signs of probable breeding observed are agitation and established territories. Evidence of confirmed breeders observed includes distraction displays, feeding young or carrying food, nests with young, or recently fledged young. The highest evidence of breeding status recorded for all priority bird species observed during breeding season is presented in Table 6.12-1. Two SAR are identified as possible breeders (Evening Grosbeak and Common Nighthawk), and two as probable (Canada warbler and Olive-sided Flycatcher) were documented. Six SOCI are identified as possible breeders, while nine show evidence of probable breeding.

Table 6.12-1: Highest Breeding Evidence for Avian SAR and SOCI within the FMS Study Area

Scientific Name	Common Name	2017 Breeding Evidence	2018 Breeding Evidence
Accipter gentilis	Northern Goshawk	Possible	N/A
Actitis macularius	Spotted Sandpiper	Probable	Possible
Spinus pinus	Pine Siskin	Possible	Possible

Table 6.12-1: Highest Breeding Evidence for Avian SAR and SOCI within the FMS Study Area (continued)

Scientific Name	Common Name	2017 Breeding Evidence	2018 Breeding Evidence
Carpodacus purpureus	Purple Finch	Possible	Possible
Catharus ustulatus	Swainson's Thrush	Probable	Probable
Chordeiles minor	Common Nighthawk	Probable	Possible
Coccothraustes vespertinus	Evening Grosbeak	Possible	Possible
Contopus cooperi	Olive-sided Flycatcher	Probable	Probable
Dendroica castanea	Bay-breasted Warbler	Probable	Probable
Empidonax flaviventris	Yellow-bellied Flycatcher	Probable	Probable
Falco sparverius	American Kestrel	Observed	Possible
Loxia curvirostra	Red Crossbill	Probable	Possible
Perisoreus canadensis	Gray Jay	Confirmed	Probable
Picoides arcticus	Black-backed Woodpecker	Probable	Probable
Poecile hudsonica	Boreal Chickadee	Possible	Possible
Regulus calendula	Ruby-crowned Kinglet	Confirmed	Probable
Sitta canadensis	Red-breasted Nuthatch	Probable	Probable
Cardellina canadensis	Canada Warbler	Confirmed	Probable

6.12.1.2 Touquoy Mine Site

6.12.1.2.1 *Priority Fish*

Moose River, within the Touquoy Mine Site, provides habitat for Atlantic salmon and brook trout. Good juvenile and rearing habitat and potential spawning habitat is available for Atlantic salmon. Several juvenile Atlantic salmon were observed in 2006, however, these species were believed to be from the landlocked population known to Scraggy Lake. Good adult and juvenile brook trout feeding habitat, fair rearing habitat, and potential spawning habitat is available within Moose River (CRA 2007).

The Nova Scotia Department of Agriculture and Fisheries conducted a fisheries resource study in Scraggy Lake in July of 1975. Fish captured included; brook trout and American eel. Atlantic salmon smolts were recorded during creel census in 1979. Fingerling landlocked Atlantic Salmon and Brook Trout were stocked in Scraggy Lake between 1998 to 2000 and 1994 to 1996, respectively (CRA 2007).

Fish surveys were completed on June 19th and June 20th, 2017 to determine the species present in the Mini Pit. Gill nets, eel pots, minnow traps, rod and reel fishing were place within various portions of the mini pit. During the surveys the species observed were: White Sucker (S5), Creek Chub (S5), Blacknose Dace (S5) and Brook Trout (S3).

6.12.1.2.2 *Priority Vascular Flora*

No SOCI plants were observed during vascular plant surveys conducted in August 2004, May and June 2005, and September 2006 as part of the EARD process (CRA 2007).

One black ash (*Fraxinus nigra*) was discovered within the Touquoy Mine Site incidentally during wetland surveys in September 2015. The permitted loss of the Black Ash as part of Touquoy Mine Site development occurred in the Spring of 2016, after the Mi'kmaq of Nova Scotia were consulted.

6.12.1.2.3 *Priority Lichens*

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

6.12.1.2.4 *Terrestrial Mammal Fauna*

Mainland moose tracks were observed within the Touquoy Mine Site in a bog during field surveys to support the Touquoy Environmental Assessment in 2006. Moose are known to the Tangier Grand Lake Wilderness Area, and evidence of moose is reported every year by NSL&F in the Moose River Gold Mines area during deer pellet surveys (CRA 2007).

In addition to the information above, a Post-Construction Moose Monitoring Program for mainland moose has been underway in lands surrounding the Touquoy Gold Mine during winter and spring in 2017 and 2018. Surveys are ongoing throughout 2019 and include a combination of winter tracking surveys and spring pellet group inventory surveys. Surveys are completed on foot along transects surrounding the Touquoy Gold Mine throughout a diversity of habitat types. During surveys, moose observations are recorded including a description of moose sign observed, a GPS location and a microhabitat assessment. To date, three sightings of moose were encountered during 2017, and two sightings of moose were encountered during 2018 surveys. 2019 surveys are ongoing. Annual reports have been provided to NS Lands and Forests as per the Touquoy Gold Mine Industrial Approval conditions.

No suitable bat hibernating areas were found within the Touquoy Mine Site during environmental screening to support the Touquoy Environmental Assessment (CRA 2007).

6.12.1.2.5 *Priority Invertebrates*

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

6.12.1.2.6 *Priority Avifauna*

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

6.12.2 Anticipated Effects and Changes to the Environment

6.12.2.1 Priority Fish Species

Two priority fish species have been identified or are expected to reside within watercourses within the FMS Study Area (brook trout and pearl dace). Fish habitat is described in Section 6.8 using brook trout and white sucker as reference species. Standard mitigation and monitoring for fish and fish habitat will address direct and indirect effects to pearl dace and brook trout.

Within the FMS Study Area, twelve watercourse reaches (19%) were categorized as moderate fish quality habitat for Brook Trout and White Sucker, five watercourse reaches (8%) were categorized as moderate-quality habitat for brook trout and low-quality for white sucker, six watercourse reaches (9%) were categorized as low-quality habitat for brook trout tan moderate-quality for white sucker, and thirty-one watercourse reaches (50%) were categorized as low-quality habitat for both species, as described in Section 6.8. Ten watercourses comprising fish habitat within the FMS Study Area are expected to directly impact watercourses, with three (30%) having moderate quality habitat for either species, and seven (70%) having low quality habitat for both brook trout and white sucker.

Expected and potential direct and indirect fish and fish habitat impacts to surface water features (wetlands and watercourses) in the immediate vicinity of the FMS Study Area as a result of the FMS Mine Site construction is described in Section 6.8. Broader potential indirect impacts to down-gradient water quality and quantity within the LAA are described in Section 6.6 and effects are evaluated within that section. These direct and indirect effects of Project activities are expected to be similar in nature between priority fish species and all other fish species. Maintaining water quality and quantity downstream in the LAA is paramount for limiting broader fish and fish habitat impacts within each affected watershed associated with the Project, particularly those known to support priority fish species.

Development of the mine will cause direct impacts to fish and fish habitat mostly within the construction phase of the Project during clearing, grubbing, blasting, and development of the mine and its associated infrastructure. On-going impacts to fish and fish habitat are possible during operations of the mine from on-going dewatering efforts within the open pit and potential siltation and release of substances to receiving surface water systems adjacent to the mine infrastructure.

The Touquoy Mine Site is currently operational. There are no direct or indirect effects to priority fish or fish habitat anticipated to be caused by the processing of ore and the management of the tailings facilities beyond that discussed in Section 6.8. Broader potential indirect impacts to down-gradient water quality and quantity within Moose River are described in Section 6.6. Since the completion of the Touquoy Gold Project EARD and Focus Report, ACCDC status ranks, and listings under the NSESA and SARA have been revised. The species identified in the EARD were reviewed and it was confirmed that there are no newly listed species which would experience Project interactions beyond what is expected in terms of interactions to the fish community in general. Furthermore, fish SOCI (even those with revised listings) are expected to experience similar Project interactions as all other fish species. As such, no additional specific mitigation of Project interactions is necessary for priority fish species based on the addition of the FMS Project to the Touquoy Mine Site.

6.12.2.2 Priority Vascular Flora and Lichens

Development of the Project will result in direct impacts to vascular and non-vascular individuals and to flora communities. The effects of the Project on flora encompass vascular and non-vascular priority flora species in wetland, and upland habitats. As such, many of the effects described in Section 6.7 specific to wetland habitat and Section 6.9 (Terrestrial Habitat and Flora) will directly relate to effects on priority flora species. The majority of direct mortality to flora will occur during site preparation.

Within the FMS Study Area, direct loss to populations of Blue Felt Lichen (*Pectenia plumbea syn. Degelia plumbea;* SARA, COSEWIC & NSESA Vulnerable), Eastern Candlewax Lichen (*Ahtiana aurescens*; S2S3) and Fringe Lichen (*Heterodermia neglecta*; S3S4) are expected due to the placement of the infrastructure. Four locations with a total of 11 thalli of blue felt lichen are expected to be directly impacted by the construction of the TMF (3) and WRSA (1). Three additional observations are within the proposed Plant and Ancillary Building Footprint. Individuals within the proposed Plant and Ancillary Building area may be avoidable at the detailed design stage of the Project. If direct avoidance is possible within the Plant and Ancillary Buildings, these three occurrences may experience indirect impact due to changes in vegetative cover surrounding the individuals.

Within the FMS Study Area, direct loss to known populations of Southern Twayblade (*Neottia bifolia syn. Listera australis;* S3) and Wiegand's Sedge (*Carex wiegandii;* S3) are expected due to infrastructure placements. The only observed population of Wiegand's Sedge within the FMS Study Area is expected to be lost as a result of the development of the TMF and associated infrastructures. Southern Twayblade populations are also expected to be lost due to infrastructure however, other populations exist outside of proposed infrastructure and are not expected to be affected by the Project.

The Touquoy Mine Site is currently in operation. There are no direct or indirect effects to vascular flora and lichen species of conservation interest anticipated to be caused by the processing of ore and the management of tailings from the FMS Mine Site. Effects to flora and habitat related to the Project are described in Section 6.9.

6.12.2.3 Priority Terrestrial Fauna

Mainland Moose is the only terrestrial fauna priority species observed during field surveys within the FMS Study Area. Mainland Moose are found in habitat mosaics of uneven age stands with abundant twigs and foliage for foraging. These uneven-aged mosaic forests that moose prefer can be formed from natural disturbance such as fire or wind throw, or anthropogenic disturbance such as timber harvesting. During the summer months, they are reliant upon aquatic systems (lakes, rivers, and wetlands) for submergent and emergent vegetation, and cover from thermal stress (NSDNR 2007). Mainland moose are not particularly affected by habitat fragmentation based on habitat preference; however, increased access into a site (construction of new roads) may increase poaching levels. As such, low-level habitat fragmentation can indirectly affect Mainland Moose.

Development of the FMS Mine Site will cause direct impacts to habitat used by Mainland Moose. The WRSA is expected to directly impact Wetland 125, where 6 observations of moose sign were documented. The number of moose sign observed within this wetland is likely reflective of the dense understory consisting of shrubs which provides suitable foraging habitat in the winter months, yet it is unclear whether this was a single individual or multiple. Upland habitat, where moose signs have been observed, are also expected to be directly impacted by the TMF, Till stockpile and the most eastern borrow pit. The Project is also within a Mainland Moose concentration area. Although direct impacts of moose habitat are to occur, suitable Mainland Moose habitat is available within the LAA. Based on the wetland cumulative effects modelling, a maximum of 23% of Mainland Moose is expected to be directly lost within the FMS Study Area due to the development of the FMS Mine Site, which equates to 2.5% of suitable Mainland Moose wetland habitat within the LAA.

Sensory disturbance to Mainland Moose would result from rock blasting, clearing and grubbing, infrastructure construction, and overall increased traffic during operations. This will likely result in the localized wildlife avoidance of the FMS Study Area, particularly in close proximity to the site infrastructure. Overall, Project activities will likely cause a localized change in usage of the FMS Study

Area by moose. Undisturbed forest patches and corridors between those patches remain within the LAA, to maintain movement of wildlife across the broader landscape. Sensory disturbance related to Project activity will occur within the FMS Study Area, and within the Touquoy Mine Site, as the additional processing of ore from the FMS mine will extend the life of the Touquoy Mine Site by 6 years.

Direct mortality of fauna species such as moose could result from Project activities, particularly due to the increase in traffic during construction and operation of the facility. Increased traffic poses a risk to wildlife within the FMS Mine Site and the Touquoy Mine Site. Indirect mortality could result from exposure to contaminants or spills from unplanned incidents.

The Touquoy Mine Site is currently operational, and it is expected for ongoing sensory disturbances to occur. Effects to terrestrial fauna species related to the Project are described in Section 6.10.

6.12.2.4 Priority Avifauna

The assessment of potential adverse interactions and effects of the Project on this VC takes into account the potential for the Project to result in changes to:

- Permanent and temporary habitat alteration and fragmentation;
- Disturbance and/or displacement;
- Potential for direct and indirect mortality to individuals; and
- Attraction and disorientation resulting from sensory disturbance.

With appropriate mitigation and monitoring, no direct mortality of priority bird species is anticipated, with the exception of the low potential for a bird strike with a haul truck or by other vehicles within the PA. Avifauna usage of the Project during construction and operation will largely be driven by changes and loss of habitat, resulting in localized avoidance of the PA by some species and occupation of nearby suitable habitat. Noise generated during all Project phases also has the potential to affect birds and cause avoidance behaviour.

Some priority species may avoid the PA in favor of undisturbed habitat in the surrounding landscape. Other priority species are anticipated to be attracted to the mine infrastructure and newly created habitat. The Common Nighthawk, for instance, is a crepuscular insectivore which nests on exposed gravel and disturbed areas. Lighting of buildings at dawn and dusk can create a foraging opportunity where insects are attracted to the lights. As such, Project activities may increase habitat suitability for the Common Nighthawk.

Twenty-two (six of which are SAR) priority avifauna species were observed within the Project's infrastructure and a direct loss of their habitat is expected. Based on the wetland cumulative effects modelling, Canada Warbler habitat is expected to have a loss of 37%, Olive-sided Flycatcher 29% and Rusty Blackbird 23% within the FMS Study Area. However, in comparison to the LAA it was estimated that up to 5.5% of suitable wetland habitat for Olive-sided Flycatcher is expected to be lost, and 0.3% of suitable wetland habitat for Rusty Blackbird (loss of wetland habitat for Canada Warbler was not evaluated at the LAA level). Refer to the wetland cumulative effects modelling (Section 6.7) which determined the extent of predicted habitat loss for three SAR species, Canada warbler, Olive-sided Flycatcher, and Rusty Blackbird within the FMS Study Area.

The Touquoy Mine Site is currently operational, and it is expected for ongoing sensory disturbances to occur. Effects to avifaunal species related to the Project are described in Section 6.11.

6.12.3 Mitigation Measures

The potential effects related to species and that are associated with the different phases of the Project are outlined in the relevant VC sections for each taxonomic group of species. Specific mitigation measures related to priority species are outlined in the following sections. For all taxa, the Proponent will engage with the NSL&F biodiversity team to identify SAR permit requirements under the NSESA to mitigate impacts to species at risk and their habitats.

6.12.3.1 Priority Fish Species

Standard mitigation for fish and fish habitat is expected to appropriately mitigate effects on priority fish species. Watercourse alteration permitting and a *Fisheries Act* authorization for the proposed Seloam Brook Realignment and other direct impacts to fish for the Project will also be required, at which time detailed fish habitat quantification and potential effects on priority fish species will be addressed. The following mitigation efforts are considered in addition to those general fish and fish habitat mitigation measures outlined in Section 6.8.3.

- Site specific terms and conditions for alteration of watercourses which support priority fish species will be communicated to all site personnel and strictly adhered to; fish rescue will be completed, wherever practicable, wherever practicable, within the FMS Study Area prior to mine construction; and
- The location of all watercourses known to support priority species will be communicated to site personnel along with recommended mitigation measures.

6.12.3.2 Priority Vascular Flora and Lichens

No vascular flora SAR has been observed within the FMS Study Area. Three priority species of vascular flora were identified across the FMS Study Area. One SAR lichens and eight SOCI lichens were identified within the FMS Study Area. Standard mitigation measures outlined previously in Sections 6.9.3 will provide appropriate guidance and in addition:

- Avoid SAR/SOCI wherever practicable, particularly during micro-siting, upgrades and new construction. Clearly identifying locations of SAR/SOCI where they will be avoided, and instruct personnel of their whereabouts;
- Adhere to the 100 m buffer zone for blue felt lichen (as described in the SMP, NSL&F 2018) wherever practicable. Where maintenance of a 100 m buffer zone on a blue felt lichen occurrence is not practicable the Proponent will consider monitoring or translocation of individual thalli into suitable habitat;
- Assess the possibility of avoiding blue felt lichen individuals within the proposed Plant and Ancillary Building footprint;
- A map of all priority vascular and non-vascular flora will be provided to site personnel during site orientation, and the locations of all priority flora species that will be avoided during Project construction will be clearly flagged in the field;
- The Proponent will transplant priority flora species, where deemed reasonable and appropriate in consultation with regulators Mi'kmaq of Nova Scotia, that are located within the direct footprint of the Project infrastructure to nearby areas where suitable habitat is present. Where avoidance or transplanting is not possible, vascular flora SOCI from areas proposed for direct impact will be collected for herbarium records or for preservation of seeds in a seed bank through Acadia University; and
- Wherever avoidance of priority lichen species is not possible, the Project Team will consult with a lichen specialist to determine the likelihood of successful transplantation of SAR lichens to adjacent areas with suitable habitat. Where avoidance and transplantation are not possible, the Project Team will collect specimens for submission to Frances

Anderson or equivalent contact at time of construction (Lichen Specialist, Research Associate, and Nova Scotia Museum). Following consultation with NSL&F and lichen specialist(s), details associated with lichen translocation will be outlined in a Blue Felt Lichen Translocation Plan.

6.12.3.3 Priority Terrestrial Fauna Species

Mainland Moose was the only priority terrestrial fauna species observed within the FMS Study Area. Standard mitigation measures outlined previously in Sections 6.10.3 will provide appropriate guidance and in addition:

- Implement the WMMP as presented in the EMS Framework Document, which outlines specific measure to monitor impacts of the Project on moose, including activities such as repeated winter track surveys and pellet group inventories, and collaboration with the Mi'kmaq of Nova Scotia to study Mainland Moose in a broader context; and,
- Wildlife observation reporting to appropriate site personnel during construction, operation and decommissioning of Project.

6.12.3.4 Priority Avifauna

The potential effects related to migratory birds and the different phases of the FMS Mine Site are outlined in Section 6.11.3. Most direct and indirect impacts on birds, including SAR, are accounted for in general mitigation/monitoring for all birds, since many have legislated protection under the *Migratory Birds Convention Act* (primarily through avoiding clearing/grubbing during nesting season if practicable, and conducting detailed pre-construction nest searches if clearing or grubbing must occur during nesting season). These pre-construction nest searches are particularly important in wetlands which provide suitable breeding habitat for the Olive-sided Flycatcher, Canada Warbler and Rusty Blackbird.

To verify the accuracy of the environmental assessment and the effectiveness of mitigation measures, a follow-up program is recommended. It is recommended that monitoring be conducted from the start of construction till the end of the decommissioning phase. Standard mitigation presented in Section 6.11.3 is recommended for priority avifauna species along with the following recommendations:

- Clearing and construction can increase habitat quality for common nighthawk (CONI), increasing potential interactions with this species. To limit attraction of CONI to the Project, the amount of exposed soil during nesting season should be limited, favoring to cover or revegetate soil wherever practicable.

6.12.4 Significance of Residual Effects

Based on avoidance, mitigation and monitoring proposed for all priority species listed above, the following residual effects are anticipated. Project VC interactions of a priority taxa (e.g., priority fish species) that have the same residual environmental effects characteristic rankings of their related non-priority specific VC (e.g., fish and fish habitat) are not carried forward.

The ecological and social context of each priority species taxa was included throughout the evaluation as was done for all VC's. In general, the ecological and social context specific to priority species are more significant than non-listed species in each taxa. Ecological (species abundance, habitat, food source etc.) and social factors (commercial, aboriginal, and recreational) for priority species are typically more specific and sensitive than for non-priority species. For example, Rusty Blackbirds have very specific ecological requirements for foraging and nesting and brook trout is of great social importance recreationally as one of Nova Scotia's most important sports fish and is also an important fish for the indigenous peoples. SAR/SOCI species are less abundant than common species (mainland moose vs. snowshoe hare), therefore, the SAR/SOCI that are directly affected from Project VC interactions typically have a higher magnitude of impact.

6.12.4.1 Priority Fish Species

There are no differences between the residual environmental effects for non-priority priority fish species compared to priority fish species found within the FMS Study Area.

6.12.4.2 Priority Vascular Flora and Lichens

There are no differences between the residual environmental effects for non-priority specific flora and lichens compared to priority flora and lichens.

6.12.4.3 Priority Terrestrial Fauna Species

Four VC interactions have been carried forward for priority terrestrial fauna species. The geographic extent, timing, duration, frequency, and reversibility of direct impacts to priority terrestrial fauna species remains the same as is with non-priority specific terrestrial fauna for these VC interactions. The magnitude of impact from the construction of the FMS Mine Site as well as from operational disturbances (of both the FMS Mine Site and Touquoy Mine Site) may be elevated relative to other terrestrial fauna, because priority terrestrial fauna is not as abundant and populations are less viable than non-priority terrestrial fauna species.

Regarding mainland moose, habitat loss and fragmentation caused by clearing and grubbing interferes with the long-term population viability and is a serious threat to the species (NSDNR 2007). Baseline conditions within the FMS Study Area has already demonstrate fragmentation as a result of a high level of forestry activity.

Vehicle and haul truck activity will occur throughout the PA during the construction, operation, and decommissioning phases. Vehicle and haul truck activity can cause impacts to priority fauna from wildlife vehicle collisions, dust, noise, and accidents (e.g., spills). Wildlife vehicle collisions can directly affect priority fauna and noise can indirectly affect priority fauna by encouraging avoidance behaviour.

Blasting and drilling of in-situ rock is expected to occur at the FMS Mine Site during the operational phase of the Project. Blasting could negatively affect priority fauna from the noise associated with the activity. Although blasting is restricted to the PA the sound disturbance to terrestrial fauna has the potential to extend into the LAA. For example, a noise disturbance can cause avoidance behaviour in all terrestrial fauna but the impact to the energy balance of a mainland moose may have more severe consequences compared to a non-priority fauna species because stress on an already endangered (NSESA) population may impede its biological success in turn having a greater impact on the species.

6.12.4.4 Priority Avifauna Species

Four VC interactions presented in Section 6.11 for Avifauna have been carried forward for priority avifauna species. The geographic extent, timing, duration, frequency, and reversibility of direct impacts to priority bird species remains the same as is with non-priority specific birds for these VC interactions, however, the magnitude of impact increases. The magnitude of impact from the construction of the FMS Mine Site (i.e., loss of habitat) as well as from operations (i.e., disturbance) has increased because priority birds are not as abundant, and populations are less viable than non-priority specific birds.

Clearing and grubbing will result in habitat loss for avifauna. Mitigation measures such as bird awareness and best management practices will be used. Construction is expected to have a high magnitude of impact because it is associated with a direct loss of habitat. Although similar habitat is available adjacent to the PA the effect of habitat loss has the potential to have a greater impact on priority bird species. For instance, the habitat requirements for rusty blackbird are very specific and include forested wetlands with standing water and riparian areas and clearing and grubbing in these habitats is a major threat to the species (Environment Canada, 2014). Disturbances (wildlife vehicle collisions, light etc.) have the potential to pose a greater impact on priority bird species in comparison to non-priority specific bird species. This can be attributed to the rarity of priority bird species.

6.13 Mi'kmaq of Nova Scotia

6.13.1 Baseline Conditions

There are 13 Mi'kmaq communities in Nova Scotia, with two First Nation (Mi'kmaq) reserves in the vicinity of the Project: Beaver Lake IR 17 (49.4 ha) is located approximately 24 km southwest from the FMS Study Area, and Sheet Harbour IR 36 (32.7 ha) is located 25 km south of the Project. Both these reserves belong to the Millbrook First Nation which is located in Truro, Nova Scotia, 64 km northwest of the FMS Study Area. The 2017 Census reports 21 and 25 Mi'kmaw residents at Beaver Lake and Sheet Harbour, respectively (Statistics Canada 2017, 2017a).

The Pictou Landing First Nation (PLFN), located north of the town of New Glasgow, is located 59 km north of the Project. The Sipekne'katik First Nation, located in Indian Brook, Nova Scotia, is located approximately 75 km west of the Project and Paqtnkek First Nation, located in Afton, Nova Scotia, is located 79 km northeast of the Project.

Mi'kmaq rights are communal rights and therefore shared amongst all members of the Mi'kmaq Nation in Nova Scotia.

6.13.1.1 FMS Study Area

6.13.1.1.1 *FMS Historic Mi'kmaq Land and Resource Use*

As described by Mi'kma'ki All Points Services (MAPS) in the MEKS for the Project, Mi'kma'ki, the district of Eskikewa'kik, and the FMS Study Area have been occupied by Mi'kmaq and their ancestors since the deglaciation some 12,000 years ago. The so far earliest physical traces of the presence of Mi'kmaq and their ancestors are archaeological finds unearthed at Debert, NS dating from 11,500 BP, a period labelled as Paleo-Indian by archaeologists or Sa'giwe'k L'nuk by Mi'kmaq (MAPS, 2019).

In general, Mi'kmaw land use and occupancy involved semi-permanent and permanent settlement at resource-rich locations. Based on the overlapping seasonal fluctuations in the local availability and abundance terrestrial and aquatic resources, Mi'kmaw groups exploited singular or multiple resources in a succession of habitats throughout their territory.

At the time of contact, 500 years ago to present day, Mi'kmaw occupied the shores of virtually all water bodies, both marine and freshwater. River systems and connected lakes were particularly important features in traditional Mi'kmaw land use as they offered a multitude of food resources as well as access to inland terrestrial habitats and their resources (The Confederacy of Mainland Mi'kmaq. 2007). Villages were usually situated at a navigable body of water. Preferred summer locations were coastal sites at the mouths of rivers with significant spawning runs of salmon, eel, gaspereau and other fish species as well as waterfowl. Such sites provided ready access to a variety of freshwater and marine resources, plus a waterway into the interior (MAPS, 2019).

East Sheet Harbour River and what are today the Marshall and Anti-Dam Flowages represented such waterways, as well as Moser and Liscomb Rivers.

Although Nova Scotia has, since the 18th century, increasingly been settled by predominantly European immigrants, no portion of Mi'kma'ki has ever been formally and legally ceded. Quite to the contrary, several treaties between the sovereign indigenous nations and the British Crown were signed between 1725 and 1779 and affirmed Mi'kmaw rights to their territory and its resources, and pledging peaceful coexistence and Mi'kmaw loyalty to the British Crown (MAPS, 2019). This covenant chain of treaties includes the 1752 and 1760/01 treaties that were affirmed by the Supreme Court of Canada as legal and binding.

During the 1800s and 1900s, European settlement expanded and increasingly appropriated the most accessible and for their economic interests most productive areas - the safe harbours, resource-rich estuaries and near-shore fishing grounds all around the Nova Scotia coast as well as the few fertile agricultural regions. In order to minimize Mi'kmaw interference in the settler economy,

the government of Nova Scotia government began in 1812 to relocate Mi'kmaw families onto a number of small reserves set up in areas deemed less productive.

To the Mi'kmaw population, the less disturbed inland areas and their resources gained in relative importance as a result, and the focus of much of their traditional harvesting activities was pushed into the Province's more remote regions. The Liscomb region in particular was a favoured hunting, fishing and trapping area for Mi'kmaw, well-known for its wildlife resources (MAPS, 2019).

Seloam Lake is named after well-known Mi'kmaw hunter Mattio Selome. He and his family were one of the Mi'kmaq groups active in the FMS Study Region during the late 1800s. He used to camp most frequently at Seloam and Ladle lakes. Mattio Selome buried his wife on an island in Seloam Lake. Typhus Lake is another one of the locations whose name relates to the presence of Mi'kmaw families in the area. Situated about 15 km east of Seloam Lake, it received its name when several Mi'kmaw died of typhoid fever at their camp and were buried at this location in the mid-1800s (MAPS, 2019).

Among today's non-indigenous residents, older individuals remember Mi'kmaw families criss-crossing the region, maintaining hunting camps or cabins throughout. It wasn't until the 1940s when they reported observing a noticeable drop in the presence and extended stays of Mi'kmaw family groups in the region. This appears to have been the result of the Federal Government's Centralization policy, an attempt to further concentrate the Mi'kmaw population onto only two large reserves, Shubenacadie Indian Reserve on the Nova Scotia mainland and Eskasoni Indian Reserve on Cape Breton Island.

The policy ultimately failed' and was abandoned in 1949, and the majority of Mi'kmaq today live in 13 communities spread out over the province. Most of the families that were active in the FMS Study Area eventually relocated to the Indian Brook (Shubenacadie), Millbrook and Paqtnkek reserves.

The decline in the visibility of Mi'kmaw families or groups in the inland in terms of seasonal camps by no means implies that the importance of their traditional lands and resources began to decline, nor harvesting activities were being abandoned.

The general pattern of Mi'kmaw land and resource uses in the area gradually changed during this period from extended seasonal inland stays, often by complete families, to briefer, frequent hunting/fishing excursions. This trend was facilitated, possibly even stimulated, by increasing accessibility through a growing network of country roads and the use of motorized vehicles.

Mi'kmaw families were thus able to re-connect with their traditional harvesting areas, as far as they had not in the meantime become subject to competing uses by the dominant society such as municipal, agricultural or industrial development, or parks and protected areas. Despite progressive developments and forced centralization, the Mi'kmaw never voluntarily or willfully abandoned any part of their traditional territory (MAPS, 2019).

6.13.1.1.2 *Known Mi'kmaq Archaeological Sites near the FMS Study Area*

The vast majority of archaeological discoveries in Nova Scotia have been incidental rather than the result of targeted archaeological surveys. More often than not they have been made in the context of some sort of development – agricultural development or residential, industrial or infrastructural construction. The FMS Study Area has to date not had significant development activities. The archaeological record for most of Eskikewa'kik is very sparse and consists mostly of sporadic surface finds.

It is obvious therefore, and important to note, that the relative lack of archaeological evidence in the FMS Study Area cannot be construed as proof of a lack of pre-contact Mi'kmaw occupancy. The archaeological potential of the FMS Study Area and surrounding region, however, is judged as being high. The area has a long history of Mi'kmaw occupancy, harvesting/gathering and guiding (MAPS, 2019).

Two known archaeological sites attest to pre-contact Mi'kmaw occupancy of this part of the interior of mainland Nova Scotia, one located just north of the FMS Study Area on an island in Seloam Lake (burial site). Just outside the FMS Study Area on Liscomb River, 11 km further to the east, is another archaeological site.

An additional cluster of sites are located at the north end of Marshall Flowage, about 8 – 9 km south of the FMS Study Area. Some of those sites contain both pre- and post-contact components.

The Proponent has shared the archaeological reports directly with KMKNO (October 2019 and then supporting documentation in May 2020) and has requested a meeting with the KMKNO archaeology team (May and June 2020) to review these conclusions and confirm if any additional known Mi'kmaq archaeological sites are present in close proximity to the Project. To date, this meeting has not occurred.

6.13.1.1.3 *Current Mi'kmaq Land and Resource Use near the FMS Study Area*

Drawing from information provided through the MEKS completed in 2018/2019, and direct information gathered from engagement activities between the Proponent and the KMKNO, Millbrook First Nation and Sipekne'katik First Nation, and the Project team's the following summary of current Mi'kmaq land and resource use has been prepared as a basis from which to understand and evaluate Project interactions and potential effects of the Project on the Mi'kmaq of Nova Scotia.

The following key aspects were considered and requested from the Mi'kmaw communities during collection of baseline data (either through direct engagement or the completion of the MEKS or through a shared questionnaire in Dec 2019/Jan 2020):

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

Baseline information that was shared and available for the Project is described in this section. It is important to note that several limitations relating to baseline information are present and thus, evaluation of Project interactions and potential effects to the Mi'kmaq of Nova Scotia within this section of the Project EIS are provided in a general format, with limitations on specific analysis:

- **Residences (Permanent or Seasonal):** No specific detail relating to location of seasonal or temporary camps/cottages/residences were provided to the Proponent. The MEKS identified a cabin, but no general or specific location was provided. Thus, no analysis of specific Mi'kmaq residential receptors has been included in this Project EIS. It is expected that a number of Mi'kmaw residents maintain or regularly use cabins or cottages in the region. However, no Mi'kmaw owned or utilized cottages or cabin have so far been recorded in or directly surrounding the FMS Study Area with the exception of the cabin noted in the MEKS. No further information was provided in the MEKS, from direct engagement with the Mi'kmaq communities and the KMKNO, or the questionnaire shared in Dec 2019/Jan 2020 relating to specific locations of seasonal residences/cottages/camps. The Proponent team requested additional information via email from the KMKNO relating to the general location of this cabin(s) identified within the MEKS on March 12, 2020. To date, no specific detail has been provided. However, conclusions relating to Project impacts at the FMS Mine Site property boundaries have been provided for each valued component in Section 6.13.2 and these conclusions can support analysis of particular camps/cottages that may be present surrounding the FMS Mine Site.

- **Drinking Water Sources:** No surface drinking water sources were identified through the MEKS, direct engagement activities with the communities, or the questionnaire shared in Dec 2019/Jan 2020. As a result, no analysis of specific surface water drinking water sources is included in this section. However, a discussion of impact of drinking water at EMZ-2 (discharge location from the Project within Anti Dam Flowage) is included as it is considered the reasonable worst case predicted water quality conditions stemming from the Project.

- **Consumption of Country Foods:** Details relating to **locations, frequency, duration and timing of harvesting** for specific fish, wildlife species, plants or other natural resources were not shared at this time with the Proponent. Traditional land use activities are an integral part of the domestic economy of many households and make an important contribution to their food security. Of the sample of Mi'kmaw individuals interviewed for the MEKS, 84% identified the traditional sector of their domestic economy, the harvesting of wildlife and plant resources, as an indispensable component of their families' food security (MAPS, 2019).

- **Ceremonial/Spiritual Activities and Sites:** General information about a sacred site was provided in the MEKS, but details relating to its specific location was not shared with the Proponent due to privacy concerns. If a general location was provided, analysis could be completed at this location to evaluate change in noise, light, and viewshed analysis from the Project. The Proponent team requested additional information via email from the KMKNO relating to the general location of this sacred site identified within the MEKS on March 12, 2020. To date, no specific detail has been provided, although the Proponent anticipates the KMKNO will provide analysis and recommendations with their EIS review.

The resulting patterns of current use described in the MEKS does not allow the conclusion that areas or locations that do not show land use are indeed not being used by Mi'kmaq. It does, however, illustrate clearly that both the FMS Study Area as well as the broader Project Area itself are being utilized by the Mi'kmaw First Nation, and that these lands and resources are integral parts of its traditional economic sector.

The pattern of reported activities shows three major spatial clusters within, or overlapping, the defined FMS Study Area:

- An area of concentration of recorded traditional land use is located between Lower Rocky Lake, Seloam Lake and Antidam Flowage, at the centre of which lies the proposed FMS Study Area;

- An area west of the FMS Study Area near Como Lake traverses the second cluster of reported land use activities; and

- A third cluster found east of the FMS Study Area just south of Hunting Lake.

As mentioned above, details relating to locations, frequency, duration and timing of harvesting for specific fish, wildlife species, plants or other natural resources were not shared with the Proponent. Specific locations for recreational uses, especially swimming, have not been provided to date. Further details relating to the context within which Mi'kmaq rights are being practiced including how subgroups (youth, elders, families, women) are using the land have not been shared. MAPS (2019) shows the level of detail provided through the MEKS format, and available through direct engagement with Mi'kmaq communities.

While many wildlife and plant species are of economic significance to Mi'kmaw harvesters, moose, salmon, eel, black ash, and various medicinal plants are of special cultural and/or spiritual importance as well. The threatened status of the mainland moose population further heightens the importance of the fact that its presence in the FMS Study Area has been confirmed during the data collection for this study.

The evidence shows Mi'kmaw occupancy and land/resource use in the FMS Study Area and wider region of Eskikewa'kik – a changing and more limited but uninterrupted use from pre-contact times to today.

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

There are limitations associated with the data collected and shared. Specific details and locations are not provided in the MEKS relating to specific foods consumed, or harvesting locations, nor was the Proponent able to collect details on locations of commercial and traditional fishing, hunting, or trapping locations within or near the Project. No information has been shared either through the procured MEKS, a questionnaire shared in Dec 2019/Jan 2020, or direct, ongoing engagement with the communities regarding seasonal or temporary sites used by the Mi'kmaq or surface water drinking water locations. No information relating to frequency, duration and timing of traditional practices was shared. As a result, analysis of Project effects and the Mi'kmaq of Nova Scotia is limited; however, a more general analysis of Project impacts is completed which allows for appropriate conclusions relating to residual impact and significance of effects. On-going engagement and dialogue during the EIS review process will continue to refine the specific conclusions and proposed mitigation and management commitments relating to the impact of this Project on the Mi'kmaq of Nova Scotia throughout the life of the environmental assessment process.

6.13.1.2 Touquoy Mine Site

The continued processing of FMS concentrate at the Touquoy Mine Site will not result in any additional impact to the Mi'kmaq of Nova Scotia, other than those effects already addressed and evaluated in the Touquoy Gold Project EA (EARD, 2007). Therefore, the effects assessment portion of this section will address only the Project in the context of the FMS Study Area.

6.13.2 Anticipated Effects and Changes to the Environment

Effects to the Mi'kmaq of Nova Scotia would begin with initiation of site preparation activities, as the land and resources within the proposed site property boundaries at the FMS Mine Site, and the existing boundaries associated with the Touquoy Mine Site will no longer be available for use and continue throughout all Project phases until completion of the active site reclamation stage. During the post-closure stage of the Closure Phase, the pit at the FMS Mine Site will be re-filling with water, and water treatment and monitoring is predicted to continue but no other site activities would affect the usage of the site area for the Mi'kmaq.

Many of the potential Project effects to the Mi'kmaq of Nova Scotia health and socio-economic conditions and current use of lands and resources for traditional purposes are via effects to VCs assessed as part of the EIS (including potential adverse effects to noise, air, light, geology/soil/sediment, surface water, groundwater, wetlands, fish and fish habitat, habitat and flora, birds, fauna, and SOCI/SAR).

Where appropriate, individual VCs have been included in a human health risk assessment (HHRA) completed by Intrinsik Corp. in 2019 to evaluate potential risk to human health from the Project. This report assesses the potential for emissions from the mine, released via Project activities, to change the chemistry of air, water and soils in the area, and whether the predicted changes have the potential to result in metals accumulation in or on vegetation or other selected country foods that may be consumed by humans. In addition, this report also provides an assessment of other exposure pathways, such as recreational swimming (Anti-Dam Flowage), and inhalation and incidental ingestion of metals on dusts in air and soil. The focus of this assessment is on the FMS Mine Site, in areas outside of the property boundary which could be accessed by the general public during various activities. The Moose River was not evaluated due to demonstrated low water levels and limited opportunity for swimming in this receiving environment.

Plant species of significance to the Mi'kmaq were identified within the FMS Study Area and surrounding LAA. Based on the knowledge of the Project team and the understanding of the regional landscape, these same species also exist within the immediate adjacent surrounding area and are expected to remain accessible to the Mi'kmaq, especially with access routes adjusted to allow for traffic to bypass the FMS Mine Site and given the large tracts of available crown land surrounding the Project. The Proponent does acknowledge that there will be destruction of some specimens, therefore altering the area available to the Mi'kmaq for their use. However, the permanent loss of some individual plants does not pose a threat to Mi'kmaq use of the species as a whole, given their abundance and availability within close proximity and the limited development pressures surrounding the FMS Study Area.

There will be a reduction in area available for hunting, trapping, gathering, fishing, spiritual ceremonies and other Mi'kmaq traditional activities within the FMS Mine Site. Due to the proximity of the mine to traditional harvesting areas as demonstrated through the MEKS, there will be a loss of access, including a potential exclusion zone in close proximity to the FMS Mine Site for the use of firearms. This will reduce the overall area of access for current Mi'kmaq traditional use within and potentially near the Project for a period of eleven years. Within the proposed property boundary of the FMS Mine Site, approximately 765 ha is crown land, with limited open water/lakes/recreational swimming or known fishing areas.

Within close proximity to the proposed property boundaries of the FMS Mine Site, there is the potential for sensory disturbance to wildlife and birds from noise and light conditions 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 to hunting, gathering and trapping activities beyond the potential adjustment of wildlife patterns (1 to 2 km) as a result of elevated noise and light in close proximity to the FMS Mine Site.

Identified archaeological sites that will be affected by the Project are not Mi'kmaq resources. Identified areas of Mi'kmaq elevated potential within the FMS Study Area for archaeological resources will be avoided. Identified Mi'kmaq archaeological features (burial site on Seloam Lake and others) are outside of the proposed FMS Mine Site property boundaries and thus will not be affected by Project development. Discussions and review of the Project by the KMKNO archaeological division have occurred.

Once the construction phase, operation phase, and active reclamation stage of the closure phase are complete (eleven years), access will be re-established within the FMS Mine Site for the Mi'kmaq of Nova Scotia. At this time, the site infrastructure will be dismantled and removed, the waste rock piles and TMF will be covered and seeded/reclaimed, and water management systems will be adjusted towards the exhausted pit to facilitate pit filling. With the exception of the pit area, where filling will be on-going and water monitoring will be occurring, it is the opinion of the Proponent that traditional practices within the FMS Mine Site can resume. The landscape will be altered, with more limited forested cover for an extended period of time. This will likely affect the specific nature of traditional practices that will resume within the FMS Mine Site. The majority of identified historical tailings will have been managed and removed from waterways, and water quality and fish habitat will be improved within the re-aligned Seloam Brook. This is a positive impact of this Project on future traditional practices with the FMS Study Area.

Given this discussion of Project interactions and the current available baseline data, the predicted impacts of the Project to the Mi'kmaq traditional use of the land are summarized below. These impacts are predicted to be low magnitude in consideration of mitigation and accommodation. A low magnitude change is defined (in part) by an observable change in the availability and baseline

condition of the lands and resources for traditional purposes for a short temporal window (<20 years) and with commitment to appropriate and negotiated accommodation and compensation with the affected Mi'kmaq community(s). The Proponent is committed to appropriate and negotiated accommodation and compensation.

- It is the conclusion of the Proponent that the permanent loss of some plant species does not pose a significant threat to Mi'kmaq use of the species as a whole, given their abundance and availability within close proximity, and the limited development pressures surrounding the FMS Study Area.
- The FMS Mine Site will be restricted for access. This area includes 765 ha of crown land, with limited open water/lakes/recreational swimming or known fishing areas;
- Access to Seloam Lake and Anti Dam Flowage will be maintained. Local bypass roads will be constructed to maintain access to Seloam Lake and local trails east of the FMS Mine Site;
- Change in noise and light levels will meet compliance with guidelines at the FMS Mine Site property boundary. Elevated noise and light levels above background conditions are expected, but only in close proximity to the FMS Mine Site (1 to 2 km);
- Within close proximity to the proposed property boundaries of the FMS Mine Site (1 to 2 km), 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;
- Access limitations are for a temporal scale of eleven years (construction, operations and the active reclamation stage of the closure phase);
- It is the opinion of the Proponent that traditional practices within the FMS Mine Site can resume during the post-closure stage of the closure phase. The landscape will be altered, with more limited forested cover for an extended period of time. This will likely affect the specific nature of traditional practices that will resume within the FMS Mine Site.
- There will be a change in surrounding viewscape of the Project. Project stockpiles will be visible from several local vantage points around the FMS Mine Site including Seloam Lake and Anti Dam Flowage;
- No known physical and cultural sites of Mi'kmaq importance will be affected by Project development. Monitoring will be completed during all phases of the Project for additional potential archaeological deposits or human remains; and
- There are limited development pressures in the area, and the closest Mi'kmaq community is 24 km from the FMS Mine Site.

These conclusions relating to Project impacts and the magnitude of these impacts have been shared with the Mi'kmaq of Nova Scotia through face-to-face meetings and discussions that included the preparation and delivery of a Summary of Mi'kmaq Effects and Proposed Mitigation Measures document and a Plain Language Summary. These documents were shared with all interested Mi'kmaq communities, and the KMKNO and feedback was requested by August 14, 2020. At the time of submission of the EIS, no formal feedback was received from any Mi'kmaq community or organization. Mi'kmaq groups acknowledged that feedback will be received once the EIS is formally accepted by IAAC, the document is publicly available, and the Mi'kmaq of Nova Scotia have the chance to review the entire document.

It is important to note that potential health impacts on Mi'kmaq communities are linked to the interconnected nature of the ability to access traditional territory to continue cultural practices, such as hunting, gathering and fishing – not only for their consumptive human health value, but also for mental and human health associated with cultural survival and continuity. While issues impacting

Indigenous health are complex, the Mi'kmaq of Nova Scotia would view a loss of access to territory and the ability to exercise Aboriginal and Treaty rights in that area to extend to potential impacts to human health outcomes.

As with the analysis of Project impacts to traditional use, specificity relating to Mi'kmaq land use and baseline health and socio-economic condition is not fully understood, and as a result, some analyses relating to health and socio-economic conditions have been completed utilizing a series of assumptions. During the course of the EIS review, should additional information become available relating to baseline health and socio-economic conditions of the Mi'kmaq of Nova Scotia beyond what is presented in this document, analyses can and will be reviewed and updated.

The HHRA followed a standard screening level risk assessment approach using methods outlined by Health Canada (2012; 2016a; 2016b; 2018) as referenced in Intrinsik (2019) The steps of a HHRA involve conducting a Problem Formulation, which involves identifying the ways by which people could be exposed to chemicals released from mining activities (which are known as exposure pathways), the identification of Chemicals of Potential Concern (known as COPCs), and identifying the characteristics of people who could be exposed (known as receptors), based on the types of activities that could occur in the area of the mine. This stage was followed by an Exposure Assessment (to estimate the potential rate of exposure to COPCs) and Toxicity Assessment (which estimates exposure rates which are considered to be without risk of adverse health effects, or of negligible risk) and a Risk Characterization step. Activities in the area could include traditional hunting and plant gathering, fishing, hiking, use of ATVs, and camping. The HHRA identified possible exposure pathways such as inhalation of air containing dusts; incidental soil and dust ingestion; ingestion of berries and/or traditional vegetation, game meats and fish; incidental consumption and dermal contact to surface waters through recreational activities (swimming), which were included in the assessment.

Chemicals of Potential Concern (COPC) were identified through examination of the geochemistry of dusts which could be released by the mine, as well as through predicted future surface water concentrations in the watercourse which will receive direct effluent discharge (Anti Dam Flowage). Screening of these sources resulted in several metals/metalloids meriting further assessment in the HHRA (aluminum; arsenic; barium; chromium; cobalt; copper; lead; manganese; molybdenum; nickel; strontium; vanadium and zinc).

Dust deposition from mine site activities was predicted by Wood (2019b), based on proposed operations and activities at the mine site, using standard methods. Predicted deposition rates were provided for the maximum point of impingement (MPOI) at the mine site property boundary, as well as a location approximately 1 km from the property boundary. These predictions were used to estimate potential future soil, vegetation and game meat concentrations in the Study area, using standard risk assessment equations provided by Health Canada and US EPA (e.g, US EPA OSW, 2005; US EPA, 1993) as referenced in Intrinsik (2019). Metal concentrations on fine and coarse particulate matter were also estimated based on predicted concentrations of $PM_{2.5}$ and PM_{10}, provided by Wood (2019b) at the MPOI. These predicted concentrations were used to assess potential inhalation exposures in areas outside the Property boundary, for either short term or chronic time frames. Effluent release into the nearby receiving environment (Anti Dam Flowage) and possible future receiving environment concentrations were predicted by Golder (2019b). These data were used to evaluate potential exposures related to recreational swimming, and fish consumption.

Potential exposures to releases of the COPCs from the proposed FMS Mine for people who could spend time in areas near the FMS Mine site were estimated using standardized equations by Health Canada (2012) and US EPA (2003; 2004). Consumption rates for various foods which could be harvested from the area near the proposed mine, such as leafy vegetation, berries, fish and game meats (deer), were identified from the First Nations Food, Nutrition and Environment Study (FNFNES) for the Atlantic region (Chan et al, 2017). Soil ingestion, dust inhalation exposure rates were identified from Health Canada (2012). Exposure rates from swimming and incidental water ingestion were identified from both Health Canada (2012) and US EPA (2003; 2004). Chronic Toxicity Reference Values (TRVs), which are exposure levels of COPCs for a lifetime below which adverse effects are not anticipated, or which are associated with negligible risk levels, were identified from Health Canada (2010), World Health Organization (2010), US EPA (1996; 1993) and other notable regulatory agencies as referenced in Intrinsik (2019). Potential risks were characterized by comparing the predicted exposure levels from all exposure pathways to the TRV, to predict a Risk Quotient (RQ) for non-carcinogens. RQs less

than 0.2 for the Project scenario, or less than 1.0 for the Baseline + Project scenario, are considered to indicate that the intake of the COPC through the consumption of traditional foods and other Project-related pathways does not exceed the TRV and no adverse health effects are expected. For carcinogenic chemicals, an Incremental Lifetime Cancer Risk (ILCR) for all life stages is calculated. A benchmark cancer risk level of 1 in 100,000 (i.e., 1×10^{-5}) is used to assess risk, and cancer risks are deemed negligible when the estimated ILCR is less than the benchmark value of 1 in 100,000 (i.e., ILCR ≤ 1.0).

Based on the assessment conducted, non-carcinogenic risks from soil and dust exposures, the consumption of country foods harvested from the vicinity of the Mine Site, and recreational water use (i.e., swimming), as well as soil ingestion, are considered to be negligible, and hence, are not anticipated to result in adverse health effects. For arsenic, predicted ILCRs were below the benchmark ILCR of 1 in 100,000 in all scenarios and assessment cases. Therefore, the potential for adverse health effects from arsenic exposure are considered negligible.

Based on the assessment conducted, it is considered unlikely that ore dust deposition from the Mine Project at the rates considered in this assessment would result in levels of metals in country foods, soils and dust that would be harmful to human health. Adverse health effects from soil and dust exposure, the consumption of country foods harvested from the vicinity of the Mine Site, and recreational water use (i.e., swimming) are not anticipated.

The Project is planned for an eleven-year timeframe within the proposed FMS Mine Site property boundaries. As described above, the HHRA has determined that there is a low risk of direct human health effects from this Project within and surrounding the FMS Mine Site. The Proponent understands that this Project may result in an impact to the socio-economic, mental and social well-being of the Mi'kmaq of Nova Scotia.

The Project may impact the economic condition of the Mi'kmaq communities. This impact could be felt in either a positive or negative way. Some of these potential changes, related to the economic condition of Mi'kmaq individuals, families and at the community level, include changes in income, population, housing conditions, employment, cost of living and food security.

With loss of access to the FMS Mine Site, the Proponent acknowledges that patterns of traditional use (hunting; trapping; medicinal, food or cultural-use plants; and recreational use of water) may change. This may result in a shift to other areas to practice traditional use, or a reduction or stoppage of the use of traditional resources in the local area, and potentially the need to purchase of goods to replace these traditional resources. These shifts could increase the cost of living for Mi'kmaq families who rely on traditional resources. There are also possible positive effects on the economic condition for the Mi'kmaq with provision of potential new job opportunities and improved socio-economic conditions through increased income. However, it is also possible that the Project may cause worker shortages in other businesses if people are recruited away from their current jobs in the community, and it is also possible that loss of access to the land and resources may have a direct effect on an individual's income.

The Proponent anticipates that the Project will have limited effect on Mi'kmaq use of navigable waters. Inside the property boundary of the proposed FMS Mine Site, there is limited open water, with the exception of Seloam Brook. Access to this brook will be limited during Project development and operations as it is situated within the FMS Mine Site property boundary. However, there is limited expectation that this brook is currently used by the Mi'kmaq for travel, given the size of the brook, elevated location in the watershed, the low water levels through this system, and given the NSPI control of this system and fluctuating water levels. As a result, the effect on navigable waters from Project development is predicted to be low.

At the time of submission of the EIS, no formal feedback was received from any Mi'kmaq community or organization. Mi'kmaq groups acknowledged that feedback will be received once the EIS is formally accepted by IAAC, the document is publicly available, and the Mi'kmaq of Nova Scotia have the chance to review the entire document.

6.13.3 Mitigation Measures

Mitigation measures and monitoring associated with related VCs are key to avoiding effects on the Mi'kmaq of Nova Scotia, as detailed in the VC sections. The Project has been planned to minimize footprint disturbance and impacts to the Mi'kmaq of Nova Scotia. While there are limited expected indirect effects on the Mi'kmaq of Nova Scotia based on the assessment of effects for related VCs, this evaluation is based on the implementation of the proposed mitigation and associated monitoring as a result of direct effects as outlined in the VC sections. There are also direct proposed mitigation measures to reduce impact on traditional practices, Mi'kmaq archaeological features (if identified) and the mental and social well-being of the Mi'kmaq of Nova Scotia. These mitigations are included in Table 6.13-1 below.

The Proponent's mitigation measures as described in Table 6.13-1 have been developed through ongoing discussions with the Mi'kmaq of Nova Scotia. Environmental monitoring and follow-up monitoring will be conducted with Mi'kmaq participation, including in planning and executing wetland compensation, wildlife monitoring, and fisheries productivity offsetting projects.

Follow-up programs will be developed in engagement with the Mi'kmaq of Nova Scotia to verify the nature and extent of the effects on current use of lands and resources for traditional purposes, to determine the effectiveness of mitigation measures, and to ensure ongoing and adaptive management of any unanticipated outcomes. A pilot Emergency Response Mi'kmaq Communications Plan has been developed and implemented with Indigenous groups to ensure the Mi'kmaq of Nova Scotia are kept informed and are able to provide feedback on key issues related to the Project; and, to implement an emergency response protocol, in the unlikely event of an incident.

Table 6.13-1: Mitigation for Potential Effects on the Mi'kmaq of Nova Scotia

Project Phase	Mitigation Measures
EIS Review	Support Mi'kmaq third party review of the Proponent's EIS, including mitigation and monitoring programs
EIS Review	Continuing to work with the Mi'kmaq to delineate the specificity of Mi'kmaq traditional use, and meet with the Mi'kmaq to receive feedback on EIS conclusions and impacts
C	Provide Mi'kmaq land users the opportunity to walk the FMS Study Area with Proponent representatives to identify and document sensitive sites prior to construction
C	Provide a tour of the FMS Mine Site and information on Project operations to interested Mi'kmaq peoples
C	Develop a Mi'kmaq Communication Plan with the Mi'kmaq of Nova Scotia that outlines an ongoing two-way communication process throughout the lifecycle of the Project
C	As part of the existing communications process, the Proponent will build upon and strengthen a Complaints Management and Action Program for Mi'kmaq input in advance of Project commencement, as an opportunity for having grievances heard and addressed, and development of an emergency communication protocol
C	Possible establishment of an environmental protection committee to review proposed and develop additional environmental mitigation protocols, oversee monitoring procedures and review/evaluate results. This committee should have representation from Proponent environmental experts, as well as Mi'kmaw representatives from Unama'ki Institute of Natural Resources, the Mi'kmaq Conservation Group, and NSE
C	Designed bypass roads allow for travel routes to by-pass the FMS Mine Site and allow access to Seloam Lake and areas east of the Project

Table 6.13-1: Mitigation for Potential Effects on the Mi'kmaq of Nova Scotia (continued)

Project Phase	Mitigation Measures
C	In the event that Mi'kmaw archaeological features are encountered during construction or operation of the Project, all work in the area will be halted and immediate notification made to the Special Places Coordinator, Nova Scotia Museum, the KMKNO and the communities of Sipekne'katik and Millbrook. As part of the EMS, the Proponent will ensure mitigation measures are undertaken to prevent irreversible damage to Mi'kmaq archaeological resources and burial site(s), including ensuring activities are within defined Project property boundaries only.
C, O, CL	The Proponent would like to ensure there are various opportunities for Mi'kmaq participation in the Project, including opportunities to participate in environmental monitoring and implementation of Mi'kmaq projects such as fish habitat offsetting, wetland compensation, and others. The Proponent will continue to engage with the Mi'kmaq on various project benefits
C, O, CL	Engage in open dialogue with affected communities relating to issues of limited Mi'kmaq access to the FMS Mine Site for the 11 year project window and discuss mitigation options including suitable alternative crown land access in close proximity to the FMS Mine Site
CL	Continue to engage with the Mi'kmaq of Nova Scotia to determine how they would like to participate and integrate traditional knowledge into the Reclamation and Closure Plan for the Project. The Proponent will also provide the opportunity for the Mi'kmaq to provide input on species used in revegetation, reclamation techniques, and the opportunity for Mi'kmaq members to join the reclamation team to execute this Project phase
C, O, CL	Commitment to developing and conducting a Mi'kmaq Cultural Awareness Program for staff and contractors. Scope to be determined based on further discussions

6.13.4 Significance of Residual Effects

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

Mitigation measures and conclusions relating to impacts to traditional practices and socio-economic and mental well-being will continue to be evaluated directly with the Mi'kmaq communities throughout the environmental assessment process, and throughout the lifecycle of the Project. Access to Seloam Lake and lands east of the Project via bypass roads, as well as the availability and suitability of nearby crown land as partial mitigation for loss of access during the eleven years that the mine will be limiting access to the FMS Mine Site area will also be discussed with the Mi'kmaq. Feedback on all summary of impacts and proposed mitigation measures has been requested and this dialogue will continue.

A significant adverse environmental effect for the Mi'kmaq of Nova Scotia 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:

6.13.4.1 During Construction:

- Direct impacts to terrestrial habitat, flora and fish habitat will be minimized through on-going Project design and micro-sighting of infrastructure footprints where practicable.
- Construction work and methods will be considerate of fish spawning timing windows and the breeding bird season.
- Construction noise and light will be limited and temporary in nature with an approximate 12 month duration.
- The Seloam Brook Realignment offers an opportunity to improve fish habitat given baseline condition of Seloam Brook due to historical mining practices (ditching/straightening of waterways) and presence of historical tailings and waste rock.
- Changes to access for the Mi'kmaq of Nova Scotia to the FMS Mine Site will be evaluated through on-going dialogue between individual Mi'kmaq communities and the Proponent as part of broader impact benefits and compensation discussions. Bypass access routes have been planned to allow access to Seloam Lake and areas east of the FMS Mine Site. There are limited development pressures in the area surrounding the FMS Mine Site and available expected alternative suitable areas for the continuation of traditional practices (large tracts of crown land).

6.13.4.2 During Operations

- Noise and air concentrations will be elevated above regulatory criteria only within the proposed property boundaries, and elevated above background near the Mine during this period. The likelihood of mobile receptors being regularly in close proximity to noise generation sites is low. Noise is predicted at levels consistent with the most conservative overnight wildlife guidance within 1.0 to 1.5 km of the property boundaries.
- It is considered unlikely that ore dust deposition from the Mine Project at the rates considered in this assessment would result in levels of metals in country foods, soils and dust that would be harmful to human health, based on the risk assessment conducted. Adverse health effects from soil and dust exposure, the consumption of country foods harvested from the vicinity of the FMS Mine Site, and recreational water use (i.e., swimming) are not anticipated.
- Changes to access for the Mi'kmaq of Nova Scotia will be evaluated through on-going dialogue between individual Mi'kmaq communities and the Proponent as part of broader impact benefits and compensation discussions. There are limited development pressures in the area surrounding the FMS Mine Site and available expected alternative suitable areas for the continuation of traditional practices (large tracts of Crown land).

6.13.4.3 During Closure

- Noise will be elevated above baseline during reclamation activities (2 to 3 years) involving mobile equipment and then drop to baseline for the post-closure period. During post-closure, water treatment and associated monitoring will be on-going, and the pit will be filling with water. However, Mi'kmaq access to the site can be restored during this stage of the Closure Phase.
- Changes to access for the Mi'kmaq of Nova Scotia will be evaluated through on-going dialogue between individual Mi'kmaq communities and the Proponent as part of broader impact benefits and compensation discussions. There are limited development pressures in the area surrounding the FMS Mine Site and available expected alternative suitable areas for the continuation of traditional practices (large tracts of crown land).

6.14 Physical and Cultural Heritage

6.14.1 Baseline Conditions

6.14.1.1 FMS Study Area

In 2008, Cultural Resource Management Group (CRM Group), undertook an archeological screening and reconnaissance program at the FMS Study Area of behalf of Acadian Mining. At that time, a surface mine was in early stage planning with the exact configuration of the mine complex unknown.

In 2018, CRM Group was retained on behalf of the Proponent to conduct archeological screening and reconnaissance at the FMS Study Area using the 2018 site development plan. As part of the 2018 archeological assessment, an archeological screening was completed prior to site reconnaissance including a review of previous archeological reports, land grants records, legal survey, historical maps, local and regional histories, topography maps, aerial photos and satellite, LiDAR and bathymetric data. Additionally, CRM Group contacted the Kwilmu'lw Maw-klusuaqn Negotiation Office's Archeological Research Division and Millbrook and Sipekne'katik First Nations for information on potential traditional or historic Mi'kmaw use of the area. In 2019, CRM Group completed additional screening and site reconnaissance to support the EIS in the western and eastern portions of the FMS Study Area (transmission line and the eastern by-pass road).

Archeological screening conducted in 2018 identified that, based on the environmental setting and the Mi'kmaq of Nova Scotia land use, as well as the long history of industrial use and settlement, the FMS Study Area exhibits an elevated potential for encountering historic Pre-contact and historic Mi'kmaw archeological resources and elevated potential for encountering historic Euro-Canadian archeological resources.

The 2008, 2018, and 2019 archeological screening and reconnaissance for the FMS Study Area consisted of visual inspection of the ground surface and did not involve sub surface testing. Based on the field reconnaissance completed as part of the 2008, 2018 and 2019 archeological assessments, seven Euro-Canadian historic sites (Sites 1 to 7) and three small areas (Areas 1, 2 and 3) of archeological potential for encountering Mi'kmaw archeological resources were identified. Details on Sites 1 to 7 and Areas 1, 2 and 3 are provided in Table 6.14-1.

Table 6.14-1: Details of Archeological Resources Identified during 2008, 2018, and 2019 Field Reconnaissance at the FMS Study Area

Site ID	Site Description
Site 1	A moss-covered log sill foundation observed during field reconnaissance was identified as being the remnants of a nineteenth century schoolhouse based on historical mapping
Site 2	A moss-covered log sill foundation and a small assortment of early twentieth century artifacts were observed during field reconnaissance but were unable to be identified through the review of available historical documentation.
Site 3	A moss-covered log sill foundation and a small assortment of early twentieth century artifacts were observed during field reconnaissance but were unable to be identified through the review of available historical documentation.
Site 4	A partially infilled cellar hole and a small assortment of early twentieth century artifacts were observed during field reconnaissance but were unable to be identified through the review of available historical documentation.

Table 6.14-1: Details of Archeological Resources Identified during 2008, 2018, and 2019 Field Reconnaissance at the FMS Study Area (continued)

Site ID	Site Description
Site 5	Building demolition rubble and partially infilled cellar hole observed during field reconnaissance were identified as the remnants of the New Egerton Gold Mining Company office based on historic mapping.
Site 6	An artificially levelled and cleared area observed during field reconnaissance was identified as the New Egerton Gold Mining Company store based on historical mapping.
Site 7	Multiple components encompassing an historic road, standing masonry, wooden crib work with iron components and a wooden channel observed during field reconnaissance were identified as the remnants of the Stanley Crusher based on historic documentation and mapping.
Area 1	A flat, dry plateau bordering Anti-Dam Flowage. Area 1 was classified as having low potential for Mi'kmaw archeological resources upon review of satellite imagery and bathymetric data for the Anti-Dam Flowage.
Area 2	An area of relatively high and level terrain in close proximity to Seloam Lake. Area 2 was classified as having elevated potential for Mi'kmaw archeological resources.
Area 3	A small flat dry area in close proximity to Glassy Lake. Area 3 was classified as having elevated potential for Mi'kmaw archeological resources. Area 3 was determined after the assessment completed by CRM Group to not be within the current FMS Study Area and therefore is not further referenced in this assessment.

6.14.1.2 Touquoy Mine Site

The Touquoy Mine Site was previously subjected to archeological reconnaissance in November 2006. An archeological screening was conducted by CRM group to evaluate the archeological potential within the Touquoy Mine development limits. The results of the study indicated that there is a low archeological potential ascribed to the area. No additional disturbances are anticipated at the Touquoy Mine Site as a result of the Project and thus, no additional evaluation is presented in this section relating to the Touquoy Mine Site.

6.14.2 Anticipated Effects and Changes to the Environment

A review of identified archeological feature locations and the current configuration of the Project infrastructure was completed with the following results:

- Sites 5 and 6 are centrally located within the proposed FMS pit and will be lost during the construction phase to support pit development and access to the mineral resource;
- The western by-pass road will be micro-sited through Site 7 to avoid the majority of the cultural features it contains except for an unavoidable section of an historic road;
- Sites 1 to 4 are located directly adjacent to the proposed pit and within or adjacent to defined historical tailings and/or waste rock, as well as within the footprint of proposed road infrastructure to support the pit development. These features will be lost during the construction phase to support pit development and access to the mineral resource;

- Area 1 has been classified by CRM Group as having low archeological potential and as such infrastructure in this area does not have any significant impacts predicted to occur; and
- No interaction of Project activities is anticipated at Area 2.

There is no potential for further additional disturbance of cultural of physical heritage resources during the operational and reclamation phases of the Project based on studies to date.

There are no known federal decisions that could affect physical and cultural heritage in the PA, or that could affect structures, sites, or items of historical, archeological, paleontological, or architectural significance of non-Indigenous Peoples.

6.14.3 Mitigation Measures

The areas included in the 2008, 2018, and 2019 archeological assessments were cleared of any requirement for further archeological investigation. Based on the 2008, 2018 and 2019 archeological assessments, the following mitigation measures for the FMS Study Area are described in Table 6.14-2 were recommended by CRM Group and are in the process of being accepted by Nova Scotia Communities, Culture and Heritage.

Table 6.14-2: Mitigation for Physical and Cultural Heritage

Project Activity	Mitigation Measures
C	Any further changes in the layout of the mine and associated facilities will be evaluated as to the potential impacts to archeological resources
C	Areas of potential archeological significance (Area 2) will be avoided, in the design and development of the Project
C	Intensified historical research, archeological shovel testing, where required, and detailed documentation will be conducted in advance of disturbance at Sites 1-6 and the historical road associated with Site 7
C	If the area of elevated archeological potential (Area 2) is to be impacted by future development, a program of archeological shovel testing will be conducted in advance of disturbance to allow for micro-siting of infrastructure
C	If archeological deposits or human remains are encountered during construction activities associated with the Project, all work in the immediate vicinity will be halted and the Special Places Program will be contacted
O, CL	N/A

Note: C= Construction Phase O= Operation Phase CL= Closure Phase

6.14.4 Significance of Residual Effects

The predicted residual environmental effects of the Project development and production on physical or cultural heritage resources are assessed to be adverse, but not significant. The overall residual effect of the Project on physical or cultural heritage resources is assessed as not significant after mitigation measures have been implemented.

6.15 Socio-economic Conditions

6.15.1 Baseline Conditions

KPMG International completed an Economic Impact Assessment to evaluate the economic benefits stemming from the Project (KPMG 2019). This assessment was conducted based on the 2018 technical report and considered the exploration, construction and operation phases and found that significant economic activity and jobs will occur as a result of the Project. In total, the Proponent will spend an estimated $399.4 million on the Project.

Construction activities will involve preparing the mine site, setting up infrastructure and facilities, and purchasing mining processing equipment to enable the Project to reach full production. Much of the spending associated with these activities will be incurred in Nova Scotia and Canada. As per the KPMG report, it was projected that initial investment costs will be approximately $123.4 million while average annual operating costs amount to $39.0 million. As a result of this spending, it is anticipated that 778 full time equivalent jobs will be created in Nova Scotia per year during construction.

Operational mining and processing activities will involve the deployment and operation of new mining production capacity. Similar to the construction phase, much of the spending associated with operation of the Project will be incurred in Nova Scotia and Canada. As per the KPMG report, it was projected that annual operating costs will be approximately $39 million year totally 234 million during the operational period. The costs can be generally categorized as follows:

- Mining costs including labour, materials and specialized equipment (43% of spending);
- Processing costs such as labour, chemicals, electricity feud (35% of total spending);
- Sustaining Capex including materials and spare parts, owner costs and environmental services (12% of total spending);
- General and administration such as electronic equipment office supplies (9 % of total spending); and
- Effluent Treatment (6% of total spending).

6.15.2 Anticipated Effects and Changes to the Environment

As a result of this spending, it was anticipated in the KPMG report that 289 yearly and recurrent full-time equivalent jobs will be created in Nova Scotia during operation.

For Canada as a whole, the construction phase will create 915 full time equivalent jobs per year. Tax revenues stemming from the construction phase are expected to be $2.4 million for the municipal government, $4.4 million for the Government of Nova Scotia, and $4.3 million for the Government of Canada. Further KPMG estimates that including supplier, the Project would create $93.1 million in wealth and support 915 additional jobs (including suppliers).

For Canada as a whole, the operation phase will create 323 yearly and recurrent full-time equivalent jobs during operation. Tax revenues stemming from the operation phase are expected to be $13 million annually for the Government of Nova Scotia and $8.6 million annually for the Government of Canada. These represent conservative estimates as corporate income taxes paid by suppliers cannot be estimated.

The Province of Nova Scotia's unemployment rate is higher than the national average (8.8%>6.9%) and its gross domestic product (GDP) growth has been the slowest of all Canadian provinces. In addition, the GDP per capita is the second lowest in Canada. The Project would greatly benefit the Province of Nova Scotia due to substantial upfront investments and significant annual operation costs contributing to job creation and government tax revenue. The Project will also provide positive growth for the local area,

supporting local infrastructure investment, housing opportunities and provide employment opportunities that will attract new residents and potentially slow or eliminate the depopulation occurring along the Eastern Shore.

6.15.3 Mitigation Measures

Mitigation measures are described in Table 6.15-1. Recreational activities at the FMS Mine Site will be restricted and the existing private road will be rerouted in keeping with consultation with local user groups. Recreational users will be notified of restricted area by signage and access will be restricted in flyrock management areas during blasting. Operation impacts on recreational users will be communicated with local recreational groups, such as the local ATV association, with a focus on minimizing impacts on users to the greatest extent practicable.

Construction of local by-pass routes will be completed to allow recreational traffic to travel around the FMS Mine Site to reach Seloam Lake and other recreational areas east of the FMS Mine Site. These bypass roads were established in consultation with the ATV Association of Nova Scotia and other local ATV clubs. The Proponent will continue to work with all interested parties to ensure the proposed bypass roads meet the needs of the local community members, Mi'kmaq of Nova Scotia and recreational groups and users in the local area. These bypass roads are shown on Figure 1-2.

No monitoring, except restricting access for safety, will be undertaken after the start of construction. The Proponent may conduct additional socio-economic studies to assess changes to confirm findings.

Table 6.15-1: Mitigation for Socio-economic Conditions

Project Phase	Mitigation Measures
C, O	Restriction of recreational activities within the spatial boundaries of the Project. Notification to be provided by signage
C	Construction of local by-pass routes to allow recreational traffic to travel around the FMS Mine Site to reach Seloam Lake and other recreational areas east of the FMS Mine Site
C	Liaison with recreation groups, such as the Sheet Harbour Snowmobile and ATV Club
O	Update of Socio-economic impact statement to assess impact. This may occur at the discretion of the Proponent. Impact Study projections are calculated to reflect conservative estimates
CL	N/A

Note: C = Construction Phase, O = Operations Phase, CL = Closure Phase

6.15.4 Significance of Residual Effects

There are no significant residual effects anticipated once mitigation measures are applied. Positive impacts are anticipated in the form of direct and indirect employment, and tax revenues for municipal, provincial and federal governments. There may be some vulnerability to the health care system and in the housing market if the local population increases as a result of the FMS Mine Site labour needs. However, a population increase would also have possible benefits to increasing school age populations, increase labour force participation rates and potentially encouraging increase residential building and construction activity.

6.16 Accidents and Malfunctions

6.16.1 Hazard Identification

Nearly all Project components and activities outlined in Section 2.0, including the processing of FMS concentrate at the Touquoy Mine Site, have the potential to create accidents and malfunctions; however, the likelihood is often extremely low. Those accidents and malfunctions that are considered either likely to occur, or unlikely to occur but have a potential significant effect should they occur, are outlined by Project phase in Table 6.16-1.

Table 6.16-1: Summary of Potential Accidents and Malfunctions

Hazard Categories	Potential Accidents and Malfunctions Scenarios	Construction Phase	Operations Phase	Closure Phase
Structural Failures	Open Pit Mine Slope Failure	○	●	○
	Stockpile Slope Failure	○	●	○
	Water Management Pond Failure	○	●	○
	TMF Dam Failure	○	●	●
	Infrastructure Failure	○	●	○
Accidents	Fuel and/or Other Spills	●	●	○
	Unplanned Explosive Event	○	●	-
	Mobile Equipment Accident	●	●	○
	Tailings and Reclaim Water Pipeline Spills at FMS Mine Site	N/A	●	N/A
	Tailings and Reclaim Water Pipeline Spills at Touquoy Mine Site	N/A	●	N/A
	Cyanide Spills at Touquoy Mine Site	N/A	●	N/A
Other Accidents and Malfunctions	Forest and/or Site Fires	●	●	○

Legend
Potential for Adverse Effects
● High potential for adverse effects
○ Low potential for adverse effects

6.16.2 Structural Failures

6.16.2.1 Open Pit Mine Slope Failure

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.

An independent qualified professional will undertake a geotechnical review of pit slopes on at least an annual basis. Design pit slopes are based on recommendations of the independent qualified professional with appropriate design safety factors applied. Slopes will be monitored for movement and evidence of instability 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 water management pond. The berm will be keyed into the bedrock to prevent shallow groundwater flow and/or surface water 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 the current delineation of ore, the open pit will be excavated through bedrock to an end depth of approximately 150 m below ground surface. Bench heights and bench face angles as prescribed by independent geotechnical review will be implemented for specific depths and zones of the open pit.

If slope failure were to occur, emergency procedures would be implemented that will be outlined in the site Emergency Response Plan, which will be developed to support the EMS Framework Document. 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. An assessment is then made using on-site staff and possibly external resources (geotechnical specialists) to make a determination if the area can be accessed to make repairs, what repairs are needed and actions to prevent future incidents. This will be detailed in a Recovery Plan, which will be developed to support the EMS Framework Document. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the repairs and return to work in the area; these are very case specific and often dependent on whether personnel were injured or equipment damaged as a result of the slope failure.

6.16.2.2 Stockpile Slope Failure

Geotechnical investigations have or will been undertaken to determine the suitability of foundation materials to support designed stockpiles and incorporated into the design of all stockpiles. Weak or unstable foundation materials will be removed prior to stockpile construction. Stockpile slopes 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.

If a stockpile slope failure were to occur, emergency procedures would be implemented that will be outlined in the site Emergency Response Plan, which will be developed to support the EMS Framework Document. Generally, stockpile slope failure emergency response includes evacuation of all equipment and personnel from the area, and areas up-slope and down-slope from the stockpile slope failure area. An assessment is then made using on-site staff and possibly external resources (geotechnical specialists) to make a determination if the area can be accessed to make repairs, what repairs are needed and actions to prevent future incidents. This will be detailed in a Recovery Plan, which will be developed to support the EMS Framework Document. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the repairs and return to work in the area, these are very case specific and often dependent on whether personnel were injured or equipment damaged as a result of the stockpile slope failure.

6.16.2.3 Water Management Pond Failure

The water management ponds will be lined with suitable materials, such as clay or a plastic liner. In the event of a 1 in 100-year precipitation event that creates volumes in excess of the capacity available in ponds and ditching, a spillway will be used for overflow to minimize the potential for an infrastructure failure. Water management ponds will be monitored regularly. In the case of a storm event, monitoring frequency will be increased.

If a water management pond failure were to occur, emergency procedures would be implemented that will be outlined in the site Emergency Response Plan, which will be developed to support the EMS Framework Document. Generally, water management pond failure emergency response includes raising the alarm and mobilizing equipment and personnel to the area in order to effect repairs and minimize releases. An assessment is then made using on-site staff and possibly external resources (including surface water and environmental specialists) as to what repairs are needed and actions to prevent future incidents. This will be detailed in a Recovery Plan, which will be developed to support the EMS Framework Document. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the repairs and return to work in the area, these are very case specific and often dependent on whether personnel were injured or equipment damaged as a result of the water management pond failure.

A TMF Operation, Maintenance and Surveillance (OMS) Manual and an Emergency Response Plan will be developed to support the EMS Framework Document for the Project and will outline emergency response procedures, trigger levels for monitoring pond levels, and any mitigation measures that may be in place (such as standby pump systems for increased flows, etc.).

6.16.2.4 TMF Dam Failure

The TMF is designed and construction is overseen and approved by qualified professional design engineers (the Design Engineer/Engineer of Record) with specific and extensive experience in designing, constructing, operating, monitoring and maintaining such structures.

The design and location of the TMF has taken into account the following general design requirements:

- situating the TMF away from sensitive environmental features including fish bearing drainages;
- clustering the facilities to minimize the overall footprint;
- staged development of the facility over the life of the Project;
- permanent, secure, and total confinement of all tailings solids within engineered disposal facilities;
- control, collection, and removal of free-draining liquids from the tailings facilities during operations for recycling as process water to the maximum practical extent; and
- release suitable quality supernatant from the pond through an engineered spillway post-closure.

The TMF design process includes extensive geotechnical investigations of foundation materials underlying the footprint of the dam. The Design Engineer/Engineer of Record specifies requirements for removal of weak or unstable materials from the footprint prior to construction of the starter dam in order to ensure foundation stability. As well, the Design Engineer/Engineer of Record specifies and tests the quality of materials for use in dam construction in order to meet the dam design criteria. In addition to the detailed dam design, the Design Engineer/Engineer of Record will undertake a Dam Breach Inundation Study for incorporation into an Emergency Response Plan, which will be developed to support the EMS Framework Document. This will be done in conjunction with development of the TMF Final Design Report which will be completed prior to construction of the TMF. The Design Engineer/Engineer of Record

will also develop the Operation, Monitoring and Surveillance (OMS) Manual which will be completed prior to operation of the TMF. The OMS Manual will outline a schedule for routine inspection and instrumentation monitoring to be developed in conjunction with the mine construction and operation schedule.

The results of the inspection and monitoring program will be used to measure the success of the management strategies and to identify where additional mitigation may be necessary. Monitoring will continue for a period of time after mine closure to confirm that reclamation objectives are being achieved and to identify repair or maintenance requirements. Inspection and monitoring may include:

- visual inspection of embankments, crests, and slopes to check for signs of cracking, settlement, or bulging;
- visual inspection of the TMF embankment toe areas to check for signs of ground heave or seepage;
- installation of piezometers during operation to monitor water pressures in the clay core and foundation;
- installation of surface survey monuments during TMF construction; and
- recording of TMF operating parameters, as required.

Monitoring and responding to any deformation of TMF embankments is critical to maintaining their stability. Instrumentation monitoring will be routinely completed during construction and operations. Measurements during construction will be taken and analyzed on a routine basis to monitor the response of the embankment fill and the foundation from the loading of the embankment fill. Surface monuments will be surveyed at least twice per year during Operations. The OMS Manual will be prepared following initial construction and prior to commissioning of the TMF, and will provide comprehensive operating instructions and monitoring frequencies for the TMF and related facilities.

Volumes of tailings deposited in the TMF will be monitored by reference to the records kept as part of the mine plan. These records will provide a basis for the purpose-designed monitoring of the performance of the TMF, which will also include visually checking the condition of embankment slopes and surface water control structures. The monitoring program will also include pond elevation, bathymetric surveys to determine pond depth and volume, as well as recording of reclaim water rates. A tailings deposition strategy will be implemented to selectively develop tailings beaches along the embankments, thereby producing an extensive low permeability zone that facilitates seepage control and maintains the operational supernatant pond away from the crest of the embankment.

In addition to the instrumentation monitoring described above, the TMF dams would be inspected at least annually by the design geotechnical engineer-of-record. The reviewer would be a Qualified Professional Engineer. Any problem areas identified would be repaired immediately. Independent Dam Safety Reviews (DSR), to further monitor operation, maintenance, surveillance, and performance of the dams during Operations and Closure, will be conducted. DSR frequencies will meet or exceed regulatory requirements.

The TMF dams have been designed to meet Canadian Dam Association (CDA) Dam Safety Guidelines (CDA, 2013; 2014) and to handle the design flood while maintaining a minimum freeboard between the water level and the dam crest. As per the Guidelines, each structure is assigned a “Dam Class”. The TMF dam classification considers the potential incremental consequences of an embankment failure defined as the total adverse effect from an event with dam failure compared to the adverse effect that would have resulted from the same event had the dam not failed. Four areas are evaluated under the conditions; potential impacts to downstream populations, potential loss of life, potential loss of environmental or cultural values, and potential infrastructure or economic losses. The Dam Class determines the minimum target levels for Inflow Design Flood (IDF) and Earthquake Design Ground Motion (EDGM) for the design of the dam structure and water management systems.

Based on an assessment of the consequences of a dam failure, which was based on a worst-case scenario predictive model, the hazard consequence classification, the TMF embankments have been assigned a dam classification of **HIGH**.

The following design flood and earthquake levels were adopted from the CDA guidelines (CDA, 2013 & 2014) for a **HIGH** dam hazard classification for the construction and operations phases of the Project:

- IDF: 1/3 between the 1/1,000 year return period event and the Probable Maximum Flood (PMF), and
- EDGM: the 1/2,475 year return period seismic event.

For a **HIGH** dam classification during the passive care phase (i.e., post-closure), CDA guidelines recommend that the TMF be designed to withstand the following seismic and precipitation events.

- IDF: 2/3 between the 1/1,000 year return period event and the PMF, and
- EDGM: 1/2 between the 1/2,475 year and the 1/10,000 year (or MCE) return period seismic events.

The IDF is the most severe inflow flood (peak, volume, shape, duration, timing) for which a dam and its associated facilities are designed (CDA 2014). The IDF is used to determine spillway and freeboard requirements, while the EDGM is used to confirm the stability of the design TMF embankments under seismic loading conditions. Based on the High dam hazard consequence classification and the applied design criteria, the design incorporates increased conservatism to reduce the likelihood of failure.

As per the CDA requirement for a High hazard classification, the IDF should be 1/3 between the 1:1000 year event and the Probable Maximum Flood (PMF). The PMF is a flood that results from a precipitation event known as the Probable Maximum Precipitation (PMP). The PMP is defined as the most extreme precipitation event physically possible in the area.

These design floods and the criteria upon which they are based are reviewed and revised as appropriate to reflect and incorporate predicted effects of climate change.

A detailed ERP specific to the TMF will be developed in conjunction with development of the OMS Manual prior to commissioning of the TMF The OMS manual and the ERP will be aligned, to ensure there are no functional gaps between normal operations and emergency response, and that procedures are in place to transition from normal conditions to an emergency situation that may arise. Carrying out operations, maintenance, and surveillance activities as outlined in the OMS Manual will help to minimize the potential for an emergency at the TMF. Personnel involved in operations, maintenance, and surveillance at the TMF will be familiarized with the ERP.

Major storm events or unforeseen operational circumstances may still result in an emergency related to the TMF. The ERP for the site discusses in detail the definition of various levels of emergency situations and response. The ERP outlines the triggers associated with specific emergencies related to the overall mine site and specifically to TMF operations.

The ERP will:

- Identify possible emergency situations that could occur during the initial construction, operations and ongoing construction, closure, and post-closure phases of the life cycle of a tailings facility, and which could pose a risk to populations, infrastructure, and the environment; and
- Describe measures to respond to emergency situations and to prevent and mitigate on and off site environmental and safety impacts associated with emergency situations.

Examples of possible emergencies addressed in ERP include:

- structural failures of the facility;
- rising water levels within the facility;
- cracking of a dam;
- a sudden loss of environmental containment of the facility; and
- or other events typically linked to the loss of one or more critical controls that present a risk to the facility.

In the event of upset conditions related to failure of the TMF embankment, an on-site staff member tasked with the responsibility of coordinating the Emergency Response Plan, which will be developed to support the EMS Framework Document, would launch an investigation of the incident and the following emergency response approach will be initiated:

- ensure the safety of the employees, site personnel, and the public;
- notify the appropriate stakeholders, including government agencies and any nearby communities or landowners; and
- mobilize the necessary equipment and crews to contain and clean up the incident and rehabilitate the site to protect the environment.

A site-wide communication system (including access roads) will ensure rapid notification of dam failure. The site will have a trained Emergency Response Team with resources to contain and recover spills, or to reduce the size of a spill if complete containment and recovery is not possible. Following a dam failure incident, a program would be implemented to monitor any residual effects in the freshwater environment, including water quality, sediment quality, aquatic resources, fish, and fish habitat.

6.16.2.5 Infrastructure Failure

Infrastructure at the FMS Mine Site will be designed and constructed in accordance with good engineering practice and applicable building codes. Given the relatively short life of the Project, failure would not be expected to occur without being acted upon by extreme natural causes, such as a hurricane or earthquake, or human error. Experienced and certified trained personnel will be employed at the site to operate and maintained equipment and infrastructure. All personnel will receive an appropriate level of training in respect of their operating area and responsibilities,

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

A Health and Safety Plan, which will be developed to support the EMS Framework Document, will be developed and implemented for the FMS Mine Site, which will include evacuation procedures, proper housekeeping procedures for the storage and use of small equipment, and materials.

6.16.3 Accidents

6.16.3.1 Fuel and/or Other Spills

The source of greatest risk for potential spills, and releases of diesel fuel, relates to accidents or malfunctions in the execution of procedures for transportation, transfer and handling to and from stationary and mobile tankage. Sources of potential spills, and releases of diesel fuel, relate to equipment failures, damage to storage or piping systems, mobile equipment accidents, and mobile refueling truck accidents. Releases of maintenance fluids pose a lesser risk in terms of magnitude, but can still occur due to equipment failures, damage to storage containers, and mobile equipment accidents. A release of these fluids may result in soil, groundwater, and/or surface water contamination that may adversely ecological receptors through absorption, and/or ingestion of contaminated media.

The contract for transportation and delivery of diesel fuel will be awarded to a reputable third party licensed commercial fuel supply company. All fuel delivery drivers will have proper certification and training in fuel transport in compliance with Transportation of Dangerous Goods (TDG) and Workplace Hazardous Materials Information System (WHMIS) legislation. Fuel suppliers will be required to provide proper documentation supporting their authority to transport fuel and present their procedures and measures to minimize the risk of and to respond to the accidental release of fuel. Transport emergency spill response procedures and mitigation measures will include such things as vehicle speed limitations, vehicle communication capabilities, vehicle GPS locators and/or emergency beacons, and vehicle spill kits.

The Proponent will take possession of the fuel once it has been transferred to the bulk storage tank. As a result, fuel delivery will be the contractor's responsibility up to that point. All fuel deliveries will be supervised by a Proponent employee. A preliminary Petroleum Management Plan has been developed to support the EMS Framework Document and will govern the storage and dispensing of fuel products on the site.

Preventative procedures will be undertaken and fuel storage and transfer areas will be designed to accommodate these procedures, such as limiting areas of fuel transfer. Staff will be trained in spill response measures and spill response kits will be accessible in areas of fuel transfer. The contingency measures developed as part of the Spill Contingency Plan, which has been developed to support the EMS Framework Document, focus on areas of high ecological importance and areas used by the Mi'kmaq of Nova Scotia and will provide a plan on how such areas could/would be protected in the event of a spill.

If a spill were to occur, emergency procedures would be implemented that will be outlined in the site Spill Contingency Plan, which was developed to support the EMS Framework Document. Generally, spill response includes raising the alarm, evacuation of all equipment and personnel from the area and possibly the area down wind, away from any vapour cloud, and establishment of a 500-1000 m radius exclusion zone from the spill location. An assessment is then made using on-site staff and possibly external resources (air quality specialists) to determine the type, quantity and source of the spill and whether Emergency Services are required. If required, Emergency Services will be contacted. The safety data sheet for the spilled material will be reviewed and will be made available to Emergency Services. A plan to contain and clean up the spill, as well as actions to prevent future incidents, will be detailed in a Recovery Plan, which will be developed to support the EMS Framework Document. If it is safe to do so, the spill source will be shut down and any ignition sources will be isolated. Barriers and signs to prevent access to the affected area may be required until the spill is completely contained and cleaned up. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the cleanup and return to work in the area, these are very case specific and often dependent on whether personnel were injured or equipment damaged as a result of the spill.

6.16.3.2 Unplanned Explosive Event

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 ERP. Generally, unplanned explosive event response includes raising the alarm and evacuation of all equipment and personnel from the area. No attempt to approach or extinguish any fire should be made. An assessment is then made using on-site staff to determine whether Emergency Services are required. If required, Emergency Services will be contacted. 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. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the clean-up and return to work in the area, these are very case specific and often dependent on whether personnel were injured or equipment damaged as a result of the unplanned explosive event.

6.16.3.3 Mobile Equipment Accident

The majority of mobile equipment traffic will be limited to the FMS Mine Site where restricted traffic patterns, speed limits, right-of-way signage, and training will minimize the risk of vehicular accidents. All highway haul truck operators will receive operator training to minimize the risk of haul truck collisions. Highway haul trucks will be remotely tracked and monitored. 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.

An ERP will be developed for the Project and will include procedures to be followed in the event of a mobile equipment accident. The legislation is well established and understood by the Proponent's staff and will be conveyed to any contractors at the site so that all know of actions to take and reporting requirements.

If a mobile equipment accident were to occur, emergency procedures would be implemented that will be outlined in the site Spill Contingency Plan, which has been developed to support the EMS Framework Document. Generally, mobile equipment accident response includes raising the alarm, providing first aid to any injured persons, and securing all equipment in the area. An assessment is then made using on-site staff to determine whether Emergency Services are required and the cause of the accident. If required, Emergency Services will be contacted. A plan to determine what repairs are needed and actions to prevent future incidents will be detailed in a Recovery Plan, which will be developed to support the EMS Framework Document. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the cleanup and return to work in the area, these are very case specific and often dependent on whether personnel were injured or equipment damaged as a result of the mobile equipment accident.

6.16.3.4 Tailings and Reclaim Water Pipelines Spills

The sections of the tailings and reclaim pipelines between the plant site and the TMF and open pit will run in 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 the FMS Mine Site will continue to be mitigated through the application of environmental management plans, operating procedures and monitoring programs, including the OMS Manual and ERP.

Given the location of the pipelines, trench and catchment pond within the FMS mine production area and near to process 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 pipeline spill were to occur, emergency procedures would be implemented that will be outlined in the site ERP. 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 neighboring 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. An assessment is then made using on-site staff and possibly external resources (surface water specialists) as to what repairs are needed and actions to prevent future incidents. This will be detailed in a Recovery Plan, which will be developed to support the EMS Framework Document. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the repairs and return to work in the area, these are very case specific and often dependent on whether personnel were injured or equipment damaged as a result of tailings and/or reclaim water pipelines spill.

6.16.3.5 Touquoy Mine Site - Cyanide Release

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. The cyanide storage area is isolated from the remainder of the mill and the fire water suppression system, and first responders have been apprised of the need for the use of an alkali powder quenching agent as opposed to water or CO_2 due to off gas potential. 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.

A detailed ERP has been developed of the Touquoy Mine Site. If cyanide exposure were to occur, emergency procedures would be implemented that will be outlined in the site Emergency Response Plan, which will be developed to support the EMS Framework Document. Generally, cyanide exposure response includes raising the alarm, contacting Emergency Services, evacuation of all personnel from the area to fresh air, removal of contaminated clothing, washing of cyanide residue from affecter personnel, administering oxygen, and securing the area. A plan to determine what repairs are needed and actions to prevent future incidents will be detailed in a Recovery Plan, which will be developed to support the EMS Framework Document. Depending on the regulator involvement there may be a requirement to file incident reports with certain regulatory agencies prior to initiating the cleanup and return to work in the area, these are very case specific and often dependent on whether personnel were injured as a result of the cyanide exposure.

6.16.4 Other Malfunctions

6.16.4.1 Forest and/or Site Fires

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 FMS 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 can be fitted with a pump and 2.5 inch hydrant hose reel for firefighting if needed. Supplementary handheld fire extinguishers, each suitable for its specific area, will be mounted in all buildings and vehicles. The site will have firefighting 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. The ERP for the FMS Mine Site will include fire response.

The site will be staffed to varying levels 24 hours a day with personnel in all areas of the FMS 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.

If a forest fire were to occur, emergency procedures would be implemented that will be outlined in the site ERP. Generally, forest fire response includes raising the alarm and evacuation of all personnel from the area. If required, Emergency Services will be contacted.

6.16.5 Mitigation

Accidents and malfunctions refer to events that are contrary to the design, and not part of any planned activity or normal operation of the Project, as has been proposed by the Proponent. Many accidents and malfunctions are preventable, and their likelihood and consequences are minimized during planning and design, and by developing thorough emergency response procedures and ensuring mitigation measures are incorporated into standard operating procedures. However, even with the implementation of best management practices and preventative measures, accidents and malfunctions still have the potential to occur and create adverse effects to the environment and worker health and safety.

Preventative and responsive procedures will be developed via the following principles:

- best management practices and proven technologies will be utilized to undertake the Project and all planned releases to the environment and their effects will be properly managed;
- worker health and safety will be the central focus of process and mine safety management;
- develop and apply procedures and training that will aim to promote safe operation of mining equipment and facilities; and
- develop and implement emergency response procedures that will reduce and control the adverse effects of an accident or malfunction.

The Project will be designed to implement preventative and mitigation procedures throughout its entire life that will minimize the potential for accidents and malfunctions to occur. Should those accidents or malfunctions occur, emergency response procedures

would be implemented to reduce or control the resulting adverse effects. Table 6.16-2 describes proposed mitigation measures relating to accidents and malfunctions.

Table 6.16-2: Mitigation for Accidents and Malfunctions

Potential Accident or Malfunction	Mitigation Measures
Open Pit Mine Slope Failure	Ensure that pit slope design, construction and monitoring follow applicable regulations and recommendations provided by a qualified geotechnical professional
Stockpile Slope Failure	Ensure that stockpile design, construction and monitoring follow applicable regulations and recommendations provided by a qualified geotechnical professional
Water Management Pond Failure	Ensure that the water management ponds are designed by a qualified professional and lined with suitable materials, such as clay or a geosynthetic liner
TMF Dam Failure	Ensure that TMF designed, and construction is overseen and approved by qualified design engineers (the Design Engineers/Engineer of Record) A tailings deposition strategy will be implemented to selectively develop tailings beaches along the embankments, thereby producing an extensive low permeability zone that facilitates seepage control and maintains the operational supernatant pond away from the crest of the embankment
Infrastructure Failure	Ensure that infrastructure is designed following applicable regulations and recommendations provided by a qualified professional
Fuel and/or other spills	All fuel delivery suppliers and their personnel will have proper certification and training in fuel transport and delivery in compliance with applicable regulatory requirements Onsite storage and dispensing of fuel products will be conducted in accordance with applicable regulatory requirements and adhere to the Petroleum Management Plan and related site-specific procedures Staff will be trained in spill response measures. Spill response kits will be accessible and dedicated in areas of fuel storage and transfer
Mobile Equipment Accident	The FMS Mine Site will have restricted traffic patterns, speed limits, right-of-way signage and training that will minimize the risk of mobile equipment accidents Highway haul trucks will be remotely tracked and monitored Communications will be maintained between vehicles using radios to minimize adverse interactions and ensure prompt response to any incident
Tailings and Reclaim Water Pipelines Spills	The tailings and reclaim pipelines between the plant site, TMF and open pit will be designed and constructed to minimize the potential for release Measures may include double walled tailings pipes, lined service trenches and adequately sized, lined, collection pond capable of containing the volume of the pipeline. The catchment pond would be lined with suitable materials, such as clay or a geosynthetic liner
Cyanide Release (Touquoy Mine Site)	Cyanide is transported stored and handled in accordance with applicable regulatory requirements and the International Cyanide Management Code Cyanide is stored and handled inside the plant footprint within a restricted area that has adequate impermeable containment

Table 16.6-2: Mitigation for Accidents and Malfunctions (continued)

Potential Accident or Malfunction	Mitigation Measures
Forest and/or Site Fires	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 buildings and key areas of the FMS Mine Site
General Commitment	Development of the Environmental Management System (EMS) and all associated management and monitoring plans

6.16.6 Risk Assessment

Each potential accident and malfunction identified was assessed considering the likelihood of occurrence and the magnitude of the consequences should these accidents and malfunctions occur. The likelihood of occurrence is given a score of 1 to 5 with an associated rating as defined below:

1. **Negligible:** accident or malfunction not likely to occur with a less than 1 in 10,000 probability of occurrence per year;
2. **Low:** accident or malfunction unlikely to occur with a less than 1 in 1,000 probability of occurrence per year;
3. **Moderate:** accident or malfunction has potential to occur with a less than 1 in 100 probability of occurrence per year;
4. **High:** accident or malfunction may occur with a less than 1 in 10 probability of occurrence per year; and
5. **Extreme:** accident or malfunction is likely to occur with a greater than 1 in 10 probability of occurrence per year.

The magnitude of the consequences should these accidents and malfunctions occur is also given a score of 1 to 5 with an associated rating as defined below:

1. **Negligible**
    - preventative requirements are minimal;
    - no long-term effects are expected; and
    - readily remediated with funds in the $0 to $10,000 range;
2. **Low**
    - preventative requirements are minimal;
    - limited long-term effects are expected; and
    - limited remediation required with funds in the $10,000 to $100,000 range;

3. **Moderate**
    - preventative requirements are moderate;
    - moderate long-term effects are expected; and
    - moderate remediation required with funds in the $100,000 to $1,000,000 range;
4. **High**
    - preventative requirements are high;
    - significant long-term effects are expected; and
    - significant remediation required with funds in the $1,000,000 to $10,000,000 range;
5. **Extreme**
    - Preventative requirements are very high;
    - permanent effects are expected; and
    - highly significant remediation required with funds in the $10,000,000 plus range.

Each potential accident and malfunction was assigned a likelihood rating and consequence rating based on the definitions provided above, activities associated with the Project, and the professional knowledge and judgment of the Project Team. The two ratings are multiplied and plotted on a Risk Rating Matrix to obtain a risk rating for each accident and malfunction. Risk ratings can range from 1 to 25 – an accident and malfunction having a rating of 1 presents a negligible risk, while an accident and malfunction having a rating of 25 presents an extreme risk. The level of risk associated with an accident or malfunction is proportionally related to its likelihood of occurrence and the magnitude of effects it may cause. Potential accidents and malfunctions assigned a risk rating of 1 to 5 are considered low risk, those assigned a risk rating of 6 to 15 are considered moderate risk, and those assigned a risk rating of 16 to 25 are considered high risk. If an accident or malfunction is assigned a risk rating of 16 or higher, it would be considered significant and would require further consideration during the Project's detailed design phase.

Table 6.16-3 provides the breakdown of ratings used to obtain the risk rating for each accident and malfunction, as well as summarizes the key VCs that would likely be affected.

The results of this qualitative analysis indicate that all identified potential accidents and malfunctions have a low or moderate risk rating and are therefore considered not significant from the perspective of requiring further design consideration or modification.

A mobile equipment accident and fuel and/or other spill are considered the riskiest with a combined likelihood and consequence rating of 8; A catastrophic tailings dam failure clearly has the most extreme consequences with a maximum rating of 5; however, with proper engineering design and construction and applied preventative mitigation measures, the likelihood of such a failure is negligible with a minimum rating of 1, resulting in a combined likelihood and consequence rating of 5 or low risk.

Table 6.16-3: Characterization Criteria for Risk Rating Matrix

Accident/ Malfunction	Worst-case Scenario (Potential Consequences)	Key VC(s) Potentially Affected	Likelihood Rating	Magnitude Rating	Risk Rating 1 = Minimum 25 = Maximum
Open Pit Mine Slope Failure	Mine wall failure affecting the FMS Mine Site's mine equipment and infrastructure, Haul Roads and worker safety.	• Socio-economic Conditions	2	4	8
Stockpile Slope Failure	Potential for till, topsoil, mine rock and low-grade ore to enter nearby watercourses, damage to infrastructure and to worker safety.	• Socio-economic Conditions • Surface Water Quality and Quantity • Fish and Fish Habitat	2	4	8
Water Management Pond Failure	Uncontrolled discharge of sediment laden water into the surrounding environment.	• Surface Water Quality and Quantity • Wetlands • Fish and Fish Habitat • Species of Conservation Interest/Species at Risk	2	3	6

Table 6.16-3: Characterization Criteria for Risk Rating Matrix (continued)

Accident/ Malfunction	Worst-case Scenario (Potential Consequences)	Key VC(s) Potentially Affected	Likelihood Rating	Magnitude Rating	Risk Rating 1 = Minimum 25 = Maximum
TMF Dam Failure	Catastrophic failure of tailings dam and release of stored tailings solids and water to the surrounding environment.	• Geology, Soils, and Sediment • Groundwater Quality and Quantity • Habitat and Flora • Wetlands • Surface Water Quality and Quantity • Fish and Fish Habitat • Avifauna • Terrestrial Fauna • Species of Conservation Interest/Species at Risk • Mi'kmaq of Nova Scotia • Physical and Cultural Heritage • Socio-economic Conditions	1	5	5
Infrastructure Failure	Failure of multiple operational components as a result of a natural cause impacting worker health and safety and surrounding environment.	• Socio-economic Conditions	1	3	3

Table 6.16-3: Characterization Criteria for Risk Rating Matrix (continued)

Accident/ Malfunction	Worst-case Scenario (Potential Consequences)	Key VC(s) Potentially Affected	Likelihood Rating	Magnitude Rating	Risk Rating 1 = Minimum 25 = Maximum
Fuel and/or Other Spills	Transportation collision causing the entire amount of fuel or hazardous material being transported to be spilled into a water body	• Geology, Soils, and Sediment • 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	2	4	8
Unplanned Explosive Event	Bodily harm and infrastructure damage as a result of improperly handling explosives.	• Socio-economic Conditions	1	4	4
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	2	4	8
Tailings/Reclaim Water Pipeline Spill	Uncontrolled discharge of tailings and/or contaminated water into the surrounding environment.	• Surface Water Quality and Quantity • Fish and Fish Habitat	2	3	6

Table 6.16-3: Characterization Criteria for Risk Rating Matrix (continued)

Accident/ Malfunction	Worst-case Scenario (Potential Consequences)	Key VC(s) Potentially Affected	Likelihood Rating	Magnitude Rating	Risk Rating 1 = Minimum 25 = Maximum
Cyanide Release	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.	• Air • Surface Water Quality and Quantity • Fish and Fish Habitat • Avifauna • Terrestrial Fauna • Species of Conservation Interest/Species at Risk • Socio-economic Conditions	1	5	5
Forest and/or Site Fire	An extreme fire that results in worker injury or death and causes significant damage to the environment.	• Habitat and Flora • Avifauna • Terrestrial Fauna • Species of Conservation Interest/Species at Risk • Socio-economic Conditions	2	5	10

7.0 Effects of the Environment on the Project

7.1 Environmental Considerations

The effects of the environment on the Project must also be considered as part of the EIS. This includes how local conditions, natural hazards, climate change and external events could affect the Project. Additionally, it is important to consider how the effects of these local conditions, natural hazards, and external events on the Project may in turn affect the environment, such as accidents or malfunctions occurring on the Project site.

The natural environment has the ability to potentially adversely impact the Project through events which may include the following:

- flooding;
- drought;
- extreme temperatures;
- Severe weather events, including snow, ice, rain, and windstorms;
- lightning strikes;
- landslides, erosion, or subsidence;
- fire; and
- seismic events.

Infrastructure will be designed to accommodate the conditions imposed by the natural environment and to accommodate the effects of external events on the Project, as much as possible.

7.1.1 Flood and Drought Conditions

Flooding or drought conditions may occur during the lifespan of the Project. These events can generally be accommodated in the Project design and construction. The mean annual precipitation (MAP) estimate for the Project area is equivalent to 1,440 mm with mean monthly values ranging from a low of 93 mm in July to a high of 164 mm in December. Based on the Halifax Airport station, 83% of the precipitation falls as rain, and the remaining 17% falls as snow annually.

Although extreme precipitation events may occur at any time during the year, rainfall in the Project area is generally highest during autumn months. The 24 hour extreme precipitation , 100 year, 200 year, and PMP values for the Project area are estimated to be 168 mm, 184 mm, and 531 mm, respectively (Knight Piesold Ltd 2018). The 1 in 200 year wet annual precipitation value is estimated to be 1,962 mm, and the 1 in 200 year dry annual precipitation is estimated to be 918 mm.

The effects of a drought or flood on the Project may include increased dust and decreased availability of water for site operations or an excess of water on the mine site. Potable water will be brought to the site and therefore a reduction in the availability of potable groundwater is not anticipated to be an adverse effect. Water from the settling ponds could be re-used during times of potential drought for dust suppression purposes, as required, and only if water quality in the ponds meets appropriate regulatory guidelines. The final design of the water management ponds, seepage collection ponds, and any additional required water management measures will be submitted as part of the IA process.

Water management ponds and associated water management structures will typically be designed to accommodate a 1-in-10 year, 24 hr storm event (approximately 116 mm) plus direct precipitation from a 1-in-200 year, 24-hr storm event (approximately 184 mm) falling directly on the surface of the pond. Water management infrastructure has been sized to pump back collected flows to the TMF supernatant pond over a 10-day drawdown period. Storm events and their design factors are adjusted as appropriate to reflect the predicted effects of climate change. Overflow weirs will be constructed in water management pond embankments to facilitate safe discharge of flows exceeding the design flows of the pond, up to the IDF for the ponds. The IDF for each pond will be estimated based on dam classification of the retaining embankments for the ponds, and will be greater than or equal to a 1-in-100 year return period storm event. The dam classification for the seepage collection pond dams will be evaluated as part of the IA process. In the case of a storm event water management ponds will be monitored regularly.

7.1.2 Extreme Temperatures, Storms, and Wind

Air temperatures vary seasonally. As stated above, the mean annual temperature is estimated to be 6.5°C, with minimum and maximum mean monthly temperatures of -5.8°C and 18.7°C occurring in January and July, respectively (Knight Piesold Ltd 2018). The Project will be designed to accommodate these temperature ranges.

Extreme temperatures and storms (ice, snow) could cause damage to site infrastructure or could directly impact site workers. A Health and Safety Plan, which will be developed to support the EMS Framework Document, will be implemented to ensure worker safety during extreme temperature events and storm events.

The estimated mean annual wind speed is approximately 4.6 m/s, with the wind direction being predominantly from the northwest in the winter and from the south in the summer. Maximum hourly wind speeds can range from 17.8 m/s in May to 25.8 m/s in November. (Knight Piesold Ltd 2018). The Project will be designed to accommodate these wind speed ranges.

7.1.3 Climate Change

Climate change is anticipated to cause an increase in frequency and intensity of extreme weather events, warmer average temperatures, higher sea levels, and more extreme rainfall and flooding events (DeRomilly and DeRomilly Limited et al. 2005). More frequent and intense extreme weather events could cause an increased risk of flooding and snow and ice storms. Increased flood events would also increase the risk of erosion. Existing infrastructure in Canada was generally not intended to withstand the more extreme and frequent storms that may be experienced in coming years; however, new construction, such as the construction of the Project is designed taking changing weather patterns and extreme events into consideration. In particular, Nova Scotia Environment's *Guide to Considering Climate Change in Environmental Assessments in Nova Scotia* states the importance of environmental assessments as planning tools for the consideration of climate change into project planning, development, operation and decommission (NSE, 2011c).

To prepare for adaption to climate change, the NSE Climate Change Unit has published scenarios of possible future climate for 13 regions within Nova Scotia. For each region, historical climate data (1961-1990) and future projections generated using the statistical downscaling method are available. Climate data provided in future projections includes minimum and maximum temperatures, precipitation, extreme precipitation and growing season length. Although advancements in climate modelling projections have occurred over the last decade, the results are not meant to be interpreted as absolutes, but rather used as guidance in the design and planning stages to facilitate climate change adaptation (W. Richards Climate Consulting, 2011). The closest of the 13 regions to the Project is the HRM. Future projections are provided for 2020s, 2050s and 2080s. Since the duration for the project is relatively short, approximately 11 years including reclamation (excluding ongoing monitoring) the future climate projections for the 2020s were used for the assessment of the effects of climate change on the Project.

Key potential effects of climate change that could impact the Project include:

- Increasing frequency of unusually high or low daily temperature extremes.
- Long-term increasing or decreasing mean annual temperatures and/or precipitation.
- Increasing or decreasing frequency of storm events (e.g., rainfall, snowfall, extreme wind).

Although the Project is relatively short in duration (approximately 11 years including reclamation and not including ongoing monitoring) and therefore the effects of climate change on the Project will likely be insignificant, climate change was still considered for each phase of the Project: site preparation; operation and maintenance; and decommissioning and reclamation. Details relating to this analysis were completed by KP and appended to the full EIS (Knight Piesold Ltd 2018).

The KP report summarizes the following conclusions relating to climate change:

- Based on the available regional climate data, it is not possible to make strong conclusions about future climatic conditions. There appears to be a general trend towards slightly warmer temperatures, while precipitation trends are less apparent, as they are increasing at some stations, but decreasing at others.
- Based on the available regional hydrologic data, it is not possible to make strong conclusions about future streamflow conditions. There is no strong indication on whether mean annual discharge and annual peak flows are increasing or decreasing.
- The available climate change models predict increased storm intensity in the Project area, which suggests annual peak flows may also increase.
- It is recommended that peak design flows are increased by 15% for structures with a design life longer than 30 years.
    - Both the TMF and Seloam Brook Realignment have been designed with considerations for a 15% increase in peak design flows.

Since the limited duration of the Project on a whole indicates that warming air temperatures will not affect the Project, and as the FMS Mine Site will be primarily cleared land, the potential for forest fires is considered to be low.

In order to minimize or offset the effects of the Project on climate change, in particular to reduce the GHG emissions associated with the construction, operation and reclamation of the mine, mitigation measures will be implemented. The federal guidance document *Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners* defines mitigation measures as "Measures to eliminate, reduce or control the adverse environmental effects of a project, including restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means" (CCCEAC, 2003, Page 23). Mitigation measures include actions such as utilizing different technologies and construction materials. Impact Management Measures and BMPs to reduce the Project's effect on the environment will be determined and implemented at the onset of each stage of the Project. Possible BMP/ Mitigation measures include:

- Implement and enforce an anti-idling policy for all vehicles and machinery on-site during the construction stage and operation stage;
- Try to utilize materials that have a lower carbon footprint and a long lifespan; and
- Replace and plant additional native vegetation to create a carbon sink.

Climate change adaptation is focused on addressing effects of climate change on the Project. The federal guide defines adaptation as an "Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (CCCEAC, 2003, Page 23). Although it was determined that climate change will have no significant adverse effects on the Project due to the relatively short duration of the Project, the identification of possible adaptation measures was undertaken to increase both Project and ecosystem resilience to climate change.

Adaptation measures that will be aimed at strengthening and increasing the resilience of the Project include:

- Designing comprehensive water management measures;
- Choosing vegetation known to withstand erosion and climatic stressors such as extreme heat, drought tolerance, and flood resistance; and
- Planting additional vegetation as required.

The above is by no means a comprehensive list of the additional adaption measures that will be considered. The development of BMP's implemented at the mine will be prepared in a way that they can flexible enough to adapt to a changing climate.

7.1.4 Slope Stability

All phases of the Project have the potential for slope failures within the footprint of the open pit, the TMF, and the topsoil, till, organics, and waste rock stockpiles. All of these slopes will be designed at an angle determined by geotechnical analysis and acceptable safety factors. However, in the event of an extreme weather event or seismic event, slope failure may be possible.

Features constructed from site materials such as waste rock stockpiles and overburden stockpiles will use the FMS Mine Site's geotechnical data for final design to produce features with appropriate safety factors to reduce the possibility of landslides, slope erosion and subsidence. With multiple-stockpiles, it is common for minor subsidence to occur in the short-term creating a landscape that is varied in topography. This approach aligns with NSL&F reclamation objectives for surfaces that are not uniform but that offer safe long-term landscapes with a variety of features.

7.1.5 Seismic Events

Although seismic activity is unpredictable, the Province of Nova Scotia as a whole is located in a next-to-lowest hazard zone, with moderate to high-hazard zones located offshore in the southern Bay of Fundy and along the Laurentian Slope (NRCAN 2015).

A seismic hazard analysis conducted for the Project recommended specific design parameters for the TMF and other structures using the National Building Code of Canada (2015) specifications (Knight Piesold Ltd 2018).

Site specific seismic ground motion parameters were determined for the Project site using the probabilistic seismic hazard database of Natural Resources Canada (NRC). The results included the peak horizontal ground accelerations (PGAs) and spectral accelerations for earthquake events having return periods from 100 years to 2,475 years (the maximum return period provided by NRC). The PGA for a return period of 475 years is only 0.023 g, indicating the project is located in a region of low seismic hazard (Knight Piesold Ltd 2018). A site-specific probabilistic seismic hazard analysis was undertaken to provide seismic parameters for return periods of up to 10,000 years. Based on this analysis, an earthquake magnitude of 7.25 was recommended for seismic design studies of site infrastructure (Knight Piesold Ltd 2018).

If an earthquake were to occur, the Project may experience slight infrastructure damage caused by ground vibrations and secondary impacts such as fires from spilled materials or broken natural gas conduits. The Project is sufficiently far inland to remain unaffected by potential tsunamis. Given that Nova Scotia is located in a low earthquake hazard zone, the potential risk of seismic activity affecting the Project is very low.

Site infrastructure will be built to National Building Code of Canada standards to aid in mitigating damage to infrastructure or injury to site workers in the event of an earthquake in the Project area.

7.2 Mitigation Measures

The Project will be designed to use commonly utilized infrastructure that will be designed to consider extreme weather events. Climate change is not anticipated to have a significant effect on the Project, based on the relatively short duration of the Project and on the climatic scenarios and events outlined above.

The following mitigation measures (Table 7.2-1) will be applied to reduce the potential effects of the environment on the Project:

- Project design will consider potential flood or drought conditions to minimize the impacts of these events on mine infrastructure.
- Project design will accommodate temperature extremes, storms, and wind speed ranges identified for the Project area.
- Structures with a life span longer than 30 years (TMF and Seloam Brook Realignment) have been designed with a 15% climate change factor applied to peak flow estimates in order to account for potential future increases in storm intensity as a result of climate change.
- Project design will follow industry standards, including the National Building Code of Canada, to prevent damage to equipment or injury to site workers.
- Topsoil, till, and waste rock stockpiles will be designed with slopes designed at an angle determined by geotechnical analysis and acceptable safety factors. Stockpiles will be constructed using collected geological data for final design and reduce the possibility of landslides, slope erosion, and subsidence.
- An Emergency Response Plan, which will be developed to support the EMS Framework Document, will be implemented for the FMS Mine Site and will consider measures that may be required during an extreme weather event to secure site infrastructure, mobile equipment, stockpiles, fuel storage, and electrical equipment.
- A Health and Safety Plan, which will be developed to support the EMS Framework Document, will be implemented for the FMS Mine Site and will consider measures that may be required during an extreme weather or temperature event, flood or drought, or storm event.

Table 7.2-1: Mitigation for Effects of the Environment on the Project

Project Phase	Mitigation Measures
C	Project design will follow industry standards, including the National Building Code of Canada
C,O	Project design to consider extreme weather events, temperature extremes, wind speed ranges, flood or drought conditions, lightning strikes
C, O, CL	Minimize the potential for slope failure
C, O, CL	Stockpile design will consider collected geological data and will be designed with slopes at the angle determined by geotechnical analysis and acceptable safety factors
C, O, CL	A Health and Safety Plan will be developed and implemented in accordance with the EMS Framework Document to protect worker health and safety
C, O, CL	An Emergency Response Plan will be developed and implemented in accordance with the EMS Framework Document

Note: C = Construction Phase, O = Opewrations Phase, CL = Closure Phase

7.3 Residual Effects

There are no significant adverse environmental effects anticipated due to the environment once mitigation measures are applied. Potential effects of the environment on the Project will be reduced as much as practicable through proper design and planning and mitigation measures outlined above. Extreme weather events cannot be predicted, but through proper design and planning the majority of the effects of these events on the Project may be minimized.

8.0 Cumulative Effects

Section 19(1)(a) of the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) requires that an EA of a designated project take into account any cumulative environmental effects that are likely to result from the designated project in combination with the environmental effects of other physical activities that have been or will be carried out. The Cumulative Effects Assessment (CEA) was carried out to meet the general requirements of the *CEAA 2012*, as well as the specific requirements laid out in the *Guidelines for the Preparation of an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012* and *Nova Scotia Registration Document pursuant to the Nova Scotia Environment Act – Fifteen Mile Stream Gold Project – Atlantic Mining NS Corp* (EIS Guidelines, 2018).

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

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

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

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

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

- The cumulative effects to Noise, Air and Light are considered to be adverse but not significant. The primary pathway for cumulative effects for these VCs is through increased traffic along the Beaver Dam Haul Road. Logging trucks, and traffic from both the FMS and Cochrane Hill Projects will account for approximately 11.6% of the total proposed traffic rates. This is not expected to result in a significant cumulative effect to any of these three VCs.

- The primary pathway for cumulative effects regarding surface water quantity and quality is through the addition of the Project, the proposed expansion of the Touquoy pit and subsequent disposal of Touquoy tailings in the exhausted pit, the Beaver Dam Mine Project and Cochrane Hill Gold Project to the processing and waste disposal facilities at the Touquoy Mine Site. The cumulative effects of these combined projects on the receiving environments are considered to be adverse, but not significant, provided all mitigation measures are implemented.

- Cumulative effects to fish and fish habitat can occur directly (through direct loss of fish habitat, for instance), or indirectly through effects of projects on water quantity and quality. No significant cumulative effects to surface water quantity and quality is expected. Timber harvesting is a predominant land use within the fish and fish habitat RAA. It is expected that timber harvesting be carried out under the Wildlife and Watercourse Protection Regulations, reducing the potential cumulative effect on fish and fish habitat. Therefore, the primary pathway for cumulative effects to fish and fish habitat is through direct fish habitat loss. The FMS Project will result in approximately 8.05 ha of direct loss of fish habitat to allow for construction of the Open Pit and associated infrastructure. The Project is expected to result in an additional 1.28 ha of indirect impact to fish habitat based on erosion and sedimentation downstream of the Seloam Brook Realignment, and due to flow reduction in local catchment areas. The presence of the East River Sheet Harbour Hydro Facility, in a sense, negates the cumulative effect of the Project on fish and fish habitat. This long history of barriers to fish passage has diminished the productive capacity and fish habitat quality of this area for anadromous fish for decades. As such, the potential for adverse significant effects to fish and fish habitat is determined to be low, with required mitigation (Seloam Brook Realignment and downstream fish habitat enhancement) and Fish Offsetting in place.

- Overall, the generalized disturbance of the landscape by forestry activities, past, present and future are the main source of cumulative effects of habitats, flora, terrestrial fauna and birds throughout the area. These cumulative effects also lead to effects on current use of land and resources for traditional purposes by Indigenous peoples and to effects to priority species (SOCI and SAR). The maximum Project edge effect will affect 275 ha of interior forest habitat, which accounts for 0.47% of predicted interior forest in the RAA. There is limited additional development pressures from other projects in the RAA, as demonstrated by the few projects identified within this evaluation with small footprints of disturbance.

- The main pathways for cumulative effects to the Mi'kmaq of Nova Scotia are described as any adverse effect to the health and socioeconomic conditions, physical and cultural heritage, and current use of lands and resources for traditional purposes. Cumulative effects of the Project on the Mi'kmaq of Nova Scotia, considering these three primary pathways, has been assessed as adverse, but not significant. The loss of access to a maximum area of 2,494 ha from all identified projects in the RAA accounts for 0.25% of all land within the RAA, and 0.75% of available crown land within the RAA. The largest regional impact to the landscape appears to be from regional forestry activities based only on aerial photography review. This impact could not be quantified herein due to a lack of publicly available data to support quantitative analysis.

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

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

9.0 Follow-up and Monitoring Programs Proposed

Monitoring commitments for the Project are described in Table 9.0-1 and will be implemented by the Proponent.

Proposed follow-up and monitoring programs have been reviewed with the Mi'kmaq of Nova Scotia during engagement efforts including meetings, sharing of technical documents (Draft EIS, poster boards, Summary of Mi'kmaq Effects and Proposed Mitigation Measures, Plain Language Summary). On-going engagement with the MI'kmaq of Nova Scotia will continue through the EA process and associated permitting relating to follow-up programs and monitoring.

Table 9.0-1: Monitoring Commitments

Valued Component	General Monitoring Commitments	Detailed Monitoring Commitments (if applicable)
Noise	No noise monitoring required, nearest residence is 5 km south of the FMS Mine Site	IA - only required on request by NSE
Air	Frequency and specific details of air monitoring will be confirmed during IA application	Air monitoring at the FMS Mine Site property boundary
Light	No light monitoring required, nearest residence is 5 km south of the FMS Mine Site	IA - only required on request by NSE
Geology, Soils, and Sediment	Construction techniques, erosion and sediment control measures, and a sediment monitoring program for the receiving environment will be described in the Erosion Prevention and Sediment Control Plan, developed in collaboration with environmental regulators, as part of the company's Environmental Management System and Industrial Approval Application for the Project.	Operational Geochemical Testing Program: confirmatory testing of open pit blast hole drill cuttings to confirm geochemical predictions of mine rock at a frequency to be determined by the Project geochemists, geologists, and with consideration of available NRCAN and comparable guidance documents.
		Delineation and subsequent management of historical tailings and waste rock (soil and sediment) that is located within the footprint of Project infrastructure.
		Geochemical source term predictions heavily rely on theoretical constraints, representative geochemical test work, and the availability of site analogue data. To close data gaps that would increase the confidence in the geochemical source term predictions for future model iterations, the following recommendations are made:
		Continued operation of FMS PAG humidity cells to assess the long-term effect of metal leaching behaviour in site-specific materials as well as to understand material-specific metal mobility under acidic conditions.
		Additional sampling and static testing of waste rock material to increase the confidence in the sulphur and NP contents as well as PAG proportions within this population, since these parameters have a direct impact on the source term model results.

Table 9.0-1: Monitoring Commitments (continued)

Valued Component	General Monitoring Commitments	Detailed Monitoring Commitments (if applicable)
Geology, Soils, and Sediment (continued)		Collection of site-specific topsoil samples to understand and assess this material's geochemical variability and in support of topsoil stockpile source terms.
		Continued tracking and reporting of Touquoy WRSF tonnage, footprint, and lithological proportions along with continued waste rock drainage monitoring to allow for better calibration of model and scaling factors which can be applied to the FMS WRSF in future model iterations. This is especially relevant for nitrogen- specific source terms, since nitrogen commonly shows lag times in its release from larger waste rock facilities.
		Concentrate from the FMS processing plant will be shipped to the Touquoy site where the final ore extraction step will be conducted using cyanidation. It is expected that the relatively small quantity of tailings generated during this process will be co-deposited with Beaver Dam tailings in the Touquoy open pit. To understand the geochemical impact of this tailings disposal plan, it is recommended that this material be tested via ABA and potentially other characterization methods.
Groundwater	Monthly water levels and quarterly water quality sampling program Groundwater predictive models will be updated, as warranted, during the Industrial Approval process.	FMS Study Area has a network of 27 monitoring wells located within the LAA. Based upon the predicted groundwater effects the Proponent has committed to install additional monitoring wells in two areas within the FMS LAA: 1. Two additional monitoring well nests will be located adjacent to the open pit to confirm the predicted groundwater radius of influence towards the south of the open pit. 2. Several additional monitoring well nests will be placed around the TMF to monitoring groundwater levels.
		Groundwater monitoring will be conducted from all on-site FMS Study Area wells with water levels being collected monthly and chemistry samples will be collected quarterly throughout construction/pre-production and operations.
		The Proponent has also committed to installing an additional groundwater well southeast of the Touquoy pit.

Table 9.0-1: Monitoring Commitments (continued)

Valued Component	General Monitoring Commitments	Detailed Monitoring Commitments (if applicable)
Surface Water	Proposed SW locations at FMS (23 locations) and at all existing locations at TQ (on-going) as per applicable federal and provincial regulations Surface water predictive models will be updated, as warranted, during the Industrial Approval process.	The surface water monitoring program will include the following, as well as potentially additional monitoring as determined through discussions with regulatory agencies:
		Surface water quality and quantity monitoring at select baseline sampling locations, for frequency and parameters required under applicable federal and provincial regulations;
		The MDMER program would involve detailed surface water quantity and quality sampling as well as effluent sampling to determine final EEM specifications; and,
		Ongoing surface water quality monitoring at the Touquoy facility.
Wetlands	A detailed Wetland Monitoring Plan will be established to support the Industrial Approval application, through the life cycle of the permitting process and will commit to monitoring during baseline/pre-construction to establish baseline conditions, and through the operational phase, reclamation and post closure (as determined to be required). Wetland monitoring will be completed for the Project on selected representative wetlands that have been predicted to have direct or indirect effects from project development.	
Fish and Fish Habitat	A Surface Water Monitoring Plan will be established through the life cycle of the permitting process and will commit to monitoring during baseline/pre-construction to establish baseline conditions, and through the operational phase, reclamation and post closure (as determined to be required). Surface water monitoring will be completed for the Project on selected representative watercourses that have been predicted to have direct or indirect effects on fish and fish habitat from project development. Both direct and indirect effects are expected related to the Seloam Brook Realignment. Monitoring of the extent of indirect effects from erosion and sedimentation at the outlet of the Realignment Channel will be required, along with monitoring the effectiveness of water control features along the North and South Channel and associated predicted flooding. As part of a detailed offset plan, and once the offset measures have been selected, a monitoring program will be developed in consultation with DFO, and included in the final offset plan and Fisheries Authorization. Fish assessment metrics such as catch per unit effort, age, length, and weight will be considered as part of the study design. Physical parameters such as lake levels, lake inflow and outflow, water temperature, lab water quality, and in-situ water quality will be incorporated to the monitoring plan. Criteria (performance measures) for the effectiveness monitoring will be developed through discussions with DFO, the Province, and other interested parties. The results of compliance and effectiveness monitoring will be compiled annually and submitted to DFO for review. After the third year of effectiveness monitoring, a summary report will be written with recommendations based on the success of the offsetting measures. Indirect effects related to flow reduction are predicted in WC2 and East Brook (SW15) due to construction of the WRSA and TMF, respectively. These habitat losses will be included in the application for HADD authorization under the *Fisheries Act*, and have been included in the Fish Habitat Offset Plan: Preliminary Concept Update (Wood, 2020). On-going assessments are currently underway and will continue through 2019 to support understanding of the WC43 system and observed barrier to fish passage under various flow regimes.	
Habitat and Flora	No specific monitoring recommended	

Table 9.0-1: Monitoring Commitments (continued)

Valued Component	General Monitoring Commitments	Detailed Monitoring Commitments (if applicable)
Fauna	A Wildlife Management Monitoring Program (WMMP) has been established, outlining wildlife mitigation and specific protocols for monitoring Mainland Moose during baseline/pre-construction to establish baseline conditions, and through the operational phase, reclamation and post closure (as determined to be required in consultation with provincial regulators). Monitoring associated with the WMMP will be completed for the Project on selected transects within suitable Mainland Moose habitat within the FMS Study Area and in regional reference locations for which baseline data has already been collected. Mainland Moose survey methods will be consistent with methods presented in the EIS, described in detail in Section 6.12.	
Avifauna	No specific avifauna monitoring required	Clearing or grubbing that could potentially impact breeding birds will be conducted outside the breeding season. If avoidance of clearing during nesting is not possible, a nest survey will be completed, in consultation with CWS, prior to clearing activities.
Species at Risk and Species of Conservation Interest	No specific monitoring requirements beyond what is identified in flora, fauna, wetlands, fish, and avifauna with the exception of monitoring for moose. Permitting may be required for Species at Risk, and any monitoring requirements will be determined during permitting, in consultation with NSL&F.	WMMP: moose monitoring will be completed on selected transects within suitable habitat WMMP: outlines protocols to minimize interactions between wildlife and Project activities. If construction is required during the active nesting season, an avian specialist will monitor for nesting activity.
Physical and Cultural Heritage	No monitoring of archaeological features required	Remaining features will be buffered and flagged in the field to ensure avoidance
Mi'kmaq of Nova Scotia	The Proponent commits to Mi'kmaq participation in community-based monitoring programs and development of the Reclamation and Closure Plan. Discussions will continue with the Mi'kmaq of Nova Scotia regarding participation in the development, implementation and evaluation of proposed compliance and effects monitoring programs which could include programs such as wetland monitoring, wildlife monitoring, including moose, and other monitoring programs including air, surface water, groundwater and noise. In addition, the Proponent will hold periodic meetings with the Mi'kmaq of Nova Scotia, including Millbrook and Sipekne'katik First Nations, to review overall environmental compliance and effects monitoring programs associated with other VCs, provide data and results of monitoring programs, and report on Project benefits. The effects monitoring programs will verify the effectiveness of mitigation measures associated with minimizing any potential effects to human health from consumption of, or contact with, country foods, water and soils, and results will be shared with local Indigenous groups.	

10.0 Closing

Paragraph 19(1) of *CEAA 2012* states:

19 (1) The environmental assessment of a designated project must take into account the following factors:

- *(a) the environmental effects of the designated project, including the environmental effects of malfunctions or accidents that may occur in connection with the designated project and any cumulative environmental effects that are likely to result from the designated project in combination with other physical activities that have been or will be carried out;*
- *(b) the significance of the effects referred to in paragraph (a);*
- *(c) comments from the public — or, with respect to a designated project that requires that a certificate be issued in accordance with an order made under section 54 of the National Energy Board Act, any interested party — that are received in accordance with this Act;*
- *(d) mitigation measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the designated project;*
- *(e) the requirements of the follow-up program in respect of the designated project;*
- *(f) the purpose of the designated project;*
- *(g) alternative means of carrying out the designated project that are technically and economically feasible and the environmental effects of any such alternative means;*
- *(h) any change to the designated project that may be caused by the environment;*
- *(i) the results of any relevant study conducted by a committee established under section 73 or 74; and*
- *(j) any other matter relevant to the environmental assessment that the responsible authority, or — if the environmental assessment is referred to a review panel — the Minister, requires to be taken into account.*

At its foundation, EA is a planning tool used to ensure that projects are carefully planned to avoid or mitigate possible negative environmental effects and to maximize potential benefits. As described throughout the EIS and this Summary document, an environmental effects assessment was conducted for each of the identified VCs to consider all the above criteria including identification of mitigation and monitoring requirements. The effects assessment process is iterative in nature and allows for improvements and innovation during the process in order to respond to and minimize significance of effects. Summaries of assessment results and the mitigation and monitoring to be implemented have been summarized herein.

Project-environment interactions are expected to occur throughout the life of the Project during the construction, operations, and closure phases. These interactions are expected, manageable and are typical of environmental impacts associated with quarry and mineral extraction projects in the region.

Given the considerations identified above and based on baseline studies completed for each of the identified VCs, the Project is not expected to result in any significant residual adverse environmental effects once mitigation measures have been applied. Monitoring programs will continue throughout the life of the Project to verify the effects of the Project on the surrounding environment relative to predictions made in the environmental effects' assessment. The Proponent is committed to implementing the planned mitigative measures and monitoring programs, as well as ongoing stakeholder and Mi'kmaq engagement as outlined in this submission.

11.0 References

Atlantic Canada Conservation Data Centre (ACCDC). 2017. Rank Definitions. Retrieved from: http://www.accdc.com/en/rank-definitions.html

Bird Studies Canada. (2016). Second Atlas of Breeding Birds of the Maritime Provinces: Breeding Evidence Codes. Retrieved from: https://www.mba-aom.ca/jsp/codes.jsp?lang=en&pg=breeding&_sm_au_=iVV411JJDR6VF15T&lang=en&pg=breeding&_sm_au_=iVV411JJDR6VF15T

Brown, T.G., Runciman, B., Bradford, M.J., and Pollard, S. 2009. A biological synopsis of yellow perch (Perca flavescens). Can. Manuscr. Rep. Fish. Aquat. Sci. 2883: v + 28 p.

Canadian Council of Ministers of the Environment (CCME). 2018. Canadian Environmental Quality Guidelines. Retrieved from: https://www.ccme.ca/en/resources/canadian_environmental_quality_guidelines/index.html

Canadian Environmental Assessment Agency (CEAA) and Nova Scotia Environment (NSE). 2018. Guidelines for the Preparation of an Environmental Impact Statement Pursuant to the Canadian Environment Assessment Act, 2012 and Nova Scotia Registration Document Pursuant to the Nova Scotia Environment Act. Fifteen Mile Stream Gold Project. 45pp.

Chan, L., Receveur, O., Batal, M., David, W., Schwartz, H., Ing, A., Fediuk, K., and Tikhonov, C. 2017. First Nations Food, Nutrition and Environment Study (FNFNES): Results from the Atlantic. Ottawa: University of Ottawa.

Conestoga-Rovers & Associates Ltd. (CRA). 2007a. Environmental Assessment Registration Document for the Touquoy Gold Project, Moose River Gold Mines, Nova Scotia. Prepared for DDV Gold Limited. March 2007. REF. NO. 820933 (3)

Conestoga-Rovers & Associates Ltd. (CRA). 2007b. Focus Report, Touquoy Gold Project, Moose River Gold Mines, Nova Scotia.

Environment Canada. 2015. Management Plan for the Rusty Blackbird (Euphagus carolinus) in Canada. Species at Risk Act Management Plan Series. Environment Canada, Ottawa. iv + 26 pp.

Environment and Climate Change Canada. 2018. Canadian Environmental Sustainability Indicators: Air pollutant emissions. Retrieved from: www.canada.ca/en/environment-climate-change/services/environmental-indicators/airpollutant-emissions.html.

Environmental Laboratory. 1987. “Corps of Engineers Wetlands Delineation Manual," Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Fisheries and Oceans Canada. 2012. Temperature threshold to define management strategies for Atlantic salmon (Salmo salar) fisheries under environmentally stressful conditions. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2012/019.

Friske, P.W.B., Ford, K.L., McNeil, R.J., Pronk, A.G., Parkhill, M.A., and Goodwin, T.A. 2014a. Soil Geochemical, Mineralogical, Radon and Gamma Ray Spectrometric Data from the 2007 North American Soil Geochemical Landscapes Project in New Brunswick, Nova Scotia and Prince Edward Island; Geological Survey of Canada, Open File 6433 (revised). doi:10.4095/293020

Friske, P.W.B., Ford, K.L., McNeil, R.J., Amor, S.D., Goodwin, T.A., Groom, H.D., Matile, G.L.D., Campbell, J.E., and Weiss, J.A. 2014b. Soil Geochemical, Radon and Gamma Ray Spectrometric Data from the 2008 and 2009 North American Soil

Geochemical Landscapes Project Field Surveys; Geological Survey of Canada, Open File 7334 (revised). doi:10.4095/293019

Jacques Whitford Limited. 2008. Groundwater Contingency Plan, Industrial Approval Application, Touquoy Gold Mine, Moose River, NS. Prepared for DDV Gold Limited.

GHD Limited. 2016a. Monitor Well Drilling, Installation and Associated Groundwater Monitoring Program (Phase 1) Touquoy Gold Project, Moose River, Nova Scotia. Letter 820933-H-05. Prepared for Atlantic Gold Corporation.

GHD Limited. 2016b. Monitor Well Drilling, Installation and Associated Groundwater Monitoring Program (Phase 2) Touquoy Gold Project, Moose River, Nova Scotia. Letter 820933-H-07. Prepared for Atlantic Gold Corporation.

GHD Limited. 2018. Noise Impact Study – Beaver Dam Mine Project. GHD Group, Waterloo, ON. Report No 7, January 2, 2018. Technical Supporting Document.

Golder Associates Ltd. (Golder). 2019a. Fifteen Mile Stream Gold Project Hydrogeological Investigation. Technical Supporting Document. September 2019.

Golder Associates Ltd (Golder). 2019b. Atlantic Gold Corporation Fifteen Mile Stream Gold Project, Hydrology Modelling Report. Technical Supporting Document. September 2019.

Government of Canada. 1994. Migratory Birds Convention Act. Retrieved from: http://laws-lois.justice.gc.ca/PDF/M-7.01.pdf

Institution of Lighting Engineers (ILE). 2005. Guidance Notes for the Reduction of Obtrusive Light. Retrieved from: http://www.britastro.org/dark-skies/pdfs/ile.pdf

Intrinsik Corp. 2019. Evaluation of Potential Human Exposures and Risks Related to Emissions from the Fifteen Mile Stream Mine Pit Project (Dust Deposition; Recreational Water Usage; Country Foods). Technical Supporting Document. Prepared for Atlantic Mining NS Corporation.

Kelly, D. 2014. White Sucker. Retrieved from: http://www.lakescientist.com/lake-facts/fish/white-sucker/

Knight Piesold Ltd. 2020. Fifteen Mile Stream Project Preliminary Waste and Water Management Design for Submission of the Environmental Impact Statement. Technical Supporting Document. Prepared for Atlantic Gold Corporation.

Knight Piesold Ltd. 2018. Moose River Consolidated Phase II Preliminary Engineering Hydrometeorology Report. Technical Supporting Document. Prepared for Atlantic Gold Corporation.

Lorax Environmental Services Ltd. 2019. Fifteen Mile Stream Project: Geochemical Source Term Predictions. Technical Supporting Document. Prepared for Atlantic Mining NS Corporation.

Mi'kma'ki All Points Service. (MAPS). 2019. Mi'kmaw Ecological Knowledge Study. Technical Supporting Document. Prepared for Atlantic Mining NS Corporation.

Fuller, P., L. Nico, M. Neilson, K. Dettloff, and R. Sturtevant. 2019. Anguilla rostrata (Lesueur, 1817): U.S. Geological Survey, Nonindigenous Aquatic Species Database, Gainesville, FL. Retrieved from: https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=310, Revision Date: 9/12/2019, Peer Review Date: 4/1/2016,

Nova Scotia Environment (NSE). 2010. Guide for the Formation and Operation of a Community Liaison Committee. Retrieved from: https://novascotia.ca/nse/issues/docs/Community_Liaison_Committee_Guideline.pdf.

Nova Scotia Environment and Labour (NSDEL). 1999. Pit and Quarry Guidelines, NSDEL, May 1999.

Nova Scotia Department of Fisheries and Aquaculture (NSDFA). 2017. Nova Scotia Freshwater Fish Species Distribution Records. Retrieved from: https://data.novascotia.ca/Fishing-and-Aquaculture/Nova-Scotia-Freshwater-Fish-Species-Distribution-R/jgyj-d4fh.

Nova Scotia Department of Natural Resources (NSDNR). 2007. Recovery Plan for Moose (Alces alces Americana) in Mainland Nova Scotia.

Nova Scotia Environment (NSE). 2014. Environmental Quality Standards for Contaminated Sites Rationale and Guidance Document. Retrieved from: https://www.novascotia.ca/nse/contaminatedsites/docs/EQS-Contaminated%20Sites-Rationale-and-Guidance-NSE-2014.pdf

Nova Scotia Power Inc (NSPI). 2009: East River Sheet Harbour Hydro System: Relicensing Report. Environmental Services, v. 2.

O'Neil, S.F., Harvie, C.J., and D.A. Longard. 1997. Stock Status of Atlantic Salmon on the Eastern Shore of Nova Scotia, Salmon Fishing Area 20 in 1995. Diadromous Fish Division Department of Fisheries and Ocean, P.O. Box 550, Halifax, NS.

Peter Clifton & Associates. 2007. Hydrogeological Investigations and Assessment, Touquoy Gold Project, Nova Scotia. Prepared for Atlantic Gold NL.

Stantec Consulting Ltd. (Stantec). 2016. Water Balance Report Revision 2.0. Atlantic Gold Tailings Management Facility. Fredericton, NB. November 25, 2016. Technical Supporting Document. Prepared for Atlantic Gold Corp.

Stantec Consulting Ltd. (Stantec). 2019a. Fifteen Mile Stream Historical Tailings & Waste Rock Management Plan. Technical Supporting Document. Prepared for Atlantic Mining NS Corporation.

Stantec Consulting Ltd. (Stantec). 2019b. Touquoy Integrated Water and Tailings Management Plan. Technical Supporting Document. Prepared for Atlantic Mining NS Corporation.

Stantec Consulting Ltd. (Stantec). 2019c. Limited Phase II Environmental Site Assessment – Fifteen Mile Stream. Technical Supporting Document. Prepared for Atlantic Mining NS Corporation.

Stantec Consulting Ltd. (Stantec). 2019d. Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Fifteen Mile Stream Tailings in Exhausted Touquoy Pit – Fifteen Mile Stream Gold Project.

Stantec Consulting Ltd (Stantec). 2019e. Study Design for the Phase 1 Environmental Effects Monitoring Program for the Touquoy Mine, Nova Scotia. Prepared for Atlantic Mining NS Corporation. Dated July 18, 2019. 68 pp + appendices.

The Confederacy of Mainland Mi'kmaq. 2007. Kekina'muek: Learning about the Mi'kmaq of Nova Scotia. Retrieved from: https://native-land.ca/wp/wp-content/uploads/2018/06/Mikmaq_Kekinamuek-Manual.pdf. Page 3.

Tittler, R., Hannon, S.J., and Norton, M.R. 2001. Residual Tree Retention Ameliorates Short-term Effects of Clear-cutting on Some Boreal Songbirds. Ecological Applications, 11(6): 1656-1666.

United States Army Corps of Engineers. 2011. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0), ed. J. S. Wakeley, R. W. Lichvar, C. V. Noble, and J. F. Berkowitz. ERDC/EL TR-12-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

Warner B.G., and Rubec C.D.A. 1997. The Canadian Wetland Classification System. Second Edition. National Wetlands Working Group. 68pp.

Wels, C., Mackie, D. and Scibek, J. 2012. Guidelines for Groundwater Modelling to Assess Impacts of Proposed Natural Resource Development Activities, British Columbia Ministry of the Environment, Water Protection & Sustainability Branch, April. Retrieved from: http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/groundwater_modelling_guidelines_final-2012.pdf

Wood. 2019a. Noise Baseline and Predictive Modelling Fifteen Mile Stream Gold Project. Technical Supporting Document. Prepared for McCallum Environmental Ltd.

Wood. 2019b. Ambient Air Quality Assessment. Technical Supporting Document.Prepared for McCallum Environmental Ltd.

Wood. 2019c. Ambient Light Baseline and Predictive Assessment Report. Technical Supporting Document. Prepared for McCallum Environmental Ltd.