Appendix H.1

Fish and Fish Habitat Baseline Report - Part 4 of 5

APPENDIX D: GEMTEC REPORTS

GEMTEC

Ecological Baseline Studies
Anaconda Mining Inc.'s Goldboro Mine Property

Goldboro, Nova Scotia
October 18, 2017

Prepared for Anaconda Mining Inc.
Project No. 80016.08

GEMTEC
Consulting Engineers and Scientists

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October 18, 2017

File: 80016.08 – R01

Anaconda Mining Inc.
238 Highway 410
Baie Verte, NL
A0K 1B0

Attention: Gordana Slepcev, P.Eng., M.Sc.,
Chief Operating Officer

Re: Ecological Baseline Studies, Anaconda Mining Inc.'s Goldboro Mine Property
Goldboro, Nova Scotia

Please find enclosed the Ecological Baseline Studies final report for Anaconda Mining Inc.'s Goldboro Mine Property in Goldboro, Nova Scotia. GEMTEC Consulting Engineers and Scientists Limited was retained to conduct the desktop study, field work and associated reporting. The field component was conducted in April, June and July, 2017.

Sincerely,

Darrol Rice

Darrol Rice, B.Tech. (Env), P.Tech., EP, PMP
Senior Project Manager

Enclosures

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Ecological Baseline Studies
Anaconda Goldboro Mine Property
Goldboro, Nova Scotia

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Executive Summary

In 2017, GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) was retained by Anaconda Mining Inc. (Anaconda) to complete a baseline ecological studies at their Goldboro Mine Property in Goldboro, Nova Scotia. Central coordinates for the Study Area are: 45.201984°N, -61.636655°W. The ecological baseline studies encompassed:

- Wetland delineation and functional assessment;
- An aquatic habitat assessment;
- A vegetation and rare flora survey;
- A wildlife and rare fauna survey (including a mainland moose survey); and
- A water quality sampling program.

The studies were completed to obtain preliminary information on the applicable Valued Environmental Components (VECs) listed in Section 6 of the "Guide to Preparing an EA Registration Document for Mining Developments in Nova Scotia" (NSE 2009). This report summarizes the findings of the 2017 baseline ecological studies within the proposed development area of the Goldboro Mine Property (herein referred to as the "Study Area").

A team of GEMTEC environmental biologists completed the field reconnaissance component of the baseline studies in April, June and July, 2017.

Based on the findings of these studies, the following conclusions are presented:

- A total of 25 wetlands were identified within the Study Area. The delineated wetlands ranged in size from 0.03 hectares to 47.19 hectares; however, several wetlands extended beyond the Study Area. In general, the encountered wetlands have high wetland functionality in native plant habitat, phosphorus retention and pollinator habitat;
- Two areas within the Study Area were determined to contain fish habitat and are fish bearing: Gold Brook Lake and Gold Brook. Nineteen fish were captured in Gold Brook and fish were observed jumping in Gold Brook Lake. In general, Gold Brook contains varying, unembedded substrate with mostly large size substrate intermixed with sand and fines. The banks are stable and no evidence of erosion or undercutting was observed. With the exception of pH and temperature, the field measured water quality is good for fish habitat;
- An unnamed beaver pond located in the northwest portion of the Study Area was deemed possible fish habitat as it contains sufficient water depths to accommodate fish, adequate

water quality, nutrient input for feeding, and seasonal or historical fish passage from Gold Brook Lake (a known fish bearing waterbody). Fish were not captured nor observed during the field investigation; however, further studies should be conducted to confirm the absence / presence of fish;

- Three species of fish were captured within Gold Brook: Brook Trout (Salvelinus fontinalis), Banded Killfish (Fundulus diaphanus) and American eel (Anguilla rostrate);
- The concentrations of aluminum, arsenic, cadmium, iron, lead, mercury and zinc in one or more water samples collected from the Study Area exceeded the Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME FWAL) and / or the Nova Scotia Environment (NSE) Tier 1 Environmental Quality Standards for Surface Water (EQS);
- pH values ranged from 4.37 to 7.49 in water samples collected from surface water sources within the Study Area. High acidity is typically associated with *Sphagnum* bogs (as per the dominant wetland conditions observed on-site);
- Two rare vascular flora species were identified within the Study Area: Variegated Horsetail (*Equisetum variegatum*) and Southern Twayblade (*Listera australis*);
- A total of 61 bird species comprising of 602 individuals were documented during the Breeding Bird Survey. Of the 61 species, 24 are considered Species at Risk (SAR) or Species of Conservation Concern (SOCC) by the Atlantic Canada Conservation Data Centre (ACCDC);
- Evidence for possible breeding owls (*i.e.,* singing males) was detected within the Study Area. Three species of owls were recorded: a Great Horned Owl (*Bubo virginiatus*), a Northern Saw-Whet (*Aegolius acadicus*) and a Boreal Owl (*Asio otus*);
- No Common Nighthawks (*Chordeiles minor*), bat species or moose were observed within the Study Area.

The statements made in this Executive Summary are intended to be read in conjunction with the entire body of this report including all appendices.

Ecological Baseline Studies
Anaconda's Goldboro Mine Property
Goldboro, Nova Scotia

1.0 Introduction

It is our understanding Anaconda Mining Inc. (Anaconda) is exploring the opportunity of developing their Goldboro Mine Property in Goldboro, Nova Scotia (the "Project"). The baseline studies were conducted as the Project is classified as a Class 1 Undertaking under the *Nova Scotia Environment Act* and will trigger the requirement for an Environmental Assessment (EA) registration with Nova Scotia Environment (NSE). The mining operations will likely result in the alteration of the current ecological conditions existing within the Project area. The baseline studies were completed to obtain preliminary information on the applicable Valued Environmental Components (VECs) listed in Section 6 of the "Guide to Preparing an EA Registration Document for Mining Developments in Nova Scotia" (NSE 2009).

The ecological baseline studies encompassed:

- Wetland delineation and functional assessments (Wetland Assessment);
- An aquatic habitat assessment;
- A vegetation and rare flora survey;
- A wildlife and rare fauna survey (including a mainland moose survey); and
- A water quality sampling program.

The following document presents the findings of the ecological baseline studies; no comment is made with respect to the development, construction or operation of the Project.

GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) was retained by Anaconda to conduct the baseline ecological studies for the Project. The studies were limited to the proposed development area of the property (herein referred to as the "Study Area"). The Study Area is comprised of portions of Service Nova Scotia (SNS) Property Identifiers (PID): 35094366, 35065267, 35065275, 35065283, 35082775, 35151208, 35065325, 35065366, 35121771, 35121789, 35125798, 35151182, 35173996, 35151190, 35065853, 35065929, 35065960, 35065986, 35097138, 35149582, 35149566, and 35149574. A Maritime & Northeast natural gas pipeline easement creates the western boundary of the Study Area. The Study Area is presented on Figure 1.

The Study Area was visited by teams of GEMTEC environmental biologists in April, June and July, 2017. Due to the seasonal sensitivity of several VEC components, multiple trips were required. The field reconnaissance schedule is presented in Table 1.

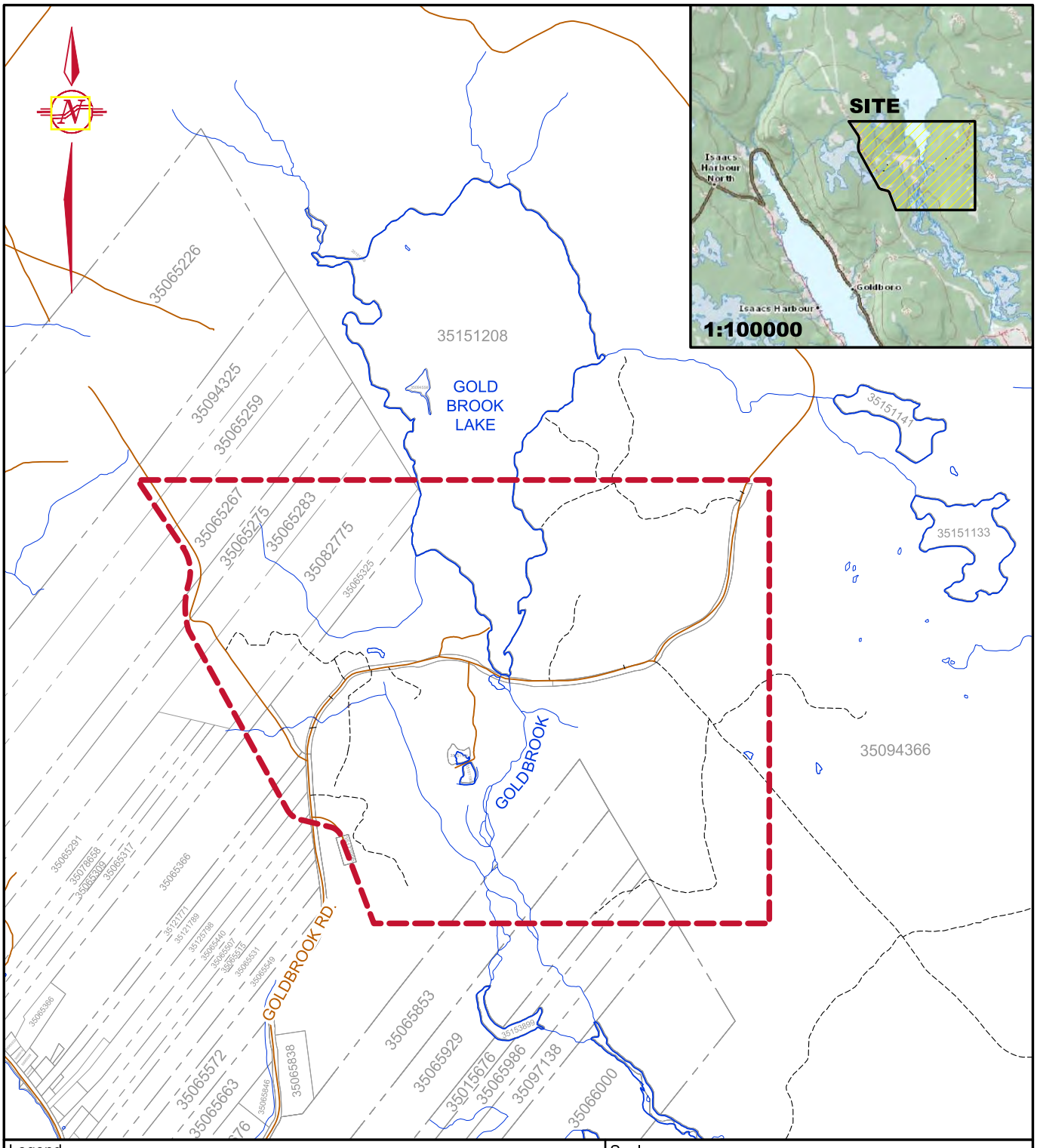
Table 1: Schedule of Field Reconnaissance Program

Site Visit Date	Field Component
April 24 to April 27, 2017	• Wildlife and Rare Fauna Survey (Mainland Moose, Owl and Raptor)
June 1 to June 11, 2017	• Wetland Assessment; • Aquatic Habitat Assessment; • Water Quality Monitoring; • Wildlife and Rare Fauna Survey (Breeding Bird Survey, Common Nighthawk Survey)
June 27 to June 29, 2017	• Vegetation and Rare Flora Survey; • Wildlife and Rare Fauna Survey (Breeding Bird Survey, Common Nighthawk Survey, Bat Survey)
July 24, 2017 to July 28, 2017	• Wetland Assessment; • Vegetation and Rare Flora Survey.

The site-specific field reconnaissance program was developed by referencing the standard methods outlined in the following reports:

- Guide to Preparing an EA Registration Document for Mining Developments in Nova Scotia;
- Guidelines for Nocturnal Owl Monitoring in North American (March 2001);
- Canadian Wildlife Service (CWS) draft protocol for conducting nightjar surveys (April 2016);
- Maritime Breeding Bird Atlas (MBBA 2006);
- Army Corps of Engineers in the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region;
- Wetland Ecosystem Services Protocol for Atlantic Canada;
- The Nova Scotia Fish Habitat Assessment Protocol: A Field Methods Manual for the Assessment of Freshwater Fish Habitat; and
- Department of Natural Resources (DNR) / Fisheries and Oceans Canada (DFO) – New Brunswick Stream Habitat Inventory.

The aforementioned documents were used as guidelines to refine a field reconnaissance program to the site-specific conditions and the scope of work in the proposed Project while obtaining the required information for the Nova Scotia (NS) EA registration document.



Legend

- STUDY AREA BOUNDARY
- PROPERTY LINE
- WATERBODY
- WATERCOURSE
- ROAD
- TRAIL

Scale 1:20000

0 400 800 1200m

Project	Drawing
GOLDBORO BASELINE STUDIES NOVA SCOTIA	SITE LOCATION PLAN

Drawn By	Date	File No.	Drawing No.	Revision No.
CHG	SEP 2017	800160801	FIGURE 1	0

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2.0 Wetland Assessment

A wetland assessment was conducted within the Study Area. The wetland assessment included:

- The boundary delineation of any encountered wetlands;
- Identifying the wetland characteristics of each encountered wetland; and
- An ecological functional assessment for each encountered wetland.

2.1 Methodology

Teams of GEMTEC environmental biologists identified the location, boundary and characteristics of each encountered wetland during the field reconnaissance program in June and July, 2017. Each team was led by a recognized wetland delineator and accompanied by a qualified field assistant. Delineations were recorded using handheld Global Positioning System (GPS) units and photos.

The wetland delineations were completed using accepted industry standards as described by the Army Corps of Engineers in the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region. The standard defines a wetland as containing all three of the following:

- Wetland hydrology features (*i.e.,* high water table, water-stained leaves, oxidized rhizospheres on living roots, drainage patterns, stunted or stressed plants, *etc*.);
- Dominant hydrophytic vegetation containing a wetland indicator rank of obligate (OBL), facultative wetland (FACW) and facultative (FAC) (*i.e., Picea mariana, Larix laricina, Osmunda cinnamomea, Gaultheria hispidula, etc.*); and
- Hydric soil (*i.e.,* histosol, thick organic layer, flooded, anaerobic conditions, chemical reduction, hydrogen sulfide odor, low matrix chroma, *etc*.).

The wetland indicator rank for vascular flora varies across regions; therefore, the NS rankings for each observed species was used during the wetland delineations within the Study Area. The NS wetland indicator rank were obtained from NSE.

As per standard practices, two test points were documented on each side of the wetland boundary (Wetland and Upland). The Wetland sample point was a location chosen to be the most representative for the wetland. The Upland sample point was located near the wetland boundary to show the definitive transition from wetland to upland. At each test point, the following steps were executed:

- Soil test pits were excavated in order to determine the presence hydric soil conditions. These pits were dug until they reached at least 30 centimetres (cm) below the ground surface, or until root or rock refusal occurred. Documented information at each pit

included: pit depth, depth of each soil layer, soil colour using Munsell Soil Color Charts, presence of redox features, soil texture and any hydric soil indicators listed on the Army Corps of Engineers in the Regional Supplement to the Corps of Engineers Wetland Delineation Manual;

- A vegetation inventory was recorded to determine the presence / absence of hydrophytic communities. Assessment of the herbaceous (herb), shrub / sapling (shrub) and tree stratums were taken to determine if hydrophytic vegetation was dominant on the sample site. The herb stratum included all non-woody plants ≤ 1 metre (m) in height, the shrub stratum included woody plants ≤ 1 m in height and < 8 cm in diameter, and the tree stratum included woody plants ≥ 8 cm in diameter. Each dominant species was assessed for percent cover within three plot sizes: herb (1.5 m radius), shrub (15 m radius) and tree (30 m radius). Percent cover and species inventory also included determining the dominance of upland species (Facultative Upland (FACU) and Upland (UPL) rank) within the plot; and
- Observations were made at each pit site and surrounding area for any primary or secondary hydrology indicators listed on the Army Corps of Engineers in the Regional Supplement to the Corps of Engineers Wetland Delineation Manual.

The aforementioned information was recorded on the NS Wetland Delineation Data Form supplied by NSE. A data form was completed for each sample point (*e.g.,* Wetland 1: Wetland Pit; Wetland 1: Upland Pit).

Each delineated wetland was assessed for ecosystem function using the Wetland Ecosystem Services Protocol for Atlantic Canada (WESP-AC). WESP-AC is a rapid assessment tool for function and value of non-tidal wetlands throughout temperate North America. WESP-AC uses three multiple choice forms to generate scores (0 to 10 scale) and ratings (Lower, Moderate, Higher) for each of the wetland's functions and benefits. The forms consist of an initial office component and is followed by a field component to assess the wetland's functions and existing stressors. The program automatically generates scores intended to reflect a wetland's ability to support the following functions:

- Water Storage and Delay;
- Sediment Retention and Stabilization;
- Phosphorus Retention;
- Nitrate Removal and Retention;
- Thermoregulation;
- Carbon Sequestration;
- Organic Matter Export;
- Pollinator Habitat;
- Aquatic Invertebrate Habitat;
- Anadromous Fish Habitat;
- Non-anadromous Fish Habitat;

- Amphibian & Reptile Habitat;
- Waterbird Feeding Habitat;
- Waterbird Nesting Habitat;
- Songbird, Raptor and Mammal Habitat;
- Pollinator Habitat; and
- Native Plant Diversity.

The higher rated wetland functions are discussed in this report as the function describes the ecological process that a particular wetland conducts within the environment. The benefit score is not discussed as it describes the context within which the function is being performed; however, the benefit scores are presented in the WESP-AC Score Sheets in Appendix C. It is important to note that not all "high-functioning" wetlands are healthy / intact and no single wetland can rate highly in all functions as many functions operate naturally in opposing directions.

2.2 Summary of Findings

A total of 25 wetlands were identified within the Study Area during the field reconnaissance program. The delineated wetlands ranged in size from 0.03 hectares (Wetland 3) to 47.19 hectares (Wetland 1). However, several wetlands continued beyond the boundary of the Study Area (Wetland 1, Wetland 2, Wetland 7, Wetland 8, Wetland 12, Wetland 15, and Wetland 17). In such instances, the delineation ceased at the Study Area boundary; thus, the actual size of the wetland is larger than described herein. Table 2 outlines the Wetland Identification (ID), size within the Study Area and notable wetland characteristics. Wetland locations are depicted on Figure 2. Site photos are presented in Appendix A; field datasheets are presented in Appendix B.

In general, the topography slopes towards Gold Brook Lake and Gold Brook, resulting in a complex drainage system towards these features. Wetland 1 is comprised of larger wetland areas (*i.e., Sphagnum* bogs, historic tailing ponds, and forested swamp wetlands) that are connected via vegetated wetland channels. Many of these channels contain flowing surface water with a riparian fringe. The flow from Wetland 21, Wetland 23 and Wetland 24 also contribute to Wetland 1 but the channels have been reduced to culverts under Goldbrook Road that may limit a persistent outflow connection; thus separate delineations were conducted. The drainage connections are presented on Figure 2.

In general, the encountered wetlands have high functionally in:

- Native plant habitat (23 wetlands);
- Phosphorus retention (22 wetlands); and
- Pollinator habitat (22 wetlands).

These functions are correlated with dense, expansive, natural vegetation communities as found within the Study Area. Other common highly rated wetland functions found within Study Area include:

- Songbird, raptor, & mammal habitat (17 wetlands);
- Carbon sequestration (15 wetlands);
- Organic nutrient export (14 wetlands);
- Aquatic invertebrate habitat (13 wetlands);
- Nitrate removal & retention (11 wetlands);
- Waterbird feeding habitat (10 wetlands); and
- Waterbird nesting habitat (10 wetlands).

The wetland containing the most highly rated functions is Wetland 18, which is comprised of varying habitats including: drainage channels, bog areas and an inactive beaver pond that may provide fish habitat. The wetland containing the fewest highly rated functions is Wetland 24, which has been impacted by clear-cutting within the last 10 years.

The high rated functions for each encountered wetland are presented in Table 2. The WESP-AC cover sheet and score pages are presented in Appendix C. Should additional information / re-calculation be required for any of the wetland functional assessments, GEMTEC can supply the full WESP-AC package on an as requested basis.

Table 2: Summary of Delineated Wetlands and Functional Assessments

Wetland ID	Wetland Size within Study Area (hectares)	Wetland Characteristics	High Rated Function Attributes
1	47.19	Wetland 1 is a large wetland system that drains towards Gold Brook. It contains several different wetland types that are connected via narrow wetland channels. Many of the channels contained flowing surface water that outlet into Gold Brook. These channels are characterized as seasonal drainage channels that do not support fish or fish habitat. The northern portion of the wetland is mostly riparian forest along Gold Brook. Historic tailings ponds are present on the east and west sides of Gold Brook which have been naturally reclaimed as wetland (Photo 1 and Photo 3, Appendix A). The tailings pond areas present floodplain characteristics with bare ground and emergent vegetation. A rare horsetail species (*Equistum variegatum*) was found within the boundaries of a historic tailings pond (Figure 4). The southern portion of the wetland is a bog dominated with dense *Kalmia angustifolia* shrubs and *Picea mariana* stunted trees (Photo 2 and Photo 4, Appendix A). The ground is saturated with thick histosol. The eastern portion is a swamp forest with dense *Sphagnum* cover. The surrounding upland areas were clear-cut approximately 5-10 years ago. Surface water runoff is collected in flowing drainage channels. The western portion contains larger wetland areas (*i.e.,* a historic tailings pond, an *Alnus incana* (alder) swale and bogs) that drain toward Gold Brook through forested drainage channels (Photo 5, and Photo 6, Appendix A).	• Stream Flow Support • Phosphorus Retention • Carbon Sequestration • Organic Nutrient Export • Resident Fish Habitat • Aquatic Invertebrate Habitat • Waterbird Feeding Habitat • Waterbird Nesting Habitat • Songbird, Raptor & Mammal Habitat • Pollinator Habitat • Native Plant Habitat

Table 2: Summary of Delineated Wetlands and Functional Assessments

Wetland ID	Wetland Size within Study Area (hectares)	Wetland Characteristics	High Rated Function Attributes
2	3.23	A flowing drainage channel originates near Goldbrook Road ditching in the southwestern portion of the wetland. The drainage channel flows north around a clear-cut area (approximately 5 – 10 year ago) to adjoin the roadside ditching in the north. Wetland 2 is predominantly a riparian swale that follows the drainage channel; a forested swamp is present in the eastern portion (Photo 7, Appendix A). The wetland contains dense *Sphagnum* cover and is dominated by *Abies balsamea* trees and *Alnus incana* shrubs.	• Water Cooling • Phosphorus Retention • Carbon Sequestration • Organic Nutrient Export • Aquatic Invertebrate Habitat • Songbird, Raptor & Mammal Habitat • Pollinator Habitat • Native Plant Habitat
3	0.03	Wetland 3 is a small, open water wetland (Photo 8, Appendix A). Water is dark and deep (greater than 1 metre). The wetland does not contain an outlet channel. An *Alnus incana* swale creates the eastern portion of the wetland and directs overland flow to the wetland. An earthen berm creates the southern wetland boundary; preventing the roadside (Goldbrook Road) ditching from entering the wetland. Surrounding vegetation is mainly trees (*Abies balsamea* and *Picea mariana*) with sparse understory.	• Surface Water Storage • Sediment Retention & Stabilisation • Phosphorus Retention • Nitrate Removal & Retention • Aquatic Invertebrate Habitat • Amphibian & Turtle Habitat • Waterbird Feeding Habitat • Waterbird Nesting Habitat • Pollinator Habitat • Native Plant Habitat

Table 2: Summary of Delineated Wetlands and Functional Assessments

Wetland ID	Wetland Size within Study Area (hectares)	Wetland Characteristics	High Rated Function Attributes
4	1.03	Wetland 4 is a forested swamp just east of Gold Brook Lake (Photo 9, Appendix A). The wetland outlets via a small drainage channel into Gold Lake (Figure 2); flowing water was observed within the channel. No fish were observed nor expected in the channel due to natural woody barriers. The wetland contains dense tree (*Abies balsamea*, *Acer rubrum* and *Picea mariana*) and shrub (*Nemopanthus mucronatus*) stratums with sparse herb cover (6%). Ground cover is mostly (greater than 99%) *Sphagnum* moss.	• Stream Flow Support • Water Cooling • Phosphorus Retention • Carbon Sequestration • Organic Nutrient Export • Aquatic Invertebrate Habitat • Waterbird Nesting Habitat • Songbird, Raptor & Mammal Habitat • Pollinator Habitat • Native Plant Habitat
5	1.35	Wetland 5 is a forested swamp that contains abundant coniferous snags, downed wood and extensive, steep micro-topography (Photo 10, Appendix A). The western wetland boundary abuts Gold Brook Lake and a small drainage channel with flowing water outlets into the lake. No fish were observed nor expected in the channel due to natural woody barriers. Dominant vegetation includes: *Picea mariana* (tree stratum), *Ledum groenlandicum* (shrub stratum) and Maianthemum canadense (herb stratum). *Sphagnum* moss covers the remaining ground surface.	• Stream Flow Support • Phosphorus Retention • Nitrate Removal & Retention • Carbon Sequestration • Aquatic Invertebrate Habitat • Pollinator Habitat • Native Plant Habitat

Table 2: Summary of Delineated Wetlands and Functional Assessments

Wetland ID	Wetland Size within Study Area (hectares)	Wetland Characteristics	High Rated Function Attributes
6	0.08	A small bog located on a natural terrace (Photo 11, Appendix A). The surrounding topography is steeply sloping to the southwest; however, the wetland is mostly flat. The surrounding upland area was clear-cut approximately 5-10 years ago. No trees are present within the wetland boundaries. Dominant vegetation includes: *Kalmia angustifolia*, *Carex trisperma* and *Vaccinium oxycoccus*.	• Surface Water Storage • Sediment Retention & Stabilisation • Phosphorus Retention • Nitrate Removal & Retention • Carbon Sequestration
7	1.01	Wetland 7 is a large bog with minimal trees. Trees and shrubs are limited to the wetland edge and small island clump (Photo 12, Appendix A). Dominant herb species include: *Trichophorum cespitosum*, *Chamaedaphne calyculata* and *Kalmia angustifola*. The ground is saturated with sparse surface water pools. Deep histosol (greater than 30 cm from ground surface) was observed. The surrounding topography is steeply sloping towards the wetland and the wetland continues beyond the boundary of the Study Area.	• Sediment Retention & Stabilization • Phosphorus Retention • Nitrate Removal & Retention • Songbird, Raptor & Mammal Habitat • Pollinator Habitat • Native Plant Habitat
8	1.14	A bog located on the top of a hill (70 metres elevation). Topography slopes slightly southeast towards Wetland 7 and southwest towards Gold Brook. Wetland 8 continues beyond the boundary of the Study Area. Trees and shrubs are limited to the wetland edges (Photo 13, Appendix A). Dominant vegetation includes: *Kalmia angustifolia*, *Picea mariana, Chadaedaphne calyculata, Rubus chamaemorus,* and *Empetrum nigrum*.	• Surface Water Storage • Sediment Retention & Stabilisation • Phosphorus Retention • Nitrate Removal & Retention • Carbon Sequestration • Native Plant Habitat

Table 2: Summary of Delineated Wetlands and Functional Assessments

Wetland ID	Wetland Size within Study Area (hectares)	Wetland Characteristics	High Rated Function Attributes
9	0.05	Wetland 9 is a small, inundated swamp present to the east and west of an old skidder path. The wetland and surrounding area has mostly been cleared of trees (*i.e.,* selective thinning) approximately 5 - 10 years ago (Photo 14, Appendix A). Herb vegetation is dominated by sedges (*Carex trisperma* and *Scirpus atrocinctus*) and rushes (*Juncus effuses*). Ferns (*Dryopteris cristata*) and woody shrubs (*Kalmia angustifolia*) are present. Trees are limited to young coniferous species (*Abies balsamea* and *Picea mariana*). *Sphagnum* moss covers the ground surface.	• Surface Water Storage • Sediment Retention & Stabilisation • Phosphorus Retention • Nitrate Removal & Retention • Carbon Sequestration • Aquatic Invertebrate Habitat • Native Plant Habitat
10	0.14	Wetland 10 is a forested bog located south of a historic trail. Some overland flow may enter the wetland from the trail during periods of high surface run-off. Evidence of historic selective thinning was observed within the wetland boundary. Wetland 10 contains abundant snags between coniferous tree / sapling cover (Photo 15, Appendix A). Herb vegetation is dominated by *Carex trisperma* and *Kalmia angustifolia*. *Sphagnum* moss covers the ground surface.	• Sediment Retention & Stabilisation • Phosphorus Retention • Carbon Sequestration • Pollinator Habitat • Native Plant Habitat

Table 2: Summary of Delineated Wetlands and Functional Assessments

Wetland ID	Wetland Size within Study Area (hectares)	Wetland Characteristics	High Rated Function Attributes
11	0.12	Wetland 11 is a forested wetland dominated by coniferous tree species (*Abies balsamea*, *Larix laricina* and *Picea mariana*). The wetland area contains very sparse shrub and herb stratums (Photo 16, Appendix A). The landform has extensive micro-topography throughout the wetland area. Abundant downed wood and snags were observed.	• Surface Water Storage • Sediment Retention & Stabilisation • Phosphorus Retention • Nitrate Removal & Retention • Carbon Sequestration • Native Plant Habitat
12	1.49	Wetland 12 is a segment of a large wetland system in the northeast portion of the Study Area. The wetland continues north, beyond the boundary of the Study Area. The eastern portion of the wetland is a large bog (Photo 19, Appendix A). The bog contains mostly herb and shrub stratums with abundant stressed / stunted *Picea mariana* trees. A drainage channel flows from Wetland 25 to enter the southern boundary of Wetland 12. Two narrow wetland channels (Photo 17 and Photo 18, Appendix A), facilitate water from the western wetland boundary to an outlet into Gold Brook Lake. Drainage channels with flowing water were observed in these areas. Snags and downed wood are present throughout the wetland area. Tree cover is sparse with dominant vegetation of *Nemopanthus mucronatus*, *Viburnum nudum* and *Kalmia angustifolia*.	• Water Cooling • Phosphorus Retention • Carbon Sequestration • Organic Nutrient Export • Aquatic Invertebrate Habitat • Waterbird Feeding Habitat • Waterbird Nesting Habitat • Songbird, Raptor & Mammal Habitat • Pollinator Habitat • Native Plant Habitat

Table 2: Summary of Delineated Wetlands and Functional Assessments

Wetland ID	Wetland Size within Study Area (hectares)	Wetland Characteristics	High Rated Function Attributes
13	0.04	Wetland 13 is a small bog located on a natural terrace. Abundant snags and downed wood are present in the wetland area (Photo 20, Appendix A). The dominant vegetation is *Nemopanthus mucronatus* and *Kalmia angustifolia* in the shrub stratum and stressed / stunted *Picea Mariana* and *Larix laricina* trees. *Sphagnum* moss covers the ground surface.	• Surface Water Storage • Phosphorus Retention • Nitrate Removal & Retention • Carbon Sequestration • Aquatic Invertebrate Habitat • Songbird, Raptor & Mammal Habitat • Pollinator Habitat • Native Plant Habitat
14	0.08	Wetland 14 is a small bog located on a natural terrace. Abundant snags and downed wood are present in the wetland area. The wetland contains extensive micro-topography (*i.e.,* hummocky, overturned trees). Ground vegetation is dominated by *Osmunda cinnamomea* (Photo 21, Appendix A). *Sphagnum* moss covers the ground surface. Tree and shrub stratums are dominated by *Picea mariana* and *Abies balsamea*.	• Surface Water Storage • Phosphorus Retention • Nitrate Removal & Retention • Carbon Sequestration • Songbird, Raptor & Mammal Habitat • Pollinator Habitat • Native Plant Habitat

Table 2: Summary of Delineated Wetlands and Functional Assessments

Wetland ID	Wetland Size within Study Area (hectares)	Wetland Characteristics	High Rated Function Attributes
15	0.35	The northern portion of Wetland 15 contains a small saturated swamp pocket that is likely influenced by the adjoining roadside ditching. A culvert under Goldbrook Road conveys surface water from north to east toward the remainder of the wetland. During periods of high precipitation / snowmelt, surface water may flow into the eastern portion of the wetland via roadside ditching. Evidence of clear-cutting (approximately 5 – 10 years ago) was observed in the upland areas adjoining Wetland 15 and abundant downed wood was observed within the wetland boundaries. The wetland contains dense herb (*Osmunda cinnamomea* and *Carex trisperma*), shrub (*Nemopanthus mucronatus* and *Viburnum nudum*) and tree (*Picea mariana*) stratums. *Sphagnum* moss covers the ground surface.	• Phosphorus Retention • Carbon Sequestration • Organic Nutrient Export • Pollinator Habitat • Native Plant Habitat
16	0.45	A culvert facilitates a drainage channel from the west side of the pipeline (located along the western boundary of the Study Area) to the east. Wetland 16, a riparian wetland, begins at the culvert outlet and extends downstream, following the drainage channel (Photo 23, Appendix A). Flowing water was present in the channel at the time of the site visit (July 28, 2017); however, no fish were observed nor expected due to abundant natural woody barriers. The drainage channel flows east, beyond the boundary of Wetland 16, to enter the western boundary of Wetland 18. The tree stratum is dominated by deciduous trees (*Acer rubrum* and *Betula papyrifera*). The shrub and herb stratum are comprised mainly of *Abies balsamea*, *Osmunda cinnamomea* and *Thelypteris noveboracensis*.	• Stream Flow Support • Water Cooling • Carbon Sequestration • Organic Nutrient Export • Waterbird Feeding Habitat • Waterbird Nesting Habitat • Songbird, Raptor & Mammal Habitat • Pollinator Habitat • Native Plant Habitat

Table 2: Summary of Delineated Wetlands and Functional Assessments

Wetland ID	Wetland Size within Study Area (hectares)	Wetland Characteristics	High Rated Function Attributes
17	6.20	Wetland 17 is a bog and forested swamp extending east from the pipeline easement across a hilltop in the northwestern portion of the Study Area. The wetland continues north, beyond the boundary of the Study Area. The ground is highly saturated and contains histosol depths greater than 1 metre from the ground surface. Drainage channels with flowing water exit the southern boundary of Wetland 17 to flow into Wetland 18. The wetland does not support a large quantity of trees or shrubs; however, a diverse herb stratum is present. Dominant species include: *Maianthemum trifolium*, *Calamagrostis pickeringii* and *Carex* spp. (Photo 24, Appendix A).	• Stream Flow Support • Organic Nutrient Export • Aquatic Invertebrate Habitat • Waterbird Feeding Habitat • Waterbird Nesting Habitat • Songbird, Raptor & Mammal Habitat • Pollinator Habitat • Native Plant Habitat

Table 2: Summary of Delineated Wetlands and Functional Assessments

Wetland ID	Wetland Size within Study Area (hectares)	Wetland Characteristic	High Rated Function Attributes
18	3.50	The southern portion of Wetland 18 contains an inactive beaver pond (Photo 25, Appendix A). Ponded water is present at unknown depths. The pond contains emergent vegetation and abundant snags along the edge. The substrate within the pond is very fine and silty. An earthen beaver berm is present in the eastern portion of Wetland 18, which allows travel across the pond. A seasonal watercourse outflows from the eastern boundary of the pond towards Gold Brook Lake. Fish may be able to pass from Gold Brook Lake to the pond during periods of high flow. Drainage channels from Wetland 16 and Wetland 17 enter the northern portion of Wetland 18. These channels contain vegetated, riparian fringe wetlands that connect to the northern side of the beaver pond. Fish were not observed nor expected within these channels due to natural woody barriers. Dominant vegetation within the wetland adjoining the pond includes *Alnus incana*, *Abies balsamea* and *Acer rubrum*.	• Stream Flow Support • Water Cooling • Phosphorus Retention • Organic Nutrient Export • Anadromous Fish Habitat • Resident Fish Habitat • Amphibian & Turtle Habitat • Waterbird Feeding Habitat • Waterbird Nesting Habitat • Songbird, Raptor & Mammal Habitat • Pollinator Habitat • Native Plant Habitat
19	0.1	Wetland 19 is a small, forested wetland located on a natural terrace. The surrounding area was clear-cut approximately 5-10 years ago. Abundant snags are present within the wetland boundaries. The wetland contains sparse tree cover with mainly shrub and herb stratum vegetation (Photo 26, Appendix A). Dominant species include: *Abies balsamea*, *Acer Rubrum*, *Kalmia angustifolia*, and *Carex trisperma*.	• Surface Water Storage • Phosphorus Retention • Nitrate Removal & Retention • Aquatic Invertebrate Habitat • Pollinator Habitat • Native Plant Habitat

Table 2: Summary of Delineated Wetlands and Functional Assessments

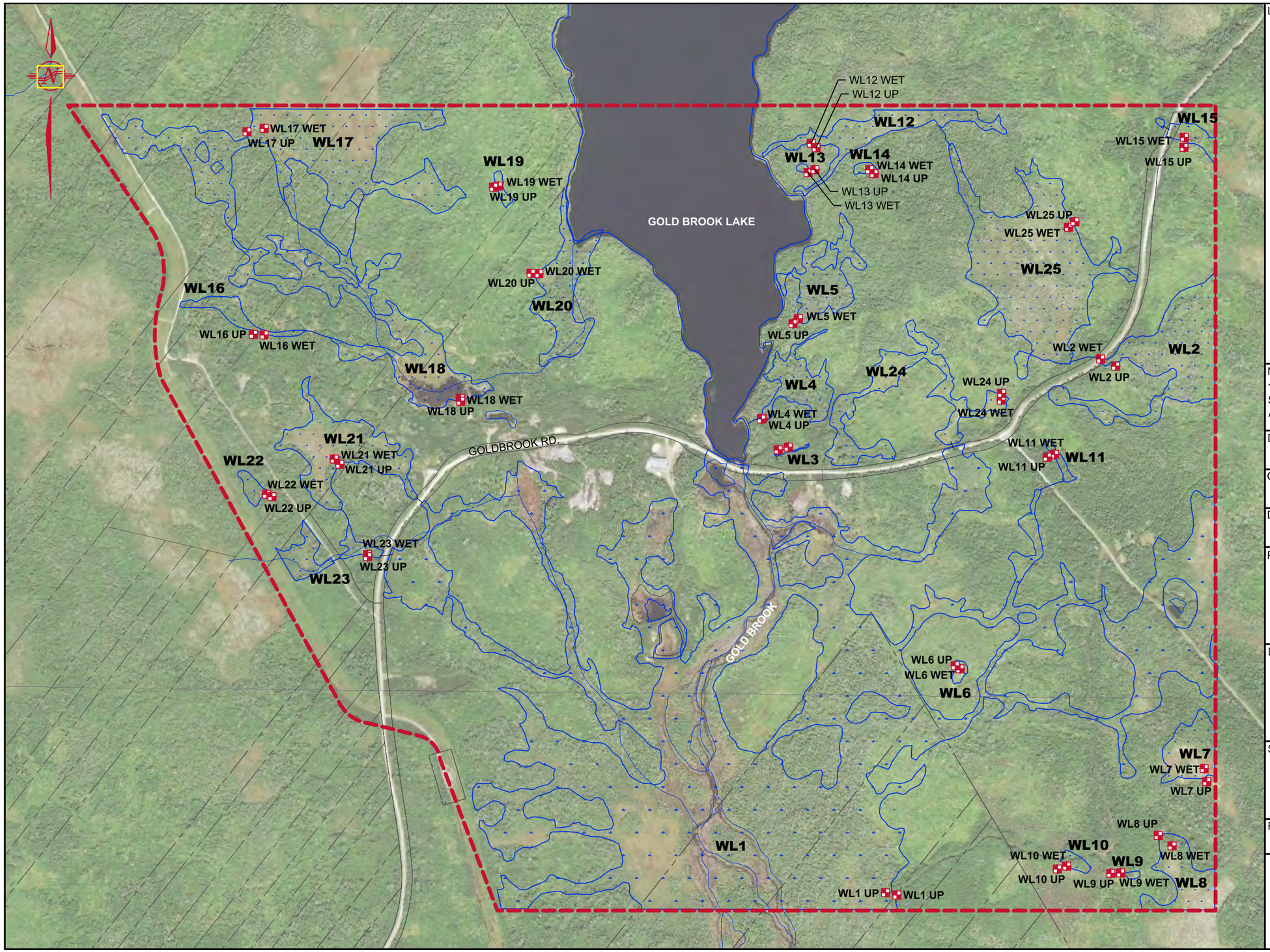
Wetland ID	Wetland Size within Study Area (hectares)	Wetland Characteristic	High Rated Function Attributes
20	1.79	A forested bog located in a natural depression that outlets to Gold Brook Lake (Photo 27, Appendix A). The surrounding upland areas were clear-cut approximately 5-10 years ago. The wetland contains deep, saturated histosol (greater than 45 cm from the ground surface) with a high water table (30 cm below ground surface). The wetland contains dense herb (*Osmunda cinnamomea* and *Carex trisperma*), shrub (*Picea mariana* sapling) and tree (*Picea mariana* and *Acer rubrum*) stratums. *Sphagnum* moss covers the ground surface.	• Phosphorus Retention • Organic Nutrient Export • Aquatic Invertebrate Habitat • Waterbird Feeding Habitat • Waterbird Nesting Habitat • Songbird, Raptor & Mammal Habitat • Pollinator Habitat • Native Plant Habitat
21	2.36	The majority of Wetland 21 is a bog with sparse trees and a dominant herb stratum (Photo 28, Appendix A). Dominant herb species include: *Myrica gale* and *Carex* spp. A small, vegetated drainage channel is present entering the northern portion of Wetland 21. The channel disperses within the bog area. However, a drainage channel exits the southern portion of the bog to a culvert which conveys the flow of surface water under the Goldbrook Road into the alder swale contained within Wetland 1. A drainage channel also flows from the southwestern portion of the bog to enter the northern portion of Wetland 23.	• Stream Flow Support • Phosphorus Retention • Organic Nutrient Export • Aquatic Invertebrate Habitat • Waterbird Nesting Habitat • Songbird, Raptor & Mammal Habitat • Pollinator Habitat • Native Plant Habitat

Table 2: Summary of Delineated Wetlands and Functional Assessments

Wetland ID	Wetland Size within Study Area (hectares)	Wetland Characteristics	High Rated Function Attributes
22	0.2	Wetland 22 is a small, forested wetland contained within a depression between the pipeline Right of Way (ROW) and the pipeline access road (Photo 29, Appendix A). The wetland is likely influenced by the roadside ditching and embankment of the pipeline. Large snags and downed trees were observed throughout the wetland. Dominant vegetation species include: *Picea mariana* (tree stratum), *Virbrunum nudum* (shrub stratum) and *Osmunda cinnamomea* (herb stratum). *Sphagnum* moss covers the ground surface.	• Organic Nutrient Export • Waterbird Nesting Habitat • Songbird, Raptor & Mammal Habitat • Pollinator Habitat
23	0.7	Wetland 23 is a small, forested swamp contained within a depression between the pipeline ROW and the pipeline access road (Photo 30, Appendix A). A shallow, vegetated drainage channel enters the northern wetland boundary (from Wetland 21) and flows through the wetland to the southern outlet at Goldbrook Road. A culvert conveys the flow of water under the road into the alder swale contained within Wetland 1. Large snags and downed trees were observed throughout the wetland. Dense tree, shrub and herb stratum are present within the wetland boundaries. Dominant vegetation species include: *Abies balsamea* (tree and shrub stratum), *Picea mariana* (tree and herb stratum), *Larix laricina* (tree stratum), *Acer rubrum* (tree stratum), *Viburnum nudum* (shrub stratum), and *Carex trisperma* (herb stratum).	• Water Cooling • Phosphorus Retention • Organic Nutrient Export • Aquatic Invertebrate Habitat • Waterbird Feeding Habitat • Songbird, Raptor & Mammal Habitat • Pollinator Habitat • Native Plant Habitat

Table 2: Summary of Delineated Wetlands and Functional Assessments

Wetland ID	Wetland Size within Study Area (hectares)	Wetland Characteristics	High Rated Function Attributes
24	1.99	Wetland 24 is a forested swamp. The eastern portion was clear-cut approximately 5 - 10 years ago, this is evidenced by ground disturbance and soil rutting in the area. The western portion is mostly undisturbed. A historic road embankment creates a defined boundary between Wetland 24 and Wetland 4. Minimal tree stratum is present in the western portion of the wetland as a result of the clear-cutting activities (Photo 31, Appendix A). *Picea mariana* saplings were observed in the shrub stratum; *Carex trisperma* and *Kalmia angustifolia* were the dominant herb species.	• Organic Nutrient Output
25	6.20	Wetland 25 is a large, forested bog atop a hillslope (Photo 32, Appendix A). The wetland contains deep (greater than 1 m), saturated histosol. A culvert facilitates flow under Goldbrook Road from Wetland 2 to Wetland 25. No fish were observed nor expected in the channel due to abundant natural woody barriers. Dominant vegetation includes *Picea mariana* and *Abies balsamea* in the tree and shrub stratum. *Kalmia angustifola* is the dominant herb stratum species.	• Phosphorus Retention • Organic Nutrient Export • Waterbird Feeding Habitat • Songbird, Raptor & Mammal Habitat • Pollinator Habitat • Native Plant Habitat



Legend

TEST PIT

STUDY AREA BOUNDARY

WETLANDS

Note

1. THIS DRAWING IS A SCHEMATIC REPRESENTATION. SIZES, LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

Drawn By	Checked By
CHG	JH
Calculations By	Checked By
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Date: SEPTEMBER 2017

Project: GOLDBORO BASELINE STUDIES
NOVA SCOTIA

Drawing: WETLAND DELINEATIONS

Scale: 1:7500

0 150 300 450m

File No.	Drawing	Revision No.
800160801	FIGURE 2	0

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3.0 Aquatic Habitat Assessment

An aquatic habitat assessment was conducted to determine the presence of any fish habitat / fish bearing watercourses within the Study Area. This assessment included:

- Determining whether fish habitat / passage was present in any areas containing surface water;
- If fish habitat was present, conduct a species presence / absence survey; and
- Conducting a steam survey of Gold Brook.

3.1 Methodology

A GEMTEC biologist determined if any encountered aquatic features (flowing or ponded waterbodies) within the Study Area contained fish habitat and / or had the potential to be fish-bearing. Fish habitat was determined by traversing the waterbody to determine the presence (or seasonal possibility) of:

- Sufficient water depths to accommodate fish;
- Adequate water quality (via field measurements of temperature, dissolved oxygen, conductivity, and pH);
- Nutrient inputs for feeding (*i.e.,* overhanging vegetation, surface water influx, woody debris, *etc.*); and / or
- Passage from Gold Brook Lake, Gold Brook or any other known fish bearing waterbodies (*i.e.,* vegetation in the stream, deadfall, beaver berm, *etc*.).

In the event that any of the aforementioned characteristics were found, a fish presence / absence survey was completed. An LR-24 Smith-Root backpack electrofisher that was powered by a 24-volt battery was used to live capture fish. Any captured fish were released into the same waterbody in which there were retrieved.

The fish habitat assessment did not include the collection of soil or sediment samples for laboratory analysis, nor the collection or analysis of Benthic Macroinvertebrate samples (BMI). Additionally, the scope of work did not include the collection of fish specimens for disease or mercury / heavy metal analysis.

3.1.1 Gold Brook Stream Survey

Gold Brook is known fish habitat and a significant aquatic feature that may be affected by the Project (*i.e.,* change in inflowing water quality / quantity). As such, a stream survey of Gold Brook was conducted within the Study Area boundaries. The scope of the stream survey was as follows:

- Visual observation of bank stability, bank erosion and riparian vegetation;

- Visual assessment of the substrate size and embeddedness;
- Measurement of flow;
- Water depth and quality determination (via field measurements of temperature, dissolved oxygen, conductivity, and pH); and
- Presence / absence survey for fish.

The aforementioned characteristics were assessed at sample points along the watercourse within the Study Area. The sample points were conducted at 100 m intervals downstream of the culvert outlet at Goldbrook Road (Point 1). In instances where the channel braided, a sample point was collected at each braid along a horizontal transect line and sub-labelled (*i.e.,* Point 7A, Point 7B, Point 7C).

Physical Habitat Assessment

In order to characterize and determine the relative bank stability the following DFO ratings were used:

- "good" – more than 80% of the bank is stable and well vegetated;
- "fair" – 50% to 80% stable banks with minimal evidence of erosion; or
- "poor" – less than 50% stable banks and considerable evidence of erosion.

Shallow waters in Gold Brook allowed for the visual observation of the substrate composition in-situ. The size of substrate was characterized using the DFO criteria outlined in Table 3.

Table 3: Substrate Classification

Name	Size
Boulder	> 461 mm
Rock	180 mm – 460 mm
Rubble	54 mm – 179 mm
Gravel	2.6 mm – 53 mm
Sand	0.06 mm – 2.5 mm
Fines	0.0005 mm – 0.05 mm

Substrate embeddedness (a measure of the amount of fine sediment that is deposited in the interstices between the larger stream substrate of boulders, rocks and rubble) was categorized using the four DFO criteria ratings:

- 1. ≤ 20% of the large substrate is surrounded or covered by fine substrate;
- 2. 20% - 35% of the large substrate is surrounded or covered by fine substrate;
- 3. 35% - 50% of the large substrate is surrounded or covered by fine substrate; and
- 4. ≥ 50% of the large substrate is surrounded or covered by fine substrate.

Flow velocity was measured in the watercourse by using a stopwatch and a float. Flow was measured three times along a length of 1 m at each sample site. Flow was not measured for sample sites that had obstructions that would prevent an accurate result.

The aforementioned information was recorded on a DNR / DFO Stream Habitat Inventory datasheet.

Water Quality

The Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME FWAL) were used as the applicable criteria for assessing of water quality. The CCME FWAL guidelines were chosen because they are good indicators of common water quality problems (*i.e.,* eutrophication, salinization, acidification, and organic pollution). Conductivity is not included in the CCME FWAL Guidelines; therefore, the Environment and Climate Change Canada (ECCC) Canada's Freshwater Quality in a Global Context Target was used for comparison purposes. The three applicable targets are listed below:

- Dissolved Oxygen: greater than 5.5 mg/L
- pH: 6.5 – 9
- Conductivity: less than 500 µS/cm (EC, 2017).

Many fish species have a distinct thermal optima; therefore, water temperature is an important factor in determining the habitat quality for fish survival and production. Salmonids are sensitive to warm water and tend to avoid areas of water with temperatures greater than 20°C (DFO, 2008). To classify the water temperature in Gold Brook, the DFO classification system for Brook Trout (*Salvelinus fontinalis*) was used:

- Cool: < 16.5°C as ideal;
- Intermediate: 16.5°C to 18.9°C as marginal; and,
- Warm: ≥ 19°C as unsuitable.

Temperature (°Celsius), conductivity (µS/cm), dissolved oxygen (mg/L), and pH were measured at twenty-two sites in Gold Brook using a calibrated YSI-556 multi-meter. Water quality readings were taken while the probe rested on the watercourse bed without being submerged in fine substrate.

Fish Survey

A fish survey was completed along the length of Gold Brook in the Study Area. An LR-24 Smith-Root backpack electrofisher powered by a 24-volt battery was used to live capture fish. All captured fish were species identified, visually measured and then released back into Gold Brook.

The fish survey did not include quantifying fish populations nor removing the fish from the Study Area. Additionally, the survey did not include obtaining specimen samples for laboratory analysis (*e.g.,* tissue sampling) as these practices are not typically required for a baseline environmental study at this stage of the Project.

3.2 Summary of Findings

The *Fisheries Act* defines fish habitat as those parts of the environment "on which fish depend, directly or indirectly, in order to carry out their life processes". Preferred habitat varies amongst fish species. Each species can be found in a range of habitat types throughout the year and throughout different life stages. Three areas were identified as containing fish habitat and / or are fish-bearing during the site visit:

- Gold Brook Lake (central coordinates 45.213514ºN, -61.637875ºW). The scope of work did not include the assessment of Gold Brook Lake (with the exception of water quality as discussed in Section 6.0). Gold Brook Lake is not expected to be effected by the Project, as such, no comment is made with respect to Gold Brook Lake;
- Gold Brook (central coordinates 45.200072ºN, -61.635883ºW). Gold Brook originates at the outlet of Gold Brook Lake and flows south through the Study Area; and
- An unnamed beaver pond (central coordinates 45.203587ºN, -61.644065ºW). It was determined that this pond contains fish habitat as it contains sufficient water depths to accommodate fish, adequate water quality, nutrient input for feeding, and seasonal or historical fish passage from Gold Brook Lake (a known fish bearing waterbody). However, no fish were captured during the electrofishing presence / absence survey nor were fish observed. An outlet channel flows east into Gold Brook Lake. At the time of the site visit, fish passage was not possible between the two waterbodies due to low water levels and abundant natural fish barriers. It is our understanding that a comprehensive fish habitat assessment will be conducted to confirm the absence / presence of fish at this location and submitted under separate cover.

3.2.1 Gold Brook Stream Assessment

A stream assessment was conducted along Gold Brook on June 7, 2017. The closest EC weather station; Malay Falls, Nova Scotia (located approximately 70 kilometers (km) southeast of Gold Brook) showed day-time air temperatures ranging from 7.9°C – 15.6°C. Recorded on-site conditions were sun with cloud.

A total of 22 sampling points were recorded at 12 - 100 m intervals along Gold Brook. Survey sampling points are presented on Figure 3. The stream assessment data forms are presented in Appendix E; watercourse photos are attached in Appendix D.

Physical Habitat Assessment

Gold Brook is an open stream originating at the outlet of Gold Brook Lake. Two damaged corrugated steel culverts facilitate flow from the lake to the watercourse, under Goldbrook Road (Photo 1, Appendix D). A historic tailings pond is present west of the culvert outlet which has naturally reclaimed to a floodplain area containing emergent vegetation. In general, the vegetation along the banks of Gold Brook is predominantly Black Spruce (*Picea* mariana), Lambkill (*Kalmia angustifolia*), Sedges, (*Carex* sp.), Rushes (*Juncaceae* sp.), Grasses (*Poaceae* sp.), and *Sphagnum* moss. Overhanging vegetation is present along some of the perimeter of the watercourse (Photo 11, Appendix D).

In general, the banks of Gold Brook appeared stable and were rated “good” on the DFO classification scale. The banks contained mostly rubble, rock and boulder sized substrate that is stable (Photo 2, Appendix D). Evidence of erosion or undercutting of the watercourse banks was not observed at any sampling points within the Study Area. The water within the watercourse is clear and suspended sediments / turbidity was not observed.

Substrate size within the Study Area is mixed. Large size boulders and rocks were observed abundantly throughout the channel with small / fine grained substrate (pebble, sand and fines) in between (Photo 18, Appendix D). Rubble and gravel sized substrate was sparsely found at the sampling points. The substrate was not highly embedded; two sampling points (10B and 11A) received an embeddedness rating of 3 and no sampling points received a rating of 4.

Gold Brook did not contain any pools. Some slow flowing water was observed just downstream of large boulders; however, all sampling points contained flowing water with riffles. The field measured flow ranged from 11.1 centimetres (cm)/s (Point 7C) to 32.5 cm/s (Point 11B).

Water Quality

Field parameters were measured at each sampling point on June 7, 2017:

- Water temperatures ranged from 13.3°C (Point 1 and Point 3) to 21.2°C (Point 12);
- Field pH ranged from 4.8 (Point 7B) to 5.69 (Point 11A);
- Dissolved Oxygen ranged from 7.9 mg/L (Point 10B) to 11.0 mg/L (Point 7B); and
- Conductivity ranged from 10.3 µS/cm (Point 7A) to 23.3 µS/cm (Point 12C).

The temperature of the water generally increased from Point 1 to Point 12 (A,B,C). This is likely due to two factors: (1) The distance / transition from the deep lake to the shallow, minimally shaded watercourse channel, and (2) The assessment began at Point 1 in the morning and ended at Point 12 in the afternoon when ambient temperatures were increasing. All temperatures at Point 9, Point 10 (A,B,C), Point 11 (A,B,C) and Point 12 (A, B, C) are considered warm for salmonid fish species.

High acidity was found throughout Gold Brook. All measured pH values are outside the CCME FWAL guideline. The concentration of dissolved oxygen and the conductivity are within the guidelines; however, the conductivity did generally increase at the downgradient sample points.

All field water quality measurements are presented in Table 4 in Appendix J.

Fish Survey

A fish survey was conducted in Gold Brook on June 5, 2017. A total of 19 fish were captured in Gold Brook during the presence / absence survey including American Eel, Banded Killfish and Brook Trout (Photo 23, Photo 24 and Photo 25, Appendix D). Visual observation of several schools of Brook Trout were also observed during the field investigation.

Table 4: Summary of Fish Recovered in Gold Brook on June 5, 2017

Common Name	Scientific Name	# of Fish	Average Length (cm)
American Eel	*Anguilla rostrata*	3	15
		11	20
		1	40
Banded Killifish	*Fundulus diaphanus*	1	4
Brook Trout	*Salvelinus fontinalis*	3	15
	Total	**19**	**-**

Legend

SAMPLE LOCATION

STUDY AREA BOUNDARY

Note

1. THIS DRAWING IS A SCHEMATIC REPRESENTATION. SIZES, LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

Drawn By	Checked By
CHG	JH
Calculations By	**Checked By**
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Date: SEPTEMBER 2017

Project: GOLDBORO BASELINE STUDIES
NOVA SCOTIA

Drawing: GOLD BROOK STREAM SURVEY

Scale: 1:5000

0 100 200 300m

File No.	Drawing	Revision No.
800160801	FIGURE 3	0

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4.0 Vegetation and Rare Flora Survey

A rare flora survey was undertaken within the proposed Study Area. The scope of work carried out for the vegetation and rare flora survey included:

- A desktop Species at Risk (SAR) Study;
- Identifying all encountered vascular vegetation within the Study Area; and
- Identifying all encountered rare flora (vascular or non-vascular) within the Study Area.

4.1 Methodology

A field botanist conducted a vascular vegetation and rare flora survey within the Study Area. A desktop study for SAR and areas of concern was conducted prior to the site visit. The SAR screening was conducted by obtaining data from the Atlantic Canada Conservation Data Centre (ACCDC); the search request was limited to within a 5 km radius of the Study Area. This database search provided the following:

- Reported observations of rare and endangered flora and fauna;
- Expert Opinion Maps information to identify species that have not been reported but are expected, based upon estimates of habitat and wildlife distribution; and
- Locations of any Special Areas such as the following:
    - Managed areas with some level of protection;
    - Significant ecological areas of interest;
    - National Defense areas; and
    - First Nations areas.

The species listed within the ACCDC report were referenced to ranking outlined by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), the *Species at Risk Act* (*SARA*), and the *Nova Scotia Endangered Species Act* (*NSESA*). During the site visit, comparison to habitats suited to any identified rare or endangered species of flora identified in the desktop study was completed. The ACCDC report, mapping and habitat comparison table are attached as Appendix F.

SARA provides protection for flora species against extirpation, extinction or endangerment from human activities. Currently, only the species listed in Schedule 1 of *SARA* are protected federally. Provisions to protect and recover a species come into effect once it has been listed in Schedule 1 of *SARA*.

The *NSESA* provides another level of legislative protection for SAR and Species of Conservation Concern (SOCC). Different levels of protection are afforded for species listed within these acts

depending on the species rarity ranking. Several agencies, including the ACCDC and Nova Scotia Department of Natural Resources (NSDNR), contribute lists of 'species of conservation concern' that are not protected by legislation. All species ranked S1 to S3 by the ACCDC are considered rare for the purpose of this report.

The botanist traversed the site by foot, focusing on unique habitats (*i.e.,* rock outcrops, watercourses and wetlands) in a random meandering fashion. In general, these habitats have an elevated potential for the occurrence of rare species. Consideration was given to the preferred habitat for several lichen species (non-vascular flora) that were identified in the ACCDC report. The locations of all encountered rare flora were recorded using a handheld GPS unit and photos. Specimens were collected if a species could not be identified in the field. The botanist also recorded an inventory list of all encountered flora species while conducting the field reconnaissance program.

4.2 Summary of Findings

The vegetation and rare flora surveys were conducted during multiple stages of the flowering season (late June and late July, 2017) to ensure identification of both the early and late flowering plants. A complete inventory of plant species encountered within the Study Area is presented in Appendix G. The locations of encountered rare flora are presented on Figure 4.

Two rare species (S3 Secure) were identified during the surveys:

- Variegated Horsetail (*Equisetum variegatum*); and
- Southern Twayblade (*Listera australis*).

A total of six Southern Twayblade plants were located in the forested swamp portion of Wetland 17 (Figure 2). The specific location was nearly free of competing herb vegetation and the hydrology appeared to be stable. The populations of Varigated Horsetail were found in isolated to wet, disturbed areas at the southern end of Gold Brook Lake and adjacent to Gold Brook. The plants formed colonies and appeared to be isolated to historic tailings ponds. Table 5 summarizes the findings of the Rare Flora survey.

Table 5: Summary of Encountered Rare Flora

Scientific Name	Common Name	S-Rank	SGS Rank	Notes	Location*	
					x	y
Equisetum variegatum	Variegated Horsetail	S3	Secure	5 x 5 m patch	607004.54	5006411.70
Equisetum variegatum	Variegated Horsetail	S3	Secure	5 x 1 m patch	607037.06	5006340.08
Equisetum variegatum	Variegated Horsetail	S3	Secure	10 x 5 m patch	607021.84	5006309.38
Equisetum variegatum	Variegated Horsetail	S3	Secure	10 x 8 m patch	607018.95	5006283.92
Listera australis	Southern Twayblade	S3	Secure	1 plant	606187.16	5006839.92
Listera australis	Southern Twayblade	S3	Secure	1 plant	606190.76	5006843.44
Listera australis	Southern Twayblade	S3	Secure	1 plant	606193.12	5006851.07
Listera australis	Southern Twayblade	S3	Secure	3 plants	606188.59	5006852.28

*Coordinate system: NAD1983 CSRS UTM Zone 20N

4.2.1 Vascular Plant Species of Conservation Concern

Only one SOCC was identified by the ACCDC as having been reported within a 5 km radius of the Study Area. The Northern Bur-Reed *(Spaganium hyperboreum)* is a perennial, aquatic herb that grows completely under water or as an emergent shallow-water aquatic along sedge-marshy borders. This type of habitat is limiting within the Study Area. There are marshy littoral wetland locations along the border of Gold Brook Lake that may provide habitat but they tend to be very small (portions of Wetland 1, Wetland 5, Wetland 12 and Wetland 20). These areas within the Study Area were extensively surveyed for emergent and aquatic plants and Northern Bur-Reed was not observed. Table F2 (Appendix F) describes the preferred habitat for any flora species listed in the ACCDC.

4.2.2 Non-Vascular Species at Risk and Conservation Concern

Most lichen SAR and SOCC identified by the ACCDC have similar habitat requirements and are addressed together in this section. The globally rare species Boreal Felt Lichen (*Erioderma pedicellatum*), in particular, prefers mature forest with an abundance of moisture-loving species such as *Sphagnum* mosses and Cinnamon fern (*Osmundastrum cinnamomeum)*.

Within the Study Area, the preferred habitat was mostly identified within coniferous forested swamps, with the exception of a few large upland stands of mature Black Spruce (*Picea mariana*) / Balsam Fir (*Abies balsame*a). Coniferous forested swamps tend to be dense with little light penetration. Mature upland areas of Spruce / Fir tended to be dry outcrops or upland islands with thin soils surrounded by the coniferous forested swamp areas. Understory vegetation in the

upland Spruce / Fir stands is sparse and the forest floor was blanketed with feather mosses (*i.e., Pleurozium schreberi* and *hylocomium splendens*). The oldest stands are between 70 and 80 years old (determined through tree core analysis); however, the Study Area tends to slope to the south which does not favour lichen development. Mature coniferous stands and forested wetlands were extensively surveyed during the field reconnaissance programs and no rare lichen species were observed.

Legend

- LISTERA AUSTRALIS
- EQUISETUM VARIEGATUM
- STUDY AREA BOUNDARY
- WETLANDS

Note

1. THIS DRAWING IS A SCHEMATIC REPRESENTATION. SIZES, LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

Drawn By	Checked By
CHG	JH
Calculations By	**Checked By**
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Date: SEPTEMBER 2017

Project: GOLDBORO BASELINE STUDIES
NOVA SCOTIA

Drawing: RARE FLORA LOCATIONS

Scale: 1:4000

0 50 100 200m

File No.	Drawing	Revision No.
800160801	FIGURE 4	0

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5.0 Wildlife and Rare Fauna Survey

A wildlife and rare fauna survey was conducted within the Study Area. The scope of work carried out for the wildlife and rare fauna survey included:

- A desktop SAR Study;
- Two Breeding Bird Surveys (early June and late June);
- An Owl and Raptor Survey (April);
- Common Nighthawk Survey (June);
- Bat Survey (June);
- Moose Survey (April);
- Habitat assessment for other species of concern (April, June, July); and
- Records of incidental observations or herpetiles, mammals, butterflies, odata and other species or evidence of those species (April, June, July).

The wildlife and rare fauna survey did not include the trapping, tracking or collection of any wildlife and / or specimens.

5.1 Methodology

SARA provides protection to fauna species against extirpation, extinction or endangerment from human activities. Currently, only the species listed in Schedule 1 of *SARA* are protected federally. Provisions to protect and recover a species come into effect once it has been listed in Schedule 1 of *SARA*. The federal *Migratory Birds Convention Act* (*MBCA*) provides overarching protection for individuals and populations of birds and their nests, including songbirds, waterfowl and seabirds, against harm or destruction. The *MBCA* and associated regulations are administered by ECCC through the Canadian Wildlife Service (CWS).

The *NSESA* provides another level of legislative protection for SAR and SOCC. Different levels of protection are afforded for species listed within these acts depending on the species rarity ranking. Several agencies including the ACCDC and NSDNR contribute lists of 'species of conservation concern' that are not protected by legislation. These species require special consideration when an EA is triggered at the provincial or federal level.

The following sections describe the field studies undertaken to identify potential SAR and their habitat that may be present within the Study Area.

5.1.1 Breeding Bird Survey

Breeding bird surveys were conducted as per the methods outlined in the Maritime Breeding Bird Atlas (MBBA). To ensure representation of all habitat types, preliminary site selection for the bird point count locations were identified based on the following:

- Forest species composition; and
- Development stage within the Study Area.

Aerial photography combined with forest inventory data from the NSDNR was used to determine the aforementioned.

Two rounds of breeding bird surveys were conducted in the month of June; one in early June (June 2 to June 5, 2017) and one in late June (June 27 to June 29, 2017). Surveys began no earlier than 05:00 and ended no later than 10:30. Each point count location was surveyed for a period of 10 minutes during the investigation. The breeding status of each species was determined using the criteria used in the MBBA. Data collected for each bird detected included: number, species, behavior, and location in relation to the survey point. Weather parameters (*i.e.,* wind speed / direction, sky condition and temperature) were also recorded at each point count location.

Species observed or heard singing in suitable nesting habitat were classified as possible breeders by exhibiting the following behaviours:

- Courtship behaviour between a male and female;
- Birds visiting a probable nest site;
- Birds displaying agitated behaviour; or
- Male and female observed together in suitable nesting habitat.

Species were confirmed as breeding if any of the following items or activities are observed:

- Nest building or adults carrying nesting material;
- Distraction display or injury feigning;
- Recently fledged young;
- Occupied nest located; or
- Adult observed carrying food or fecal sac for young.

Area searches were also conducted to ensure a more complete list of bird species. This approach required walking through the Study Area and recording the presence / breeding evidence of bird species between point count locations. Incidental bird observations / singing were also recorded

in conjunction with wetland and rare flora field reconnaissance programs. This ensured that the entire Study Area was surveyed at least once.

5.1.2 Owl Survey

An owl survey was conducted on the evening of April 24, 2017. Two survey locations were situated within the Study Area boundary (Owl 1 and Owl 2) and two were situated outside of the Study Area boundary as control points (Owl 13 and Owl 4). Control points were not required for this survey but were added so that a larger area could be assessed to determine what species were present at a landscape level. As a safety precaution all sites were limited in areas that were accessible by road. Surveys locations were situated approximately 1.6 km apart as per the owl survey protocol (Takats et al., 2001). An owl playback recording was broadcast via a vehicle audio sound system to elicit a response from owls. The first of four, ten minute surveys began at 20:41 (30 minutes after sunset) and the last survey ended at 22:15. At each survey location, weather parameters (*i.e.,* wind speed / direction, sky condition and temperature) were recorded. If an owl was detected during the survey, the bearing and estimated distance from the survey location was recorded.

5.1.3 Common Nighthawk Survey

A Common Nighthawk (*Chordeiles minor*) survey was conducted on June 25, 2017 in accordance with the methodologies outlined in the CWS draft protocol for conducting nightjar surveys (April 2016). Surveys commenced no earlier than 1 hour before sunset and ended no later than 2 hours after sunset and included:

- Recording the weather parameters: wind speed (Beaufort scale), temperature, and percent cloud cover / sky illumination at the beginning of each survey;
- Beginning each survey with 1 minute of silence followed by 6 minutes of passive listening, broken into 1 minute recording intervals;
- Common Nighthawk calls were broadcast via a vehicle audio sound system for 2 minutes followed by a final 2 minute listening period; and
- Maintaining a written record of all species detected during the survey.

Common Nighthawk surveys were not conducted when winds exceeded 20 km / hour (Beaufort scale of 3), the temperature dropped below 7ºC, or when precipitation was forecasted. Due to time constraints, it was not possible to conduct surveys during periods of high lunar illumination when Nighthawks are most active.

5.1.4 Bat Survey

In 2014, several bat species including: Little Brown Bat (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*), and Tri-Colored Bat (*Perimyotis subflavus*), were listed as Endangered under *SARA* because of the threat posed by white nose syndrome (WNS). WNS is a fungus

(*Pseudogymnoascus destructans*) introduced from Europe that causes these species to arouse during hibernation, depleting them of resources leading to death in almost all cases (Environment Canada 2014). The Endangered status provides legal protection for individuals and their residences (*e.g.,* roosts and hibernacula).

An assessment of known abandoned mine shafts was conducted to determine if potential habitat exists (*i.e.,* not flooded). Habitat preferences for foraging and roosting include: freshwater and wetland habitats, forest edges, large trees, unsealed buildings, and abandoned mine shafts.

An emergence survey was conducted at one unflooded mine shaft location and within a warehouse on-site after a visual assessment of the building indicated evidence of historic use by bats.

The visual assessment of the warehouse included:

- Inspection of the exterior and interior building surfaces looking for possible entrances to cavities (*e.g.,* walls and attic spaces);
- Inspection of interior and exterior surfaces (including spider webs) for evidence of bat guano;
- Collection and visual analysis of dropping samples that were found to determine the presence or absence of chitin (*i.e.,* the main constituent of arthropod exoskeleton); and
- Inspection of any constructed or hard surface (*e.g.,* asphalt or patio) surrounding the exterior of a building for evidence of bat activity (*i.e.,* bat guano).

5.1.5 Moose Survey

Spring pellet surveys were conducted for Mainland Moose (*Alces alces Americana*), with transects running through different habitat types and high-probability areas such as fens and marshes.

Prior to visiting the Study Area, environmental biologists reviewed available mapping for habitat types that support a high potential for moose, or corridors typically used by moose, to select sampling transects. Transects were reviewed and approved by NSDNR prior to the commencement of the survey. During the field investigation, any evidence of moose was noted via handheld GPS units and photos. Evidence included (but was not limited to) incidental sightings, tracks, antler sheds, rubbings, scat (pellets), and / or evidence of browsing and trails.

In total, twelve 1 km long by 2 m wide transects were surveyed from April 25 to April 27, 2017. A total of seven transects were located inside the Study Area and five transects were located outside the Study Area as control surveys.

In addition to conducting formal moose surveys, the Study Area was continuously surveyed for incidentals during the other field reconnaissance programs in June and July, 2017.

5.1.6 Other Species of Concern & Incidental Observations

The ACCDC identified the Atlantic Salmon (*Salmo salar*) and Brook Trout (*Salvelinus fontinalis*) as having been observed within 5 km of the Study Area. The Nova Scotia Southern Upland population of Atlantic Salmon is Endangered under COSEWIC. Other populations of Atlantic Salmon have an ACCDC rank of S1 and a SGS rank of "May be at Risk". Brook Trout has a SGS rank of Sensitive.

In waterbodies within the Study Area that was deemed to contain suitable fish habitat, a presence / absence survey was conducted using a backpack electrofisher. Any captured fish were identified, sized and released back into the waterbody they were retrieved from.

Any incidental sightings of fauna species, preferred habitat or evidence of wildlife presence (*i.e.,* tracks, dens, scat, etc.) were recorded using a handheld GPS unit and photos were taken (when possible).

5.2 Summary of Findings

The ACCDC report is presented in Appendix F. A summary table outlining the species ranking (Table F1) and a summary table of the preferred habitat for each ACCDC listed species (Table F2) are also presented in Appendix F.

5.2.1 Breeding Bird Survey

A total of 61 bird species comprising of 602 individual records were documented during the survey (Appendix H). The most numerous species recorded overall, in descending order, are:

- White-throated Sparrow (*Zonotrichia albicollis);*
- Common Yellowthroat (*Geothlypis trichas*);
- Magnolia Warbler (*Setophaga magnolia*);
- Black-throated Green Warbler (*Setophaga virens*);
- Alder Flycatcher (*Empidonax alnorum*);
- Hermit Thrush (*Catharus guttatus*);
- Ruby-crowned Kinglet (*Regulus calendula*);
- Yellow-rumped Warbler (*Setophaga coronate*); and
- Boreal Chickadee (*Poecile hudsonicus*).

The observed abundance of these species would be expected given the development stage and species composition of the forest within the Study Area. A review of the MBBA indicates that a total of 147 birds species have been recorded in square 20PR00 (in which the Study Area is contained). The number of bird species anticipated within the Study Area is expected to be lower

due to the relatively low diversity of habitat types and absence of coastal features. The majority of observed bird species are characteristic of early to mid-successional forest and wetland habitats that are found within the Study Area.

No raptor nests were noted in the Study Area; however, an active Osprey (*Pandion haliaetus*) nest was observed during the moose surveys at the northern end of Gold Brook Lake. Osprey were also observed numerous times flying over and foraging in the vicinity of Gold Brook Lake.

Wetland 18, Gold Brook Lake and Gold Brook represent quality habitat for waterfowl and other wetland and shorebird species. Waterfowl and wetland bird species, including: Spotted Sandpiper (*Actitis macularius*), Green-wing Teal (*Anas carolinensis*), Tree Swallows (*Tachycineta bicolor*), Belted Kingfisher (*Megaceryle alcyon*), Great Blue Heron (*Ardea Herodias*), Common Loon (*Gavia immer*) and Osprey were observed foraging in these habitats.

A total of one SAR and 23 SOCC bird species were recorded during the breeding bird surveys and are summarized in Appendix H. Most of these species tend to be regionally abundant but uncommon provincially.

Breeding bird survey locations are presented in Figure 5.

5.2.2 Owl Survey

Evidence for possible breeding owls (*i.e.,* singing males) was detected within the Study Area. The accounts of owls included:

- A Great Horned Owl (*Bubo virginiatus*) was observed during the daytime moose surveys at approximately 8:30, near the Owl 1 sample point location. This was a serendipitous observation and may have been an individual passing through the area or hunting during early morning hours. This species was not detected at Owl 1 during the owl survey;
- A Northern Saw-Whet (*Aegolius acadicus*) was detected approximately 400 m from Owl 3 sample point location (at a bearing of 20^0) which is a control point located outside of the Study Area; and
- A Boreal Owl (*Asio otus*) was detected approximately 500 m from the Owl 1 sample point location (at a bearing of 286^0). This location indicates that the Boreal Owl was using a relatively large patch of mature coniferous forest on the edge of a coniferous swamp / bog (Wetland 25).

Owl Survey locations in relation to the Study Area are presented in Figure 5. Table 7 summarizes the findings of the Owl Survey.

Table 7: Summary of Owl Survey Results

Point	Common Name	Scientific Name	Bearing / Distance	S-Rank	General Status	#
Owl 1	Boreal Owl	*Asio otus*	286º 500 m	S2?B	Undetermined	1
Owl 1	Great Horned Owl	*Bubo virginiatus*	Incidental	S4	Secure	1
Owl 2	-	-	-	-	-	-
Owl 3	Northern Saw-Whet Owl	*Aegolius acadicus*	20º 400 m	S4B	Secure	1
Owl 4	-	-	-	-	-	-

5.2.3 Common Nighthawk Survey

Despite considerable effort through targeted and incidental surveys, no Common Nighthawks (*Chordeiles minor*) were detected.

An abundance of suitable habitat is found within and adjoining the Study Area boundaries including; the pipeline ROW, open bogs and disturbed areas. Additionally, the most recent MBBA lists multiple records of Common Nighthawk within square 20PR00. Due to the high potential for this species to occur, Common Nighthawk surveys were conducted on three non-consecutive evenings in late June. Higher quality nesting habitat may be more abundant in the surrounding landscape. Large bogs and open coniferous treed swamps are relatively common in this region and may present better nesting and foraging opportunities.

5.2.4 Bat Survey

Evidence of historic bat roosting was found in the warehouse building. This included:

- Old droppings which contained chitin (determined through visual analysis); and
- A vent within the building had written testimonial evidence that indicated bats had used the vent for roosting.

The building had a number of openings that were observed for approximately an hour at dusk to determine if bats were present. No bats were observed.

One abandoned mine shaft determined to have limited potential for bats was observed for approximately an hour. The mine shaft was first investigated in April 2017 during the moose surveys; at that time it was flooded. An emergence survey was conducted in late June 2017 when it was dry to ensure it was not being used by bats. No bats were observed.

Bats were also considered while conducting Common Nighthawk surveys. Gold Brook Lake, Gold Brook and road corridors were scanned at dusk in an effort to detect bat presence. No bats were observed. Further, there was no evidence found to suggest that bats are currently using the building or mine shaft within the Study Area.

Bat survey locations are presented in Figure 5.

5.2.5 Moose Survey

No evidence of antler sheds, rubbings, tracks, and / or pellets was observed during the moose survey. Light browse was observed in almost every transect; however, it was deemed associated with White-tailed Deer (*Odocoileus virginianus*) based on other evidence such as tracks and trails. Two locations in close proximity to each other along Transect 6 showed old evidence of browsing on Balsam Fir (*Abies balsamea*). Moose are more likely to browse Balsam Fir than White-tailed Deer; however, without further evidence it was difficult to determine with certainty that it was moose browse. One old track was found at the southern end of the Study Area near Gold Brook (Figure 6). While moose are known to occur in the region, it was apparent that moose activity was very low within and adjoining the Study Area.

The moose survey transects are presented in Figure 6.

5.2.6 Other Species of Concern & Incidental Observations

Birds

Bird species determined to be SOCC by the ACCDC list of were reviewed. Table F1 (Appendix F) summarizes the federal and provincial rankings for each listed species. Table F2 (Appendix F) summarizes the preferred habitat and distribution / population for each listed species.

Of the species identified as threatened or Endangered by the ACCDC, only Canada Warbler (*Cardellina pusilla*) was identified in the Study Area. Canada Warbler was determined to be a probable breeding species during the Breeding Bird Survey (Appendix H). Canada Warbler is listed as Endangered under the *NSESA* and Threatened under Schedule 1 of *SARA*.

A mentioned above, Canada Warbler was detected during the late June 2017 breeding bird survey at two locations within the Study area. In all instances it was detected in coniferous wetland with a well-developed shrub layer. Canada Warbler prefers forested habitat with a well-developed shrub layer and structurally complex forest floor. Regenerating stands also provide good habitat (COSEWIC 2008). This habitat type is abundant regionally and within the Study Area.

Canada Warbler was recorded as a possible breeder in the 1st and 2nd MBBA survey within square (20PR00) (MBBA 2017). Indicating that habitat at a regional or landscape level is abundant. Two of the three occurrences were observed pairs in suitable nesting habitat and one was a singing male that appeared to be agitated.

Habitat requirements bird species detected during surveys or identified by ACCDC as potentially occurring within the Study Area are addressed in Table 8.

Fish

Several fish species were captured during the presence / absence survey in Gold Brook (Section 3.2.1); including:

- Brook Trout (*Salvelinus fontinalis)*;
- Banded Killfish (*Fundulus diaphanus*); and
- American eel (*Anguilla rostrate*).

Brook Trout was listed in the ACCDC report obtained for this Project as a species recorded within a 5 km radius of the Study Area. Brook Trout is not protected federally (*SARA*) or provincially (*NSESA*) but has a S3 rank by ACCDC and is considered Sensitive by SGS.

The American Eel has a COSEWIC status of Threatened; however, is not currently protected under *SARA* or the *NSESA*. Eels are catadromous fishes that spend most of their lives in freshwater but return to a marine habitat to spawn. They are found on the western side of the Atlantic Ocean from the Caribbean Sea to Iceland. In Canada, American Eels are found in all freshwater, estuaries and coastal marine waters (SARA 2017).

The mainland populations of Banded Killfish are considered Not at Risk by COSEWIC and are not listed within *NSESA*.

Table 8: Summary of SOCC Bird Species and Habitat Requirements

Species	Scientific Name	Habitat Summary
American Kestrel*	*Falco sparverius*	American Kestrel inhabits any kind of open or semi-open habitat such as forest clearings or wherever it can find adequate prey and some raised perches. Nest sites are usually located in snag cavities (Audubon 2017). One American Kestrel was detected in the Study Area and appeared agitated. Forest openings (*i.e.,* clearcuts) and snags tend to be common throughout the region.
Barn Swallow	*Hirudo rustica*	Before European colonization, Barn Swallows nested mostly in caves, holes, crevices and ledges in cliff faces. Following European settlement, they shifted largely to nesting in and on artificial structures, including barns and other outbuildings, garages, houses, bridges, and road culverts. Barn Swallows prefer various types of open habitats for foraging, including grassy fields, pastures, various kinds of agricultural crops, lake and river shorelines, cleared rights-of-way, cottage areas and farmyards, islands, wetlands, and subarctic tundra (Audubon 2017). Barn swallows are relatively abundant in the region as evidenced by the most recent MBBA with 59 records. The Study Area does provide ample foraging opportunities; however, there may be few nesting sites available. The exception being a warehouse which was thoroughly inspected for evidence of bat use. During that survey no evidence of Barn Swallow was found.
Bay-breasted Warbler	*Dendroica castanea*	Bay-breasted Warblers prefer dense coniferous forest consisting of spruce and fir. Where dense spruce is not found, it will nest in deciduous or mixed second-growth woods of birches, maples, firs, and pines (Audubon 2017). Dense spruce / fir dominated forest stands are common in the Study Area and surrounding region. Bay-breasted Warblers are fairly common in the region with 55 individuals recorded during the last MBBA. It is not known why they were not detected during surveys given that suitable habitat is abundant in the regionally.

Table 8: Summary of SOCC Bird Species and Habitat Requirements

Species	Scientific Name	Habitat Summary
Boreal Chickadee*	*Poecile hudsonicus*	Boreal Chickadees prefers conifer forests, especially spruces, but also in some mixed forest (Audubon 2017). Boreal Chickadees were abundant throughout the Study Area and would be expected to be abundant regionally due to the large amount of suitable habitat.
Boreal Owl*	*Asio otus*	Boreal Owl prefers mixed-wood, conifer forest, bogs and swamps in the boreal forest. Nests are most commonly in forests where spruce or fir are mixed with deciduous trees. In general, this habitat type is associated with forested swamps in the throughout this region. Red maple is the most common deciduous component of coniferous dominated swamps. Only one singing Boreal Owl was detected during April owl surveys. The Study Area appears to be at the southern extent of their range and there are no records of this species occurring in the 1st or 2nd MBBA. Despite its apparent rarity, suitable habitat appears to be abundant in this region and it may be more common than indicated.
Blackpoll Warbler	*Dendroica striata*	Blackpoll Warblers breed in spruce dominated forest (Audubon 2017). There is an abundance of this habitat in the Study Area and region. The Study Area is located near the southern limit of its breeding range and likely explains its absence.
Common Nighthawk	*Chordeiles minor*	Common Nighthawks prefer sparsely vegetated habitat with flat to rolling topography such as; sand dunes; beaches; burn areas; forest clearings; logged areas; pastures; open forests; bogs; marshes; graveled areas; rocky outcrops and gravel roof tops in developed areas for nesting (COSEWIC 2007). Common Nighthawk was identified as a possible breeder in the most recent MBBA (MBBA 2009). However, it was not detected during the targeted survey. Potential habitat (i.e., pipeline line, tailings piles and bogs) does exist within the Study Area. Higher quality nesting habitat may be more abundant in the surrounding landscape. Large bogs and open coniferous treed

Table 8: Summary of SOCC Bird Species and Habitat Requirements

Species	Scientific Name	Habitat Summary
		swamps are relatively common in this region presenting better nesting opportunities and may explain its absence.
Evening Grosbeak	*Coccothraustes vespertinus*	Breeds in coniferous and mixed forests and is often associated with forests dominated by spruce and fir (Audubon 2017). According to the MBBA, Evening Grosbeaks are relatively common with 30 individuals recorded. There are a few large stands of mature spruce / fir in the Study Area where they forage and nest; however, there may be more contiguous patches outside that provide better foraging opportunities. They are known to frequent bird feeders and be attracted to neighboring rural communities where food sources may be abundant.
Fox Sparrow	*Passerella iliaca*	Fox Sparrows inhabit coniferous forest during the breeding season. The Study Area is located at the southern extent of their breeding range; however, this region has an abundance of preferred nesting habitat which likely accounts for its presence. There are numerous records of this species in the 1st and 2nd MBBA for square 20PR00.
Gray Catbird*	*Dumetella carolinensis*	Gray Catbird prefers shrub thickets, regenerating forest and residential areas. Gray Catbird was identified during June 2017 surveys at two locations in the Study Area. One location on overgrown tailing piles and the second, along Goldbrook Lake. Gray Catbird was recorded as a possible breeder in the 1st and 2nd MBBA survey within square (20PR00) (MBBA 2017). Alder thickets growing on disturbed soils, regenerating forest, and residential areas are relatively common habitat types regionally indicating that this species may be more abundant in this region than it is at a provincial level.

Table 8: Summary of SOCC Bird Species and Habitat Requirements

Species	Scientific Name	Habitat Summary
Gray Jay*	*Perisoreus canadensis*	Gray Jay prefer mature boreal forests where black or white spruce trees are common. They nest at low to moderate height, often choosing a tree close to the south-facing edge of a forest patch. One pair of Gray Jays were detected as incidentals during the field studies; however, they are likely more common than indicated by the survey. Mature conifer forest and edge habitat are common throughout the region.
Greater Yellowlegs*	*Tringa melanoleuca*	Breeds in wet bogs with small wooded islands, and coniferous forests with abundant clearings. One Greater Yellowlegs was detected during the survey singing in or near a bog / coniferous swamp wetland. There are only 2 records of Greater Yellowlegs in the MBBA both occurring in the 2nd atlas for square 20PR00. It is listed as a possible breeder. The Study Area is located at the southern extent of their breeding range; however, this region has an abundance of preferred nesting habitat which likely accounts for its presence.
Long-eared Owl	*Asio otus*	Long-eared Owl favors dense forest for nesting and roosting, open country for hunting. It inhabits a wide variety settings, including coniferous forest with extensive meadows. This species tends to avoid contiguous forested habitats (Audubon 2017). There are only two records of Long-eared Owl in the MBBA indicating that this species is rare in this region. The Study Area and region appears to provide abundant habitat for Long-eared Owl. However, it is possible that prey availability is low within the Study Area and may explain its absence.
Olive-sided Flycatcher	*Contopus Cooperi*	Olive-sided Flycatcher prefers open areas, including clear cuts, and forest edges containing tall trees or snags for perches for nesting. It was identified as a possible breeder in the current MBBA, but was not detected during the bird survey of the Study Area. There may not be suitable nesting habitat for this species within the Study Area.

Table 8: Summary of SOCC Bird Species and Habitat Requirements

Species	Scientific Name	Habitat Summary
		There are some open areas associated with past beaver activity at Wetland 18; however, a large percentage of the Study Area that was clear-cut 5 to 15 years ago has developed with few openings. This could explain its absence within the Study Area.
Red-breasted Merganser	*Mergus serrator*	Red-breasted Merganser prefer lakes and rivers, surrounded by forest during the breeding season (Audubon 2017). The MBBA indicates that they are regionally rare although there were 34 individuals recorded. This region has a large number of lakes and coastal bays and there may be better foraging and nesting opportunities located throughout the region.
Red-breasted Nuthatch*	*Sitta canadensis*	Red-breasted Nuthatches inhabit coniferous forests of spruce, fir and larch which is abundant throughout the area. Red-breasted Nuthatches were common throughout the Study Area and throughout the regions due to the abundance of suitable nesting and foraging habitat.
Ruby-crowned Kinglet*	*Regulus calendula*	Ruby-crowned Kinglets prefer dense conifer forests such as spruce, fir, and tamarack. Ruby-crowned Kinglets were common throughout the Study Area and throughout the regions due to the abundance of suitable nesting and foraging habitat.
Short-eared Owl	*Asio flammeus*	The Short-eared Owl makes use of a wide variety of open habitats, including arctic tundra, grasslands, peat bogs, marshes, sand-sage concentrations and old pastures. It also occasionally breeds in agricultural fields. Preferred nesting sites are dense grasslands, as well as tundra with areas of small willows. While the Short-eared Owl has a marked preference for open spaces, the main factor influencing the choice of its local habitat is believed to be the abundance of food, in both summer and winter. Suitable breeding, migration and wintering habitat has declined significantly throughout the 20th century, resulting in a reduction in the number of owls (*SARA* 2017). There are only two records of Short-eared Owl in the MBBA indicating that this species, like the Long-eared Owl, is rare in this region. A combination of

Table 8: Summary of SOCC Bird Species and Habitat Requirements

Species	Scientific Name	Habitat Summary
		factors likely account for this species absence; however, prey availability may be the primary reason for its absence.
Spotted Sandpiper*	*Actitis macularius*	Spotted Ssandpiper are common near freshwater, including rivers and streams. Nesting occurs near shoreline with patches of dense vegetation for sheltering the chicks. A Spotted Sandpiper was observed on numerous occasions along the shoreline or Gold Brook and Goldbrook Lake. It was most likely nesting along the shoreline of Gold Brook.
Swainson's Thrush*	*Catharus ustulatus*	Swainson's Thrush breeds in coniferous forests in its eastern range. It was common throughout the Study Area due to the abundance of suitable habitat.
Tennessee Warbler	*Vermivora peregrina*	Tennessee Warblers breed in bogs, swamps, and forests. However, it prefers openings in second growth balsam-tamarack bogs and / or edges of dense spruce forest (Audubon 2017). The Study Area and surrounding region have an abundance of suitable habitat. Tennessee Warbler appears to be relatively common in the region according to the MBBA (square 20PR00) with 44 individuals recorded during the 2nd atlas. It is not known why they were not detected during surveys given that suitable habitat is abundant in the regionally.
Veery	*Catharus fuscescens*	Veery prefers dense understory and leafy low growth near water as breeding habitat. Surrounding habitat is usually deciduous woods, sometimes mixed or coniferous woods. In mature forest, it avoids areas with little understory, concentrating along streams or other openings (Audubon 2017). Although, there are numerous seasonal watercourses and associated riparian wetlands dominated by dense tall shrub species, namely Speckled Alder, adjacent habitat tends to be dominated by coniferous forest in various stages of development. This may deter Veery's from nesting along these riparian areas.

Table 8: Summary of SOCC Bird Species and Habitat Requirements

Species	Scientific Name	Habitat Summary
Wilson's Warbler*	*Cardellina pusilla*	Wilson's Warblers breed along the edges of lakes and bogs. Two Wilson's Warblers were detected during the surveys. There are numerous records of this species in the 1st and 2nd MBBA for square 20PR00 indicating that they may be abundant in the region.
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Yellow-bellied Flycatchers breed in coniferous forests and nest moist forests, bogs and swamps. Yellow-bellied Flycatchers were abundant throughout the Study Area and would be expected to be abundant regionally due to the large amount of suitable habitat.
* Indicates that this species was detected during point count surveys or as incidentals.		

Legend

- BOREAL BIRD
- OWL
- STUDY AREA BOUNDARY

Note

1. THIS DRAWING IS A SCHEMATIC REPRESENTATION. SIZES, LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

Drawn By	Checked By
CHG	JH
Calculations By	**Checked By**
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Date: SEPTEMBER 2017

Project: GOLDBORO BASELINE STUDIES
NOVA SCOTIA

Drawing: BIRD SURVEY LOCATIONS

Scale: 1:15000

0 300 600 900m

File No.	Drawing	Revision No.
800160801	FIGURE 5	0

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CONSULTING ENGINEERS AND SCIENTISTS

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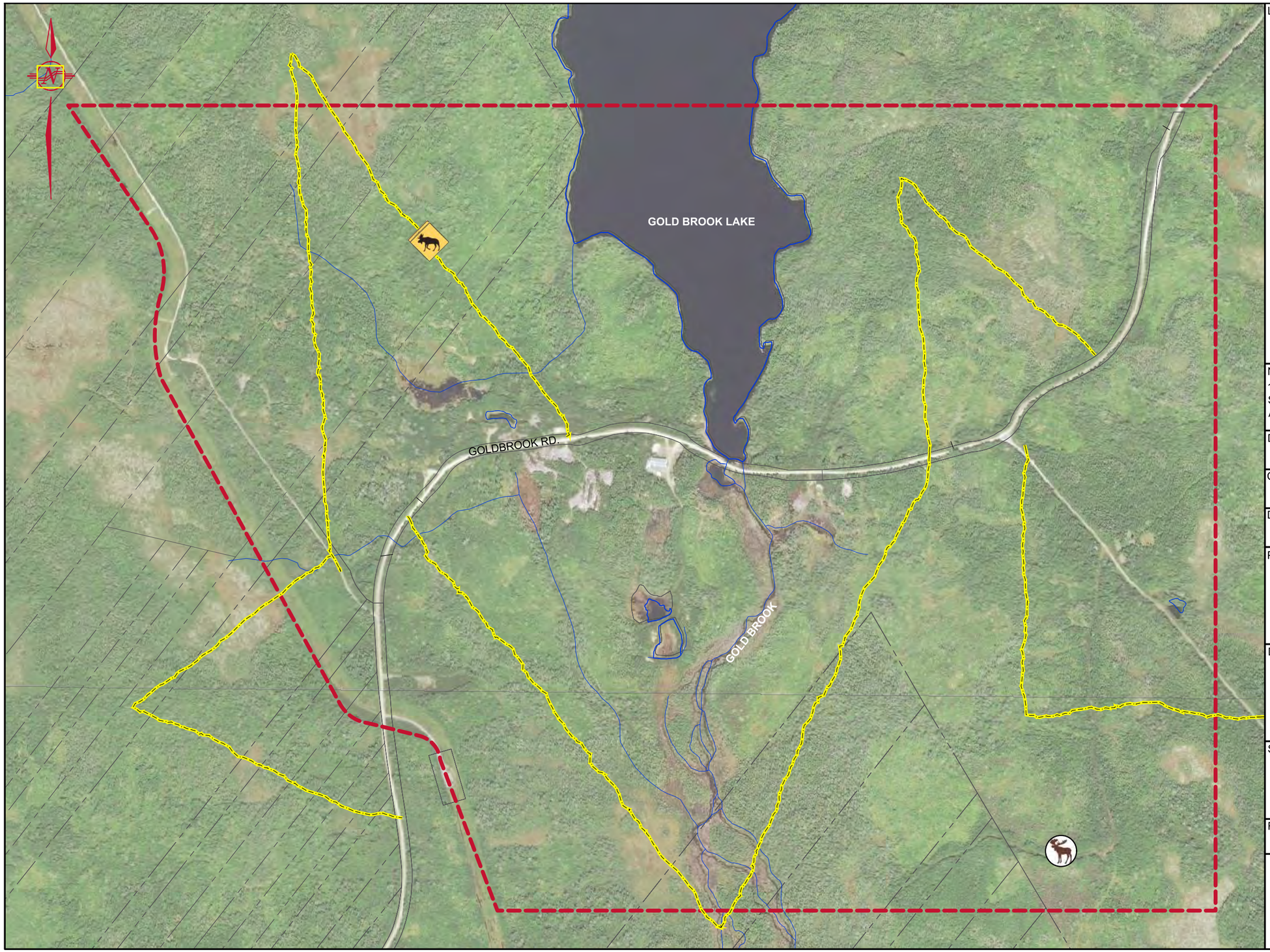

Legend

MOOSE BROWSE

MOOSE TRACK

MOOSE TRANSECT

STUDY AREA BOUNDARY

Note

1. THIS DRAWING IS A SCHEMATIC REPRESENTATION. SIZES, LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

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Calculations By	**Checked By**
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Date: SEPTEMBER 2017

Project: GOLDBORO BASELINE STUDIES
NOVA SCOTIA

Drawing: MOOSE SURVEY

Scale: 1:7500

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File No.	Drawing	Revision No.
800160801	FIGURE 6	0

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6.0 Water Quality Sampling

A water quality sampling program was undertaken at pre-determined sampling points within the Study Area. The scope of work for the water quality monitoring included:

- Collection of 12 surface water samples from flowing watercourses;
- Collection of 1 groundwater source (historic mine shaft); and
- A field duplicate sample as per Quality Assurance / Quality Control (QA/QC) protocol.

6.1 Methodology

A desktop study was conducted prior to the monitoring program to determine the location of waterbodies within the Study Area. The sampling locations are as follows:

- Seven surface water sampling points were selected to evaluate general property conditions (WS1, WS2, WS3, WS5, WS9, WS10, and WS11);
- Five surface water sampling points at historic tailings ponds and / or their outlets (WS4, WS6, WS7, WS8 and WS12);
- Several mine shafts are located throughout the Study Area; however, during a field investigation of the mine shafts on June 11, 2017, only one shaft contained water (MS1); and
- Proper QA/QC protocols were followed including the submission of a duplicate sample for laboratory analysis (Duplicate).

Sampling locations are presented on Figure 7.

Grab surface water samples were collected on June 10, 2017 (WS10) and June 11, 2017 (all other samples). When collecting from the tailings pond locations, efforts were made to collect from outflows when possible. Otherwise, samples were collected from ponded water reachable from the bank of the pond. Samples collected from flowing watercourses and drainage channels were collected in water reachable from the bank of the channel. The duplicate sample (Duplicate) was collected at the same location and time as WS3.

The laboratory-supplied bottles were used for sample collection. Temperature (degrees Celsius), conductivity (µS/cm), dissolved oxygen (mg/L), and pH were measured using a calibrated YSI-556 multi-meter. Water quality readings were taken while the probe rested on the watercourse bed without being submerged in fine substrate. GPS coordinates and photos were also captured at each sample location. All samples were stored in laboratory supplied coolers with ice to maintain temperatures +/- 5°C. Samples were submitted to Atlimax Couriers on June 12, 2017 for delivery to AGAT Laboratories on June 13, 2017. The laboratory submission form shows samples were measured at 4°C at the time of arrival. Water samples were analysed for general

chemistry, total metals and petroleum hydrocarbons (benzene, toluene, ethylbenzene, xylenes (BTEX) and modified total petroleum hydrocarbons (TPH)), and the results were compared to the CCME FWAL and NSE Tier 1 EQS.

6.2 Summary of Findings

Petroleum hydrocarbon analytical results are presented in Table 2 (Appendix I), general chemistry analytical results are presented in Table 3 (Appendix I) and total metals analytical results are presented in Table 4 (Appendix I). Laboratory reports are presented in Appendix J. Sample locations are presented in Figure 7 and coordinates are presented in Table 1 (Appendix I).

With respect to the NSE Tier 1 EQS and the CCME FWAL guidelines, the following exceedances are noted:

- Aluminium exceeded the NSE Tier 1 EQS guideline limit in all samples;
- The concentrations of arsenic exceeded the guideline of 5 µg/L in the samples collected from WS3 (13 µg/L), WS4 (128 µg/L), WS5 (33 µg/L), WS6 (85 µg/L), WS7 (1610 µg/L), WS8 (288 µg/L), WS9 (7 µg/L), WS11 (44 µg/L), WS12 (52µg/L) and Duplicate (15 µg/L). Three samples (WS1, WS2, and WS10) containing arsenic concentrations below 5 µg/L are located upgradient of the historical mining operations / tailings ponds;
- The concentration of cadmium (0.036 µg/L) exceeded the NSE Tier 1 EQS in WS7;
- Iron concentrations exceeded the guideline limit of 300 µg/L in all samples collected within the Study Area. It is likely that high concentrations of iron are naturally occurring in this area;
- The concentration of lead slightly exceeded the guideline (1 µg/L) in WS1 (1.2 µg/L), WS3 (1.2 µg/L) and Duplicate (1.1 µg/L);
- The mercury concentration in the samples collected from WS3 (0.029 µg/L) and WS8 (0.034 µg/L) exceeded the guideline of 0.026 µg/L;
- The concentration of zinc exceeded the guideline (30 µg/L) in the sample recovered from WS12 (53 µg/L);
- The CCME FWAL does not identify ammonia guidelines in samples with a pH lower than 6.0. The pH was lower than 6.0 in eleven of the thirteen samples; therefore, it cannot be determined whether many of these samples analyzed exceeded the guideline; and
- pH was outside the CCME FWAL guideline of 6.5 – 9.0 in eleven samples. The pH ranged from 4.37 (Duplicate) to 7.49 (WS12). High acidity is typically associated with *Sphagnum* bogs (as per the conditions observed on site).

Petroleum hydrocarbons were not detected in any of the surface water samples. Toluene was detected in water collected from the mine shaft (MS1) at a concentration of 0.008 mg/L.

Field parameters were measured at the time of sample collection:

- Water temperatures ranged from 10.4°C (WS11) to 20.1°C (WS6);
- Field pH ranged from 3.88 (WS3) to 6.79 (WS6);
- Dissolved Oxygen ranged from 3.8 mg/L (MS1) to 9.4 mg/L (WS7); and
- Conductivity ranged from 63.1 µS/cm (WS12) to 12.2 µS/cm (WS8).

Field parameters are presented in Table 5 in Appendix I.

Legend

WATER QUALITY SAMPLE

STUDY AREA BOUNDARY

Note

1. THIS DRAWING IS A SCHEMATIC REPRESENTATION. SIZES, LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

Drawn By	Checked By
CHG	JH
Calculations By	**Checked By**
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Date: SEPTEMBER 2017

Project: GOLDBORO BASELINE STUDIES
NOVA SCOTIA

Drawing: WATER QUALITY SAMPLING LOCATIONS

Scale: 1:7500

0 150 300 450m

File No.	Drawing	Revision No.
800160801	FIGURE 7	0

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7.0 Conclusions

Based on the findings of this assessment, the following conclusions are presented:

- A total of 25 wetlands were identified within the Study Area. The delineated wetlands ranged in size from 0.03 hectares to 47.19 hectares; however, several wetlands extended beyond the Study Area. In general, the encountered wetlands have high wetland functionality in native plant habitat, phosphorus retention and pollinator habitat;
- Two areas within the Study Area were determined to contain fish habitat and are fish bearing: Gold Brook Lake and Gold Brook. Nineteen fish were captured in Gold Brook and fish were observed jumping in Gold Brook Lake. In general, Gold Brook contains varying, unembedded substrate with mostly large size substrate intermixed with sand and fines. The banks are stable and no evidence of erosion or undercutting was observed. With the exception of pH and temperature, the field measured water quality is good for fish habitat;
- An unnamed beaver pond located in the northwest portion of the Study Area was deemed possible fish habitat as it contains sufficient water depths to accommodate fish, adequate water quality, nutrient input for feeding, and seasonal or historical fish passage from Gold Brook Lake (a known fish bearing waterbody). Fish were not captured nor observed during the field investigation; however, further studies should be conducted to confirm the absence / presence of fish;
- Three species of fish were captured within the Study Area: Brook Trout (*Salvelinus fontinalis)*, Banded Killfish (*Fundulus diaphanus*) and American eel (*Anguilla rostrate*);
- The concentrations of aluminum, arsenic, cadmium, iron, lead, mercury and zinc in one or more water samples collected from the Study Area exceeded the Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME FWAL) and / or the Nova Scotia Environment (NSE) Tier 1 Environmental Quality Standards for Surface Water (EQS);
- pH values ranged from 4.37 to 7.49 in water samples collected from surface water sources within the Study Area. High acidity is typically associated with *Sphagnum* bogs (as per the dominant wetland conditions observed on site);
- Two rare vascular flora species were identified within the Study Area: Variegated Horsetail (*Equisetum variegatum*) and Southern Twayblade (*Listera australis*);
- A total of 61 bird species comprising of 602 individuals were documented during the Breeding Bird Survey. Of the 61 species, 24 are considered Species at Risk (SAR) or Species of Conservation Concern (SOCC);
- Evidence for possible breeding owls (*i.e.,* singing males) was detected within the Study Area. Three species of owls were recorded: a Great Horned Owl (*Bubo virginiatus*), a Northern Saw-Whet (*Aegolius acadicus*) and a Boreal Owl (*Asio otus*);
- No Common Nighthawks (*Chordeiles minor*), bat species or moose were observed within the Study Area.

8.0 Closure

This report has been prepared for the sole benefit of our client, Anaconda Mining Inc. The report may not be relied upon by any other person or entity without the express written consent of GEMTEC Consulting Engineers and Scientists Limited and our client, Anaconda Mining Inc.

Any use that a third party makes of this report, or any reliance or decisions made based on it, is the responsibility of such third parties. GEMTEC Consulting Engineers and Scientists Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The conclusions presented represent the best judgment of the trained professionals and technical staff based on current environmental standards and on the project area conditions observed by staff at the time the work was performed.

Should additional information become available, GEMTEC Consulting Engineers and Scientists Limited requests that this information be brought to our attention so that we may re-assess the conclusions presented herein.

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Appendix A

Wetland Site Photos

Photo 1: Wetland 1, northeastern portion (June 2, 2017).

Photo 2: Wetland 1, southeastern portion (June 2, 2017).

Photo 3: Wetland 1, northwestern portion containing historic tailings ponds (June 4, 2017).

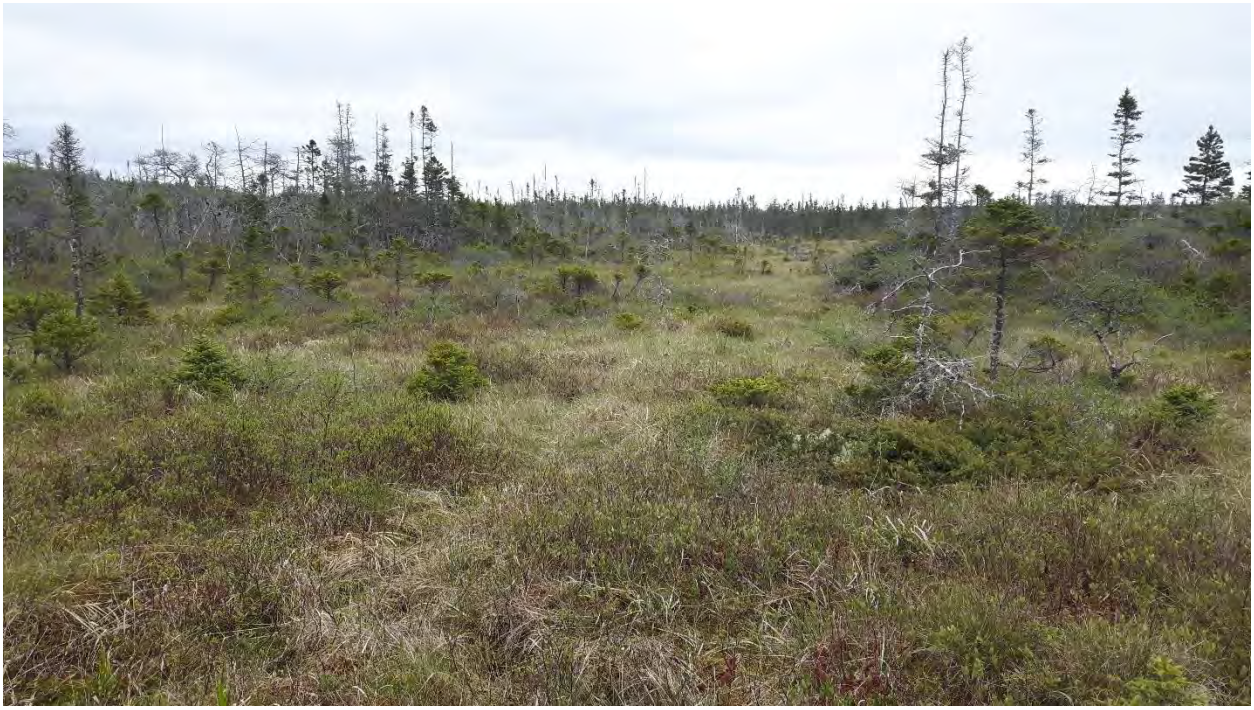

Photo 4: Wetland 1, southwestern portion (June 4, 2017).

Photo 5: Wetland 1, western portion containing historic tailings ponds (June 9, 2017).

Photo 6: Wetland 1, western portion along a drainage channel (June 9, 2017).

Photo 7: Wetland 2 (June 6, 2017).

Photo 8: Wetland 3 (June 10, 2017)

Photo 9: Wetland 4 (June 10, 2017).

Photo 10: Wetland 5 (June 10, 2017).

Photo 11: Wetland 6 (July 25, 2017).

Photo 12: Wetland 7 (July 26, 2017).

Photo 13: Wetland 8 (July 26, 2017).

Photo 14: Wetland 9 (July 26, 2017).

Photo 15: Wetland 10 (July 26, 2017).

Photo 16: Wetland 11 (July 27, 2017).

Photo 17: Wetland 12, southwestern portion (July 27, 2017).

Photo 18: Wetland 12, northwestern portion (July 27, 2017).

Photo 7: Gold Brook Sample Point 7A (June 7, 2017).

Photo 8: Gold Brook Sample Point 7B (June 7, 2017).

Photo 9: Gold Brook Sample Point 7C (June 7, 2017).

Photo 10: Gold Brook Sample Point 8A (June 7, 2017).

Photo 11: Gold Brook Sample Point 8B (June 7, 2017).

Photo 12: Gold Brook Sample Point 8C (June 7, 2017).

Photo 13: Gold Brook Sample Point 8D (June 7, 2017).

Photo 14: Gold Brook Sample Point 9 (June 7, 2017).

Photo 15: Gold Brook Sample Point 10A (June 7, 2017).

Photo 16: Gold Brook Sample Point 10B (June 7, 2017).

Photo 17: Gold Brook Sample Point 11A (June 7, 2017).

Photo 18: Gold Brook Sample Point 11B (June 7, 2017).

Photo 19: Gold Brook Sample Point 11C (June 7, 2017).

Photo 20: Gold Brook Sample Point 12A (June 7, 2017).