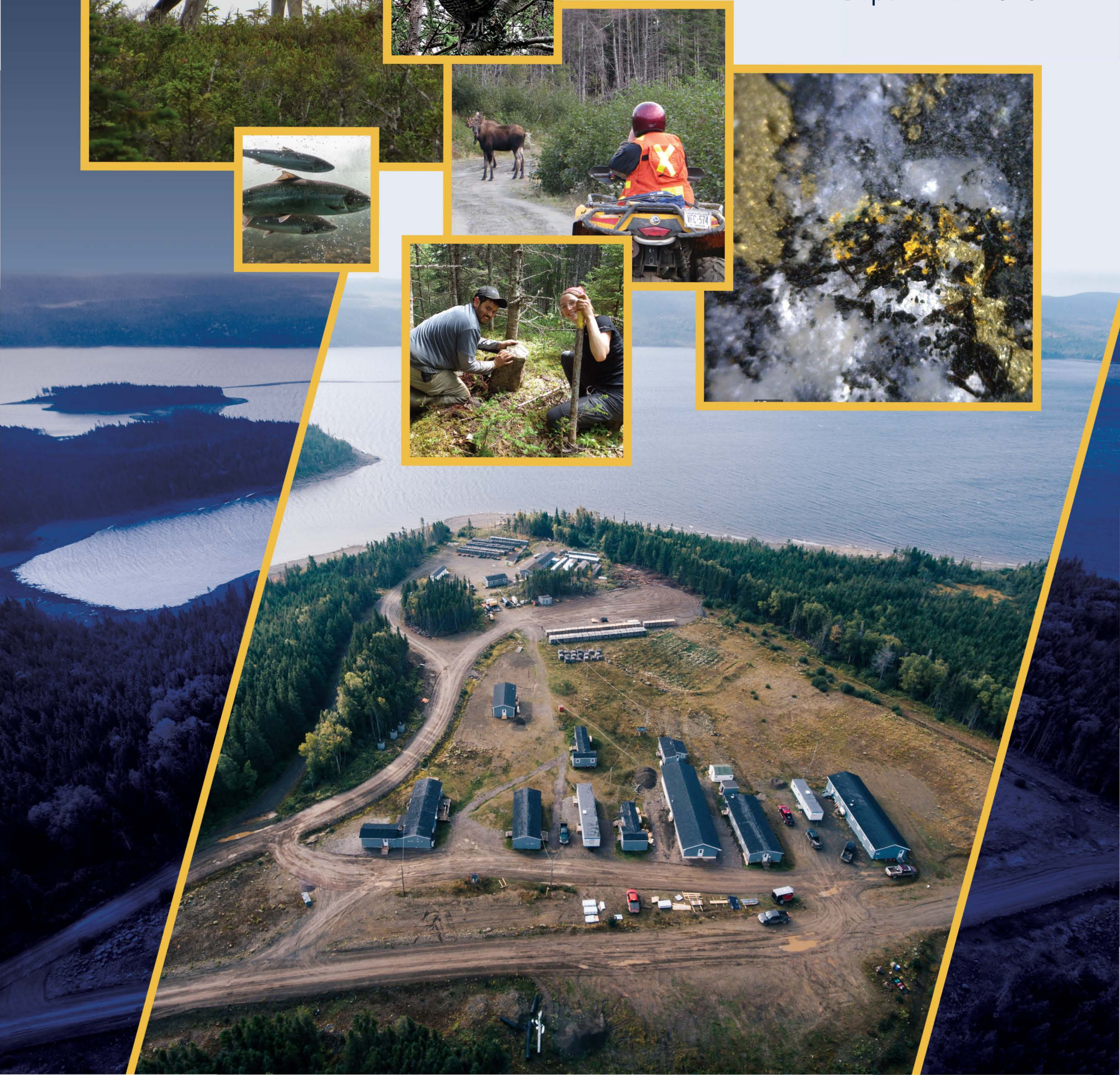
MARATHON GOLD

Valentine Gold Project Baseline Study Appendix 7: Avifauna, Other Wildlife and Their Habitats

September 2020



Valentine Gold Project
Environmental Impact Statement

Final Report

Baseline Study Appendix 7: Avifauna, Other Wildlife and Their Habitats (BSA.7)

MARATHON GOLD

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Abbreviations and Acronyms

AC CDC	Atlantic Canada Conservation Data Center
ANPC	Alberta Native Plant Council
ARD/ML	Acid Rock Drainage / Metal Leaching
BSA	Baseline Study Appendix
EIS	Environmental Impact Statement
ELC	Ecological Land Classification
GIS	geographic information system
km	kilometres
Marathon	Marathon Gold Corporation
MUN CREAIT	Memorial University of Newfoundland Core Research Equipment and Instrument Training
NL	Newfoundland and Labrador
NLDECCM	Newfoundland and Labrador Department of Environment, Climate Change and Municipalities
NLEPA	Newfoundland and Labrador *Environmental Protection Act*
NL ESA	NL *Endangered Species Act*
TMF	tailings management facility
SAR	Species at Risk
SARA	*Species at Risk Act*
SOCC	Species of Conservation Concern
SWA	Sensitive Wildlife Area
VC	Valued Components

1.0 INTRODUCTION

Marathon Gold Corporation (Marathon) is planning to develop an open pit gold mine south of Valentine Lake, located in the Central Region of the Island of Newfoundland, approximately 60 kilometres (km) southwest of the town of Millertown, Newfoundland and Labrador (NL) (Figure 1-1). The Valentine Gold Project (the Project) will consist primarily of open pits, waste rock piles, crushing and stockpiling areas, conventional milling and processing facilities (the mill), a tailings management facility, personnel accommodations, and supporting infrastructure including roads, on-site power lines, buildings, and water and effluent management facilities. The mine site is accessed by an existing public access road that extends south from Millertown approximately 88 km to Marathon's existing exploration camp. Marathon will upgrade and maintain the access road from a turnoff approximately 8 km southwest of Millertown to the mine site, a distance of approximately 76 km.

The Minister of the NL Department of Environment, Climate Change and Municipalities (NLDECCM) has determined that the Project will require preparation of an Environmental Impact Statement (EIS) under the *Environmental Protection Act* (NLEPA). The Provincial EIS Guidelines require the preparation of a number of baseline studies to describe and provide data on specific components of the environment to address baseline data requirements to support the assessment of one or more Valued Components (VCs); and to support the development of mitigation measures and follow-up monitoring programs. Each has been prepared as a stand-alone Baseline Study Appendix (BSA) to the EIS:

- BSA.1: Dam Safety
- BSA.2: Woodland Caribou
- BSA.3: Water Resources
- BSA.4: Fish, Fish Habitat and Fisheries
- BSA.5: Acid Rock Drainage / Metal Leaching (ARD/ML)
- BSA.6: Atmospheric Environment
- BSA.7: Avifauna, Other Wildlife and Their Habitats
- BSA.8: Species at Risk (SAR) / Species of Conservation Concern (SOCC)
- BSA.9: Community Health, Services and Infrastructure / Employment and Economy
- BSA.10: Historic Resources

Table 1.1 outlines the organization for BSA.7: Avifauna, Other Wildlife and Their Habitats.

Table 1.1 BSA.7: Avifauna, Other Wildlife and Their Habitats

Number	Baseline Study Appendix	Attachment Number	Attachment Name
BSA.7	Avifauna, Other Wildlife and Their Habitats	7-A	Winter Wildlife (2013)
		7-B	2011 Forest Songbird Surveys (2014)
		7-C	2011 Baseline Waterfowl and Waterfowl Habitat Study (2014)
		7-D	Ecological Land Classification (2015)
		7-E	Waterfowl (2017)
		7-F	Vegetation Baseline Study, Rare Plants Survey (2017)
		7-G	Newfoundland Marten (2018)
		7-H	Forest Songbird Survey (2019)
		7-I	Vegetation Baseline Study (2019)

Note that the BSAs consist of data reports that have been prepared for Marathon over a number of years (i.e., 2011 to 2020), during which the Project has undergone a series of refinements. The study areas and Project references in these data reports reflect the Project description at the time of preparation of these reports. The current Project description for the purposes of environmental assessment is found in Section 2 of the EIS.

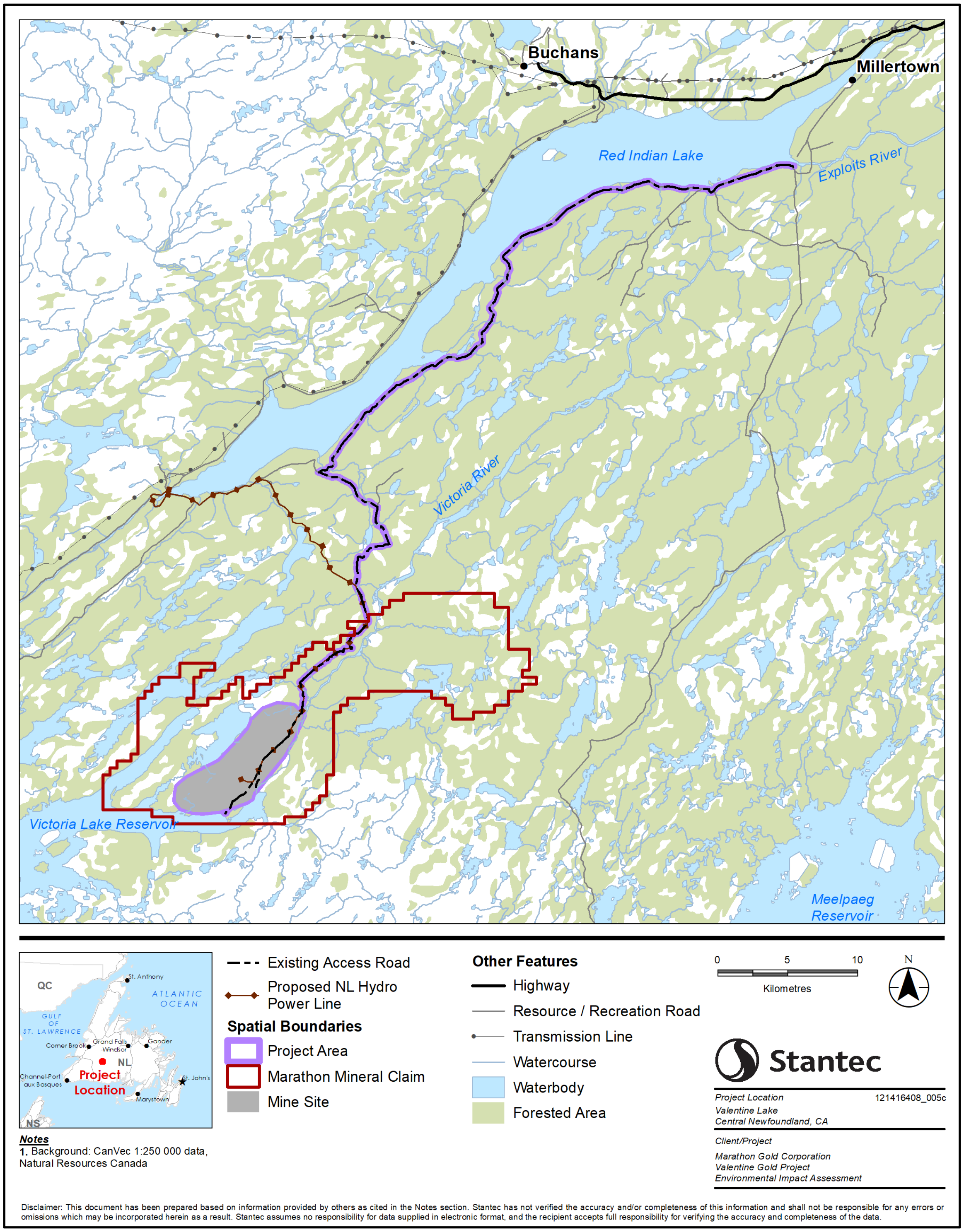

Figure 1-1 Project Area

Note that the BSAs consist of data reports that have been prepared for Marathon over a number of years (i.e., 2011 to 2020), during which the Project has undergone a series of refinements. The study areas and Project references in these data reports reflect the Project description at the time of preparation of these reports. The current Project description for the purposes of environmental assessment is found in Section 2 of the EIS.

2.0 SUMMARY OF AVIFAUNA, OTHER WILDLIFE AND THEIR HABITATS BSA ATTACHMENTS

Nine studies / field programs were completed by Stantec Consulting Inc. (Stantec) between 2013 and 2019 in support of the assessment of Project effects on avifauna, other wildlife and their habitats:

- 2013 winter field program for wildlife
- 2011 forest songbird survey
- 2011 survey of waterfowl use and habitat
- ecological land habitat classification (ELC) in 2015
- 2017 waterfowl baseline study
- 2017 rare plant survey
- 2018 field survey (hair snag traps) for American marten (Newfoundland population)
- 2019 forest songbird survey
- 2019 follow-up rare plant survey

Table 2.1 provides a summary of the objectives, study area, methods and results of each of these programs and studies.

Table 2.1 Summary of Avifauna, Other Wildlife and Their Habitats BSA Attachments

Rationale / Objectives and Study Area	Methods	Results
Attachment 7-A - Winter Wildlife (2013)		
Rationale / Objectives The two main objectives were: 1. To examine the presence and distribution of winter mammal wildlife within the study area via aerial and ground winter track surveys 2. To determine the presence of Newfoundland marten in the Study Area **Study Area** The study area was within the Marathon Mineral Claim Area (Figure 1-1), with the exception of the aerial survey which followed parallel transect lines from southwest-northeast, encompassing the Marathon Mineral Claim Area, as well as slightly outside the boundary, covering ~65% of the Mineral Claim Area.	**Aerial Surveys**: On February 28, 2013, a series of parallel transect lines at 800 m spacing, oriented with the topography (i.e., southwest-northeast) were flown by helicopter and observers recorded wildlife and tracks observed. **Ground Track Surveys**: On February 28, 2013, two teams of two observers on snowshoes followed predetermined 1 km long transects and recorded tracks encountered. **Newfoundland Marten Hair Snag:** Three trap sites were accessed via helicopter and snowshoe on February 28, 2013. Traps were deployed on February 28, 2013 (two sites) and March 8, 2013 (one site) and remained in place for one month. Each trap was checked (and re-baited if necessary) on three occasions, approximately once per week.	**Aerial Surveys**: Signs of seven mammal species (Canada lynx, eastern coyote, moose, red fox, river otter, snowshoe hare and woodland caribou) and two upland game birds (grouse and ptarmigan) were observed, in addition to an unidentified ungulate and canid. The highest track densities observed were snowshoe hare, eastern coyote and moose. **Ground Track Surveys**: Canada lynx, eastern coyote, ermine, Newfoundland marten, moose, red fox, red squirrel, snowshoe hare, small mammals and upland game birds were recorded. Snowshoe hare, ermine, red squirrel and small mammals had the highest track densities amongst the species observed. **Newfoundland Marten Hair Snag:** successfully obtained one hair sample. Further analyses determined the individual was female.
Attachment 7-B - 2011 Forest Songbird Surveys (2014)		
Rationale / Objectives The study's main objective was to document breeding songbird species present within the Marathon Mineral Claim Area and provide insight regarding forest songbird populations in the areas surveyed. **Study Area** Transects were selected in areas of current and future exploration within the Marathon Mineral Claim Area (Figure 1-1): Leprechaun Pond, Valentine Lake East and Frozen Ear Pond.	A series of ten minute songbird point count surveys were conducted from June 14-18, 2011 at locations spaced ~300 m apart. Four transects were completed over five mornings. The ornithologist stood in a fixed location for ten minutes and tallied bird species observed or heard. Surveys commenced at dawn (~0515 h) and no point counts were initiated after 0900 h. Vegetation data was recorded and photographs of habitat were taken at each point count.	Forty-five point counts were conducted. A total of 38 species were identified. The most common species recorded were: white-throated sparrow, ruby-crowned kinglet, Swainson's thrush and yellow-bellied flycatcher. Two federally and provincially listed (threatened) species were detected: olive-sided flycatcher (COSEWIC 2009) and common nighthawk (COSEWIC 2007; SSAC 2007).

Table 2.1 Summary of Avifauna, Other Wildlife and Their Habitats BSA Attachments

Rationale / Objectives and Study Area	Methods	Results
Attachment 7-C - 2011 Baseline Waterfowl and Waterfowl Habitat Study (2014)		
Rationale / Objectives The objective was to survey waterfowl use of the Project Area and identify the types of wetland habitat within the area of the proposed Project. **Study Area** The study area was within the Marathon Mineral Claim Area (Figure 1-1). The Victoria Steadies Sensitive Wildlife Area (SWA) overlaps the study area. The study focussed on the Valentine Lake East Site, the Frozen Ear Pond site, and the Leprechaun Pond Site, but only the latter location encompassed waterbodies of sufficient size to support waterfowl.	**Waterfowl Breeding Pair Survey**: Aerial helicopter surveys were conducted on May 16, 2011. The flight path was oriented according to the presence of waterbodies. Waterfowl observations were recorded, including social status classification (i.e., lone male, lone female, breeding pair, flocked males and number, flocked females and number, mixed flocks, and actual number by sex). Waterfowl were described in terms of 'indicated pairs' (Dzubin 1969) to distinguish individuals that would likely breed in a given area. **Waterfowl Brood Survey** occurred on July 7, 2011, approximately seven weeks after the breeding pair survey. It focused on locations around Valentine Lake where breeding pairs were observed in May and examined a 50 km stretch of the Victoria River extending northeast and downstream, following similar protocols as for the breeding pair survey. Observations of waterfowl broods were aged following standards outlined in Gollop and Marshall (1954). **Wetlands Characterization:** Wetlands were opportunistically evaluated during waterfowl surveys in May 2011. Wetlands and wetland/waterfowl habitats were classed according to the Canadian Wetland Classification System (Warner and Rubec 1997), identifying three levels of wetland features – class, form and type.	**Waterfowl Breeding Pair Survey:** The following species were observed: common loon, Canada goose, ring-necked duck, American black duck, red-breasted merganser, common goldeneye, and common merganser. Waterfowl were only observed at the Leprechaun Pond Site and in the vicinity of the Frozen Ear Pond Site. No sightings occurred at the Valentine Lake East Site. **Waterfowl Brood Survey:** Seventy-six observations of seven waterfowl species (and three unidentified species) occurred, including broods and evidence of adult moulting activity. Most of the observations occurred along Victoria River. Broods were common and the age of young ranged from approximately one to six weeks. The same species of waterfowl observed during the breeding pair surveys were also observed in the July brood survey. Waterfowl were only observed at the Leprechaun Pond Site and in the vicinity of the Frozen Ear Pond Site. No sightings occurred at the Valentine Lake East Site. **Wetlands Characterization:** The majority of the wetland classes encountered were bogs and fens, with shallow water wetlands observed in association with lakes and large rivers in the region, which were further divided into three bog forms (i.e., domed bog, slope bog and basin bog) and two fen forms (i.e., slope fen and ribbed fen).

Table 2.1 Summary of Avifauna, Other Wildlife and Their Habitats BSA Attachments

Rationale / Objectives and Study Area	Methods	Results
Attachment 7-D - Ecological Land Classification (2015)		
Rationale / Objectives The objectives for the ELC were to: 1. Provide descriptions of vegetation using a taxonomic vegetation hierarchy and using standardized criteria and nomenclature 2. Conduct a field sampling program to evaluate ecotypes on the basis of vegetation characteristics, using consistent sampling methods and ecosystem mapping standards 3. Collect ground-verified plot data to support satellite-based ecosystem mapping of ecotypes 4. Use ecological data to develop a geographic information system (GIS) database and mapping products to understand ecological relationships at a variety of scales 5. Identify and evaluate the occurrence of environmentally sensitive areas or features, and support habitat suitability modelling for key wildlife species in the Study Area **Study Area** The boundaries of the Project ELC Study Area encompass the Marathon Mineral Claim Area (Figure 1-1). The ELC Study Area fully encompasses the proposed mine site and most of the access road (Figure 1-1) (only a portion of the northeastern end of the access road outside the ELC boundary).	Methods involved pre-survey planning, information review, field sampling (soil pit excavation and vegetation surveys), ecosystem classification, map platform selection and ecosystem mapping, taxonomic nomenclature and ranking, ArcGIS spatial data management, quality assurance / control procedures, and incidental wildlife observations.	**Terrain units** observed include morainal, glaciofluvial, fluvial, colluvium, organic, weathered bedrock, rock, and anthropogenic material. Medium-textured, morainal (till) surface materials were the most common. **Soil map units** were mostly complexes of organic and mineral soils, reflecting the varied topography of the underlying till. The most abundant mineral soil unit was Red Indian soil unit. **Vegetation** included predominantly softwood forests, balsam fir forests with dense carpets of stairstep moss, black spruce - sheep laurel and balsam fir - Schreber's feathermoss forest types were also very common. No federally or provincially designated "at risk" flora species were identified; several SOCC were present, all of which were graminoids. These included short-scale sedge, perennial bentgrass, forest bluegrass and cottongrass bulrush. **Ecosystem Units and Ecotypes:** A total of 12 ecosystem units were mapped, nine of which were vegetated, and three of which were sparsely vegetated, naturally non-vegetated, and/or anthropogenic ecosystem units.

Table 2.1 Summary of Avifauna, Other Wildlife and Their Habitats BSA Attachments

Rationale / Objectives and Study Area	Methods	Results
Attachment 7-E - Waterfowl (2017)		
Rationale / Objectives The study had two objectives: 1. To describe wetland productivity in terms of waterfowl species richness and species counts in the study area during spring breeding and fall staging, as well as describe the breeding social structure in the spring breeding survey 2. To assess waterfowl use of wetland habitat by calculating the relative abundance of waterfowl using densities and habitat selection during spring breeding and fall staging surveys **Study Area** The waterfowl study area was delineated during 2011 baseline surveys and includes the Project footprint, the Sensitive Wildlife Area, and wetland habitats within the Mineral Claim Area (Figure 1-1).	**Surveys**: Spring breeding surveys occurred on June 6, 2017 and fall staging surveys were completed on September 27, 2017. Transects and protocols were repeated from baseline surveys conducted in 2011. **Productivity:** Guilds of waterfowl (ducks) and waterbirds (geese and shorebirds) that use wetlands were included to assess the productivity of wetlands in the waterfowl study. A guild of raptors was also included due to observations during surveys and known predatory behaviour on waterfowl (Buehler 2000, Smith et al. 2011). **Habitat Use**: The relative abundance of the guilds (described above) was determined based on the density of species in wetland habitats along transects within the waterfowl study area.	**Productivity**: Waterfowl productivity was the highest during the spring breeding survey in 2017 for both species richness and counts. The highest counts were amongst the guilds of geese, dabbling ducks and diving ducks. No species at risk (SAR) were observed during surveys. **Habitat Use**: Dabbling ducks, diving ducks and geese had the highest densities in the waterfowl study. Analyses indicated that waterfowl are selecting the preferred wetland habitats rather than being distributed randomly across the landscape. Waterfowl productivity and habitat use indicate that the wetland habitats in the waterfowl study area are used by waterfowl during spring breeding and fall staging.

Table 2.1 Summary of Avifauna, Other Wildlife and Their Habitats BSA Attachments

Rationale / Objectives and Study Area	Methods	Results
Attachment 7-F - Vegetation Baseline Study, Rare Plants Survey (2017)		
Rationale / Objectives Objectives of the survey were to: 1. Establish the floristic diversity and develop a list of vascular plant species for the Project Area 2. Determine whether provincially rare species of plants, as determined by the Atlantic Canada Conservation Data Center (AC CDC), were present in the Project Area 3. Provide information on the location (spatial distribution), population size, and habitat of rare vascular plant taxa occurring within the Project Area 4. Provide information to Marathon for consideration in Project planning **Study Area** The study area was within the Marathon Mineral Claim Area (Figure 1-1).	The survey involved review of available information on rare plant species in the area, field surveys, post-survey data analysis, and quality assurance / control. Field work was completed July 17-21, 2017, covering over 44 linear km or 39 ha (based on 5 m-wide transect). **Survey Method**: In accordance with the Alberta Native Plant Council (ANPC) (2012) Update, field surveys were floristic and completed through random meander searches of the Project Area, with surveyors walking transects through each of the plant communities / habitat types identified. Survey effort focused on those plant communities with elevated potential to support endangered, threatened or rare species, or otherwise unusual results.	Results included ~293 vascular plant species distributed into 175 genera and 69 families, with the *Cyperaceae* (49 species) *Poaceae* (22 species) and *Asteraceae* (22 species) representing the largest families. The majority of the Project Area is not considered to have high potential for rare species due to habitat type, tree species composition, stand age and/or microclimatic conditions. None of the observed plant species are listed under the federal *Species at Risk Act* (SARA) or NL's *Endangered Species Act* (NL ESA). However, the Project Area does support three provincially rare vascular plant species that may be of conservation concern to the Province. These include nodding water nymph (S2 AC CDC), short-scaled sedge (S2 AC CDC), and perennial bentgrass (S2 AC CDC).

Table 2.1 Summary of Avifauna, Other Wildlife and Their Habitats BSA Attachments

Rationale / Objectives and Study Area	Methods	Results
Attachment 7-G - Newfoundland Marten (2018)		
Rationale / Objectives The American marten (Island of Newfoundland population) is a threatened species at both the provincial and federal levels (Government of Canada 2007; The Newfoundland Marten Recovery Team 2010). The Newfoundland Marten Recovery Team (2010) identified breeding individuals in the Red Indian Lake Area, which overlaps portions of Marathon's Mineral Claim Area. Winter track surveys (aerial and ground) conducted in 2013 also identified the presence of Newfoundland marten. The objective was to assess the activity of the species within the Mineral Claim Area. **Study Area** The Study Area for the marten study was Marathon's Mineral Claim Area (Figure 1-1).	Following the guidance provided by the provincial Wildlife Division (Herdman 2012), three marten hair snag traps were established in locations proximate to those for the 2013 efforts to replicate that study. Hair snag traps were set up on February 26, 2018 and remained in place until March 27, 2018. The traps were checked, rebaited and sticky pads collected or replaced approximately every eight to ten days. Samples were shipped to the Memorial University of Newfoundland Core Research Equipment and Instrument Training (MUN CREAIT) Network laboratory for analyses. Samples were screened with 11 microsatellite loci to identify individual marten, and the sex of each individual was determined.	Two of the three sites yielded marten hair samples. Based on analysis of the hair samples, five individual marten were identified. Two of the five were determined to be female; the sex of the other three was undetermined. None of the marten captured in this study had been previously documented at the MUN CREAIT Network laboratory facility. Samples were added to the provincial database.

Table 2.1 Summary of Avifauna, Other Wildlife and Their Habitats BSA Attachments

Rationale / Objectives and Study Area	Methods	Results
Attachment 7-H - Forest Songbird Survey (2019)		
Rationale / Objectives Objectives were to: 1. Establish the avifauna diversity and develop a list of bird species for the Mineral Claim Area (Figure 1-1) 2. Determine whether provincially rare species of birds, as determined by the AC CDC, were present in the Project Area 3. Provide information on the location (spatial distribution), population size and habitat of rare bird taxa occurring within the Project Area 4. Provide information to Marathon for consideration in Project planning **Study Area** The Study Area was within the Mineral Claim Area (Figure 1-1). The field sampling plan was created by overlaying the current Project footprint with previously surveyed areas to identify spatial gaps in surveyed areas.	**Songbird Surveys** were conducted on June 26-28, 2019. Songbird survey sites were visited once during the field program, and observers conducted a 10-minute morning point count at each site, following a protocol based on a modified fixed-radius point count sampling procedure (Bibby et al. 2000). Bird species detected during the point count surveys were recorded. Surveys began near dawn and continued until ~10:00 am each survey morning. **Common Nighthawk Survey** was conducted on June 28, 2019. Eight survey stations were established along roads through the Project Area near areas with potential to provide nesting or foraging habitat. The survey was conducted starting ~60 minutes before sunset and continued until up to two hours after sunset. Survey followed a 6-minute passive point count sampling procedure (Canadian Nightjar Survey Protocol 2018).	**Songbird Surveys:** Fifty-two point counts were completed in various habitat types including forested and wetland habitats. Forty-nine species, including two incidental observations of common tern and tree swallow, were identified during the point counts. Excluding incidental observations, the most abundant species observed across the point counts were white-throated sparrow (59 individuals), yellow-bellied flycatcher (52 individuals), and ruby-crowned kinglet (35 individuals). **Common Nighthawk Survey:** No common nighthawks were observed or heard during the field surveys. Two bird SOCC, Nashville warbler and bay-breasted warbler, were encountered in the Project Area.
Attachment 7-I - Vegetation Baseline Study (2019)		
Rationale / Objectives The objectives of the 2019 program were similar to the 2017 program, but survey effort focused on locations within the refined Project footprint, not previously surveyed in 2017. **Study Area** The study area was within the Marathon Mineral Claim Area (Figure 1-1). Surveys focused on the planned locations of Project components and infrastructure not surveyed in 2017.	The survey was completed from June 25-29, 2019 covering ~51 linear km, or 25.5 ha surveyed (based on 5 m-wide transect). A list of observed plant taxa was complied. The field survey repeated the plan developed for the 2017 surveys, as described above.	176 vascular plants were observed, including 29 species that were not previously recorded in 2017 or 2015. Of the species observed in 2019, none are SAR nor SOCC. Several vascular plants ranked S3 were observed, including russet cotton-grass, little yellow-rattle, twin-stemmed bladderwort, and northern yellow-eyed-grass. While S3 species are of concern from a provincial biodiversity perspective, they are often not included because their populations are considered less sensitive.

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ATTACHMENT 7-A

Winter Wildlife (2013)

Winter Wildlife Survey

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Final Report

May 22, 2014

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1.0 INTRODUCTION

1.1 Project Description

Marathon Gold Corporation (Marathon) is conducting a drilling program at its Valentine Lake prospect in Central Newfoundland. Drilling activities have targeted the Valentine East site and the Leprechaun Pond site (Figure 1-1). Pending final analysis of the drilling program, the project would involve the exploration, construction and operation of mining infrastructure in Central Newfoundland. Should Marathon wish to develop the mineral deposit, an Environmental Assessment (EA) would be required.

Baseline work to support the anticipated EA has been ongoing for anticipated valued ecosystem components (*e.g.*, landbirds, waterfowl, and freshwater fish) during spring and summer. This study aims to gather information to complement other baseline work with the identification of mammal species occurring within Marathon's mineral claim area. Winter track surveys (aerial and ground) are an effective approach to document wildlife species as several species would be easier to detect when there is snow cover. Of particular interest is whether Newfoundland Marten (*Martes americana atrata*) are present. The Newfoundland marten is a threatened species (2007) at both the provincial (NLESA) and federal (SARA) levels (The Newfoundland Marten Recovery Team 2010). The Newfoundland Marten Recovery Team (2010) identified breeding individuals in the Red Indian Lake Area. Some of Marathon's mineral claim area is located within the Red Indian Lake Subregion, however, no marten have been confirmed within the claim area.

Winter tracking surveys are useful to estimate species diversity, richness (number of individuals observed), and relative abundance among habitat types. These surveys can be designed to collect baseline data or to monitor wildlife throughout various stages of project development. Target species during winter tracking surveys are mid-large mammals that are active during winter. Limited information can be collected for small mammals (such as mouse, voles, and shrews) they are highly active in subnivean tunnels and upland game birds (ptarmigan *and* grouse) who do not always travel via ground routes.

1.2 Study Objectives

The study's two main objectives include: 1) To examine the presence and distribution of winter mammal wildlife within the study area via aerial and ground winter track surveys and 2) To determine the presence of Newfoundland marten in the study area.

Although Marathon is in the exploratory stage in this mineral claim area, it was deemed prudent to understand the ecological setting and potential mitigating factors as the planning process continues.

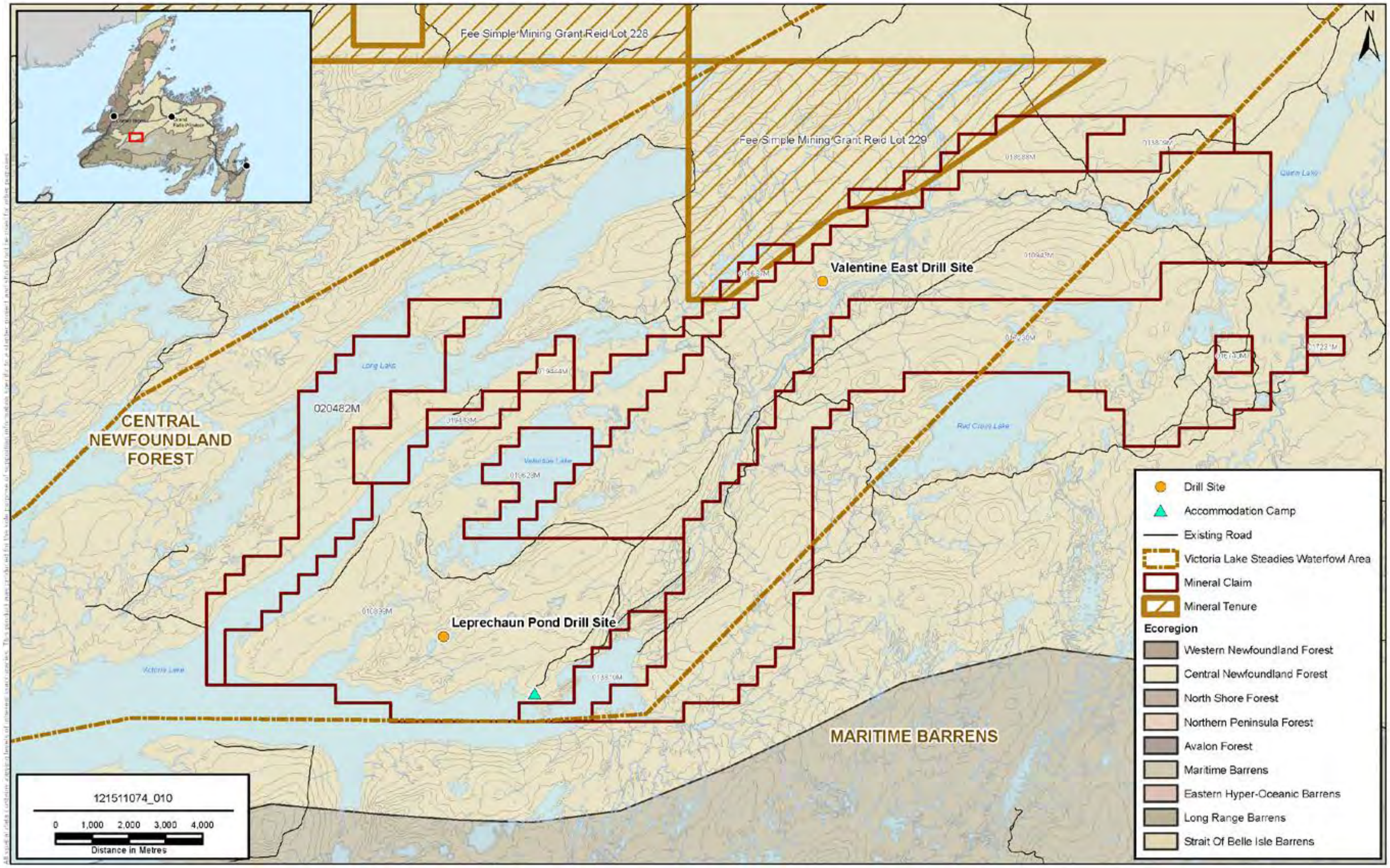

Figure 1-1 Study Area

1.3 Study Area

Marathon's mineral claim area is composed of the Central Newfoundland Forest Ecoregion and the Red Indian Lake Subregion (Damman 1983, NLDEC 2008; Figure 1-1). The landscape is characterized by remote upland forests interspersed by wetlands (bogs/fens), krummholtz, barrens and waterbodies. The dense forests are composed of balsam fir (*Abies balsamea*) and black spruce (*Picea mariana*), common to Central Newfoundland Forests. Stands of pure hardwood and mixedwood are also present, with the dominant species being white birch (*Betula papyrifera*) and trembling aspen (*Populus tremuloides*). While the majority area is in a relatively natural state, timber harvesting and mining activity have occurred.

There are a variety of Newfoundland mammal species, small mammals (mice, voles, and shrews) and upland game birds that would be expected to be detected during winter within the Study Area including (NLDEC 2012):

- Large Ungulates:
  - Moose (*Alces americanus*)
  - Woodland Caribou (*Rangifer tarandus*)
- Carnivores:
  - American Mink (*Neovison vison*)
  - Canada Lynx (*Lynx canadensis*)
  - Eastern Coyote (*Canis latrans*)
  - Ermine (Weasel) (*Mustela erminea*)
  - Newfoundland Marten (*Martes americana atrata*; Species at Risk)
  - Red Fox (*Vulpes vulpes*)
  - River Otter (*Lontra canadensis*)
- Rodents:
  - Red Squirrel (*Tamiasciurus hudsonicus*)
- Lagomorphs:
  - Arctic Hare (*Lepus arcticus*)
  - nowshoe Hare (*Lepus americanus*)
  - Upland Game Birds:
  - Ruffed Grouse (*Bonasa umbellus*)
  - Spruce Grouse (*Falcipennis Canadensis*)
  - Willow Ptarmigan (*Lagopus lagopus*)

1.4 Study Team

A team of five Stantec members, a helicopter pilot, and one Marathon Gold Corporation employee carried out the field component of the winter wildlife survey. The complete project team, their affiliation and project role is included in Table 1.1.

Table 1.1 Personnel, Affiliation and Roles for Winter Wildlife Survey

Personnel	Affiliation	Role(s)
Barry Wicks	Stantec	Project Manager
Perry Trimper	Stantec	Technical Lead and Senior Review
Tina Newbury	Stantec	Field Lead; aerial survey (observer/data recorder), ground track survey; data entry and report preparation
Stacey Camus	Stantec	Ground track survey; data entry and report preparation
Tony Parr	Stantec	Aerial survey (navigator/observer); ground track survey; placement of marten hair snag traps
Karen Rashleigh	Stantec	Aerial survey (observer/data recorder); ground transect survey
Wayne Tucker	Stantec	Ground transect survey and report preparation
Peter Jefford	Universal Helicopters Newfoundland and Labrador	Pilot
Scott McCrindle	Marathon Gold Corporation	Checking of marten hair snag traps

2.0 METHODS

Prior to commencing the winter survey two permits were obtained from the Newfoundland and Labrador Wildlife Division (NLWD), Newfoundland and Labrador Department of Environment and Conservation (NLDEC):

- A permit to conduct research and possess specimens of a threatened species under the Newfoundland and Labrador Endangered Species Act (Appendix A-1); and
- A scientific research permit to undertake one day aerial and ground based winter reconnaissance surveys to examine the presence and distribution of wildlife within the study area (Appendix A-2).

A review of Stantec's health, safety, and environment safe work practices (SWP) (*e.g.*, Working in Remote Areas, Helicopter Safety) by members of the Study Team was undertaken prior to the start of the field program.

To meet the two objectives of the study, three methods were used: 1) Aerial Surveys; 2) Ground Track Surveys; and 3) Newfoundland Marten Hair Snag.

2.1 Aerial Survey

The aerial survey was designed to assess the species diversity, richness, and relative abundance of larger mammals, more specifically ungulate species (*e.g.*, moose and caribou). Further, all observations and signs of species were recorded. During the aerial survey, a 151 km^2 polygon covering 65 % of the mineral claim area was flown (Figure 2-1). The aerial survey was conducted in a L4 helicopter under good flying conditions (-5ºC, light eastern winds) on February 28, 2013. The aerial survey crew consisted of the pilot, a navigator, and two observers.

An assessment of the landscape composition and configuration of the study area was conducted to maximize the efficiency of the aerial survey. Through discussions with the pilot, a series of parallel transect lines, at 800 m spacing, were oriented with the topography (i.e., southwest-northeast). Prior to the flight, these predetermined transects were uploaded onto both the pilot's and navigator's GPS units for navigation. The grid pattern was flown at a speed of approximately 125 km/hr and height of 100 m above ground level. Observers scanned an area of 200 m either side of the helicopter. Disturbance to wildlife was minimized by maintaining the flight altitude and minimizing hovering and circling unless required to confirm a specific track. All wildlife and tracks observed were recorded with locational data. Other parameters such as: snow and ice cover, start and end times of each transect, and habitat descriptions were also recorded. The flight track file and digital photos were stored for future reference if necessary.

Track densities were calculated for each species using the following formula:

$$\text{track density} = \frac{\text{\# tracks per species}}{\text{transect length (20km) x field of view (400m) x \# transects (13)}}$$

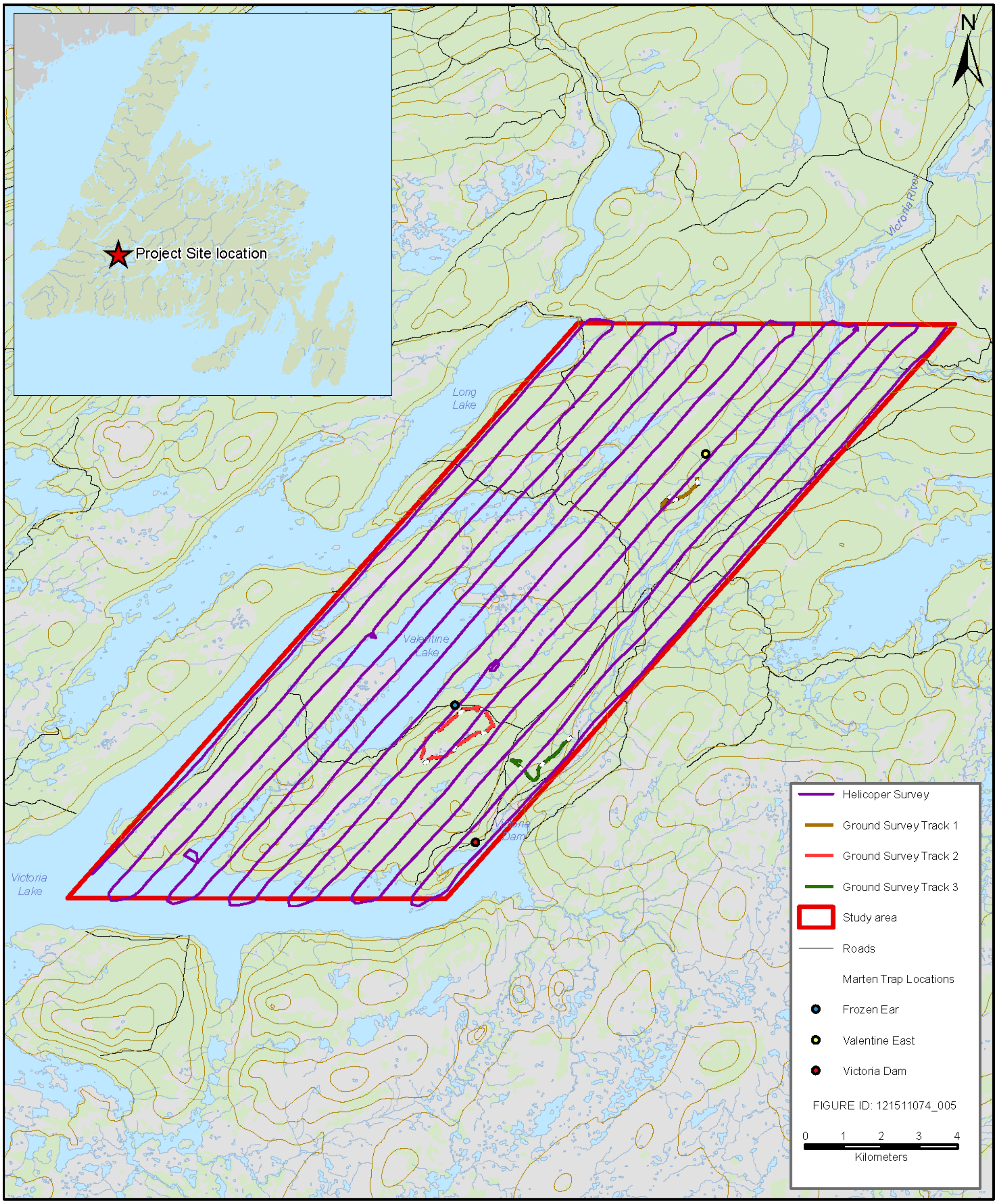

Figure 2-1 2013 Winter Wildlife Surveys

2.2 Ground Track Survey

Winter ground track surveys were designed to observe species diversity, richness, and relative abundance. Based on an assessment of the various habitat types in the study area, three transects were predetermined prior to the survey based on the following factors:

- start points were selected near accessible locations to enhance survey efficiency;
- transects were >1 km in length to account for species (e.g. caribou) that avoid access features;
- transects were oriented perpendicular to existing environmental gradients (such as topography), to examine a variety of adjacent habitats; and
- transects were oriented in a variety of directions to examine greater ecological variability.

Two teams of two observers on snowshoes, followed the predetermined transects (Figure 2-1) using a handheld GPS. Weather and snow condition, dominant tree and shrub vegetation and all tracks encountered were recorded on data sheets. Track files from each GPS and digital photos were stored for future reference.

Track densities were calculated for each species using the following formula:

$$\text{track density} = \frac{\Sigma \text{ tracks observed}}{\Sigma \text{ transect length surveyed by transect and habitat (km)x } \Sigma \text{ track period (days)}}$$

2.3 Newfoundland Marten Hair Snag

Newfoundland marten hair snag traps were constructed and deployed according to guidelines provided by the NLWD (Herdman 2012). A triangular shaped trap was constructed from three boards that were wired together. Suitable Newfoundland marten habitat was selected using mapping provided by the NLWD and was verified during the aerial survey before deployment. The three trap sites were accessed via helicopter and snowshoe on February 28, 2013. Each hair snag trap was mounted horizontally (with screws) to a large living coniferous tree. Four sticky pads and one can of sardines were placed in each trap. A GPS waypoint and digital photo was taken at each trap placement site (Figure 2-1). Marten hair snag traps remained in place for one month. Each of the traps were checked and re-baited if necessary on three occasions, approximately once per week (Table 2.1).

Table 2.1 Marten Hair Snag Locations

Trap	Location	Date Set	Dates Checked
Victoria Dam	N48.35260 W-57.12880	March 8	March 13, 21, 29
Frozen Ear Pond	N48.38508 W-57.13621	February 28	March 8, 13, 21, 29
Valentine Lake northeast	N48.44458 W-57.04724	February 28	March 8, 13, 21, 29

When traps were successful in obtaining hair samples, the sticky pads were collected and placed in labeled envelopes. Sticky pads were replaced and bait was recharged on subsequent visits. Hair snag samples were forwarded to the MUN CREAIT laboratory for analyses.

3.0 RESULTS

3.1 Aerial Survey

A total transect distance of 274 km was flown during the aerial survey. The survey lasted 2 hours and 13 minutes, including ferry time between transects (<30 seconds each turnaround).

Sign of seven mammal species (Canada lynx, eastern coyote, moose, red fox, river otter, snowshoe hare, and woodland caribou) two upland game birds (grouse and ptarmigan) and an unidentified ungulate and canid were observed (Table 3.1). The highest track densities observed were snowshoe hare, eastern coyote, and moose. Coniferous stands had Canada lynx and snowshoe hare tracks. Hardwood stands had tracks from Canada lynx, moose, and snowshoe hare. Edge habitats had red fox, river otter, and snowshoe hare tracks. Open barrens and bogs contained tracks from woodland caribou, eastern coyote, and upland game birds.

Incidental wildlife observations during the aerial track survey included an unidentified passerine species and Common Raven (*Corvus corax*).

Table 3.1 Aerial Track Density by Wildlife Species

Wildlife Groupings	Species	Total number of tracks	Survey area (km^2)	Track density (total number of tracks/survey area (km^2)
Large Ungulates	Moose	106	104	1.01
	Woodland caribou	29	104	0.27
	Unidentified ungulate[1]	3	104	0.028
Carnivores	Canada lynx	21	104	0.20
	Eastern coyote	140	104	1.34
	Red fox	65	104	0.62
	River otter	8	104	0.076
	Unidentified canid[2]	1	104	0.0096
Lagomorphs	Snowshoe hare	535	104	5.14
Upland game birds	Grouse or Ptarmigan	4	104	0.038

[1] moose or caribou
[2] fox or coyote

3.2 Ground Track Survey

The ground survey covered 10.4 km over 7 hours and 6 minutes of person effort. Snow conditions varied from site to site. The last recorded snowfall for the area was on February 25, 2013, three days prior to the surveys. There was 100 % snow cover throughout the area. Higher elevation transects (Ground Track 2 – Figure 2-1) were windblown with a snow hardness of approximately 40 g/cm^3. Snow conditions at lower elevations transects (Ground Track 1 and 3 – Figure 2-1) were ideal for tracks with a firm layer covered by 5 cm of uncompacted snow. Snow hardness was less at lower elevations with values of approximately 25 g/cm^3.

Canada lynx, eastern coyote, ermine, Newfoundland martin, moose, red fox, red squirrel, small mammals, snowshoe hare and upland game birds were recorded (Table 3.2). Overall, snowshoe hare, small mammals, ermine, and red squirrel had the highest track densities amongst the species observed. In coniferous stands, all 10 of the observed species were recorded, while there were 9 species in hardwood and 6 species in bogs and barrens. Snowshoe hare, Newfoundland marten, eastern coyote, and moose were the most common in coniferous stands based on track density. Track densities were highest in hardwood stands for all species except eastern coyote, which had highest track density in bog/barren habitat. The fact that Newfoundland marten exhibited highest track density in hardwood habitat was unexpected, as marten are generally associated with mature coniferous forests.

Incidental wildlife observations outside of the track surveys included: Boreal Chickadee (*Poecile hudsonicus*), Gray Jay (*Perisoreus canadensis*), and Red-breasted Nuthatch (*Sitta canadensis*).

Table 3.2 Ground Track Density by Stand Type

Stand Type	Track Density (tracks/km*day)											Total Species Observed	Total Kilometers Sampled
	Moose [1]	Canada Lynx [2]	Eastern Coyote [2]	Ermine [2]	Newfoundland Martin [2]	Red Fox [2]	Red Squirrel [3]	Snowshoe Hare [4]	Small Mammals	Upland Game Birds	Unidentified Tracks		
Conifer-ous	0.25	0.10	0.29	0.18	0.47	0.25	0.18	3.88	0.21	0.03	0.07	10	9.1
Hard-wood	0	3.33	3.33	20	3.33	6.66	16.66	120	50	6.66	3.33	9	0.1
Bogs/ Barrens	0	0.81	5.73	0	0.81	0.81	0	0.81	4.09	0.81	0	6	1.2
Totals	0.25	4.24	9.35	20.18	4.61	7.72	16.84	124.69	54.30	7.50	3.40	10	10.4

[1]Large Ungulates; [2]Carnivores; [3]Rodents; and [4]Lagomorphs.

3.3 Newfoundland Marten Hair Snag

The total trapping effort for the program was 22 trap-nights at the Victoria Dame Site and 30 trap-nights at both the Frozen Ear Pond and Valentine Lake northeast Site (Figure 2-1). One hair snag trap deployed at the Frozen Ear Pond site was successful in obtaining a Newfoundland marten hair sample. The Marten visited the Frozen Ear Pond site between February 29 and March 8, 2013.

A complete microsatellite haplotype was identified for this individual marten as it did not match any of the 172 Newfoundland marten that were currently in the provincial database. Further analyses were conducted and determined that this individual was female. This information was included as a new addition to the provincial database.

4.0 DISCUSSION

The three types of survey techniques provided different perspectives as to the presence and distribution of wildlife within the Valentine Lake area during winter. The wildlife (mammal and upland game bird species) species identified during the survey were consistent with those expected in the area based on the habitats surveyed (Banfield 1984, NLDEC 2012). Coniferous habitats were the most species diverse with a total of ten wildlife species documented. The high utilization of coniferous forest was expected as this habit provides essential cover which offers protection from both weather and predators. Newfoundland marten was confirmed in both coniferous and hardwood stands within the Study Area.

Large Ungulates

Evidence of woodland caribou presence was predominantly in two locations: 1) hummocks at higher elevations and 2) areas adjacent to and on a frozen lake. At the frozen lake, many coyote tracks were present and an individual coyote was observed feeding on a recent caribou kill. Woodland caribou occur in higher elevation areas as these windblown areas typically have less snow cover, providing easier travel and therefore reduced energetic output. During winter caribou are known to select feeding areas with extensive ground lichen cover and the amount of snow cover in an area affects caribou distribution (Pruitt 1959; Brown and Theberge 1990). Caribou can forage through up to 1 meter or more of snow through cratering, an activity where they use their hooves to dig through snow and ice to forage (Brown and Theberge 1990). In addition to ease of travel and increased forage availability in higher elevation areas the vantage provided on the higher, open barren ground may be advantageous to caribou wary of predators.

Moose tracks were in coniferous stands, valley bottoms and mixedwood stands. These are typical areas for moose to overwinter as they are relatively protected from wind and their food sources are more readily accessible (Parker and Morton 1978; S. Fudge and Associates 1989). Coniferous stands also provide thermal cover (Renecker and Hudson 1986).

Carnivores

Eastern coyotes, Canada lynx, ermine, red fox, and river otter were documented. Eastern coyote tracks were frequently observed around open forest edges, a commonly used area by predators to avoid detection. Canada lynx tracks were noted in conjunction with snowshoe hare, in coniferous and hardwood stands as is usually the case in this close predator-prey relationship (O'Donoghue et al. 1998). Ermine were found in coniferous and hardwood stands as documented elsewhere (Banfield 1984). Red fox tracks were observed in hardwood habitat, bog/barren habitat and coniferous habitat (edge habitat). Red foxes are generally found in open areas which include shores, river valleys, and natural clearings in forests (Banfield 1984). River otter tracks were observed as expected proximate to frozen water bodies and near areas of open water. River otter are known to prefer lakes, ponds, stream and riverine edge habitats due to their piscivorous diets and amphibious behaviour (Banfield 1984).

Rodents, Lagomorphs, Small Mammals, and Upland Game Birds

In the Study Area, there were tracks of red squirrel, snowshoe hare, small mammals and upland game birds. Red squirrels were found in hardwood and coniferous stands as documented elsewhere (Banfield 1984). Snowshoe hare tracks were common throughout the study area in most habitat types. Tracks were most prevalent in hardwood forest habitat. Association of hares with white birch as forage has been documented (Newbury and Simon 2005, MacCracken et al. 1988). Small mammal signs were evident throughout the Study Area. Subnivean activity was documented in hardwood and coniferous forests, as well as open edges around bog areas, where the windblown snow did not obscure identification of activity. Upland game bird tracks were in coniferous, hardwood habitats as well as open areas. Ruffed grouse is primarily associated hardwood stands of trembling aspen and white birch stands but is also found in young mixedwood stands (Rusch et al. 2000). Spruce grouse are found in dense coniferous stands (Boag and Schroeder 1992). Willow Ptarmigan in Newfoundland occupies barrens and coniferous krummholtz (Hannon et al. 1998).

Species at Risk

Newfoundland marten presence in the study area was confirmed through the observation of tracks and analyses of collected hair samples. This species was expected but unconfirmed in the Valentine Lake area, based on the habitat available and proximity to identified core and critical habitat ranges (The Newfoundland Marten Recovery Team 2010). The detection of a new individual female marten through the genetic analysis of the hair sample was included in the Newfoundland database and may be used by the NLWD to monitor Newfoundland marten abundance throughout its range in the province.

There were Newfoundland marten tracks within both coniferous and hardwood stands. Structure and other habitat features such as canopy cover provided by coniferous forests are well-documented as important characteristics for Newfoundland marten (Gosse et al. 2005; Buskirk et al. 1989). Use of hardwood forests is not well-documented in Newfoundland. Hardwood stands may be included in their home range as a response to prey availability (Gosse et al. 2005). Marten may be responding to prey fluctuations that in turn are resulting from high seed crops in hardwood stands (Jensen et al. 2012). Prior to this study, Newfoundland marten were recorded in areas just west of the study area in older growth coniferous forests. Their documented presence within the Study Area and in particular in relatively undocumented habitats is important as it may reflect on both the quality of habitat (such as structure, food sources) as well as expansion of the species in the area.

Limitations

While all efforts were made to ensure a successful survey, there are always limitations that must be acknowledged. Particular limitations to this study were:

- The last recorded snowfall in the areas was three days prior to survey date. Some literature recommends that track surveys be conducted within twelve hours of the last snowfall (RIC 1998) while others reference three days (AMBI 2010). Based on the existing weather patterns and forecast at the time of the study, it was felt that the window of opportunity was limited and there was risk in delaying for ideal snow conditions.
- Snow conditions varied over the sites surveyed. Transects located at higher elevations were somewhat windblown in open areas, which may have made detection of tracks from species such as small mammals and upland game birds difficult to distinguish. A decision to consolidate small mammals and upland game birds was made as a result.

The results of this type of study are often used in baseline reporting, ecological model verification in Environmental Impact Assessments, and as a monitoring tool. Because three different survey techniques were used for the study, the results are more comprehensive than any single technique. The breadth and depth of knowledge gained can assist Marathon with future planning and permitting related to the Project.

5.0 CONCLUSION

All species and/or species sign documented were expected in the Study Area. There were ten wildlife (*i.e.*, mammal and upland game bird species) species observed based on tracks during the ground surveys and eight wildlife (*i.e.*, mammal and upland game bird species) species during the aerial surveys. The presence of Newfoundland marten was confirmed by the observation of tracks, as well as the analyses of the hair sample, which identified a new individual to the NL database.

No significant environmental effects are expected as a result of this survey. The Study Team acted to minimize all disturbances associated with helicopter use so no wildlife was unnecessarily disturbed as part of the survey. Surveys of this nature have been completed in the past (in Newfoundland and Labrador, as well as other areas) without the detection of any significant effects on behavior.

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APPENDIX A-1

A permit to conduct research on, and possess specimens of a threatened species under the Newfoundland and Labrador Endangered Species Act

Newfoundland Labrador

GOVERNMENT OF
NEWFOUNDLAND AND LABRADOR

Department of
Environment and Conservation
Wildlife Division

A PERMIT TO CONDUCT RESEARCH ON, AND POSSESS SPECIMENS OF A THREATENED SPECIES UNDER THE *ENDANGERED SPECIES ACT* OF NEWFOUNDLAND AND LABRADOR

Date: February 25, 2013

Endangered Species Permit Number: **2012/13-24**

Issued To: Tina Newbury, Stantec Consulting Ltd., 19 Union St. Corner Brook, NL A2H 6G7

Permit To: Collect and possess hair specimens from American marten (*Martes americana atrata*)

Expiry Date: May 1, 2013

CONDITIONS:

1. The permit holder may designate other individuals to collect and possess hair specimens on his/her behalf. The permit holder is responsible for the training of any designated individuals and must ensure designated individuals follow all regulations related to this permit.

2. Nominees under this permit include: Scott McCrindle, Tony Parr, Stacey Camus

3. Information about the location of collection and any other relevant information must be transferred to the Wildlife Division, Department of Environment and Conservation as soon as possible following hair collection.

4. All marten hair samples are to be transferred to the Wildlife Division, Department of Environment and Conservation or to the CREAIT Laboratory at Memorial University of Newfoundland. Any remaining hair samples after analysis are to be transferred to the Wildlife Division, Department of Environment and Conservation.

5. A final report including the methods and results of the study and including full genetic results must be provided to the Wildlife Division, Department of Environment and Conservation by May 1, 2013.

6. Names and contact information for all individuals participating in hair snagging activities must be provided to the Wildlife Division, Department of Environment and Conservation once activities are completed for the year.

The permit holder may at any time request the permit be amended to allow for the loan, exchange or donation of specimens covered under this permit to other institutions or individuals for the purposes of, conservation, identification or study.

<Original signed by>

JOHN BLAKE
Director

APPENDIX A-2

Scientific research permit: to undertake one day aerial and ground based winter reconnaissance surveys to examine the presence of and distribution of wildlife within the study area during winter

Newfoundland Labrador

GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
Dept of Environment & Conservation

Scientific Research Permit

(as under Section 86 of the Wildlife Regulations, Consolidated Newfoundland and Labrador Regulation 1156/96)

Project Title: *Marathon Gold – 2013 Winter Wildlife Reconnaissance Surveys*

Issued to:

Tina Newbury
Stantec Consulting Ltd.
19 Union Street
Corner Brook, NL CA A2H 6G7
Tel: (709) 639-9712

Permit to: Undertake one-day aerial and ground based winter reconnaissance surveys to examine the presence of and distribution of wildlife within and the study area during winter.

Dates:
1-Day survey that will be undertaken between February 26 & March 8, 2013
Permit expires April 1, 2013

Location: The study area consists of approximately 172 km2 within the Marathon Gold Corp. Valentine Lake Property claim area. This claim area falls within the area of Victoria Lake and Valentine Lake (NTS 12A/06 &12A/07).

Conditions:

1) Prior to initiation of surveys, a digital copy of the shapefiles of all survey routes must be provided to the Wildlife Division, Senior Wildlife Biologist, Habitat Management Program, Kirsten Miller at: kirstenmiller@gov.nl.ca

2) The Wildlife Division advises applicants to operate under established regulations and guidelines with respect to wildlife and wildlife habitat to minimize adverse impacts (Section 106 of the *Wild Life Regulations* under the *Wild Life Act* (O.C. 96-809)).

3) The Project will be conducted using accepted wildlife research techniques and target species will be disturbed as little as possible.

4) Upon completion of the report writing, a copy of the final reports will be remitted to the Wildlife Division, Senior Wildlife Biologist, Habitat Management Program, Kirsten Miller at: kirstenmiller@gov.nl.ca by May 15, 2013. In addition, a list of all wildlife sightings and sign with their coordinates will be forwarded to the Wildlife Division after each survey.

5) Any unusual wildlife observations or any adverse effects observed during this survey are

to be reported immediately to the Wildlife Division – Corner Brook.

6) The methods and survey dates described in the application will be followed as closely as possible. Any changes to the survey design or methodology outlined in the initial permit request will require prior approval before implementation.

7) All conditions of this permit must be adhered to and data and results from previous projects submitted to the Wildlife Division prior to another permit being issued.

<Original signed by>

Date

<Original signed by>

Senior Manager – Habitat/Game and Fur

Wildlife Division
PO Box 2007
Corner Brook, NL A2H 7S1
Ph (709) 637-2383
Fax (709) 637-2004

ATTACHMENT 7-B

2011 Forest Songbird Surveys (2014)

2011 Forest Songbird Surveys at the Valentine Lake Prospect

Stantec

Stantec Consulting Ltd.
607 Torbay Road
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Tel: (709) 576-1458
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Prepared for

Marathon Gold Corporation
Suite 1505, 33 Bay Street
Toronto, ON

Final Report

File No. 121510621

Date: August 13, 2014

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1.0 INTRODUCTION

A breeding songbird point count survey was carried out between 14 and 18 June 2011 to document the species present and provide insight regarding forest songbird populations in the areas surveyed. The survey occurred at a time when all migrants had returned to the area based on the presence of Yellow-bellied Flycatchers, typically a late arriving migrant. Songbirds are members of the Order *Passeriformes* and are defined as 'perching birds'. Songbirds are important species in many regards but as foragers of insects they serve to keep many insect species in check and are beneficial to forests and crops in this way. Songbirds have been in decline in recent years and this may be attributed to a decline in winter habitat as well as breeding habitat fragmentation (USFWS 2002).

The 2011 breeding songbird surveys were completed in advance of an Ecological Land Classification, so transects were placed in areas that were identified to Stantec as areas of current and future exploration: Leprechaun Pond, Valentine Lake East and Frozen Ear Pond. Four transects were completed over five mornings. All bird species detected during point count surveys were recorded.

A total of 38 species were identified. The most common species recorded were: White-throated Sparrow, Ruby-crowned Kinglet, Swainson's Thrush and Yellow-bellied Flycatcher. Two federally and provincially listed (*threatened*) species were detected: Olive-sided Flycatcher (COSEWIC 2007; SSAC 2009) and Common Nighthawk (COSEWIC 2007; SSAC 2007).

2.0 METHODOLOGY

No permits were required to conduct forest songbird surveys. Internally, Stantec completed a review of health and safety issues related to the project. A health and safety checklist was reviewed with participants on 14 June. A safety toolbox meeting was completed and documented the following 4 days.

All bird species detected during the point count surveys were recorded. This methodology entails having an observer stand in a fixed location for a pre-determined amount of time and tallying all bird species observed or heard. The data collected can be used to determine the relative abundance of species. Over time, trends in abundance may be assessed (Huff et al. 2000). Songbird point count surveys were conducted between 14 and 18 June 2011 at existing and future disturbances as well as adjacent areas at the Valentine Lake prospect site. One Survey Team participated in the field program, comprised of a lead ornithologist and a field technician. 1:50,000 National Topographic Series map sheets, GPS, and compass were used for field navigation. Sites were accessed each morning by ATV, truck and by foot. While the focus of these surveys was on forest songbirds, observations of all avifauna and other wildlife were recorded. The Stantec team was led by the Project Manager, Mr. Barry Wicks and included Ms. Tina Newbury who participated as lead ornithologist on each of the five days. Ms. Marina Joury (Marathon employee) participated as field technician from 14 to 18 June, 2011.

A series of ten minute point count surveys were conducted at locations spaced at least 300 m apart. Each waypoint was recorded with a handheld GPS unit. Surveys commenced at dawn (approximately 0515 h) and no point counts were initiated after 0900 h, due to documented declines in the frequency of song later in the morning (Ralph et al. 1993). All birds heard or seen during this period were recorded by the ornithologist. Vegetation data including forest, shrub and ground cover species was recorded (Appendix A). Photographs of habitat were taken at each point count. Data were organized by birds heard and/or seen during two consecutive five minute surveys at each 300 m spaced point count. As these surveys rely on auditory cues, poor weather (i.e., precipitation and/or windy conditions) resulted in a delay (or postponement for that day) until conditions improved. High winds (winds ranking greater than 2 on Beaufort Scale) and heavy rain negatively affect the observers' ability to detect avian species. Bibby et al. (2000) recommend the restriction of point counts to wind conditions of Beaufort 3 and below, with a preference for 2 and below if possible, and to avoid counting in precipitation exceeding occasional light drizzle or brief showers.

3.0 RESULTS

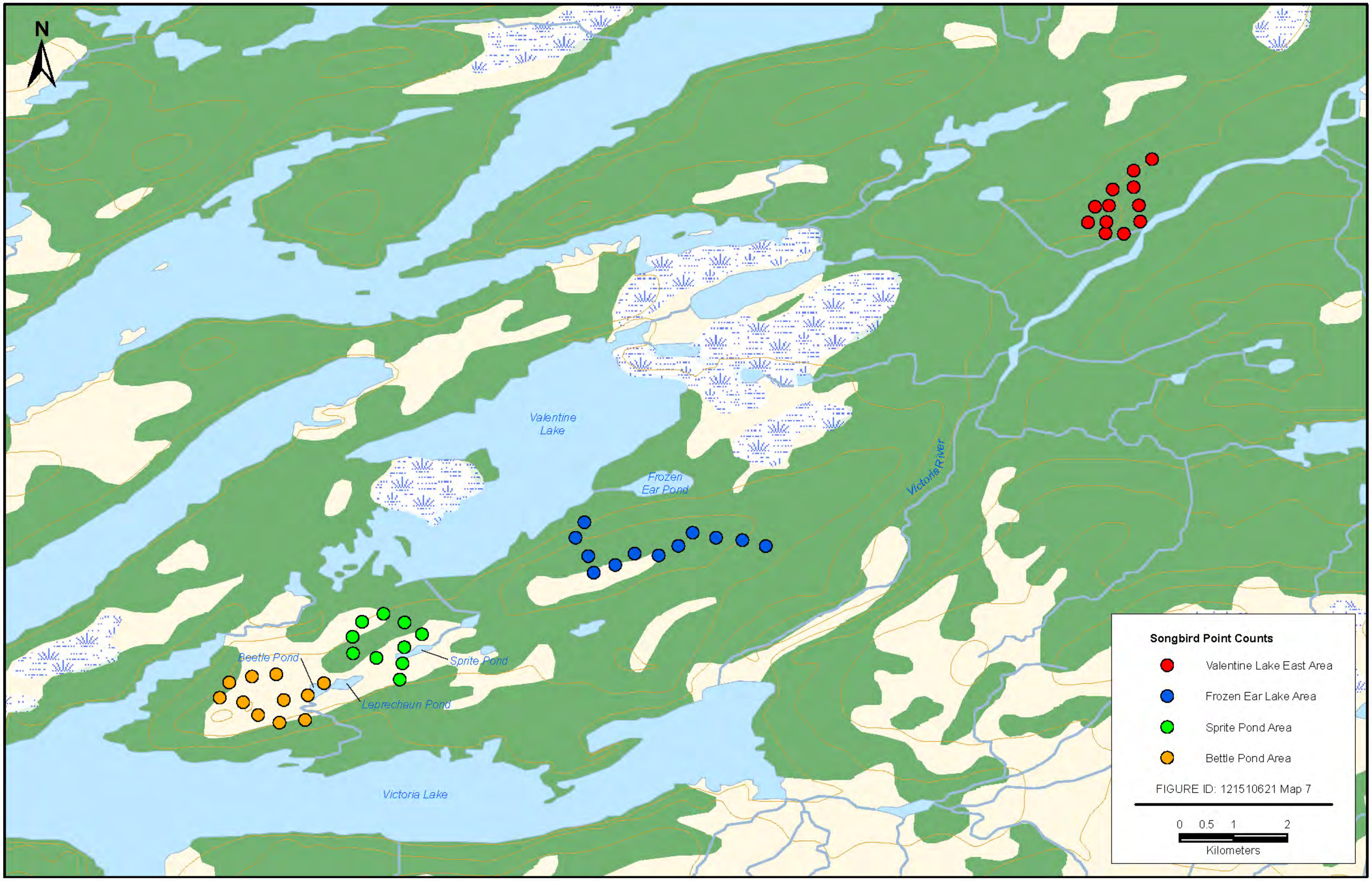
Forty-five point counts were conducted within the areas of interest at the Valentine Lake prospect during 14 to18 June 2011. Weather conditions were favourable (i.e. no precipitation, and nil to light wind conditions) except for the morning of the 16 June when there was rain. A partial transect (3 point counts) was completed on this date. In the Leprechaun Pond area there were two transects: Beetle Pond (N=11), Sprite Pond (N=10). There was one transect completed in the Frozen Ear Pond area (N=12) and one transect completed in the Valentine Lake East area (N=12) (Figure 3-1).

Surveys began as early as 0520 hrs. and the latest point count was finished at 0905 hrs. Species richness ranged between 4.84 and 5.36 and abundance ranged between 6.20 and 7.33 (Table 3.1). No trend was detected over time.

Table 3.1 Species richness and abundance hourly following sunrise

Survey Time	# points	Mean # of species	Mean # of individuals
0431-0530 h	3	5.33	7.33
0531-0630 h	10	5.10	6.90
0631-0730 h	13	4.84	6.15
0731-0830 h	14	5.36	7
0831-0930 h	5	5.2	6.2
Note: mean # of species and mean # of individuals calculated from first 5 minute sampling period at each point count			

Figure 3-1 Songbird Point Count Locations, June 14 – 18, 2011 at Valentine Lake Prospect



A total of 38 breeding songbirds plus one unidentified woodpecker were detected during point count surveys. There were six additional avian species as well as six mammals and one amphibian detected on the Valentine Lake property incidentally (Appendix B).

The Valentine Lake Property is entirely within the Maritime Barrens Ecoregion. This ecoregion is characterized by foggy weather with cool summer temperatures and as having balsam fir (*Abies balsamea*) as the dominant tree species (http://www.heritage.nf.ca/environment/ecoregions_nfld.html). Point counts were conducted in seven habitat types encountered: wetlands, barren, black spruce (stunted), mature black spruce forest, mature balsam fir forest, riparian and mixed wood forest. Wetlands, barren, black spruce (stunted), and mature balsam fir forest had the largest avian communities that ranged from 19 to 26 species (Table 3.2). Riparian and mixed wood forest habitat types had notably smaller avian communities with a total of nine and five species, respectively. Mature black spruce forest had a mid-range avian community with a total of fifteen species detected.

Table 3.2 Presence of avian species in surveyed habitat types on the Valentine Lake Prospect, June 2011

Species	Wetlands (bog/fen) (N=7)	Barren (hilltop) (N=9)	Black spruce (stunted) (N=5)	Black spruce (forest)[1] (N=6)	Balsam fir (forest)[2] (N=15)	Riparian (N=2)	Mixed wood (Deciduous)[3] (N=1)
American Goldfinch			•				
American Robin		•			•		
Black-and-White Warbler	•		•	•			
Blackpoll Warbler	•	•	•			•	
Black-throated Green Warbler		•			•		•
Boreal Chickadee	•	•	•		•	•	
Brown Creeper					•		
Common Loon[4]	•	•		•			
Common Yellowthroat		•	•		•	•	
Fox Sparrow	•	•	•	•	•		
Golden-crowned Kinglet					•		
Gray Jay	•						
Greater Yellowlegs	•	•			•	•	
Hermit Thrush	•	•	•	•			
Least Flycatcher							•
Lincoln's Sparrow	•	•	•		•	•	
Magnolia Warbler			•	•	•		
Merlin	•						
Mourning Warbler				•	•		
Nashville Warbler					•		
Northern Goshawk					•		
Northern Waterthrush		•	•	•	•		•

Species	Wetlands (bog/fen) (N=7)	Barren (hilltop) (N=9)	Black spruce (stunted) (N=5)	Black spruce (forest)[1] (N=6)	Balsam fir (forest)[2] (N=15)	Riparian (N=2)	Mixed wood (Deciduous)[3] (N=1)
Olive-sided Flycatcher	•	•	•	•	•		
Palm Warbler			•	•			
Pine Grosbeak	•						
Pine Siskin		•	•				
Pine Warbler		•					
Ruby-crowned Kinglet	•	•	•	•	•		
Savannah Sparrow		•					
Slate-coloured Junco	•	•	•	•	•	•	
Swainson's Thrush	•	•	•	•	•	•	•
Swamp Sparrow	•	•			•		
White-throated Sparrow	•	•	•	•	•	•	•
White-winged Crossbill					•		
Wilson's Snipe	•				•		
Yellow-bellied Flycatcher	•	•	•	•	•		
Yellow-rumped Warble	•	•	•	•	•	•	
Yellow-shafted Flicker					•		
Unidentified Woodpecker					•		

All data, GPS waypoints and photographs of habitat at each waypoint are available electronically. The avian community detected in the Valentine Lake area is typical for these habitat types found within Newfoundland. The only exception is the Common Nighthawk which is considered a rarity on the island.

4.0 LISTED SPECIES

The Olive-sided Flycatcher (*Contopus cooperi*) is listed federally and provincially as *threatened* (COSEWIC 2007; SSAC 2009) and individuals were detected at six point count surveys during the 2011 field season. These individuals were observed in habitat typically associated with this species, i.e., bog (edge); Balsam Fir mature forest and Black Spruce mature forest. This habitat is not limiting within the study area or within the province. The Olive-sided Flycatcher is found throughout the island and southern Labrador.

The Common Nighthawk (*Chordeiles minor*) is listed both provincially and federally as *threatened* (COSEWIC 2007; SSAC 2007). One individual was incidentally encountered along open, roadside habitat during the 2011 field season - outside of the point count surveys. This species is typically found open habitat (ex: gravel beaches, grasslands, rocky outcrops, burns). This habitat type is not limiting within the province. Within the province this species is known to breed in southern Labardor but is considered a rarity on the island of Newfoundland.

Both the Olive-sided Flycatcher and Common Nighthawk are boreal forest birds. The provincial and federal listings for these two species result from habitat decline throughout their range. Listed species range from *vulnerable* (provincial designation) or *special concern* (federal designation) to *extinct* with *threatened* as the second ranking. A species that has been listed as *vulnerable* is likely to become *endangered* if the factors affecting its vulnerability are not reversed (COSEWIC 2011).

The inadvertent disturbance or loss of nest sites and/or eggs is referred to as incidental take. Incidental take is a current issue and Environment Canada has outlined an approach to be taken (Environment Canada 2011). This approach asks proponents to show due diligence in reducing or eliminating the risk of incidental take. The Provincial Government Management plans for these two species in Newfoundland and Labrador are pending.

5.0 LITERATURE CITED

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http://www.heritage.nf.ca/environment/ecoregions_nfld.html Ecoregions of Newfoundland map (accessed electronically 11 August 2011)

APPENDIX A

Data Sheet

Songbird Point Count Surveys- 2011

Valentine Lake area

Observer: ____________ Assistant: ______________________ Start time: _____ End time:______ Date: __June 2011

Waypoint: _____ Grid Ref: ____ Latitude: _________________ Longitude: ________________ Photo#:____________

%CC: ___ Temp(°C): ___ Precip: ____________ Wind direction:____________ Wind speed (Beaufort scale):_______

Canopy: species ____ % cover:___________

Shrub layer: dominant species ____

Ground veg: dominant species ____

	First 5 min.			**Second 5 min.**		
Species	<50 m	<100 m	>100 **m**	<50 m	<100 m	>100 m
COLO						
CAGO						
MALL						
OSPR						
RUGR						
SPGR						
GRYE						
SOSA						
SPSA						
WISN						
HERG						
NOFL						
HAWO						
BBWO						
TTWO						
YBFL						
ALFL						
LEFL						
OSFL						
TRES						
BANS						
GRAJ						
BLUJ						
AMCR						
CORA						
BCCH						
BOCH						
RBNU						
BRCR						
RCKI						
GCKI						
WIWR						
SWTH						
GCTH						
HETH						
AMRO						
NOSH						
EUST						
CEDW						
REVI						
TEWA						
OCWA						

	First 5 min.			**Second 5 min.**		
Species	<50 m	<100 m	>100 m	<50 m	<100 m	>100 m
NAWA						
YWAR						
MAWA						
YRWA						
BTNW						
PAWA						
BLPW						
BAWW						
AMRE						
NOWA						
MOWA						
WIWA						
SAVS						
FOSP						
SOSP						
LISP						
SWSP						
WTSP						
WCSP						
SCJU						
RUBL						
AMGO						
EVGR						
PIGR						
PUFI						
WWCR						
PISI						

Additional Observations: (species seen/heard between point counts as well as flyovers)

APPENDIX B

Incidental wildlife observations encountered on the Valentine Lake Prospect outside of point count surveys from 14 to 18 June, 2011

SPECIES	SIGN
Birds	
Common Raven (*Corvus corax*)	observed
Common Nighthawk (*Chordeiles minor*)	observed
Great Horned Owl (*Bubo virginianus*)	observed
Spruce Grouse (*Falcipennis canadensis*)	scat
Tree Swallow (*Tachycineta bicolor*)	observed
White-crowned Sparrow (*Zonotrichia leucophrys*)	observed
Other Wildlife	
American toad (*Bufo americanus*)	observed
Caribou (*Rangifer tarandus*)	tracks
Eastern coyote (*Canis latrans thammos*)	tracks/others at camp heard
Lynx (*Lynx canadensis*)	unconfirmed scat
Moose (*Alces alces*)	tracks
Red squirrel (*Tamiasciurus hudsonicus*)	heard/middens observed
Snowshoe hare (*Lepus americanus*)	scat

ATTACHMENT 7-C

2011 Baseline Waterfowl and Waterfowl Habitat Study (2014)

Stantec

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2011 Baseline Waterfowl and Waterfowl Habitat Study
Valentine Lake Project

Prepared for

Marathon Gold Corporation
Suite 1505, 330 Bay Street
Toronto, ON

Final Report

File No. 121510621

Date: August 13, 2014

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1.0 INTRODUCTION

Marathon Gold Corp. (Marathon) is currently conducting a drilling program for gold at its Valentine Lake prospect in Central Newfoundland. Drilling activities to date have targeted two locations, at Valentine East and at Leprechaun Pond. To prepare for an anticipated environmental assessment, Marathon commissioned Stantec Consulting Ltd (Stantec), to prepare a baseline waterfowl and waterfowl habitat report as part of overall baseline aquatic and terrestrial studies for the Valentine Lake Gold Project (the Project).

Given its location in Newfoundland and surrounding wetland habitat, the Project is expected to interact with a variety of waterfowl associated species such as American Black Duck, Ring-necked Duck, Red-breasted Merganser, American Green-winged Teal, Canada Goose, Common Goldeneye, and Common Loon. Other wildlife expected in this type of habitat include colonial nesting seabirds, migrating shorebirds, raptors, passerines and large and small mammals.

In addition to their role as wildlife habitat, wetlands also contribute to water storage and flood regulation, and store vast amounts of carbon. Thus, various agencies, organizations and governments have recently placed emphasis on the need to preserve and maintain wetlands. The Federal Policy on Wetland Conservation (Government of Canada 1991) states its main objective is “to promote the conservation of Canada’s wetlands to sustain their ecological and socio-economic functions, now and in the future.” The Federal Policy on Wetland Conservation, as well as similar wetland policies in many provinces, also aims to ensure “maintenance of the functions and values derived from wetlands throughout Canada” and “no net loss of wetland functions on all federal lands and waters in Canada”.

This *Waterfowl and Waterfowl Habitat Study* presents information on these resources in the area of current and possible future mineral exploration activity. Also relevant for these resources and therefore included, is a high-level evaluation of wetlands completed to further describe waterfowl habitat in the area. The results of aerial surveys for waterfowl in 2011 (and incidental observations from 2011) and an evaluation of waterfowl habitat (wetlands) within the proposed “area of interest” to the Project comprise the field investigations.

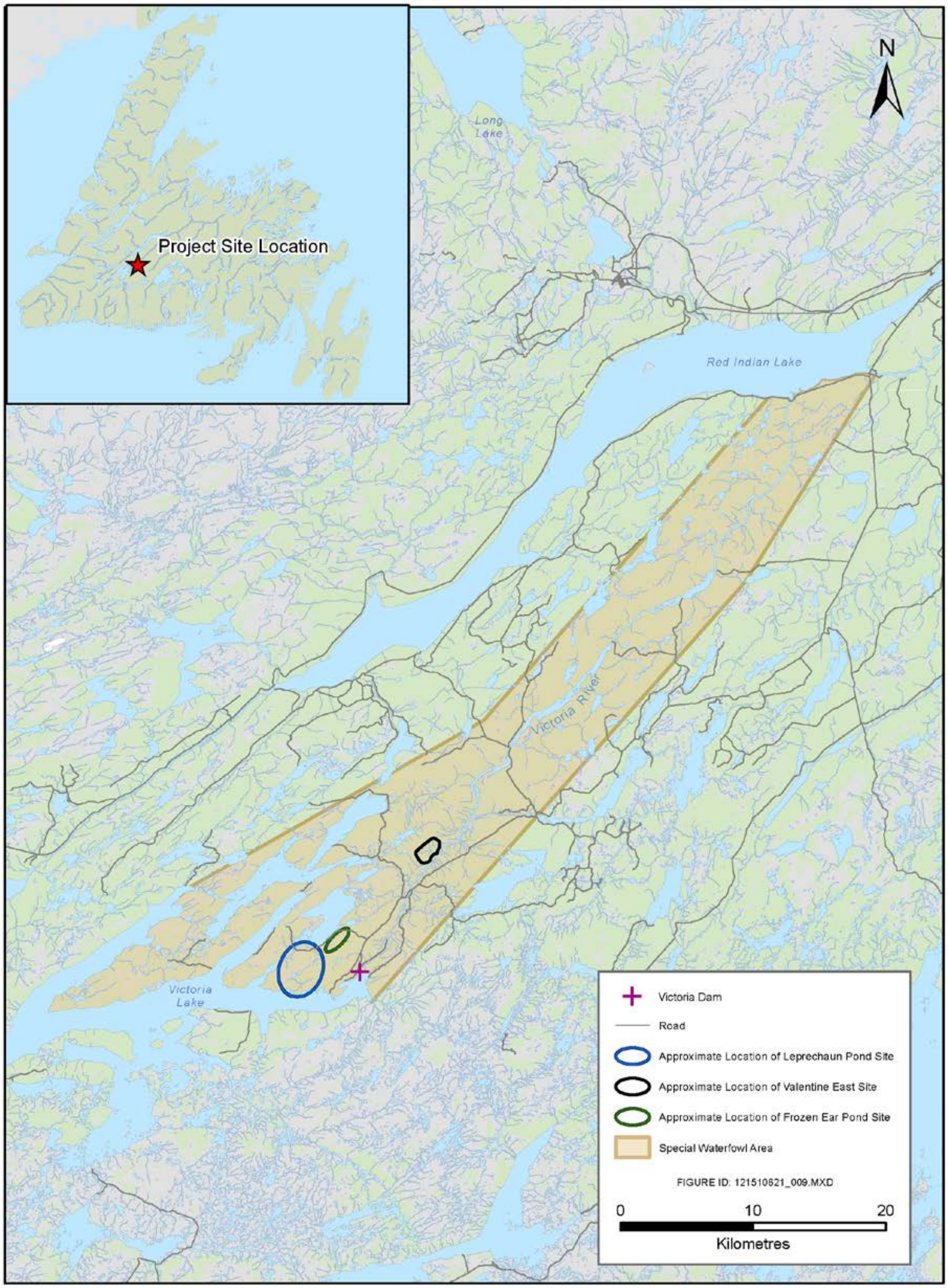
2.0 STUDY AREA

The Project involves the exploration, construction and operation of mining infrastructure in west central Newfoundland. The Valentine Lake Project is located approximately 57 km south of Buchans (Figure 2.1). The Project area is accessible by paved and gravel roads and extends from Victoria Lake in the south, northeast along the Victoria River and west to Valentine Lake. There are three areas of particular interest to Marathon: the Valentine Lake East Site, the

Frozen Ear Pond site and the Leprechaun Pond Site. Only the latter location appears to encompass waterbodies of sufficient size to support waterfowl.

The Project area is characterized by remote, upland forest interspersed by wetlands (bogs/fens), scrub lands, barrens and water. There has been previous timber harvesting and mining activity in the Project area and there is a network of various abandoned forest access roads and bridges. Of note is the presence of a “Protected or Special Management Area” that is known as the Victoria Steadies Special Waterfowl Area (SWA). This SWA was designated by the Newfoundland and Labrador Department of Environment and Conservation Wildlife Division (NLDEC).

Figure 2-1 Site Location Map



3.0 STUDY PURPOSE

At this stage of the Project, Marathon is developing a more detailed understanding of selected biophysical components of the environment potentially affected by the Project. This includes the distribution of these biophysical components in relation to on-going and proposed Project infrastructure (conceptual). The purpose of this *Waterfowl and Waterfowl Habitat Study* is to survey waterfowl use of the Project area, and identify the types of habitat (i.e., wetlands) within the area of the proposed activity. Planning and design work for the proposed Project will have the objective of avoiding difficult terrain and environmentally sensitive areas, such as wetlands, wherever possible.

The biophysical components considered in this report include waterfowl, waterfowl habitat (i.e., wetlands), and other wildlife, including terrestrial mammals and other incidental bird observations (e.g., raptors, passerines and shorebirds). The actual scope of any future environmental assessment will depend on the final Project description and direction from the regulating agencies, based on stakeholder input. The eventual location of all Project components will influence potential interactions with and effects on waterfowl and their habitats (i.e., wetlands). This will involve identifying (and attempting to avoid, where possible) wetlands and wetland habitats, for both practical and environmental considerations.

4.0 METHODS

Prior to completing field surveys, Stantec verified permitting requirements with provincial and federal regulators. Neither a provincial nor federal permit was required for this scope of work. Standard operating procedures developed by Stantec were employed for the waterfowl surveys. Daily safety meetings were held each day prior to starting field work. Safety meetings included a review of a health and safety checklist, safe work practices, and personal protective equipment required for safe completion of the work scope.

4.1 Waterfowl Breeding Pair Survey

Waterfowl species in the Project area are migratory, arriving at breeding sites in spring. Waterfowl occur as highly visible, breeding pairs at this time, prior to the onset of continuous incubation. The timing of this arrival varies between species according to ecological preferences/niches. Based on breeding chronology of waterfowl in Newfoundland, mid-May is an optimal time to observe both earlier and later nesting waterfowl species at breeding locations (Jacques Whitford 1995).

The study team consisted of an observer in the front of the aircraft who also aided in navigation through the study area, and two rear observers, one on either side of the aircraft (Table 4.1).

Table 4.1 Field Team for breeding waterfowl survey at Valentine Lake, 16 May 2011

Role	Personnel
Project Manager	Mr. Barry Wicks
Navigator and Observer	Mr. Bruce Turner
Observers	Mr. Sean Bennett, Ms. Tina Newbury
Pilot (Universal Helicopters)	Mr. Darren Barrett

On the morning of the survey, the navigator confirmed the expected route, weather conditions, location for refueling and other details with the pilot. Coordinates of the starting point for the survey was uploaded to the aircraft prior to departure for ease of navigation. The navigator guided the pilot through the Study Area and recorded observations directly on 1:50,000 National Topographic map sheets and on survey data sheets. A Bell 206LR helicopter (equipped with enhanced visibility or 'bubble' windows), flew at speeds of ≤ 70 km/h and altitudes of approximately 15 m above forest cover or the ground. The flight path was oriented according to the presence of waterbodies with the navigator ensuring that all features of potential breeding pair habitat were examined. Using a '12-hour' clock system of communication, the navigator guided the pilot (or vice-versa) when necessary. The recording and geo-referencing of environmental conditions, time of day, search effort, incidental observations of waterfowl and other wildlife, and any other noteworthy observations followed protocols established by Thomas (2006). Coordinates for each sighting were determined using a hand-held Global Positioning System (GPS) employed by one of the rear observers. The social status of all waterfowl observed were classified (i.e., lone male, lone female, breeding pair, flocked males and number, flocked females and number, mixed flocks and actual number by sex) and also described in terms of 'indicated pairs' (Dzubin 1969) to distinguish individuals that would likely breed in a given area. Spacing between individuals, group size and behavior were used in making this determination. All incidental sightings and sign of other wildlife species were also recorded. Digital photos were taken to demonstrate environmental conditions (i.e., snow and ice coverage) at the time of the survey and to document the variety of habitats within the study area. Note that while not usually considered a waterfowl species, observations of Common Loon were included for the purposes of this report. Appendix A contains latin names of waterfowl and other wildlife observed.

4.2 Waterfowl Brood Survey

A brood survey was planned to better define areas of productivity in the Project area. Insight from this aspect of waterfowl ecology can provide a measure of reproductive success for a given area (Bookhout 1994; Cassirer and Groves 1992). Early July was determined as an appropriate time for the brood survey as ducks and geese typically require 30-35 days to complete a clutch and to incubate to hatching, and another 45-55 days to days to raise young to flight (Jacques Whitford 1995). Therefore the young of any waterfowl laying in early May, an appropriate date for the area, will be flightless until at least the middle of July. Late-nesting species and re-nesting attempts may result in some clutch initiations not occurring until late May or possibly early June. Also as broods age they become more visible as they grow larger. The Study Team has also found that early July coincides with the moulting period in Newfoundland.

The brood survey focused on locations around Valentine Lake where breeding pairs were observed in May, and examined a 50 km stretch of the Victoria River extending northeast and downstream. The field team (Table 4.2) followed similar protocols as for the breeding pair survey.

Table 4.2 Field Team for Waterfowl Brood Survey at Valentine Lake, 7 July 2011

Role	Personnel
Project Manager	Mr. Barry Wicks
Navigator and Observer	Mr. Bruce Turner
Observers	Ms. Mary-Ann Aylward, Ms. Tina Newbury
Pilot (Canadian Helicopters)	Mr. Glenn Pearcey

The brood survey occurred on 7 July, 2011, approximately seven weeks after the breeding pair survey. All safety precautions and operating procedures described above for the breeding pair surveys were repeated. An exception was the use of an A-star helicopter (instead of a Long Ranger) for this survey. Observations of waterfowl broods were aged following standards outlined in Gollop and Marshall (1954). The behaviour of females in particular was noted as possible cues for undetected broods. All incidental sightings of other wildlife were recorded.

4.3 Wetlands Characterization

Wetlands and wetland/waterfowl habitats were classified according to criteria outlined in the Canadian Wetland Classification System (Warner and Rubec 1997). This hierarchical system was used to identify three general levels of wetland features – class, form, and type. Assigned wetland classes (e.g., bog, fen, swamp, marsh, shallow water) were based on properties reflecting their origin and the nature of the wetland environment. Each class of wetland was divided on the basis of ecological and floristic features, into a variety of wetland forms on the basis of surface morphology of the wetland (e.g., slope, raised, flat), position in the landscape (e.g., valley, delta, basin), surface features (e.g., ridges, nets, ribbed, mounds) and proximity to water bodies and tidal effects. The final level, known as wetland types, were further subdivisions of their forms and subforms based on the physiognomic characteristics of their vegetation communities (Warner and Rubec 1997).

Wetlands were opportunistically evaluated during waterfowl surveys of the Project area in May 2011. Owing to the nature of this study, wetlands were generally described according to their class, with a general overview of each wetland form inferred from aerial observations performed during the study. In the context of this study, the ability of the wetlands to provide habitat for waterfowl was assessed through an evaluation of their structural attributes and through direct observations of wildlife usage. In particular, wetlands were assessed in relation to their value as waterfowl habitat. As surveys were conducted primarily by helicopter, a key feature in the evaluation of wetlands was the interspersion of vegetation and open water used to provide general information on the ability of a wetland to provide habitat for a diversity of wildlife.

5.0 RESULTS

5.1 Breeding Waterfowl Survey

The breeding pair survey occurred on 16 May 2011 during excellent conditions (i.e., clear sky with calm to light northeast winds up to 15 km/hr, no precipitation, temperature 0°C). Only traces of snow and ice remained at this time. The aerial survey required 2.25 hours to examine an area of approximately 104 km^2. Thirty-four observations of seven waterfowl species were recorded (Table 5.1).

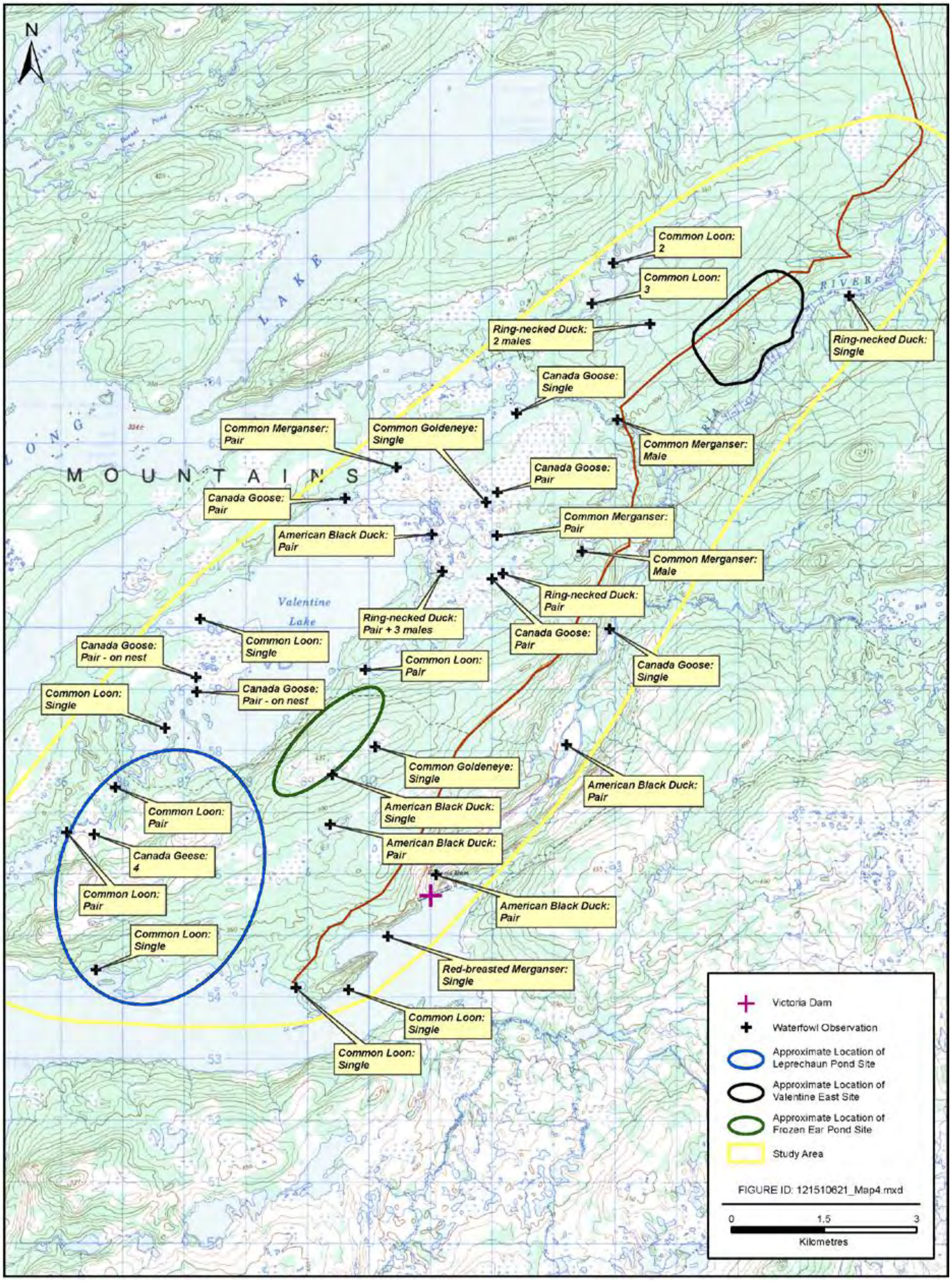
Observations of Common Loon, Canada Goose and five duck species, occurred on waterbodies and wetlands throughout the Project area and locations of interest to the Project (Figure 5.1). Four observations of Ring-necked Duck (pairs plus individuals) were observed on a fen northeast of Valentine Lake, other individual observations of this species were on Victoria River and a small pond in the northern part of the Project area. Five observations of American Black Duck (i.e., four pairs and a single male) were noted in the south-central portion of the Project area. One observation of Red-breasted Merganser was further south on Victoria Lake. Ten observations of paired and single Common Loon were made on larger waterbodies throughout the Project area. Two individual observations of Common Goldeneye were noted in the central portion of the Project area. Four observations of Common Merganser included two pairs on a fen northeast of Valentine Lake and two individual males to the east of this fen. Seven out of eight observations of Canada Goose (single and paired) were made on the fens west and north east of Valentine Lake. The other sighting of a Canada Goose, was of a single individual on the Victoria River. Note that of the three locations of interest to Marathon, waterfowl were only observed at the Leprechaun Pond Site and in the vicinity of the Frozen Ear Pond site. No sightings occurred at the Valentine Lake East Site. (Figure 5-1).

Observations of three mammal species or their sign (i.e., beaver, caribou and moose) and eight additional avian species (i.e., American Bittern, Black-capped Chickadee, greater Yellowlegs, Herring Gull, Merlin, Ruby-crowned Kinglet, Spotted Sandpiper and Yellow-rumped Warbler) were made during this survey. A list of these observations and their location is presented in Appendix B. An adult female moose and yearling were observed at the Valentine Lake East Site, no wildlife was observed within the Frozen Ear Pond site. At the Leprechaun Pond Site, a beaver lodge, a moose, a Merlin and two sightings of Greater Yellowlegs were recorded.

Table 5.1 Waterfowl Detected during Breeding Pair Survey, 16 May 2011

Waterfowl Observation (listed sequentially)	Social Structure				
	Lone Male	Lone Female	Unidentified Individual	Pair	Flocked Males
Ring-necked Duck	•				
Canada Goose				•	
American Black Duck				•	
American Black Duck				•	
Red-breasted Merganser			•		
Common Loon			•		
Common Loon			•		
Common Loon			•		
Common Loon				•	
Canada Goose			4		
Common Loon				•	
Common Loon			•		
Canada Goose				• with nest	
Canada Goose				• with nest	
American Black Duck				•	
Ring-necked Duck				• +3 individuals	
Canada Goose				•	
Common Goldeneye	•				
Canada Goose			•		
Common Merganser	•				
Common Merganser	•				
Ring-necked Duck				•	
Canada Goose				•	
Common Loon				•	
Common Merganser				•	
Ring-necked Duck					2
Common Loon			3		
Common Loon			2		
Common Merganser				•	
Canada Goose				•	
Common Loon			•		
American Black Duck	•				
Common Goldeneye			•		
American Black Duck				•	
Note: • indicates social structure (e.g., lone male, pair)					

Figure 5-1 Waterfowl Observed during Breeding Pair Survey, 16 May 2011



5.1.1 Waterfowl Brood Survey

The survey occurred under suitable survey conditions (i.e., overcast skies with southwest winds gusting from 30 km/hr to 50 km/hr, intermittent, light rain at mid-day, temperature 14°C). Fog formed during the morning and caused some delays. The aerial survey required 3.2 hours to examine and area of approximately 142 km^2 which included the same area surveyed during the breeding waterfowl survey in May as well as an approximately 50 km section of Victoria River extending from Red Indian Lake to Victoria Lake.

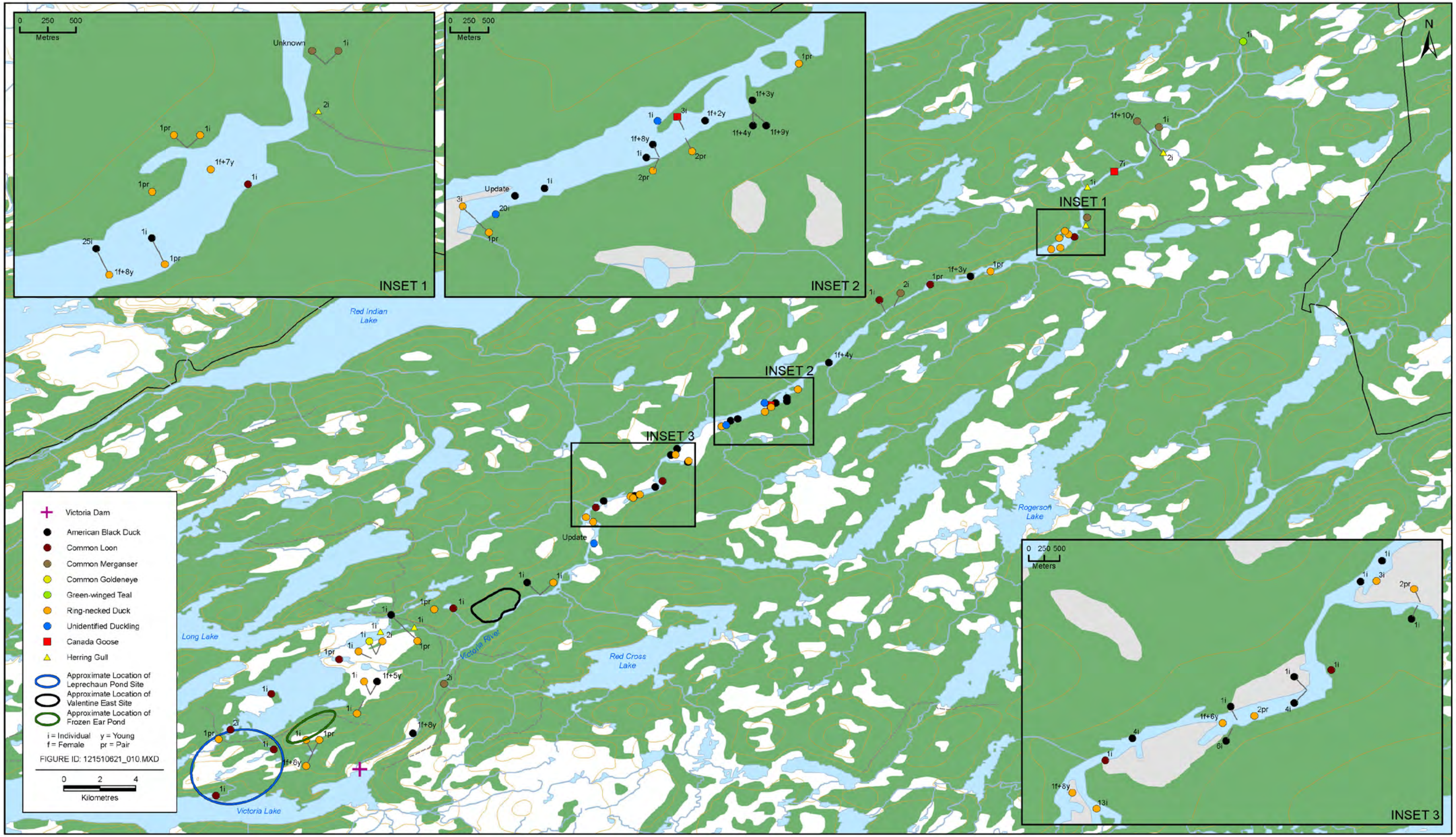
Seventy-six observations of seven waterfowl species (and three unidentified species) occurred during this survey that included broods and evidence of adult moulting activity (Table 5.2). Most of the observations occurred along Victoria River (Figure 5.2). Broods were common as 16 were observed with an attending female. In addition, there were three observations of broods or young not accompanied by a female. The age of these 19 observations of young ranged from approximately one to six weeks.

Table 5.2 Waterfowl Detected during Brood Survey, 7 July 2011

Waterfowl Observation (listed sequentially)	Structure	Moulting (yes or no)	# of young	Age class	Accompanied by female (yes or no)
Green-winged Teal				1a	N
Merganser	Female				
Merganser			9	1b	Y
Canada Goose		Y	7		
Merganser			5	1b	Y
Merganser	Adult				
Common Loon	Individual				
Ring-necked Duck	Pair				
American Black Duck	Individual	N			
Ring-necked Duck			8	1a	Y
American Black Duck	25	Y			
Ring-necked Duck			7	1a	Y
Ring-necked Duck	Pair + female	N			
Ring-necked Duck	Pair	N			
Ring-necked Duck	Pair	N			
American Black Duck			3	2b	Y
Common Loon	Pair				
Merganser sp.	2	N			
Common Loon	1				
American Black Duck			4	2b	Y
Ring-necked Duck	Pair	N			
American Black Duck			3	1a	Y
American Black Duck			4	1c	Y
Ring-necked Duck			9	1a	Y
American Black Duck			2	2b	Y
Canada Goose	3 adults				
Ring-necked Duck	2 pairs	N			
Ring-necked Duck	2 pairs				
American Black Duck			8	1c	Y

Waterfowl Observation (listed sequentially)	Structure	Moulting (yes or no)	# of young	Age class	Accompanied by female (yes or no)
American Black Duck	1	Y			
Unidentified duckling	1				
American Black Duck	1	Y			
American Black Duck			1	2b	
Unidentified ducklings	20 (in flight)	N			
Ring-necked Ducks	Pair plus 3				
Ring-necked Duck	3 males	N			
Ring-necked Duck	2 pairs	N			
American Black Duck	1	N			
American Black Duck	1	N			
American Black Duck	1	N			
Common Loon	1				
American Black Duck	1	Y			
American Black Duck	4	N			
Ring-necked Duck	2 pairs	N			
American Black Duck	1	N			
Ring-necked Duck			6	1b	Y
Ring-necked Duck	2 females; 4 males				
American Black Duck	4	N			
American Black Duck	1	N			
Common Loon	1				
Ring-necked Duck			8	1b	Y
Ring-necked Duck	1 female ;12 males	Y			
Unidentified duck	1	N			
American Black Duck	1	N			
Ring-necked Duck	1	Female			
Common merganser	2				
American Black Duck			8	1c	Y
Ring-necked Duck	Pair	N			
Common Loon	2				
Common Loon	1				
Common Loon	Pair				
Ring-necked Duck	Male	N			
Ring-necked Duck	2 males	N			
Common Goldeneye	Male	N			
Ring-necked Duck	Pair	N			
Common Loon	1				
Ring-necked Duck	Pair	N			
American Black Duck			5	2c	Y
Ring-necked Duck	Female	N			
Ring-necked Duck	Male	N			
Ring-necked Duck	Pair				
Ring-necked Duck			8	1b	Y
Common Loon	1				
Note: N = no; Y= yes 1a, 1b, 1c, 2a, 2b and 2c = age classes of ducklings (Gollop and Marshall 1954)					

Figure 5-2 Waterfowl Observed during Brood Survey, 7 July 2011



The same species of waterfowl observed during the breeding pair surveys were also observed in the July brood survey. The most frequently encountered species was Ring-necked Duck. There were 27 observations of paired birds, females with broods, individuals and groups. These were found throughout the Project area but were concentrated along the Victoria River. American Black Duck were also common with 22 observations (individuals, females with broods and groups) recorded throughout the Project area and along the Victoria River. Two Common Mergansers were observed at the southern end of the Victoria River. Four observations (individuals as well as two broods with females) of Merganser species were made along the Victoria River (mid-section to northern end). One male Common Goldeneye was observed on a fen northeast of Valentine Lake. A Green-winged Teal duckling was observed at the northern end of the Victoria River. Unidentified ducklings were observed in three locations along the central section of the Victoria River. There were ten observations of pairs and individual Common Loon throughout the Project area and along the Victoria River. Note that of the three locations of interest to Marathon, waterfowl were observed at the Leprechaun Pond Site and in the vicinity of the Frozen Ear Pond Site. No observations were made in the Valentine Lake East Site (Figure 5-2).

Table 5.3 Waterfowl Detected during Brood Survey, 7 July 2011

Species	Number of Broods Observed on 7 July 2011	Breeding Pairs Observed on 16 May 2011
American Black Duck	9	4
Canada Goose	0	6
Common Loon	0	3
Green-winged Teal	1	0
Merganser species	2	2
Ring-necked Duck	6	2
Unidentified ducklings	2	0

Observations of beaver (sign only), caribou, moose and 11 additional avian species (American Bittern, Caspian Tern, Common Raven, Greater Yellowlegs, Herring Gull, Osprey, Rusty Blackbird, Spotted Sandpiper, unidentified blackbird, unidentified gulls, unidentified sandpipers, and unidentified shorebirds) were also observed during this survey. The observations of Rusty Blackbird were of two individuals observed together on the Victoria River, approximately 36 km downstream from Victoria Dam. This species is listed both provincially (*vulnerable*) (SSAC 2007) and federally (*special concern*) (COSEWIC 2006). A list of other wildlife observations and their location is presented in Appendix C. There were five incidences of beaver activity (i.e. dams and lodges) and one caribou found northeast of Valentine Lake. There was no wildlife detected in the three areas of interest to Marathon. Additional avifauna observed in this area were Greater Yellowlegs, Sandpiper sp. and Common Raven.

5.2 Wetlands / Waterfowl Habitat

Wetlands were distributed throughout the Project area where they form a mosaic with upland habitats. The majority of the wetland classes encountered were bogs and fens, with shallow water wetlands observed in association with lakes and large rivers in the region. Within the

Project area these wetland classes were further divided into three bog forms (i.e., domed bog, slope bog and basin bog) and two fen forms (i.e., slope fen and ribbed fen). Alternatively, some of the wetlands suggested characteristics of two or more wetland forms. Although these wetlands occur adjacent to one another, it was inferred that they maintain the same hydrological, ecological and floristic features that normally characterize each ecosystem.

Fens

By order of magnitude, fens comprised the largest land area characterized by wetlands within the Project area. These were minerotrophic peat lands with fluctuating water levels (Warner and Rubec 1997). Surface water movement was common within fens and may be observed in pools or small channels. Their vegetation was influenced by water depth and chemistry and were dominated by graminoids, bryophytes, shrubs, and/or trees. Large, sloped fens were identified at two sites within the Project area, northeast of Valentine Lake and at a point of land extending into Valentine Lake from the west. Complexes of sloped and ribbed fens were also observed. Smaller fens were present elsewhere within the Project area but were difficult to distinguish from the helicopter.

Fens have relatively higher biological productivity when compared to bogs but less than that of marshes. The potential for fens to provide habitat for wildlife species is highly variable dependent on location, form and wildlife in the area. However, fens may provide habitat to more species than that of the bog wetlands.

Bogs

Bogs were the second most prominent wetland class and were distributed throughout the Project area. Numerous smaller peat deposits were distributed across the site and generally characterized as slope and basin bogs.

Bogs are peat wetlands which are raised or level with the surrounding terrain and are unaffected by runoff waters or groundwater from the surrounding mineral soils (Warner and Rubec 1997). Water levels are generally at or slightly below the surface of the bog. Because they receive their nutrient and water input from atmospheric deposition, they are typically nutrient poor and have a low pH. They have a well-developed peat layer comprised of peatmoss and the woody remains of shrubs. Both bog types are typically treeless and shallow, rarely exceeding peat depths of more than 2 m (Wells and Pollett 1983).

Bogs have a relatively low rate of biological productivity when compared to the other wetland classes in the area. Lower biological productivity generally means there is less consumable biomass (food). However, wildlife may also use wetlands for shelter, travel routes and as staging areas. Various wetland forms will provide particular habitat requirements for a number of species and therefore affect habitat values. For example, string bogs and the associated open water pools will provide more suitable habitat to waterfowl than domed bogs.

Shallow Water

Within the Project area, the shallow water wetlands were characteristically associated with Valentine Lake and the Victoria River, but smaller components were also observed to be independent of these features.

Shallow water wetlands usually occupy the transitional areas between wetlands that are saturated or seasonal wet and permanent, deep water bodies, such as are associated with lakes. They have standing or flowing water that is <2 m deep during mid-summer but their hydrological character is quite varied. Water levels with shallow water wetlands may be seasonally stable, permanently flooded, or intermittently exposed during droughts, low flows, or intertidal periods (Warner and Rubec 1997).

Wetland Complexes

Wetland complexes, characterized by two or more individual wetlands with overlapping ecological function, were observed within two large wetlands in the area of Valentine Lake Project. However, this observation likely reflected the manner in which wetlands were identified. That is, wetlands within the Project area were not subject to field surveys and the collection of detailed site information, but were based on observations from the air during the waterfowl survey. As such, their current classification may reflect limitations that are commonly associated with such survey techniques (including identifying their vegetative composition, boundaries, and connectivity to other patches of wetland).

6.0 SUMMARY

The two aerial surveys that took place in May and July, 2011 provide an overview of the waterfowl habitat potential of the Project area; waterfowl utilization of this habitat; as well as the nesting, breeding and brood rearing habitat preferences. The waterfowl species observed were typical of the region (Jacques Whitford 1995).

The extensive fens northeast of Valentine Lake, and on the point of land extending into Valentine Lake provide waterfowl with breeding and brood raising habitat. Canada Geese nest on two large fens within the Project area. Canada Geese use fens throughout the breeding season for feeding and brood rearing. Observations of the other six waterfowl species observed during the 16 May survey were distributed along the Victoria River and throughout smaller waterbodies and wetlands throughout the Project area. Open water provides habitat for many species of waterfowl throughout the breeding season. The fens, particularly the fen northeast of Valentine Lake, provided habitat requirements during the breeding season for American Black Duck, Ring-necked Duck, Common Merganser and Canada Geese, in particular. Other prior surveys by Stantec in the region also indicate Canada Geese use fens for breeding (Jacques Whitford 1995). Note that none of these observations occurred within the Valentine Lake East Site where potential waterfowl habitat is limited. There was a single American Black Duck observed on the periphery of the Frozen Ear Pond site during the breeding waterfowl survey and an individual plus pair of Ring-necked Ducks in this area during the waterfowl brood survey. The Leprechaun Pond Site has some waterbodies and wetland areas present. Waterfowl were found in this area during the brood survey.

The concentrations of waterfowl along the Victoria River (outside the three locations of interest to Marathon) included individuals, pairs and broods of several species. Of note was that there were more observations of broods made for Green-winged Teal, Ring-necked Duck, American Black Duck and unidentified ducks in July than there were breeding pair observations in May. There were two merganser breeding pairs observed and two broods of this species observed. Although there were numerous Common Loon and Canada Geese breeding pairs detected, no broods were detected during the early July survey. During the brood survey observations of several species were also observed using the fen northeast of Valentine Lake: Common Goldeneye, Common Loon, American Black Duck, Ring-necked Duck, Common Loon and the only observation of Common Goldeneye (a single male).

The only listed wildlife species recorded was two observations of individual Rusty Blackbird on Victoria River, outside the locations of interest to Marathon and downstream of the Dam. This species is of interest given its provincial and federal status. The provincial government management plan for this species in Newfoundland and Labrador is pending.

The distribution and abundance of wetlands within the Project area are consistent with this region of Newfoundland in terms of wetland class and form (South. 1983). Of these three wetland classes, bogs have the lowest biological productivity and shallow water wetlands have the highest. While bogs are an important habitat for many wildlife species, the increased biological productivity in fens and, in particular, marshes, results in higher overall habitat values. Due to their location within the landscape, fens and marshes play more of a role in attenuating surface water flows than bogs.

With respect to the ability of the wetlands in the Project area to provide habitat for wildlife, particularly waterfowl, wetland habitats within the survey area possess features, including the interspersion of open water (i.e., shallow pools) and vegetation (i.e., narrow ridges or strings of hummocky vegetation), in which waterfowl (e.g., breeding pairs of Canada geese) or other waterbirds were observed. Vegetation interspersion is a measure of the abundance of edges between vegetation and/or open water, and is a valuable attribute for wildlife. Wetlands that contain vegetation interspersed with open water are more likely to support greater on-site diversity and/or abundance of wildlife species. Those with dense vegetation and no channels or open water areas are less likely to be important within this context (Tiner 2009). For wetlands characterized by multiple vegetative communities, the increased structural diversity and amount of edge associated with greater interspersion is generally positively correlated with wildlife habitat quality (Tiner 2009). Wetlands for which the degree of interspersion between vegetation and open water was generally associated with areas of sloped fen / ribbed fen wetland complex; although some other wetland types were represented in this designation.

The surveys conducted for this study indicate that only the Leprechaun Pond Site appears to have sufficient aquatic and wetland habitat to attract waterfowl. Such habitat appears insufficient to attract waterfowl at either the Valentine Lake East Site or the Frozen Ear Pond site.

The inadvertent disturbance or loss of nest sites and/or eggs associated with the development of projects is referred to as incidental take. The potential for incidental take is a current issue with Environment Canada and this agency requires that proponents show due diligence in reducing or eliminating the risk of incidental take (Environment Canada, 2011).

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APPENDIX A

Table A-1 Common and Scientific Names of Wildlife Observed during Aerial Surveys in 2011

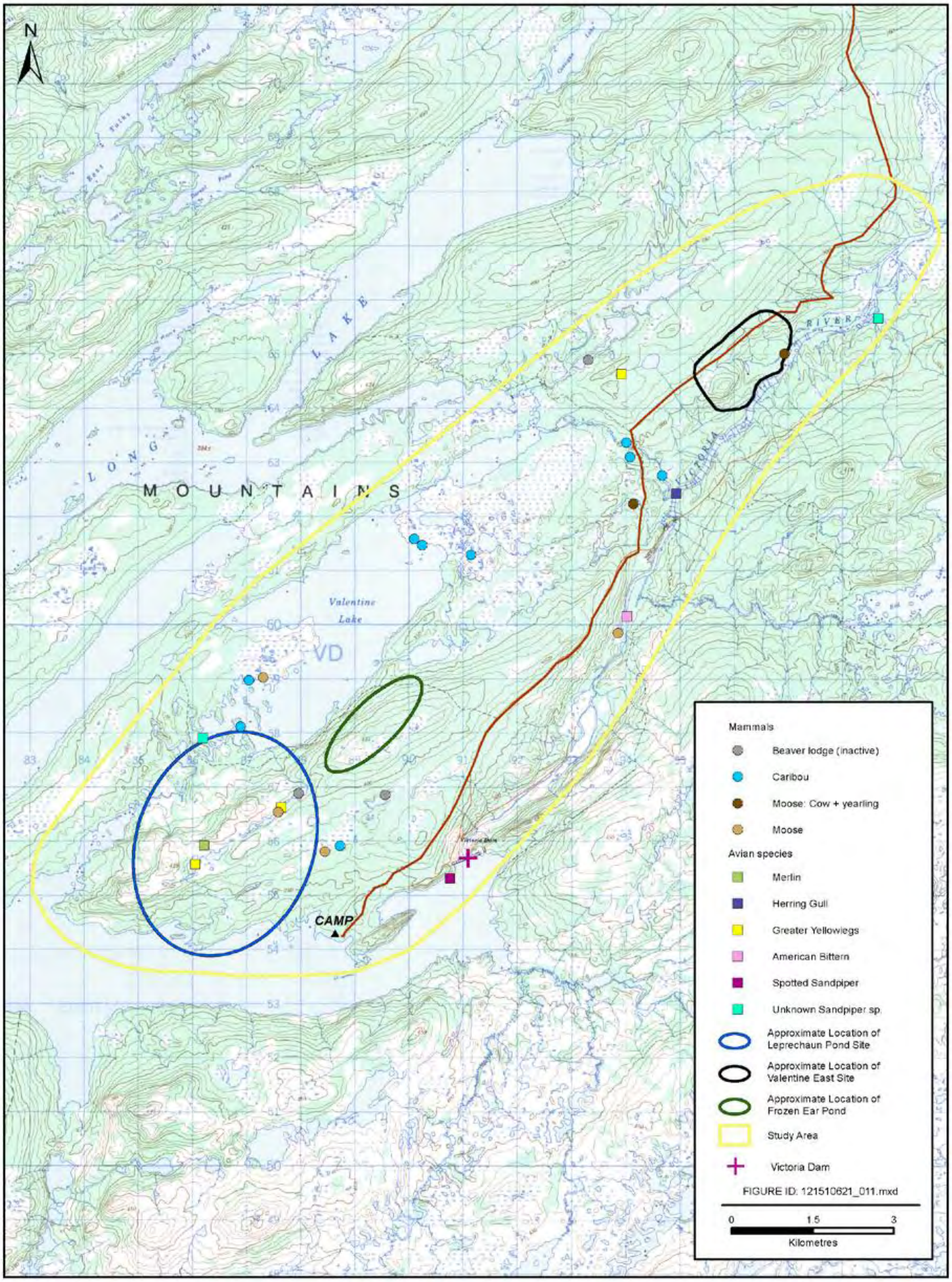
Birds	
Common Name	**Scientific Name**
American Bittern	*Botaurus lentiginosus*
American Black Duck	*Anas rubripes*
Black-capped Chickadee	*Poecile atricapillus*
Canada Goose	*Branta canadensis*
Caspian Tern	*Hydroprogne caspia*
Common Goldeneye	*Bucephala clangula*
Common Loon	*Gavia immer*
Common merganser	*Mergus merganser*
Common Raven	*Corvus corax*
Greater Yellowlegs	*Tringa melanoleuca*
Green-winged Teal	*Anas crecca*
Herring Gull	*Larus argentatus*
Merlin	*Falco columbarius*
Osprey	*Pandion haliaetus*
Red-breasted merganser	*Mergus serrator*
Ring-necked Duck	*Aythya collaris*
Ruby-crowned Kinglet	*Regulus calendula*
Rusty Blackbird	*Euphagus carolinus*
Spotted Sandpiper	*Actitis macularius*
Yellow-rumped Warbler	*Dendroica coronata*
Mammals	
Common Name	**Scientific Name**
Beaver	*Castor canadensis*
Caribou	*Rangifer tarandus*
Moose	*Alces alces*

APPENDIX B

Table B-1 Incidental Observations of Other Wildlife, 16 May 2011

Avian	
Species	**Sign**
American Bittern	individual (observed)
Black-capped Chickadee	Individual (heard)
Greater Yellowlegs	Individuals (observed)
Herring Gull	Individual (observed)
Merlin	Individual (observed)
Ruby-crowned Kinglet	Individual (heard)
Spotted Sandpiper	Individuals (observed)
Yellow-rumped Warbler	Individual (heard)
Mammal	
Species	**Sign**
Beaver	old lodges
Caribou	Individuals
Moose	4 individuals and 2cows with yearlings

Figure B-1 Locations of Other Wildlife Observed, 16 May 2011



APPENDIX C

Table C-1 Incidental Observations of Other Wildlife in the Valentine Lake Area, 7 July 2011

Avian	
Species	**Sign**
American Bittern	individual (observed)
Caspian Tern	Individual (observed)
Common Raven	Individuals
Greater Yellowlegs	Individuals (observed)
Herring Gull	Individual (observed)
Osprey	Individual (observed)
Rusty Blackbird	2 individuals (observed)
Spotted Sandpiper	Individuals (observed)
Unidentified blackbird	Individual (observed)
Unidentified gulls	Individuals (observed)
Unidentified sandpipers	Individuals (observed)
Unidentified shorebirds	Individuals (observed)
Mammal	
Species	**Sign**
Beaver	old and active lodges and dams
Caribou	cow plus calf
Moose	Individual

Figure C-2 Locations of Other Wildlife Observed, 7 July 2011

ATTACHMENT 7-D

Ecological Land Classification (2015)

Ecosystem Classification and Mapping of the Marathon Gold Corporation Valentine Lake Project, Central Newfoundland

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Final Report

File No. 121511074.600

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Executive Summary

This report presents a description of efforts to develop an Ecological Land Classification (ELC) for an area encompassing the proposed Marathon Gold Corporation (Marathon) Valentine Lake Gold Mine Project (the Project). An ELC was undertaken for the Project to describe the local ecological context of the mineral claims area and expanded regional area (herein refered to as the "Study Area"), such that interactions between biota, the physical environment and the Project can be assessed within the context of the specific ecology of the area.

Baseline information was compiled using the results of field sampling programs conducted by Stantec Consulting Ltd. (Stantec), literature reviews, interpretation of aerial photography and existing mapping information, as well as other Project-specific information. This baseline compilation and review also considered the applicable methods for interpretation of terrain, soil, vegetation and wildlife resources, including mapping conventions previously used for projects in Newfoundland and Labrador. Details of the methods applied to this baseline are provided.

Stantec conducted a field program in the Study Area in August 2014 and September 2015, during which 136 field plots were inspected (Original ELC Survey[2014]: 74 points; Accuracy Assessment [2015]: 62). The distribution of the sites was planned in order to sample within the mineral claims areas for the Valentine East and Leprechaun Pond deposits, in addition to any of those habitat types deemed of interest.

Medium textured, morainal till surface materials are the most commonly observed parent material within the Study Area. This material is variable in thickness ranging from a few centimetres (cm) to over 1 metre (m). Other common soil parent material types were organic (fen), colluvium, bedrock and fluvial. In poorly drained soils, the presence of the bedrock and other shallow unconsolidated material contributed substantially to the extent of organic soils in the Study Area. Colluvium, in varying forms, occurring primarily on steep slopes often in complexes with both till and exposed bedrock, was observed infrequently. Lacustrine deposits were found in association with a narrower band of habitat surrounding Red Indian Lake and Victoria Lake (Reservoir). Bedrock, till and colluvium-derived soils were common at mid to high elevations. Fluvial deposits, though infrequent, originated from glaciofluvial sands and silts, and were found along the shoreline of the Victoria River and on small islands associated with large river systems in the area.

The soil orders present on these parent materials included Podzolic, Gleysolic, Regosolic and Organic. Soil map units were mostly complexes of organic and mineral soils, reflecting the varied topography of the underlying till. The most abundant mineral soil unit on well to imperfectly drained soils was the Red Indian soil unit. Gleysols, which are poorly drained transitional soils between organic and upland soils, were less extensive and included mainly Silver Mountain soil units. Soils developed on fen peat parent materials occupied the Deadwolf Pond and

Ebbegunbaeg soil units. Anthropogenic or disturbed land was primarily associated with historic mineral exploration and forest management activities in the area. Water occupied a substantial portion of the Study Area.

There are 12 ecosystem units (or land cover classes) within the Study Area: Balsam Fir Forest, Black Spruce Forest, Kalmia-Black Spruce Woodland, Mixedwood Forest, Regenerating Forest, Alder Thicket, Riparian Thicket, Wet Coniferous Forest, Open Wetlands, Open Water, Exposed Sand / Gravel Shoreline and Anthropogenic. Of these, nine are vegetated and three are sparsely vegetated, naturally non-vegetated and/or anthropogenic ecosystem units. Approximately 56% of the Study Area is occupied by upland environments, 22% by lowlands (i.e., wetlands) and 22% by open water. Upland areas are dominated by softwood forests (i.e., the Balsam Fir - Black Spruce Forest Ecosystem Unit), alder thickets and mixedwood forests, whereas lowland sites are comprised of open peatlands and treed wetlands. Fourteen ecotypes have been identified within the mapped ecosystem units. Most mapped ecosystem units are direct correlates with ecotypes, but multiple ecotypes have been identified for the Kalmia- Black Spruce Woodland (Kalmia-Black Spruce Forest and Kalmia Heath) and Open Wetlands (Shrub / Graminoid Fen and Shrub Bog) units based on field data collected within the 136 field plots (ground and visual). Ecotypes vary considerably in their vegetative structure and composition.

A total of 224 plant taxa were recorded during surveys conducted in support of the ELC. Of these, 198 were vascular plants, 19 were mosses / liverworts, and seven were lichens. The population statuses of all plant species encountered during the ELC surveys were determined through a review of the species status reports prepared by Newfoundland and Labrador Department of Environment and Conservation (NLDEC 2014), Atlantic Canada Conservation Data Centre (AC CDC 2010), the Committee on the Status of Endangered Wildlife in Canada Wildlife Species Assessment (COSEWIC 2015) and the Newfoundland and Labrador *Endangered Species Act* (NL *ESA* 2007). No federally or provincially designated "at risk" species were found, but several regionally uncommon graminoids were encountered, including: short-scale sedge (*Carex deweyana*), perennial bentgrass (*Agrostis perennans*), forest bluegrass (*Poa saltuensis*) and cottongrass bulrush (*Scirpus cyperinus*).

Accuracy assessment is an integral component of any mapping project based on remote sensing. As the land-cover map for the Study Area was completed, thematic accuracy was assessed to measure general and categorical qualities of the data. Assessing accuracy for this regional mapping project was a complex task, largely owing to the size of the Study Area relative to the spatial resolution of the RapidEye Thematic Map data used. The accuracy assessment results were derived from analysis of the error matrix summarization of the reference data. The accuracy assessment for the Project ELC was completed using 162 reference points obtained through ground truthing of the Study area in September 2015. The estimated overall accuracy for the habitat classification was 83%.

Abbreviations

AC CDC	Atlantic Canada Conservation Data Centre
CanSIS	Canadian Soil Information System
CEAA, 2012	*Canadian Environmental Assessment Act, 2012*
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
ELC	Ecological Land Classification
EIS	environmental impact statement
GIS	geographic information system
GIF	ground inspection plot
GPS	global positioning system
LFH	Litter, fibric and humic layer; organic layer
MoELP-MoF	British Columbia Ministry of Environment, Lands and Parks and British Columbia Ministry of Forestry
NLDEC	Newfoundland and Labrador Department of Environment and Conservation
NL ESA	Newfoundland and Labrador *Endangered Species Act*
NL EPA	Newfoundland and Labrador *Environmental Protection Act*
NS	Nova Scotia
The Project	Valentine Lake Gold Mine Project
QMS	Quality Management System
RIC	Resources Inventory Committee
SARA	*Species at Risk Act*
SMR	soil moisture regime
SNR	soil nutrient regime
SOCC	species of conservation concern

Glossary

Anthropogenic	Caused by human activity.
Biogeoclimatic ecosystem classification	A classification system incorporating soils and or geology, climate and vegetation into defined regional units (zones, subzones and variants) with recognized and characteristic ecosystems. An ecosystem is manifested as the interactions between climate and soil to determine vegetation potential on any site.
Bog	Nutrient-poor, acidic and peat-forming wetlands that receive water only from precipitation.
Classification	A taxonomic activity involving the aggregation of samples into a logical framework.
Clay	(i) As a particle size term: a size fraction less than 0.002 mm equivalent diameter, or some other limit (geology or engineering). (ii) As a rock term: a natural, earthy, fine grained material that develops plasticity with a small amount of water. (iii) As a soil term: a textural class. See also soil. (iv) As a soil separate: a material usually consisting largely of clay minerals but commonly also of amorphous free oxides (sesquioxides) and primary minerals.
Ecodistrict	A broad subdivision of the landscape based on differences in landscape pattern, topography and dominant soils.
Ecosystem Mapping	An approach where site, soil and vegetation information are used to delineate map units that are internally consistent and sufficiently different from adjacent areas to enable separation of a landscape continuum into ecologically meaningful units. It involves a collaborative interdisciplinary process involving clear timely communication within and between offices (and scientists) and the application of consistent mapping approaches to the integration of site, soil and vegetation information, using the best available technology and appropriately trained staff.

Ecological Land Classification (ecosystem classification)	The process of subdividing landscapes using ecological criteria (climate, terrain, biota) into units that is internally consistent and distinguished from their neighbors.
Ecotone	An ecotone is a transitional area between two different ecosystems, such as a forest and a wetland. In landscape ecology, an ecotone is the border area where two patches meet that have different ecological composition. The ecotone contains elements of both bordering communities, as well as species that are characteristic and restricted to the ecotone.
Ecotype	A classification unit applied to mapping where an abstract vegetation community developed from synthesis of ground plot information is related to a set of soil moisture and soil nutrient conditions under which it occurs within a Natural Subregion or combination of Subregions. Site, generalized soil and vegetation composition and cover information are used to determine the closest fit to one of many described ecotypes.
Ecosystem	An integrated and stable association of living and non-living resources functioning within a defined physical location. A community of organisms and its environment functioning as an ecological unit. For the purposes of assessment, the ecosystem must be defined according to a particular unit and scale.
Edatopic grid	A two-dimensional representation of moisture and nutrient classes, generally with moisture on the y-axis (wettest to driest bottom to top) and nutrients on the x-axis (nutrient poor to the left, nutrient rich to the right). Under a given regional climate, ecotypes or vegetation types occupy various positions on the grid according to the moisture and nutrient conditions under which plant communities with recognizable species compositions generally recur.
Eutrophic	High fertility conditions, rich in nutrients.
Fen	Sedge peat materials derived primarily from sedges with inclusions of partially decayed stems of shrubs formed in a eutrophic environment due to the close association of the material with mineral rich waters. Minerotropic peat-forming wetlands that receive surface moisture from precipitation and groundwater. Fens are less acidic than bogs, deriving most of their water from groundwater rich in calcium and magnesium.

Fibric	Organic materials containing large amounts of weakly decomposed fibres whose botanical origins are readily identifiable; fibric material has 40% or more of rubbed fibre by volume (or weight of rubbed fibre retained on a 100 mm mesh sieve) and is classified in the von Post scale of decomposition as class 1 to class 4. See also horizon, soil.
Forest Peat	Peat materials derived mainly from trees such as black spruce, from ericaceous shrubs, and from feather mosses.
Gleysolic Soil	An order of soils that have properties indicating prolonged, intermittent or continuous saturation with water during soil development. Diagnostic horizon is either Bg or Cg.
Gleying	Gleying is a reduction process that takes place in soils that are saturated with water for long periods of time. The horizon of most intense reduction is characterised by a gray, commonly mottled appearance, which on drying shows numerous rusty brown iron stains or streaks.
Horizon	A layer of soil or soil material approximately parallel to the land surface; it differs from adjacent genetically related layers in properties such as colour, structure, texture, consistence and chemical, biological and mineralogical composition. More detailed definitions of some horizons and layers may be found in the "Soil Survey Handbook" (Agriculture Canada 1987).
Humic	Organic material that is at an advanced stage of decomposition. It has the lowest amount of fibre, the highest bulk density, and the lowest saturated water-holding capacity of the organic materials; it is physically and chemically stable over time, unless it is drained; the rubbed fibre content is <10% by volume and the material usually is classified in the von Post scale of decomposition as class 7 or higher. See also horizon, soil.

LFH	an organic horizon containing > 17% organic C (approximately ≥ 30% organic matter) by weight. It is developed primarily from the accumulation of leaves, twigs, and woody materials with or without a minor component of mosses. It is also normally associated with upland forested soils with imperfect drainage or drier. • L: this organic horizon is characterized by an accumulation of organic matter in which the original structures are easily discernible. • F: this organic horizon is characterized by an accumulation of partly decomposed organic matter. Some of the original structures are difficult to recognize. The material may be partly comminuted (pulverized) by soil fauna as in moder (a non-matted forest humus), or it may be a partly decomposed mat permeated by fungal hyphae as in mor. • H: this organic horizon is characterized by an accumulation of decomposed organic matter in which the original structures are indiscernible. This horizon differs from the F by having greater humification due chiefly to the action of organisms. It is frequently intermixed with mineral grains, especially near the junction with mineral horizons.
Lowlands	Areas with ground slopes of less than 0.5% and typically poorly drained.
Mapping	The division and description of a landscape into units that are distinct from neighboring map units. Map units may be simple (one element) or complex (two or more elements expressed as proportions of a polygon.
Mesic	A moderate soil moisture regime value whereby water is removed somewhat slowly in relation to supply; neither wet nor dry. Available soil water reflects climatic inputs.
Mesotrophic	Moderately fertile conditions.

Mineral Soil	Soils containing low levels of organic matter. Soils that have evolved on morainal, fluvial, glaciofluvial and lacustrine parent material. The A, B and C horizons and underlying parent material.
Morainal	Unsorted and heterogeneous drift (morainal "till" material), consisting of clay, silt, sand, gravel and boulders intermingled in any proportion, deposited by and underneath a glacier without subsequent reworking by glacial meltwater.
Moisture Regime	The relative moisture supply at a site available for plant growth.
Nutrient Regime	The relative supply of nutrients available for plant growth at a given site.
Oligotrophic	Surface fed directly and exclusively by precipitation.
Ombrogenous, Bog	A peat-forming vegetation community lying above groundwater level, it is separated from the ground flora and the mineral soil, and thus dependent on rainwater for mineral nutrients. The resulting lack of dissolved bases gives strongly acidic conditions and only specialized vegetation, predominantly Sphagnum species (bog mosses), will grow. Two types of ombrogenous bogs are commonly distinguished: raised bogs; and blanket bogs.
Ombrotrophic	Water derived from precipitation, not groundwater.
Order, Soil	A category in the Canadian system of soil classification. All the soils within an order have one or more characteristics in common.
Organic Soil	A soil order that have developed primarily on organic deposits. Soils containing high percentages of organic matter (fibric and humic inclusions).
Paludification	a natural process involving the gradual accumulation of a thick layer of organic matter.
Parent Material	The unconsolidated and more or less chemically weathered mineral or organic matter from which the solum of a soil has developed by pedogenic processes.

Peat	Material constituting peatlands, exclusive of live plant cover, consisting largely of organic residues accumulated as a result of incomplete decomposition of dead plant constituents under conditions of excessive moisture.
Peatland	Areas where there is an accumulation of peat material at least 40 cm thick. These are represented by bog and fen wetlands types.
Poor Fens	Poor fen is a sedge-dominated wetland found on very strongly to strongly acid, saturated peat that is moderately influenced by acidic groundwater. Fens which tend to support a less diverse flora and fauna than fens fed by more alkaline water.
Regosolic Soil	The only great group in the Regosolic order. The soils in the group have insufficient horizon development to meet the requirements of the other orders.
Sand	(i) As a particle size term: a size fraction between 0.05 and 2.0 mm equivalent diameter, or some other limit (geology or engineering). (ii) As a soil term: a textural class with abundant sand sized particles.
Silt	(i) As a particle size term: a size fraction between 0.002 and 0.05 mm equivalent diameter, or some other limit (geology or engineering). (ii) As a soil term: a textural class with abundant silt sized particles.
Site series	Describes all land areas (within a defined biogeoclimatic unit [subzone or variant] capable of producing the same late seral or climax plant community.
Soil	The naturally occurring, unconsolidated mineral or organic material at least 10 cm thick that occurs at the Earth's surface and is capable of supporting plant growth. Soil extends from the Earth's surface through the genetic horizons, if present, into the underlying material to the depth of the control section (normally approximately 1 to 2 m). Soil development involves climatic factors and organisms, conditioned by relief and water regime, acting through time on geological materials, and thus modifying the properties of the parent material (Agriculture Canada 1987).

Soil Classification	The systematic arrangement of soils into categories based on their characteristics. Broad groupings are made on the basis of general characteristics and subdivisions on the basis of more detailed differences in specific properties.
Soil Horizon	A layer of mineral or organic soil material approximately parallel to the land surface that has characteristics altered by processes of soil formation. A soil mineral horizon is a horizon with 17% or less total organic carbon by weight. A soil organic horizon is a horizon with more than 17% organic carbon by weight.
Soligenous	Wetness induced by lateral water movement (i.e. sideways through the soil or rock, as on seepage slopes).
Study Area	Marathon's Valentine Lake mineral claims area, plus an expanded regional area
Subgroup	A category in the Canadian system of soil classification. These soils are subdivisions of the great groups, and therefore are defined more specifically.
Terrestrial ecosystem map	An ecosystem map based on field data collection and aerial photo interpretation of terrain and vegetation into ecosystem units that incorporate ecological features, including climate, physiography, surficial material, bedrock geology, soil and vegetation.
Uplands	Areas where the soil is not saturated for extended periods as indicated by vegetation and soils.
Unsupervised Satelite Classification	An ecosystem map that is produced through a computer modelling process incorporating all available information including vegetation cover mapping, soil or terrain mapping, topography, and field data (predictive ecosystem map).
Veneer	Unconsolidated materials too thin to mask the minor irregularities of the underlying unit surface. A veneer ranges from 10 cm to 1 m in thickness and possesses no form typical of the materials' genesis.
Water Table	The shallowest saturated ground below ground level - technically, that surface of a body of unconfined groundwater in which the pressure is equal to atmospheric pressure.

Wetland	Wetlands are land where the water table is at, near or above the surface or which is saturated for a long enough period to promote such features as wet-altered soils and water tolerant vegetation. Wetlands include organic wetlands or "peatlands" and mineral wetlands or mineral soil areas that are influenced by excess water but produce little or no peat.

1.0 INTRODUCTION

1.1 Project Description

Marathon Gold Corporation (Marathon) is conducting a drilling program at its Valentine Lake prospect in Central Newfoundland. Drilling activities have targeted the Valentine East and the Leprechaun Pond sites (Figure 1-1). Pending final analysis of the drilling program, the Valentine Lake Gold Mine Project ("the Project") would involve the construction and operation, and rehabilitation and closure of mining infrastructure in Central Newfoundland.

Should Marathon wish to develop the mineral deposit, the Project will require approval from the Government of Newfoundland and Labrador and is subject to environmental assessment under the Newfoundland and Labrador *Environmental Protection Act* (NL EPA) and associated *Environmental Assessment Regulations*. Under the *Canadian Environmental Assessment Act, 2012* (CEAA, 2012). The Project is a Designated Project pursuant to Section 15(a) *Regulations Designating Physical Activities* and will require federal environmental assessment. This environmental study was conducted in support of the environmental assessment process for the Project.

Baseline work to support the anticipated environmental assessment has been ongoing for anticipated valued components (*e.g.*, landbirds, waterfowl, freshwater fish and winter wildlife). This Ecological Land Classification (ELC) Study was conducted to gather information to complement other baseline work with the identification of primary information on the biological and physical characteristics of habitat types occurring within Marathon's Valentine Lake mineral claims area, in addition to that of the expanded regional area (herein refered to as the "Study Area"). ELC is perhaps the most appropriate tool used to classify and integrate a broad range of physical and biotic characteristics into discrete and ecologically unique units, providing an understanding of ecosystem form and function by linking abiotic and biotic components of each system. Classification is contained within a nested, hierarchical framework that allows for different levels of generalization (and scale) when describing ELC units. In this framework, the ELC provides a description of the physical and biological environment affecting the ecological structures and processes and the biodiversity of ecosystems.

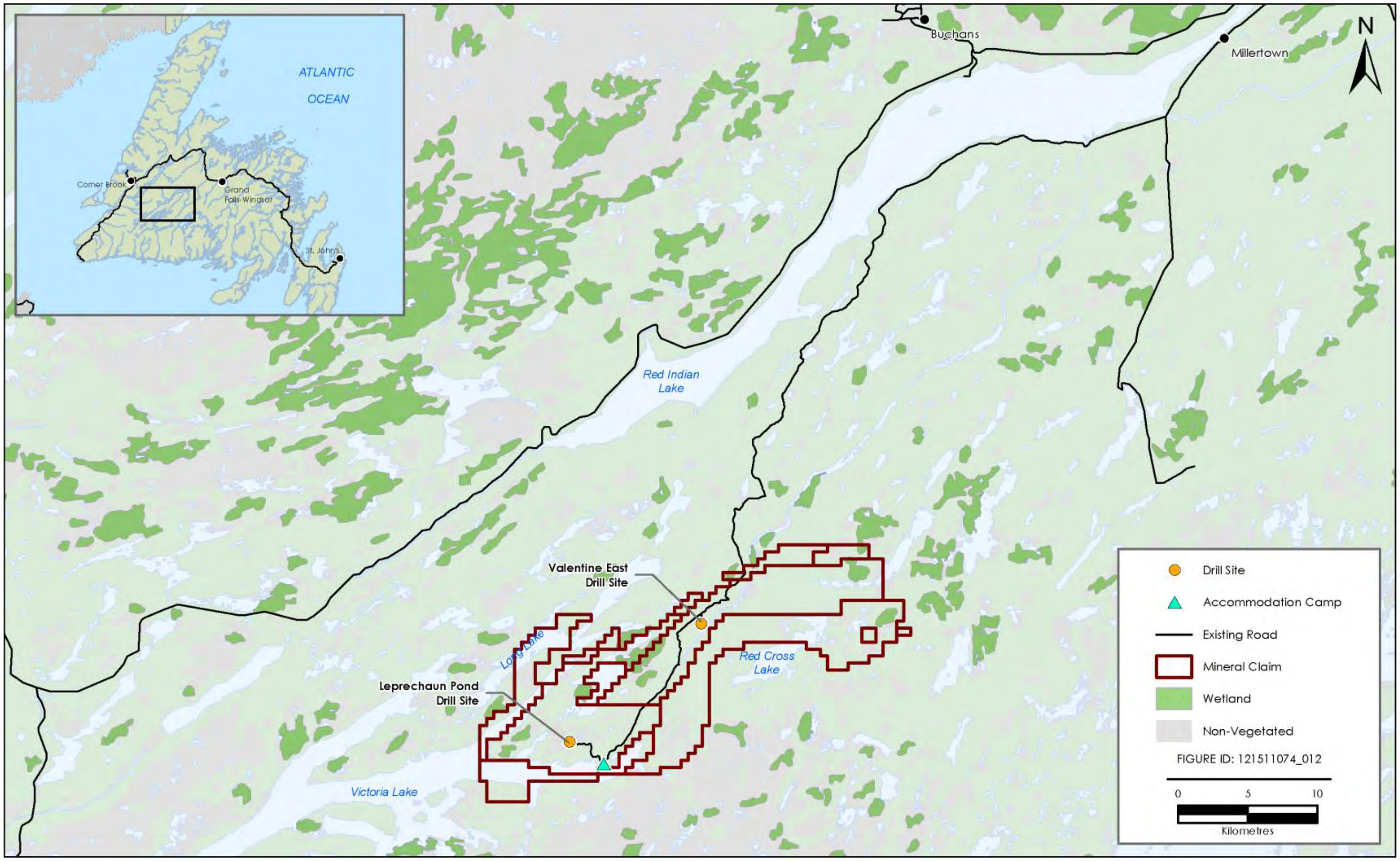


Figure 1-1 Project Location for the Marathon Valentine Lake Gold Mine Project

1.2 Ecological Land Classification Overview

The ELC is an important tool for examining the interactions between the Project and the surrounding physical environment by interpreting key issues that may result from the Project in the context of the ecosystem properties identified in the ELC. While ELC describes the ecological mosaic of the Project, it is also important in the understanding of other components of the existing environment, such as the identification and evaluation of existing wildlife habitat, and provides a basis for understanding the potential effects of the Project in relation to the surrounding environment.

The ELC was completed in order to identify, compile, summarize and present information on vegetation and vegetation communities and wildlife habitat near the proposed Project, and which may interact with it. The description of vegetation communities found within the Study Area aims to document the presence of sensitive habitats, including wetlands and/or other potentially rare or uncommon habitats. Such habitats may contain species at risk, of conservation concern or uncommon plant species. In addition, these communities provide a wide variety of habitats that are essential to wildlife by offering areas for foraging, feeding, calving, etc. Key species for habitat consideration included major ungulates such as: caribou (*Rangifer tarandus*) and moose (*Alces alces*); key predators such as lynx (*Lynx canadensis*) and raptors; economically important species such as furbearers; migratory species; songbirds and songbird guilds; and species of conservation concern such as the Newfoundland marten (*Martes americana atrata*) and Harlequin Duck (*Histrionicus histrionicus*).

The ELC provides a useful estimate of species diversity, richness (number of species observed) and relative abundance among habitat types. Surveys were designed to collect baseline data or to aid in the monitoring of wildlife throughout various stages of project development. Therefore, the ELC is complementary to the Avifauna, Waterfowl, and Large and Small Mammal studies conducted between 2010 and 2013. This information will be used as supporting information in the Environmental Impact Statement (EIS).

1.3 Study Team

The ELC was conducted by Stantec Consulting Ltd. (Stantec). The Study Team included a Project Manager / Lead Project Scientist, Senior Reviewer, Project Scientists and Information Management / Geographic Information System (GIS) Specialists (Table 1.1). All team members have in-depth knowledge and experience in their fields of expertise and a broad general knowledge of the work conducted by other experts in related fields. Brief biographical statements, highlighting project roles and responsibilities and relevant education and employment experience, are provided below.

Table 1.1 Study Team – Ecological Land Classification Study

Plant Species Classification	Probability of Occurring in Wetland
Project Manager / Lead Project Scientist	Sean Bennett
Senior Review	Michael Crowell
	Ellen Tracy
Project Scientist	Sean Bennett
	Rich LaPaix
Data Analysis and Report Preparation	Sean Bennett
	Rich LaPaix
Information Management / GIS	Heather Ward
	Ryan Melanson

Sean Bennett, P.Biol., R.P.F. | Ecologist | Project Manager & Lead Project Scientist

Sean is a terrestrial ecologist and Lead Project Scientist with Stantec's Biophysical and Ecological Services team in St. John's, NL. His responsibilities include performing ecological and botanical assessments and characterizations; natural resource inventories including rare, endangered, threatened and vulnerable species surveys; wetland delineations and function and value assessments; wildlife surveys; soil surveys; and long-term biological monitoring. He has also explored the interactions among various components of terrestrial ecosystems while developing a strong, interdisciplinary background in the areas of soils / terrain science, vegetation ecology and wildlife biology. Sean has demonstrated experience and extensive training that includes project, discipline and team management with emphasis on the planning, design, execution and management of field programs with diverse ecological objectives. Working with the Project team, Sean will be responsible for overall management of the Project; as well as acting as Lead Project Scientist, having been involved in similar projects throughout Canada.

Rich LaPaix, M.Sc. | Ecologist | Technical Lead

Rich is a terrestrial ecologist for Stantec's office in Dartmouth, NS, and is primarily involved with environmental assessment and monitoring initiatives that address the effects of various anthropogenic activities on rare or sensitive species and habitats. He is an experienced botanist and vegetation ecologist, having conducted numerous botanical surveys and plant community studies in a wide range of habitat types throughout Atlantic Canada. Rich also has expertise as a wildlife biologist, particularly in performing surveys of songbirds within Atlantic Canada, and as a wetland ecologist, having extensive experience in the delineation, classification and functional assessment of wetlands within the Acadian and Boreal Forest Regions. He has been involved in several of the baseline environmental studies for the Kami Mine Project, including the rare plant surveys. Rich was a field researcher and technical Lead for this Project and has been involved in similar projects within Newfoundland and Labrador, including development of an ELC for the Labrador-Island Transmission Link project.

Michael Crowell, M.Sc. | Ecologist | Senior Review

Michael is a terrestrial ecologist in Stantec's Dartmouth, NS, office, with over 30 years' experience in plant taxonomy, plant ecology, wetland ecology and wildlife ecology. He has also conducted a number of vascular plant and ELC studies in Newfoundland and Labrador, including work in the Lower Churchill Hydroelectric Generation Project, Voisey's Bay, Labrador City, the DND practice bombing range in southern Labrador and the Trans Labrador Highway. Michael served in the capacity of Senior Reviewer for the Project.

Heather Ward, M.Sc. |GIS Analyst | Remote Sensing

Heather is a GIS Coordinator with the Information Management team in Stantec's St. John's, NL, office. Heather completed her Masters in Geography at Memorial University with a focus in Remote Sensing. Her experience comes from a combination of private sector work in Remote Sensing and GIS, and work related to her Master of Science program. She has considerable experience with Remote Sensing, geo-statistical and spatial analysis as well as cartography. Heather also teaches GIS sciences at Memorial University.

Ryan Melanson, B.Sc. |GIS Analyst | GIS

Ryan is a GIS Analyst with the Information Management team in Stantec's St. John's, NL, office. His background is in GIS and environmental monitoring. Ryan has five years of experience between creating geospatial solutions and sampling freshwater, marine and terrestrial environments. He has contributed to projects through data collection, analysis and reporting.

2.0 RATIONALE AND OBJECTIVES

This ELC Study forms one aspect of Marathon's environmental baseline programs for the Project. The purpose of this and other such environmental studies has been to gather and present information on key aspects of the environment, providing an appropriate level of understanding of the existing environmental conditions within and near the Study Area for use in the EIS. Although Marathon is in the exploratory stage in this mineral claim area, it was deemed prudent to understand the ecological setting and potential mitigating factors as the planning process continues.

To achieve this objective, Stantec defined and delineated ecological units within the Study Area at varying organizational scales based on climate, physiography, bedrock, surficial geology, soils and corresponding vegetation. The system is primarily vegetation-driven as plants best integrate the combined influence of numerous environmental factors. Specifically, the Project ELC investigated the distribution and grouping of plant species according to ecosystem patterns and processes. ELC is widely considered a useful tool in the inventory and evaluation of wildlife habitat.

Information presented herein will provide valuable information about the distribution of ecosystem units (or land cover classes) across the land base and is intended to support and/or supplement that contained in associated environmental studies prepared for the Project. These studies will be used collectively to guide ongoing Project planning, as well as to support and inform the environmental assessment for the Project.

The objectives for the Project ELC and wildlife habitat studies were to:

- provide descriptions of vegetation at various levels of generality using a complete taxonomic vegetation hierarchy (e.g., Ecozones, Ecoregions, Ecodistricts and Ecotypes) and using standardized criteria and nomenclature. Classification is based on floristic, ecological and physiognomic criteria, with Ecotype used as the basic unit of classification;
- establish a field sampling program that effectively examines and evaluates ecotypes on the basis of vegetation characteristics that can be objectively measured and delineated in the field using consistent sampling methods and ecosystem mapping standards;
- collect high-quality, ground-verified plot data used to support satellite-based ecosystem mapping (e.g., a combination of ground verification and remote-sensing industry analytical tools to identify and delineate similar areas of ground vegetation cover) of ecotypes;
- compile ecological data for use in the preparation and development of a comprehensive GIS database and thematic mapping products. These database and map products serve as the basis for understanding ecological relationships at a variety of scales and will enable the analysis of the effects of the Project on the natural environment; and

- identify and evaluate the occurrence of environmentally sensitive areas or feature, as well as supporting future habitat suitability modelling for key wildlife species in the Study Area, as required.

In summary, the application of an ecosysytem-specific approach will see the Study Area stratified into ecologically uniform segments. A consistent and ecologically meaningful stratification, in turn, requires an appropriate ecosystem classification system. The ELC serves as an essential and integral component of the environmental assessment, and provides key and core information that will be used in assessing and quantifying the Project's potential interactions with aspects of the terrestrial environment (soil, vegetation, wildlife and wildlife habitat). Information provided through this and other associated supporting studies prepared for the Project is considered appropriate and adequate for these purposes.

3.0 STUDY AREA OVERVIEW

3.1 Project Location and Surrounding Land Use

The boundaries of the Project ELC are shown in Figure 3-1. Boundaries of the ELC Study Area are similar to that used for other environmental baseline studies relating to the Project (e.g., Songbird and Waterfowl Survey, Winter Wildlife Survey) and were selected to encompass the Valentine Lake mineral claim area, including any proposed developments associated with the Project.

Boundaries for the ELC analysis were selected using the following criteria:

- all features and infrastructure associated with the proposed Valentine Lake Gold Mine site will be within the ELC Study Area;
- the ELC Study Area will include representative habitats for key wildlife species that could potentially interact with the proposed Project;
- accommodate habitat and potential migrations routes for key species within and/or in the vicinity of the Project; and
- the ELC Study Area encompasses key areas of resource harvesting, recreation and cultural activities.

The ELC Study Area comprises an area of 1,831 km^2 and fully encompasses the proposed mine site, access road, and transportation components, and therefore the “zone of influence”, which is anticipated to be directly affected by construction, operation and maintenance, and rehabilitation and closure of the Project (Figure 3-1). Ecosystem mapping at this scale is considered appropriate and will provide very detailed information on ecosystem composition and structure, which can in turn be used to assess potential effects of the Project in the EIS.

The Project occupies the Central Newfoundland Forest Ecoregion and the Red Indian Lake Subregion (Damman 1983; Newfoundland and Labrador Department of Environment and Conservation (NLDEC 2008); Figure 3-1). The landscape is characterized by remote upland forests interspersed by wetlands (bogs/fens), krummholtz, barrens and waterbodies. The dense forests are composed of balsam fir (*Abies balsamea*) and black spruce (*Picea mariana*), common to Central Newfoundland Forests. Stands of pure hardwood and mixedwood are also present, with the dominant species being white birch (*Betula papyrifera*) and trembling aspen (*Populus tremuloides*). While the majority area is in a relatively natural state, road construction, timber harvesting, mineral exploration, mining, recreational use, and various other ground-disturbing activities have occurred.

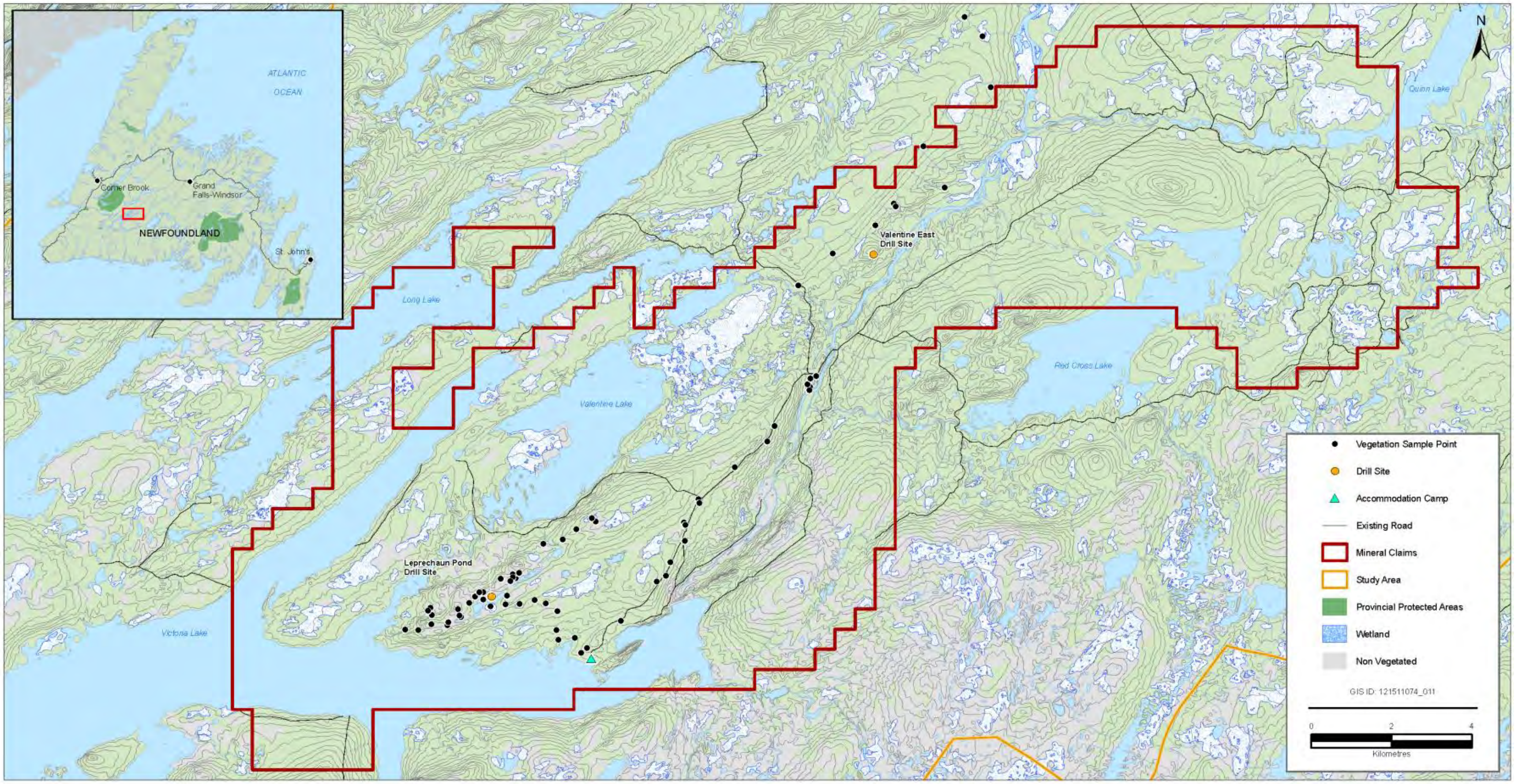


Figure 3-1 Project Location for the Marathon Gold Project

4.0 ECOLOGICAL LAND CLASSIFICATION

4.1 Ecological Land Classification in Canada

ELC uses climate, physical land features and vegetation to identify and classify regional terrestrial ecosystems into a hierarchy of nested units at progressively smaller scales.

Marshall and Schut (1999) describe a hierarchical framework for ELC in Canada that forms the basis of this ELC. This framework provides a consistent, national spatial context within which ecosystems, at various levels of generalization, can be described, classified and monitored. Using this framework, the Project ELC incorporates a standard and well-validated methodology for describing ecological units, thereby facilitating comparisons of ELCs undertaken in other jurisdictions, including those undertaken in Newfoundland and Labrador.

ELC is hierarchical (or nested) in its organization and describes regional ecological units at multiple scales, in which broad scale ecological units (i.e., *zones*) encompass successively smaller ones (i.e., finer scale *districts*).

4.1.1 Ecozones

At the top of the hierarchy, Ecozones are defined on the basis of generalized characteristics and global and continental climate. There are 15 Ecozones delineated for Canada (Natural Resources Canada 2007), of which one overlaps with insular Newfoundland: the Boreal Shield Ecozone. Ecozones typically differ from one another on the basis of climate, geomorphology, terrain, soils and vegetation species composition and growth pattern.

The ELC Study Area is located entirely within the Boreal Shield Ecozone, Canada's largest ecozone. This ecozone stretches in a broad, u-shape pattern from northeastern Alberta to the eastern tip of Newfoundland covering an area of more than 1.8 million km^2, or approximately 20% of Canada's land mass and 10% of its fresh water (Environment Canada 2005). The Boreal Shield Ecozone in Newfoundland and Labrador encompasses the island of Newfoundland and southeastern Labrador, where it is primarily coastal extending north to Hamilton Inlet and the Lake Melville area. A massive rolling plain of ancient bedrock blanketed with gravel, sand and other glacial deposits, its topography is comprised of broadly rolling uplands that form poorly drained depressions covered by lakes, ponds and wetlands. The climate of the Boreal Shield Ecozone is generally continental, with long, cold winters, short, warm summers and abundant precipitation. Although the moderating effect of the Atlantic Ocean produces warmer winters and cooler summers for insular Newfoundland, the central region has the most continental climate found on the island. Cool temperatures and a short growing season, along with acidic soils, reduces productivity, although most of the area is forested, primarily coniferous species, intermixed with hardwoods, mixed with bogs and other wetlands. Lichens and shrubs are common on areas of exposed rock (Wilkin 1986).

4.1.2 Ecoregions and Ecodistricts

This Ecozone is further divided into a number of Ecoregions. Ecoregions are smaller land units within Ecozones that have distinctive, recurring patterns of vegetation and soil that are determined and controlled by local climate and geology (Stantec 2010). Ecoregions also differ from each other in their combinations of plant communities, landscapes, geology and other features (Marshall and Schut 1999; Parks and Natural Areas Division 2008). For practical purposes, they are effectively mapped at a scale of 1:750,000 or less. Ecoregions identify areas of the landscape with characteristic regional climate and landform, as expressed in typical vegetation physiognomy and composition, landforms, soils and topography. The Study Area occupies two ecoregions: Central Newfoundland and the Maritime Barrens (Figure 4-1).

Central Newfoundland Forest

> *This maritime-influenced ecoregion covers the north-central part of Newfoundland. The ecoregion is marked by cool summers and short, cold winters. It is the most continental part of the island. This ecoregion is classified as having a maritime mid-boreal ecoclimate. Its forests are dominated by closed, intermediate to low stands of balsam fir and black spruce on steep, moist, upland slopes. Paper birch, aspen, and black spruce are typical of disturbed sites. Drier sites are characterized by woodlands of black spruce, kalmia heath, and lichens. Dwarf, open stands of black spruce and tamarack with ericaceous shrubs are found on raised domed bogs. Where forest growth is poor, exposure to winds and wet, cold soils are the main causes. Where stream erosion has cut deeply, the uplands are rugged and rocky, but elsewhere they present a rolling terrain of low relief. The surface of the uplands is dominated by hummocky to ridged, sandy morainal deposits with slopes that range from 5-30% and are associated predominantly with Humo-Ferric Podzols. (From Agriculture and Agri-Food Canada's National Ecological Framework 2013).*

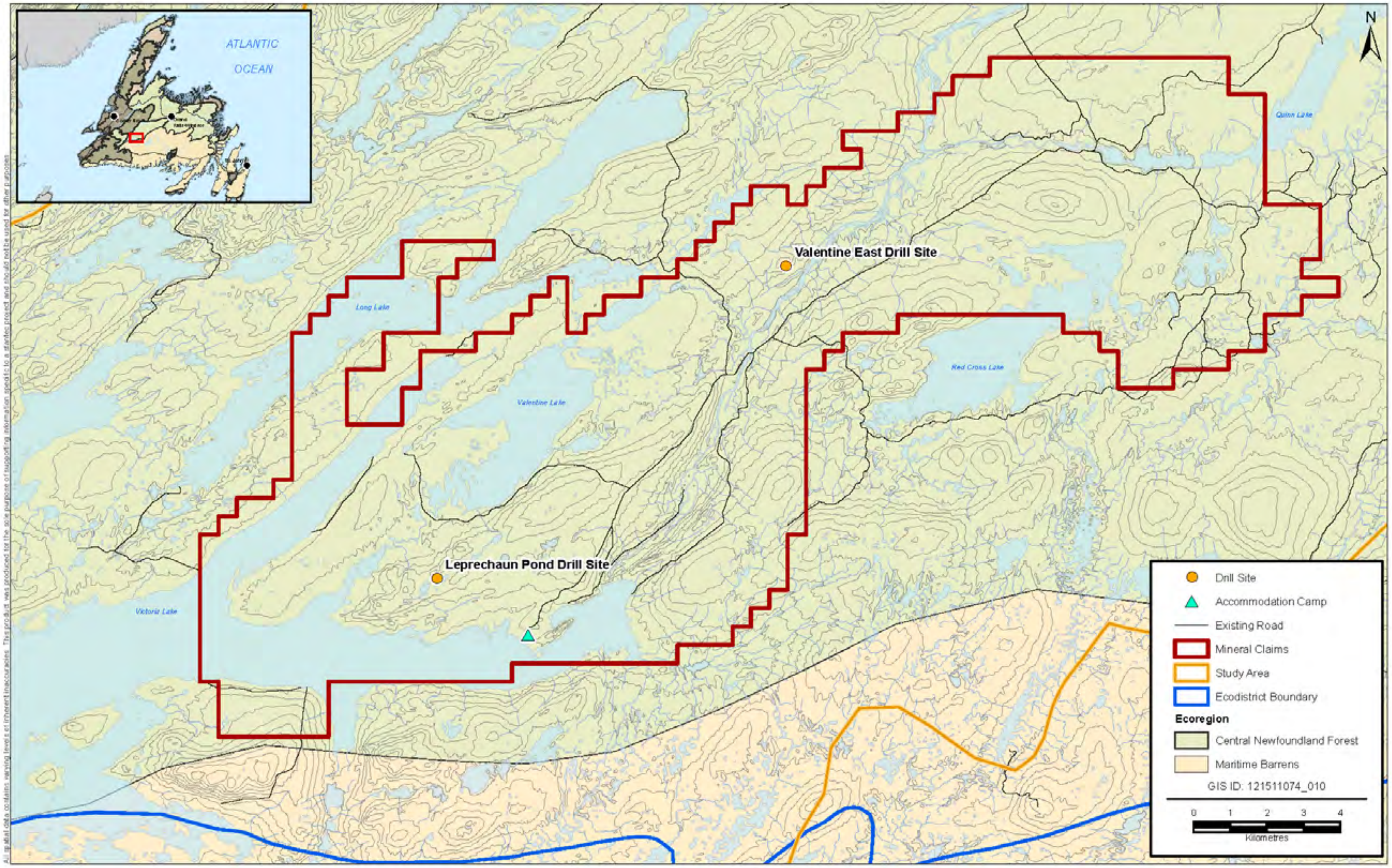


Figure 4-1 Ecoregions of the Marathon Gold Study Area

Maritime Barrens

> *This Atlantic Ocean-influenced boreal ecoregion extends westward across the southern half of the uplands of Newfoundland to the Long Range Mountains. The ecoregion is marked by foggy, cool summers and short; relatively moderate winters along the coast and colder inland. This ecoregion is classified as having an oceanic mid-boreal ecoclimate. It is dominated by nearly pure, closed, intermediate stands of balsam fir. Fires have caused widespread destruction of the forests and the subsequent replacement of fir by stands of sparse black spruce, balsam fir, tamarack, and mixed ericaceous shrubs, along with mosses and lichen. Kalmia and sphagnum moss occur on large tracts of blanket and flat bogs. The ecoregion ranges from sea level to about 250 m asl in elevation and is composed predominantly of a mixture of late Precambrian and Palaeozoic sedimentary rocks and granites. Where stream erosion has cut deeply, the uplands are rugged and rocky, but elsewhere they present a rolling terrain of low relief. The surface of the uplands is dominated by rolling to hummocky; sandy morainal deposits and is associated predominantly with Humo-Ferric Podzolic soils* (*From Agriculture and Agri-Food Canada's National Ecological Framework 2013*).

Ecodistricts are the next level of division in the ELC framework. Ecodistricts are sub-units of the ecoregions, and are characterized by distinctive assemblages of topography, landform, geology, soil, vegetation, water bodies and fauna. This unit is best mapped at a scale of 1:500,000 or less. The Study Area is located almost entirely within the Red Indian Subregion (Ecodistrict ED467) and extends only slightly into the Central Barrens Subregion (Ecodistrict ED472) at its southeastern periphery. No general descriptions of these Ecodistricts have been published (Marshall and Schut 1999).

4.1.3 Ecosections and Ecotypes

The national ELC system described by Marshall and Schut (1999) does not map units smaller than Ecodistricts. However, ELC systems often include smaller units such as Ecosections, with scales generally between 1:50,000 to 1:100,000, and Ecotypes, with approximate scales of 1:10,000 to 1:50,000. At fine spatial scales (1:10,000 to 1:50,000), the system is extended through the use of the ecotype unit, which is defined as a landscape area consisting of typical, recurring associations of vegetation and substrate types.

The most detailed level of classification used in the development of the Project ELC was that of the Ecotype, mapped at scales of 1:30,000. Focusing at this scale was a practical decision based on the scale of mapping and imagery, the local area focus of a project of this size, and cost for value considerations. Ecotypes are generally defined by their relative soil nutrient and soil moisture regimes influenced by local climate, surficial geology and topography. These soil nutrient and moisture regime combinations often dictate the type of vegetation community that can be expected to naturally develop under these conditions. Therefore, an ecotype is generally a group of related ecosystems physically and biologically similar enough that they have or would have similar vegetation at maturity. Once a site has been classified, site quality can be described in terms of the ecological drivers associated with each ecotype.

To determine ecotypes, homogeneous vegetation (e.g., upland, lowland, aquatic) polygons are classified based on stable features such as substrate depth, soil texture and landform. These features are considered ecological drivers that influence vegetation community structure and function. Once they have been identified, the polygon boundaries are delineated to reflect current vegetation character of the area. The process is achieved through a combination of expert knowledge of plant communities and substrates, ground-based validation of these factors and remotely sensed data.

It is important to recognize that ecotypes or vegetation associations are not always clearly defined entities with abrupt boundaries, and that a given plant species may well inhabit two or more different such communities. Ecotypes and/or vegetation associations are typically dependent on or affected by a variety of factors; including geographic location, elevation, precipitation, microclimates, orientation of slopes, soil types and successional considerations. Therefore, it would not be uncommon to find a particular plant or grouping of plants growing outside what would be thought of as its customary habitat if some of the above factors are advantageous to that growth.

4.2 Wildlife and Wildlife Habitat

In this report, wildlife is defined as mammals, avifauna (birds) and amphibians. Fieldwork for wildlife and wildlife habitat was completed in the Study Area in conjunction with the ELC, to inform future habitat suitability modelling and document occurrences of some species groups, while for other species groups a literature review (including review of previous studies) and habitat ratings were used in assessing their occurrence in the Study Area. The following sections provide incidental observations of wildlife noted through the delivery of ELC field surveys completed in 2014 and guidance for future wildlife species habitat models.

4.2.1 Incidental Wildlife Observations

Incidental observations (observations made without specifically surveying) of wildlife species of interest (e.g., mammals, birds, and previously undocumented, uncommon species occurrences) are useful to document important wildlife features (e.g., dens, raptor nests, roost trees, drumming sites), presence of species of management concern, and to provide additional information on presence and distribution of wildlife outside of formal survey periods and protocols. Systematically recording wildlife observations in this manner is an inexpensive method of collecting information about wildlife populations associated with an area or habitat type.

4.2.2 Wildlife Habitat Assessments (Future Studies)

Habitat models provide information about wildlife habitat that can be used during various components of project planning, including a description of the environmental setting and the assessment of potential environmental effects of the Project.

Wildlife habitat mapping is a relatively recent development for identifying and quantifying areas of importance to wildlife. As defined by RIC (1999), suitability models and maps identify areas which, in their current condition, provide functioning (i.e., suitable) habitat for a particular species. Suitable habitat generally means that the physical attributes (e.g., elevation, slope, aspect and geographical location) and the biological components (e.g., vegetation species composition, structure and age) of an area are likely appropriate for the species in question. The creation of a habitat map identifies areas of suitable habitat for wildlife species, provides a basis to evaluate the effects of development on wildlife habitat, and allows for the potential loss or alteration of these habitats to be placed into a local and regional context. Data derived from ecosystem maps and other biophysical information are used to develop spatial inventories of wildlife habitat that can then be used for land management planning.

Ecosystem mapping, as described herein, represents the stratification of the landscape into similar units based upon ecological features such as terrain, soil, and vegetation communities. It provides information on the type and distribution of ecological units and can be used in creating a broad-scale representation of suitable habitat for selected species and particular seasons of use. In addition, documenting wildlife habitat features or important wildlife habitat at a finer scale is integral in understanding the quality of habitat for any one species. Examples of these fine-scale features are migration routes, mineral licks, nest sites and bear dens. Such features may be essential for the subsistence of a wildlife population.

Field studies to identify wildlife species that inhabit the area of the Marathon Project, including those of species at risk and/or species of conservation concern (SOCC), have been conducted intermittently (2011 to 2014) for the Project. Breeding songbird point count surveys were conducted in June 2011, and dedicated winter wildlife surveys were conducted in March of 2013.

5.0 METHODS

5.1 Pre-Survey Planning

Project planning and initial data compilation included defining the objectives and the purpose of the work; conducting a review of prior vegetation and ecosystem classification studies performed within the Study Area and/or the region; and developing a field sampling plan and appropriate survey intensity. Additional details are provided in Sections 5.2 to 5.6.

5.2 Information Review

Information used in support of the ELC was derived from reviews of both historical and existing data sources, including:

- a review of existing literature information pertaining to the distribution and character of vegetation communities within the region, including peer-reviewed academic journals, research project reports, and government publications;
- recent aerial photographs and topographical maps that could indicate the abundance and distribution of ecotype's in the Study Area; and
- data collected (2011 to 2014) as a part of baseline data collection programs for the Project.

Prior to field surveys, a search of existing information was completed with focus on potential vegetation type's occurring within the Study Area. This was achieved using existing 1:50,000 topographical maps, 1:10,000 aerial photography, and Google Earth Pro Imagery. Additional information was gained through topographic maps, bedrock and surficial geology maps, recent digital aerial photography and land use maps.

In addition, relevant data from provincial and federal government databases, such as the *Species at Risk Act* (*SARA*) Public Registry, Newfoundland and Labrador General Status of Wild Species and the Atlantic Canada Conservation Data Centre (AC CDC), as well as other non-governmental and provincial conservation programs, were also used to determine the potential for wildlife species (flora / fauna) at risk, of conservation concern or those considered uncommon in Newfoundland and Labrador and with potential to occur in / near the Study Area.

The majority of data was collected through on-site surveys, as completed during the 2013-2014 field seasons (Stantec 2014). The field surveys included detailed vegetation surveys, soil surveys and incidental wildlife observations, where possible.

5.3 Field Sampling

5.3.1 Terrain and Soils

Soils were classified within the Study Area as part of the ELC for the Project. Field methodologies followed The Manual for Describing Soils in the Field (Agriculture Canada Expert Committee on Soil Survey 1983) and the Field Manual for Describing Terrestrial Ecosystems (British Columbia Ministry of Environment, Lands and Parks and British Columbia Ministry of Forestry (MoELP-MoF) 1998). Soils were classified according to the Canadian Soil Information System (CanSIS) (Agriculture Canada Expert Committee on Soil Survey 1983), the Canadian System of Soil Classification (Soil Classification Working Group 1998), and the classification of humus forms described by Green et al. (1993). Ground plot descriptions were based on those found in the Field Manual for Describing Terrestrial Ecosystems (MoELP-MoF 1998).

Sites chosen for soil description and classification were based primarily on assessments of landform and vegetation units to provide descriptions of the range of soil and humus conditions within the Study Area. Where necessary, unique sites identified through aerial reconnaissance were also targeted for sampling.

To characterize soils, soil pits were excavated to a minimum depth of approximately 60 cm or to the C-horizon, unless potential restrictions (e.g., bedrock, stony soils) were encountered. Soil profiles were photographed as well as described. All soil and humus form classifications were based on field assessments only.

5.3.2 Vegetation

In 2014, an ELC of the area in the vicinity of the proposed Project was completed by Stantec. This survey collected information to assess the baseline conditions of terrain, soils, vegetation and wildlife habitat.

To support satellite-based land cover classification and development of mapping products, a field program was completed by Stantec on August 25 and 30, 2014. A total of 74 sites were surveyed, with detailed vegetation surveys performed at approximately 30 of those. Between August 2014 and September 2015 (accuracy assessment), 106 sites were visually inspected and as such, a formal plot was not created, but rather, emphasis was placed on characterization of the site and completion of a site description.

Detailed survey plots were sampled to collect information to confirm the ELC mapping and to characterize the vegetation composition of the Study Area, including species composition, and presence of rare plant species or communities. Detailed sample plots were established in representative vegetation types to: characterize site and terrain conditions (moisture and nutrient conditions, slope, aspect and location); describe the overstorey species and characteristics (composition, cover, height, density); obtain information on forest seral stage; and identify and assign cover values to all vascular plant species. Common non-vascular plants were also recorded at the species or genus taxonomic level. Sampling plot locations were selected to encounter the broadest range of ecotypes within the Study Area. Plot locations were also selected from those vegetation types (e.g., early successional vegetation types - scrub / shrub lands and barren areas) deemed potentially difficult to classify through the remote sensing process alone. Wherever possible, a minimum of five sample plots per ecotype / land cover unit were targeted to support the classification. Ecotypes / land cover units that occupied a large proportion of the Study Area (e.g., wetlands) were sampled at a greater density than ecotype / land cover units with less areal coverage. Detailed plots were placed a minimum of 50 m from the stand edge to minimize edge effects. Overstorey data were collected in a 400 m^2 quadrat, with shrubs and vascular / nonvascular ground cover from within a 100 m^2 quadrat.

Surveys were conducted by two-person field crews comprised of a vegetation ecologist / wildlife biologist and soil specialist. Detailed sampling of dominant vegetation communities was performed at representative sites throughout the Study Area. Data collected in the field provided information on local species distributions and occurrence patterns as required to: (1) characterize ecosystem units; (2) refine the classification of ecotypes; (3) verify ecotype map unit designations; and (4) confirm accuracy of preliminary vegetation mapping. Sampling effort was directed at inspecting as many biotic habitats, plant communities and biophysical features as possible. Consequently, ground-truthing or verification of satellite-based land cover classification was achieved at two levels: ground plots (GIFs) and visual inspections. Each sample plot was located with a global positioning system (GPS). Plot boundaries encompassed a homogeneous vegetation community and varied in shape to ensure homogeneity.

Ground inspections are abbreviated plots that provide basic ecological data and confirm the identified ecosystem unit, as well as provide some data for characterizing ecosystem attributes. GIFs recorded site, soil and vegetation information. A list of minimum data collected for GIF plots is provided in Standard for Terrestrial Ecosystem Mapping in British Columbia (RIC 1998). Notes describing the plot, in context and variability within the polygon, were recorded and photographs were taken at each plot.

Visual inspections are the least detailed type of field data collection. Visual checks involved recording brief point or area characteristics made from the air (helicopter) or ground, and were used to note the basic ecosystem unit, vegetation and other key features. The primary function of visual plots was to aid in the delineation of mapping labels and to confirm the placement of mapping boundaries used in the photo interpretation and mapping phases

5.4 Ecosystem Classification

All naturally vegetated lands in the Study Area were summarized according to the forest types presented in the *Forest Site Classification Manual: A Field Guide to the Damman Forest Types of Newfoundland* (Meades and Moores 1994 Second Edition. This field guide was used to identify mappable ecological (ecosystem) units that are relatively uniform in terms of biophysical characteristics. Ecotypes are functional units that develop under specific environmental conditions reflecting the local climate, moisture regime, and nutrient regime. Moisture and nutrient regimes form the edatope, upon which ecotypes are 'mapped' (Section 6.2). Each sampled vegetation plot was assigned to an ecotype based on its characteristics. Anthropogenic lands, non-vegetated lands (e.g., lands cleared for exploration activity), water bodies and watercourses were assigned a classification according to their land cover class. Clear cuts, cutlines, and other clearings were considered as vegetated disturbances because natural regeneration was either already occurring or was anticipated to occur on these areas.

ELC classes are described in terms of terrain, soils, moisture and nutrient regime (Appendix C), and plant species richness. Measures of species richness include percent cover and frequency of occurrence by species, dominant species (≥5% cover and occurring in ≥50% of sample plots), and unique species. Dominant species are the typical vegetation species in each ELC type and may be used to help determine the species that should be present following successful reclamation.

Summary data for each ELC ecosystem unit (ecotype) are presented that compare the mean regional vegetation characteristics to the characteristics of vegetation observed during the Project baseline surveys. Data comparison summaries include:

- composition and mean percent cover of vascular and non-vascular plant species;
- forest structure (number of snags, downed logs and mean stand ages);
- site characteristics (soils, moisture, nutrients, slope);
- species richness (total and mean richness of vascular and nonvascular plants); and
- representative site photos.

Mapping of the Study Area for the Project ELC is presented at a scale of 1:30,000.

5.5 Map Platform Selection / Ecosystem Mapping

An effective and efficient process for integrating terrain, soils, vegetation and wildlife information means the practitioners involved in the process agree upon mapping procedures, data handling and reporting. GIS experts occupy a central position in the approach and as Stantec's project experience has shown, their ability to control and manage data and workflow processes is invaluable to ensure consistency and efficiency.

Ecosystem mapping, as defined here, involves the integration of site, soil, terrain and vegetation information to delineate map units that are internally consistent and sufficiently different from adjacent units to enable separation of a landscape continuum into ecologically meaningful parts.

An iterative approach using a variety of data formats including satellite imagery (RapidEye 5m multispectral), aerial ortho-photos, elevation and field survey data served as the foundation for the ELC. This combination of data formats resulted in a field survey program (Section 5.3) designed to support a systematic remote sensing-based mapping program. The combination of these two separate but interrelated programs provided the best combination for the acquisition of ecological information relevant to the Project and mapping accuracy over the geographic area involved. This approach to the regional satellite-based land cover classification is consistent with typical remote sensing-based vegetation classification practice and is closely aligned with recently completed projects in Newfoundland and Labrador, including Alderon's Kami Mine Site and Nalcor Energy's Labrador-Island Transmission Link.

Satellite imagery data served as the foundation for the selection of survey site locations. Field surveys were designed to provide information on vegetation abundance and community composition, which was used to assess overall plant species distribution and wildlife habitat ratings. Surveyed sites were also used to identify specific locations and the distribution of defined Ecotype units.

Field surveys are a key requirement in the development and validation of a remote sensing-based, unsupervised classification algorithm, which is a procedure or formula for effectively solving a problem using a sequence of instructions. The degree of coverage chosen for the field survey (136 plots in total) was to allow for adequate representation of the land class types found regionally in the Study Area, and the accurate application of their descriptions to the algorithm output. Ultimately, this insures the production of a high quality ELC product. The ground-verified plot locations are presented in Figure 5-1.

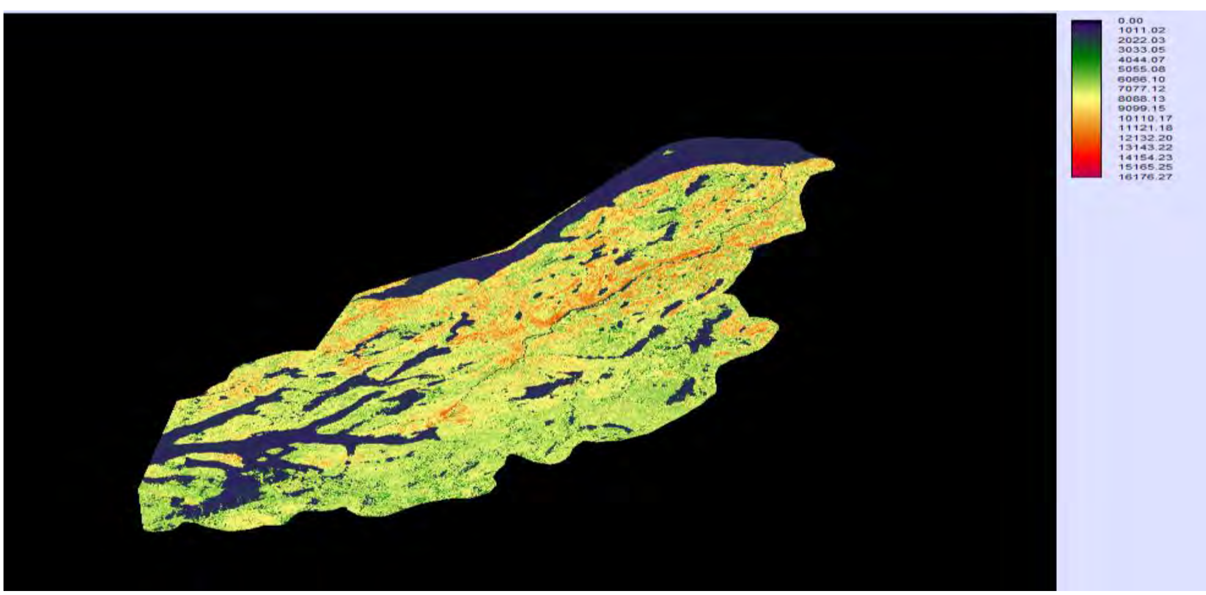


Figure 5-1 Near Infrared Band for Marathon Gold Project Regional Area. Note the reflectance contrast between water (dark blue) and land cover.

A computer-based algorithm was developed using satellite images to delineate the habitats identified in the field program for the entire Study Area. The use of satellite images and remote sensing technologies allowed for a systematic and consistent identification and delineation of large-scale vegetation patterns throughout the geographic extent of the Study Area. Therefore, the use of remote sensing technologies and satellite images was preferred over manual interpretation due to the large geographic extent of the Study Area. The output of the computer-based algorithm is a raw classification grid that is further processed to identify areas / classes of confusion and then generalized for mapping presentation.

The resultant maps were not designed to provide detailed site-specific information, but rather, an appropriate representation of the regional landscape. A similar approach to ELC mapping has been used for other projects and in support of environmental assessments, including the Alderon Kami Mine Project (Stassinu Stantec 2012) and the Labrador-Island Transmission Link (Stantec 2010).

5.5.1 Satellite-based Land Cover Classification

The focus of the ELC study is to use remote sensing software along with vegetation training areas derived from desktop research and field verification of model land cover classes from across the Study Area, and regionally. The resulting preliminary land cover classification is then verified through the field program, in addition to that of an accuracy (error) assessment process used to confirm the validity of the modelling exercise. The final classification is then used in the environmental assessment to complement other baseline studies (i.e., wildlife habitat modelling) and for regional comparisons required as part of the Project EIS.

Satellite-based ELC programs use a combination of ground-verified areas and remote sensing industry analytical tools to identify and delineate areas of similar ground vegetation cover. Individual satellite images often differ from each other due to the difference in environmental conditions at the time of acquisition (e.g., differences in time of year, time of day, or amount of cloud cover). Because of these differences, each image used in a mapping program requires specific processing and analysis. Additionally, satellite images are rich in information that must be summarized prior to final use.

The Study Area was covered by RapidEye's 5-band, 5 m, multispectral imaging platform. The analysis required 11 separate RapidEye images to cover the entire Study Area. Although RapidEye imagery was used as the primary mapping platform, high-resolution ortho-corrected air photos (captured during the summer of 2012) were also acquired and used to verify and adjust the algorithm for areas of specific interest.

5.5.1.1 Background and Technical Information

Image-based classifications are used to automatically aggregate pixel values within an image into predefined land cover classes of statistically similar spectral reflectance values. Pixels are placed into classes based on their spectral signature / reflectance pattern across all multispectral bands used in the analysis of the image. The available multispectral bands vary depending on the remote sensing platform used to capture the imagery. Classes (ELC ecotypes) are defined differently between a supervised classification, and the unsupervised classification process employed in this study.

A supervised classification relies on user-delineated "training" areas to define example reflectance patterns and spectral characteristics of each ELC ecotype desired in the final output. Training areas are collected with the aid of existing reference data, such as field surveys and regional vector data. The classification algorithm then analyzes the reflectance value for each pixel analyzed across all spectral bands input by the analyst and places it into the class, as defined by the training areas, to which it is most similar.

An unsupervised classification process was used in this ELC. This was supported by an algorithm that looks at each pixel (analyzed across all spectral bands input by the analyst) and places them into clusters / natural collections called spectral classes. These classes are based on similarities in reflectance patterns. This works on the assumption that values belonging to the same class will be similar or close in proximity in the measurement space, and pixels that do not belong together will not. The analyst then compares the spectral classes to reference data and assigns each an appropriate ELC ecotype. This type of classification is preferred when working with a large number of classes, which renders a supervised classification and adequate training impossible.

5.5.1.2 Data Specifications and Sources

Satellite-based multispectral imagery was used for this classification. The imagery was captured by RapidEye's constellation of five Earth observation satellites. This unique "constellation" of satellites allows RapidEye to provide complete coverage of current data over any location in a very short period. Each identical satellite is equipped with a five band, multi-spectral "push broom" imaging platform. This platform collects high-resolution imagery with a pixel resolution of 5 m from an orbit 630 km above the earth. Each satellite provides image data in the Blue, Green, Red, Red Edge and Near Infra- Red portions of the electromagnetic spectrum. All five bands were used during image classification to provide unique information about the land cover.

5.5.1.3 Extent of Satellite Imagery

Eleven images provided by RapidEye's satellite constellation required to cover the Study Area with seamless, multi-spectral imagery. The RapidEye imagery was captured between July and August, 2012. Images were selected on the basis of a qualitative assessment (i.e., they were acquired during snow-free conditions during a period in the growing season where vegetation differentiation could be maximized and the extent of cloud cover reduced (less than 10%)).

5.5.1.4 Image Processing

Specialized imaging processing techniques are required to convert the apparent surface reflectance before analysis can take place. Each of the 11 scenes required a considerable amount of pre-processing before any classifications were run. Each scene's spectral bands (five in total) were imported and combined into one, multi-band image file. The 11 scenes were then mosaiced into one seamless image of the entire Study Area. A "Normalized Difference Vegetation Index" analysis was performed to assist technicians and vegetation specialists in the classification process. The following five channels were used to build the foundation of the classification:

- RapidEye Multi-Spectral Band 1 (Blue);
- RapidEye Multi-Spectral Band 2 (Green);
- RapidEye Multi-Spectral Band 3 (Red);
- RapidEye Multi-Spectral Band 4 (Red Edge); and
- RapidEye Multi-Spectral Band 5 (Near-Infrared).

5.5.1.5 Preliminary Image Classification

To complete the image classification, unsupervised classification techniques were used. This involved running an iterative self-organizing (ISOCLUST) classifier in Idrisi GIS on all five bands. With ISOCLUST, the user simply identifies which bands Idrisi should use to create the classifications, and into how many classes to categorize the land cover features. The ISOCLUST algorithm first determines how many classes can be extracted by using the spectral signature within the five bands and then statistically classifies each pixel in the image based on the probability that it belong to one of the classes. The classification is known as an unsupervised classification because it does not indicate which land cover/ land use type is represented by each class. The classification simply indicates the classes that are statistically different from one another. Decisions were then made concerning which land cover types each category falls within. Ground-truthing what was seen in the digital image with that actually present at the time the image was recorded makes this task more efficient and more accurate. Field data were used after the fact in order to inform the user as to which class represents which land cover/land use type.

5.5.1.6 Classification of Open Water

Open water was classified using the Near Infrared (NIR) band only. NIR wavelengths (0.76 to 0.88 μm) are largely absorbed by water and thus there is very little reflectance signature for the satellite to pick up. The results are “dark” areas of open water that appear in heavy contrast to the surrounding land cover, which reflects NIR wavelengths (see Figure 5-1).

A threshold reflectance value was determined in review of the histogram for open water areas in the NIR band. Pixels below this threshold were isolated and classified as open water. Pixels with a reflectance value above the threshold were left to be analyzed as part of the preliminary, unsupervised classification and ultimately assigned a land cover type description (see figure 5-2).

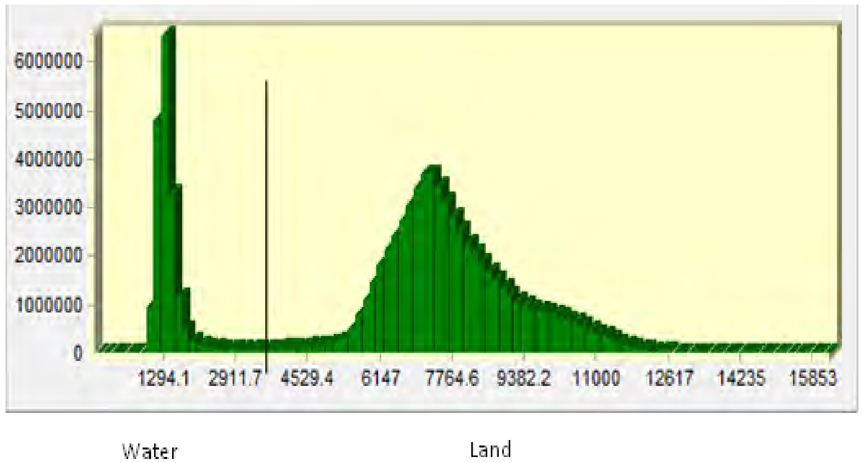


Figure 5-2 Near Infrared Band Histogram – Water vs. Land Post-Processing / Accuracy Assessment (x-axis is the range of the available digital numbers and y-axis is the number of pixels in the image having a given digital number)

As with all classification, some degree of post-processing is required. Post-processing is required to correct errors / confusions in the output of the classification such that the classification was reviewed and any error / confusion isolated and corrected.

The majority of the post-processing involved the visual identification of errors / confusions, masking and then re-classing them manually. A common example of this occurred when the algorithm mistakenly grouped the highly reflective understory of Exposed Earth / Anthropogenic class with Wetlands. These two classes were spectrally similar enough that it was common for areas of Exposed Earth / Anthropogenic to be misclassified as Wetlands, particularly when tree cover associated with the wetland was sparse and the ground vegetation dominated by graminoids, a predominant factor in its spectral signature. These types of issues were identified and corrected manually.

5.5.1.7 Final Classification

To complete the classification, grids (land cover types and open water) were combined into one continuous, raster dataset. This ensured there were no "No-Data" areas and gaps in the data.

5.6 Taxonomic Nomenclature and Ranking

Taxonomical nomenclature for all plants collected during in-field surveys in 2014 subscribes to that identified by the AC CDC (2010). The plants listed in this report are generally referred to using their accepted common names but their scientific name is also provided the first time they are referenced in the text. Some plants have no common names, in which case only the scientific name is used. Where there is a list of several species in the same genus, this report follows the commonly used procedure of using the genus name first, and only the initial for that genus in the rest of the text (e.g., "*Carex lasiocarpa, C. livida,* and *C. exillis*").

All species of vascular plant encountered during the surveys were identified and their population status in Newfoundland and Labrador were determined through a review of the species rankings provided by NLDEC (NLDEC 2010), AC CDC (AC CDC 2010), Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2010) and those listed under SARA and the Newfoundland and Labrador *Endangered Species Act* (NL ESA). Although not a focused objective of the ELC, the identification of potentially rare plant species observed through detailed vegetation surveys at ground-truthing locations was recorded during field surveys.

5.7 ArcGIS

ArcGIS software was used to manage all spatial data collected for the Project ELC. All data were stored in personal geodatabase format in accordance with the established Project information management standards. Data were stored in a Geographic NAD 83 system, while mapping was created using UTM NAD 83. Sampling location databases, ELC polygons, and associated base map information and imagery were all managed in ArcGIS. ArcGIS was also used for all data analysis and cartographic output.

5.8 Quality Assurance / Quality Control Procedures

To ensure consistent delivery of high quality products and services, Stantec has developed and implemented a Quality Management System (QMS) within its operations. The QMS is registered to ISO 9001:2008 (QMS - Requirements) by QMI Management Systems Registration (CERT-0011312:026332).

A quality assurance / quality control review of the mapping was performed by comparing a number of ground-truthed sampling locations with that of the mapped vegetation types. Accuracy assessments determine the quality of the information derived from remotely sensed data. The assessment assigns a measure of validity to the map product and allows users to understand the reliability with which the mapped vegetation classes capture conditions on the ground. Knowing the accuracy of the map enables potential users to determine the suitability of the map for any particular application (Environmental Systems Research Institute et al. 1994).

Map accuracy was assessed by comparing the mapped vegetation type to the field verified vegetation type at various evaluation points (i.e., training sites). Accuracy was calculated for each individual map class, as well as for all map classes combined.

5.9 Incidental Wildlife Observations

Incidental observations were recorded throughout the Study Area. Incidental observations of wildlife and wildlife sign detected outside of standardized survey protocols were recorded. Surveyors recorded evidence of direct and indirect wildlife use, including direct (visual) observations and vocalizations (auditory), as well as indirect (sign) tracks, game trails, scat, feeding activities (e.g., browsed or grazed vegetation), mineral licks, residences [e.g., upland bird nests, nest cavities woodpecker holes and burrows), feathers, skeletal remains or kill sites. Use of forest types and special habitat features by wildlife was deduced from an analysis of habitat features, and observations and evidence of use noted at the time of ELC survey.

Incidental wildlife observations were recorded throughout the survey by recording the UTM coordinates a description of the observation (e.g., species, sex, and number) and where possible, the habitat in which the observation occurred.

6.0 RESULTS

6.1 Overview of Study Area

6.1.1 General Description of Terrain Units

The types of terrain units observed in the Study Area are described below. Terrain units were identified on the basis of the parent materials associated with the formation of the landform and/or the steepness of the representative slopes (e.g., upland soils formed on terrain with noticeable relief that is a result of morainal till material).

Terrain units observed within the Study Area include:

- Morainal (M) - Material deposited directly by glacier ice without modification by any other agent of transportation. Gentle slopes (slopes from 0.5% to 5%) and blankets were the most commonly observed surface expression. Gully erosion was the most common geomorphological process, and morainal materials were typically well to moderately-well drained. During the field program, it was noted that while present over much of the area, the local till is not uniformly distributed over the landscape; rather, it occurs discontinuously in association with local bedrock outcropping. Till thickness generally increases with lower slope positions, as a direct result of the predominantly bedrock controlled landscape.
- Glaciofluvial (GF) - Materials that exhibit clear evidence of being deposited by glacial meltwater streams either directly in front of or in contact with glacier ice. Slopes ranged from 0.5% to 30%, surface expressions range from undulating to hummocky to hummocky ridged. Gullying and meltwater channeling were the most common geomorphological processes and drainage was generally moderate to well.
- Fluvial (F) - Fluvial materials are associated with deposition of sediments along modern stream floodplains, and in some cases are synonymous with alluvial. Typically this parent material contains stratified sediments comprising silt, sand and gravel. Finer textured sediments may also occur when flooding events occur. In general, the topographic form of the fluvial sediments is a floodplain with level to terraced topography. These deposits may also be expressed as low slope gradient fans and were primarily observed in association with the Victoria River and its tributary streams, in addition to that of other riverine systems in the Study Area.
- Colluvium (C) - Materials that have reached their present positions as a result of direct, gravity-induced movement not involving an agent of transportation such as water or ice, although the moving material may have contained water or ice. Colluvium was observed infrequently and typically in association with steep valley sides. Moderate slopes and hummocks were the most frequently mapped surface expressions. Slow mass movement was the most common geomorphological process and drainage was usually rapid to well.
- Organic (O) – Sediments composed largely of organic materials resulting from the accumulation of vegetative matter. They contain at least 30% organic matter by weight-

17% or more organic carbon. Organic accumulations are generally found in topographic depressions, within former shallow pond basins, along the margins of active low-gradient watercourses, and within areas where shallow seepage is forced to the surface. Two major organic deposits, bogs and fens, are found within the Study Area. Bogs are ombrotrophic, wet, poorly drained peatlands occupying level or depressional areas in the landscape. Ombrotrophic is defined as all water being derived from precipitation and not groundwater. Accumulation of slightly to moderately decomposed organic material, mainly Sphagnum mosses, results in these deposits being acidic in nature. In addition, there is generally a stagnant water regime and low nutrient availability. The depth of organics over the underlying mineral contact varies considerably from <50 cm to over 2 m. Fens are peat-covered or peat-filled wetlands characterized by high water tables (i.e., water table is at or near the surface for at least part of the year). As opposed to the stagnant conditions of the bog units, fens have varying degrees of surface or subsurface lateral flow that produce a nutrient-medium to -rich, oxygenated environment (minerotrophic) originating from mineral soils via overland or subsurface flow. Fens develop on accumulations of slightly to moderately decomposed organic material, made up primarily of mosses and sedges.

- Weathered Bedrock (D) – Weathered bedrock has been modified in situ by mechanical and chemical weathering. Weathered bedrock is found as a discontinuous very thin veneer (Dx) overlying gently sloping or undulating bedrock outcrops. It typically contains a high proportion of angular coarse fragments with varying amounts of interstitial silty sand. It is non-cohesive and rapidly to very rapidly drained.
- Rock (R) – A considerable percentage of exposed bedrock outcrops and/or rock covered by a thin mantle (up to 10 cm thick) of unconsolidated or organic materials was also observed throughout the Study Area.
- Anthropogenic (A) - Anthropogenic materials are human-modified sediments or geological materials so modified by human activity that their original physical properties (e.g., structure, cohesion, consolidation) have been drastically altered. Anthropogenic materials were observed in association with historic mining and forest management activities in the area.

In the Study Area, medium-textured, morainal (till) surface materials were the most commonly observed parent material. This material was often of variable thickness, ranging from a few centimetres to >1 m. Other common soil parent material types were organic (bog and fen), colluvium, bedrock, lacustrine and fluvial. In poorly drained soils, the presence of near-surface bedrock and other shallow unconsolidated material contributed substantially to the extent of organic soils. Colluvium, in varying forms was observed infrequently, primarily on steep slopes often in complexes with both till and exposed bedrock. Bedrock, till and colluvium-derived soils were common at mid to high elevations. Lacustrine deposits were found primarily in association with a narrow band of riparian vegetation surrounding Red Indian Lake and Victoria Lake (Reservoir). Fluvial deposits, though infrequent, originated from glaciofluvial sands and silts, and were found along the shoreline of the Victoria River and on small islands associated with this and other medium to large river systems in the region.

6.1.2 General Description of Soil Units

Soils mapping for the Study Area is based primarily on existing information (i.e., CanSIS data). The map polygons described in this report are based on diagnostic properties of the principal soil series after which they have been named (i.e., Red Indian, Silver Mountain, The Topsails). Thus, once assigned a series name, a map polygon is called a soil unit. Although a soil unit is named after a particular soil series, it is not meant to imply that all soils within the boundaries of that particular map unit will conform to the description of a typical profile of that soil series. Instead, the predominant soil series within a specified polygon falls within the range of natural variability determined for that soil series. Other series can occur within that polygon as minor components or inclusions. Soil inspections in the field are classified at the sub-group level according to "The Canadian System of Soil Classification" (Soil Classification Working Group 1998).

Orthic Humo-Ferric and Orthic Ferro-Humic Podzols are the dominant soils in upland areas. Gleyed Podzols (Gleyed Humo-Ferric Podzol) are found where drainage is imperfect. Soils are dominantly acidic throughout (pH 4 to 5 or less), but values can be higher (pH 5 to 6) where seepage inputs (subsurface flow or groundwater flow, or both, in addition to precipitation) are the main water sources. Orthic Gleysols, Orthic Regosols, Gleyed Regosols and Organic soils (Mesisols) predominate in poorly drained areas (fens and bogs). Drainage is restricted in these areas due to bedrock (or basal till) and a lack of slope. Folisols (upland organic soils) can also be found where bedrock is close to the surface. Humus forms are dominated by hemimors.

Drainage associated with bedrock and moraine derived soils range from poor to well, depending on slope position and soil depth. In upland areas drainage is mainly well to moderately-well; however, in some cases, in particular Humo-Ferric and Ferro-Humic Podzols associated with the Red Indian and The Topsails soil units, drainage may be slowed by cemented (Ortstein) variants of these soils and/or sub-surface horizons of massive structure. Where this occurs, drainage may be moderately well, imperfect, or even poor. Colluvium derived soils are generally associated with steeper slopes where drainage is mainly well to imperfect, depending on slope position and seepage inputs. Alternatively, at lower slope positions drainage may be moderately well to imperfect due to seepage inputs from above. Drainage on level areas is often bedrock-controlled, with only minor elevation differences between poorly drained wetlands and associated uplands. Drainage associated with fluvial deposits is mainly rapid to well, but can also be moderately-well to imperfect at lower slope positions.

Within the Study Area, soil map units were mostly complexes of organic and mineral soils, reflecting the varied topography of the underlying till. The most abundant mineral soil unit on well to imperfectly drained soils is that of the Red Indian soil unit (described below). Gleysols, which are poorly drained transitional soils between organic and upland soils, are less extensive and include mainly Silver Mountain soil units. Soils developed on fen peat parent materials occupy the Deadwolf Pond and Ebbegunbaeg soil units. Anthropogenic or disturbed land is primarily associated with historic mineral exploration and forest management activities in the area. Water occupies a substantial portion of the Study Area.

Red Indian and Gleyed Red Indian Soil Units

As a group, the Red Indian soils are primarily Orthic Humo-Ferric Podzol developed on moist, moderately-coarse textured, morainal (till) parent materials. They occur in upland positions on slopes of 10% to 15%.

Red Indian soils are typically labelled with an xt modifier that indicates the presence of moraine within 1 m of the surface (lithic contact 50 to 100 cm from the mineral surface). Gleyed Red Indian soils have a subhygric moisture regime with a steady supply of water. There is distinctive mottling within the soil profile, and gley colours are typically observed below 50 cm.

Based on site inspection and existing mapping (Woodrow 1988), subgroup composition for the Red Indian soil units include:

- Orthic Humo-Ferric Podzols;
- Gleyed Humo-Ferric Podzols;
- Orthic Gleysols;
- Humic Gleysols and
- Other inclusions.

Mapped soil units encompassing the Study Area were primarily comprised of the Orthic Gleysols subgroup, developed on predominantly medium to moderately fine textured (i.e., sandy clay loam), wet morainal deposits. These soils typically occur in depressional and lower slope positions, on less than 2.5% of slopes, and with poor drainage.

Silver Mountain Soil Unit

Silver Mountain soils are mapped (Woodrow 1988) primarily in the southern portion of the Study Area. The Silver Mountain soil unit is characterized by Gleyed Humo-Ferric Podzol soils occurring on morainal veneer deposits overlying hummocky to rolling bedrock. They occur in upland positions on slopes of 16% to 30%. Large areas of rock outcroppings are associated with these soils. As such, Silver Mountain is commonly very shallow and has a subhygric moisture regime with a steady supply of water. There is distinctive mottling within the soil profile and gley colours (Gleyed Red Indian) are typically observed below 50 cm. Silver Mountain soils are typically labelled with an xt modifier that indicates the presence of moraine within 1 m of the surface (lithic contact 50 to 100 cm from the mineral surface).

Based on site inspections, the subgroup composition for Silver Mountain soil units include:

- Gleyed Humo-Ferric Podzols;
- Ortstein Humo-Ferric Podzols;

- Orthic Humo-Ferric Podzols (lithic phase); and
- Other inclusions.

The Topsails Soil Unit

The Topsails soils are mapped (Woodrow 1988) in the north central portion of the Study Area. The Topsails soil unit is characterized by Gleyed Ortstein Ferro-Humic Podzol (lithic phase) soils developed on washed, partially sorted, coarse textured morainal till. They occur in upland positions on undulating (slopes 2% to 5%) to hummocky moraine (slopes 6% to 9%). Drainage is imperfect and the soils are exceedingly stony and slightly rocky.

Based on existing mapping of the Study Area, the subgroup composition for The Topsails soil unit include:

- Gleyed Ortstein Ferro-Humic Podzol (lithic phase);
- Gleyed Regosols; and
- Rock Outcrops.

Organic Soil Units

Deadwolf Pond soils typically occur as subdominants within the Red Indian and Gander soils. These organic soils are developed on domed bogs, several of which occur in the Study Area. The mineral soils in depressions between the domes may contain Red Indian soils. When Deadwolf Pond soils occur as subdominant they are mapped as sloping and domed bogs. Deadwolf Pond soils are mainly Terric Fibrisols. The mainly fibric peat material is derived mostly from sphagnum moss, and is underlain by unconsolidated material or bedrock.

Ebbegunbaeg soil units are characterized by organic soils developed in fens, with peat depths ranging from 40 to more than 160 cm. These soils developed on sloping bogs are classified mainly as Typic Mesisols. They consist of moderately decomposed sphagnum peat underlain by moderately coarse textured glacial till or bedrock.

These soils developed on sloping bogs and are classified mainly as Typic Mesisols. They consist of moderately decomposed sphagnum peat underlain by compacted till deposits**.** The Ebbegunbaeg soil units occur in the areas of very poorly drained, low-lying depressions between mineral soils, knobs or hummocks with slopes that are <0.5%, grading up to 2.5% at the upper margins.

Based on site inspections, subgroup composition for the Ebbegunbaeg soil units includes:

- Terric Mesisols (40 to 100 cm, average 70 cm)
- Typic Mesisols (101 to 200 cm, average 140 cm)
- Terric Humisols (40 to 100 cm, average 70 cm)
- Typic Humisols (40 to 100 cm, average 70 cm)

The mineral material found beneath the peat ranges from clay to sand, but is predominantly of moderately fine texture (i.e., clay loam, sandy clay loam and silty clay loam).

Peat depths range from 25 cm to greater than 110 cm. Common soil types include: Terric Fibrisols and Mesisols. These sites tolerate variable hydrology.

6.1.3 General Description of Dominant Vegetation

The Study Area is within the Central Newfoundland Ecoregion, as identified by the *Forest Site Classification Manual: A Field Guide to the Damman Forest Types of Newfoundland* (Meades and Moores 1994, Second Edition). The main characteristics of this ecoregion are a gently rolling to hilly topography with thin discontinuous till veneers, underlain by acidic bedrock. Vegetation within this ecoregion reflects its continental climate, which are attributed the highest summer and lowest winter temperatures of insular Newfoundland (Meades and Moores 1994).

Like the majority of insular Newfoundland, softwood forests predominate throughout the ecoregion. Balsam fir forests with dense carpets of stairstep moss *(Hylocomium splendens*) occupy the zonal or reference site for the region (Meades and Moores 1994), occurring in those areas not having been disturbed by fire in the last century (South 1983). Black spruce - sheep laurel (*Kalmia angustifolia*) and balsam fir - Schreber's feathermoss (*Pleurozium schreberi)* forest types are also very common. Forest fires have played a more important role in the Central Newfoundland Ecoregion compared to others and have resulted in much of the balsam fir-dominated forest types being converted to black spruce stands, and some of the richer types to hardwood forests dominated by paper birch (*Betula papyrifera*) and trembling aspen. Aspen has been noted as being more pronounced in this ecoregion than others and yellow birch (*Betula alleghaniensis*) is absent from the ecoregion because of the short frost-free period (Meades and Moores 1994). Alders (*Alnus* spp.) are common on wet seepage slopes and represent a silivicularal problem following tree harvesting initiatives.

Like much of insular Newfoundland, peatlands are a prominent feature on the landscape with both fen and bog classes being represented. Ombrogenous and soligenous peatlands are common; the latter being medsotrophic or oligotrophic. Eutrophic fens are rare.

Edaphic vegetation types are found in association with exposed hills where shallow and nutrient poor soils result in shrub-dominated communities largely comprised of stunted coniferous trees and ericaceous plants. In particular, dwarf shrub heath-dominated communities dominated by sheep laurel have been reported to occur with regularity throughout the region, occupying local areas with nutrient poor parent materials (South 1983).

The Red Indian Lake Subregion encompasses the southwest end of the Study Area. The rolling to undulating topography of this subregion is similar to much of the rest of the Central Newfoundland Ecoregion, but it is described as colder and receiving more precipitation (Meades and Moores 1994). Balsam fir forest types predominate throughout this subregion, and unlike much of the ecoregion, paper birch is more common than black spruce (Meades and

Moores 1994). The Rubus-Balsam Fir and Dryopteris-Lycopodium- Balsam Fir Damman forest types have been noted to dominate the subregion, both of which regularly contain occurrences of paper birch. The forests of the subregion are amongst the most productive forest types in central Newfoundland but succession to alder thickets following cutting and fire is described as an important silivicultural issue (Meades and Moores 1994).

6.1.4 Ecosystem Units and Ecotypes

A total of 12 ecosystem units were mapped within the Study Area (Table 6.1). Of these, nine are vegetated and three are sparsely vegetated, naturally non-vegetated and/or anthropogenic ecosystem units. The Study Area covers a total area of 1,831 km^2 (Table 6.1), approximately 56% of which is occupied by upland environments, 22% by lowlands (i.e., wetlands), and 22% by open water. Upland areas are dominated by softwood forests (i.e., the Balsam Fir Forest, Black Spruce Forest Ecotypes), Alder Thickets and Mixedwood Forests; whereas lowland sites are comprised of open peatlands (i.e., Shrub / Graminoid Fen and Shrub Bog Ecotypes) and treed wetlands (i.e., Wet Coniferous Forest Ecotype). The relative frequency of ecotypes or ecosystem units found in the Study Area is presented in Figure 6-1.

Table 6.1 Ecosystem Units and Ecotypes within the Study Area

Ecosystem Units	Ecotypes	Description	Map Unit	Area (km^2) in Study Area	Percentage of Study Area
Balsam Fir Forest	Balsam Fir Forest	Dry to moist and sometimes wet conifer dominated forests	BF	126.9	6.9
Black Spruce Forest	Black Spruce Forest	Dry to moist and sometimes wet conifer dominated forests	BS	233.1	12.7
Kalmia- Black Spruce Woodland	Kalmia-Black Spruce Forest	Dry to moist and sometimes wet stunted tree and shrub/heath dominated communities	KB	208.8	11.4
	Kalmia Heath		KH		
Mixedwood Forest	Mixedwood Forest	Mesic to moist forests with high hardwood component	MF	179.3	9.8
Regenerating Forest	Regenerating Forest	Forests regenerating as a result of harvesting, fire, windthrow, etc.	RF	139.5	7.6
Alder Thicket	Alder Thicket	Alder-dominated communities on moist seepage slopes and riparian areas	AT	97.4	5.3
Riparian Thicket	Riparian Thicket	Shrub thickets located in transitional areas and subject to periodic flooding	RT	15.1	0.8
Wet Coniferous Forest	Wet Coniferous Forest	Very moist to wet conifer forests	WC	130.7	7.1
Open Wetlands	Shrub /	Very moist to wet shrub/herb	SF	280.3	15.3

Ecosystem Units	Ecotypes	Description	Map Unit	Area (km^2) in Study Area	Percentage of Study Area
	Graminoid Fen	dominated peatlands			
	Shrub Bog		SB		
Open Water	Open Water	Waterbodies (lakes, ponds, rivers and streams)	OW	408.5	22.3
Exposed Sand / Gravel Shoreline	Exposed Sand / Gravel Shoreline	Sparsely vegetated and/or un-vegetated shorelines	ES	2.8	0.2
Anthropogenic	Anthropogenic	Areas currently or historically subject to intense levels of human disturbance and use (does not include areas regenerating from forest management)	ANTH	8.2	0.5
Total				1,830.6	100.0

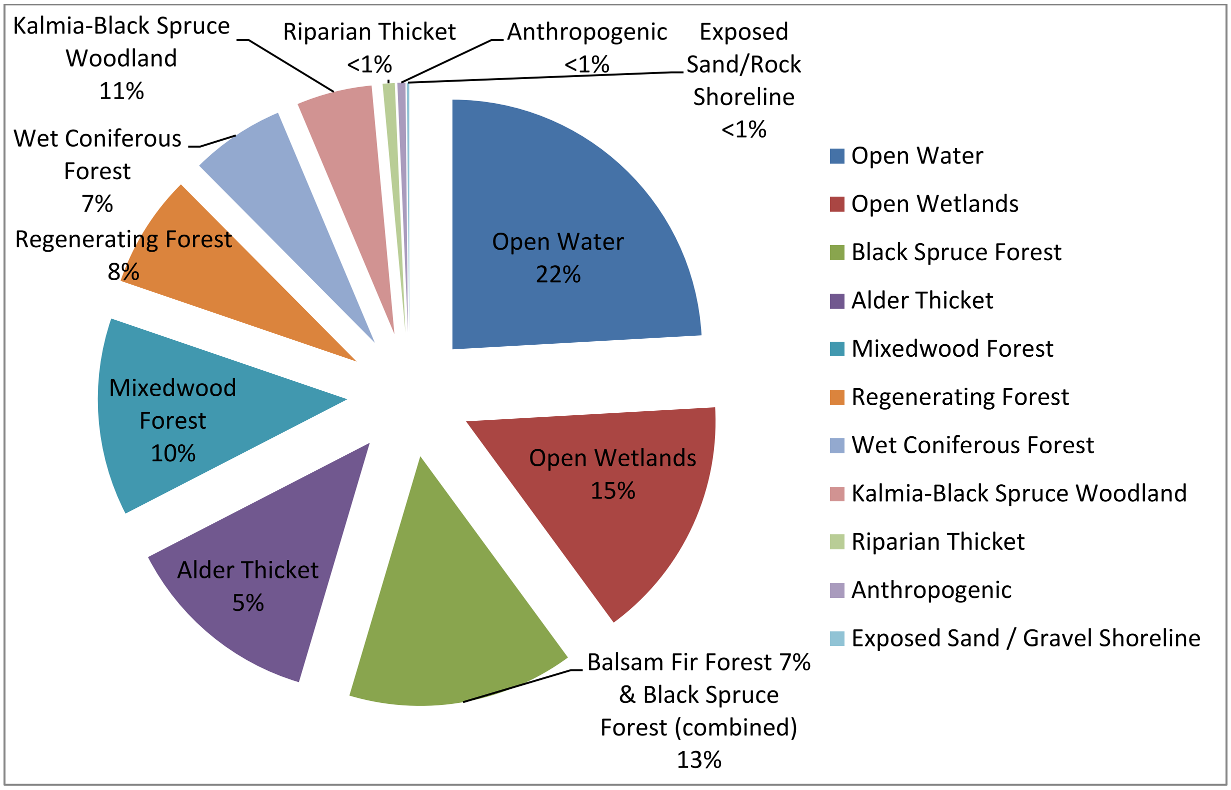


Figure 6-1 Relative Frequency of Ecotypes and Ecosystem Units Found in the Study Area

Fourteen ecotypes have been identified within the mapped ecosystem units (Table 6.1). Whereas most mapped ecosystem units are direct correlates with ecotypes, multiple ecotypes have been identified for Kalmia-Black Spruce Woodland and Open Wetlands units based on field data collected within the 136 field plots (ground and visual). Riparian Transition, Anthropogenic, and Exposed Sand / Gravel Shoreline ecotypes and ecosystem units represent <1% of the Study Area and may therefore be considered relatively rare within the region. Mapping of the distribution of each ecosystem unit within the Study Area is available in Appendix A; detailed descriptions of each of the ecotypes is provided in Section 6.2.

Vegetated upland ecosystems within the Study Area are represented by both forested and shrub-dominated communities. Upland ecotypes that are characterized by a well-established overstory tree canopy include the Balsam Fir Forest, Black Spruce Forest, and Mixedwood Forest ecotypes, which together account for over 29% of the Study Area. Upland forested ecosystem units are generally characterized by mesic to subhygric moisture regimes with well to imperfectly drained soils, typically not saturated with water for extended periods of time. Shrub-dominated communities are represented within the Kalmia-Black Spruce Woodland unit (i.e., Kalmia-Black Spruce Forest and Kalmia Heath), Regenerating Forest, Alder Thicket, and Riparian Thicket ecotypes and cumulatively comprise approximately 25% of the Study Area. Although shrub-dominated, many of these ecotypes also have a diffuse tree layer. The Kalmia-Black Spruce Forest and Kalmia Heath ecotypes exist as edaphic climax units maintained by exposed, dry and nutrient-poor soil conditions, whereas the Riparian Thicket ecotype reflects the influence of periodic flooding from adjacent waterways. The Regenerating Forest ecotype is a temporal phase that will convert to forest with succession. The Alder Thicket ecotype occurs both as a temporal seral stage following poor tree regeneration after forest management activities and as an edaphic community on moist seepage slopes and in association with riparian areas. Wetlands are represented by the Wet Coniferous Forest, Shrub / Graminoid Fen and Shrub Bog ecotypes. Wetland ecosystem units have soils that are saturated for all or part of the year, characterized by hygric to hydric moisture regimes and poor to very poor drainage. As a result of similarities in their vegetative structure and composition, the Shrub / Graminoid Fen and Shrub Bog ecotypes are jointly represented by the Open Wetland ecosystem unit. Open wetlands comprise a dominant component of the landscape within the Study Area and data indicate that they are of much greater prominence than forested wetlands, which are encompassed by the Wet Coniferous Forest ecotype. Although data on the relative abundance of open fens and bogs is not available, field observations indicate that the Shrub / Graminoid Fen ecotype is more common than Shrub Bog in the vicinity of the Project.

Sparsely vegetated, naturally non-vegetated, and/or anthropogenic ecosystem units include Open Water (i.e., lakes, ponds, rivers), Exposed Sand / Gravel Shoreline and Anthropogenic (Table 6.1). Open water is the most prominent of these ecosystem units or ecotype types, covering 22% of the Study Area. Existing disturbances, including access roads and trails, clearings, exploration drill sites, and recreational properties cover <1% of the Study Area. Similarly, the Exposed Sand / Gravel Shoreline ecotype is a minor component of the Study Area, accounting for much less than 1% of its area.

Although ecotypes and ecosystem units were defined on the basis of site (orientation of the slope, form of the site and topography), soil (drainage, humus form, texture, soil depth and coarse fragment content) and vegetation characteristics, there is considerable natural variability in the landscape with ecotones being common. Plant species abundance, organic matter thickness and soil moisture vary across the landscape as one ecological unit grades into another. As a result, not every site encountered is easily classified into the ecological units described herein.

6.1.5 How to Read and Interpret the Ecosystem Factsheets

The site, soil and vegetation ecological descriptors that describe each ecotype are summarized using a factsheet format that is designed to provide a concise synopsis of the important ecological characteristics of each ecotype. A sufficient number of sample plots (minimum three, where possible) were targeted within these ecosystem units (ecotypes) to capture enough variation to be described for the Study Area as a whole. As such, each fact sheet represents a composite or average representation of ecotypes determined by averaging all plot data for a particular ecotype. A brief explanation of each fact sheet component is provided below.

- **Ecotype Heading**: Ecotypes are named using the potential dominant one or two "near-climax species" followed by the indicative subordinate species of a different growth form (e.g., tree / shrub / moss) for the plant community or association on which they are based. An example is Black Spruce-Labrador Tea-Feathermoss. The growth forms of different "layers" are separated by a dash (-). When more than one plant species is used to name a vegetation type from the same layer and growth form, a slash (/) is used. An example is Balsam Fir - Black Spruce Forest.
  - The names of the vegetation (plant community) types are provided in three formats:
    - By common names (Balsam Fir / Black Spruce –Feathermoss Forest);
    - By scientific names (*Abies balsamea* / *Picea mariana -Pleurozium schreberi*); and
    - By ecotype codes (BF).
- **General Ecotype Description**: A general description of the ecotype, including the geographic location, elevational range, slope percentage, aspect, micro topography and slope orientation from sampled plots.
- **Edatopic Grid**: The edatopic grid arranges all ecotypes that occur within an area into a two-way matrix of estimated soil moisture regime (SMR), and soil nutrient regime (SNR) status and communicates information on the plant communities typically associated with combinations of these grid classes, including the proportion of sampling sites within each of these classes. SMR and SNR in the edatopic grids are estimated from site and soil properties such as vegetation community and indicator plant species, as well as site (slope position, site shape and topography), and soil (drainage, humus form, texture, depth and coarse fragment content) characteristics. The grid class occupied by each ecotype represents the approximate distribution of plots belonging to each specific ecotype.
- **Photos**: Representative images (aerial, ground, detailed vegetation cover and soil profile) of the various plant associations / plant communities were selected from photographs taken at the Project site by Stantec Field Team members for most major ecotypes.
- **Summary of Ecological Condition**: A summary table of key environmental information (site and soil characteristics and vegetation structure and composition), as well as other important environmental / physical parameters associated with a site that may assist in the preliminary identification of each described ecotype is provided. An example of a summary table for ccological conditions is provided in Table 6.2.

Table 6.2 Example Summary for Ecological Condition

Ecotype Name	
Site Information	
Ecoregion:	1
Ecotype:	2
General Location:	3

Ecotype Name	
Inventory Numbers	4
Number of Sample Plots (n):	5
Site Characteristics	
Surface Expression	6
Slope Position	7
Slope	8
Aspect	9
Soil Nutrient Regime	10
Soil Moisture Regime	11
Successional Status	12
Structural Stage	13
Soil Characteristics	
Organic Thickness / LFH Thickness (cm)	14
Humus Form	15
Surface (Topsoil) Texture	16
Average Topsoil Thickness (cm)	17
Seepage	18
Drainage	19
Depth to Water Table	20
Depth to Mottles / Gleying	21
Effective Rooting Depth (cm)	22
Coarse Fragment Percent / Type	23
Depth to Bedrock	24
Parent Material	25
Soil Classification (CSSC)	26
Vegetation	
Dominant Tree Species	27
Dominant Shrub Species	28
Dominant Herb Species	29
Dominant Mosses, Liverwort, Lichen Species	30
Dominant Aquatic / Wetland Species	31
Plant Indicator Species	32
Plant Species Richness (Avg. Vascular / Avg. Non-Vascular	33

Ecotype Name	
Species At Risk / Species of Conservation Concern	34

Site Information

1. **Ecoregion:** ecoregion in which the ecotype is located.
2. **Ecotype:** ecotype name.
3. **General Location:** an overview of the geographical location of the ecotype within the Study Area.
4. **Inventory Numbers:** present all plot numbers associated with specific field sampling sites.
5. **Number of Sample Plots (n):** the total number of field sampling sites (detailed, ground and visual) for the ecotype.

Site Characteristics

6. **Surface Expression:** refers to the shape and form of the land surface (e.g., level, inclined, rolling, undulating, hummocky, ridged, steep) associated with the ecotype. Varying terrain will often have gradients of ecological condition.
7. **Slope Position:** presents the position of the site relative to the localized catchment area (i.e., crest, upper slope, middle slope, lower slope, toe, depression, or level). Indirectly relates to several other ecological factors, including wind exposure, depth of unconsolidated surficial materials, degree of soil development, erosion potential and moisture status.
8. **Slope:** approximation of the percent slope associated with the site.
9. **Aspect:** approximation the orientation of the slope associated with the site. Aspect differences can influence site temperatures and soil moisture regime. Northern aspects are generally cooler, while south and southwesterly aspects warmer and drier.
10. **Soil Moisture Regime:** presents the soil moisture regime (a synopsis of site and soil characteristics that effect soil hydrology) range encompassed by the ecotype (Appendix C).
11. **Soil Nutrient Regime:** presents the soil nutrient regime (a synopsis of site, soil and soil humus characteristics that determine soil nutrient availability) range encompassed by the ecotype (Appendix C).

12. **Successional Status:** presents the successional status (i.e., non-vegetated, pioneer seral, young seral, mature seral, overmature seral, young climax, young climatic climax, young edaphic climax, maturing climax, maturing climatic climax, maturing edaphic climax and disclimax) for the ecotype. Generally applies to ecotypes where forest succession is expected to occur.

13. **Structural Stage:** presents the structural development (sparse / bryoid, herb, shrub / herb, pole / sapling, young forest, mature forest or old forest) for the ecotype.

Soil Characteristics

14. **Organic Thickness / LFH Thickness:** is the depth of organic layer overlying the mineral substrate. It is considered an important source of macronutrients and water for plant growth.

15. **Soil Humus Form:** presents the typical soil humus forms for the ecotype forest floor. Sites with high quality litter and a rapid turnover of nutrients are potentially more productive for plant growth than sites with acidic litter.

16. **Surface Texture:** is the proportion of different-sized mineral particles contained within a soil (sand, silt and clay). Soil texture influences plant community development by effecting water- and nutrient-holding capacity, and root penetration.

17. **Average Topsoil Thickness:** is the depth of uppermost layer of soil (Ah, Ae, Ahe, or Ap horizons) and contains the highest concentration of organic matter, microorganisms and nutrients.

18. **Seepage:** groundwater seepage represents an enhanced and stable supply of soil moisture than associated upland sites, often resulting in more productive plant growth.

19. **Drainage:** describes the speed and extent to which water is removed from a mineral soil in relation to inputs and indicates the general availability of moisture. Drainage class codes follow MoELP-MoF (1998): very rapidly drained; rapidly drained; well drained; moderately-well drained; imperfectly drained; poorly drained; and very poorly drained.

20. **Depth to Water Table:** indicates where the groundwater table currently occurs. The occurrence of water at or near the ground surface is indicative of imperfectly to very poorly drained soils.

21. **Depth to Mottles / Gleying:** depth and degree of mottle development indicates how wet a soil may be at varying times during the year even in absence of water at the time of assessment. Where gleying occurs, it indicates that soil is saturated with moisture for most of the year.

22. **Effective Rooting Depth:** the volume of soil that a plant community can exploit, measured as the rooting depth range and average in centimetres. A deep, effective rooting zone can allow plants to exploit a broader range of moisture and nutrient resources.

23. **Coarse Fragment (percent cover):** gives the average in percent for the coarse fragments (gravel to boulders) in a soil. Coarse fragments reduce the volume of sand, silt and clay in the soil, which can reduce water- and nutrient-holding capacity, and effective rooting depth.

24. **Depth to Bedrock:** indicates how much unconsolidated material occurs over bedrock. Sites with less than 25 cm of unconsolidated material over bedrock represent severe limitations to plant growth.

25. **Parent Material:** presents surficial geology deposits associated with the ecotype. Provides a general indication of the physical characteristics and variability of substrates on which vegetation will grow.

26. **Soil Classification:** presents the various soil subgroups (follows the Soil Classification Working Group 1998) associated with the ecotype.

Vegetation Characteristics

27. **Dominant Tree Species:** identifies the general tree composition of the forest overstorey associated with the ecotype.

28. **Dominant Shrub Species:** identifies the dominant vegetation associated with the ecotype. Abundant species are potentially more reliable indicators of site conditions than those with low abundance.

29. **Dominant Herb Species:** identifies the dominant herbaceous vegetation associated with the ecotype. Abundant species are potentially more reliable indicators of site conditions than those with low abundance.

30. **Dominant Mosses, Liverwort, Lichen Species:** identifies the dominant non-vascular vegetation associated with the ecotype. Abundant species are potentially more reliable indicators of site conditions than those with low abundance.

31. **Dominant Aquatic / Wetland Species:** identifies the dominant vegetation associated with the ecotype. Abundant species are potentially more reliable indicators of site conditions than those with low abundance.

32. **Plant Indicator Species:** reflects the interpretive value of some plant species as "good" indicators of a particular site condition.

33. **Plant Species Richness:** the number of species recorded within ground plots with separate average values provided for vascular and non-vascular plants. Only dominant non-vascular plants, to genus or their species epithet, were recorded.

34. **Species at Risk / Species of Conservation Concern:** identifies occurrences of provincially or federally listed species at risk (i.e., designated under the federal SARA or the NL ESA), or species of conservation concern (i.e., those that are not considered species at risk but are ranked SH, S1, or S2 by the AC CDC).

- **Plant Community Diversity:** A table used to depict characteristic plant species, including scientific and common names (grouped into tree, shrub, forb, graminoid and moss / lichen layers), from the complete list of plant species found at the site. Minimum maximum, and average coverage values are provided for each species encountered within the ecotypes. Constancy refers to the frequency of occurrence of a species in the total number of ground plots used for describing the ecotype. These tables are intended as general guides to the identification of the dominant and indicator plant species used to characterize each described ecotype and are provided in Appendix B. An example is provided as Table 6.3.

Table 6.3 Ecotype Plant Species Description

Ecotype						
Scientific Name 1	Common Name 2	Growth Form 3	Minimum Cover (%) 4	Maximum Cover (%) 5	Average Cover (%) 6	Constancy (%) 7

1. **Scientific name:** the scientific binomial of each plant species recorded in the ecotype, as identified by the AC CDC (2010).
2. **Common name:** the common plant name for each species recorded in the ecotype, as identified by the AC CDC (2010).
3. **Growth form:** the following designations have been assigned to plants based on their physiognomy: tree; tall shrub; low shrub; dwarf shrub; forb; graminoid; moss; and lichen. Species may occupy one or more of the tree, tall shrub, low shrub and dwarf shrub designations depending on their height.
4. **Minimum cover (%):** the minimum percent cover for each plant species recorded in the ecotype. Percent cover is estimated as the percentage of the ground surface covered when the crowns are projected vertically. The minimum value recorded to note the presence of a species at a given site was 0.5%.
5. **Maximum cover (%):** the maximum percent cover for each plant species recorded in the ecotype.
6. **Average cover (%):** the average percent cover for each plant species recorded in the ecotype.
7. **Constancy:** the frequency of occurrence within ground plots (i.e., plant was present in x plots/total number of plots in the ecotype).

- **Rarity:** Rare elements under the protection of SARA or the NL ESA (i.e., listed as "Special Concern" in Schedule 1 of SARA; listed in Schedule 2 or 3 of SARA); or ranked as SH, S1, or S2 by the AC CDC have been identified from vascular plant species found within each ecotype.
- **Succession / Disturbance Ecology:** A brief narrative of the successional dynamics of key ecotypes and their environmental requirements. The response to disturbance by plants and the community. The principal natural and anthropogenic disturbances influencing the vegetation in the Study Area have been fire, insects and disease, and human activity.
- **Wildlife and Wildlife Habitat:** Provides a brief overview of area wildlife and their relationship to habitat components comprising each of the identified ecotypes.

Mapping of ecotypes and ecosystem units within the Study Area is provided in Appendix A.

6.2 Ecotypes and Ecosystem Units

The following are descriptions of the regional ecosystem mapping categories and ecotypes that outline the main vegetation and site characteristics found in the Central Newfoundland Forest Ecoregion that includes the Marathon Gold Study Area. These descriptions are based on field data collected during the summer of 2014.

6.2.1 Forested Ecosystem Units

6.2.1.1 CNF Ecotype 01: Balsam Fir Forest

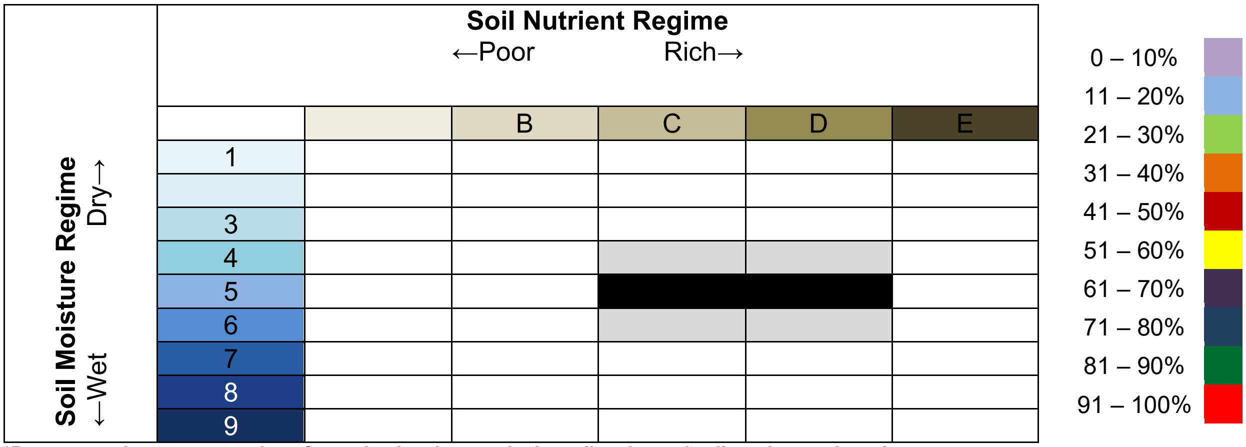
General Site Description

The Balsam Fir Forest (BF) ecotype tends to occur on level ground and in a variety of slope positions and is dominated by balsam fir. Although balsam fir forest types are generally described as being closed-canopy softwood stands that have a high component of balsam fir, other species may often provide an important component of the overstory (Meades and Moores 1994). Black spruce was an important component of the majority of field sites visited and although paper birch typically comprised a minor component of the tree canopy, it was frequently encountered within sites prescribed to this forest type. Additionally, white spruce (*Picea glauca*) was occasionally present in the overstory of the Balsam Fir Forest ecotype. The understory vegetation within this ecotype is typically comprised of minor vascular plant growth and a well-developed moss layer. Shrub cover was characteristically dominated by an understory of balsam fir, lesser amounts of black spruce and scattered occurrences of other regenerating tree species, ericaceous shrubs and deciduous shrubs. Dwarf shrubs such as creeping snowberry (*Gaultheria hispidula*) and twinflower (*Linnaea borealis*) are often common but typically of low abundance along with scattered herbaceous plants, most notably bunchberry (*Cornus canadensis*) and mountain wood-fern (*Dryopteris campyloptera*). A variety of other forbs and graminoids may also be present depending on the local moisture regime, including stiff clubmoss (*Lycopodium annotinum*), one-sided wintergreen (*Orthilia secunda*), dewberry (*Rubus pubescens*), northern oak fern (*Gymnocarpium dryopteris*), threefruit sedge

(*Carex trisperma*) and hoary sedge (*Carex canescens*). This ecotype is characterized by an almost continuous layer of moss on the forest floor, the majority of which is stairstep moss and/or Schreber's feathermoss, with lesser amounts of plume moss (*Ptilium crista-castrensis*), common broom moss (*Dicranum scoparium*), wavy-leaved broom moss (*Dicranum polysetum*), and three-lobed whipwort (*Bazzania trilobata*) being present. Peatmoss (*Sphagnum* spp.) may also be abundant in localized areas with imperfect drainage, but does not typically comprise an important component of this ecotype's understory vegetation.

Field data indicate that the Balsam Fir Forest Ecotype may comprise multiple Damman Forest Types described for the region. Alhough a majority of sites visited during the field program are best characterized as *Hylocomium-Balsam Fir (Fh) #9* or *Pleurozium-Balsam Fir (Fp) #11* forest types. The *Hylocomium-Balsam Fir* forest type, as described by Meades and Moores (1989), is considered the zonal forest type in those areas of the Central Newfoundland Ecoregion not affected by stand-replacing disturbance regimes. It is also one of the more common types in the Study Area, and is often associated with fresh to moist, nutrient-poor to medium soils with morainal (till) parent materials overlying bedrock. Soils of this ecotype are generally medium to coarse textured and often stony.

Soils associated with this ecotype are primarily Orthic Humo-Ferric Podzols, Orthic Humic Podzols and Orthic Humic Regosols derived from morainal (till) or colluvial deposits. Gravel and cobble content is generally low to moderate in surface horizons. Stone and boulder content is low to moderate, but was observed as high in soils derived from colluvial deposits. These are typically fresh, fine to medium textured soils, with soil texture varying greatly by site, but with near-surface, horizons dominated loam, clay loam, and silt loam soil textures. Profiles generally contain a well-developed Ae horizon, and may contain partially or fully cemented B-horizons (Bfc, Bhfc). Partially or fully cemented B-horizons were not encountered although Ortstein horizons that form in acid soils with high iron and organic matter are relatively common throughout the region. Lower slope seepage potential may be high for soils with restricted vertical drainage with occasional distinct mottling noted within the top 50 cm of the mineral soil surface. Gleyed Humo-Ferric Podzols, occupy mid to lower slopes with restricted vertical drainage, with Orthic and Rego Gleysols in depressional areas. Alternatively, in areas of shallow, weathered bedrock, coarser sandy loam textures may also occur. Drainage ranges from moderately well to imperfectly drained, depending on slope position, slope percent, soil depth and the occurrence of vertical drainage restrictions. This forested ecotype is generally nutrient-poor to medium, and soil moisture regime is mesic to subhygric (Figure 6-2). Humus forms are dominated by Hemimors. Organic / LFH layer thicknesses are usually in the 8 to 13 cm range. Topsoil thickness ranges from 21 to 38 cm. Site productivity is typically moderate.



***Percentage denotes proportion of sample plots in a particular soil moisture / soil nutrient regime class**

Figure 6-2 Edatopic Grid for Balsam Fir Forest Ecotype

The BF map unit occupies approximately 7% (126.9 km^2) of the Study Area (Table 6.1).

Environmental Information

A summary of the environmental information is provided in Table 6.4.

Table 6.4 Summary of Ecological Condition for Balsam Fir Forest Ecotype

Balsam Fir Forest Ecotype	
Site Information	
Ecoregion	Central Newfoundland
Ecotype	Balsam Fir-Feathermoss
Model Classification	Black Spruce / Balsam Fir Forest
Map Unit	BF
Damman Forest Site Classification Equivalent	*Hylocomium-Balsam Fir (Fh) #9 or Pleurozium-Balsam Fir (Fp) #11*
General Location	Widespread across insular Newfoundland and especially common in the Central Newfoundland Ecoregion and Red Indian Lake Subregion. One of the more common sites in the Study Area, often occupying coarse textured morainal deposits.
Number of Sample Plots (n)	n=11
Inventory Numbers	G1, G13, G17, G23, G24, V7, V10, V14, V16, V20, V33
Total Area (km^2)	126.9
Percentage of Study Area (%)	7
Site Characteristics	
Surface Expression	Gently sloping; Flat (Level)
Slope Position	Range of slope positions - Upper Slope, Mid Slope; Lower

Balsam Fir Forest Ecotype	
	Slope; Level
Slope	Variable
Aspect	North, South, West and East (Variable)
Soil Nutrient Regime	Poor (B) to Medium (C), with the majority of sites classed as medium
Soil Moisture Regime	Submesic (3) to subhygric (5)
Successional Status	Typically as stable forest communities in the maturing seral stage, although extensive areas of burned forest are present where pioneer and young seral communities of the CNF01 ecotype may exist
Structural Stage	Pole Sapling; Young Forest; Mature Forest; Old Forest
Soil Characteristics	
Organic Thickness / LFH Thickness (cm)	8-13
Humus Form	Hemimors
Surface (Topsoil) Texture	Loam; Clay loam; Silt loam
Average Topsoil Thickness (cm)	23
Seepage	Yes
Drainage	Moderately-well to Imperfectly Drained
Depth to Water Table (cm)	>50 cm
Depth to Mottles / Gleying (cm)	>50 cm
Effective Texture	Clay Loam
Effective Rooting Depth (cm)	20-30
Coarse Fragment Percent (%) and Type	<30 gravels and cobbles
Depth to Bedrock (cm)	50-100
Parent Material	Morainal (till); Colluvium
Soil Classification (CSSC):	Orthic Humo-Ferric Podzols; Gleyed Ferro-Humic Podzols; Orthic Gleysols; Rego Gleysols;
Vegetation	
Dominant Tree Species	*Abies balsamea, Picea mariana*
Dominant Shrub Species	*Abies balsamea, Picea mariana*
Dominant Herb Species	*Cornus canadensis, Dryopteris campyloptera*
Dominant Mosses, Liverwort, Lichen Species	*Hylocomium splendens, Pleurozium schreberi*
Dominant Aquatic / Wetland Species	N/A
Plant Indicator Species	-
Plant Species Richness (Avg. Vascular / Avg. Non-Vascular)	15.6 / 7.6
Species At Risk / Species of Conservation	*Scirpus cyperinus*

Balsam Fir Forest Ecotype	
Concern	

Photo 1 Balsam Fir Forest Ecotype – Overview

Photo 2 Balsam Fir Forest Ecotype –Vegetation

Photo 3 Balsam Fir Forest Ecotype –Soil Profile

Rarity

No plants under the protection of SARA or the NL ESA have been identified from surveys of the Balsam Fir Forest ecotype. However, one regionally uncommon graminoid species, cottongrass bulrush (*Scirpus cyperinus*), and ranked as *S2S3* by the AC CDC, was recorded from this ecotype.

Disturbance and Succession Ecology

The natural disturbance regime of Balsam Fir Forest ecotype is characterized by frequent, small and intermediate-scale wind events and infrequent, medium to high-severity fire regimes, with estimated return intervals ranging from 10 to 80 years. Insect epidemics and early growing-season snow press are also important disturbance factors.

Black spruce ultimately achieves dominance after stand-replacing disturbance events lead to the recruitment of pioneering hardwood species. The black spruce and balsam fir component initiates in the latter part of the early seral stage and achieves dominance in late seral stage of stand development.

6.2.1.2 CNF Ecotype 02: Black Spruce Forest

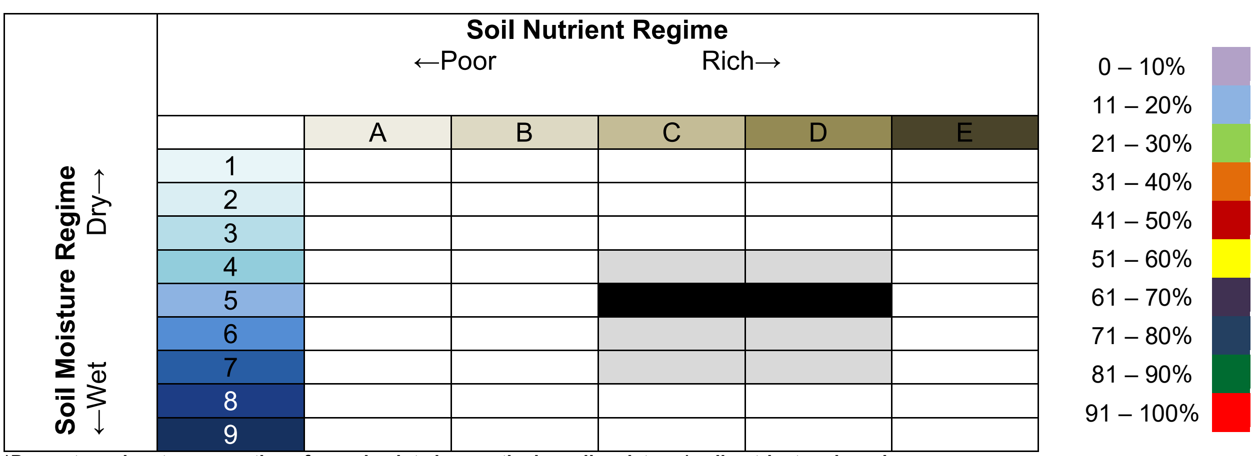
General Site Description

The Black Spruce Forest (BS) ecotype is widespread across insular Newfoundland, often associated with morainal parent materials overlying bedrock. The BS ecotype tends to occur on gently sloping (in a variety of slope positions) to level ground and is mainly associated with fresh to moist, nutrient poor soils.

Black Spruce Forest types are characterized by a moderately dense overstory of softwood cover that contains a high abundance of black spruce (Meades and Moores 1994). Balsam fir and paper birch are also typically present within the overstory, although the later may comprise a relatively minor component of the canopy. This ecotype is typically characterized by a moderately to well-developed shrub layer (e.g., tall shrubs, low shrubs, ground shrubs). Black spruce is typically the most dominant component of the shrub layer, but sheep-laurel is also often abundant and a variety of other shrubs may be common including rhodora (*Rhododendron canadense*), balsam fir and the dwarf shrubs creeping snowberry and trailing arbutus (*Epigaea repens*). A moderate to well-developed understory of herbaceous plants is typically present. Herbaceous species composition varies depending on localized moisture availability but bunchberry is typically a dominant component. Other species that are typically present or may be abundant depending on local moisture conditions include threefruit sedge, dewberry, little prickly sedge (*Carex echinata*), northern oak fern, goldthread (*Coptis trifolia*) and yellow clintonia (*Clintonia borealis*). Stairstep moss and Schreber's feathermoss provide a prominent moss carpet on well-drained sites, but are also abundant at imperfectly drained sites within this ecotype.

The majority of field sites that fall within the Black Spruce Forest ecotype most closely reflect the *Black Spruce-Feathermoss/Dry (SM/D) #15*, *Black Spruce-Feathermoss/Moist (SM/M) #17*, and *Sphagnum-Black Spruce (Ss) #12* Damman forest types (Meades and Moores 1994).

The Black Spruce Forest ecotype encompasses forests that vary considerably in their soil conditions and moisture regimes. As above, soils associated with this ecotype include Orthic Humo-Ferric Podzols, Orthic Humic Podzols and Orthic Humic Regosols derived from morainal (till) or colluvial deposits; however, the prevelance of Gleyed Ferro-Humic Podzols, Orthic Humic Podzols, Orthic Gleysols and Rego Gleysols is a reflection of the varied moisture regimes in which this ecotype may occur. Gravel and cobble content is generally low to moderate in surface horizons. Stone and boulder content is low to moderate, but was observed as high in soils derived from colluvial deposits. Soils are typically somewhat moist and moist to somewhat wet, and fine to medium textured, with soil texture varying by site. Near-surface horizons (topsoils) are dominated by loam, clay loam, and silt loam soil textures. Profiles generally contain a well-developed Ae horizon, with BC and C-horizons often mottled because of restricted drainage and/or poor aeration of subsoil and shallow bedrock. These soils may also contain partially or fully cemented B-horizons (Bfc, Bhfc). Lower slope seepage potential may be high for soils with restricted vertical drainage (cemented hardpans - Ortstein horizons) with occasional distinct mottling noted within the top 50 cm of the mineral soil surface. In areas of shallow, near surface, weathered bedrock, coarser sandy loam textures may also occur. Drainage ranges from moderately well to imperfect depending on slope position, slope percent, soil depth and the occurrence of vertical drainage restrictions. This forested ecotype is generally nutrient-poor to medium, and soil moisture regime is mesic to subhygric (Figure 6-3). Humus forms are dominated by Hemimors. Organic / LFH layer thicknesses are usually in the 8 to 13 cm range. Site productivity is typically moderate.



***Percentage denotes proportion of sample plots in a particular soil moisture / soil nutrient regime class**

Figure 6-3 Edatopic Grid for Black Spruce-Feathermoss Ecotype

The BS map unit occupies approximately 13% (233.1 km^2) of the Study Area (Table 6.1).

Environmental Information

A summary of the environmental information is provided in Table 6.5.

Table 6.5 Summary of Ecological Condition for Black Spruce Forest (BS) Ecotype

Black Spruce Forest Ecotype	
Site Information	
Ecoregion	Central Newfoundland
Ecotype	Black Spruce Forest
Model Classification	Black Spruce / Balsam Fir Forest
Map Unit	BS
Damman Forest Site Classification Equivalent	*Black Spruce-Feathermoss/Dry (SM/D) #15, Black Spruce-Feathermoss/Moist (SM/M) #17, and Sphagnum-Black Spruce (Ss) #12*
General Location	Widespread across insular Newfoundland, and especially common in the Central Newfoundland Ecoregion and Red Indian Lake Subregion. One of the more common sites in the Study Area, often-occupying coarse-textured morainal deposits.
Number of Sample Plots (n)	n=5
Inventory Numbers	G1, V23, V27, V37, V39
Total Area (km^2)	233.1
Percentage of Study Area (%)	13
Site Characteristics	
Surface Expression	Gently sloping; flat
Slope Position	Range of slope positions - Upper Slope, Mid Slope; Lower Slope; Level
Slope	Variable
Aspect	North, South, East, and West (Variable)
Soil Nutrient Regime	Poor (B) to medium (C), with the majority of sites classed as medium
Soil Moisture Regime	Submesic (3) to subhygric (5)
Successional Status	Typically as stable forest communities in the maturing seral stage, although extensive areas of burned forest are present where pioneer and young seral communities of the CNF03 ecotype exist
Structural Stage	Pole Sapling; Young Forest; Mature Forest
Soil Characteristics	
Organic Thickness / LFH Thickness (cm)	13
Humus Form	Hemimors
Surface (Topsoil) Texture	Loam; Clay loam; Silt loam

Black Spruce Forest Ecotype	
Average Topsoil Thickness (cm)	21
Seepage	Yes
Drainage	Moderately-well to Imperfectly Drained
Depth to Water Table (cm)	>50
Depth to Mottles / Gleying (cm)	>50
Effective Texture	Clay Loam
Effective Rooting Depth (cm)	20-30
Coarse Fragment Percent (%) and Type:	<30 gravels and cobbles
Depth to Bedrock (cm) (cm)	50-100
Parent Material	Morainal (till); Colluvium
Soil Classification (CSSC)	Orthic Humo-Ferric Podzols; Gleyed Ferro-Humic Podzols; Orthic Gleysols; Rego Gleysols
Vegetation	
Dominant Tree Species	*Picea mariana*
Dominant Shrub Species	*Picea mariana, Gaultheria hispidula, Kalmia angustifolia*
Dominant Herb Species	*Cornus canadensis, Carex trisperma*
Dominant Mosses, Liverwort, Lichen Species	Hylocomium splendens, Pleurozium schreberi
Dominant Aquatic / Wetland Species	N/A
Plant Indicator Species	-
Plant Species Richness (Avg. Vascular / Avg. Non-Vascular)	35.0 / 7.0
Species At Risk / Species of Conservation Concern	None encountered

Photo 4 Black Spruce Forest Ecotype – Overview

Photo 5 Black Spruce Forest Ecotype – Typical Vegetation

Photo 6 Black Spruce Forest Ecotype – Typical Soil Profile

Rarity

No plants under the protection of SARA or the NL ESA; or ranked as SH, S1, or S2 by the AC CDC have been identified from this ecotype.

Disturbance and Succession Ecology

Nutrient poor to medium soils of the Black Spruce Forest ecotype typically give rise to an edaphic climax community with an overstory dominated by black spruce and balsam fir. The natural disturbance regime is characterized by infrequent, medium to high-severity fire regimes, with even aged forests typically following these stand-replacing disturbances. The estimated return interval ranges from 10 to 80 years. In the absence of stand-level disturbance, it is likely that black spruce will maintain itself as the dominant canopy species.

6.2.1.3 CNF Ecotype 03: Kalmia-Black Spruce Forest

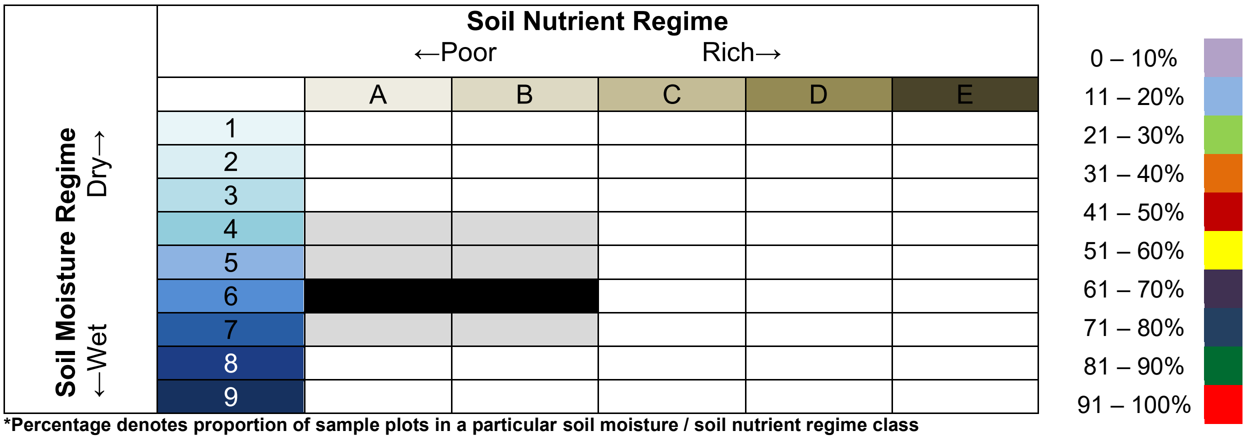
General Site Description

The Kalmia-Black Spruce Forest (KB) ecotype occurs on ridges and upper slope positions where soil depths are typically shallow and/or stony, and exposed bedrock may be present. These sites are typically nutrient poor, dry to moist and exposed to desiccating winds, which also remove protective snow cover during winter. Soil moisture increases with organic accumulation, particularly areas where shallow, near-surface bedrock restricts soil drainage. As such, these sites are typically harsh environments for plant growth. This ecotype typically occurs in association with Kalmia Heath but is differentiated based on a patchy, stunted tree layer with many areas having intermediate characteristics.

Kalmia-Black Spruce Forest ecotype's represent open black spruce forests with an understory dominated by numerous black spruce layers, ericaceous shrubs and lichens and a sparse cover of herbaceous vegetation (Meades and Moores 1994). Balsam fir and tamarack (*Larix laricina*) may also contribute to the tree layer. Scrubby black spruce and sheep-laurel are the dominant components of the shrub layer, with other prominent species including rhodora, late lowbush blueberry (*Vaccinium angustifolium*) and creeping snowberry. Bunchberry is typically the most abundant component of the limited herbaceous layer, with other relatively common species including goldthread and threefruit sedge. Schreber's feathermoss dominates a well-developed moss layer, with peatmoss present in localized depressions with imperfect drainage and wavy-leaved broom moss and three-lobed whipwort scattered throughout the more prevalent upland conditions that characterize the ecotype. Reindeer lichens (*Cladina* spp.) are typically common in patches throughout this ecotype with gray reindeer lichen (*C. rangiferina*) being most abundant, followed by lesser amounts of green reindeer lichen (*C. mitis*), reindeer lichen (*C. arbuscula*), star-tipped reindeer lichen (*C. stellaris*) and various species of cladonia lichen (*Cladonia* spp.).

This ecotype is consistent with the *Kalmia-Black Spruce Forest* group described by Meades and Moores (1989), which occurs in association with nutrient-poor soils over a range of moisture conditions. Although sites are typically dry, proximity of bedrock to the surface results in localized areas of imperfect drainage and associated vegetation. Field sites within this ecotype most typically approximate the *Kalmia-Black Spruce (SK) #20* type described by Meades and Moores (1989). They may also strongly reflect the *Sphagnum-Kalmia-Black Spruce (SKs) #23* and *Cladonia-Kalmia-Black Spruce (SKc) #21* types and may verge towards *Kalmia Heath (K) #33* where tree cover is particularly limited.

Soils associated with this ecotype are typically derived from morainal (till) deposits. Shallow soils and near surface, weathered bedrock are prevalent resulting in moderate to high gravel and cobble content in surface horizons. Stone and boulder content is moderate, increasing in crest and upper slope positions. Moist, medium to coarse-textured soils, with near surface textures dominated by sandy loams. Drainage ranges from rapidly drained upland organic Folisols to moderately well drained Orthic Humo-Ferric and Ferro-Humic Podzols. Fragmental colluvial deposits supporting upland organic Folisols are also associated with this ecotype. Profiles generally contain interrupted Ae horizons. The ecotype is nutrient-poor, and soil moisture regime is submesic to mesic (Figure 6-4). Humus forms are dominated by Hemimors. Organic / LFH layer thicknesses are usually in the 8-20 cm range. Site productivity is typically low.



*Percentage denotes proportion of sample plots in a particular soil moisture / soil nutrient regime class

Figure 6-4 Edatopic Grid for Kalmia-Black Spruce Forest Ecotype

The combined KF and KH map unit occupies approximately 11% (208.8 km^2) of the Study Area (Table 6.1).

Environmental Information

A summary of the environmental information is provided in Table 6.64.

Table 6.6 Summary of Ecological Condition for Kalmia-Black Spruce Forest Ecotype

Kalmia-Black Spruce Forest Ecotype	
Site Information	
Ecoregion	Central Newfoundland
Ecotype	Kalmia-Black Spruce Forest
Model Classification	Kalmia-Black Spruce Forest
Map Unit	KB
Damman Forest Site Classification Equivalent	*Kalmia-Black Spruce (SK) #20; Sphagnum-Kalmia-Black Spruce (SKs) #23; and Cladonia-Kalmia-Black Spruce (SKc) #21*
General Location	Ecotype is widespread and floristically consistent across the boreal range, often associated with shallow soils on bedrock ridges and outcrops
Number of Sample Plots (n)	n=5
Inventory Numbers	G3, G11, G28, V4, V31
Total Area (km^2)	208.8
Percentage of Study Area (%)	11

Kalmia-Black Spruce Forest Ecotype	
Site Characteristics	
Surface Expression	Ridge; Gently Sloping
Slope Position	Range of slope positions - Upper Slope, Mid Slope; Lower Slope; Level
Slope	Variable
Aspect	Variable
Soil Nutrient Regime	Poor (B) to Medium (C), with the majority of sites classed as Poor
Soil Moisture Regime	Submesic (4) to Subhygric (6)
Successional Status	Edaphic Climax
Structural Stage	Most stands are mid-successional but this ecotype can be expressed at a variety (early to late) of successional stages.
Soil Characteristics	
Organic Thickness / LFH Thickness (cm)	8-20
Humus Form	Hemimor; Humimor
Surface (Topsoil) Texture	Sandy Loam; Loam
Average Topsoil Thickness (cm)	22
Seepage	Yes
Drainage	Moderately-well to imperfectly drained
Depth to Water Table (cm)	<50
Depth to Mottles / Gleying (cm)	None
Effective Texture	Loam
Effective Rooting Depth (cm)	0-30
Coarse Fragment Percent (%) and Type	<30 gravels and cobbles
Depth to Bedrock (cm)	<100
Parent Material	Morainal (till); Colluvium
Soil Classification (CSSC)	Orthic Humo-Ferric Podzols, Organic Folisols
Vegetation	
Dominant Tree Species	*Picea mariana, Abies balsamea*
Dominant Shrub Species	*Kalmia angustifolia, Picea mariana, Rhododendron canadense, Vaccinium angustifolium*
Dominant Herb Species	*Cornus canadensis, Carex trisperma*
Dominant Mosses, Liverwort, Lichen Species	*Pleurozium schreberi, Cladina rangiferina, Sphagnum spp.*
Dominant Aquatic / Wetland Species	N/A
Plant Indicator Species	-

Kalmia-Black Spruce Forest Ecotype	
Plant Species Richness (Avg. Vascular / Avg. Non-Vascular)	20.7 / 9.3
Species At Risk / Species of Conservation Concern	None encountered

Photo 7 Kalmia-Black Spruce Forest Ecotype – Ground View (mesic site)

Photo 8 Kalmia-Black Spruce Forest Ecotype – Typical Vegetation

Photo 9 Kalmia-Black Spruce Forest Ecotype – Typical Soil Profile

Rarity

No plants under the protection of SARA or the NL ESA; or ranked as SH, S1, or S2 by the AC CDC have been identified from this ecotype.

Disturbance and Succession Ecology

Kalmia-Black Spruce Forest sites are relatively stable and less prone to natural disturbance regimes. Fire frequency is low, and fire severity is also low owing to a lack of flash fuels (woody debris) and sometimes rocky, gravelly nature of the sites. The KF ecotype is largely maintained by exposure, limiting soil conditions sites and early growing-season snow press.

Early seral stages are represented by a dominance of ericaceous shrubs where stand-replacing fires have occurred; and a mix of patchily distributed black spruce, ericaceous and deciduous shrubs where mixed-severity burns have occurred. In stand-replacement burns, black spruce is often slow to re-establish. Ericaceous shrubs, including common Labrador tea (*Rhododendron groenlandicum*), late lowbush blueberry, bog bilberry (*Vaccinium uliginosum*) and partridgeberry (*Vaccinium vitis-idaea*), usually precedes the establishment of canopy-forming trees following stand replacement burns until the site has regained warmer, moister conditions and less exposure to frost. Succession advances very slowly owing to the short growing season, deep lingering snows and low soil temperatures. As these sites are not expected to succeed to later successional stages, it is often considered a type of edaphic climax.

6.2.1.4 CNF Ecotype 04: Kalmia Heath

General Site Description

The Kalmia Heath (KH) Ecotype occurs on the crests of hills and ridges where bedrock is exposed or near surface. Drainage was predominantly rapid, with moisture regimes of xeric to submesic. Nutrient regime typically ranged from very poor to poor. The dominant soil subgroup within this ecosystem unit was that of Orthic Regosol, with the majority of soil inspection sites exhibiting almost no soil development. These sites are typically infertile, very dry and exposed to desiccating winds, which also remove protective snow cover during winter. As such, these areas are harsh environments for plants. This ecotype typically occurs in association with the Kalmia-Black Spruce Forest ecotype and has been primarily differentiated by the absence of a tree layer, but many areas have intermediate characteristics. In areas of open heath, climatic exposure, in particular winter snow depth, is an important determining factor in overall vegetation species composition and structure. Soil fertility is typically masked by a deep organic layer characteristic of most heath types (Meades and Moore 1999).

The Kalmia Heath ecotype closely approximates the *Kalmia Heath (K) #33* type described by Meades and Moores (1989) and is characterized by an absence of tree cover and abundant cover of shrubs. This ecotype occurs on the crest of exposed hills and grades into the Kalmia-Black Spruce Forest ecotype, often resembling the *Cladonia-Kalmia-Black Spruce (SKc) #21* Damman type represented therein. The prominent cover of low and ground shrubs that characterize this ecotype is primarily comprised of stunted black spruce along with sheep-laurel and rhodora. Other low-lying shrubs are also commonly present but are typically much less abundant, including late lowbush blueberry, black crowberry (*Empetrum nigrum*), leatherleaf (*Chamaedaphne calyculata*), balsam fir and creeping snowberry. Although of minor abundance, scattered forbs and graminoids are present and reflect both very dry and imperfectly drained soil conditions as a result of the shallow soils that characterize the ecotype. Although of intermittent occurrence, the following herbaceous species were most commonly encountered within the Kalmia Heath ecotype during field surveys: bunchberry, northern pitcher-plant (*Sarracenia purpurea*), goldthread, cloudberry (*Rubus chamaemorus*), stiff clubmoss, northern starflower (*Trientalis borealis*), deergrass (*Trichophorum caespitosum*), threefruit sedge, few-flowered sedge (*Carex pauciflora*) and few-seeded sedge (*Carex oligosperma*). A moderate cover of both mosses and lichens is present within this ecotype. Moss coverage is primarily comprised of Schreber's feathermoss and other feathermosses in dry areas and by peatmoss in localized depressions. The prominent cover of lichens is provided by gray reindeer lichen, reindeer lichen, and star-tipped reindeer lichen, with lesser amounts of other species (including *Cladonia* spp. and *Cetraria* spp.).

Soils associated with this ecotype are typically derived from morainal (till) deposits. Shallow soils and near-surface, weathered bedrock is prevalent resulting in moderate to high gravel and cobble content in surface horizons. Stone and boulder content is moderate, increasing in crest and upper slope positions. Moist, medium to coarse-textured soils, with near surface textures dominated by sandy loams. Drainage ranges from rapidly drained upland organic Folisols to moderately well drained Orthic Humo-Ferric and Ferro-Humic Podzols. Fragmental colluvial deposits supporting upland organic Folisols are also associated with this ecotype. The ecotype is nutrient-poor, and soil moisture regime is submesic to mesic (Figure 6-5). Organic / LFH layer thicknesses are usually in the 4 to 14 cm range. Site productivity is typically low.

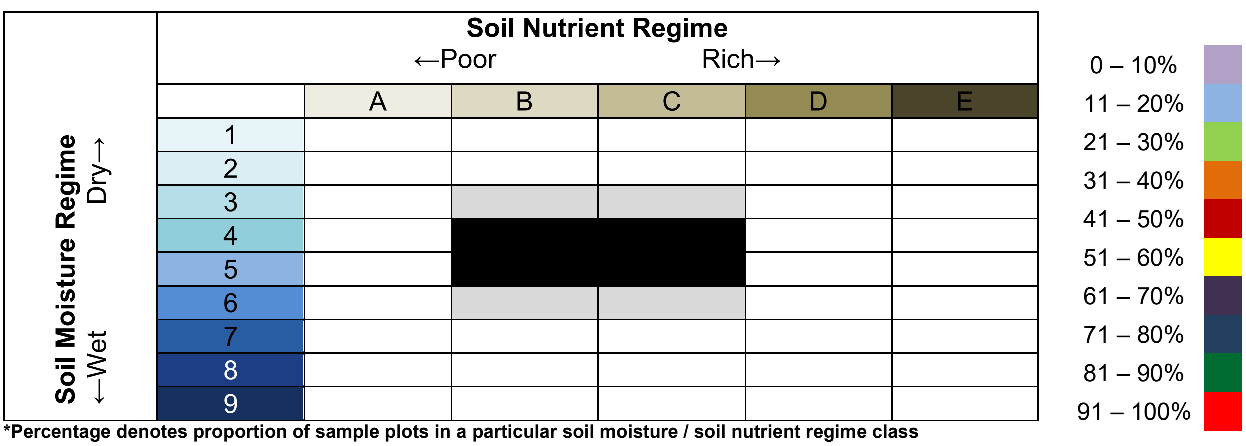


Figure 6-5 Edatopic Grid for Kalmia Heath Ecotype

The combined KF and KH map unit occupies approximately 11% (208.8 km^2) of the Study Area (Table 6.1).

Environmental Information

A summary of the environmental information is provided in Table 6.7.

Table 6.7 Summary of Ecological Condition for Kalmia Heath Ecotype

Kalmia Heath Ecotype	
Site Information	
Ecoregion	Central Newfoundland Forest
Ecotype	Kalmia Heath
Model Classification	Kalmia-Black Spruce Woodland
Map Unit	KH
Damman Forest Site Classification Equivalent	*Kalmia Heath (K) #33*
General Location	Ecotype is widespread and floristically consistent across the boreal range, often associated with shallow soils on bedrock ridges and outcrops
Number of Sample Plots (n)	n=6
Inventory Numbers	G4, G6, G9, V2, V21, V28
Total Area (km^2)	208.8
Percentage of Study Area (%)	11
Site Characteristics	
Surface Expression	Ridge; Hummock; Undulating; Gently Sloping
Slope Position	Crest; Upper Slope
Slope	Variable
Aspect	Variable
Soil Nutrient Regime	Poor (B) to Medium (C), with the majority of sites classed as Poor
Soil Moisture Regime	Submesic (3) to mesic (4)
Successional Status	Edaphic Climax
Structural Stage	Most stands are mid-successional but this ecotype may be expressed at a variety of successional stages - early to late.
Soil Characteristics	
Organic Thickness / LFH Thickness (cm)	6-14
Humus Form	Hemimors; Humimors
Surface (Topsoil) Texture	Sandy Loam to Loam
Average Topsoil Thickness (cm)	5
Seepage	
Drainage	Well to moderately-well drained
Depth to Water Table (cm):	<100
Depth to Mottles / Gleying (cm)	None
Effective Texture	Loam

Kalmia Heath Ecotype	
Effective Rooting Depth (cm)	0-30
Coarse Fragment Percent (%) and Type	30-50 gravels and cobbles
Depth to Bedrock (cm)	<100
Parent Material	Morainal (till); Colluvium
Soil Classification (CSSC)	Organic Folisols, Orthic Humo-Ferric Podzols
Vegetation	
Dominant Tree Species	-
Dominant Shrub Species	*Picea mariana, Kalmia angustifolia, Rhododendron canadense, Empetrum nigrum, Vaccinium angustifolium*
Dominant Herb Species	*Cornus canadensis, Trichophorum caespitosum, Sarracenia purpurea*
Dominant Mosses, Liverwort, Lichen Species	*Pleurozium schreberi ,Cladina rangiferina, Cladina arbuscula, Cladina stellaris*
Dominant Aquatic / Wetland Species	N/A
Plant Indicator Species	-
Plant Species Richness (Avg. Vascular / Avg. Non-Vascular)	20.3 / 10.7
Species At Risk / Species of Conservation Concern	None encountered

Photo 10 Kalmia Heath Ecotype –Ground View

Photo 11 Kalmia Heath Ecotype – Vegetation

Photo 12 Kalmia Heath – Typical Soil Profile

Rarity

No plants under the protection of SARA or the NL ESA; or ranked as SH, S1, or S2 by the AC CDC have been identified from this ecotype.

Disturbance and Succession Ecology

Similar to the Kalmia-Black Spruce Forest ecotypes described above, the Kalmia Heath ecotypes are relatively stable and less prone to natural disturbance regimes (e.g., fire, wind). As previously discussed, the Kalmia Heath ecotype is maintained primarily by exposure, and limiting soil conditions.

Early seral stages are represented by a dominance of ericaceous shrubs; and may include a mix of patchily distributed black spruce, ericaceous shrubs where mixed-severity burns have occurred. As these sites are not expected to succeed to later successional stages, the Kalmia Heath ecotype is often considered a type of edaphic climax.

6.2.1.5 CNF Ecotype 05: Mixedwood Forest

General Site Description

The Mixedwood Forest (MW) Ecotype represents an early mid-successional stage ecotype and is intended to characterize stands with an overstory dominated by balsam fir, often with a substantial component of white birch. Openings in the forest canopy often give way to extensive conifer regeneration. It is typical of a range of slope positions, but generally observed on moderately well to well drained, mid to upper slopes. Soils are often fresh to moist, nutrient medium and of variable texture, often on substrates derived from morainal (till) and colluvial deposits. The current extent of this ecotype in the Study Area is moderate.

The Mixedwood Forest Ecotype is characterized by a well-developed overstory dominated by balsam fir and white birch. Other tree species may be present in lesser amounts, including white spruce. The structure and species composition of the understory is largely shaped by canopy structure and soil attributes. Stands with an open tree canopy often have a well-developed cover of red raspberry in the understory whereas regenerating tree species provide a diffuse shrub layer within more closed-canopy stands. A variety of other shrubs may occur in the understory including scattered Canada yew (*Taxus canadensis*), mountain maple (*Acer spicatum*) and the dwarf shrubs twinflower (*Linnaea borealis*) and creeping snowberry. The character of the herbaceous layer varies considerably with the density of the tree canopy but pteridophytes are typically dominant, particularly mountain wood-fern (*Dryopteris campyloptera*) and lesser amounts of evergreen woodfern (*Dryopteris intermedia*). Bunchberry is also a typical dominant on the forest floor with a variety of other forbs and graminoids also being present depending on local site conditions, including wood reedgrass (*Cinna latifolia*), northern starflower, dewberry, northern oak fern and small enchanter's nightshade (*Circaea alpina*). Moss cover varies with canopy structure, the abundance of hardwood species, and related amounts of leaf litter on the forest floor but is typically patchy. Stairstep moss and wavy-leaved broom moss are typically dominant, with lesser amounts of Schreber's feathermoss, common broom moss, and other species (e.g., *Rhytidiadelphus* sp.) being present. Lichens are generally absent from the forest floor.

Mixedwood stands encountered during field surveys fall within various Damman Balsam Fir Forest types, particularly *Dryopteris-Hylocomium-Balsam Fir (Fdh) #5, Equisetum-Rubus-Balsam Fir (Fre) #1, Pleurozium-Balsam Fir (Fp) #11,* and *Rubus-Balsam Fir (Fr) #2*. Although not encountered at any of the survey site, trembling aspen is known to be more prominent in the Central Newfoundland Ecoregion than in other parts of the province (Meades and Moores 1994) and occurrences of this species were observed during field surveys. Some of the richer sites within the region have been described as being dominated by trembling aspen and paper birch (Meades and Moores 1994) and such hardwood-dominated stands have potential to occur within the Study Area for the Project.

Soils associated with this ecotype are primarily Orthic Humo-Ferric Podzols and Ferro-Humic Podzols along with their Gleyed variants., Orthic Humic Podzols and Orthic Humic Regosols derived from morainal (till) or colluvial deposits are also common. Gravel and cobble content is generally low to moderate in surface horizons. Stone and boulder content is low to moderate, and high in soils derived from colluvial deposits. These are typically fresh, fine to medium textured soils, with soil texture varying greatly by site, but with near-surface horizons dominated by loam, clay loam and silt loam soil textures. Profiles generally contain a well-developed Ae horizon, and may contain partially or fully cemented B-horizons (Bfc, Bhfc). Partially or fully cemented B-horizons were not encountered, although Ortstein horizons that form in acid soils with high iron and organic matter are relatively common throughout the region. Lower slope seepage potential may be high for soils with restricted vertical drainage, with occasional distinct mottling noted within the top 50 cm of the mineral soil surface. Gleyed Humo-Ferric Podzols, occupy mid to lower slopes with restricted vertical drainage, with Orthic and Rego Gleysols in depressional areas. Drainage is variable and can range from imperfect to well-drained depending on slope position, slope percent, soil depth and the occurrence of vertical drainage restrictions. Soils may possess a range of soil nutrient conditions but is frequently in areas with medium soil fertility. Moisture and nutrient levels are often enhanced in these soils as a result of seepage inputs or perched water, occasionally promoting development of thin Ahe or Ah horizons. An edaphic grid for this ecotype is presented in Figure 6.6. Humus forms are dominated by Hemimors and Humimors, but Mormoders can also occur as a result of hardwood litter inputs.

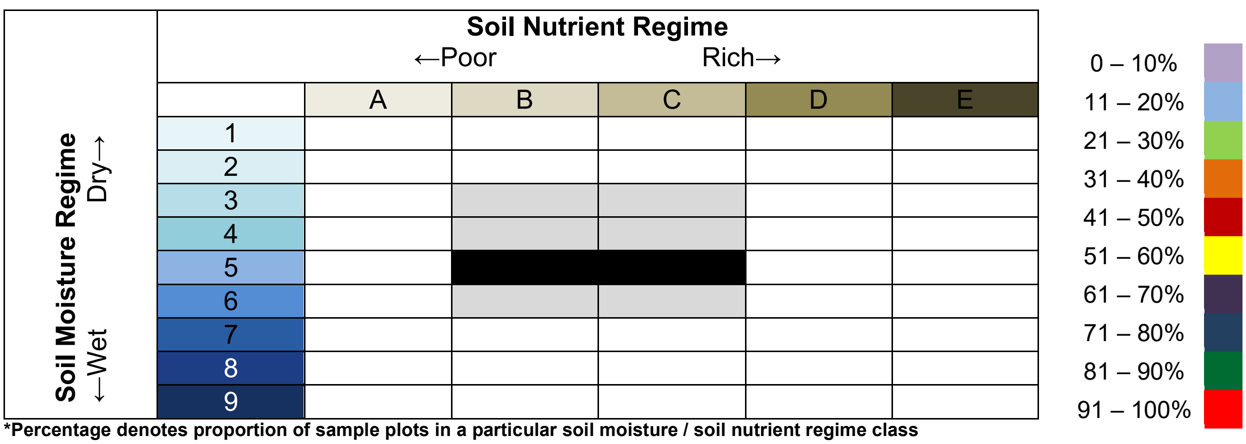


Figure 6-6 Edatopic Grid for Mixedwood Forest Ecotype

The Mixedwood Forest map unit occupies approximately 10% (179.3 km^2) of the Study Area (Table 6.1).

Environmental Information

A summary of the environmental information is provided in Table 6.8.

Table 6.8 Summary of Ecological Condition for Mixedwood Forest Ecotype

Mixedwood Forest Ecotype	
Site Information	
Ecoregion	Central Newfoundland Forest (CNF)
Ecotype	Mixedwood Forest
Model Classification	Mixedwood Forest
Map Unit	MW
Damman Forest Site Classification Equivalent	*Dryopteris-Hylocomium-Balsam Fir (Fdh) #5; Equisetum-Rubus-Balsam Fir (Fre) #1; Pleurozium-Balsam Fir (Fp) #11; and Rubus-Balsam Fir (Fr) #2*
General Location	Mainly on slopes, associated with fresh, nutrient medium soils of glacial origin (morainal) and/or colluvial deposits; predominantly as inclusions within the broader coniferous forest.
Number of Sample Plots (n)	n=7
Inventory Numbers	G2, G15, G18, V3, V15, V17, V43
Total Area (km^2)	179.3
Percentage of Study Area (%)	9.8
Site Characteristics	
Surface Expression	Undulating, Rolling, Hummocky
Slope Position	Range of slope positions - Upper Slope, Mid Slope; Lower Slope; Level
Slope	Variable
Aspect	East, West
Soil Nutrient Regime	Medium
Soil Moisture Regime	Submesic to subhygric
Successional Status	Early to mid-successional
Structural Stage	Young to mature forest
Soil Characteristics	
Organic Thickness / LFH Thickness (cm)	6-12
Humus Form	Hemimors, humimors and mormoders
Surface (Topsoil) Texture	Sandy Loam to loam
Average Topsoil Thickness (cm)	19
Seepage	Possible
Drainage	Well to imperfect
Depth to Water Table (cm)	50-100
Depth to Mottles / Gleying (cm)	None
Effective Texture	Loam
Effective Rooting Depth (cm)	25-50
Coarse Fragment Percent (%) and Type	<50 gravels and cobbles

Mixedwood Forest Ecotype	
Depth to Bedrock (cm)	>100
Parent Material:	Morainal (till), Colluvium, Fluvial
Soil Classification (CSSC):	Orthic Humo-Ferric and Ferro-Humic Podzols;
Vegetation	
Dominant Tree Species	*Abies balsamea, Betula papyrifera, Picea glauca*
Dominant Shrub Species	*Rubus idaeus, Abies balsamea*
Dominant Herb Species	*Dryopteris campyloptera, Cornus canadensis*
Dominant Mosses, Liverwort, Lichen Species	*Hylocomium splendens, Dicranum polysetum, Pleurozium schreberi, Dicranum scoparium*
Dominant Aquatic / Wetland Species	N/A
Plant Indicator Species	-
Plant Species Richness (Avg. Vascular / Avg. Non-Vascular)	20.0 / 7.7
Species At Risk / Species of Conservation Concern	*Poa saltuensis*

Photo 13 Mixedwood Forest Ecotype – Ground View

Photo 14 Mixedwood Forest Ecotype –Vegetation

Photo 15 Mixedwood Forest Ecotype – Typical Soil

Rarity

No plants under the protection of SARA or the NL ESA have been identified from this ecotype, but one regionally uncommon graminoid, forest bluegrass (*Poa saltuensis*), and ranked as *S2S3* by the AC CDC, was recorded within the Mixedwood Forest ecotype.

Disturbance and Succession Ecology

Stand-replacing disturbances such as fire, windthrow, insect epidemics and harvesting are the primary disturbances that affect these communities.

The MW ecotype is considered a mid-seral plant community for the CNF ecoregion and usually precedes the establishment of canopy forming trees – balsam fir; following die-off or senescence of the short-lived and shade-intolerant white birch. Given enough time between disturbances, sites characterized by the MW ecotype could be expected to succeed to mature and overmature CNF 02 sites.

6.2.1.6 CNF Ecotype 05: Regenerating Forest

General Site Description

As the name implies, the Regenerating Forest (RF) ecotype represents post-disturbance sites in which tree cover has been greatly reduced or eliminated due to varied stand-replacing disturbances, including fire, windthrow, insect epidemics and timber harvesting. Historical activities, including timber harvesting, and to a lesser extent mineral exploration and extraction, are important factors determining the abundance of the Regenerating Forest ecotype in the Study Area. Numerous stand-replacing fires have occurred in northern sections of the Central Newfoundland Forest ecoregion (South 1983), which includes upland sites throughout the Study Area. Such mixed- and high-severity fire regimes are usually wind-driven, with large, high-severity fires capable of creating medium to large burned over patches on the landscape. Black spruce is typically slow to establish after fire and is replaced by post-fire tree and shrub species that have evolved mechanisms for rapid regeneration within these burn patches. Depending on site conditions and the severity of the disturbance regime, sites may succeed to Black Spruce or Mixedwood ecotypes before returning to mature conifer cover, presumably Balsam Fir Forest.

At this stage, tree cover generally consists of isolated patches of regenerating trees, particularly black spruce and balsam fir, with scattered paper birch. These trees and ericaceous species typically form a prominent shrub layer. Sheep laurel is often abundant, as is late lowbush blueberry. Additional ericaceous dwarf shrubs are also often abundant, including partridgeberry (*Vaccinium vitis-idaea*) and creeping snowberry, along with scattered hardwood shrubs, particularly speckled alder (*Alnus incana*) and fire cherry (*Prunus pensylvanica*). A moderately developed herbaceous layer is typically present, with bunchberry being a common dominant and other species being occasionally abundant, including stiff clubmoss, bristly sarsaparilla (*Aralia hispida*) and yellow clintonia. Non-vascular plant cover is comprised of a moderately well-developed moss layer dominated by feathermosses, with crustose lichens also being prevalent at the drier sites.

For the most part, soils are the same as those that existed prior to the stand-replacing disturbance event and described for mesic Balsam Fir Forest or Black Spruce Forest sites, except that forest floor horizons are thinner on burned sites. An edaphic grid for this ecotype is presented in Figure 6.7.

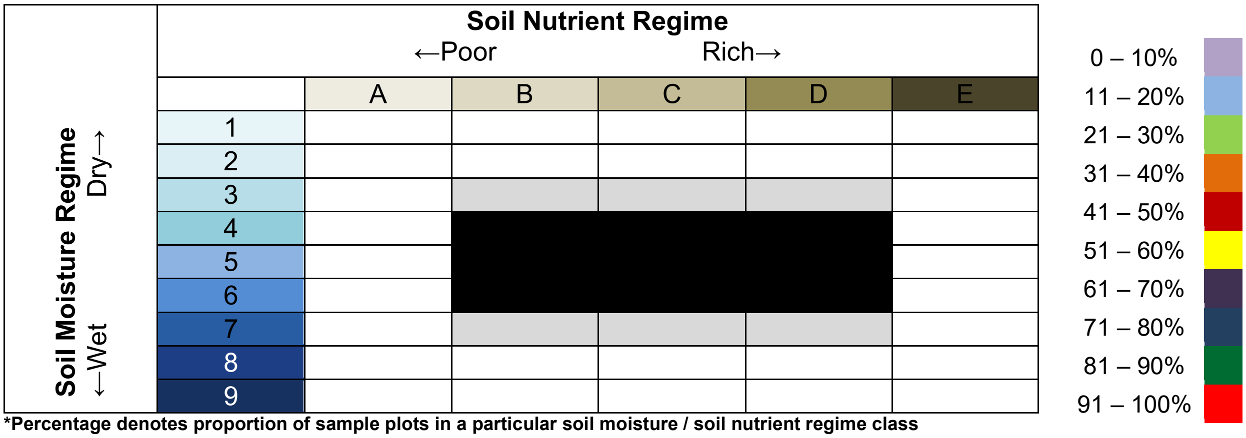


Figure 6-7 Edatopic Grid for Regenerating Forest Ecotype

The Regenerating Forest (RF) ecotype occupies approximately 8% (139.5 km^2) of the Study Area (Table 6.1).

Environmental Information

A summary of the environmental information is provided in Table 6.9.

Table 6.9 Summary of Ecological Condition for Regenerating Forest Ecotype

Regenerating Forest Ecotype	
Site Information	
Ecoregion	Central Newfoundland Forest (CNF)
Ecotype	Regenerating Forest
Model Classification	Regenerating Forest
Map Unit	RF
Damman Forest Site Classification Equivalent	n/a
General Location	Variable
Number of Sample Plots (n)	n=4
Inventory Numbers	-
Total Area (km^2)	139.5
Percentage of Study Area (%)	7.6
Site Characteristics	
Surface Expression	Undulating, Rolling, Hummocky
Slope Position	Range of slope positions - Upper Slope, Mid Slope; Lower Slope; Level
Slope	Variable

Regenerating Forest Ecotype	
Aspect	North, South, West and East (Variable)
Soil Nutrient Regime	Poor to Medium
Soil Moisture Regime	Submesic to subhygric
Successional Status	Early seral
Structural Stage	Young Forest
Soil Characteristics	
Organic Thickness / LFH Thickness (cm)	-
Humus Form	Hemimors and humimors
Surface (Topsoil) Texture	Silt Loam to loam
Average Topsoil Thickness (cm)	19
Seepage	Possible
Drainage	Well to imperfect
Depth to Water Table (cm)	50 to 100
Depth to Mottles / Gleying (cm)	None
Effective Texture	Loam
Effective Rooting Depth (cm)	25-50
Coarse Fragment Percent (%) and Type	<30 gravels and cobbles
Depth to Bedrock (cm)	>100
Parent Material:	Morainal (till), Colluvium
Soil Classification (CSSC):	Orthic and Orstein Humo-Ferric and Ferro-Humic Podzols
Vegetation	
Dominant Tree Species	*Picea mariana, Abies balsamea, Betula papyifera*
Dominant Shrub Species	*Kalmia angustifolia, Vaccinium angustifolium*
Dominant Herb Species	*Cornus canadensis*
Dominant Mosses, Liverwort, Lichen Species	*Pleurozium schreberi, Hylocomium splendens*
Dominant Aquatic / Wetland Species	N/A
Plant Indicator Species	-
Plant Species Richness (Avg. Vascular / Avg. Non-Vascular)	N/A
Species At Risk / Species of Conservation Concern	*Scirpus cyperinus*

Rarity

No plants under the protection of SARA or the NL ESA have been identified from this ecotype, but one regionally common graminoid, cottongrass bulrush, and ranked as *S2S3* by the AC CDC, was recorded within the Regenerating Forest ecotype.

Disturbance and Succession Ecology

The Regenerating ecotype is considered an early-seral plant community for the CNF ecoregion. Stand-replacing disturbances such as fire, windthrow, insect epidemics and harvesting are the primary disturbances that affect these communities. Early seral stages are represented by an abundance of ericaceous shrubs where stand-replacing fires have occurred, and a mix of patchily distributed black spruce, ericaceous and deciduous shrubs where mixed-severity burns have occurred. In stand-replacement burns, black spruce is often slow to re-establish. Ericaceous shrubs, including sheep-laurel, common Labrador tea, late lowbush blueberry and partridgeberry, usually precedes the establishment of canopy forming trees following stand-replacement burns until the site has regained warmer, moister conditions and less exposure to frost. Succession advances very slowly owing to the short growing season, deep lingering snows and cold temperatures.

6.2.1.7 CNF Ecotype 06: Alder Thicket

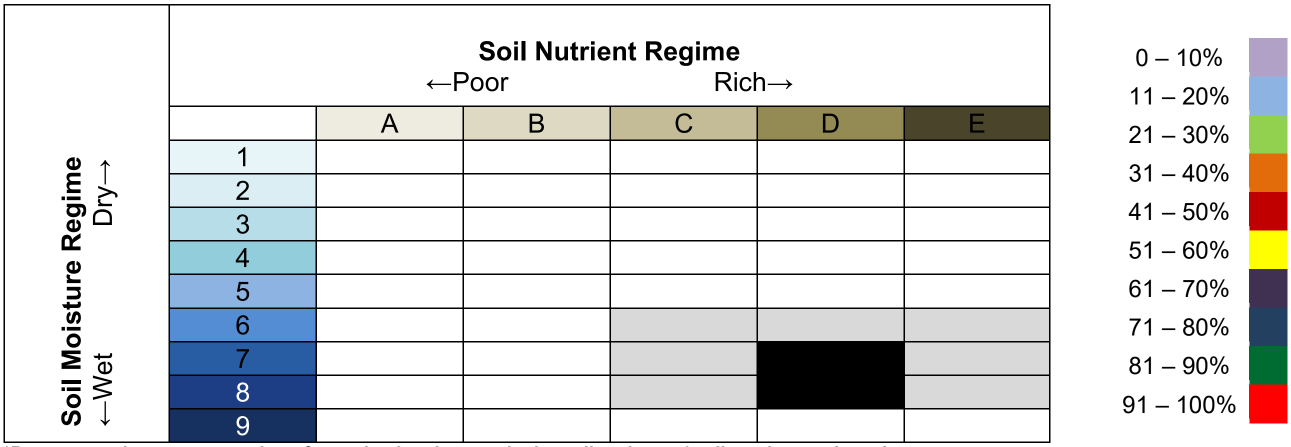
General Site Description

The Alder Thicket (AT) ecotype is most often associated with morainal (till) parent materials occupying depressions, but may also occupy sloping terrain in areas of concentrated lateral flow (seepage) or groundwater discharge. Groundwater seepage is an important attribute of the Alder Thicket ecotype, and such areas are typically associated with increased soil moisture and nutrient regimes as compared to adjacent sites, with concomitant changes in vegetation. The rolling to undulating topography is characterized by deep, nutrient-enriched sites with a soil texture ranging from silt loam to loam, usually with a fragipan that promotes seepage in the rooting zone. Midslopes are dominated by the Balsam Fir Forest ecotype in level to gently sloping terrain, with the Black Spruce Forest ecotype occupying seepage slopes. Succession to alder thickets after commercial harvest and fire is considered a serious silvicultural problem (Newfoundland and Labrador Department of Natural Resources 2014). Stands of alder that originated following logging and/or wildfire will usually revert to forest, although on heavy, poorly drained soils, forest re-growth can be problematic owing to raised water tables resulting in a "swamping" effect. These thickets may eventually develop into coniferous or mixedwood forest types.

The majority of Alder Thicket Ecotypes are characterized by the *Alder Swamps (Aa)* or *Lycopodium-Alder Swamp (AL) #31* Damman types, with many showing intermediate characteristics. The *Lycopodium-Alder Swamp (AL) #31* type is described by Meades and Moores (1989) as being dense alder thickets with scattered balsam fir and/or white spruce showing good growth and an understory dominated by leaves and scattered patches of sedges and forbs. The *Alder Swamps (Aa)* type is differentiated by the typical presence of stunted softwood trees, is moist to somewhat wet, periodically inundated and often associated with floodplains. These thickets often have an understory dominated by sedges and forbs (Meades and Moores 1994). The successional history of these alder thickets is unclear, but their occurrence is undoubtedly indicative of nutrient-enriched settings on slopes and within depressions fed by groundwater seepage. Alders are known to be common on wet seepage slopes within the ecoregion (Meades and Moores 1994). Once established, alder thickets can persist over the long-term, particularly where disturbance factors prevent tree establishment and growth.

Speckled alder was the dominant species within the majority of sites, but green alder (*A. viridis*) was dominant at several sites. The composition of the diffuse tree canopy varied and included both hardwood and softwood species, with scattered occurrences of balsam fir, paper birch, white spruce and black spruce being observed within this unit. Although of limited abundance, trees sometimes exhibited good growth. Other species found to contribute to the prominent shrub layer, include red raspberry, currant (*Ribes* sp.), balsam fir and sweet gale (*Myrica gale*). Herbaceous vegetation was varied and ranged from moderately to well-developed. Ferns were typically the most prominent component of the herbaceous vegetation, particularly evergreen woodfern and mountain wood-fern, but a variety of other forbs and graminoids were also often common, including dewberry, bluejoint reedgrass (*Calamagrostis canadensis*), purplestem aster (*Symphyotrichum puniceum*) and hoary sedge. A thick, nutrient-rich layer of fallen leaves (litter) largely precludes the occurrence of mosses, which were typically scattered in small patches. However, peatmoss was observed to provide a prominent cover at several wetter sites, often in association with riparian features.

Soils associated with this ecotype are mainly Orthic Gleysols, Orthic Humic Gleysols, and Rego Gleysols. Orthic and Gleyed Humic Regosols are also common. Orthic Humic Podzols are also possible on older sites that are no longer subject to saturated conditions. In depression areas, soils can also have surface O-horizons, which (when thick enough) move them into the Organic soil order. Soils tend to be moist to wet, nutrient-rich, mineral soils, or occasionally well-decomposed sapric peat. Mineral soil texture can be fine to coarse, ranging from silt loam to sandy loam depending on parent material type, and usually with a fragipan that promotes seepage in the rooting zone. Soils range from poorly drained to well drained, with the majority of sites remaining wetted throughout the growing season. Potential rooting depth is variable, but tends to be less than 50 cm due to high water levels and potential root restricting layers (i.e., fragipans). Humus forms vary depending on drainage conditions and vegetation sources, with mulls dominant. Moder humus forms are also possible on drier sites. This ecotype is generally nutrient-medium to rich, with a mesic to subhygric soil moisture regime (Figure 6.8). Site productivity is typically medium-rich.



*Percentage denotes proportion of sample plots in a particular soil moisture / soil nutrient regime class

Figure 6-8 Edatopic Grid for Alder Thicket Ecotype

This ecotype is limited in its extent and currently occupies approximately 5% (97.4 km^2) of the Study Area (Table 6.1).

Environmental Information

A summary of the environmental information is provided in Table 6.10.

Table 6.10 Summary of Ecological Condition for Alder Thicket Ecotype

Alder Thicket Ecotype	
Site Information	
Ecoregion	Central Newfoundland Forest (CNF)
Ecotype	Alder Thicket Ecotype
Model Classification	Alder Thicket Ecotype
Map Unit	AT
Damman Forest Site Classification Equivalent	*Lycopodium-Alder Swamp (AL) #31*
General Location	Semi-stable thickets form on gently sloping, level to lightly depressed areas on seepage slopes derived from morainal (till) deposits
Number of Sample Plots (n)	n=9
Inventory Numbers	G22, G25, G26, G27, V8, V9, V19, V38, V40,
Total Area (km^2)	97.4
Percentage of Study Area (%)	5.3
Site Characteristics	
Surface Expression	Gently sloping; Level
Slope Position	Level (slopes <2%); Depression
Slope	<2%

Alder Thicket Ecotype	
Aspect	Variable
Soil Nutrient Regime	Medium (C) to rich (D) nutrient status
Soil Moisture Regime	Subhygric (6) to Subhydric (8)
Successional Status	Early to mid-seral
Structural Stage	Shrub
Soil Characteristics	
Organic Thickness / LFH Thickness (cm)	8-40
Humus Form	Mull
Surface (Topsoil) Texture	Silt Loam, Loam, Loamy Sand, Silty Clay
Average Topsoil Thickness (cm)	31
Seepage	Yes
Drainage	Imperfect to Poor
Depth to Water Table (cm)	0 to 20
Depth to Mottles / Gleying (cm)	10+
Effective Texture	Loam
Effective Rooting Depth (cm)	20 - 40
Coarse Fragment Percent (%) and Type	<5
Depth to Bedrock (cm)	50-100
Parent Material	Morainal (till), Fluvial
Soil Classification (CSSC):	Orthic Gleysol; Rego Gleysol; Orthic Humic Gleysol; Orthic Regosol; Gleyed Regosol
Vegetation	
Dominant Tree Species	*Abies balsamea, Betula papyrifera*
Dominant Shrub Species	*Alnus incana, Alnus viridis, Myrica gale*
Dominant Herb Species	*Dryopteris intermedia, Dryopteris campyloptera*
Dominant Mosses, Liverwort, Lichen Species	*Sphagnum sp.*
Dominant Aquatic / Wetland Species	N/A
Plant Indicator Species	-
Plant Species Richness (Avg. Vascular / Avg. Non-Vascular)	26.3 / 3.5
Species At Risk / Species of Conservation Concern	*Agrostis perennans, Carex deweyana, Scirpus cyperinus*

Photo 16 Alder Thicket Ecotype – Ground View

Photo 17 Alder Thicket – Typical Vegetation

Photo 18 Alder Thicket Ecotype – Typical Soil Profile

Rarity

No plants under the protection of SARA or the NL ESA have been identified from this ecotype, but three regionally uncommon graminoids were recorded within the Alder Thicket ecotype: short-scale sedge (*Carex deweyana*), ranked *S1S2* by the AC CDC; perennial bentgrass (*Agrostis perennans*), ranked *S2*; and cottongrass bulrush; *S2S3*.

Disturbance and Succession Ecology

The Alder Thicket ecotype can be expressed at a variety of successional stages. Moister occurrences are expected to persist as an edaphic climax, while stands on better drained sites are relatively stable but expected to transition to a later successional stage defined by the Balsam Fir Forest, Black Spruce Forest or Mixedwood Forest ecotypes. Successional history of the Alder Thicket ecotype is otherwise not fully understood.

6.2.2 Riparian Ecosystem Units

The Marathon Gold Study Area encompasses both the eastern shoreline of Red Indian Lake, Victoria Lake (reservoir) and the Victoria River drainage basin. Riparian areas buffered along the streams and rivers account for 15.1 km^2 (<1%) of the Study Area (Appendix A). Riparian ecosystems were determined based on a 20 m buffer width assigned to all rivers and streams classified as permanent within the Study Area. In a majority of instances, the presence or absence of these features has not been confirmed on the ground; the results are therefore considered approximate.

6.2.2.1 CNF Ecotype 07: Riparian Thicket

General Site Description

The Riparian Thicket (RT) ecotype is most often associated with fluvial (alluvial) and lacustrine deposits. These non-forested ecosystem units are typically associated with active floodplains that are annually or periodically flooded and enriched by sediments. Within the Study Area, these ecotypes occupy the shores of larger rivers and lakes, including the eastern shoreline of Red Indian Lake, Victoria Lake (reservoir) and the Victoria River drainage basin; below the annual high-water line, and in areas somewhat protected from the extremes of ice scour and flooding. Substrates are generally fresh to moist, mineral, peaty-phase mineral or organic, moderately deep and with variable texture.

The vegetation of the Riparian Thicket ecotype is characterized by a dense shrub thicket, composed largely of low shrub species. They are rich, diverse sites typically lacking an overstory. The tree layer, if present, is composed of scattered coniferous and deciduous species. Sweet gale is typically the dominant shrub but other common species include narrow-leaved meadow-sweet (*Spiraea alba*), leatherleaf and green alder. A well-developed herbaceous layer is dominated by a mixture of graminoids, particularly cottongrass bulrush, inflated sedge (*Carex vesicaria*), little prickly sedge, red-tinged bulrush (*Scirpus microcarpus*) and slender sedge (*C. lasiocarpa*). However, a variety of forbs are also present, including water horsetail (*Equisetum fluviatile*), blueflag (*Iris versicolor*), marsh St. John's-wort (*Triadenum fraseri*), sensitive fern (*Onoclea sensibilis*) and white turtlehead (*Chelone glabra*). Vegetation composition, particularly the herbaceous element, varies with proximity to the water's edge.

Soils associated with this ecotype are mainly Orthic, Gleyed, or Cumulic Regosols. Orthic Humic Podzols and Dystric Brunisols are also possible on older sites that are no longer subject to flooding and sedimentation. Mineral soil texture can be fine to coarse, depending on parent material type and/or deposition event. Sandy textures predominate, although silt loam textures are also possible. Drainage is generally moderately well to imperfect; however, sandy and gravelly sites located far from current shorelines or river channels may be well to rapidly drained. Potential rooting depth is variable, but tends to be less than 50 cm due to high water levels. Humus forms vary depending on drainage conditions and vegetation sources, with mulls dominant. Moder humus forms are also possible on sites with intermittent flooding. This ecotype is generally nutrient-medium to rich, with a subhygric to subhydric soil moisture regime (Figure 6.9). Site productivity is typically medium-rich.

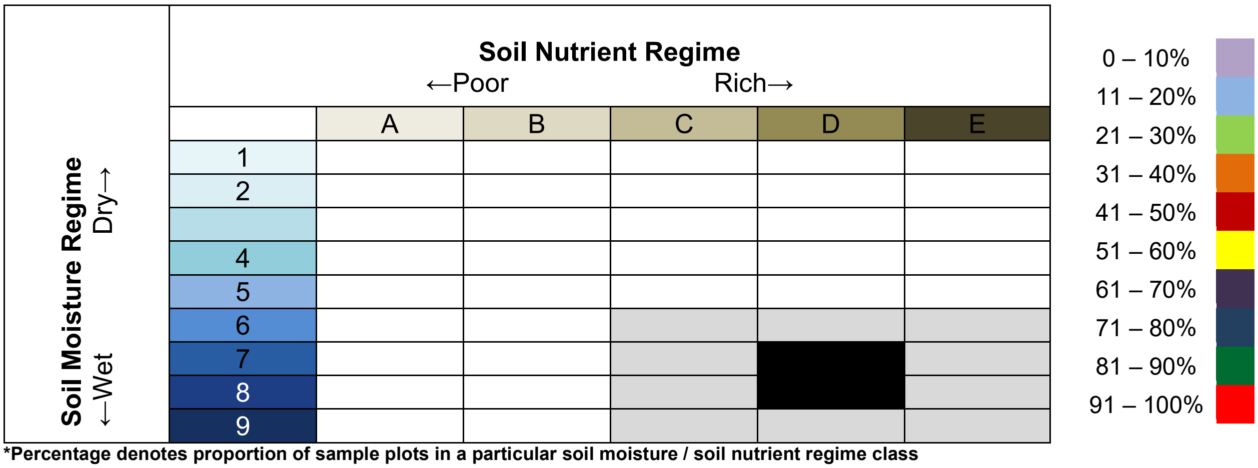


Figure 6-9 Edatopic Grid for Riparian Thicket Ecotype

Free-flowing stream systems, in conjunction with beaver activity (e.g., dams, impoundments) are considered important to the development and persistence of these non-forested riparian ecosystem.

The Riparian Thicket (Alluvial) ecotype is limited in its extent and distribution and currently occupies <1% (15.1 km^2) of the Study Area (Table 6.1).

Environmental Information

A summary of the environmental information is provided in Table 6.11.

Table 6.11 Summary of Ecological Condition for Riparian Thicket Ecotype

Riparian Thicket Ecotype	
Site Information	
Ecoregion:	Central Newfoundland Forest (CNF)
Ecotype:	Riparian Thicket Ecotype
Model Classification	Riparian Thicket Ecotype
Map Unit	RT
Damman Forest Site Classification Equivalent	*Alder Swamps (Aa)*
General Location	These vegetation types are found on active floodplain sites and occasionally on infrequently flooded terraces and gentle riparian slopes associated with (alluvial) fluvial deposits.
Number of Sample Plots (n)	n=1
Inventory Numbers	G21
Total Area (km^2)	15.1

Riparian Thicket Ecotype	
Percentage of Study Area (%)	0.8
Site Characteristics	
Surface Expression	Gently sloping; Level
Slope Position	Level (slopes <2%); Depression
Slope	<2%
Aspect	Variable
Soil Nutrient Regime	Medium (C) to Rich (D)
Soil Moisture Regime	Hygric (6) to Hydric (8)
Successional Status	Late sere in vegetation succession on fluvial deposits
Structural Stage	Shrub / Herb
Soil Characteristics	
Organic Thickness / LFH Thickness (cm):	10
Humus Form:	Mull
Surface (Topsoil) Texture	Sandy Loam to Clay Loam
Average Topsoil Thickness (cm)	10
Seepage	No
Drainage	Imperfect to Poor
Depth to Water Table (cm)	0 to 30
Depth to Mottles / Gleying (cm)	10+
Effective Texture	Clay Loam
Effective Rooting Depth (cm)	0 to 50
Coarse Fragment Percent (%) and Type	<5
Depth to Bedrock (cm)	Variable
Parent Material	Fluvial, Lacustrine, Morainal (till)
Soil Classification (CSSC):	Orthic Gleysol; Rego Gleysol; Orthic Humic Gleysol; Orthic Regosol; Gleyed Regosol;
Vegetation	
Dominant Tree Species	N/A
Dominant Shrub Species	*Myrica gale*
Dominant Herb Species	*Calamagrostis canadensis, Equisetum fluviatile*
Dominant Mosses, Liverwort, Lichen Species	N/A
Dominant Aquatic / Wetland Species	*Myrica gale, Equisetum fluviatile*
Plant Indicator Species	-
Plant Species Richness (Avg. Vascular / Avg. Non-Vascular)	31.0 / 0.0
Species At Risk / Species of Conservation Concern	*Scirpus cyperinus; S2S3*

Photo 19 Riparian Thicket Ecotype – Ground View

Photo 20 Riparian Thicket– Typical Vegetation

Photo 21 Riparian Thicket Ecotype – Typical Soil Profile

Rarity

No plants under the protection of SARA or the NL ESA have been identified from this ecotype, but one regionally uncommon graminoid, cottongrass bulrush; *S2S3*, did form an important component of the herbaceous layer for the Riparian Thicket ecotype.

Disturbance and Succession Ecology

The Riparian Thicket ecotype occurs predominantly along watercourses (large and small rivers, and streams), where a range of communities dominated by shrubs and small trees of the Salicaceae family, typically willow (*Salix* spp.) tend to occur. These sites are often prone to severe flooding and scour by ice during spring break-up. Other disturbances include damage because of over-browsing, especially in areas where larger animals (i.e., moose) tend to frequent these sites in high numbers due to the availability of food, water and shade and level terrain.

Although some of these vegetation communities may be disclimaxes induced through disturbance, most are undisturbed, natural (climax) vegetation for which hardwood thickets (of various forms) appears to be the riparian climax on developing fluvial/lacustrine deposits. As the thickness of these deposits increases, the frequency and severity of flood events and scouring by ice decreases, allowing shrubs and some trees to become established. Over time, a dense shrub thicket establishes to form the Riparian Thicket ecotype. Although these sites are considered productive due to an abundance of moisture and rich, fluvial / lacustrine soils, the rate and course of succession in this ecotype is dictated by the frequency, timing and severity of seasonal flooding and ice scour events.

6.2.3 Wetland Ecosystem Units

Wetland ecosystems occupy 410 km^2 (22 %) of the Study Area. Two general wetland types were identified – bogs and fens. These "peatland" ecosystems form in wetland conditions when production rates of plant biomass exceed its decomposition, resulting in a net accumulation of organic substrate materials. This accumulation of peat is generally the result of low decomposition rates caused by lack of oxygen, high acidity and nutrient availability. Bogs and fens occur along a gradient of these substrate conditions, from very acidic and nutrient-poor (bogs) to nutrient-medium, pH neutral or slightly alkaline (fens).

They typically occur on exposed sites, in level to depressional topography, with soils derived from organic parent materials (i.e., peatlands). Within the Study Area, peatlands support somewhat differing vegetation communities (i.e., wetland cover types) tolerant of wet, generally acidic, nutrient-poor soils. They include a mosaic of wet herbaceous (e.g., wet herb), scrub-shrub wetlands (e.g., wet heath) and forested communities along a gradient of decreasing water availability. Although wetlands may be represented by several vegetation communities, the overall site was deemed to support two somewhat topographically confined wetland types. Apart from the grouping of unclassified wetlands as required to produce the unsupervised classification, three main wetland types, identified using designations provided by the Canadian Wetland Classification System (1997), were encountered, including fens, bogs and shallow open water. Fens are the most common wetland type, with poor shrub fen (weakly minerotrophic) and graminoid basin fen (weakly minerotrophic) accounting for a majority of the peat dominated wetlands. Detailed descriptions of wetland ecotype units comprising the Project are provided in the following sections.

6.2.3.1 CNF Ecotype 08: Wet Coniferous Forest

General Site Description

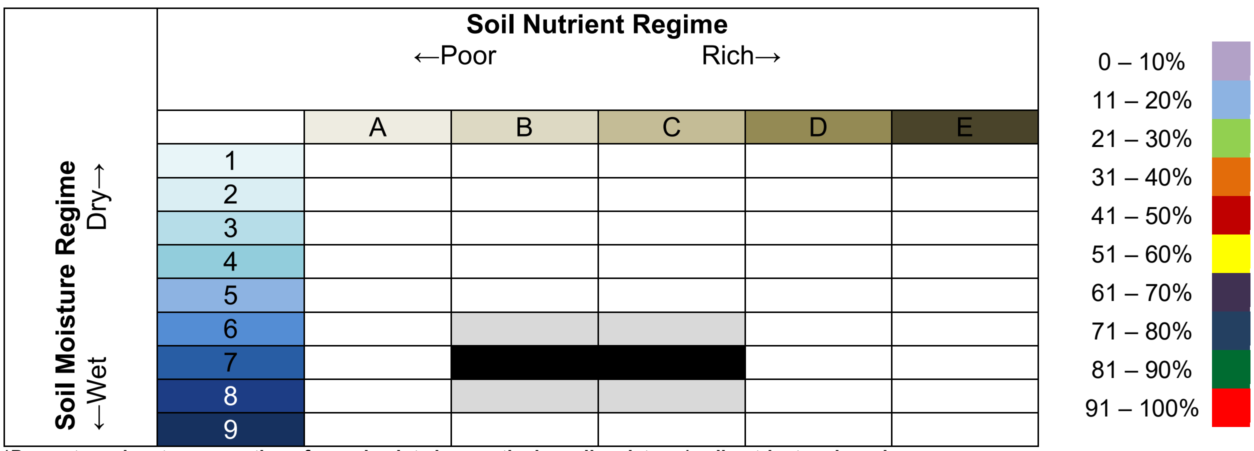
The Wet Coniferous Forest (WC) ecotype primarily represents treed wetlands that may occur as extensive areas or in the transitional zone of more open peatland communituies (i.e., bogs and fens). This ecotype often occurs in association with other adjacent wetland types as part of larger wetland complexes. They are found in lower slope and toe positions of gentle slopes, shallow depressions and along drainage channels. Soils are generally derived form morainal (till) and/or organic deposits. Soil nutrient regime is low except where nutrient availability is enhanced by groundwater or seepage inputs.

Coniferous treed fens are common in the Study Area and are often associated with or adjacent to other types of wetlands. The overall topography of these ecotypes is flat to gently undulating with micro-topography characterized by hummocks and hollows. Soils are typically poorly drained, peaty mineral to organic, and enriched by minerals seeping through the morainal (till) parent materials. As with coniferous treed fens, coniferous treed bogs may also be present in the Study Area; in association with or adjacent to other types of wetlands. Treed bogs are often transitional to fens (i.e., slightly more acidic – pH <4.6) and tend to be comprised of higher percentages of glow moss (*Aulacomnium palustre*), golden fuzzy fen moss (*Tomenthypnum nitens*) and a greater proportion of graminoids (especially, sedges (*Carex* spp.)). In the boreal zone, transitional bogs often contain a component of tamarack.

The Wet Coniferous Forest ecotype is characterized by a unique and diverse flora with a rich herbaceous layer and well-developed moss carpet. Black spruce is the dominant tree within this ecotype, but scattered balsam fir and tamarack are common. Because of their imperfect to poor drainage, trees are typically stunted and the aforementioned tree species are typically dominant components within the tall and low shrub strata, along with alder, sweet gale and leatherleaf. Ground vegetation is dominated by herbaceous species, but dwarf shrubs such as creeping snowberry, twinflower and late lowbush blueberry are common occurrences. Herbaceous vegetation is comprised of a mixture of forbs and graminoids, including a relatively high diversity of sedges. Commonly encountered and/or often abundant herbs within the understory include three-leaf Solomon's-plume (*Maianthemum trifolium*), bunchberry, dewberry, threefruit sedge, little prickly sedge, Atlantic sedge (*Carex atlantica*), Buxbaum's sedge (*C. buxbaumii*) and bristlestalk sedge (*C. leptalea*). Peatmoss is the dominant component of the moss carpet, but feathermosses and other species more typical of upland conditions may be prevalent on hummocks.

Field sites of the Wet Coniferous Forest ecosystem unit most closely reflect the Black Spruce Fen types as described by Meades and Moores (1989). In particular, the vegetation structure and composition of field sites typically reflected the *Carex-Black Spruce (Sc) #18* and/or *Osmunda-Black Spruce (SO) #19* types (their understory often contained indicators of both types), with elements of *Sphagnum-Black Spruce (Ss) #12* also encountered. Forested fens are described by Meades and Moores (1989) as being poorly-drained open black spruce stands with a lush understory of forbs and sedges, a number of which are considered indicative of relatively fertile conditions.

Soils associated with Wet Coniferous Forest ecotypes include Terric Fibrisols and Terric Mesisols, usually originating from organic parent material in early to moderate stages of decomposition (Of and Om horizons). Typic Fibrisols and Typic Mesisols may also be present in areas where peat depth exceeds 160 cm. In a majority of cases, poorly drained soils have surface horizons derived from peat (sphagnum) mosses. Organic soils often grade into mineral soils (i.e., Rego Gleysols, Gleyed Regosols) at the periphery of these sites. Wet Coniferous Forest ecotypes are characterized by poorly drained soils with near-surface mottles (prominent) and/or gley conditions and above-average clay content. Wet medium to coarse-textured Gleyed Humo-Ferric and Ferro-Humic Podzols are also possible. They are described as loamy mineral soils, with thin Ae or Ahe horizons, imperfect drainage and mottling at depth. In a majority of areas gravel / cobble content can vary from low to high. The water table is generally near surface, and sites are nutrient-poor to medium, with subhygric to subhydric soil moisture regimes. Drainage is often imperfect to poor due to slope position (lower slope, level, depressional) and/or restricted vertical drainage in areas of gentle slope. Rooting depths are typically shallow due to high water levels. Site productivity is typically low to moderate in relation to the surrounding landscapes. An edaphic grid for this ecotype is presented in Figure 6.10.



*Percentage denotes proportion of sample plots in a particular soil moisture / soil nutrient regime class

Figure 6-10 Edatopic Grid for Wet Coniferous Forest Ecotype

The Wet Coniferous Forest ecotype occupies approximately 7% (130.7 km^2) of the Study Area (Table 6.1).

Environmental Information

A summary of the environmental information is provided in Table 6.12.

Table 6.12 Summary of Ecological Condition for Wet Coniferous Forest Ecotype

Wet Coniferous Forest Ecotype	
Site Information	
Ecoregion	Central Newfoundland
Ecotype	Wet Coniferous Forest
Model Classification	Treed Wetland - Treed Bogs & Treed Fens
Map Unit	WC
Damman Forest Site Classification Equivalent	*Carex-Black Spruce (Sc)* #18; *Osmunda-Black Spruce (SO)* #19; elements of *Sphagnum-Black Spruce (Ss)* #12

Wet Coniferous Forest Ecotype	
General Location	Widespread across the boreal range and often associated with poorly drained, wetted depressions, underlain by peat and/or coarse textured morainal parent materials.
Number of Sample Plots (n)	n=5
Inventory Numbers	G12, G16, G20, V13, V26
Total Area (km^2)	130.7
Percentage of Study Area (%)	7.1
Site Characteristics	
Surface Expression	Flat (level); Depressional
Slope Position	Level, Depression
Slope	<2%
Aspect	None
Soil Nutrient Regime	Poor (B) to Medium (C)
Soil Moisture Regime	Hygric (6) to Hydric (8)
Successional Status	Edaphic Climax
Structural Stage	Most stands are mid-successional but this ecotype is expressed in a variety of successional stages (early to late).
Soil Characteristics	
Organic Thickness / LFH Thickness (cm)	40-160
Humus Form	Fibrimors; Mesimors
Surface (Topsoil) Texture	Fibric; Mesic
Average Topsoil Thickness (cm)	N/A
Seepage	N/A
Drainage	Poor
Depth to Water Table (cm)	Near surface
Depth to Mottles / Gleying (cm)	Yes
Effective Texture	N/A
Effective Rooting Depth (cm)	0 to 20
Coarse Fragment Percent (%) and Type	N/A
Depth to Bedrock (cm)	40-160
Parent Material	Organic, Morainal (Till)
Soil Classification (CSSC)	Terric Fibrisol; Terric Mesisol; extending to Typic Fibrisols and Typic Mesisols where topography has led to the development of thick organics deposits.
Vegetation	
Dominant Tree Species	*Picea mariana*
Dominant Shrub Species	*Picea mariana, Abies balsamea, Myrica gale*

Wet Coniferous Forest Ecotype	
Dominant Herb Species	*Maianthemum trifolium, Sanguisorba canadensis, Carex buxbaumii, Trichophorum caespitosum, Cornus canadensis, Rubus pubescens*
Dominant Mosses, Liverwort, Lichen Species	*Sphagnum spp.*
Dominant Aquatic / Wetland Species	-
Plant Indicator Species	-
Plant Species Richness (Avg. Vascular / Avg. Non-Vascular)	43.7 / 5.3
Species At Risk / Species of Conservation Concern	*Poa saltuensis; S2S3 and Scirpus cyperinus; S2S3*

Photo 22 Wet Coniferous Forest Ecotype – OverView

Photo 23 Wet Coniferous Forest Ecotype – Vegetation

Photo 24 Wet Coniferous Forest Ecotype –Soil Profile

Rarity

No plants under the protection of SARA or the NL ESA have been identified from this ecotype; however, two regionally uncommon graminoids, cottongrass bulrush; ranked *S2S3* by the AC CDC and forest bluegrass; ranked *S2S3* were recorded within the Wet Coniferous Forest ecotype.

Disturbance and Succession Ecology

These sites are relatively stable. Fire frequency is low, and fire severity is low owing to their position in moist areas of low relief. As a result, the dominant natural disturbance associated with Coniferous Treed Wetland ecotypes are seasonal and yearly water level fluctuations, the quality and quantity of which is crucial to the maintenance of the wetland. Seasonally, water levels tend to be highest during the winter and spring and lowest in late summer and early fall.

Wet Coniferous Forest ecotypes are considered edaphic climax communities limited by excessive soil moisture and low soil fertility. Disturbance regimes, including fluctuating water tables, fire, insects and disease, can result in a range of successional stages depending on frequency and intensity.

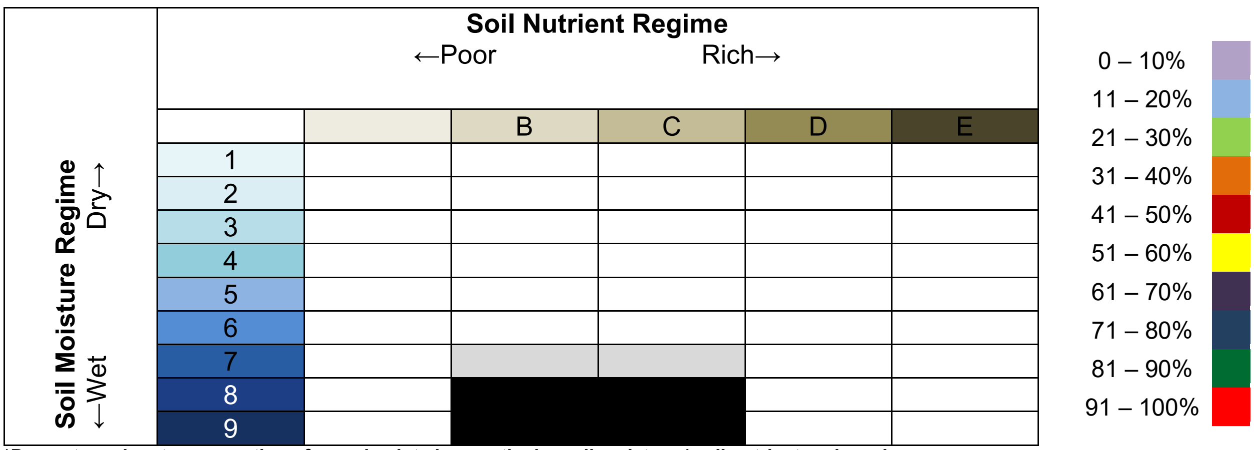
6.2.3.2 CNF Ecotype 09: Shrub / Graminoid Fen

General Site Description

Shrub / Graminoid Fen (SF) ecotypes typically occur on flat areas or poorly-drained, peat-filled depressions (basins), on neutral to moderately alkaline substrates classed as organic (either as well-decomposed organic material or as floating mats of organic material held together by live plant roots and rhizomes), overlying bedrock and morainal (till) deposits. The overall topography is flat to gently undulating with micro-topography characterized by hummocks and hollows. This ecotype tends to be more common of the wetlands (peatlands) observed in the Study Area, often occurring in association with other adjacent wetland types as a gradient between fresh to moist bedrock-controlled uplands and wetted lowland areas.

The open fens of the Study Area are characterized by a lack of tree cover, a diffuse tall shrub strata (if present) and a prominent cover of low-lying shrubs, herbs and mosses. Sweet gale is typically the most abundant shrub within these fens, but Michaux's dwarf birch (*Betula michauxii*) and shrubby cinquefoil (*Dasiphora fruticosa*) are also prominent, along with lesser amounts of tamarack, black spruce and purple chokeberry (*Photinia* spp.). Scattered tamarack often characterizes a very diffuse tall shrub stratum. Graminoids dominating the herbaceous layer include deergrass, white beakrush (*Rhynchospora alba*), few-seeded sedge and Pickering's reedgrass (*Calamagrostis pickeringii*) considered common. Other typical components of the herbaceous layer for the Shrub / Graminoid Fen ecotype include bottlebrush (*Sanguisorba canadensis*), coast sedge (*Carex exilis*) and bog goldenrod (*Solidago uliginosa*). Peatmoss provides the dominant bryophyte coverage within this ecotype, but more upland associated species are present in association with hummocks and scattered occurrences of other species are also present. The fens within the Study Area are typically nutrient-poor and their vegetation closely resembles that present within the Shrub Bog ecotype. However, the fens are distinguished based on the presence and abundance of species that are indicative of nutrient enrichment, including both shrubs and herbs such as Michaux's dwarf birch, shrubby cinquefoil, bottlebrush, balsam groundsel (*Packera paupercula*) and Michaux's sedge (*Carex michauxiana*).

Organic soils associated with this ecotype are mainly Mesisols, dominated by organic layers in a moderate stage of decomposition (Om horizons). Organic soils may grade into mineral Gleysols at the edges of these wetlands. Drainage is usually poor to very poor, but is imperfect on transitional sites. Potential rooting depth is usually shallow due to high water levels. Humus forms are dominated by Fibrimors and Mesimors on wet sites and by Hemimors on imperfectly drained sites. The water table is usually at or near the surface, particularly in hollows / pools between peat ridges. The ecotype is generally nutrient-poor to -medium, with a hygric to hydric soil moisture regime (Figure 6.11). Site productivity is typically poor.



*Percentage denotes proportion of sample plots in a particular soil moisture / soil nutrient regime class

Figure 6-11 Edatopic Grid for Shrub / Graminoid Fen Ecotype

The combined Shrub / Graminoid Fen and Shrub Bog wetland map units occupy approximately 15% (280.3 km^2) of the Study Area (Table 6.1).

Environmental Information

A summary of the environmental information is provided in Table 6.13.

Table 6.13 Summary of Ecological Condition for Shrub / Graminoid Fen Ecotype

Shrub / Graminoid Fen Ecotype	
Site Information	
Ecoregion	Central Newfoundland
Ecotype	Shrub / Graminoid Fen Ecotype
Model Classification	Non-Treed Wetland
Map Unit	SF
Damman Forest Site Classification Equivalent	N/A
General Location	Ecotype is widespread and floristically consistent across the boreal range, often occupying poorly drained, wetted depressions, underlain by peat and/or coarse textured morainal parent materials.
Number of Sample Plots (n)	n=14
Inventory Numbers	G5, G7, G8, G19, G29, G30, V1, V5, V12, V22, V25, V30, V32, V36
Total Area (km^2)	280.3
Percentage of Study Area (%)	15.3
Site Characteristics	
Surface Expression	Flat (level); Depressional
Slope Position	Level, Depression
Slope	<2%
Aspect	None
Soil Nutrient Regime	Typically classed as having Poor (B) or Poor (B) to Medium (C) nutrient status.
Soil Moisture Regime	Hygric (6) to Hydric (8)
Successional Status	Edaphic Climax
Structural Stage	Shrub/Herb (SH)
Soil Characteristics	
Organic Thickness / LFH Thickness (cm)	40-160+
Humus Form	Fibrimors; Mesimors
Surface (Topsoil) Texture	Fibric; Mesic
Average Topsoil Thickness (cm)	N/A
Seepage	N/A
Drainage	Poor to Very Poor
Depth to Water Table (cm)	0-20
Depth to Mottles / Gleying (cm)	Variable
Effective Texture	N/A

Shrub / Graminoid Fen Ecotype	
Effective Rooting Depth (cm)	0 to 20
Coarse Fragment Percent (%) and Type	N/A
Depth to Bedrock (cm)	40-160
Parent Material	Organic, Morainal (Till)
Soil Classification (CSSC)	Terric Fibrisol; Terric Mesisol; extending to Typic Fibrisols and Typic Mesisols where topography has led to the development of thick organics deposits.
Vegetation	
Dominant Tree Species	N/A
Dominant Shrub Species	*Myrica gale, Betula michauxii, Dasiphora fruticosa*
Dominant Herb Species	*Trichophorum caespitosum, Rhynchospora alba, Carex oligosperma*
Dominant Mosses, Liverwort, Lichen Species	*Sphagnum* spp.
Dominant Aquatic / Wetland Species	*Myrica gale, Betula michauxii, Dasiphora fruticosa*
Plant Indicator Species	*Dasiphora fruticosa, Betula michauxii, Sanguisorba canadensis*
Plant Species Richness (Avg. Vascular / Avg. Non-Vascular)	34.3 / 5.0
Species At Risk / Species of Conservation Concern	None encountered

Photo 25 Shrub / Graminoid Fen Ecotype – Ground View

Photo 26 Shrub / Graminoid Fen Ecotype – Typical Vegetation

Photo 27 Shrub / Graminoid Fen Ecotype – Typical Soil Profile

Rarity

No plants under the protection of SARA or the NL ESA or ranked as SH, S1, or S2 by the AC CDC have been identified from this ecotype.

Disturbance and Succession Ecology

These sites are relatively stable. Fire frequency is low, and fire severity is low owing to their position in moist areas of low relief. As a result, the dominant natural disturbance associated with Shrub / Graminoid Fen ecotypes are seasonal and yearly water level fluctuations, the quality and quantity of which is crucial to the maintenance of the fen. Seasonally, water levels tend to be highest during the winter and spring and lowest in late summer and early fall.

The Shrub / Graminoid Fen ecotypes are considered to be primarily edaphic climax communities limited by excessive soil moisture and low soil fertility. Repeated disturbances, including fluctuating water tables, fire, insects and disease, though uncommon, could maintain these ecotypes in this early successional state, provided the regenerative capacity of the shrub layer was maintained. In the absence of disturbance, paludification may convert some fen types to that of bog communities over time. Sphagnum patches and associated bog vegetation in the fens may be early signs of paludification.

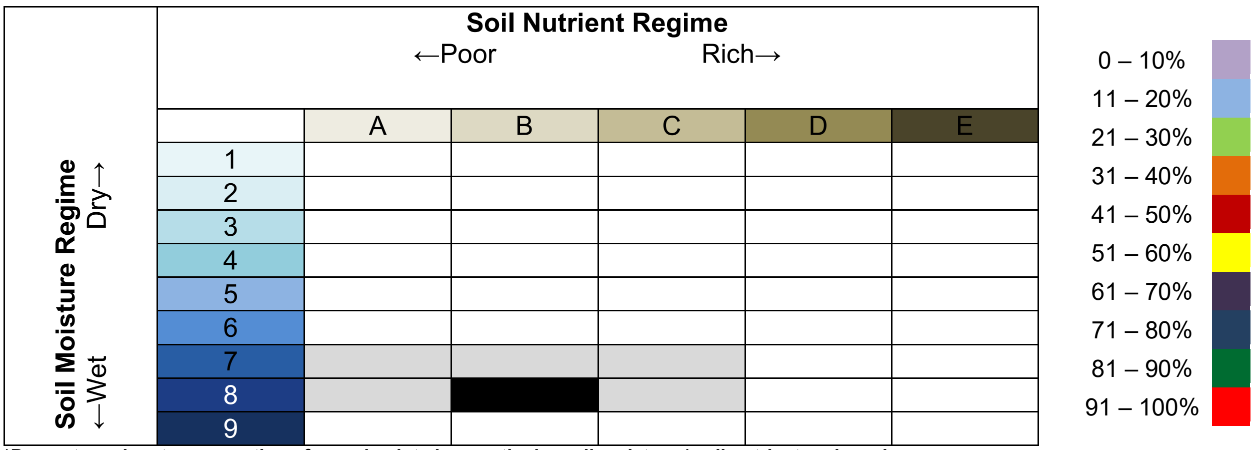
6.2.3.3 CNF Ecotype 11: Shrub Bog

General Site Description

Shrub Bog (SB) ecotypes typically occur on flat areas or poorly drained, peat-filled depressions (basins), on neutral to moderately acidic substrates classed as organic (either as well-decomposed organic material or as floating mats of organic material held together by live plant roots and rhizomes), overlying bedrock and morainal (till) deposits. The overall topography is flat to gently undulating, with micro-topography characterized by hummocks and hollows. This ecotype often occurs in association with other adjacent wetland types as a gradient between fresh to moist bedrock-controlled uplands and wetted lowland areas.

Open shrub bogs of the Study Area are characterized by a lack of tree and tall shrub strata, but well-developed low and dwarf shrub layer intermixed with herbaceous species. This is considered indicative of acidic wetland conditions. A prominent cover of peatmoss and lichens also occurs here. Low shrub cover is primarily provided by sheep-laurel and leatherleaf, with other common species including black spruce, bog rosemary (*Andromeda polifolia*), rhodora, black chokeberry (*Photinia melanocarpa*), black crowberry, northern blueberry (*Vaccinium boreale*), common Labrador tea, and Bog Laurel (*Kalmia polifolia*). Herbaceous cover is mostly provided by graminoids, with deergrass being particularly abundant and coast sedge and white beakrush also being important components. Although of minor abundance, other commonly occurring herbaceous plants include northern pitcher-plant and roundleaf sundew (*Drosera rotundifolia*). Peatmoss forms a prominent carpet throughout much of the extent of this ecotype and feathermosses occupy the drier hummocks. Reindeer lichens are a distinct component of this wetland type, with gray reindeer lichen and green reindeer lichen being particularly abundant. Other species of lichen are scattered throughout and may be dominant in discrete patches, including *Cladonia* lichens and species belonging to the genus *Cetraria*. Although the Shrub Bog ecotype is of similar vegetation structure and composition to that of open fens of the Study Area, bogs are differentiated by the lack or low abundance of species that are indicative of nutrient enrichment and a higher occurrence of those associated with acidic wetland conditions, such as sheep-laurel, leatherleaf, black spruce, and blueberry (*Vaccinium* spp.). Furthermore, the Shrub Bog ecotype has a high prominence of vegetation that reflects the drier surface conditions (e.g., such as the prominence of ground lichens) that are typically associated with this wetland class compared to fens.

Organic soils associated with this ecotype are mainly Mesisols, dominated by organic layers in a moderate stage of decomposition (Om horizons). Organic soils may grade into mineral Gleysols at the edges of these wetlands. Drainage is usually poor to very poor, but is imperfect on transitional sites. Potential rooting depth is usually shallow due to high water levels. Humus forms are dominated by Fibrimors and Mesimors on wet sites and by Hemimors on imperfectly drained sites. The water table is usually at or near the surface, particularly in hollows / pools between peat ridges. The ecotype is generally nutrient-poor to -medium, with a hygric to hydric soil moisture regime (Figure 6.12). Site productivity is typically poor.



*Percentage denotes proportion of sample plots in a particular soil moisture / soil nutrient regime class

Figure 6-12 Edatopic Grid for Shrub Bog Ecotype

The combined Shrub / Graminoid Fen and Shrub Bog wetland map units occupy approximately 15% (280.3 km²) of the Study Area (Table 6.1).

Environmental Information

A summary of the environmental information is provided in Table 6.14.

Table 6.14 Summary of Ecological Condition for Shrub Bog Ecotype

Shrub Bog Ecotype	
Site Information	
Ecoregion	Central Newfoundland
Ecotype	Shrub Bog Ecotype
Model Classification	Non-Treed Wetland
Map Unit	SB
Damman Forest Site Classification Equivalent	N/A

Shrub Bog Ecotype	
General Location	Ecotype is widespread and floristically consistent across the boreal range, often occupying poorly drained, wetted depressions, underlain by peat and/or coarse textured morainal parent materials.
Number of Sample Plots (n)	n=14 (combined with Shrub / Graminoid Fen)
Inventory Numbers	G5, G7, G8, G19, G29, G30, V1, V5, V12, V22, V25, V30, V32, V36
Total Area (km^2)	280.3
Percentage of Study Area (%)	15.3
Site Characteristics	
Surface Expression	Flat (level); Depressional
Slope Position	Level, Depression
Slope	<2%
Aspect	None
Soil Nutrient Regime	Typically classed as having Poor (B) to Medium (C)
Soil Moisture Regime	Hygric (6) to Hydric (8)
Successional Status	Edaphic Climax
Structural Stage	Shrub / Herb (SH)
Soil Characteristics	
Organic Thickness / LFH Thickness (cm)	40-160+
Humus Form	Fibrimors; Mesimors
Surface (Topsoil) Texture	Fibric; Mesic
Average Topsoil Thickness (cm)	N/A
Seepage	N/A
Drainage	Poor to Very Poor
Depth to Water Table (cm)	Near surface
Depth to Mottles / Gleying (cm)	Yes
Effective Texture	N/A
Effective Rooting Depth (cm)	0 to 20
Coarse Fragment Percent (%) and Type	N/A
Depth to Bedrock (cm)	40-160
Parent Material	Organic, Morainal (Till)
Soil Classification (CSSC)	Terric Fibrisol; Terric Mesisol; extending to Typic Fibrisols and Typic Mesisols where topography has led to the development of thick organics deposits.
Vegetation	
Dominant Tree Species	N/A

Shrub Bog Ecotype	
Dominant Shrub Species	*Kalmia angustifolia, Chamaedaphne calyculata*
Dominant Herb Species	*Trichophorum caespitosum, Carex exilis, Rhynchospora alba*
Dominant Mosses, Liverwort, Lichen Species	*Sphagnum spp., Cladina rangiferina, Cladina mitis*
Dominant Aquatic / Wetland Species	*Chamaedaphne calyculata, Andromeda polifolia, Trichophorum caespitosum, Sphagnum spp.*
Plant Indicator Species	*Chamaedaphne calyculata, Carex exilis, Rhynchospora alba*
Plant Species Richness (Avg. Vascular / Avg. Non-Vascular)	31.0 / 7.0
Species At Risk / Species of Conservation Concern	None encountered.

Photo 28 Shrub Bog Ecotype – Ground View

Photo 29 Shrub Bog Ecotype – Typical Vegetation

Photo 30 Shrub Bog Ecotype – Typical Soil Profile

Rarity

No plants under the protection of SARA or the NL ESA or ranked as SH, S1, or S2 by the AC CDC have been identified from this ecotype.

Disturbance and Succession Ecology

These sites are relatively stable. Fire frequency is low, and fire severity is low owing to their position in moist areas of low relief. The Shrub Bog ecotypes are considered to be primarily edaphic climax communities limited by excessive soil moisture and low soil fertility.

6.2.4 Sparsely Vegetated, Naturally Non-Vegetated and Anthropogenically Altered / Disturbed Ecosystem Units

A number of sparsely vegetated, naturally non-vegetated and/or anthropogenic ecosystem units were also mapped.

6.2.4.1 CNF 12 Ecosystem Unit: Exposed Sand / Gravel Shoreline (ES)

The Exposed Sand / Gravel Shoreline ecosystem unit occupies <1% (2.8 km^2) of the Study Area.

The ES ecotype is characterized by natural areas with less than 20% vegetative cover, mostly elongated landforms generated by waves and currents and usually running parallel to the shore. It is composed of unconsolidated small, rounded cobbles, pebbles, stones and sand. This unit was primarily associated with distinct shorelines of Red Indian and Victoria Lakes, where the artificial basin created by the impoundment of water behind a human-made structure such as a dam, berm, dyke or wall and control of water within this impoundment has exposed the sandy or gravelly shoreline. Occurring in very specific geographies with limited extent throughout the Study Area, these units are typically small in scale. Where sediments occur close to the modern shoreline of the aforementioned systems, there is little or no vegetation due to the erosive action of the river and/or waves. Walking inland reveals evidence of early plant succession. Gradually, dwarf ericaceous shrubs, lichens and mosses become established. Dust, sand and plant material including seeds and spores collects, and eventually a soil sufficient to support a more consistent cover of rooted plants begins to develop. They tend to support a very sparse cover of willows, grasses, sedges and horsetails, as well as a small assortment of forbs.

6.2.4.2 CNF 13 Ecosystem Unit: Open Water (OW)

The Open Water Ecosystem Unit includes lakes, ponds and rivers across the Study Area. Lakes are defined as naturally occurring static bodies of water, greater than 2 m deep in some portion. The boundary for the lake is the natural high water mark. A pond is a small body of water greater than 2 m deep, but not large enough to be classified as a lake (e.g., less than 50 ha). Rivers include any watercourse formed when water flows between continuous, definable banks. The flow may be intermittent or perennial. An area that has an ephemeral flow and no channel with definable banks is not considered a river.

The Open Water Ecosystem Unit occupies approximately 22% (408.5 km^2) of the Study Area, the largest areal extent covered by any ecosystem unit.

6.2.4.3 CNF 14 Ecosystem Unit: Anthropogenic (AN)

This ecosystem unit includes any area of exposed soil that is not included in any of the other definitions. It includes areas of recent disturbance, such as slumping, mass wasting, flooding and anthropogenic disturbances (e.g., access roads used for exploration drilling, borrow pits), where vegetation cover is <5% or absent entirely. This ecosystem unit occupies <1% (8.2 km^2) of the Study Area.

Vegetation cover within the Anthropogenic ecosystem unit is typically limited as much of these areas are subject to frequent disturbance. Where the frequency and intensity of disturbances allow (e.g., along the margins or roads), native and exotic ruderal herbs provide some ground cover, with commonly occurring species including rough bentgrass (*Agrostis scabra*), poverty Oatgrass (*Danthonia spicata*), pearly everlasting (*Anaphalis margaritacea*), flat-top fragrant-golden-rod (*Euthamia graminifolia*) and low hop clover (*Trifolium campestre*). Although dominated by exposed substrates, minor amounts of remnant vegetation are sometimes present within sites recently disturbed by human activities (e.g., mining scrapes). Conversely, areas that once supported intense anthropogenic land uses that have ceased may support a well-developed regenerating plant community. For example, green alder may form a dense shrub layer on previously disturbed sites and facilitate succession to more mature plant communities. Habitats that are at more advanced stages of successional development following cessation of human activities may support a variety of shrubs, herbs and non-vascular species that are indicative of the soil conditions in less altered environments.

6.2.5 Accuracy Assessment

An accuracy assessment was performed as part of the quality assurance / quality control review of vegetation mapping for the Project ELC. The map accuracy was assessed by comparing the mapped vegetation type to the field-verified vegetation type at various points (chosen prior to field work) to represent the full range of map classes in the Study Area in a statistically valid manner. Accuracy was calculated for each individual map unit as well as for all map units combined.

The accuracy assessment quantifies data quality so that map users may evaluate the utility of a thematic map for its intended applications. The thematic accuracy of the Project ELC was assessed by comparing the vegetation type (ecotype / subtype) shown on the map to that identified on the ground for a representative sample (totaling 162) of evaluation points. When polygons representing vegetation types are mapped and labelled with the correct community types, then the map has “high” thematic accuracy.

The accuracy assessment for the Project ELC was completed using 162 reference points. A total of 136 reference points were in situ field samples collected in the field (Original ELC Survey[2014]: 74 points; Accuracy Assessment [2015]: 62) as a result of ground-truthing (points accurate to +/- 10 m using Garmin GPS Map 76CSx technology). Twenty-six points were identified from an independent assessment (desktop) of existing aerial imagery in an effort to account for those classes (i.e., Open Water, Exposed Sand / Gravel Shoreline, Riparian Thicket) not sampled in the field. The accuracy estimates using only high confidence sites are reported in Table 6.15. Over the entire Study Area, high confidence sites represent 83% of all sample sites, and the proportion of high confidence sites is approximately the same for all classes.

The output classification was analyzed and an accuracy assessment performed. Classification error matrices were generated to quantify the results of the assessment and to provide overall accuracy for the classification. Table 6.15 depicts the confusion matrix prepared based on observations and ground-truthing information gathered in September 2014.

Table 6.15 Confusion (Error) Matrix for Data Accuracy

Land Cover Class	Reference Data												Total	User's Accuracy (%)
	Shrub Fen / Shrub Bog	Regenerating Forest	Mixedwood Forest	Alder Thicket	Balsam Fir Forest	Black Spruce Forest	Kalmia-Black Spruce Woodland	Wet Coniferous	Riparian Thicket	Exposed Sand / Gravel Shoreline	Anthropogenic	Water		
Shrub Fen / Shrub Bog	29		1	1		2	1						**34**	**85**
Regenerating Forest	1	5											**6**	**83**
Mixedwood Forest		1	15	1	2								**19**	**79**
Alder Thicket				16									**16**	**100**
Balsam Fir Forest					15	4							**19**	**79**
Black Spruce Forest			2	1	2	14	1						**20**	**70**
Kalmia-Black Spruce Woodland	1			1		1	6				1		**10**	**60**
Wet Coniferous								12					**12**	**100**
Riparian Thicket								2	5				**7**	**71**
Exposed Sand / Gravel Shoreline	1									4			**5**	**80**
Anthropogenic											9		**9**	**100**
Water												5	**5**	**100**
Total Points Per Class	**32**	**6**	**18**	**20**	**19**	**21**	**8**	**14**	**5**	**4**	**10**	**5**	**135**	
Producer's Accuracy (%)	**91**	**83**	**83**	**80**	**79**	**67**	**75**	**86**	**100**	**100**	**90**	**100**		
													Overall Accuracy (% Correct)	**83**

Overall or total classification accuracy is typically computed by dividing the total number of correctly classified pixels (i.e., the sum of the elements along the major diagonal) by the total number of reference pixels. When completed for the Project ELC, the Overall Accuracy for the habitat classification is 83%. Ultimately, this means that if 100 reference points were evaluated, 83 would be classified correctly through the classification procedure, and thus, if a pixel is selected at random, there is a 83% chance that that pixel is classified correctly.

Accuracy estimates may vary greatly among the 12 individual classes. When either user's or producer's accuracy is considered, results are low or moderately low for two identified classes; Black Spruce Forest and Kalmia-Black Spruce Woodland have the lowest class accuracy with 70% and 60% user's accuracy, respectively. It is important to understand what factors may have contributed to the low results. These factors may be attributed to variation in tree height, density and growth stage, resulting in a similar spectral response and thus misclassification of the ecotype class. Additionally, depending on the dates of the image data, the presence and optical properties of groundwater can affect whether the land cover is classified as woody wetland or forest, as suggested by confusions in Table 6.15.

The Project ELC mapping is conducted over a very large area with a relatively large number of land cover / vegetation type classes. Some of the land cover classes (such as the Black Spruce Forest and Kalmia-Black Spruce Woodland classes) are very similar spectrally, posing a challenge to both the mapping and photointerpretation during accuracy assessment. Given these conditions, the overall and class-specific accuracy estimates for the Project ELC are generally satisfactory. Most misclassification errors occur along edges of heterogeneous land-cover a majority of the confusion is between related land-cover classes.

6.2.6 Summary

6.2.6.1 Plant Species Richness

A total of 224 plant taxa were recorded during surveys conducted in support of the ELC. Of these, 198 were vascular plants, 19 were mosses / liverworts and seven were lichens. The most prevalent tree species were balsam fir, black spruce and paper birch, with small amounts of red maple (*Acer rubrum*), tamarack and white spruce also recorded. Although not recorded within survey plots, trembling aspen was also observed in small patches of the Study Area. A complete list of the flora identified during surveys is provided in Appendix C.

Ecotype units varied considerably with respect to their species richness. The highest vascular plant species richness was associated with the Wet Coniferous Forests, with an average of approximately 44 species / plot. The Black Spruce Forest and Graminoid / Shrub Fen ecotype units also had relatively high vascular plant diversity, with 35 and 34 species / plot, respectively. The Balsam Fir Forest ecotype obtained the lowest measure of species richness, with <16 species / plot. The average richness amongst the ecotypes was 29 species / plot. In general, data indicate that wetland and poorly drained ecotype units had a higher richness of vascular plants than did sites with more mature forest cover or ecotypes associated with dry soil conditions. Due to difficulties inherent in non-vascular plant identification, only the most dominant mosses and lichens were identified to species or genus level. As such, calculated values for average non-vascular species richness are not reliable indicators of the diversity of bryophyte of lichen communities within ecotypes.

6.2.6.2 Species at Risk / Species of Conservation Concern

The population statuses of all species of flora and fauna encountered during the ELC surveys were determined through a review of the species status reports prepared by NLDEC (2014), AC CDC (2010), COSEWIC (2014) and NL ESA (2007). No federally or provincially designated "at risk" flora species were found to be present in the Study Area; several SOCC were present, all of which are graminoids. These include short-scale sedge, perennial bentgrass, forest bluegrass and cottongrass bulrush. Two federally and provincially listed (*threatened*) faunal species were detected during the breeding songbird point count survey in June 2011: Olive-sided Flycatcher (*Contopus cooperi*) (COSEWIC 2007; and Common Nighthawk (*Chordeiles minor*) (COSEWIC 2007) (Stantec 2014).

The population of short-scale sedge within Newfoundland is ranked as *S1S2* by the AC CDC and has a general status rank of *may be at risk* (AC CDC 2010). Although these designations indicate that it is considered rare within the province, its population at the national and global level is secure, being identified as *N5* and *G5T5*, respectively. Short-scale sedge was observed at two locations within the Alder Thicket ecotype, where it was present in trace amounts. This species is generally observed from forested settings (Gleason and Cronquist 1991) and historical records indicate that it is known to occur in Central Newfoundland (Flora of North America Association 2008).

Perennial bentgrass is ranked as *S2* by the AC CDC and its population on the Island of Newfoundland is considered *may be at risk* (AC CDC 2010). It is widespread and common in eastern North America. At the global and national level, it is considered common, widespread and abundant and has been assigned statuses of *G5* and *N5*, respectively. Records for this species are available throughout western, northern and eastern Newfoundland, but are relatively absent from more central parts of the Island's interior (Flora of North America Association 2008). Perennial bentgrass is known to grow in association with a variety of habitats, including roadsides, fields, fens, woodlands and periodically inundated stream banks (Flora of North America Association 2008). It was observed at one site within the Alder Thicket ecotype, located within the riparian zone of Victoria River.

The Newfoundland population of forest bluegrass is ranked *S2S3* by the AC CDC and is considered *sensitive* (AC CDC 2010). Its global population is considered secure (*G5*) and its national population as apparently secure (*N4?*). This species has been recorded throughout much of the western portion of Newfoundland and is generally described as being found in association with woodlands (Flora of North America Association 2008). Forest bluegrass was recorded at three sites during field surveys, two of which have been classified as the Wet Coniferous Forest ecotype and one Mixedwood Forest.

Cottongrass bulrush is ranked *S2S3* by the AC CDC and sensitive on the Island of Newfoundland (AC CDC 2010), but is considered to have a secure population at the national and global scale (i.e., ranked *G5* and *N5*, respectively). This species is noted as being extremely variable throughout its range, where it is frequently found growing in association with a variety of disturbed areas, marshes, moist meadows, ditches and shallow ponds (Flora of North America Association 2008). Data indicate that it is known to occur in Central Newfoundland (Flora of North America Association 2008). Cottongrass bulrush was recorded at seven locations; including within the Wet Coniferous Forest (one), Riparian Thicket (one), Regenerating Forest (two), Balsam Fir Forest (one), and Alder Thicket (two) ecotypes during field surveys in support of the ELC. This species was also observed at several other locations within the Study Area, primarily in imperfectly drained portions of regenerating cut blocks, where it often formed relatively large swards.

6.3 Wildlife & Wildlife Habitat

6.3.1 Incidental Wildlife Observations

A total of seven mammal species were observed during delivery of the ELC survey. Visually recorded species included moose, woodland caribou), Canada lynx, eastern coyote (*Canis latrans*), red fox (*Vulpes vulpes*), snowshoe hare (*Lepus americanus*) and American red squirrel (*Tamiasciurus hudsonicus*). Species most frequently encountered were moose, woodland caribou, snowshoe hare and American red squirrel. In addition, there were indications (i.e., wildlife sign, including but not limited to, tracks, scat, markings, feeding activity, kill sites, bedding and nests and lodges and dams) of several more species, including, muskrat (*Ondatra zibethicus*), river otter (*Lontra canadensis*), red-backed vole (*Myodes* rutilus) and meadow vole (*Microtus pennsylvanicus*). Black bear (*Ursus americanus*) and two other predator species - ermine (*Mustela erminea*) and mink (*Neovison vison*), as well as Newfoundland marten, are known to occur in the Study Area, but were not confirmed during 2014 ELC field survey. Newfoundland marten, Newfoundland population, is protected under SARA; designated Threatened in April 2007, and listed as Threatened under the NL ESA. Evidence of beaver (*Castor canadensis*) activity including dams, lodges, stumps and cutting, as expected, were recorded along some small rivers and streams, and while no individual animals were observed, this species is believed to occur throughout the Study Area, where suitable habitat exists (i.e., habitat with a permanent water supply). No other mammal species listed under SARA or the NL ESA were encountered.

The number and composition of avifauna encountered was typical of what may be expected, based on the experience of the field team, the seasonal timing and available habitat in the region of the Study Area. There were 21 species observed during the survey. The list includes raptors, passerines, waterfowl / waterbirds and upland game birds.

Observations of raptors in the Study Area consisted mainly of Bald Eagle (*Haliaeetus leucocephalus*), Osprey (*Pandion haliaetus*) and Boreal Owl (*Aegolius funereus*). Other species previously observed (Stantec 2011) or likely to occur in the Study Area include Merlin (*Falco columbarius*), Northern Harrier (*Circus cyaneus*), Northern Goshawk (*Accipiter gentilis*), Sharp-shinned Hawk (*Accipiter striatus*), American Kestrel (*Falco tinnunculus*), Great-horned Owl (*Bubo virginianus*) and Short-eared Owl (*Asio flammeus*), where suitable habitats occur (Gosse and Montevecchi 2000).

Twelve forest songbird (passerines) species were detected during the 2014 ELC survey. Songbird species recorded during and in the course of delivering the ELC survey include: American Robin (*Turdus migratorius*), Black-capped Chickadee (*Poecile atricapillus*), Boreal Chickadee (*Poecile hudsonicus*), Black-and-white Warbler (*Mniotilta varia*), Black-throated Green Warbler (*Setophaga virens*), Common Yellowthroat (*Geothlypis trichas*), Dark-eyed Junco (*Junco hyemalis*), Red-breasted Nuthatch (*Sitta canadensis*), Lincoln's Sparrow (*Melospiza lincolnii*), Ovenbird (*Seiurus aurocapilla*), Song Sparrow (*Melospiza melodia*), and White-crowned Sparrow (*Zonotrichia leucophrys*). Thirty-eight avian species were identified during the breeding songbird point count survey in June 2011. The most common species recorded were White-throated Sparrow (*Zonotrichia albicollis*), Ruby-crowned Kinglet (*Regulus calendula*), Swainson's Thrush (*Catharus ustulatus*) and Yellow-bellied Flycatcher (*Empidonax flaviventris*) (Stantec 2014).

Other songbird species that could occur in the Study Area include: Alder Flycatcher (*Empidonax alnorum*), American Goldfinch, (*Spinus tristis*), American Redstart (*Setophaga ruticilla*), Blackpoll Warbler (*Dendroica striata*), Fox Sparrow (*Passerella iliaca*), Golden-crowned Kinglet (*Regulus satrapa*), Gray-cheeked Thrush (*Catharus minimus*), Hermit Thrush (*Catharus guttatus*), Least Flycatcher (*Empidonax minimus*), Mourning Warbler (*Oporornis philadelphia*), Nashville Warbler (*Vermivora ruficapilla*), Olive-sided Flycatcher, Palm Warbler (*Dendroica palmarum*), Pine Grosbeak (*Pinacola enucleator*), Pine Sisken (*Spinus pinus*), Ruby-crowned Kinglet, Rusty Blackbird (*Euphagus carolinus*), Red Crossbill (*Loxia curvirostra*), Swamp Sparrow (*Melospiza georgiana*), Swainson's Thrush, Tree Swallow (*Tachycineta bicolor*), White-throated Sparrow, Yellow-rumped Warbler (*Dendroica coronata*), and Yellow-bellied Flycatcher (Stantec 2014).

Several woodpecker species were also recorded, including Northern Flicker (*Colaptes auratus*), Yellow-shafted Flicker (*Colaptes auratus*) and Black-backed Woodpecker (*Picoides arcticus*). Those species with potential to occur include Downy Woodpecker (*Picoides pubescens*), Pileated Woodpecker (*Dryocopus pile*atus), and Yellow-bellied Sapsucker (*Sphyrapicus varius*).

Additional avifauna species such as American Crow (*Corvus brachyrhynchos*), Gray Jay (*Perisoreus canadensis*) and Belted Kingfisher (*Megaceryle alcyon*) were also detected but not included above as they are not forest songbirds (i.e., family Corvidae).

Upland game bird species Ruffed Grouse (*Bonasa umbellus*) and Spruce Grouse (*Falcipennis canadensis*) were distributed throughout the Study Area, while Willow Ptarmigan (*Lagopus*

lagopus) (also known as "partridge") were restricted to barren areas in open habitats characterized by low conifers and dwarf shrubs (e.g., blueberries and crowberries).

A small number of waterfowl / waterbirds were also recorded, including American Black Duck (*Anas rubripes*) and Common Loon (*Gavia immer*). Common Merganser (*Mergus merganser*), Common Goldeneye (*Bucephala clangula*), Green-winged Teal (*Anas carolinensis*) and Common Eider (*Somateria mollissima*) are also possible in open water habitats. An abundance of Canada Goose (*Branta canadensis*)during the Fall season (coinciding with fall migration for many species) would not be unexpected, given the many shrub wetlands, bogs, fens, smaller waterbodies and large lakes that provide favourable nesting habitat for geese (Mowbray et al. 2002). Shorebirds including sandpipers, phalaropes and snipe may occupy lowland habitats throughout the Study Area. Observations of Killdeer (*Charadrius vociferus*), Wilson's Snipe (*Gallinago delicata*) and Greater Yellowlegs (*Tringa melanoleuca*) were noted from within the Study Area.

A complete list of wildlife species identified during the surveys is provided in Appendix F.

6.3.1.1 Wildlife Species at Risk and/or Species of Conservation Concern

Species at Risk (i.e., listed under Schedule 1 of SARA or listed under the NL ESA and/or SOCC (i.e., listed as S1, S2 or S3 by AC CDC; listed as At Risk, May be at Risk, or Sensitive by NLDEC or by COSEWIC, but not listed under Schedule 1, have potential to occur in the region. Mammals species at risk with potential to occur in the Study Area include the Newfoundland population of American marten). Newfoundland marten are listed as *Threatened* and are protected both federally under SARA (COSEWIC 2007) and the NL ESA (Government of Newfoundland and Labrador 2004). Avifauna species at risk with potential to occur in the Study Area include Olive-sided Flycatcher, Gray-cheeked Thrush, Rusty Blackbird, Red Crossbill, Common Nighthawk, Short-eared Owl and Bank Swallow (*Riparia riparia*). Olive-sided Flycatcher is listed as "*Threatened*" under SARA, while Rusty Blackbird is listed as a "*Special Concern*" under SARA. Gray-cheeked Thrush is listed as "*Vulnerable*" under the NL ESA, but it has a recommended status of "*Threatened*" (Island of Newfoundland), due to population declines (SSAC 2010; Endangered Species and Advisory Committee Section 2010). Bank Swallow has been identified as a "species of interest" by provincial regulators. Potential habitat for Olive-sided Flycatcher included forested areas with tall, prominent snags. Potential habitat for Rusty Blackbird, and similarly that of Short-eared Owl, included relatively large, open fens with surrounding coniferous forest. Potential habitat for Red Crossbill included mature coniferous forest. Potential habitat for Common Nighthawk include logged or burned forest, woodland clearings, open forests and rock outcrops. Burrows associated with near-vertical, sandy embankments along large river systems may provide habitat for Bank Swallows.

Two federally and provincially listed (*threatened*) species were detected during earlier baseline studies conducted in the Study Area (Stantec 2013), including Olive-sided Flycatcher (COSEWIC 2007; SSAC 2009) and Common Nighthawk (COSEWIC 2007). The Olive-sided Flycatcher is listed federally and provincially as "*threatened*" (COSEWIC 2007; SSAC 2009) and individuals were previously detected during point count surveys performed in the Study Area (Stantec 2014). These individuals were observed in habitat typically associated with this species (i.e., Wet Coniferous Forest (wetland edge), and in Balsam Fir - Black Spruce Forest. Olive-sided Flycatcher is found throughout the Island and southern Labrador. Common Nighthawk (*Chordeiles minor*) is listed both provincial and federally and provincially as "*threatened*" (COSEWIC 2007), with a single individual having been incidentally observed in roadside habitat during songbird surveys conducted in 2011. Within the province, this species is known to breed in southern Labrador, but is considered a rarity on the Island of Newfoundland.

Both the Olive-sided Flycatcher and Common Nighthawk are boreal forest birds. The provincial and federal listings for these two species result from habitat decline throughout their range. Most avifauna. particularly those associated with federal and/or provincial endangered species lists, will require a management plan to reduce and possibly eliminate potential disturbance to nest sites. Management plans for these two species in Newfoundland and Labrador are pending. Note that the inadvertent disturbance or loss of nest sites is referred to as incidental take, and requires discussion with Environment Canada before this can occur. Unique mitigation measures to avoid or minimize disturbance may also be required.

6.3.2 Wildlife Habitat Assessment

6.3.2.1 Habitat Availability

Eleven ecosystem units representing 14 ecotypes (13 natural and 1 anthropogenic) were identified within the Study Area (Table 6.1). A majority of the Study Area is characterized by lowland ecotypes comprised of the Open Wetland (15%) and Wet Coniferous Forest (7%), followed by upland ecotypes, Balsam Fir Forest (7) and Black Spruce Forest (13), and mixed coniferous types or Mixedwood Forest ecotypes (10%). Only a small proportion of the Study Area (<1.0%) was characterized by anthropogenic disturbances comprised of existing and historic mineral exploration and forestry activities. On a landscape level, upland communities (Balsam Fir Forest, Black Spruce Forest, Mixedwood Forest, Kalmia-Black Spruce Forest, Kalmia Heath, Regenerating Forest, Alder Thicket and Riparian Thicket ecotypes) occupy 56% of the Study Area; lowland communities (Wet Coniferous Forest, Shrub / Graminoid Fen and Shrub Bog ecotypes) occupy 22.0% and open water, 22%.

Lowland treed and shrub habitats were the most abundant habitat types in the Study Area. Treed bogs and fens, although generally known to support lower bird and mammal density and diversity compared to upland habitats, provide important habitat for woodland caribou (Stuart-Smith et al. 1997). Treed lowlands also provide habitat for Olive-sided Flycatcher. Lowland shrub habitats are also used by various large mammal species (e.g., moose, woodland caribou and black bear), and support many bird species including Rusty Blackbird, Short-eared Owl and Common Yellowthroat. Graminoid dominated fen habitat may contain several wetland bird species of interest including Rusty Blackbird and Common Nighthawk. These areas often have standing water, and can be important habitat for water birds and amphibians alike.

Coniferous / Mixed coniferous and Mixedwood habitat were the second and third most abundant types, occupying 19.6% (385.1 ha) and 9.8% (179.3 ha) of the Study Area, respectively (Table 6.1). Mustelids such as marten and ermine may use the Coniferous / Mixed Coniferous habitat, particularly in areas of old growth. Although these sites do not support much songbird diversity, Olive-sided Flycatcher, Grey-cheeked Thrush and Black-throated Green Warbler may use stands comprised of mature balsam fir and black and white spruce. Mature mixed coniferous stands with reindeer lichen may also be used by woodland caribou, particularly those comprised of black spruce and balsam fir.

The majority of the Mixedwood habitat type is comprised of balsam fir-dominated white birch stands, although some spruce-dominated white birch stands. Species of interest include, but are not limited to, Northern Goshawk, Ruffed Grouse and Black-throated Green Warbler. Important mammalian species such as moose and black bear also use this habitat, as do marten, weasel and red squirrel during the denning season, in addition to many other small mammals. Bats, including the northern myotis (*Myotis septentrionalis*) and little brown myotis (*Myotis lucifugus*) (recently listed as *Endangered* under SARA; COSEWIC 2013), are also expected to roost in mature mixedwood forest

The remaining habitat types of Kalmia-Black Spruce Forest and Kalmia Heath, comprising approximately 11.4% (208.8 ha) of the Study Area combined (Table 6.1), may provide important winter forage for woodland caribou because of the presence of arboreal and ground lichens.

Existing anthropogenic disturbances accounted for less than 1% (8.2 ha) of the Study Area (Table 6.1).

6.3.2.2 Wildlife Habitat Assessment (Future Studies)

The following provides context to future studies, as required, in particular the assignment of wildlife habitat ratings for wildlife (i.e., mammals, birds, amphibians) in relation to the availability of ELC land cover classes found in the Study Area. Habitat ratings are selected due to the importance of identifying the current potential of each land cover class (i.e., ecotype or ecosystem unit) to provide the necessary life requisites (e.g., food, cover) or habitat attributes to support each species for a specified season. A combination of field sampling and cross-referencing to ecotype / ecosystem unit data may be used to derive the wildlife species and habitat ratings. This can be achieved for all ecosystem units and ecotypes in the Study Area.

Ranking the suitability of available habitat for each wildlife species involves the use of standard ecosystem mapping products that identify and spatially define habitat across an area of interest (RIC 1999). Because the land cover classes identified through ecosystem mapping for the Project represent relatively broad habitat types (i.e., coarse scale), a habitat association approach will likely be used to estimate habitat availability within the Study Area. Specifically, each land cover class will be evaluated to determine whether it could provide suitable habitat using knowledge of seasonal habitat requirements for a select list of species. Ratings are assigned for each species based on assumptions made about the habitat requirements of these species. For mammals, year-round habitat requirements are typically considered to account for breeding habitat during the summer (includingdenning and foraging habitat) and overwintering habitat requirements (*e.g*., denning sites). For migratory birds and raptors, the land cover classes are evaluated for suitable breeding habitat only (including nesting and foraging); migratory and winter habitat is not assessed. Habitat associations may be not assigned for some species, depending on their degree of association with specific habitat features and/or restrictions to their distribution within the province. Ratings of high, moderate and low value habitats for a select list of species are assigned.

High value habitat is defined as habitat that provides foraging, protection, nesting and resting habitat; Moderate habitat provides an abundance of one or more (or marginal amounts of all) of the critical elements; Low value habitat provides marginal foraging, protection or resting opportunities or may be used only during transit; and lastly Nil for those habitats possessing limited value to a species.

6.3.2.3 Key or Representative Wildlife Species Selected for Habitat Suitability

Habitat suitability models are developed for wildlife species selected because they represent at risk species (species at risk or SOCC in Newfoundland and Labrador), and/or of cultural, economic (e.g., furbearers, game species), and/or species of biological importance (e.g., possible indicators of ecosystem health). Habitat suitability models for the following species and seasonal attributes are anticipated: beaver; American marten - winter habitat; black bear - natal denning / hibernating habitat; moose - both spring / summer and early / late winter habitat; Canada lynx - both spring / summer and early / late winter habitat and woodland caribou - growing season (combined spring, summer, and fall) habitat.

American Beaver

Beaver select habitat with availability of preferred forage, which consists of aquatic vegetation and ericaceous shrubs in summer and alder (*Alnus* spp.) and birch (*Betula* spp.), aspen and other hardwoods in winter (Northcott 1971). Beavers are closely associated with streams, ponds and lakes that provide escape cover and den sites such as lodges or bank burrows (Allen 1983). High quality habitat for beaver in the Study Area includes Open Water, Open Wetlands (i.e., shrub bog ecotype), Wet Coniferous Forest and Riparian Thicket. Habitats for beaver in the Study Area deemed of Moderate quality include Wet Coniferous Forest, Regenerating Forests, Alder Thickets and Open Wetlands (i.e., shrub / graminoid fen ecotype). Low quality habitats include Balsam Fir-Black Spruce Forest and Kalmia- Black Spruce Woodland. Disturbed habitats characterized as Anthropogenic are typically avoided, providing no (NIL) habitat for beaver.

American Marten

Marten, on the Island of Newfoundland are a genetically and geographically distinct population of the American marten, and are restricted to three core habitats in Newfoundland. Five subpopulations are distributed among three core areas (near Main River, Terra Nova and west-central Newfoundland). The west-central Newfoundland population overlaps with or are adjacent to the Study Area.

The Little Grand Lake / Red Indian Lake Marten population encompasses a large area in west-central Newfoundland (6,232 km^2). Also included in this core area is a smaller core area just south of Sandy Lake with four adult marten locations documented between 1990 and 2007. To the south of the Little Grand Lake / Red Indian Lake core area is another small core area near Crabbes River. This core area contains an estimated 14 to 16 marten (Schmelzer 2008). The marten population in the Little Grand Lake / Red Indian Lake core area is estimated to be between 237 and 481 individuals (Schmelzer 2008). Critical habitat for the Newfoundland marten identified in the western portion of the island overlaps the Valentine Lake Study Area (The Newfoundland Marten Recovery Team 2010).

American marten require structural complexity of multistory mature coniferous forest (Smith and Schaefer 2002; Payer and Harrison 2003; Goose et al. 2005; Hearn et al. 2010). Forest structure complexity provides prey (such as red-backed voles (s.n.)) habitats, denning sites, thermoregulation, subnivean habitats and protection from predators (Andruskiw et al. 2008; Godbout and Ouellet 2010; McLaren et al. 2013). Marten in Newfoundland have a generalist foraging strategy; their diet varies seasonally with the availability of prey and berries. Habitat selection by marten generally depends on the availability of dense canopy forest patches within a matrix of bogs and scrub (Smith and Schaefer 2002). High quality habitat for American marten in the Study Area therefore includes mature to overmature Balsam Fir - Black Spruce Forest. Moderate quality habitats Black Spruce and Lichen Forest, Wet Conifer Forest, Kalmia- Black Spruce Woodland and Mixedwood Forest habitat types. The remaining habitat types are classified as low quality, based on the provision of limited foraging, protection and resting opportunities.

Black Bear

Black bear forage in various habitat types such as meadows, berry-dominated fields and bogs depending on the time of year (Pelton 1999). Dens are often constructed using existing blowdown or other coarse woody debris as the main structure, but crevices in rock formations are also used (Dennis et al. 1996). Black bear prefer areas with dense understory vegetation and spend the majority of their time in coniferous and deciduous forests, wetlands and areas remote from humans (Pelton 1999).

Spring / Summer

High quality habitat for black bear in the Study Area during the spring / early summer seasons includes Balsam Fir - Black Spruce Forest, Mixedwood Forest, Regenerating Forest, Open Wetland (shrub bog ecotype), Wet Coniferous Forest, Riparian Thicket and Exposed Sand / Gravel Shoreline. Modertate quality habitats include Open Wetland (Shrub / Graminoid Fen ecotype), Regeneration, Open Water and Anthropogenic. These same habitats are preferred during late summer / fall.

Given that black bear are omnivorous and have opportunistic feeding behaviours, all habitats in the Study Area may be considered either high or moderate quality.

Canada Lynx

During winter, lynx select complex multistory mature coniferous stands providing prey (i.e., snowshoe hare) and cover, while summer and denning habitat selection also include some younger forests with complex multistory (Moen et al. 2008; Squires et al. 2010; Simons-Legaard et al. 2013). High quality habitat for lynx in the Study Area includes Balsam Fir - Black Spruce Forest (e.g., open spruce moss forest, closed spruce moss forest), Open Wetlands – Shrub Bog ecotype, Wet Coniferous Forest, Alder Thicket, Riparian Thicket, and Exposed Sand / Gravel Shoreline. Moderate quality habitats are Kalmia- Black Spruce Woodland, Mixedwood Forest, and Regenerating Forest. Low quality habitats for lynx are Open Water, Open Wetlands – Shrub / Graminoid Fen ecotype, Open Water, and Anthropogenic.

Moose

Moose are found in relatively high densities in Newfoundland, with an estimated population of 125,000 (McLaren et al. 2004). Quotas within Big Game Management Areas in the central Newfoundland region of the Study Area are generally higher than elsewhere in the Province (NLDEC 2012), and may reflect higher densities in this region. Moose are generally associated with mixedwood or coniferous habitats (i.e., Balsam Fir - Black Spruce Forest, Mixedwood Forest). Conifers are sometimes used as a supplementary food source (Bowyer et al. 2003), although the use of conifer dominated forests by moose is likely dependent on the amount of balsam fir (important for browse and cover) present.

Spring / Summer

During the spring / summer, Mixedwood / Hardwood Forests, Regenerating Forest and Open Wetlands (particularly those that support aquatic plants) provide particularly important (High quality) moose habitat. Mixedwood Forests provide high quality habitat because of the food, protection and shelter it provides. Similarly, Open Wetlands provide primary habitat due to the presence of high quality forage (aquatic vegetation) typically important at this time.

Coniferous habitats, including Balsam Fir - Black Spruce Forest and Kalmia- Black Spruce Woodland have a moderate importance in the spring / summer.

Fall / Winter

In the fall / winter season, three habitat types provide high quality habitat. Coniferous forests (Balsam Fir - Black Spruce Forest and Wet Coniferous Forest) are of primary importance in the fall

/ winter because they provide forage and cover. Regenerating Forest is also of some importance in the fall / winter (secondary in the spring / summer), as young balsam fir and birch may occur here and is an important food source. The fourth habitat type with primary importance in the fall / winter is Mixedwood Forest; this high quality habitat provides shelter, and the deciduous portion may be an important food source at this time.

Kalmia - Black Spruce Woodland and Open Wetlands are both of moderate importance to moose year round, providing some foraging opportunities, with Kalmia - Black Spruce Woodland used in the winter when snow depth is low. Mixedwood Forests and Open Wetland habitats are of moderate and low importance in the fall / winter. Mixedwood Forests do not offer much cover, and Open Wetlands are likely frozen, thus preventing access to vegetation.

All other habitat types were considered low quality, based on limited protection, resting or foraging opportunities.

Woodland Caribou

Woodland caribou are an important cultural, economic, and ecosystem component in Newfoundland and Labrador, supplying a hunting resource for residents and prey for wildlife. Woodland caribou within Newfoundland and Labrador are classified as one of three ecotypes: (i) sedentary; (ii) migratory; or (iii) montane (Thomas and Gray 2002; Boulet et al. 2007; Bergerud et al. 2008). Currently, the province recognizes the sedentary caribou are the forest dwelling ecotype that undergoes a seasonal dispersion (rather than migration) during calving (Bergerud et al. 2008).

Woodland caribou regularly occur in the Study Area, with many caribou moving south following the calving period. Woodland caribou were generally associated with dry, mesic coniferous scrub (Kalmia - Black Spruce Woodland and Kalmia Heath ecotypes) and wetland habitat types (including Wet Coniferous Forest and Open Wetland). With the exception of habitat classified as Open Water, these habitats have been identified as primary habitat for caribou during calving and post calving. In particular, deciduous shrubs, sedges, reindeer moss or lichen (*Cladina* spp.), and fungi are important to caribou in Newfoundland during summer (Bergerud 1972), and evidence suggests that barrens and Wetlands are preferred calving habitats (McCarthy et al. 2011). Hardwood and softwood scrub are also used during calving, as well as post-calving and fall (Mahoney and Virgil 2003). Open water can also be important to caribou, as it offers escape from predators (Bergerud et al. 2008).

Both bear and coyote are predator species in insular Newfoundland, and known predators of Woodland caribou, and are known to occur in Study Area.

Additionally, the province has eight species with NL ESA designations that are known, or potentially present within the Study Area (Table 6.17).

Table 6.16 Key or Representative Wildlife Species Selected for Habitat Suitability

Species	NLESA Designation
Common Nighthawk	Threatened
Gray-cheeked Thrush	Endangered
Harlequin Duck	Vulnerable
Olive-sided Flycatcher	Threatened
Red Knot	Endangered
Red Crossbill	Endangered
Rusty Blackbird	Endangered
Short-eared Owl	Vulnerable

7.0 ELC REPORT AND MAP USE

This ELC report and the cover classes described within are intended to be reflective of ecological conditions within the Study Area; however, variability is the norm within ecosystems and no classification can be expected to capture all this variation. In addition, the ELC map produced for this Project reflects dominant current conditions within each polygon, which are subject to change over time. In particular, burned ecotypes will change considerably as they move through successional stages. In addition, mapped polygons will usually contain inclusions of ecotypes too small to be reflected in the supervised classification and represented in polygon labels. Therefore, this ELC report and map should be used as a guide to ecotypes within the Study Area. Users should verify conditions on the ground before proceeding with any ELC-associated site-specific activity.

8.0 CLOSURE

This report has been prepared for the benefit of Marathon Gold Corporation. The report may not be used by any other person or entity without the express written consent of Stantec and Marathon Gold Corporation.

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

The information presented in this report represents the best technical judgment of Stantec based on the data obtained from the work. The conclusions are based on the site conditions observed by Stantec at the time the work was performed at the specific testing and/or sampling locations, and can only be extrapolated to another time and location without further analysis.

This assessment was prepared by Sean Bennett and Rich LaPaix and has been reviewed for technical quality by Mike Crowell. We trust that the above meets your requirements at this time. Please contact Sean Bennett at (709) 576-1458 if there are any questions respecting this report.

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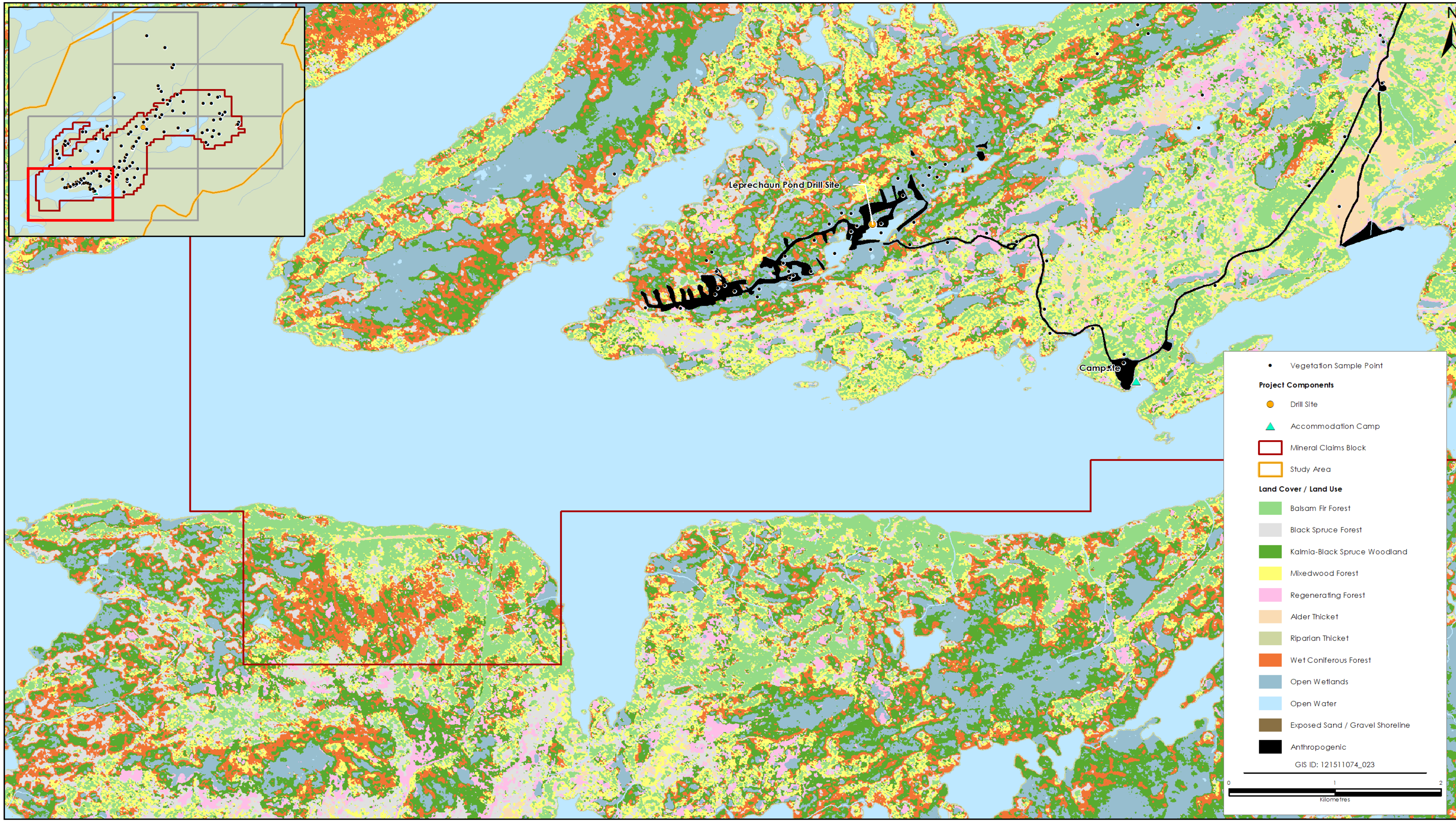
APPENDIX A

Ecosystem Mapping of the Study Area



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REVIEWED BY: C. SHUPE

CLIENT: Marathon Gold

Victoria Lake Region, Newfoundland and Labrador

Ecological Land Classificaiton -Mineral Claims Block - Page 1 of 8

FIGURE NO.: X.X

DATE: Sep 24, 2020

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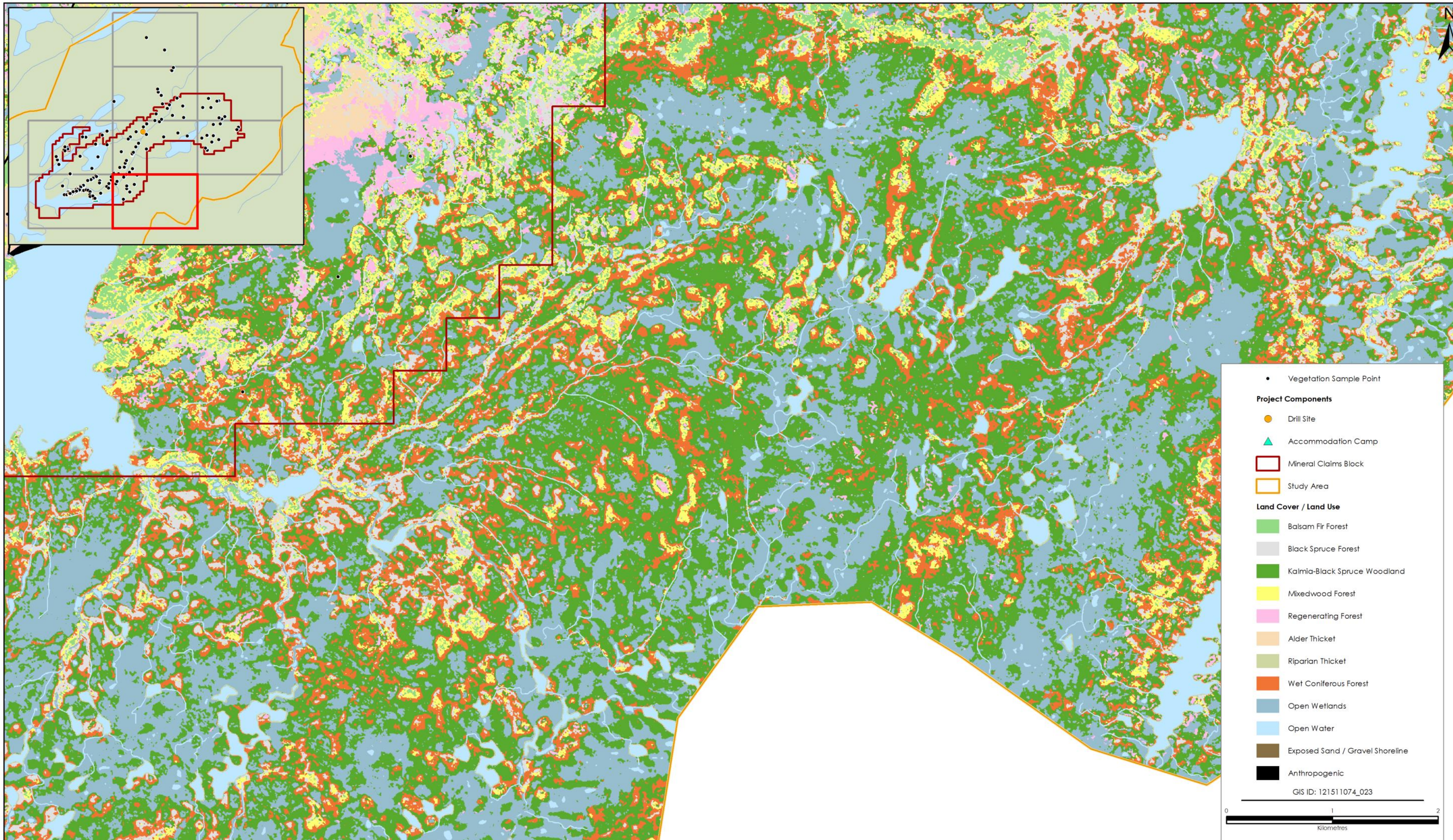

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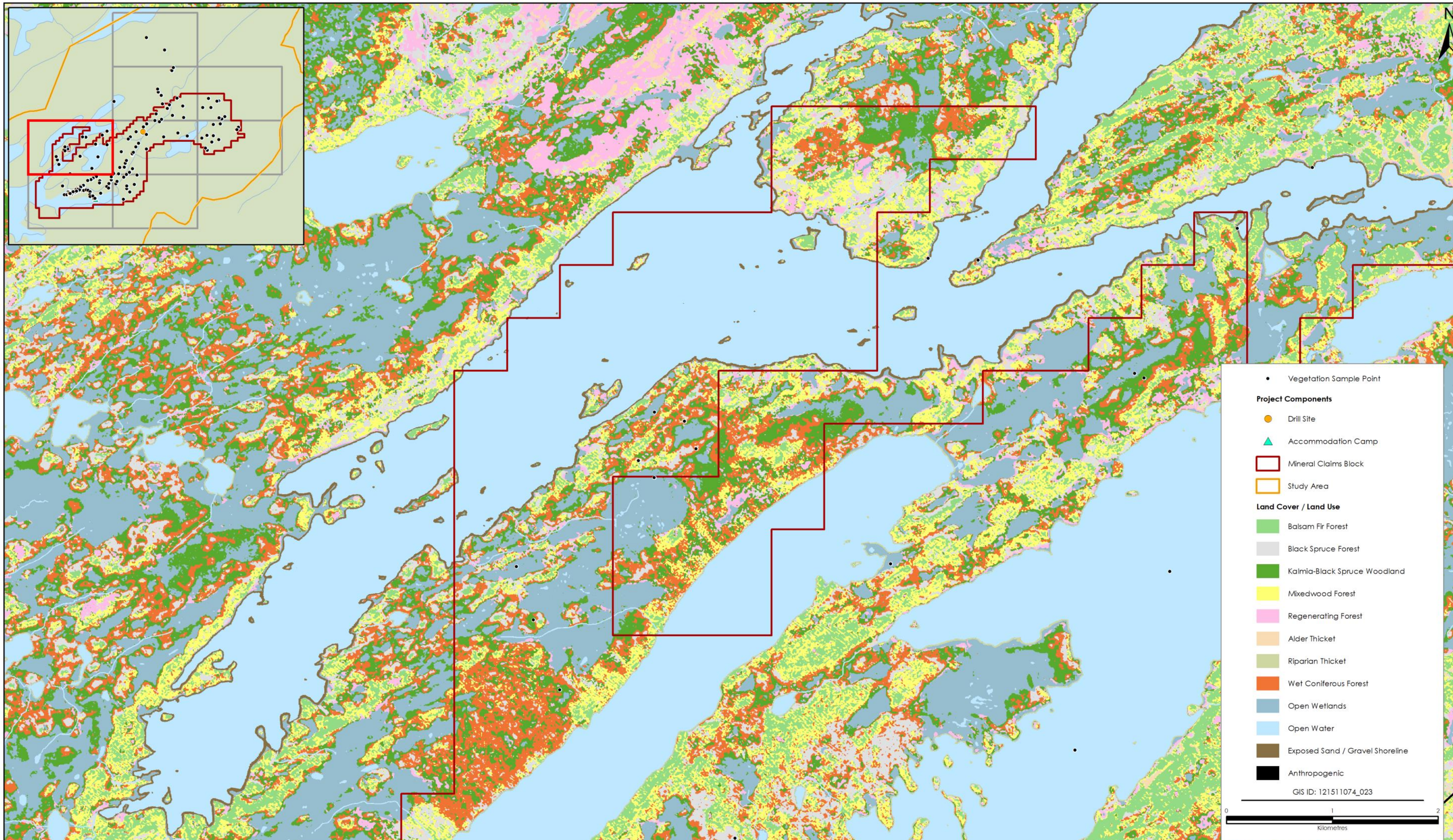

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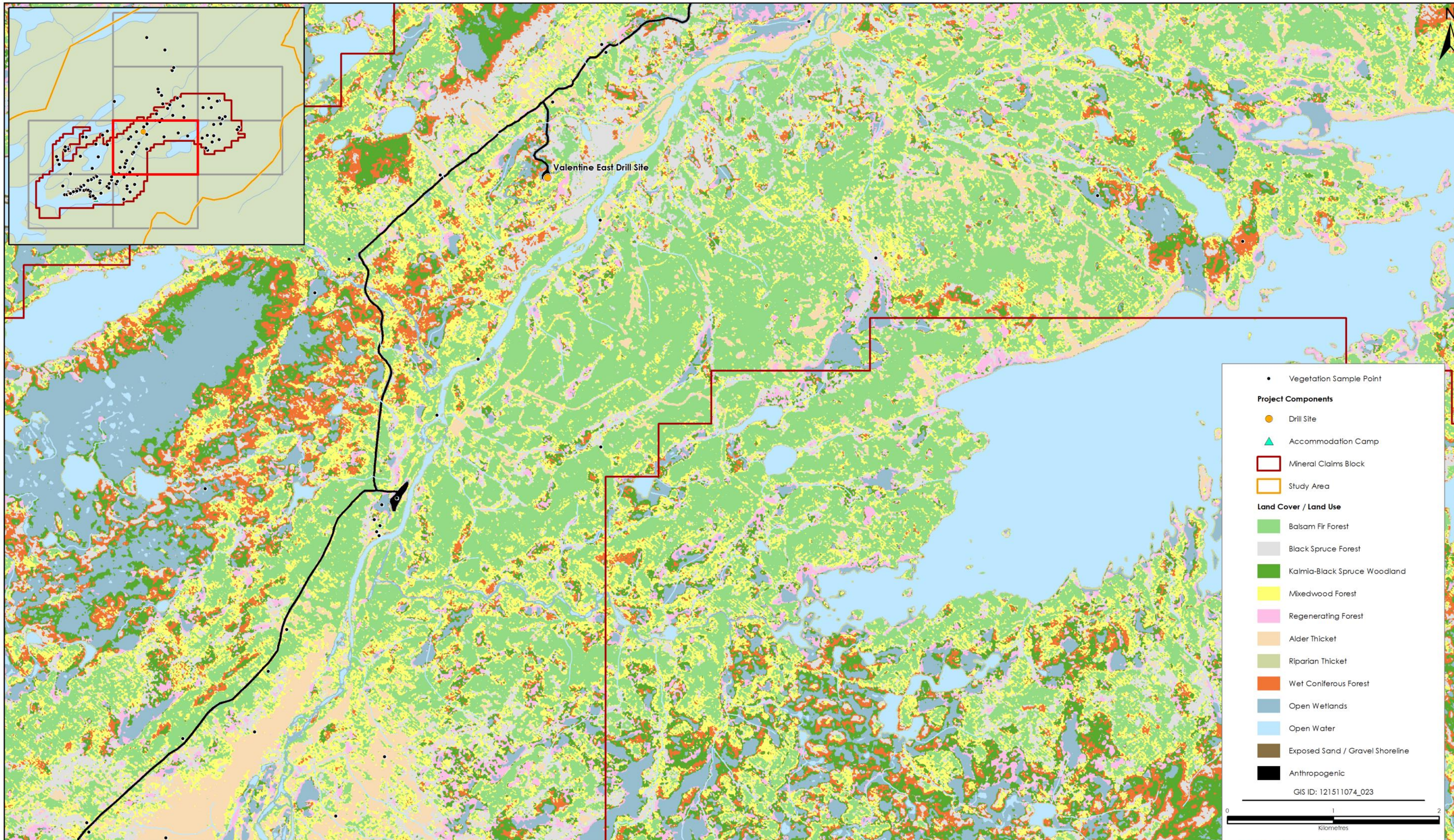

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Ecological Land Classificaiton -Mineral Claims Block - Page 4 of 8

FIGURE NO.: X.X

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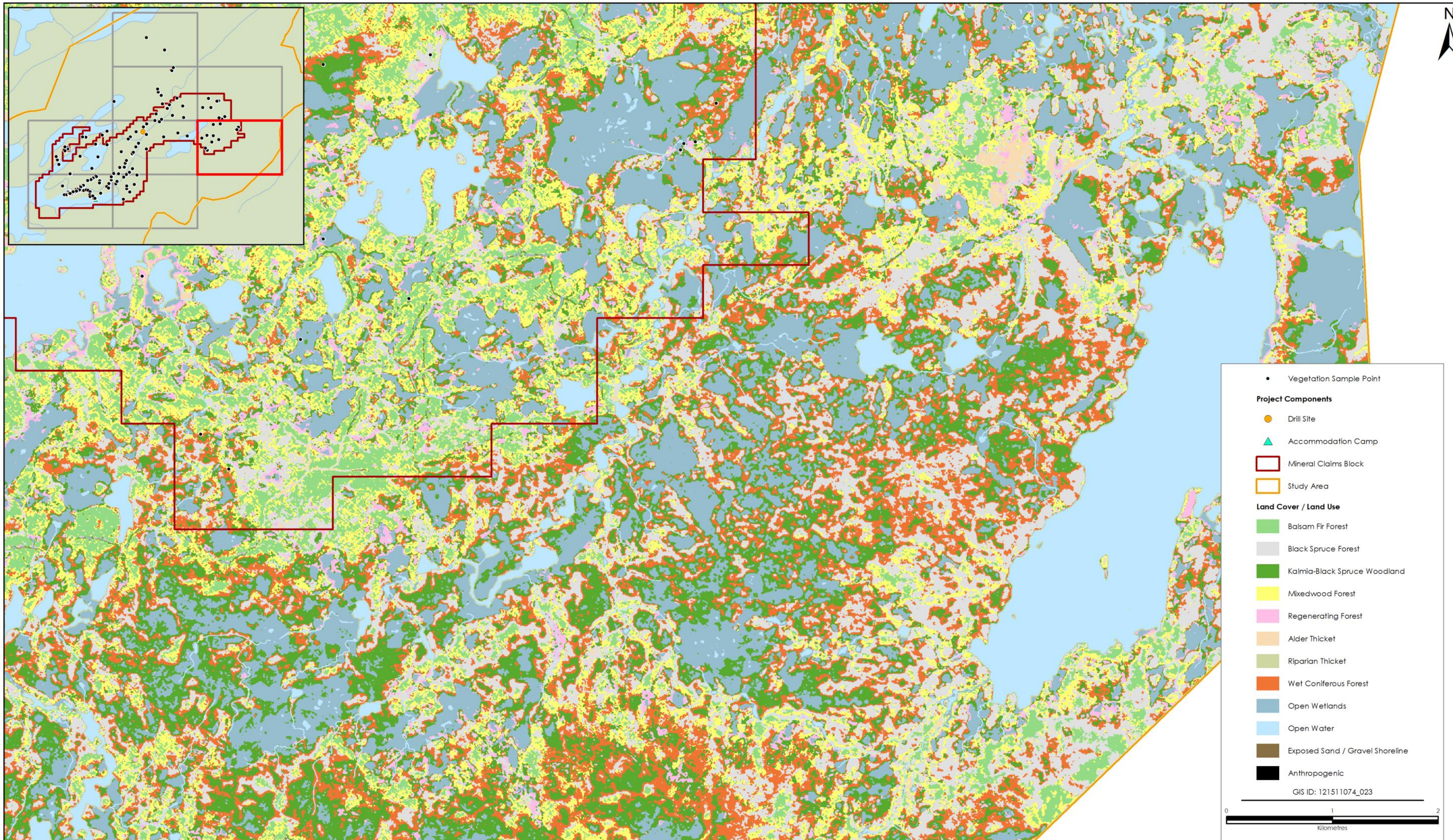

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Victoria Lake Region, Newfoundland and Labrador

Ecological Land Classificaiton -Mineral Claims Block - Page 5 of 8

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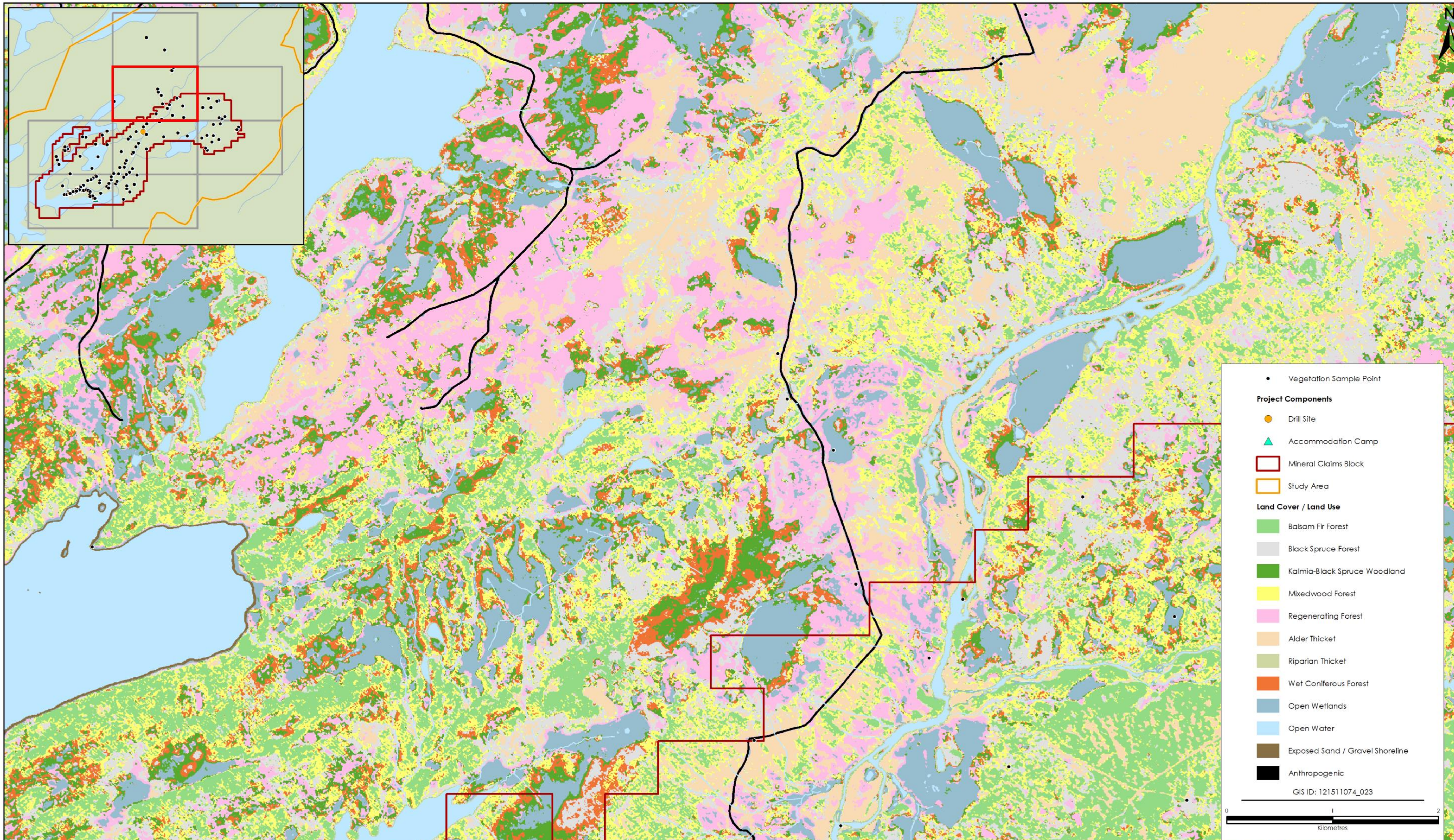

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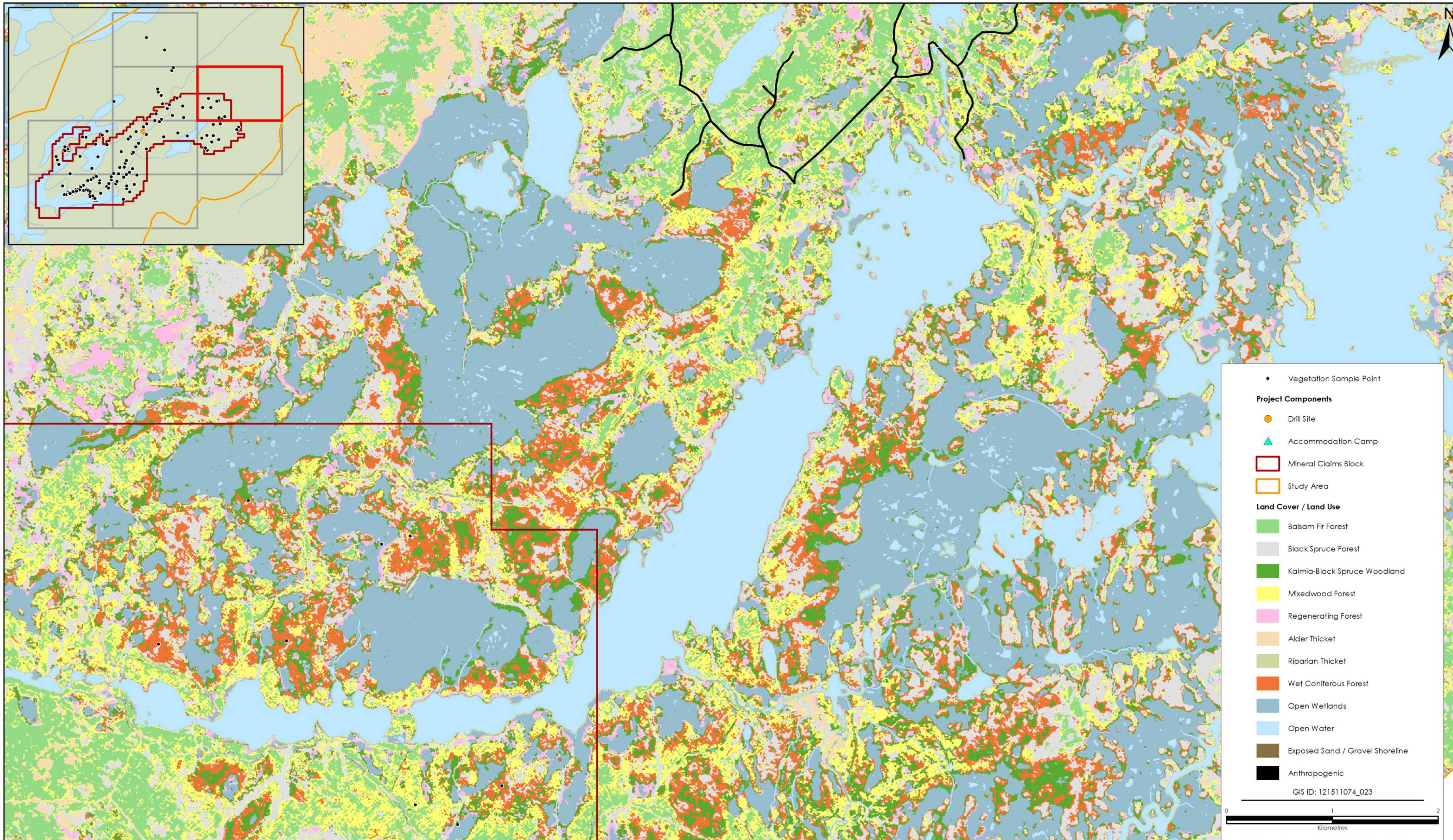

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Victoria Lake Region, Newfoundland and Labrador

Ecological Land Classificaiton -Mineral Claims Block - Page 7 of 8

FIGURE NO.: X.X

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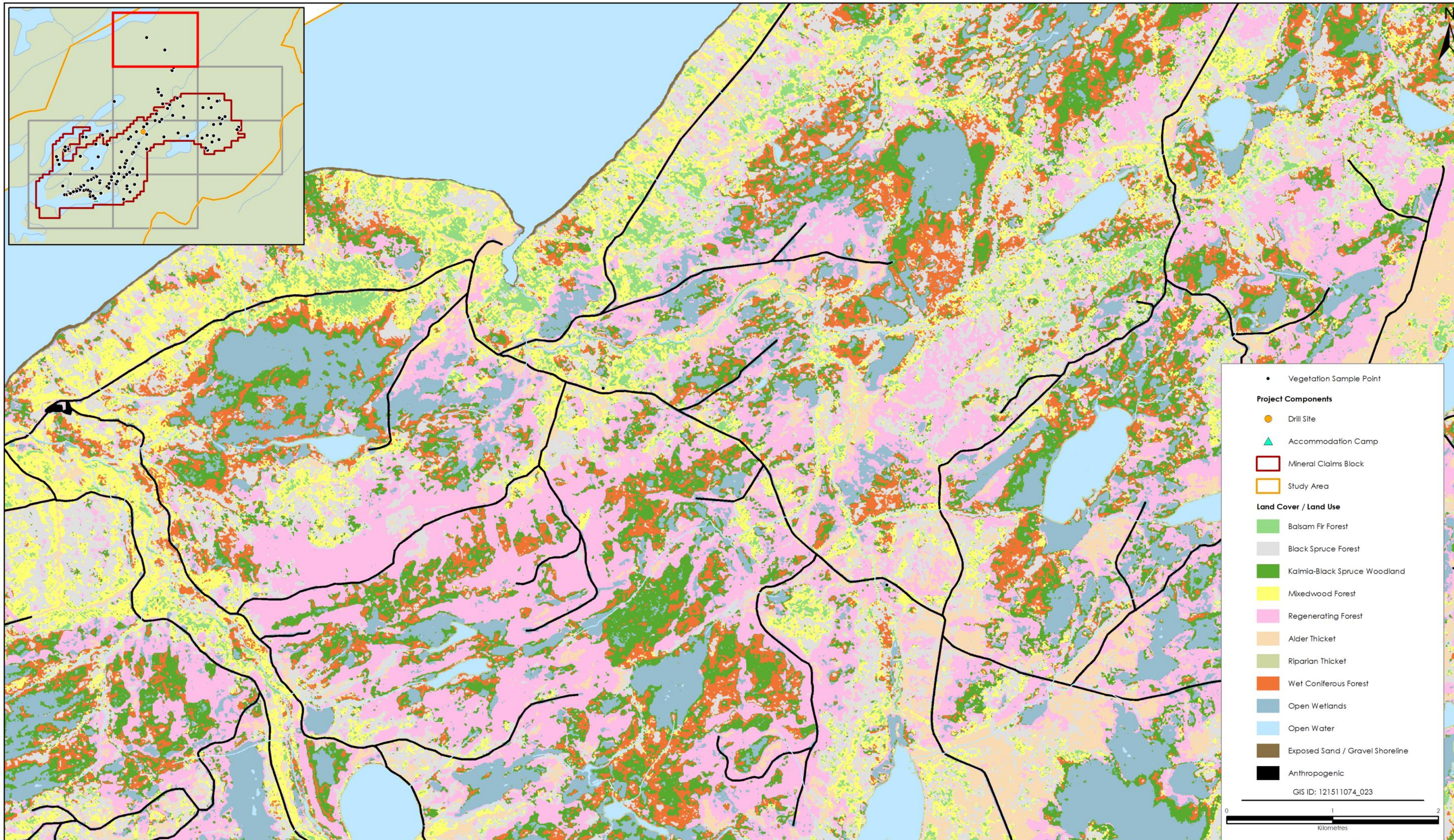

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APPENDIX B

Plant Species Observed within Field Sites

Table B1 Vascular and Non-vascular Plant Species Observed within ELC Field Sites in the Marathon Valentine Lake Gold Mine Study Area

Family	Scientific Name	Common Name	G Rank	N Rank	S Rank	General Status Rank
Trees / Shrubs						
Aceraceae	*Acer rubrum*	Red Maple	G5	N5	S5	Secure
Betulaceae	*Betula papyrifera*	Paper Birch	G5	N5	S5	Secure
Pinaceae	*Abies balsamea*	Balsam Fir	G5	N5	S5	Secure
Pinaceae	*Larix laricina*	Tamarack	G5	N5	S5	Secure
Pinaceae	*Picea glauca*	White Spruce	G5	N5	S5	Secure
Pinaceae	*Picea mariana*	Black Spruce	G5	N5	S5	Secure
Shrubs						
Aquifoliaceae	*Ilex mucronatus*	Mountain Holly	G5	N5	S5	Secure
Adoxaceae	*Viburnum nudum*	Northern Wild Raisin	G5	NNR	S5	Secure
Adoxaceae	*Viburnum trilobum*	Highbush Cranberry	G5	N5	S5	Secure
Adoxaceae	*Sambucus racemosa*	Red Elderberry	G5	N5	S4	Secure
Adoxaceae	*Sambucus sp.*	Elderberry				
Betulaceae	*Alnus incana*	Speckled Alder	G5	N5	S4S5	Secure
Betulaceae	*Alnus viridis* subsp. *crispa*	Mountain Alder	G5	N5	S5	Secure
Betulaceae	*Betula michauxii*	Michaux's Dwarf Birch	G3G4	N2N4	S3	Secure
Betulaceae	*Betula pumila*	Bog Birch	G5	N5	S5	Secure
Caprifoliaceae	*Linnaea borealis*	Twinflower	G5	NNR	S5	Secure
Caprifoliaceae	*Lonicera villosa*	Mountain Fly-Honeysuckle	G5	NNR	S5	Secure
Cornaceae	*Cornus sericea*	Silky Dogwood	G5	NNR	S5	Secure
Cupressaceae	*Juniperus communis var. depressa*	Ground Juniper	G5	N5	S4S5	
Cupressaceae	*Juniperus horizontalis*	Creeping Juniper	G5	N5	S5	Secure
Empetraceae	*Empetrum eamesii*	Rock Crowberry	G5	NNR	S4	Secure
Empetraceae	*Empetrum nigrum*	Black Crowberry	G5	NNR	S5	Secure
Ericaceae	*Andromeda polifolia*	Glaucousleaf Bog Rosemary	G5	NNR	S5	Secure
Ericaceae	*Chamaedaphne calyculata*	Leatherleaf	G5	N5	S5	Secure
Ericaceae	*Epigaea repens*	Trailing Arbutus	G5	NNR	S3	Sensitive
Ericaceae	*Gaultheria hispidula*	Creeping Snowberry	G5	NNR	S5	Secure

Family	Scientific Name	Common Name	G Rank	N Rank	S Rank	General Status Rank
Ericaceae	*Kalmia angustifolia*	Sheep-Laurel	G5	NNR	S5	Secure
Ericaceae	*Kalmia polifolia*	Bog Laurel	G5	NNR	S5	Secure
Ericaceae	*Rhododendron groenlandicum*	Labrador Tea	G5	N5	S5	Secure
Ericaceae	*Rhododendron canadense*	Rhodora	G5	NNR	S5	Secure
Ericaceae	*Vaccinium angustifolium*	Late Lowbush Blueberry	G5	N5	S5	Secure
Ericaceae	*Vaccinium boreale*	Northern Blueberry	G4	N4	S4S5	Secure
Ericaceae	*Vaccinium macrocarpon*	Large Cranberry	G4	N4?	S5	Secure
Ericaceae	*Vaccinium oxycoccos*	Small Cranberry	G5	N5	S5	Secure
Ericaceae	*Vaccinium uliginosum*	Bog Bilberry	G5	NNR	S5	Secure
Ericaceae	*Vaccinium vitis-idaea*	Partridgeberry	G5	NNR	S5	Secure
Grossulariaceae	*Ribes glandulosum*	Skunk Currant	G5	N5	S5	Secure
Grossulariaceae	*Ribes lacustre*	Bristly Black Currant	G5	NNR	S3S4	Secure
Grossulariaceae	*Ribes sp.*	a Currant				
Rhamnaceae	*Rhamnus alnifolia*	Alderleaf Buckthorn	G5	NNR	S5	Secure
Rosaceae	*Amelanchier bartramiana*	Bartram's Chuckleypear	G5	NNR	S5	Secure
Rosaceae	*Dasiphora fruticosa*	Shrubby Cinquefoil	G5	NNR	S3S5	Secure
Rosaceae	*Photinia melanocarpa*	Black Chokeberry	G5	NNR	SNR	Undetermined
Rosaceae	*Photinia sp.*	Chokeberry	G5	NNR		
Rosaceae	*Prunus pensylvanica*	Fire Cherry	G5	NNR	S4S5	Secure
Rosaceae	*Rosa nitida*	Shining Rose	G5	N4N5	S4S5	Secure
Rosaceae	*Rubus idaeus*	Red Raspberry	G5	N5	S5	Secure
Rosaceae	*Sorbus americana*	American Mountain-Ash	G5	NNR	S3S5	Secure
Rosaceae	*Sorbus decora*	Showy Mountain-Ash	G4G5	NNR	S3S5	Secure
Rosaceae	*Spiraea alba*	Narrow-Leaved Meadow-Sweet	G5	N5	S3S5	-
Sapindaceae	*Acer spicatum*	Mountain Maple	G5	N5	S5	Secure
Taxaceae	*Taxus canadensis*	Canada Yew	G5	N5	S3	Sensitive
Graminoids						
Cyperaceae	*Carex atlantica*	Atlantic Sedge	G5	NNR		-
Cyperaceae	*Carex brunnescens*	Brownish Sedge	G5	N5	S3S5	Secure
Cyperaceae	*Carex buxbaumii*	Buxbaum's Sedge	G5	N5	S3S5	Secure

Family	Scientific Name	Common Name	G Rank	N Rank	S Rank	General Status Rank
Cyperaceae	*Carex canescens*	Hoary Sedge	G5	N5	S3S5	Secure
Cyperaceae	*Carex debilis*	White-Edge Sedge	G5T5	N5	S3S5	Secure
Cyperaceae	*Carex deweyana*	Short-Scale Sedge	G5T5	N5	S1S2	May be at risk
Cyperaceae	*Carex disperma*	Softleaf Sedge	G5	N5	S3S5	Secure
Cyperaceae	*Carex echinata*	Little Prickly Sedge	G5T5	N5	S3S5	Secure
Cyperaceae	*Carex exilis*	Coast Sedge	G5	N5	S3S5	Secure
Cyperaceae	*Carex flava*	Yellow Sedge	G5	N5	S3S5	Secure
Cyperaceae	*Carex interior*	Inland Sedge	G5	N5	S3S5	Secure
Cyperaceae	*Carex intumescens*	Bladder Sedge	G5	N5	S3S5	Secure
Cyperaceae	*Carex lasiocarpa*	Slender Sedge	G5	N5	S3S5	Secure
Cyperaceae	*Carex leptalea*	BristlestalkSedge	G5	N5	S3S5	Secure
Cyperaceae	*Carex limosa*	Mud Sedge	G5	N5	S3S5	Secure
Cyperaceae	*Carex magellanica*	Boreal Bog Sedge	G5T5	N5	S3S5	Secure
Cyperaceae	*Carex michauxiana*	Michaux Sedge	G5	N5	S3S5	Secure
Cyperaceae	*Carex oligosperma*	Few-Seeded Sedge	G5	N5	S5	Secure
Cyperaceae	*Carex pauciflora*	Few-Flowered Sedge	G5	N5	S3S5	Secure
Cyperaceae	*Carex sp.*	a sedge				
Cyperaceae	*Carex stipata*	Stalk-Grain Sedge	G5T5	N5	S3S5	Secure
Cyperaceae	*Carex tenuiflora*	Sparse-Flowered Sedge	G5	N5	S3S5	Secure
Cyperaceae	*Carex trisperma*	Threefruit sedge	G5	N5	S5	Secure
Cyperaceae	*Carex utriculata*	Bear Sedge	G5	N5	S4S5	Secure
Cyperaceae	*Carex vesicaria*	Inflated Sedge	G5	N5	S3S5	Secure
Cyperaceae	*Carex wiegandii*	Wiegand's Sedge	G4	N3N4	S3	Secure
Cyperaceae	*Eriophorum angustifolium*	No Common Name In Tracker	G5T5	NNR	S3S5	Secure
Cyperaceae	*Eriophorum vaginatum*	Tussock Cotton-Grass	G5	N5	S3S5	Secure
Cyperaceae	*Eriophorum virginicum*	Tawny Cotton-Grass	G5	N5	S3S5	Secure
Cyperaceae	*Eriophorum viridicarinatum*	Green-Keel Cottongrass	G5	N5	S3S5	Secure
Cyperaceae	*Rhynchospora alba*	White Beakrush	G5	N5	S3S5	Secure
Cyperaceae	*Schoenoplectus subterminalis*	Water Bulrush	G4G5	NNR	S3S5	Secure
Cyperaceae	*Scirpus atrocinctus*	Black-Girdle Bulrush	G5	N5	S3S5	Secure
Cyperaceae	*Scirpus cyperinus*	Cottongrass Bulrush	G5	N5	S2S3	Sensitive
Cyperaceae	*Scirpus microcarpus*	Red-Tinged Bulrush	G5	N5	S3S5	Secure
Cyperaceae	*Trichophorum alpinum*	Alpine Cotton-Grass	G5	N5	S3S5	Secure
Cyperaceae	*Trichophorum*	Deergrass	G5	NNR	S3S5	Secure

Family	Scientific Name	Common Name	G Rank	N Rank	S Rank	General Status Rank
	caespitosum					
Juncaceae	*Juncus brevicaudatus*	Short-tail Rush	G5	N5	S5	Secure
Juncaceae	*Juncus canadensis*	Canada Rush	G5	N5	S4	Secure
Juncaceae	*Juncus effusus*	Soft Rush	G5	N5	S5	Secure
Juncaceae	*Juncus pelocarpus*	Brown-Fruited Rush	G5	N5	S4	Secure
Juncaceae	*Juncus stygius*	Moor Rush	G5	NNR		
Poaceae	*Agrostis capillaris*	Colonial Bentgrass	GNR	NNA	SE	Exotic/Alien
Poaceae	*Agrostis gigantea*	Black Bentgrass	G4G5	NNA	SE	Exotic/Alien
Poaceae	*Agrostis perennans*	Perennial Bentgrass	G5	N5	S2	May be at risk
Poaceae	*Agrostis scabra*	Rough Bentgrass	G5	N5	S3S5	Secure
Poaceae	*Bromus ciliatus*	Fringed Brome	G5T5	N5	S3S5	Secure
Poaceae	*Calamagrostis canadensis*	Bluejoint Reedgrass	G5	N5	S5	Secure
Poaceae	*Calamagrostis pickeringii*	Pickering's Reedgrass	G4	NNR	S3S5	Secure
Poaceae	*Cinna latifolia*	Wood Reedgrass	G5	N5	S3S5	Secure
Poaceae	*Danthonia spicata*	Poverty Oatgrass	G5	N5	S3S5	Secure
Poaceae	*Glyceria canadensis*	Canada Manna-Grass	G5	N4N5	S3S5	Secure
Poaceae	*Glyceria striata*	Fowl Manna-Grass	G5	N5	S3S5	Secure
Poaceae	*Muhlenbergia glomerata*	Marsh Muhly	G5	N5	S3S5	Secure
Poaceae	*Muhlenbergia uniflora*	Fall Dropseed Muhly	G5	NNR	S3S5	Secure
Poaceae	*Poa palustris*	Fowl Bluegrass	G5	N5	SNA	Exotic/Alien
Poaceae	*Poa saltuensis*	Forest Bluegrass	G5	N4?	S2S3	Sensitive
Poaceae	*Schizachne purpurascens*	Purple False Melic	G5	N5	S3	Sensitive
Scheuchzeriaceae	*Scheuchzeria palustris*	Pod Grass	G5	NNR	S3	Sensitive
		Forbs				
Apiaceae	*Heracleum maximum*	Cow Parsnip	G5	N5	S5	Secure
Araliaceae	*Aralia hispida*	Bristly Sarsaparilla	G5	N5	S4S5	Secure
Araliaceae	*Aralia nudicaulis*	Wild Sarsaparilla	G5	N5	S5	Secure
Asteraceae	*Anaphalis margaritacea*	Pearly Everlasting	G5	N5	S5	Secure
Asteraceae	*Aster sp.*	unknown aster				
Asteraceae	*Cirsium muticum*	Swamp Thistle	G5	N5?	S5	Secure
Asteraceae	*Doellingeria umbellata*	Parasol White-Top	G5	N5	S5	Secure

Family	Scientific Name	Common Name	G Rank	N Rank	S Rank	General Status Rank
Asteraceae	*Erigeron sp.*	Fleabane				
Asteraceae	*Eurybia radula*	Rough-Leaved Aster	G5	NNR	S5	Secure
Asteraceae	*Euthamia graminifolia*	Flat-Top Fragrant-Golden-Rod	G5	N5	S5	Secure
Asteraceae	*Eutrochium maculatum*	Spotted Joe-Pye Weed	G5	N5	S4S5	Secure
Asteraceae	*Oclemena nemoralis*	Bog Aster	G5	N5	S5	Secure
Asteraceae	*Packera aurea*	Golden Ragwort	G5	N5	S4S5	Secure
Asteraceae	*Packera paupercula*	Balsam Groundsel	G5	N5	S4	Secure
Asteraceae	*Prenanthes trifoliolata*	Three-Leaved Rattlesnake-root	G5	NNR	S5	Secure
Asteraceae	*Solidago rugosa*	Rough-Leaf Goldenrod	G5	N5	S5	Secure
Asteraceae	*Solidago uliginosa*	Bog Goldenrod	G4G5	N5	S5	Secure
Asteraceae	*Symphyotrichum puniceum*	Purplestem aster	G5	N5	S5	Secure
Asteraceae	*Taraxacum officinale*	Common Dandelion	G5	N5	SNA	Exotic/Alien
Boraginaceae	*Myosotis laxa*	Small Forget-Me-Not	G5	N5	SU	Undetermined
Clusiaceae	*Hypericum sp.*	St John's-Wort				
Clusiaceae	*Triadenum fraseri*	Marsh St. John's-Wort	G5	N5	S4	Secure
Cornaceae	*Cornus canadensis*	Bunchberry	G5	N5	S5	Secure
Droseraceae	*Drosera intermedia*	Spoon-Leaved Sundew	G5	NNR	S4S5	Secure
Droseraceae	*Drosera rotundifolia*	Roundleaf Sundew	G5	N5	S5	Secure
Dryopteridaceae	*Athyrium filix-femina*	Lady Fern	G5T5	N5	S5	Secure
Dryopteridaceae	*Dryopteris campyloptera*	Mountain Wood-Fern	G5	NNR	S5	Secure
Dryopteridaceae	*Dryopteris intermedia*	Evergreen woodfern	G5	N5	S5	Secure
Dryopteridaceae	*Gymnocarpium dryopteris*	Northern Oak Fern	G5	N5	S5	Secure
Dryopteridaceae	*Matteucia struthiopteris*	Ostrich Fern			S3S4	Secure
Dryopteridaceae	*Onoclea sensibilis*	Sensitive Fern	G5	N5	S4	Secure
Equisetaceae	*Equisetum arvense*	Field Horsetail	G5	N5	S5	Secure
Equisetaceae	*Equisetum fluviatile*	Water Horsetail	G5	N5	S4	Secure
Equisetaceae	*Equisetum sylvaticum*	Woodland Horsetail	G5	N5	S5	Secure
Eriocaulaceae	*Eriocaulon aquaticum*	Seven-Angled Pipewort	G5	N5	S5	Secure

Family	Scientific Name	Common Name	G Rank	N Rank	S Rank	General Status Rank
Fabaceae	*Trifolium campestre*	Low Hop Clover	GNR	NNA	SNA	Exotic/Alien
Iridaceae	*Iris versicolor*	Blueflag	G5	N5	S5	Secure
Lamiaceae	*Galeopsis tetrahit*	Brittle-Stem Hempnettle	GNR	NNA	SNA	Exotic/Alien
Lamiaceae	*Lycopus uniflorus*	Northern Bugleweed	G5	NNR	S5	Secure
Lamiaceae	*Mentha arvensis*	Corn Mint	G5	N5	S5	Secure
Lamiaceae	*Prunella vulgaris*	Self-Heal	G5	N5	S3S4	Secure
Lentibulariaceae	*Utricularia cornuta*	Horned Bladderwort	G5	NNR	S5	Secure
Lentibulariaceae	*Utricularia intermedia*	Flatleaf Bladderwort	G5	NNR	S5	Secure
Liliaceae	*Clintonia borealis*	Yellow clintonia	G5	N5	S5	Secure
Liliaceae	*Maianthemum trifolium*	Three-Leaf Solomon's-Plume	G5	N5	S5	Secure
Liliaceae	*Tofieldia pusilla*	Scotch False-Asphodel	G5	N5	S4	Secure
Lycopodiaceae	*Lycopodiella inundata*	Bog Clubmoss	G5	N5	S5	Secure
Lycopodiaceae	*Lycopodium annotinum*	Stiff Clubmoss	G5	N5	S5	Secure
Lycopodiaceae	*Lycopodium dendroideum*	Treelike Clubmoss	G5	N5	S3S4	Secure
Menyanthaceae	*Menyanthes trifoliata*	Bog Buckbean	G5	NNR	S5	Secure
Monotropaceae	*Monotropa uniflora*	Indian-Pipe	G5	N5	S5	Secure
Myricaceae	*Myrica gale*	Sweet Gale	G5	NNR	S5	Secure
Nymphaeaceae	*Nuphar lutea*	Yellow Cowlily	G5T5	N5		Secure
Onagraceae	*Chamerion angustifolium*	Fireweed	G5	NNR	S5	Secure
Onagraceae	*Circaea alpina*	Small Enchanter's Nightshade	G5	NNR	S5	Secure
Onagraceae	*Epilobium ciliatum*	Hairy Willow-Herb	G5	NNR	S5	Secure
Onagraceae	*Epilobium palustre*	Marsh Willow-Herb	G5	NNR	S5	Secure
Orchidaceae	*Malaxis unifolia*	Green Adder's-Mouth	G5	NNR	S3	Sensitive
Orchidaceae	*Platanthera clavellata*	Club-Spur Orchid	G5	NNR	S5	Secure
Orchidaceae	*Platanthera dilatata*	Leafy White Orchis	G5T5	N5	S5	Secure
Orchidaceae	*Pogonia ophioglossoides*	Snakemouth	G5	NNR	S4	Secure
Orchidaceae	*Spiranthes romanzoffiana*	Hooded Ladies'-Tresses	G5	N5	S4S5	Secure
Osmundaceae	*Osmunda cinnamomea*	Cinnamon Fern	G5	N5	S5	Secure
Osmundaceae	*Osmunda regalis*	Royal Fern	G5T5	N5	S4	Secure

Family	Scientific Name	Common Name	G Rank	N Rank	S Rank	General Status Rank
Polygonaceae	*Polygonum hydropiper*	Marshpepper Smartweed	GNR	NNR	SNA	Exotic/Alien
Primulaceae	*Trientalis borealis*	Northern Starflower	G5	NNR	S5	Secure
Pyrolaceae	*Orthilia secunda*	One-Side Wintergreen	G5	NNR	S5	Secure
Ranunculaceae	*Coptis trifolia*	Goldthread	G5	N5	S5	Secure
Ranunculaceae	*Ranunculus acris*	Tall Butter-Cup	G5	NNA	SNA	Exotic/Alien
Ranunculaceae	*Ranunculus repens*	Creeping Butter-Cup	GNR	NNA	SNA	Exotic/Alien
Ranunculaceae	*Thalictrum alpinum*	Alpine Meadow-Rue	G5	NNR	S5	Secure
Ranunculaceae	*Thalictrum pubescens*	Tall Meadow-Rue	G5	NNR	S5	Secure
Rosaceae	*Fragaria virginiana*	Virginia Strawberry	G5	NNR	S4S5	Secure
Rosaceae	*Geum macrophyllum*	Large-Leaved Avens	G5	N5	S4S5	Secure
Rosaceae	*Geum sp.*	Avens				
Rosaceae	*Rubus arcticus*	Northern Blackberry	G5	NNR	S3	Sensitive
Rosaceae	*Rubus chamaemorus*	Cloudberry	G5	NNR	S5	Secure
Rosaceae	*Rubus pubescens*	Dewberry	G5	NNR	S5	Secure
Rosaceae	*Sanguisorba canadensis*	Bottlebrush	G5	NNR	S3S5	Secure
Rubiaceae	*Galium sp.*	Bedstraw				
Sarraceniaceae	*Sarracenia purpurea*	Northern Pitcher-Plant	G5	N5	S5	Secure
Saxifragaceae	*Mitella nuda*	Naked Bishop's-Cap	G5	NNR	S5	Secure
Scrophulariaceae	*Chelone glabra*	White Turtlehead	G5	NNR	S4	Secure
Scrophulariaceae	*Veronica americana*	American Speedwell	G5	NNR	S4	Secure
Selaginellaceae	*Selaginella selaginoides*	Low Spike-Moss	G5	NNR	S4S5	Secure
Thelypteridaceae	*Phegopteris connectilis*	Northern Beech Fern	G5	N5	S5	Secure
Violaceae	*Viola sp.*	Violet				
Mosses						
Aulacomniaceae	*Aulacomnium palustre*	Glow Moss	G5	NNR		
Dicranaceae	*Dicranum polysetum*	Wavy-leaved Broom Moss	G5	NNR		
Dicranaceae	*Dicranum scoparium*	Common Broom Moss	G5	NNR		
Dicranaceae	*Dicranum sp.*	Broom Moss				
Grimmiaceae	*Racomitrium sp.*	a Moss				
Hylocomiaceae	*Hylocomium splendens*	Stairstep Moss	G5	NNR		

Family	Scientific Name	Common Name	G Rank	N Rank	S Rank	General Status Rank
Hylocomiaceae	*Rhytidiadelphus sp.*	a Mosss				
Hylocomiaceae	*Feathermoss*	Feathermoss				
Hylocomiaceae	*Pleurozium schreberi*	Schreber's feathermoss	G5	NNR		
Hypnaceae	*Ptilium crista-castrensis*	Plume moss	G5	NNR		
Lepidoziaceae	*Bazzania trilobata*	Three-lobed Whipwort	G5	NNR		
Mniaceae	*Plagiomnium sp.*	Leafy Moss				
na	*na*	Unidentified liverwort				
na	*na*	Unidentified moss				
Polytrichaceae	*Polytrichum sp.*	Haircap Moss				
Ptilidiaceae	*Ptilidium sp.*	Fringewort	G5	NNR		
Sphagnaceae	*Sphagnum rubellum*	Red Peat Moss	G5	NNR		
Sphagnaceae	*Sphagnum sp.*	Peatmoss				
Thuidiaceae	*Thuidium recognitum*	Hook-leaved Fern Moss	G5	NNR		
Lichens						
Cladoniaceae	*Cladina arbuscula*	Reindeer Lichen	G5			
Cladoniaceae	*Cladina mitis*	Green Reindeer Lichen	G5			
Cladoniaceae	*Cladina rangiferina*	Gray Reindeer Lichen	G5			
Cladoniaceae	*Cladina sp.*	Reindeer Lichen				
Cladoniaceae	*Cladina stellaris*	Star-tipped Reindeer Lichen	G5			
Cladoniaceae	*Cladonia sp.*	Cladonia Lichen				
Parmeliaceae	*Cetraria sp.*	a lichen				

APPENDIX C

Soil Nutrient and Moisture Regime Classes and Relationship to Site Properties

Table C1 Soil Nutrient Regime Classes

Parameter	Oligotrophic Very Poor (A)	Submesotrophic Poor (B)	Mesotrophic Medium (C)	Permesotrophic Rich (D)	Eutrophic Very Rich (E)
Available nutrients	very low	low	moderate	abundant	very abundant
Humus form	**mor**				
			moder		
				mull	
A horizon	**Ae horizon present**				
			A horizon absent		
				Ah horizon present	
Organic matter content	**low (light coloured)**				
		medium (intermediate in colour)			
			high (dark coloured)		
Growth rate	**slow**				
		moderate			
				rapid	
Soil depth	**extremely superficial**				
		very superficial to deep			
Soil texture	**coarse texture**				
			medium to fine texture		
% Coarse fragment	**high**				
			moderate to low		
Parent material mineralogy	**low base (low Ca content)**				
		medium base (medium Ca content)			
				strong base (high Ca content)	
Soil pH	**extremely-moderately acidic**				
		moderately acidic-neutral			
				slightly acidic-mildly alkaline	
Water pH (wetlands)	**<4-5**	**4.5-5.5**	**5.5-6.5**	**6.5-7.4**	**7.4+**
Seepage			**temporary**	**→→→→**	**permanent**

Table C2 Soil Moisture Regime Classes

Moisture Regime	Description	Primary Water Source	Idealized Slope Position	Surface Organic Thickness (cm)	Common Soil Texture	Water Table Depth (cm)	Soil Drainage Class	Common Ecotypes
Very xeric (0)	Water is removed extremely rapidly in relation to supply; soil remains moist for a negligible amount of time following precipitation.	Precipitation	Crest-Upper Slope	<3	Very coarse (gravel to coarse sand); shallow soils	>100	Very rapid	ES
Xeric (1)	Water is removed from the soil very rapidly in relation to supply; soil remains moist for brief period s following precipitation.	Precipitation	Crest-Upper Slope	<3	Coarse (sand)	>100	Very rapid to rapid	ES
Subxeric (2)	Water is removed from the soil rapidly in relation to supply; the soil remains wet for short periods of time following precipitations. Linked to a rapid drainage, depending on the amount of precipitation.	Precipitation	Upper Slope-Mid Slope to Variable	<3	Coarse to moderately coarse (loamy sand-sandy loam)	>100	Rapid	BF, RT
Submesic (3)	Water is removed from the soil rapidly in relation to supply; water is available for moderately short periods following precipitation.	Precipitation	Upper Slope-Mid Slope to Variable	3-5	Moderately coarse (sandy loam)	>100	Rapid to well	BF, BS, RT
Mesic (4)	Water is removed from the soil rather slowly in relation to supply; soil may remain moist for a significant, but sometimes for short period of the year. Available soil moisture reflects climatic input.	Precipitation in moderate to fine-textured soil and limited seepage in coarse-textured soils	Mid Slope-Lower Slope to Variable	6-9	Medium (L) to fine (SCL); few coarse fragments	>100	Well to moderately well	BF, BS, MF, KB, KH
Subhygric (5)	Water is removed slowly enough in relation to supply to keep the soil wet for a significant part of the growing season; some temporary seepage and possibly mottling below 20 cm.	Precipitation and seepage	Lower Slope to Variable	10-40	Variable	<100	Imperfect	BF, BS, MF, KB, KH
Hygric (6)	Water is removed slowly enough in relation to supply to keep the soil wet for most of the growing season; permanent seepage and mottling (hygric aerated); gleyed colours common (hygric reduced).	Permanent seepage; water table fluctuates often <100 cm	Toe Slope-Depression-Level to Variable	10-40	Variable	30-100	Poor	BF, BS, KB, KH, RT, TF
Subhydric (7)	Water is removed so slowly that the water table remains at or near the soil surface for most of the year; gleyed mineral or organic soils; permanent seepage <30 cm below surface.	Seepage or permanent water table <30 cm	Depression-Level to Variable	>40	Variable; predominantly organics	0-30	Very poor	BS, RT, AT, WC, SF, SB, ES
Hydric (8)	Water is removed so slowly that the water table remains at or above the soil surface all year; gleyed mineral or organic soils	Permanent surface water table	Depression-Level to Variable	>40	Variable; predominantly organics	0	Very poor	RT, SF, SB

APPENDIX D

Ecotype Plant Occurrence Summaries (Gound Plot Data)

Table D1 Balsam Fir Forest - Plant Occurrence Summary (Ground Plot data)

Scientific Name	Common Name	Growth Form	Balsam Fir Forest (n=5)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Tree Layer						
Abies balsamea	Balsam Fir	Tree	30.0	60.0	47.0	1.00
Betula papyrifera	Paper Birch	Tree	0.0	15.0	4.4	0.60
Picea glauca	White Spruce	Tree	0.0	15.0	4.0	0.40
Picea mariana	Black Spruce	Tree	0.0	35.0	17.0	0.80
Shrub Layer						
Abies balsamea	Balsam Fir	Tall Shrub	1.0	30.0	10.2	1.00
Alnus viridis	Green Alder	Tall Shrub	0.0	3.0	0.6	0.20
Picea glauca	White Spruce	Tall Shrub	0.0	1.0	0.2	0.20
Picea mariana	Black Spruce	Tall Shrub	0.0	5.0	2.5	0.80
Abies balsamea	Balsam Fir	Low Shrub	0.0	5.0	1.1	0.40
Alnus viridis	Green Alder	Low Shrub	0.0	1.0	0.2	0.20
Amelanchier bartramiana	Bartram's Chuckleypear	Low Shrub	0.0	0.5	0.1	0.20
Betula papyrifera	Paper Birch	Low Shrub	0.0	1.0	0.3	0.40
Kalmia angustifolia	Sheep-Laurel	Low Shrub	0.0	0.5	0.1	0.20
Picea mariana	Black Spruce	Low Shrub	0.0	3.0	0.8	0.40
Ribes lacustre	Bristly Black Currant	Low Shrub	0.0	0.5	0.1	0.20
Rubus idaeus	Red Raspberry	Low Shrub	0.0	1.0	0.2	0.20
Sambucus sp.	Elderberry	Low Shrub	0.0	0.5	0.1	0.20
Viburnum opulus	Guelder-Rose Viburnum	Low Shrub	0.0	1.0	0.2	0.20
Abies balsamea	Balsam Fir	Dwarf Shrub	0.5	3.0	1.0	1.00
Epigaea repens	Trailing Arbutus	Dwarf Shrub	0.0	3.0	0.6	0.20
Gaultheria hispidula	Creeping Snowberry	Dwarf Shrub	0.0	3.0	0.9	0.60
Linnaea borealis	Twinflower	Dwarf Shrub	0.0	2.0	0.8	0.40
Picea mariana	Black Spruce	Dwarf Shrub	0.0	0.5	0.1	0.20
Vaccinium angustifolium	Late Lowbush Blueberry	Dwarf Shrub	0.0	0.5	0.2	0.40
Forb Layer						
Anaphalis margaritacea	Pearly Everlasting	Forb	0.0	0.5	0.1	0.20
Aster sp.	unknown aster	Forb	0.0	0.5	0.1	0.20
Athyrium filix-femina	Lady Fern	Forb	0.0	0.5	0.2	0.40
Chamerion angustifolium	Fireweed	Forb	0.0	0.5	0.1	0.20
Coptis trifolia	Goldthread	Forb	0.0	0.5	0.1	0.20

Scientific Name	Common Name	Growth Form	Balsam Fir Forest (n=5)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Cornus canadensis	Bunchberry	Forb	0.5	15.0	3.8	1.00
Dryopteris campyloptera	Mountain Wood-Fern	Forb	0.0	10.0	3.0	0.80
Dryopteris intermedia	Evergreen woodfern	Forb	0.0	0.5	0.2	0.40
Epilobium palustre	Marsh Willow-Herb	Forb	0.0	0.5	0.1	0.20
Equisetum sylvaticum	Woodland Horsetail	Forb	0.0	1.0	0.2	0.20
Fragaria virginiana	Virginia Strawberry	Forb	0.0	0.5	0.1	0.20
Galium sp.	Bedstraw	Forb	0.0	0.5	0.1	0.20
Gymnocarpium dryopteris	Northern Oak Fern	Forb	0.0	1.0	0.3	0.40
Lycopodium annotinum	Stiff Clubmoss	Forb	0.0	0.5	0.3	0.60
Lycopodium dendroideum	Treelike Clubmoss	Forb	0.0	0.5	0.1	0.20
Maianthemum trifolium	Three-Leaf Solomon's-Plume	Forb	0.0	1.0	0.2	0.20
Mitella nuda	Naked Bishop's-Cap	Forb	0.0	0.5	0.1	0.20
Monotropa uniflora	Indian-Pipe	Forb	0.0	0.5	0.1	0.20
Orthilia secunda	One-Side Wintergreen	Forb	0.0	0.5	0.3	0.60
Rubus pubescens	Dewberry	Forb	0.0	2.0	0.5	0.40
Trientalis borealis	Northern Starflower	Forb	0.0	0.5	0.2	0.40
Graminoid Layer						
Agrostis scabra	Rough Bentgrass	Graminoid	0.0	0.5	0.1	0.20
Calamagrostis canadensis	Bluejoint Reedgrass	Graminoid	0.0	0.5	0.1	0.20
Carex canescens	Hoary Sedge	Graminoid	0.0	5.0	1.1	0.40
Carex echinata	Little Prickly Sedge	Graminoid	0.0	1.0	0.2	0.20
Carex trisperma	Threefruit sedge	Graminoid	0.0	5.0	1.2	0.40
Carex vesicaria	Inflated Sedge	Graminoid	0.0	2.0	0.4	0.20
Cinna latifolia	Wood Reedgrass	Graminoid	0.0	0.5	0.1	0.20
Glyceria canadensis	Canada Manna-Grass	Graminoid	0.0	2.0	0.4	0.20
Glyceria striata	Fowl Manna-Grass	Graminoid	0.0	0.5	0.1	0.20
Scirpus cyperinus	Cottongrass Bulrush	Graminoid	0.0	1.0	0.2	0.20
Moss / Lichen Layer						
Cladina rangiferina	Gray Reindeer Lichen	Lichen	0.0	0.5	0.1	0.20
Cladonia sp.	Cladonia Lichen	Lichen	0.0	0.5	0.2	0.40
Bazzania trilobata	Three-lobed Whipwort	Moss	0.0	13.0	3.1	0.60
Dicranum polysetum	Wavy-leaved Broom Moss	Moss	0.0	10.0	4.8	0.80
Dicranum scoparium	Common Broom	Moss	0.0	15.0	5.5	0.80

Scientific Name	Common Name	Growth Form	Balsam Fir Forest (n=5)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
	Moss					
Dicranum sp.	Broom Moss	Moss	0.0	1.0	0.2	0.20
Hylocomium splendens	Stairstep Moss	Moss	15.0	60.0	37.0	1.00
na	Unidentified moss	Moss	0.0	1.0	0.4	0.40
Pleurozium schreberi	Schreber's feathermoss	Moss	25.0	50.0	33.0	1.00
Polytrichum sp.	Haircap Moss	Moss	0.0	1.0	0.4	0.40
Ptilidium sp.	Fringewort	Moss	0.0	5.0	1.0	0.20
Ptilium crista-castrensis	Plume moss	Moss	5.0	15.0	9.0	1.00
Rhytidiadelphus sp.	a Mosss	Moss	0.0	5.0	1.0	0.20
Sphagnum sp.	Peatmoss	Moss	0.0	25.0	5.4	0.40

Table D2 Black Spruce Forest - Plant Occurrence Summary (Ground Plot Data)

Scientific Name	Common Name	Growth Form	Black Spruce Forest (n=1)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Tree Layer						
Abies balsamea	Balsam Fir	Tree	3.0	3.0	3.0	1.00
Betula papyrifera	Paper Birch	Tree	3.0	3.0	3.0	1.00
Picea mariana	Black Spruce	Tree	30.0	30.0	30.0	1.00
Shrub Layer						
Abies balsamea	Balsam Fir	Tall Shrub	2.0	2.0	2.0	1.00
Picea mariana	Black Spruce	Tall Shrub	10.0	10.0	10.0	1.00
Abies balsamea	Balsam Fir	Low Shrub	3.0	3.0	3.0	1.00
Acer rubrum	Red Maple	Low Shrub	0.5	0.5	0.5	1.00
Amelanchier bartramiana	Bartram's Chuckleypear	Low Shrub	0.5	0.5	0.5	1.00
Kalmia angustifolia	Sheep-Laurel	Low Shrub	8.0	8.0	8.0	1.00
Lonicera villosa	Mountain Fly-Honeysuckle	Low Shrub	0.5	0.5	0.5	1.00
Ilex mucronatus	Mountain Holly	Low Shrub	0.5	0.5	0.5	1.00
Picea mariana	Black Spruce	Low Shrub	25.0	25.0	25.0	1.00
Sorbus decora	S Mountain-Ash	Low Shrub	0.5	0.5	0.5	1.00
Taxus canadensis	Canada Yew	Low Shrub	0.5	0.5	0.5	1.00
Vaccinium angustifolium	Late Lowbush Blueberry	Low Shrub	3.0	3.0	3.0	1.00
Viburnum nudum	Possum-Haw Viburnum	Low Shrub	0.5	0.5	0.5	1.00
Empetrum nigrum	Black Crowberry	Dwarf Shrub	0.5	0.5	0.5	1.00
Epigaea repens	Trailing Arbutus	Dwarf Shrub	5.0	5.0	5.0	1.00
Gaultheria hispidula	Creeping Snowberry	Dwarf Shrub	15.0	15.0	15.0	1.00
Linnaea borealis	Twinflower	Dwarf Shrub	3.0	3.0	3.0	1.00
Vaccinium angustifolium	Late Lowbush Blueberry	Dwarf Shrub	2.0	2.0	2.0	1.00
Vaccinium vitis-idaea	Partridgeberry	Dwarf Shrub	2.0	2.0	2.0	1.00
Forb Layer						
Clintonia borealis	Yellow clintonia	Forb	2.0	2.0	2.0	1.00
Coptis trifolia	Goldthread	Forb	3.0	3.0	3.0	1.00
Cornus canadensis	Bunchberry	Forb	20.0	20.0	20.0	1.00
Epilobium palustre	Marsh Willow-Herb	Forb	0.5	0.5	0.5	1.00
Equisetum sylvaticum	Woodland Horsetail	Forb	1.0	1.0	1.0	1.00
Galium sp.	Bedstraw	Forb	0.5	0.5	0.5	1.00

Scientific Name	Common Name	Growth Form	Black Spruce Forest (n=1)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Gymnocarpium dryopteris	Northern Oak Fern	Forb	3.0	3.0	3.0	1.00
Lycopodium annotinum	Stiff Clubmoss	Forb	0.5	0.5	0.5	1.00
Orthilia secunda	One-Side Wintergreen	Forb	0.5	0.5	0.5	1.00
Platanthera dilatata	Leafy White Orchis	Forb	0.5	0.5	0.5	1.00
Rubus pubescens	Dewberry	Forb	5.0	5.0	5.0	1.00
Symphyotrichum puniceum	Purplestem aster	Forb	1.0	1.0	1.0	1.00
Graminoid Layer						
Carex echinata	Little Prickly Sedge	Graminoid	3.0	3.0	3.0	1.00
Carex leptalea	Bristlestalk Sedge	Graminoid	1.0	1.0	1.0	1.00
Carex sp.	a sedge	Graminoid	2.0	2.0	2.0	1.00
Carex trisperma	Threefruit sedge	Graminoid	10.0	10.0	10.0	1.00
Cinna latifolia	Wood Reedgrass	Graminoid	0.5	0.5	0.5	1.00
Glyceria striata	Fowl Manna-Grass	Graminoid	1.0	1.0	1.0	1.00
Moss / Lichen Layer						
Cladina sp.	Reindeer Lichen	Lichen	0.5	0.5	0.5	1.00
Cladonia sp.	Cladonia Lichen	Lichen	0.5	0.5	0.5	1.00
Dicranum sp.	Broom Moss	Moss	0.5	0.5	0.5	1.00
Hylocomium splendens	Stairstep Moss	Moss	45.0	45.0	45.0	1.00
Pleurozium schreberi	Schreber's feathermoss	Moss	30.0	30.0	30.0	1.00
Ptilium crista-castrensis	Plume moss	Moss	0.5	0.5	0.5	1.00
Sphagnum sp.	Peatmoss	Moss	2.0	2.0	2.0	1.00

Table D3 Kalmia - Black Spruce Forest - Plant Occurrence Summary (Ground Plot Data)

Scientific Name	Common Name	Growth Form	Kalmia - Black Spruce Forest (n=3)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Tree Layer						
Abies balsamea	Balsam Fir	Tree	0.0	5.0	1.7	0.33
Larix laricina	Tamarack	Tree	0.0	1.0	0.3	0.33
Picea mariana	Black Spruce	Tree	0.0	10.0	3.5	0.67
Shrub Layer						
Abies balsamea	Balsam Fir	Tall Shrub	0.0	4.0	1.7	0.67
Larix laricina	Tamarack	Tall Shrub	0.0	1.0	0.7	0.67
Picea mariana	Black Spruce	Tall Shrub	15.0	25.0	20.0	1.00
Abies balsamea	Balsam Fir	Low Shrub	0.5	1.0	0.8	1.00
Amelanchier bartramiana	Bartram’s Chuckleypear	Low Shrub	0.5	1.0	0.7	1.00
Kalmia angustifolia	Sheep-Laurel	Low Shrub	30.0	35.0	31.7	1.00
Kalmia polifolia	Bog Laurel	Low Shrub	0.0	1.0	0.3	0.33
Rhododendron groenlandicum	Common Labrador Tea	Low Shrub	0.5	1.0	0.8	1.00
Ilex mucronatus	Mountain Holly	Low Shrub	0.0	1.0	0.7	0.67
Picea mariana	Black Spruce	Low Shrub	5.0	35.0	21.7	1.00
Rhododendron canadense	Rhodora	Low Shrub	4.0	20.0	11.3	1.00
Vaccinium angustifolium	Late Lowbush Blueberry	Low Shrub	0.0	0.5	0.2	0.33
Viburnum nudum	Possum-Haw Viburnum	Low Shrub	0.0	0.5	0.2	0.33
Amelanchier bartramiana	Bartram's chuckleypear	Dwarf Shrub	0.0	0.5	0.2	0.33
Empetrum nigrum	Black Crowberry	Dwarf Shrub	0.5	3.0	1.3	1.00
Epigaea repens	Trailing Arbutus	Dwarf Shrub	0.0	1.0	0.5	0.67
Gaultheria hispidula	Creeping Snowberry	Dwarf Shrub	1.0	2.0	1.7	1.00
Kalmia angustifolia	Sheep-Laurel	Dwarf Shrub	4.0	5.0	4.7	1.00
Kalmia polifolia	Bog Laurel	Dwarf Shrub	0.0	0.5	0.3	0.67
Rhododendron groenlandicum	Common Labrador Tea	Dwarf Shrub	0.0	1.0	0.3	0.33
Ilex mucronatus	Mountain Holly	Dwarf Shrub	0.0	0.5	0.2	0.33
Rhododendron canadense	Rhodora	Dwarf Shrub	0.0	1.0	0.3	0.33
Vaccinium	Late Lowbush	Dwarf	2.0	15.0	6.7	1.00

Scientific Name	Common Name	Growth Form	Kalmia - Black Spruce Forest (n=3)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
angustifolium	Blueberry	Shrub				
Vaccinium boreale	Northern Blueberry	Dwarf Shrub	0.0	1.0	0.3	0.33
Vaccinium oxycoccos	Small Cranberry	Dwarf Shrub	0.5	0.5	0.5	1.00
Vaccinium vitis-idaea	Partridgeberry	Dwarf Shrub	0.0	0.5	0.3	0.67
Forb Layer						
Clintonia borealis	Yellow clintonia	Forb	0.0	0.5	0.2	0.33
Coptis trifolia	Goldthread	Forb	0.5	1.0	0.7	1.00
Cornus canadensis	Bunchberry	Forb	2.0	4.0	2.7	1.00
Maianthemum trifolium	Three-Leaf Solomon's-Plume	Forb	0.0	0.5	0.2	0.33
Orthilia secunda	One-Side Wintergreen	Forb	0.0	0.5	0.3	0.67
Rubus chamaemorus	Cloudberry	Forb	0.0	0.5	0.2	0.33
Graminoid Layer						
Carex echinata	Little Prickly Sedge	Graminoid	0.5	1.0	0.7	1.00
Carex pauciflora	Few-Flowered Sedge	Graminoid	0.0	2.0	0.7	0.33
Carex trisperma	Threefruit sedge	Graminoid	0.5	2.0	1.0	1.00
Trichophorum caespitosum	Deergrass	Graminoid	0.0	0.5	0.2	0.33
Moss / Lichen Layer						
Cladina arbuscula	Reindeer Lichen	Lichen	0.0	5.0	2.3	0.67
Cladina mitis	Green Reindeer Lichen	Lichen	0.0	5.0	3.3	0.67
Cladina rangiferina	Gray Reindeer Lichen	Lichen	10.0	15.0	13.3	1.00
Cladina stellaris	Star-tipped Reindeer Lichen	Lichen	0.0	3.0	1.7	0.67
Cladonia sp.	Cladonia Lichen	Lichen	0.0	1.0	0.5	0.67
Bazzania trilobata	Three-lobed Whipwort	Moss	0.5	5.0	2.2	1.00
Dicranum polysetum	Wavy-leaved Broom Moss	Moss	0.5	10.0	5.2	1.00
Hylocomium splendens	Stairstep Moss	Moss	0.0	5.0	2.0	0.67
Pleurozium schreberi	Schreber's feathermoss	Moss	35.0	65.0	53.3	1.00
Polytrichum sp.	Haircap Moss	Moss	0.0	2.0	0.7	0.33
Ptilidium sp.	Fringewort	Moss	0.0	0.5	0.2	0.33
Ptilium crista-castrensis	Plume moss	Moss	0.0	5.0	1.7	0.33
Sphagnum sp.	Peatmoss	Moss	5.0	25.0	12.3	1.00

Table D4 Kalmia Heath - Plant Occurrence Summary (Ground Plot Data)

Scientific Name	Common Name	Growth Form	Kalmia Heath (n=3)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Shrub Layer						
Abies balsamea	Balsam Fir	Tall Shrub	0.0	0.5	0.2	0.33
Larix laricina	Tamarack	Tall Shrub	0.5	2.0	1.0	1.00
Picea mariana	Black Spruce	Tall Shrub	0.0	0.5	0.2	0.33
Abies balsamea	Balsam Fir	Low Shrub	0.5	1.0	0.8	1.00
Amelanchier bartramiana	Bartram's Chuckleypear	Low Shrub	0.0	1.0	0.3	0.33
Andromeda polifolia	Bog Rosemary	Low Shrub	0.0	1.0	0.3	0.33
Betula papyrifera	Paper Birch	Low Shrub	0.0	0.5	0.3	0.67
Chamaedaphne calyculata	Leatherleaf	Low Shrub	1.0	3.0	1.7	1.00
Juniperus communis var. depressa	Ground Juniper	Low Shrub	0.0	0.5	0.2	0.33
Kalmia angustifolia	Sheep-Laurel	Low Shrub	0.0	35.0	21.7	0.67
Larix laricina	Tamarack	Low Shrub	0.0	0.5	0.3	0.67
Rhododendron groenlandicum	Common Labrador Tea	Low Shrub	0.0	0.5	0.2	0.33
Ilex mucronatus	Mountain Holly	Low Shrub	0.0	0.5	0.3	0.67
Picea mariana	Black Spruce	Low Shrub	30.0	40.0	35.0	1.00
Rhododendron canadense	Rhodora	Low Shrub	10.0	15.0	11.7	1.00
Vaccinium angustifolium	Late Lowbush Blueberry	Low Shrub	2.0	5.0	3.0	1.00
Chamaedaphne calyculata	Leatherleaf	Dwarf Shrub	0.0	2.0	0.8	0.67
Empetrum eamesii	Rock Crowberry	Dwarf Shrub	0.0	0.5	0.3	0.67
Empetrum nigrum	Black Crowberry	Dwarf Shrub	2.0	10.0	5.7	1.00
Gaultheria hispidula	Creeping Snowberry	Dwarf Shrub	0.5	2.0	1.2	1.00
Kalmia angustifolia	Sheep-Laurel	Dwarf Shrub	0.0	5.0	2.7	0.67
Kalmia polifolia	Bog Laurel	Dwarf Shrub	0.0	0.5	0.3	0.67
Rhododendron groenlandicum	Common Labrador Tea	Dwarf Shrub	0.0	1.0	0.3	0.33
Rhododendron canadense	Rhodora	Dwarf Shrub	0.0	2.0	1.0	0.67
Vaccinium angustifolium	Late Lowbush Blueberry	Dwarf Shrub	2.0	10.0	5.0	1.00
Vaccinium boreale	Northern Blueberry	Dwarf Shrub	0.5	1.0	0.8	1.00
Vaccinium oxycoccos	Small Cranberry	Dwarf	0.0	0.5	0.2	0.33

Scientific Name	Common Name	Growth Form	Kalmia Heath (n=3)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
		Shrub				
Vaccinium uliginosum	Bog Bilberry	Dwarf Shrub	0.0	1.0	0.5	0.67
Vaccinium vitis-idaea	Partridgeberry	Dwarf Shrub	0.0	1.0	0.5	0.67
Forb Layer						
Coptis trifolia	Goldthread	Forb	0.0	0.5	0.2	0.33
Cornus canadensis	Bunchberry	Forb	0.0	0.5	0.3	0.67
Drosera rotundifolia	Roundleaf Sundew	Forb	0.0	0.5	0.2	0.33
Lycopodium annotinum	Stiff Clubmoss	Forb	0.0	0.5	0.2	0.33
Rubus chamaemorus	Cloudberry	Forb	0.0	0.5	0.2	0.33
Sarracenia purpurea	Northern Pitcher-Plant	Forb	0.0	0.5	0.3	0.67
Trientalis borealis	Northern Starflower	Forb	0.0	0.5	0.2	0.33
Graminoid Layer						
Carex oligosperma	Few-Seeded Sedge	Graminoid	0.0	0.5	0.2	0.33
Carex pauciflora	Few-Flowered Sedge	Graminoid	0.0	0.5	0.2	0.33
Carex trisperma	Threefruit sedge	Graminoid	0.0	0.5	0.2	0.33
Trichophorum caespitosum	Deergrass	Graminoid	0.0	0.5	0.3	0.67
Moss / Lichen Layer						
Cetraria sp.	a lichen	Lichen	0.0	0.5	0.2	0.33
Cladina arbuscula	Reindeer Lichen	Lichen	1.0	25.0	17.0	1.00
Cladina mitis	Green Reindeer Lichen	Lichen	0.0	0.5	0.2	0.33
Cladina rangiferina	Gray Reindeer Lichen	Lichen	25.0	35.0	28.3	1.00
Cladina stellaris	Star-tipped Reindeer Lichen	Lichen	5.0	20.0	11.7	1.00
Cladonia sp.	Cladonia Lichen	Lichen	1.0	5.0	2.7	1.00
Aulacomnium palustre	Glow Moss	Moss	0.0	0.5	0.2	0.33
Dicranum sp.	Broom Moss	Moss	0.0	1.0	0.5	0.67
Hylocomium splendens	Stairstep Moss	Moss	0.5	10.0	4.2	1.00
Pleurozium schreberi	Schreber's feathermoss	Moss	20.0	50.0	31.7	1.00
Ptilidium sp.	Fringewort	Moss	0.5	5.0	2.0	1.00
Racomitrium sp.	a Moss	Moss	0.5	1.0	0.8	1.00
Sphagnum rubellum	Red Peat Moss	Moss	0.0	1.0	0.3	0.33
Sphagnum sp.	Peatmoss	Moss	0.0	25.0	8.7	0.67

Table D5 Mixedwood Forest - Plant Occurrence Summary (Ground Plot Data)

Scientific Name	Common Name	Growth Form	Mixedwood Forest (n=3)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Tree Layer						
Abies balsamea	Balsam Fir	Tree	20.0	65.0	45.0	1.00
Betula papyrifera	Paper Birch	Tree	20.0	25.0	21.7	1.00
Picea glauca	White Spruce	Tree	0.0	20.0	9.0	0.67
Shrub Layer						
Abies balsamea	Balsam Fir	Tall Shrub	0.0	10.0	3.7	0.67
Picea glauca	White Spruce	Tall Shrub	0.0	2.0	0.7	0.33
Abies balsamea	Balsam Fir	Low Shrub	0.0	5.0	2.7	0.67
Acer spicatum	Mountain Maple	Low Shrub	0.0	2.0	0.7	0.33
Betula papyrifera	Paper Birch	Low Shrub	0.5	2.0	1.2	1.00
Picea glauca	White Spruce	Low Shrub	0.0	1.0	0.3	0.33
Ribes lacustre	Bristly Black Currant	Low Shrub	0.0	0.5	0.2	0.33
Rubus idaeus	Red Raspberry	Low Shrub	0.0	25.0	8.3	0.33
Sambucus racemosa	Red Elderberry	Low Shrub	0.0	2.0	0.7	0.33
Sambucus sp.	Elderberry	Low Shrub	0.0	1.0	0.3	0.33
Sorbus americana	American Mountain-Ash	Low Shrub	0.0	0.5	0.2	0.33
Sorbus decora	Showy Mountain-Ash	Low Shrub	0.0	1.0	0.3	0.33
Taxus canadensis	Canada Yew	Low Shrub	0.0	0.5	0.3	0.67
Vaccinium angustifolium	Late Lowbush Blueberry	Low Shrub	0.0	1.0	0.3	0.33
Viburnum opulus	Guelder-Rose Viburnum	Low Shrub	0.0	0.5	0.2	0.33
Abies balsamea	Balsam Fir	Dwarf Shrub	0.0	1.0	0.7	0.67
Gaultheria hispidula	Creeping Snowberry	Dwarf Shrub	0.0	4.0	1.3	0.33
Linnaea borealis	Twinflower	Dwarf Shrub	0.0	3.0	1.2	0.67
Viburnum opulus	Guelder-Rose Viburnum	Dwarf Shrub	0.0	0.5	0.2	0.33
Forb Layer						
Anaphalis margaritacea	Pearly Everlasting	Forb	0.0	1.0	0.3	0.33
Circaea alpina	Small Enchanter's Nightshade	Forb	0.0	0.5	0.3	0.67
Cornus canadensis	Bunchberry	Forb	1.0	35.0	13.7	1.00
Dryopteris campyloptera	Mountain Wood-Fern	Forb	5.0	35.0	18.3	1.00
Dryopteris intermedia	Evergreen woodfern	Forb	0.5	2.0	1.2	1.00
Epilobium ciliatum	Hairy Willow-Herb	Forb	0.0	0.5	0.2	0.33
Equisetum sylvaticum	Woodland Horsetail	Forb	0.0	0.5	0.2	0.33

Scientific Name	Common Name	Growth Form	Mixedwood Forest (n=3)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Gymnocarpium dryopteris	Northern Oak Fern	Forb	0.0	1.0	0.5	0.67
Lycopodium dendroideum	Treelike Clubmoss	Forb	0.0	0.5	0.2	0.33
Monotropa uniflora	Indian-Pipe	Forb	0.0	0.5	0.2	0.33
Orthilia secunda	One-Side Wintergreen	Forb	0.0	0.5	0.2	0.33
Osmunda cinnamomea	Cinnamon Fern	Forb	0.0	0.5	0.2	0.33
Rubus pubescens	Dewberry	Forb	0.0	2.0	1.0	0.67
Trientalis borealis	Northern Starflower	Forb	0.5	0.5	0.5	1.00
Graminoid Layer						
Agrostis scabra	Rough Bentgrass	Graminoid	0.0	1.0	0.3	0.33
Calamagrostis canadensis	Bluejoint Reedgrass	Graminoid	0.0	0.5	0.2	0.33
Carex canescens	Hoary Sedge	Graminoid	0.0	1.0	0.3	0.33
Carex echinata	Little Prickly Sedge	Graminoid	0.0	1.0	0.3	0.33
Carex leptalea	Bristlestalk Sedge	Graminoid	0.0	0.5	0.2	0.33
Carex magellanica	Boreal Bog Sedge	Graminoid	0.0	1.0	0.3	0.33
Carex trisperma	Threefruit sedge	Graminoid	0.0	1.0	0.3	0.33
Cinna latifolia	Wood Reedgrass	Graminoid	0.0	2.0	0.7	0.33
Glyceria striata	Fowl Manna-Grass	Graminoid	0.0	1.0	0.3	0.33
Juncus effusus	Soft Rush	Graminoid	0.0	0.5	0.2	0.33
Poa saltuensis	Forest Bluegrass	Graminoid	0.0	0.5	0.2	0.33
Moss / Lichen Layer						
Bazzania trilobata	Three-lobed Whipwort	Moss	0.0	3.0	2.0	0.67
Dicranum polysetum	Wavy-leaved Broom Moss	Moss	0.0	20.0	11.7	0.67
Dicranum scoparium	Common Broom Moss	Moss	0.0	10.0	5.0	0.67
Dicranum sp.	Broom Moss	Moss	1.0	5.0	3.7	1.00
Hylocomium splendens	Stairstep Moss	Moss	0.5	20.0	13.5	1.00
na	Unidentified moss	Moss	0.0	2.0	0.7	0.33
Pleurozium schreberi	Schreber's feathermoss	Moss	5.0	10.0	6.7	1.00
Polytrichum sp.	Haircap Moss	Moss	0.0	2.0	0.7	0.33
Ptilium crista-castrensis	Plume moss	Moss	0.5	5.0	2.2	1.00
Rhytidiadelphus sp.	a Mosss	Moss	0.0	10.0	4.3	0.67
Sphagnum sp.	Peatmoss	Moss	0.0	0.5	0.2	0.33

Table D6 Alder Thicket - Plant Occurrence Summary (Ground Plot data)

Scientific Name	Common Name	Growth Form	Alder Thicket (n=4)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Tree Layer						
Abies balsamea	Balsam Fir	Tree	0.0	10.0	4.3	0.75
Betula papyrifera	Paper Birch	Tree	0.0	5.0	2.3	0.50
Picea glauca	White Spruce	Tree	0.0	5.0	1.3	0.25
Picea mariana	Black Spruce	Tree	0.0	1.0	0.3	0.25
Shrub Layer						
Abies balsamea	Balsam Fir	Tall Shrub	0.0	1.0	0.3	0.25
Alnus incana	Speckled Alder	Tall Shrub	0.0	70.0	52.5	0.75
Alnus viridis	Green Alder	Tall Shrub	0.0	60.0	15.0	0.25
Abies balsamea	Balsam Fir	Low Shrub	0.0	0.5	0.3	0.50
Alnus incana	Speckled Alder	Low Shrub	0.0	25.0	15.0	0.75
Alnus viridis	Green Alder	Low Shrub	0.0	10.0	2.5	0.25
Chamaedaphne calyculata	Leatherleaf	Low Shrub	0.0	1.0	0.3	0.25
Myrica gale	Sweet Gale	Low Shrub	0.0	40.0	10.0	0.25
Ribes sp.	a Currant	Low Shrub	0.0	0.5	0.4	0.75
Rubus idaeus	Red Raspberry	Low Shrub	1.0	5.0	3.0	1.00
Sambucus sp.	Elderberry	Low Shrub	0.0	0.5	0.1	0.25
Spiraea alba	Narrow-Leaved Meadow-Sweet	Low Shrub	0.0	5.0	1.3	0.25
Taxus canadensis	Canada Yew	Low Shrub	0.0	0.5	0.1	0.25
Abies balsamea	Balsam Fir	Dwarf Shrub	0.0	0.5	0.3	0.50
Forb Layer						
Athyrium filix-femina	Lady Fern	Forb	0.0	0.5	0.1	0.25
Chelone glabra	White Turtlehead	Forb	0.0	10.0	2.5	0.25
Circaea alpina	Small Enchanter's Nightshade	Forb	0.0	1.0	0.4	0.50
Cornus canadensis	Bunchberry	Forb	0.0	1.0	0.4	0.50
Doellingeria umbellata	Parasol White-Top	Forb	0.0	1.0	0.3	0.25
Dryopteris campyloptera	Mountain Wood-Fern	Forb	0.0	50.0	15.5	0.75
Dryopteris intermedia	Evergreen woodfern	Forb	0.0	60.0	22.5	0.75
Epilobium ciliatum	Hairy Willow-Herb	Forb	0.0	0.5	0.1	0.25
Equisetum fluviatile	Water Horsetail	Forb	0.0	5.0	1.3	0.25
Equisetum sylvaticum	Woodland Horsetail	Forb	0.0	3.0	1.0	0.50
Eurybia radula	Rough-Leaved Aster	Forb	0.0	0.5	0.1	0.25
Eutrochium	Spotted Joe-Pye	Forb	0.0	2.0	0.5	0.25

Scientific Name	Common Name	Growth Form	Alder Thicket (n=4)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
maculatum	Weed					
Galium sp.	Bedstraw	Forb	0.0	1.0	0.4	0.50
Gymnocarpium dryopteris	Northern Oak Fern	Forb	0.0	1.0	0.3	0.25
Iris versicolor	Blueflag	Forb	0.0	10.0	2.5	0.25
Lycopodium annotinum	Stiff Clubmoss	Forb	0.0	4.0	1.3	0.50
Lycopus uniflorus	Northern Bugleweed	Forb	0.0	0.5	0.1	0.25
Mentha arvensis	Corn Mint	Forb	0.0	2.0	0.5	0.25
Mitella nuda	Naked Bishop's-Cap	Forb	0.0	2.0	0.5	0.25
Osmunda regalis	Royal Fern	Forb	0.0	1.0	0.3	0.25
Phegopteris connectilis	Northern Beech Fern	Forb	0.0	0.5	0.1	0.25
Ranunculus repens	Creeping Butter-Cup	Forb	0.0	3.0	1.0	0.50
Rubus pubescens	Dewberry	Forb	2.0	10.0	5.5	1.00
Sanguisorba canadensis	Bottlebrush	Forb	0.0	2.0	0.5	0.25
Solidago rugosa	Rough-Leaf Goldenrod	Forb	0.0	1.0	0.3	0.25
Symphyotrichum puniceum	Purplestem aster	Forb	0.0	10.0	3.0	0.75
Thalictrum pubescens	Tall Meadow-Rue	Forb	0.0	2.0	1.0	0.50
Triadenum fraseri	Marsh St. John's-Wort	Forb	0.0	0.5	0.1	0.25
Trientalis borealis	Northern Starflower	Forb	0.5	1.0	0.6	1.00
Graminoid Layer						
Agrostis capillaris	Colonial Bentgrass	Graminoid	0.0	1.0	0.3	0.25
Agrostis perennans	Perennial Bentgrass	Graminoid	0.0	2.0	0.5	0.25
Calamagrostis canadensis	Bluejoint Reedgrass	Graminoid	0.0	10.0	5.3	0.75
Carex brunnescens	Brownish Sedge	Graminoid	0.0	5.0	1.6	0.75
Carex canescens	Hoary Sedge	Graminoid	0.0	5.0	3.0	0.75
Carex debilis	White-Edge Sedge	Graminoid	0.0	0.5	0.1	0.25
Carex deweyana	Short-Scale Sedge	Graminoid	0.0	0.5	0.3	0.50
Carex echinata	Little Prickly Sedge	Graminoid	0.0	5.0	1.3	0.25
Carex flava	Yellow Sedge	Graminoid	0.0	0.5	0.1	0.25
Carex intumescens	Bladder Sedge	Graminoid	0.0	2.0	0.5	0.25
Carex leptalea	Bristlestalk Sedge	Graminoid	0.0	3.0	1.3	0.75
Carex stipata	Stalk-Grain Sedge	Graminoid	0.0	2.0	0.8	0.50
Carex trisperma	Threefruit sedge	Graminoid	0.0	7.0	1.8	0.25
Carex utriculata	Bear Sedge	Graminoid	0.0	4.0	1.0	0.25

Scientific Name	Common Name	Growth Form	Alder Thicket (n=4)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Cinna latifolia	Wood Reedgrass	Graminoid	0.0	1.0	0.5	0.50
Glyceria canadensis	Canada Manna-Grass	Graminoid	0.0	5.0	2.3	0.50
Glyceria striata	Fowl Manna-Grass	Graminoid	0.5	2.0	1.1	1.00
Poa palustris	Fowl Bluegrass	Graminoid	0.0	2.0	0.5	0.25
Scirpus cyperinus	Cottongrass Bulrush	Graminoid	0.0	1.0	0.5	0.50
Moss / Lichen Layer						
Dicranum scoparium	Common Broom Moss	Moss	0.0	0.5	0.1	0.25
Dicranum sp.	Broom Moss	Moss	0.0	0.5	0.3	0.50
Hylocomium splendens	Stairstep Moss	Moss	0.0	0.5	0.1	0.25
na	Unidentified moss	Moss	0.0	1.0	0.2	0.25
Plagiomnium sp.	Leafy Moss	Moss	0.0	0.5	0.1	0.25
Pleurozium schreberi	Schreber's feathermoss	Moss	0.0	0.5	0.3	0.50
Polytrichum sp.	Haircap Moss	Moss	0.0	0.5	0.1	0.25
Ptilium crista-castrensis	Plume moss	Moss	0.0	0.5	0.1	0.25
Rhytidiadelphus sp.	a Mosss	Moss	0.0	1.0	0.3	0.25
Sphagnum sp.	Peatmoss	Moss	0.0	50.0	12.6	0.50
Thuidium recognitum	Hook-leaved Fern Moss	Moss	0.0	0.5	0.1	0.25

Table D7 Riparian Thicket - Plant Occurrence Summary (Ground Plot Data)

Scientific Name	Common Name	Growth Form	Riparian Thicket (n=1)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Shrub Layer						
Alnus viridis	Green Alder	Tall Shrub	5.0	5.0	5.0	1.00
Alnus viridis	Green Alder	Low Shrub	1.0	1.0	1.0	1.00
Chamaedaphne calyculata	Leatherleaf	Low Shrub	1.0	1.0	1.0	1.00
Myrica gale	Sweet Gale	Low Shrub	70.0	70.0	70.0	1.00
Spiraea alba	Narrow-Leaved Meadow-Sweet	Low Shrub	2.0	2.0	2.0	1.00
Forb Layer						
Chelone glabra	White Turtlehead	Forb	1.0	1.0	1.0	1.00
Equisetum fluviatile	Water Horsetail	Forb	10.0	10.0	10.0	1.00
Eurybia radula	Rough-Leaved Aster	Forb	0.5	0.5	0.5	1.00
Eutrochium maculatum	Spotted Joe-Pye Weed	Forb	0.5	0.5	0.5	1.00
Galium sp.	Bedstraw	Forb	0.5	0.5	0.5	1.00
Hypericum sp.	St John's-Wort	Forb	0.5	0.5	0.5	1.00
Iris versicolor	Blueflag	Forb	5.0	5.0	5.0	1.00
Onoclea sensibilis	Sensitive Fern	Forb	1.0	1.0	1.0	1.00
Sanguisorba canadensis	Bottlebrush	Forb	2.0	2.0	2.0	1.00
Thalictrum pubescens	Tall Meadow-Rue	Forb	0.5	0.5	0.5	1.00
Triadenum fraseri	Marsh St. John's-Wort	Forb	1.0	1.0	1.0	1.00
Viola sp.	Violet	Forb	0.5	0.5	0.5	1.00
Graminoid Layer						
Calamagrostis canadensis	Bluejoint Reedgrass	Graminoid	15.0	15.0	15.0	1.00
Carex atlantica	Atlantic Sedge	Graminoid	1.0	1.0	1.0	1.00
Carex buxbaumii	Buxbaum's Sedge	Graminoid	1.0	1.0	1.0	1.00
Carex canescens	Hoary Sedge	Graminoid	1.0	1.0	1.0	1.00
Carex echinata	Little Prickly Sedge	Graminoid	5.0	5.0	5.0	1.00
Carex intumescens	Bladder Sedge	Graminoid	1.0	1.0	1.0	1.00
Carex lasiocarpa	Slender Sedge	Graminoid	5.0	5.0	5.0	1.00
Carex stipata	Stalk-Grain Sedge	Graminoid	1.0	1.0	1.0	1.00
Carex utriculata	Bear Sedge	Graminoid	1.0	1.0	1.0	1.00
Carex vesicaria	Inflated Sedge	Graminoid	5.0	5.0	5.0	1.00
Glyceria canadensis	Canada Manna-Grass	Graminoid	1.0	1.0	1.0	1.00
Juncus brevicaudatus	Short-tail Rush	Graminoid	0.5	0.5	0.5	1.00
Juncus canadensis	Canada Rush	Graminoid	2.0	2.0	2.0	1.00
Scirpus cyperinus	Cottongrass Bulrush	Graminoid	5.0	5.0	5.0	1.00
Scirpus microcarpus	Red-tinged bulrush	Graminoid	5.0	5.0	5.0	1.00

Table D8 Wet Coniferous Forest - Plant Occurrence Summary (Ground Plot Data)

Scientific Name	Common Name	Growth Form	Wet Coniferous Forest (n=3)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Tree Layer						
Abies balsamea	Balsam Fir	Tree	0.0	20.0	6.7	0.33
Betula papyrifera	Paper Birch	Tree	0.0	0.5	0.2	0.33
Larix laricina	Tamarack	Tree	0.0	5.0	3.0	0.67
Picea mariana	Black Spruce	Tree	5.0	25.0	16.7	1.00
Shrub Layer						
Abies balsamea	Balsam Fir	Tall Shrub	0.0	25.0	9.0	0.67
Alnus viridis	Green Alder	Tall Shrub	0.0	3.0	1.7	0.67
Larix laricina	Tamarack	Tall Shrub	0.0	4.0	1.7	0.67
Picea mariana	Black Spruce	Tall Shrub	3.0	20.0	14.3	1.00
Abies balsamea	Balsam Fir	Low Shrub	0.0	5.0	2.7	0.67
Alnus viridis	Green Alder	Low Shrub	0.5	5.0	2.0	1.00
Amelanchier bartramiana	Bartram's Chuckleypear	Low Shrub	0.0	1.0	0.3	0.33
Chamaedaphne calyculata	Leatherleaf	Low Shrub	0.0	10.0	3.3	0.33
Cornus sericea	Silky Dogwood	Low Shrub	0.0	1.0	0.3	0.33
Dasiphora fruticosa	Shrubby Cinquefoil	Low Shrub	0.0	1.0	0.3	0.33
Kalmia angustifolia	Sheep-Laurel	Low Shrub	0.0	4.0	1.3	0.33
Kalmia polifolia	Bog Laurel	Low Shrub	0.0	0.5	0.2	0.33
Rhododendron groenlandicum	Common Labrador Tea	Low Shrub	0.0	3.0	1.2	0.67
Lonicera villosa	Mountain Fly-Honeysuckle	Low Shrub	0.0	1.0	0.3	0.33
Myrica gale	Sweet Gale	Low Shrub	0.0	15.0	5.3	0.67
Picea mariana	Black Spruce	Low Shrub	0.5	20.0	11.8	1.00
Rhamnus alnifolia	Alderleaf Buckthorn	Low Shrub	0.0	1.0	0.3	0.33
Taxus canadensis	Canada Yew	Low Shrub	0.0	0.5	0.2	0.33
Viburnum nudum	Possum-Haw Viburnum	Low Shrub	0.0	0.5	0.2	0.33
Viburnum opulus	Guelder-Rose Viburnum	Low Shrub	0.0	0.5	0.2	0.33
Epigaea repens	Trailing Arbutus	Dwarf Shrub	0.0	0.5	0.2	0.33
Gaultheria hispidula	Creeping Snowberry	Dwarf Shrub	0.5	2.0	1.2	1.00
Kalmia angustifolia	Sheep-Laurel	Dwarf Shrub	0.0	1.0	0.3	0.33
Kalmia polifolia	Bog Laurel	Dwarf Shrub	0.0	0.5	0.2	0.33
Rhododendron groenlandicum	Common Labrador Tea	Dwarf Shrub	0.0	1.0	0.3	0.33

Scientific Name	Common Name	Growth Form	Wet Coniferous Forest (n=3)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Linnaea borealis	Twinflower	Dwarf Shrub	0.5	2.0	1.2	1.00
Lonicera villosa	Mountain Fly-Honeysuckle	Dwarf Shrub	0.0	0.5	0.2	0.33
Taxus canadensis	Canada Yew	Dwarf Shrub	0.0	0.5	0.2	0.33
Vaccinium angustifolium	Late Lowbush Blueberry	Dwarf Shrub	0.0	2.0	0.8	0.67
Vaccinium macrocarpon	Large Cranberry	Dwarf Shrub	0.0	0.5	0.2	0.33
Vaccinium oxycoccos	Small Cranberry	Dwarf Shrub	0.0	0.5	0.2	0.33
Forb Layer						
Anaphalis margaritacea	Pearly Everlasting	Forb	0.0	0.5	0.2	0.33
Athyrium filix-femina	Lady Fern	Forb	0.0	1.0	0.3	0.33
Cirsium muticum	Swamp Thistle	Forb	0.0	0.5	0.2	0.33
Clintonia borealis	Yellow clintonia	Forb	0.0	3.0	1.7	0.67
Coptis trifolia	Goldthread	Forb	0.0	0.5	0.2	0.33
Cornus canadensis	Bunchberry	Forb	2.0	15.0	6.3	1.00
Drosera rotundifolia	Roundleaf Sundew	Forb	0.0	0.5	0.2	0.33
Dryopteris campyloptera	Mountain Wood-Fern	Forb	0.0	1.0	0.3	0.33
Epilobium ciliatum	Hairy Willow-Herb	Forb	0.0	0.5	0.2	0.33
Epilobium palustre	Marsh Willow-Herb	Forb	0.0	0.5	0.2	0.33
Equisetum arvense	Field Horsetail	Forb	0.0	5.0	1.8	0.67
Equisetum sylvaticum	Woodland Horsetail	Forb	0.0	5.0	2.7	0.67
Eurybia radula	Rough-Leaved Aster	Forb	0.0	0.5	0.2	0.33
Fragaria virginiana	Virginia Strawberry	Forb	0.0	0.5	0.2	0.33
Galium sp.	Bedstraw	Forb	0.0	0.5	0.2	0.33
Geum macrophyllum	Large-Leaved Avens	Forb	0.0	2.0	0.7	0.33
Geum sp.	Avens	Forb	0.0	0.5	0.2	0.33
Gymnocarpium dryopteris	Northern Oak Fern	Forb	0.0	1.0	0.5	0.67
Maianthemum trifolium	Three-Leaf Solomon's-Plume	Forb	0.5	15.0	6.8	1.00
Mitella nuda	Naked Bishop's-Cap	Forb	0.0	0.5	0.3	0.67
Orthilia secunda	One-Side Wintergreen	Forb	0.0	0.5	0.2	0.33
Osmunda cinnamomea	Cinnamon Fern	Forb	0.0	1.0	0.7	0.67
Packera aurea	Golden Groundsel	Forb	0.0	0.5	0.2	0.33
Platanthera dilatata	Leafy White Orchis	Forb	0.0	0.5	0.2	0.33
Prenanthes trifoliolata	Three-Leaved Rattlesnake-root	Forb	0.0	0.5	0.2	0.33

Scientific Name	Common Name	Growth Form	Wet Coniferous Forest (n=3)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Prunella vulgaris	Self-Heal	Forb	0.0	0.5	0.2	0.33
Ranunculus acris	Tall Butter-Cup	Forb	0.0	0.5	0.2	0.33
Ranunculus repens	Creeping Butter-Cup	Forb	0.0	1.0	0.3	0.33
Rubus arcticus	Northern Blackberry	Forb	0.0	0.5	0.3	0.67
Rubus pubescens	Dewberry	Forb	0.0	15.0	6.0	0.67
Sanguisorba canadensis	Bottlebrush	Forb	0.0	20.0	6.7	0.33
Solidago uliginosa	Bog Goldenrod	Forb	0.0	0.5	0.2	0.33
Spiranthes romanzoffiana	Hooded Ladies'-Tresses	Forb	0.0	0.5	0.2	0.33
Symphyotrichum puniceum	Purplestem aster	Forb	0.0	2.0	0.8	0.67
Thalictrum alpinum	Alpine Meadow-Rue	Forb	0.0	1.0	0.3	0.33
Thalictrum pubescens	Tall Meadow-Rue	Forb	0.0	5.0	1.7	0.33
Viola sp.	Violet	Forb	0.0	0.5	0.2	0.33
Graminoid Layer						
Agrostis gigantea	Black Bentgrass	Graminoid	0.0	0.5	0.2	0.33
Agrostis scabra	Rough Bentgrass	Graminoid	0.0	1.0	0.5	0.67
Bromus ciliatus	Fringed Brome	Graminoid	0.0	0.5	0.2	0.33
Calamagrostis canadensis	Bluejoint Reedgrass	Graminoid	0.0	1.0	0.3	0.33
Calamagrostis pickeringii	Pickering's Reedgrass	Graminoid	0.0	2.0	0.7	0.33
Carex atlantica	Atlantic Sedge	Graminoid	2.0	5.0	3.3	1.00
Carex brunnescens	Brownish Sedge	Graminoid	0.0	0.5	0.2	0.33
Carex buxbaumii	Buxbaum's Sedge	Graminoid	0.0	10.0	6.7	0.67
Carex canescens	Hoary Sedge	Graminoid	0.0	1.0	0.7	0.67
Carex disperma	Softleaf Sedge	Graminoid	0.0	0.5	0.2	0.33
Carex echinata	Little Prickly Sedge	Graminoid	4.0	5.0	4.7	1.00
Carex flava	Yellow Sedge	Graminoid	0.0	5.0	1.8	0.67
Carex interior	Inland Sedge	Graminoid	0.0	0.5	0.2	0.33
Carex leptalea	Bristlestalk Sedge	Graminoid	0.0	10.0	3.5	0.67
Carex magellanica	Boreal Bog Sedge	Graminoid	0.0	2.0	0.7	0.33
Carex oligosperma	Few-Seeded Sedge	Graminoid	0.0	2.0	0.7	0.33
Carex pauciflora	Few-Flowered Sedge	Graminoid	0.0	2.0	0.7	0.33
Carex tenuiflora	Sparse-Flowered Sedge	Graminoid	0.0	1.0	0.3	0.33
Carex trisperma	Threefruit sedge	Graminoid	5.0	5.0	5.0	1.00
Carex utriculata	Bear Sedge	Graminoid	0.0	3.0	1.0	0.33
Carex wiegandii	Wiegand's Sedge	Graminoid	0.0	0.5	0.2	0.33
Eriophorum angustifolium	No Common Name In Tracker	Graminoid	0.0	1.0	0.3	0.33
Eriophorum viridicarinatum	Green-Keel Cottongrass	Graminoid	0.0	0.5	0.2	0.33

Scientific Name	Common Name	Growth Form	Wet Coniferous Forest (n=3)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Glyceria striata	Fowl Manna-Grass	Graminoid	0.0	3.0	1.3	0.67
Juncus brevicaudatus	Short-tail Rush	Graminoid	0.0	0.5	0.2	0.33
Poa saltuensis	Forest Bluegrass	Graminoid	0.0	0.5	0.3	0.67
Schizachne purpurascens	Purple Oat	Graminoid	0.0	0.5	0.2	0.33
Scirpus atrocinctus	Black-Girdle Bulrush	Graminoid	0.0	1.0	0.3	0.33
Scirpus cyperinus	Cottongrass Bulrush	Graminoid	0.0	1.0	0.3	0.33
Trichophorum caespitosum	Deergrass	Graminoid	0.0	20.0	6.7	0.33
Moss / Lichen Layer						
Cladina rangiferina	Gray Reindeer Lichen	Lichen	0.0	1.0	0.3	0.33
Dicranum polysetum	Wavy-leaved Broom Moss	Moss	0.0	3.0	1.0	0.33
Dicranum sp.	Broom Moss	Moss	0.0	3.0	1.0	0.33
Hylocomium splendens	Stairstep Moss	Moss	0.0	15.0	6.7	0.67
na	Unidentified moss	Moss	0.0	3.0	1.3	0.67
na	Unidentified liverwort	Moss	0.0	15.0	5.0	0.33
Ptilidium sp.	Fringewort	Moss	0.0	0.5	0.2	0.33
Ptilium crista-castrensis	Plume moss	Moss	0.0	4.0	1.3	0.33
Rhytidiadelphus sp.	a Mosss	Moss	0.0	5.0	1.7	0.33
Pleurozium schreberi	Schreber's feathermoss	Moss	2.0	10.0	4.7	1.00
Sphagnum sp.	Peatmoss	Moss	60.0	65.0	63.3	1.00

Table D9 Shrub / Graminoid Fen - Plant Occurrence Summary (Ground Plot Data)

Scientific Name	Common Name	Growth Form	Shrub / Graminoid Fen (n=3)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Shrub Layer						
Larix laricina	Tamarack	Tall Shrub	0.0	0.5	0.3	0.67
Andromeda polifolia	Bog Rosemary	Low Shrub	0.0	1.0	0.3	0.33
Betula michauxii	Michaux's Dwarf Birch	Low Shrub	0.0	8.0	4.3	0.67
Chamaedaphne calyculata	Leatherleaf	Low Shrub	0.0	0.5	0.2	0.33
Dasiphora fruticosa	Shrubby Cinquefoil	Low Shrub	0.0	10.0	4.0	0.67
Juniperus communis var. depressa	Ground Juniper	Low Shrub	0.0	1.0	0.3	0.33
Juniperus horizontalis	Creeping Juniper	Low Shrub	0.0	0.5	0.2	0.33
Larix laricina	Tamarack	Low Shrub	1.0	2.0	1.7	1.00
Rhododendron groenlandicum	Common Labrador Tea	Low Shrub	0.0	0.5	0.2	0.33
Lonicera villosa	Mountain Fly-Honeysuckle	Low Shrub	0.0	1.0	0.5	0.67
Myrica gale	Sweet Gale	Low Shrub	2.0	25.0	9.7	1.00
Photinia melanocarpa	Black Chokeberry	Low Shrub	0.0	3.0	1.3	0.67
Photinia sp.	Chokeberry	Low Shrub	0.0	1.0	0.3	0.33
Picea mariana	Black Spruce	Low Shrub	0.0	4.0	1.5	0.67
Andromeda polifolia	Bog Rosemary	Dwarf Shrub	0.0	2.0	1.0	0.67
Betula michauxii	Michaux's Dwarf Birch	Dwarf Shrub	0.0	4.0	2.0	0.67
Chamaedaphne calyculata	Leatherleaf	Dwarf Shrub	0.5	2.0	1.0	1.00
Dasiphora fruticosa	Shrubby Cinquefoil	Dwarf Shrub	0.0	1.0	0.3	0.33
Empetrum nigrum	Black Crowberry	Dwarf Shrub	0.0	0.5	0.2	0.33
Juniperus communis var. depressa	Ground Juniper	Dwarf Shrub	0.0	0.5	0.2	0.33
Juniperus horizontalis	Creeping Juniper	Dwarf Shrub	0.0	0.5	0.2	0.33
Kalmia angustifolia	Sheep-Laurel	Dwarf Shrub	0.0	1.0	0.3	0.33
Kalmia polifolia	Bog Laurel	Dwarf Shrub	0.5	1.0	0.7	1.00
Rhododendron groenlandicum	Common Labrador Tea	Dwarf Shrub	0.0	0.5	0.2	0.33
Lonicera villosa	Mountain Fly-Honeysuckle	Dwarf Shrub	0.0	1.0	0.5	0.67
Myrica gale	Sweet Gale	Dwarf Shrub	0.0	1.0	0.3	0.33

Scientific Name	Common Name	Growth Form	Shrub / Graminoid Fen (n=3)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Photinia melanocarpa	Black Chokeberry	Dwarf Shrub	0.0	4.0	1.3	0.33
Photinia sp.	Chokeberry	Dwarf Shrub	0.0	4.0	1.3	0.33
Rosa nitida	Shining Rose	Dwarf Shrub	0.0	0.5	0.2	0.33
Vaccinium oxycoccos	Small Cranberry	Dwarf Shrub	0.5	0.5	0.5	1.00
Forb Layer						
Drosera intermedia	Spoon-Leaved Sundew	Forb	0.0	0.5	0.2	0.33
Drosera rotundifolia	Roundleaf Sundew	Forb	0.5	0.5	0.5	1.00
Eurybia radula	Rough-Leaved Aster	Forb	0.5	2.0	1.0	1.00
Lycopodium annotinum	Stiff Clubmoss	Forb	0.0	0.5	0.2	0.33
Maianthemum trifolium	Three-Leaf Solomon's-Plume	Forb	0.0	0.5	0.2	0.33
Malaxis unifolia	Green Adder's-Mouth	Forb	0.0	0.5	0.2	0.33
Oclemena nemoralis	Bog Aster	Forb	0.0	1.0	0.7	0.67
Packera paupercula	Balsam Groundsel	Forb	0.0	5.0	1.7	0.33
Platanthera clavellata	Club-Spur Orchid	Forb	0.0	0.5	0.2	0.33
Platanthera dilatata	Leafy White Orchis	Forb	0.0	0.5	0.2	0.33
Pogonia ophioglossoides	Snakemouth	Forb	0.0	0.5	0.2	0.33
Rubus arcticus	Northern Blackberry	Forb	0.0	0.5	0.3	0.67
Sanguisorba canadensis	Bottlebrush	Forb	1.0	5.0	2.3	1.00
Sarracenia purpurea	Northern Pitcher-Plant	Forb	0.5	1.0	0.7	1.00
Selaginella selaginoides	Low Spike-Moss	Forb	0.0	0.5	0.3	0.67
Solidago uliginosa	Bog Goldenrod	Forb	1.0	4.0	2.0	1.00
Thalictrum alpinum	Alpine Meadow-Rue	Forb	0.0	1.0	0.5	0.67
Thalictrum pubescens	Tall Meadow-Rue	Forb	0.0	0.5	0.2	0.33
Tofieldia pusilla	Scotch False-Asphodel	Forb	0.0	0.5	0.2	0.33
Utricularia cornuta	Horned Bladderwort	Forb	0.0	0.5	0.2	0.33
Utricularia intermedia	Flatleaf Bladderwort	Forb	0.0	0.5	0.2	0.33
Viola sp.	Violet	Forb	0.0	0.5	0.2	0.33

Scientific Name	Common Name	Growth Form	Shrub / Graminoid Fen (n=3)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Graminoid Layer						
Calamagrostis pickeringii	Pickering's Reedgrass	Graminoid	0.0	10.0	3.7	0.67
Carex buxbaumii	Buxbaum's Sedge	Graminoid	0.0	0.5	0.2	0.33
Carex exilis	Coast Sedge	Graminoid	0.5	5.0	2.0	1.00
Carex limosa	Mud Sedge	Graminoid	0.0	5.0	1.7	0.33
Carex michauxiana	Michaux Sedge	Graminoid	0.0	4.0	1.5	0.67
Carex oligosperma	Few-Seeded Sedge	Graminoid	2.0	20.0	8.0	1.00
Carex pauciflora	Few-Flowered Sedge	Graminoid	0.0	0.5	0.2	0.33
Eriophorum virginicum	Tawny Cotton-Grass	Graminoid	0.0	0.5	0.3	0.67
Eriophorum viridicarinatum	Green-Keel Cottongrass	Graminoid	0.0	0.5	0.2	0.33
Juncus canadensis	Canada Rush	Graminoid	0.0	1.0	0.3	0.33
Juncus pelocarpus	Brown-Fruited Rush	Graminoid	0.0	3.0	1.0	0.33
Juncus stygius	Moor Rush	Graminoid	0.0	1.0	0.3	0.33
Muhlenbergia glomerata	Marsh Muhly	Graminoid	0.0	0.5	0.2	0.33
Muhlenbergia uniflora	Fall Dropseed Muhly	Graminoid	0.0	0.5	0.2	0.33
Rhynchospora alba	White Beakrush	Graminoid	4.0	15.0	9.7	1.00
Trichophorum alpinum	Alpine Cotton-Grass	Graminoid	0.0	2.0	1.0	0.67
Trichophorum caespitosum	Deergrass	Graminoid	5.0	30.0	18.3	1.00
Moss / Lichen Layer						
Cladina mitis	Green Reindeer Lichen	Lichen	0.0	2.0	0.7	0.33
Cladina rangiferina	Gray Reindeer Lichen	Lichen	0.5	4.0	2.2	1.00
Dicranum sp.	Broom Moss	Moss	0.0	2.0	1.0	0.67
na	Unidentified moss	Moss	0.0	30.0	10.0	0.33
Pleurozium schreberi	Schreber's feathermoss	Moss	0.5	3.0	1.8	1.00
Polytrichum sp.	Haircap Moss	Moss	0.0	1.0	0.3	0.33
Ptilidium sp.	Fringewort	Moss	0.0	1.0	0.3	0.33
Sphagnum sp.	Peatmoss	Moss	20.0	75.0	40.0	1.00

Table D10 Shrub Bog - Plant Occurrence Summary (Ground Plot Data)

Scientific Name	Common Name	Growth Form	Shrub Bog (n=3)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Shrub Layer						
Abies balsamea	Balsam Fir	Low Shrub	0.0	0.5	0.2	0.33
Betula michauxii	Michaux's Dwarf Birch	Low Shrub	0.0	1.0	0.3	0.33
Betula pumila	Bog Birch	Low Shrub	0.0	0.5	0.2	0.33
Chamaedaphne calyculata	Leatherleaf	Low Shrub	0.0	8.0	2.7	0.33
Kalmia angustifolia	Sheep-Laurel	Low Shrub	0.0	10.0	3.3	0.33
Kalmia polifolia	Bog Laurel	Low Shrub	0.0	0.5	0.2	0.33
Larix laricina	Tamarack	Low Shrub	0.0	2.0	0.8	0.67
Myrica gale	Sweet Gale	Low Shrub	0.0	0.5	0.2	0.33
Ilex mucronatus	Mountain Holly	Low Shrub	0.0	0.5	0.2	0.33
Picea mariana	Black Spruce	Low Shrub	0.5	2.0	1.0	1.00
Rhododendron canadense	Rhodora	Low Shrub	0.0	1.0	0.7	0.67
Viburnum nudum	Possum-Haw Viburnum	Low Shrub	0.0	0.5	0.2	0.33
Andromeda polifolia	Bog Rosemary	Dwarf Shrub	2.0	2.0	2.0	1.00
Betula michauxii	Michaux's Dwarf Birch	Dwarf Shrub	0.0	2.0	0.7	0.33
Chamaedaphne calyculata	Leatherleaf	Dwarf Shrub	1.0	10.0	6.3	1.00
Empetrum eamesii	Rock Crowberry	Dwarf Shrub	0.0	0.5	0.2	0.33
Empetrum nigrum	Black Crowberry	Dwarf Shrub	1.0	3.0	1.7	1.00
Juniperus communis var. depressa	Ground Juniper	Dwarf Shrub	0.0	0.5	0.2	0.33
Kalmia angustifolia	Sheep-Laurel	Dwarf Shrub	2.0	15.0	7.3	1.00
Kalmia polifolia	Bog Laurel	Dwarf Shrub	0.5	1.0	0.8	1.00
Larix laricina	Tamarack	Dwarf Shrub	0.0	0.5	0.2	0.33
Rhododendron groenlandicum	Common Labrador Tea	Dwarf Shrub	1.0	2.0	1.3	1.00
Lonicera villosa	Mountain Fly-Honeysuckle	Dwarf Shrub	0.0	1.0	0.3	0.33
Photinia melanocarpa	Black Chokeberry	Dwarf Shrub	0.0	4.0	1.7	0.67
Photinia sp.	Chokeberry	Dwarf Shrub	0.0	1.0	0.3	0.33
Picea mariana	Black Spruce	Dwarf Shrub	0.0	7.0	2.3	0.33

Scientific Name	Common Name	Growth Form	Shrub Bog (n=3)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Rhododendron canadense	Rhodora	Dwarf Shrub	0.0	5.0	2.0	0.67
Vaccinium angustifolium	Late Lowbush Blueberry	Dwarf Shrub	0.0	2.0	0.7	0.33
Vaccinium boreale	Northern Blueberry	Dwarf Shrub	0.0	5.0	1.7	0.33
Vaccinium macrocarpon	Large Cranberry	Dwarf Shrub	0.0	0.5	0.2	0.33
Vaccinium oxycoccos	Small Cranberry	Dwarf Shrub	0.5	1.0	0.7	1.00
Forb Layer						
Coptis trifolia	Goldthread	Forb	0.0	1.0	0.3	0.33
Cornus canadensis	Bunchberry	Forb	0.0	1.0	0.5	0.67
Drosera intermedia	Spoon-Leaved Sundew	Forb	0.0	0.5	0.2	0.33
Drosera rotundifolia	Roundleaf Sundew	Forb	0.5	1.0	0.7	1.00
Equisetum fluviatile	Water Horsetail	Forb	0.0	1.0	0.3	0.33
Eriocaulon aquaticum	Seven-Angled Pipewort	Forb	0.0	0.5	0.2	0.33
Lycopodiella inundata	Bog Clubmoss	Forb	0.0	1.0	0.3	0.33
Lycopodium annotinum	Stiff Clubmoss	Forb	0.0	3.0	1.3	0.67
Maianthemum trifolium	Three-Leaf Solomon's-Plume	Forb	0.0	1.0	0.7	0.67
Menyanthes trifoliata	Bog Buckbean	Forb	0.0	0.5	0.2	0.33
Nuphar lutea	Yellow Cowlily	Forb	0.0	1.0	0.3	0.33
Oclemena nemoralis	Bog Aster	Forb	0.0	1.0	0.5	0.67
Pogonia ophioglossoides	Snakemouth	Forb	0.0	0.5	0.2	0.33
Rubus chamaemorus	Cloudberry	Forb	0.0	1.0	0.7	0.67
Sanguisorba canadensis	Bottlebrush	Forb	0.0	0.5	0.2	0.33
Sarracenia purpurea	Northern Pitcher-Plant	Forb	0.5	1.0	0.7	1.00
Schoenoplectus subterminalis	Water Bulrush	Forb	0.0	1.0	0.3	0.33
Solidago uliginosa	Bog Goldenrod	Forb	0.0	1.0	0.5	0.67
Utricularia cornuta	Horned Bladderwort	Forb	0.0	0.5	0.3	0.67
Graminoid Layer						
Calamagrostis pickeringii	Pickering's Reedgrass	Graminoid	0.0	3.0	1.2	0.67

Scientific Name	Common Name	Growth Form	Shrub Bog (n=3)			
			Minimum Cover (%)	Maximum Cover (%)	Average Cover (%)	Constancy
Carex exilis	Coast Sedge	Graminoid	2.0	10.0	5.7	1.00
Carex limosa	Mud Sedge	Graminoid	0.0	1.0	0.3	0.33
Carex oligosperma	Few-Seeded Sedge	Graminoid	0.0	3.0	1.0	0.33
Carex pauciflora	Few-Flowered Sedge	Graminoid	0.0	0.5	0.2	0.33
Carex utriculata	Bear Sedge	Graminoid	0.0	1.0	0.3	0.33
Eriophorum vaginatum	Tussock Cotton-Grass	Graminoid	0.0	1.0	0.3	0.33
Eriophorum virginicum	Tawny Cotton-Grass	Graminoid	0.0	0.5	0.2	0.33
Rhynchospora alba	White Beakrush	Graminoid	0.0	10.0	3.7	0.67
Scheuchzeria palustris	Pod Grass	Graminoid	0.0	1.0	0.5	0.67
Trichophorum alpinum	Alpine Cotton-Grass	Graminoid	0.0	0.5	0.2	0.33
Trichophorum caespitosum	Deergrass	Graminoid	10.0	15.0	13.3	1.00
Moss / Lichen Layer						
Aulacomnium palustre	Glow Moss	Moss	0.0	5.0	1.7	0.33
Cetraria sp.	a lichen	Lichen	0.0	2.0	1.0	0.67
Cladina arbuscula	Reindeer Lichen	Lichen	0.0	5.0	1.7	0.33
Cladina mitis	Green Reindeer Lichen	Lichen	2.0	15.0	7.0	1.00
Cladina rangiferina	Gray Reindeer Lichen	Lichen	5.0	35.0	16.7	1.00
Cladina stellaris	Star-tipped Reindeer Lichen	Lichen	0.0	1.0	0.3	0.33
Cladonia sp.	Cladonia Lichen	Lichen	0.0	5.0	2.3	0.67
Dicranum polysetum	Wavy-leaved Broom Moss	Moss	0.0	1.0	0.3	0.33
Pleurozium schreberi	Schreber's feathermoss	Moss	0.0	2.0	1.0	0.67
Polytrichum sp.	Haircap Moss	Moss	0.0	3.0	1.0	0.33
Racomitrium sp.	a Moss	Moss	0.0	1.0	0.3	0.33
Sphagnum sp.	Peatmoss	Moss	30.0	65.0	53.3	1.00

APPENDIX E

Incidental Wildlife Sightings Observed Within the Study Area

Table E1 Incidental Wildlife Sightings Observed Within the Study Area

Species		Observation				Associated Breeding Habitat[2]
Common Name	Scientific Name	Visual	Audio	Other[1]	Total	
MAMMALS						
Ungulates						
Caribou	*Rangifer tarandus*	1		6		
Moose	*Alces alces*	1		18		
Small Mammals / Carnivores						
Black bear	*Ursus americanus*					
Canada lynx	*Lynx canadensis*	1*		1**		
Eastern coyote	*Canis latrans*	1*		1		
Red fox	*Vulpes vulpes*	1*		1		
Newfoundland marten	*Martes americana*			1**		
River otter	*Lontra canadensis*	1*		1		
Ermine	*Mustela erminea*			1**		
Mink	*Neovison vison*					
Rodents						
American red squirrel	*Tamiasciurus hudsonicus*	3	3	1		
Beaver	*Castor canadensis*			1		
Meadow vole	*Microtus pennsylvanicus*					
Muskrat	*Ondatra zibethicus*					
Red-backed vole	*Myodes rutilus*			3		
Lagomorphs						
Snowshoe hare	*Lepus americanus*	1		9		
AVIFAUNA						
Raptors						
American Kestrel	*Falco tinnunculus*					
Bald Eagle	*Haliaeetus leucocephalus*	1				
Boreal Owl	*Aegolius funereus*	1				
Great Horned Owl	*Bubo virginianus*					Open Mixed Forests and Wetlands (Houston et al. 1998)
Merlin	*Falco columbarius*					
Osprey	*Pandion haliaetus*					
Red-tailed Hawk	*Buteo jamaicensis*					
Rough-legged	*Buteo lagopus*					

Species		Observation				Associated Breeding Habitat[2]
Common Name	Scientific Name	Visual	Audio	Other[1]	Total	
Hawk						
Sharp-shinned Hawk	*Accipiter striatus*					
Short-eared Owl	*Asio flammeus*					
Great Horned Owl	*Bubo virginianus*	1				
Waterfowl and Waterbirds						
American Black Duck	*Anas rubripes*					Wetlands (Longcore et al. 2000)
Canada Goose	*Branta Canadensis*					Wetlands near treeless and forested areas (Mowbray et al. 2002)
Common Goldeneye	*Bucephala clangula*					Wetlands and Riparian near Mature Forests (Eadie et al. 1995)
Common Loon	*Gavia immer*	2				Wetlands (Evers et al. 2010)
Common Merganser	*Mergus merganser*					Riparian near Coniferous and Mixed Forests (Malory and Metz 1999)
Green-winged Teal	*Anas crecca*					Wetlands (Johnson 1995)
Lesser Scaup	*Aythya affinis*					Wetlands (Austin et al. 1998)
Northern Shoveler	*Anas clypeata*					Wetlands (Dubowy 1996)
Red-breasted Merganser	*Mergus serrator*					Wetlands (Titman 1999)
Wood Duck	*Aix sponsa*					Riparian and Wetlands (Hepp and Bellrose 1995)
Shorebirds						
Common Tern	*Sterna hirundo*					Sandy, Gravel, Shell, or Cobble Areas on Islands (Nisbet 2002)
Greater Yellowlegs	*Tringa melanoleuca*	1				Wetlands with wooded islands and Coniferous Forests (Elphick and Tibbitts 1998)
Herring Gull	*Larus argentatus*					Rock or Sandy Areas on Islands (Pierotti and Good 1994)
Semipalmated Plover	*Charadrius semipalmatus*					Beaches and Grassy Borders In Riparian Areas (Nol and Blanken 1999)
Short-billed Dowitcher	*Limnodromus griseus*					Wetlands interspersed with coniferous stands (Jehl et al. 2001)
Sora	*Porzana carolina*					Wetlands (Melvin and Gibbs 2012)
Solitary Sandpiper	*Tringa solitaria*					Wetlands in mainly Coniferous Forests (Moskoff 2011)
Spotted Sandpiper	*Actitis macularius*					Riparian Areas (Reed et al. 2013)
Least Sandpiper	*Calidris minutilla*					Wetlands (Nebel and Cooper 2008)

Species		Observation				Associated Breeding Habitat[2]
Common Name	Scientific Name	Visual	Audio	Other[1]	Total	
Wilson's Snipe	*Gallinago delicata*		1			Wetlands (Mueller 1999)
Woodpeckers and Flycatchers						
Black-backed Woodpecker	*Picoides arcticus*	1				Coniferous Forests (Dixon and Saab 2000)
American Three-toed Woodpecker	*Picoides doStudy Arealis*					Coniferous Forests (Leonard Jr. 2001)
Downy Woodpecker	*Picoides pubescens*					Open Deciduous Forests near Riparian Areas (Jackson and Ouellet 2002)
Hairy Woodpecker	*Picoides villosus*					Mixed, Coniferous, and Deciduous Forests (Jackson et al. 2002)
Yellow-bellied Sapsucker	*Sphyrapicus varius*					Deciduous and Mixed Forests usually near Riparian Areas (Walters et al. 2002)
Northern Flicker	*Colaptes auratus*					Open Coniferous, Deciduous, and Mixed Forests, Snags in Disturbed Areas (burns and cutovers) and wetlands (Wiebe and Moore 2008)
Least Flycatcher	*Empidonax minimus*					Deciduous and Mixed Forests, may occasionally occur in disturbed areas (burns), wetlands, and shrubby fields (Tarof and Briskie 2008)
Alder Flycatcher	*Empidonax alnorum*					Shrubby Wetlands (Lowther 1999)
Yellow-bellied Flycatcher	*Empidonax flaviventris*					Coniferous and Mixed Forests as well as Wetlands (Gross and Lowther 2011)
Olive-sided Flycatcher	*Contopus cooperi*					Open Coniferous Forests and near forests openings or disturbed areas (anthropogenic and natural) (Altman and Sallabanks 2012)
Songbirds						
Tree Swallow	*Tachycineta bicolor*					Wetlands and Riparian Areas with standing dead trees (Winkler et al. 2011)
Bank Swallow	*Riparia riparia*					Vertical banks along Riparian Areas and Wetlands as well as artificial structures such as sand and gravel quarries, and road cuts (Garrison 1999)

Species		Observation				Associated Breeding Habitat[2]
Common Name	Scientific Name	Visual	Audio	Other[1]	Total	
Red-eyed Vireo	*Vireo olivaceus*					Deciduous and Mixed Forests (Cimprich et al. 2000)
Philadelphia Vireo	*Vireo philadelphicus*					Deciduous and Mixed Forests as well as Forest Edges with shrubby understory (Moskoff and Robinson 2011)
Northern Shrike	*Lanius excubitor*					Riparian Areas in open areas and forest edges (Cade and Atkinson 2002)
Black-capped Chickadee	*Poecile atricapillus*	2				Mixed and Deciduous Forests, Riparian, and disturbed areas with some residual forest (Foote et al. 2010)
Boreal Chickadee	*Poecile hudsonicus*	1				Coniferous Forests (Ficken et al. 1996)
Red-breasted Nuthatch	*Sitta canadensis*		1			Coniferous Forests or Mixed Forests with slightly more coniferous than deciduous species (Ghalambor and Martin 1999)
Brown Creeper	*Certhia americana*					Coniferous and Mixed Forests (Hejl et al. 2002)
Winter Wren	*Troglodytes hiemalis*					Coniferous, Deciduous, and Mixed Forests, and Riparian (Hejl et al. 2002)
Ruby-crowned Kinglet	*Regulus calendula*					Coniferous and Mixed Forests (Swanson et al. 2008)
Golden-crowned Kinglet	*Regulus satrapa*					Coniferous, Mixed, and Deciduous Forests with possibility of breeding in open or closed, edges, or near water (Swanson et al. 2012)
Grey-cheeked Thrush	*Catharus minimus*					Coniferous Forests (Lowther et al. 2001)
Swainson's Thrush	*Catharus ustulatus*					Coniferous Forests (Mack and Yong 2000)
Hermit Thrush	*Catharus guttatus*					Coniferous, Deciduous and Mixed Forests (Dellinger et al. 2012)
American Robin	*Turdus migratorius*					Open Mixed Forests and Disturbed Areas (Sallabanks and James 1999)
Bohemian Waxwing	*Bombycilla garrulus*					Open Coniferous, Mixed Forests, Disturbed areas (burns) and near Riparian Areas and Wetlands (Witmer 2002)

Species		Observation				Associated Breeding Habitat[2]
Common Name	Scientific Name	Visual	Audio	Other[1]	Total	
Cedar Waxwing	*Bombycilla cedrorum*					Riparian Areas and Open Coniferous, Deciduous, and Mixed Forests (Witmer et al. 1997)
American Pipit	*Anthus rubescens*					Wetlands and Riparian (Hendricks and Verbeek 2012)
Black-and-white Warbler	*Mniotilta varia*	2	2			Mixed and Deciduous Forests (Kricher 1995)
Tennessee Warbler	*Oreothlypis peregrina*					Deciduous, Mixed, and Coniferous Forests (Rimmer and Mcfarland 2012)
Orange-crowned Warbler	*Oreothlypis celata*					Open Deciduous Forests, Mixed and Coniferous Forest Edges (Gilbert et al. 2010)
Nashville Warbler	*Oreothlypis ruficapilla*					Open Deciduous and Mixed Forests (Lowther and Williams 2011)
Yellow Warbler	*Setophaga petechial*					Wet Deciduous Riparian Areas and Disturbed Areas (Lowther et al. 1999)
Palm Warbler	*Setophaga palmarum*					Wetlands and Open Coniferous Forests (Wilson 1996)
Magnolia Warbler	*Setophaga magnolia*					Coniferous and Mixed Forests (Dunn and Hall 2010)
Yellow-rumped Warbler	*Setophaga coronate*					Mature Coniferous and Mixed Forests (Hunt and Flaspohler 1998)
Blackpoll Warbler	*Setophaga striata*					Coniferous and Mixed Forests (DeLuca et al. 2013)
Cape May Warbler	*Setophaga tigrina*					Coniferous Forests (Baltz and Latta 1998)
Black-throated Green Warbler	*Setophaga virens*					Coniferous, Mixed, and Deciduous Forests (Morse and Poole 2005).
Wilson's Warbler	*Cardellina pusilla*					Riparian (Ammon and Gilbert 1999)
Warbler (unidentified)		3				
American Redstart	*Setophaga ruticilla*					Riparian and Mixed Forests (Sherry and Holmes 1997)
Northern Waterthrush	*Parkesia noveboracensis*					Riparian (Eaton 1995)
Common Yellowthroat	*Geothlypis trichas*					Wetlands and Riparian Areas (Guzy and Ritchison 1999)

Species		Observation				Associated Breeding Habitat[2]
Common Name	**Scientific Name**	**Visual**	**Audio**	**Other[1]**	**Total**	
Rusty Blackbird	*Euphagus carolinus*			1		Wet Coniferous and Mixed Forests, Riparian and Wetlands (Avery 2013)
Savannah Sparrow	*Passerculus sandwichensis*					Wetlands and Riparian Areas (Wheelwright and Rising 2008)
Song Sparrow	*Melospiza melodia*			3		Coniferous, Mixed, and Deciduous Forests and Riparian Areas (Arcese et al. 2002)
Lincoln's Sparrow	*Melospiza lincolnii*			1		Wetlands and Riparian (Ammon 1995)
Swamp Sparrow	*Melospiza georgiana*					Wetlands and Riparian (Mowbray 1997)
White-throated Sparrow	*Zonotrichia albicollis*					Open Coniferous and Mixed Forests (Falls and Kopachena 2010)
White-crowned Sparrow	*Zonotrichia leucophrys*					Coniferous Forests and Riparian Areas (Chilton et al. 1995)
Fox Sparrow	*Passerella iliaca*					Coniferous and Mixed Forests (Weckstein et al. 2002)
Sparrow (unidentified)		2	1			
Dark-eyed Junco	*Junco hyemalis*		1			Coniferous Forests (Nolan et al. 2002)
Pine Siskin	*Spinus pinus*					Coniferous Forests (Dawson 1997)
Common Redpoll	*Acanthis flammea*					Coniferous Forests (Knox and Lowther 2000)
Purple Finch	*Haemorhous purpureus*					Coniferous Forests, Mixed Forests, and Riparian Areas (Wootton 1996)
Red Crossbill	*Loxia curvirostra*					Coniferous Forests (Benkman 2012)
White-winged Crossbill	*Loxia leucoptera*					Coniferous Forests (Benkman 2012)
Pine Grosbeak	*Pinacola enucleator*					Coniferous Forests (Adkisson 1999)
Gray Jay	*Perisoreus canadensis*	7				Coniferous and Mixed Forests (Strickland and Ouellet 2011)
American Crow	*Corvus brachyrhynchos*	1				Open Areas in Edge Habitats such as Riparian Areas and anthropogenic structures (Verbeek and Caffrey 2002)
Common Raven	*Corvus corax*					Mixed, Coniferous, and Deciduous Forests (Boarman and Heinrich 1999)

Species		Observation				Associated Breeding Habitat[2]
Common Name	Scientific Name	Visual	Audio	Other[1]	Total	
Belted Kingfisher	*Megaceryle alcyon*					Near waterbodies with vertical nest exposures for nest burrows (Kelly and Bridge 2009)
Common Nighthawk	*Chordeiles minor*					Open areas such as disturbed areas, open forests, rock outcrops, and flat gravel areas (Brigham et al. 2011)
Mourning Dove	*Zenaida macroura*					Open Forest and Edges as well as Riparian Areas (Otis et al. 2008)
Passerine (unidentified)		1				
Upland Game Birds						
Ruffed Grouse	*Bonasa umbellus*	1				Deciduous and Mixed Forests (Rusch et al. 2000)
Spruce Grouse	*Falcipennis canadensis*	1		1		Coniferous Forests (Boag and Schroeder 1992)
Willow Ptarmigan	*Lagopus lagopus*					Barrens
AMPHIBIANS						
American Toad	*Bufo americanus*	2				Wetlands
Green Frog	*Rana clamitans*	2				Wetlands

1 "Other" refers to wildlife sign, including but not limited to, tracks, scat, markings, feeding activity, bedding and nests, lodges, dams and kill sites.

2 Sources: Birds of North America Online

* "Observed during 2013 Marathon Winter Wildlife Surveys - aerial surveys.

** "Observed during 2013 Marathon Winter Wildlife Surveys -snow-tracking surveys.

ATTACHMENT 7-E

Waterfowl (2017)

Valentine Lake Project: Waterfowl Baseline Study

Aerial Waterfowl Spring Breeding and Fall Staging Surveys

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Final Report

December 1, 2017

Sign-off Sheet

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Executive Summary

Stantec Consulting Ltd. (Stantec) was retained by Marathon Gold Corporation (Marathon) to conduct environmental surveys at the Valentine Lake Project site, including a waterfowl baseline program. The goal of the waterfowl baseline program was to characterize the existing waterfowl within wetland habitats at Marathon's Valentine Lake Mine Site (the Project), the results of which will be used to support the Environmental Assessment (EA) Registration of the Project.

Waterfowl use different habitats during different seasons. Breeding waterfowl in Newfoundland and Labrador use wetlands, that are extensively available, resulting in a wide distribution of waterfowl at low densities. Staging and molting habitats are generally focused on inland wetlands and coastal sites, where large numbers of waterfowl flock during spring and fall migration. Wetland habitats within the Project area were surveyed for waterfowl during breeding and staging seasons, which will be referred to as the waterfowl study area.

The waterfowl baseline study had two objectives: (1) To describe wetland productivity in terms of waterfowl species richness and species counts in the study area during spring breeding and fall staging, as well as describing the breeding social structure in the spring breeding survey, and (2) To assess waterfowl use of wetland habitat by calculating the relative abundance of waterfowl using densities and habitat selection during spring breeding and fall staging surveys.

Aerial surveys were conducted in spring (2011 and 2017) and fall (2017). Species richness was calculated for species observed during the spring and fall surveys. Social structure was determined for spring breeding surveys in 2011 and 2017 based on total counts by species within guilds. Density was calculated within low and high density strata and overall for the waterfowl study area. A chi-square test of independence was conducted for observations within the density strata (high and low) to determine if there was any significant difference in habitat use.

Waterfowl productivity was the highest during the spring breeding survey in 2017. Similar waterfowl productivity of species richness and counts was observed during spring breeding surveys in 2011 and fall staging surveys in 2017. The highest counts were amongst the guilds of geese, dabbling ducks, and diving ducks during the three surveys. The species with the highest counts included Canada Goose, American Black Duck, Green-winged Teal, and Ring-necked Duck. There was evidence of breeding pairs observed during both 2011 and 2017 in the waterfowl study area. Dabbling ducks, diving ducks, and geese had the highest densities in the waterfowl study area. Waterfowl used high density wetland habitats significantly more than the non-wetland lower density stratum in both 2017 surveys, but there was no significant difference in 2011.

Waterfowl productivity and habitat use suggest that the wetland habitats in the waterfowl study area are used by waterfowl during spring breeding and fall staging.

1.0 INTRODUCTION

1.1 Background

Stantec Consulting Ltd. (Stantec) was retained by Marathon Gold Corporation (Marathon) to conduct environmental surveys at the Valentine Lake Project site, including a waterfowl baseline program. The goal of the waterfowl baseline program was to characterize the existing waterfowl within wetland habitats at Marathon's Valentine Lake Mine Site (the Project), the results of which will be used to support the Environmental Assessment (EA) Registration of the Project.

At the time of this study (spring-fall 2017), the Project included four near-surface, mainly pit-shell constrained, gold deposits: Marathon Deposit, Leprechaun Deposit, Sprite Deposit, and Victory Deposit (Figure 1-1). Additional gold-mineralized zones have been identified immediately to the southwest of the Leprechaun deposit (J. Frank zone) and approximately 1 km northeast of the Victory deposit. The overall site includes a gold system approximately 20 km long and 240 km^2 in central Newfoundland, approximately 57 km south of Buchans.

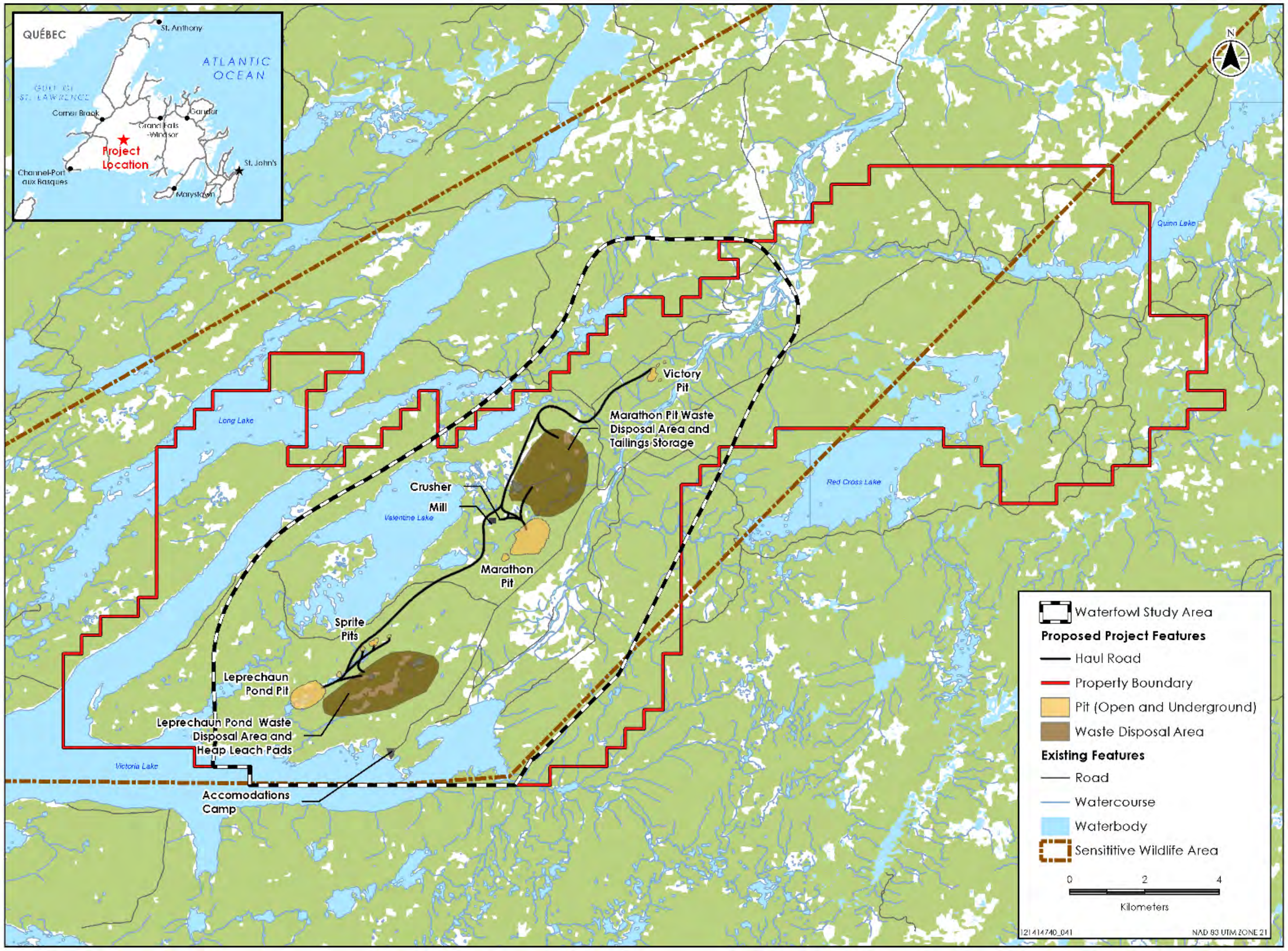

Figure 1-1 Valentine Lake Project Site Plan – May 2017

1.2 Waterfowl Overview

Waterfowl use wetland habitats in both inland and coastal areas during breeding, staging, and molting in Newfoundland and Labrador (NL-EHJV 2008). Breeding waterfowl use wetlands, that are found extensively throughout the province, resulting in a wide distribution of waterfowl at low densities (NL-EHJV 2008). The Newfoundland Boreal Ecozone is rated as moderately important for breeding waterfowl relative to other ecozones in Canada (Fast et al. 2011). Breeding surveys conducted annually since 1990 by the Black Duck Joint Venture show the population trends for five key inland waterfowl species as stable for American Black Duck (*Anas rubripes*), Common Goldeneye (*Bucephala clangula*), Ring-necked Duck (*Aythya collaris*), and Green-winged Teal (*Anas crecca*), with an increase in the Canada Goose (*Branta canadensis*) (NL-EHJV 2008). The Eastern Habitat Joint Venture (EHJV) science team has also found a seasonal importance for these key waterfowl species (NL-EHJV 2008) as follows: American Black Duck and Common Goldeneye breed, stage, and winter in Newfoundland and Labrador; Canada Goose breeds and stages in Newfoundland and Labrador; and both Green-winged Teal and Ring-necked Duck only breed in the province. Breeding waterfowl trends from the Canadian Wildlife Service for the Newfoundland Boreal Ecozone show similar trends for American Black Duck, Ring-necked Duck, Common Goldeneye, and Canada Goose populations (Fast et al. 2011).

Waterfowl staging and molting sites in Newfoundland and Labrador are common in inland wetland and coastal sites. Large numbers of waterfowl flock to these habitats during spring and fall migration, including American Black Duck and Canada goose; however, limited information is available on staging numbers (NL-EHJV 2008). Wintering habitats are coastal open waters off of Newfoundland for non-migratory waterfowl species (NL-EHJV 2008).

One of the main threats to waterfowl habitat identified for Newfoundland and Labrador is habitat loss, fragmentation, and degradation from anthropogenic activities based on natural resource developments (NL-EHJV 2008). There is currently no wetland inventory available for the province; however, they are acknowledged for their important ecological functions for wildlife and other species (NL-EHJV 2008). Other risks include the following: increased access and disturbance from anthropogenic developments and recreational activities; ecotourism; contaminants particularly in coastal habitats from spills and illegal bilge pumping; human health risks for bird-related diseases such as avian influenza; avian and mammal predation; recreational and subsistence hunting; and climate change (NL-EHJV 2008).

1.3 Regulatory Context

Waterfowl and their habitats in Newfoundland and Labrador are managed under the following management framework (Figure 1-2):

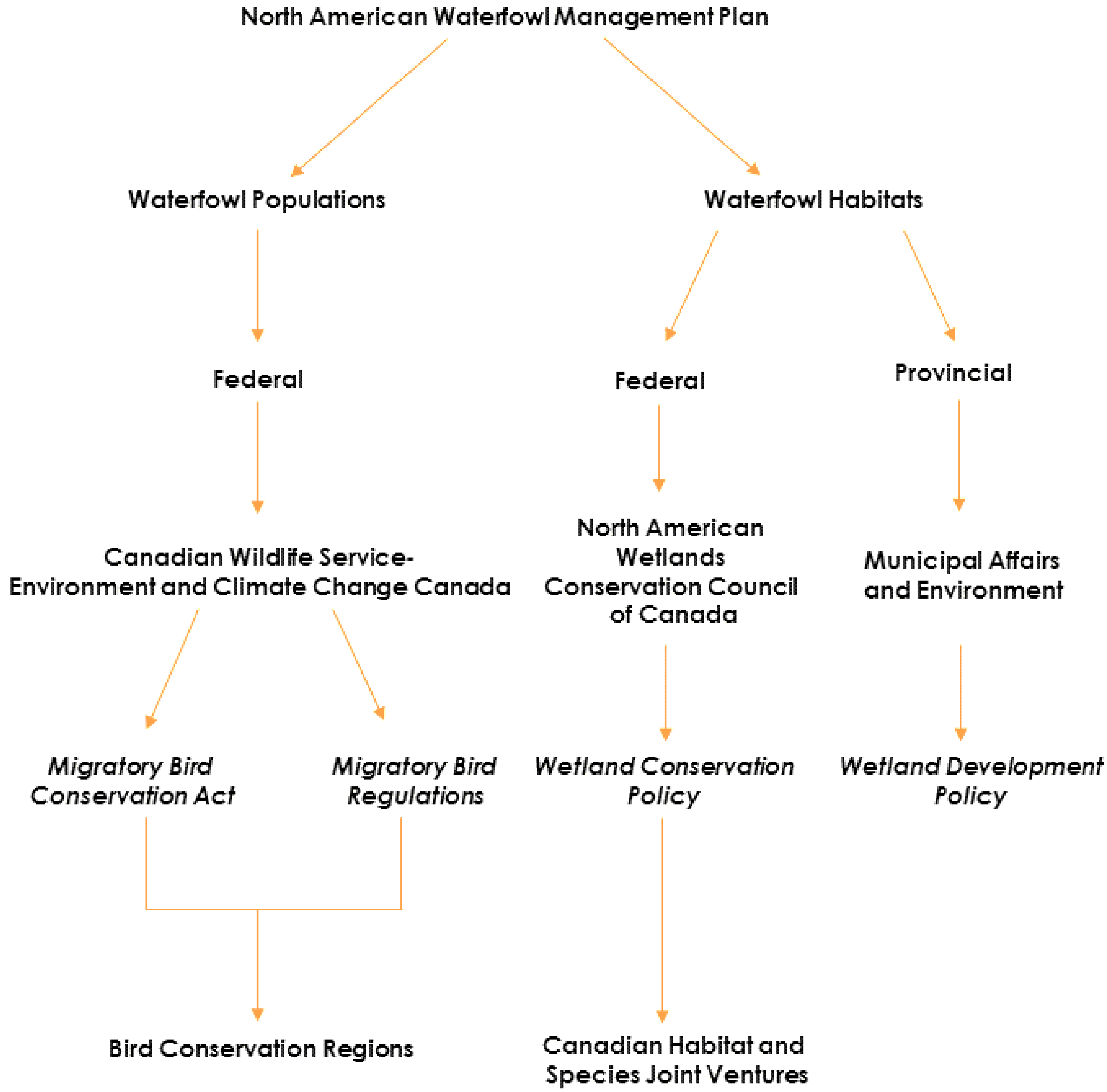

Figure 1-2 Management Framework of Waterfowl and Their Habitats

The North American Waterfowl Management Plan (NAWMP) was established to protect and restore waterfowl populations and their habitats. NAWMP released its 4th revision in 2012 since its first inception in 1986 (North American Waterfowl Management Plan 2012). The main revision to the plan in 2012 was to the management of waterfowl and their habitats with the ecological, economic, and social changes occurring to landscape use and alteration. Canadian conservation strategies for waterfowl species and their habitats are applied within Bird Conservation Regions (BCR) which have been aligned with conservation goals and priorities outlined in the NAWMP (Environment Canada 2013).

Waterfowl are managed and regulated at the federal level by the Canada Wildlife Service within Environment and Climate Change Canada who administers the *Migratory Bird Conservation Act* and associated *Migratory Birds Regulations*, designed to protect and conserve migratory birds, both as populations and individual birds, and their nests located on all land regardless of ownership in Canada. The federal *Species at Risk Act* (SARA) was established to provide wildlife species additional protection against extirpation, extinction, or endangerment.

In terms of waterfowl habitat management, the North American Wetlands Council of Canada nationally applies the NAWMP and leads the Canadian Habitat and Species Joint Ventures (North American Wetlands Conservation Council Canada 2015). Wetlands are managed under the Federal Policy on Wetland Conservation (Government of Canada 1991). At a regional scale, the EHJV works with multiple stakeholders to protect, conserve, and manage waterfowl and their habitats within the Atlantic Flyway (six eastern Canadian provinces) aligning with the goals and targets outlined of the NAWMP (Eastern Habitat Joint Venture 2010). Locally, Newfoundland and Labrador has been part of the EHJV since 1998 (NL-EHJV 2008). The wetland policy is provincially regulated by Municipal Affairs and Environment under the *Water Resources Act*. Further wetland policies are being developed or enhanced in Newfoundland and Labrador under the EHJV (Eastern Habitat Joint Venture 2010).

Environment Canada has the main conservation objective of maintaining adequate habitat availability for 37 identified priority bird species (Environment Canada 2013). The waterfowl species were chosen based on NAWMP. Of the 37 priority species identified, seven occur within the Project area, including Canada Goose, American Black Duck, Green-winged Teal, Ring-necked Duck, Common Goldeneye, Common Merganser (*Mergus merganser*), and Common Loon (*Gavia immer*). The priority species are primarily associated with wetland, coniferous forests, coastal (above high tide) and riparian habitats. Newfoundland is within the Atlantic sub-region, BCR 8 NL. Overall threat magnitude for habitat were high for wetland, coastal, and riparian in BCR 8, based on the knowledge gaps of the distribution, abundance, and population trends as well as habitat changes from effects of climate change. Medium threats included changes to hydrologic regimes, water management, or river channelization from habitat loss or degradation from the destruction and manipulation of inland waterbodies, wetlands, coastal, and riparian habitats. There is one waterfowl species protected under SARA in newfoundland and Labrador, Harlequin Duck (*Histrionicus histrionicus*), which is found in coastal habitats.

1.4 Study Objectives

The waterfowl baseline study had two objectives:

1. To describe wetland productivity of waterfowl species richness and species counts in the study area during spring breeding and fall staging as well as describing the breeding social structure in the spring breeding survey
2. To assess waterfowl use of wetland habitat by calculating the relative abundance of waterfowl using densities and habitat selection during spring breeding and fall staging surveys

2.0 METHODS

2.1 Study Area

Marathon's mineral claim area is composed of the Central Newfoundland Forest Ecoregion and the Red Indian Lake Subregion (Damman 1983, NLDFLR 2008). The landscape is characterized by remote upland forests interspersed by wetlands (bogs/fens), krummholtz, barrens, and waterbodies. The upland forests are composed of balsam fir (*Abies balsamea*) and black spruce (*Picea mariana*), common to central Newfoundland forests. Stands of pure hardwood and mixedwood are also present, with the dominant species being white birch (*Betula papyrifera*) and trembling aspen (*Populus tremuloides*).

While the majority of the area is in a relatively natural state, timber harvesting and mining activity have occurred. The EHJV has a Sensitive Wildlife Area established for the protection of wetland habitat in the Victoria Steadies through provincial securements (NL-EHJV 2008). The waterfowl study area was delineated during 2011 baseline surveys and includes the Project footprint, the Sensitive Wildlife Area, and wetland habitats within the property boundary of the mining claim area (Figure 1-1). The survey boundary was delineated by the mining claim area, provided by the Newfoundland and Labrador Department of Fisheries and Land Resources, that overlapped with the Victoria Steadies Sensitive Wildlife Area.

2.2 Aerial Survey Protocols

The aerial surveys were timed with the peak of spring breeding season and fall staging to assess use of waterfowl habitats in the waterfowl study area. The spring breeding season was determined using the Bird Studies Canada Nesting Calendar Query Tool (Bird Studies Canada 2017) for the waterfowl study area (Appendix A). Fall staging surveys were based on timing reported in other northern boreal forest ecoregions from Stantec's Standard Operating Procedures (SOP) for Aerial Waterbird Surveys (Stantec Consulting Ltd. 2014). Spring breeding surveys occurred on June 6, 2017, where fall staging surveys were completed on September 27, 2017.

Survey transects were repeated from baseline surveys conducted in 2011 (Stantec Consulting Ltd. 2014). The SOP for Aerial Waterbird Surveys (Stantec Consulting Ltd. 2014) was also use to establish survey protocols. Transects were place 1 km apart, with west-east orientation to reduce the effects of sun glare. Surveys spanned morning hours due to calmer winds providing better visibility (Stantec Consulting Ltd. 2014). Favourable survey weather conditions included no precipitation, good visibility, low water turbulence, and winds less than 39 km/h (Conant et al. 2007). Transects were flown using a Bell 206 Long Ranger equipped with bubble windows, with a field of view 200 m on each side of the helicopter. A team of three observers composed of a primary observer, navigator, and data recorder, conducted the surveys. Waterfowl sightings as well as incidental observations were recorded on datasheets (Appendix B) and georeferenced using a Garmin GPSmap 78 GPS unit. Survey data will be submitted electronically with the report.

2.3 Productivity

It is common in bird studies to group similar species based on guilds. Guilds are defined as species which use resources in a similar manner. For this study, guilds of waterfowl (ducks) and waterbirds (geese and shorebirds) that use wetlands were included to assess the productivity of wetlands in the waterfowl study area (Table 2.1). A guild of raptors was also included due to observations during surveys and known predatory behaviour on waterfowl (Buehler 2000, Smith et al. 2011). Two metrics, species counts and species richness, were used to described the productivity of wetland habitats. Species count was calculated by summing the total individuals within each guild. Species richness is defined as a count of the different species present in an area, and was calculated for each different species observed in the guilds during the spring and fall surveys. Social structure was also determined for spring breeding surveys (2011 and 2017) based on total counts by species within guilds.

Table 2.1 Species by Guild Observed during Waterfowl Surveys

Guild	Species
Geese	Canada Goose (Branta canadensis)
Dabbling Ducks	Mallard (*Anas platyrhynchos*) American Black Duck (*Anas rubripes*) Green-winged Teal (*Anas crecca*)
Diving Ducks	Ring-necked Duck (*Aythya collaris*) Common Goldeneye (*Bucephala clangula*) Common Merganser (*Mergus merganser*) Red-breasted Merganser (*Mergus serrator*)
Loons	Common Loon (*Gavia immer)*
Raptors	Northern Harrier (*Circus hudsonicus*) Bald Eagle (*Haliaeetus leucocephalus*)
Shorebirds	Greater Yellowlegs (*Tringa melanoleuca*) Spotted Sandpiper (*Actitus macularius*)

2.4 Habitat Use

The relative abundance of the guilds (described above) was determined based on the density of species in wetland habitats along transects within the waterfowl study area. The wetland habitats along the transects were determined based on an Ecological Land Classification (ELC) (Table 2.2) previously completed for the regional study area for the Project (Stantec Consulting Ltd. 2015). The ELC was classified at a scale of 1:30,000, and included the following wetland habitats: alder thicket, riparian thicket, treed fen, wetland, and water. All other habitats were considered non-wetland habitats. Wetland habitats were considered as the high density stratum and non-wetland habitats as the low density stratum. The density was calculated for high and low density strata and overall study area using the number of observations by guilds divided by area (km^2) of waterfowl habitat along transects, with a 200 m buffer on each side to account for field of view during surveys. Observations greater than 200 m from the transect were therefore excluded from the density calculations. Habitats used by waterfowl were calculated by buffering the survey observations by 25 m to account for GPS error and a heterogenous landscape. The predominant ELC class composing at least 70% of the buffer around observations was considered as the habitat used.

A chi-square test of independence was conducted for waterfowl and waterbird observations in the density strata (high and low) within the ELC habitats using the following equation:

$$x^2 = \sum \frac{(Observed - Expected)^2}{Expected}$$

Significance was calculated from chi-square test statistic (x^2) compared to the critical value to derive the p-value within a significance level of 95 % (α = 0.05) in R 3.4.2. (R Core Team 2017). A separate test was conducted for each survey based on ecological timing of breeding and staging.

Table 2.2 Habitats in the Waterfowl Study Area Defined by the Ecological Land Classification (ELC)

Density Strata	Habitat (Ecosystem Units)[1]	Description[1]	Composition of the Waterfowl Study Area
High	Alder Thicket	Alder dominated communities on moist seepage slopes and riparian areas	14.3 %
	Riparian Thickets	Shrub thickets located in transitional areas and subject to periodic flooding	0.9 %
	Treed Fen	Very moist to wet conifer forests	5.4 %
	Wetland	Very moist to wet shrub herb dominated peatland. It includes ecotypes of shrub, graminoid fen, and shrub bog	10.9 %
	Water	Waterbodies such as lakes, ponds, rivers, and stream	19.6 %
	Total		51 %
Low	Black Spruce Feathermoss	Dry to moist and sometimes wet	13.5 %
	Mixedwood Forest	Mesic to moist forests with high hardwood component	27.2 %
	Black Spruce Scrub	Very moist to wet conifer forests	2.7 %
	Regeneration	Forests regenerating as a result of disturbances such as harvesting, fire, windthrow, etc.	4.8 %
	Anthropogenic	Areas currently or historically subject to intense levels of human disturbance and use (does not include areas regenerating from forest management)	0.8 %
	Total		49 %

Source: Stantec Consulting Ltd. 2015

3.0 RESULTS

3.1 Survey Conditions

Both spring breeding and fall staging surveys were timed for peak periods of the waterfowl study area under appropriate survey conditions (Table 3.1). The survey transects were constant for both surveys in 2017 and covered approximately 107 km (Figure 3-1). The survey covered 29 % of the waterfowl study area with similar effort in high density and low density stratum (Figure 3-1 and Table 3.2).

Incidental observations within the waterfowl study area during spring breeding were caribou (*Rangifer tarandus*), moose (*Alces alces*), beaver (*Castor canadensis*), and Herring Gull (*Larus argentatus*). Caribou observations within the waterfowl study area were adults; however, a female and calf were observed approximately 10 km to the northwest of the Project footprint. Moose (moose and calf in the Victoria Steadies) and caribou were recorded as incidental observations in fall staging surveys. In addition, a stick nest in a tree top was found in upland habitat indicating breeding raptors in the waterfowl study area, and a flock of approximately 70 Canada Geese were observed staging 20 km West of Red Indian Lake.

Table 3.1 Survey Conditions during Spring Breeding and Fall Staging 2017

Survey	Date	Start Time	End Time	Wind (km/h)	Temperature (°C)	Visibility	Precipitation
Spring Breeding	June 6	1020	1150	10	14	Excellent	None
Fall Staging	Sep 27	1055	1155	10	4	Excellent	None

Table 3.2 Survey Effort Along Transects within the Survey Area

Transect	High Density Stratum Waterfowl Habitat Area (km^2)	Low Density Stratum Waterfowl Habitat Area (km^2)	Total Area (km^2) of Transect
T1	0.61	0.58	1.20
T2	0.49	0.71	1.20
T3	0.76	0.84	1.60
T4	0.38	0.82	1.20
T5	0.76	1.23	2.00
T6	0.55	1.04	1.60
T7	1.42	1.37	2.80
T8	1.06	1.33	2.40
T9	1.83	1.76	3.60

Transect	High Density Stratum Waterfowl Habitat Area (km^2)	Low Density Stratum Waterfowl Habitat Area (km^2)	Total Area (km^2) of Transect
T10	1.95	1.25	3.20
T11	1.69	1.91	3.60
T12	1.27	1.52	2.80
T13	1.44	1.35	2.80
T14	1.81	0.19	2.00
T15	3.06	2.62	5.69
Total Area (km^2)	**19.14**	**18.59**	**37.74**
Survey Effort (%)	**50.73**	**49.26**	**100**
Waterfowl Study Area (km^2)	**66.67**	**64.05**	**137.72**

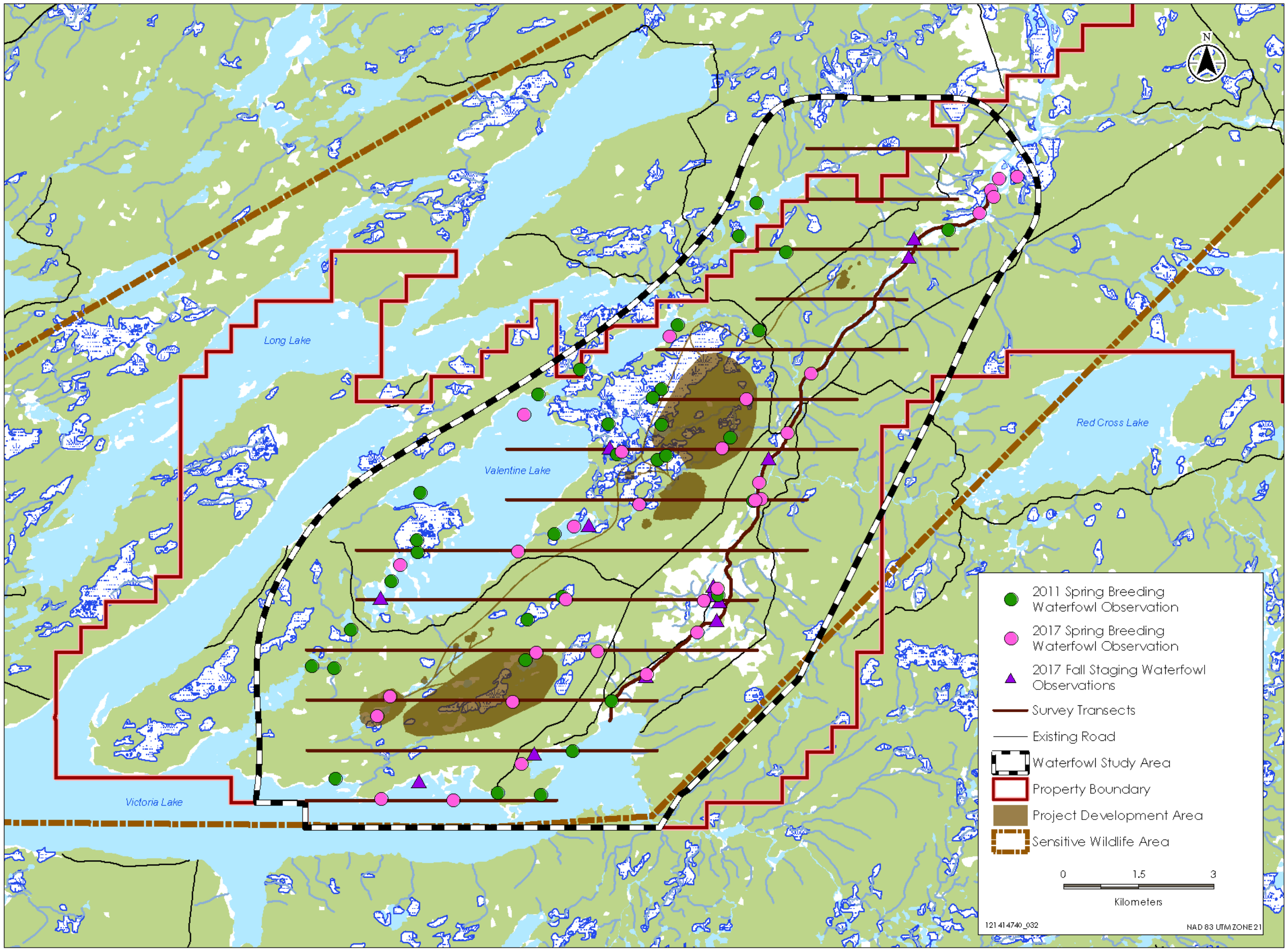

Figure 3-1 Survey Observations and Transects in the Waterfowl Study Area

3.2 Productivity

Waterfowl productivity was the highest during the spring breeding survey in 2017 for both species richness and counts (Table 3.3 and Table 3.4). Similar waterfowl productivity of species richness and counts was observed during spring breeding surveys in 2011 and fall staging surveys in 2017. The highest counts were amongst the guilds of geese, dabbling ducks, and diving ducks during all three surveys (Table 3.4). The species with the highest counts included Canada Goose, American Black Duck, Green-winged Teal, and Ring-necked Duck (Table 3.4). Species observed in lower numbers included Common Goldeneye, Common Merganser, Red-breasted Merganser, and Mallard (*Anas platyrhynchos*). The most common shorebird species was Spotted Sandpiper. Bald Eagle (*Haliaeetus leucocephalus*) and Northern Harrier (*Circus hudsonicus*) were observed in fall staging surveys. No species at risk were observed during surveys.

Table 3.3 Species Richness from Spring Breeding and Fall Staging Surveys in 2017

	Spring Breeding 2011	Spring Breeding 2017	Fall Staging 2017
Species Richness	10	13	9

Table 3.4 Species Counts during Spring Breeding and Fall Staging Surveys in 2017

Surveys	Guild	Species	Number of Individuals Observed
Spring Breeding 2017	Geese	Canada Goose	22
	Dabbling Ducks	American Black Duck	19
		Green-winged Teal	1
	Diving Ducks	Ring-necked Duck	28
		Common Goldeneye	2
	Loons	Common Loon	12
	Shorebirds	Greater Yellowlegs	2
		Spotted Sandpiper	14
	Unidentified Waterfowl	N/A	2
		Overall Total	**102**
Fall Staging 2017	Geese	Canada Goose	0
	Dabbling Ducks	American Black Duck	8
		Mallard	1
		Green-winged Teal	14
	Diving Ducks	Ring-necked Duck	11
		Common Goldeneye	4
	Loons	Common Loon	3
	Raptors	Northern Harrier	1
		Bald Eagle	1
		Overall Total	**43**

Surveys	Guild	Species	Number of Individuals Observed
Spring Breeding 2011	Geese	Canada Goose	16
	Dabbling Ducks	American Black Duck	9
	Diving Ducks	Ring-necked Duck	10
		Common Merganser	4
		Red-breasted Merganser	1
		Common Goldeneye	1
	Loons	Common Loon	15
		Overall Total	**56**

Evidence of breeding pairs was observed during both 2011 and 2017 spring breeding surveys (Table 3.5). Pairs of Canada Goose, American Black Duck, Ring-necked Duck, Common Goldeneye, and Common Loon were observed in both 2011 and 2017. The only difference in breeding pairs species observed between the two survey years was a pair of Common Mergansers in 2011. In 2017, a pair of Canada Goose was observed with a brood of three goslings in the Victoria Steadies area.

Table 3.5 Social Structure of Waterfowl during Spring Breeding Surveys

Year	Guild	Species	Pair[3]	Mixed Flock[2]	Lone Males	Unknown Sex	Total Individuals Observed[1]
2017	Geese	Canada Goose	5	0	0	9	19[3]
	Dabbling Ducks	American Black Duck	0	1 (1♂ + 1♀+ 1 Unknown)	0	16	19
		Green-winged Teal	0	0	1	0	1
	Diving Ducks	Ring-necked Duck	12	0	4	0	28
		Common Goldeneye	1	0	0	0	2
	Loons	Common Loon	3	0	0	6	12
	Unknown	N/A	0	0	0	2	2
		Overall Total	**21**	**1**	**5**	**33**	**83**
2011	Geese	Canada Goose	5	0	0	6	16
	Dabbling Ducks	American Black Duck	4	0	0	1	9
	Diving Ducks	Ring-necked Duck	2	0	5	1	10
		Common Goldeneye	0	0	0	1	1
		Common Merganser	1	0	2	0	4
		Red-breasted Merganser	0	0	0	1	1

Year	Guild	Species	Pair[3]	Mixed Flock[2]	Lone Males	Unknown Sex	Total Individuals Observed[1]
	Loons	Common Loon	3	0	0	9	15
		Overall Total	**15**	**0**	**7**	**19**	**56**

Notes
1. Number of pairs were multiplied by 2 to calculate total individuals observed
2. Mixed flocked composition in brackets
3. A brood of 3 goslings was observed with a pair of Canada goose

3.3 Habitat Use

Dabbling ducks, diving ducks, and geese had the highest densities in the waterfowl study area (Table 3.6). The guilds with the highest densities overall align with the species counts within guild (Table 3.4). The higher densities observed in the low stratum of non-wetland habitats, compared to densities in the high stratum wetland habitats (Table 3.6) relates to the distribution of the birds and the habitat in the waterfowl study area. Observations in the low stratum consisted of few birds in a small area which inflated the density, while the high stratum had a larger number of birds over a larger area.

Table 3.6 Waterfowl Relative Abundance (number of birds/km²) in Spring Breeding and Fall Staging Surveys

Guilds	Seasonal Survey	Density (Individuals/km²)		
		High Stratum	Low Stratum	Overall Waterfowl Study Area
Geese	Spring Breeding 2017	0.49	2.34	1.60
	Fall Staging 2017	0	0	0
	Spring Breeding 2011	1.17	0	1.17
Dabbling Ducks	Spring Breeding 2017	1.48	1.77	1.62
	Fall Staging 2017	2.15	0.76	1.68
	Spring Breeding 2011	0.49	0	0.49
Diving Ducks	Spring Breeding 2017	0.71	1.41	1.02
	Fall Staging 2017	1.27	2.96	1.69
	Spring Breeding 2011	1.22	0	1.22
Loons	Spring Breeding 2017	0.73	0.64	0.70
	Fall Staging 2017	0.81	0	0.81
	Spring Breeding 2011	1.00	3.56	1.28
Raptors	Spring Breeding 2017	0	0	0
	Fall Staging 2017	0.33	0	0.33
Shorebirds	Spring Breeding 2017	0.68	1.49	0.80
	Fall Staging 2017	0	0	0
Unidentified Waterfowl	Spring Breeding 2017	0.94	0.81	0.87

Observations by guilds within the high density stratum were significantly higher than the lower density stratum in both spring breeding surveys (x^2 = 203.92, ρ = 0) and fall breeding surveys (x^2 = 20.48, ρ < 0.001) in 2017 (Table 3.7). This indicates that waterfowl are selecting the preferred wetland habitats rather than being distributed randomly across the landscape, as observed in Figure 3-1. There was no significant difference (x^2 = 7.82, ρ = 0.09) between observations in spring breeding surveys 2011. The 2011 results were however almost significant with a ρ-value of 0.09 since it had few observations in the low stratum resulting in observed values close to expected values (Table 3.7).

Table 3.7 Observed and Expected Observations Within Guilds by Density Strata, Spring Breeding 2017

Survey	Density Stratum	Guild	Observed Values	Expected Values
Spring Survey 2017	High	Dabbling Ducks	13	2.14
		Diving Ducks	7	2.67
		Geese	3	3.74
		Loons	6	10.68
		Shorebirds	9	1.07
		Unknown	1	6.95
	Low	Dabbling Ducks	7	11.75
		Diving Ducks	10	1.86
		Geese	11	2.33
		Loons	3	3.26
		Shorebirds	2	9.32
		Unknown	1	0.93
Fall Staging Survey 2017	High	Dabbling Ducks	20	10.91
		Diving Ducks	11	6.82
		Loons	3	1.36
		Raptors	2	0.91
	Low	Dabbling Ducks	4	2.18
		Diving Ducks	4	1.36
		Loons	0	0.27
		Raptors	0	0.18
Spring Survey 2011	High	Dabbling Ducks	5	4.63
		Diving Ducks	13	12.05
		Geese	11	10.20
		Loons	9	11.12
	Low	Dabbling Ducks	0	0.37
		Diving Ducks	0	0.95
		Geese	0	0.80
		Loons	3	0.88

4.0 DISCUSSION

4.1 Productivity

The most common species observed in the waterfowl study area based on counts and densities were Canada Goose, American Black Duck, Green-winged Teal, and Ring-necked Duck. This is not unexpected based on stable or increasing population of breeding populations of American Black Duck, Common Goldeneye, Ring-necked Duck, and Green-winged Teal in Newfoundland (Fast et al. 2011; NL-EHJV 2008). Brood surveys along the Victoria River in 2011 recorded broods of Canada Goose, American Black Duck, Ring-necked Duck, and species of Mergansers (*Mergus spp.*). Higher species counts recorded during the spring breeding survey in 2017 versus 2011 may be explained by the overall waterfowl productivity as well as the spring conditions. In 2017, overall waterfowl production showed improvement from 2016 in Eastern Canada surveys, and breeding wildlife surveys indicated good breeding habitat conditions for waterfowl in Newfoundland, except for some areas of the Northern Peninsula (U.S. Fish and Wildlife Service 2017).

Fall staging surveys had lower species counts than during either spring survey. There is limited knowledge on inland staging of waterfowl due to the lack of studies so it is not possible to draw conclusions on expected numbers. It has been acknowledged that waterfowl do stage in Newfoundland, particularly in coastal habitats (NL-EHJV 2008). The surveys coincided with the legislated waterfowl hunt which opened on September 16 (Government of Canada 2017). Hunters were observed in waterfowl habitat during the survey which may have impacted the survey observations. Harvest mortality is considered to have a strong influence on population dynamics in eastern waterfowl populations (NL-EHJV 2008). Along with hunters, known waterfowl predators of Bald Eagle (Buehler 2000) and Northern Harrier (Smith et al. 2011) were also observed in wetland habitats which may also have influenced the sightings during the survey. Furthermore, the large flock of Canada Geese observed to the North of the waterfowl study area in the vicinity of Red Indian Lake, may indicate that waterfowl started migrating prior to the survey.

4.2 Habitat Use

Dabbling ducks, diving ducks, and geese had the highest densities in the waterfowl study area, which was expected based on the common waterfowl species observed in Newfoundland (Fast et al. 2011, NL-EHJV 2008) as discussed above (Section 4.1).

High stratum wetland habitats were selected by waterfowl in the study area significantly more than other lower stratum non-wetland habitats during 2017 surveys. The 2011 survey results were non-significant, as there were few observations in the low stratum resulting in observed values close to expected values. The significant selection of wetland habitats in 2017 was expected based on the suitability of wetlands habitats described in baseline studies conducted in 2011 (Stantec Consulting Ltd. 2014).

The selected habitats observed in this study concur with preferred habitats of common species observed within their breeding ranges. Canada Goose is a generalist that breeds in treeless and forested areas near permanent water (Mowbray et al. 2002). American Black Duck also shows generalist behaviour, breeding in areas from salt and river marshes, freshwater to brackish impoundments, woodland wetlands and bogs, and wooded swamps (Longcore et al. 2000). Green-winged Teal prefer wooded ponds, sedge meadows with brush thickets, and woodlands next to marshes and ponds (Johnson 1995). Ring-necked Duck are found in freshwater wetlands, particularly marshes, fens, and bogs that are shallow and acidic with edge habitats of sedges and herbaceous shrubs and vegetation (Roy et al. 2012).

5.0 SUMMARY

Waterfowl productivity and habitat use indicate that the wetland habitats in the waterfowl study area are used by waterfowl during spring breeding and fall staging.

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APPENDIX A

Waterfowl Breeding Nesting Calendar from Bird Studies Canada Nesting Calendar Query Tool

The following parameters were used in the nest calendar query tool to determine timing of breeding surveys:

Species: Waterfowl

Ecodistricts: Red Indian

Bird Conservation Region: Boreal Softwood Shield

Ecoregion: Boreal Shield Newfoundland

Nesting Zone: D3-4

Province and Territories: Newfoundland and Labrador

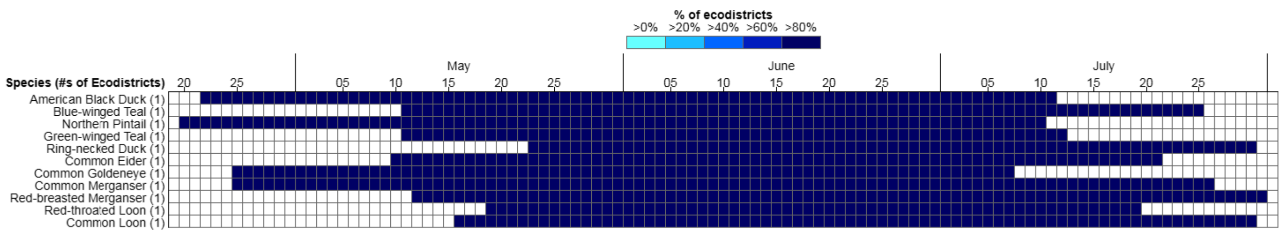

Figure A-1 Nesting Calendar for Red Indian Lake Ecoregion Indicating the Percent of Population Breeding by Species

APPENDIX B

Datasheet Template

121414740 – Marathon Gold Aerial Waterfowl Survey

Page ____ of _____ for Transect _____ Data Recorder/navigator (Front Left): ____________________ Date: ________________

Pilot (Company): ____________________ Helicopter: __________ Rear Left: ____________________ Rear Right: ____________________

Snow Cover (%): ____________________ Ice Cover (%) : ____________________ Visibility/Precipitation: ______________________

Habitat and Effort

Habitat Description	Start				End			
	Time	ºC	Wind	Cloud	Time	ºC	Wind	Cloud

Observations

Wpt #	Species	Number	Social Structure						Comments/ Photos
			Lone ♂ (#)	Lone ♀ (#)	Pair (#)	Flocked ♂'s (#)	Flocked ♀'s (#)	Mixed Flock (#♂/#♀)	

Note: All survey data will be provided electronically.

APPENDIX C

Photos

Photo 1: Canada Goose (*Branta canadensis*) pair with 3 goslings indicated with red circle in the Victoria Steadies

Photo 2: Victoria Steadies Wetland Habitats, Spring Breeding Survey

Photo 3: Upland Lake Habitat, Spring Breeding Survey

Photo 4: Upland Wetland and Lake Waterfowl Habitat, Spring Breeding Surveys

Photo 5: Victoria Steadies Riparian Waterfowl Habitat, Fall Staging Survey

Photo 6: Victoria Steadies Waterfowl Habitat, Fall Staging Survey

Photo 7: Upland Wetland and Lake Waterfowl Habitat, Spring Breeding Surveys

ATTACHMENT 7-F

Vegetation Baseline Study, Rare Plants Survey (2017)

**Valentine Lake Project:
Vegetation Baseline Study**

2017 Rare Plant Survey Report

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Final Report

November 30, 2017

Sign-off Sheet

This document entitled Valentine Lake Project: Vegetation Baseline Study was prepared by Stantec Consulting Ltd. (“Stantec”) for the account of Marathon Gold Corp (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ____
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Reviewed by ____
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Elizabeth Way

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Abbreviations

AC CDC	Atlantic Canada Conservation Data Centre
Marathon Gold	Marathon Gold Corporation
ANPC	Alberta Native Plant Council
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DFLR	Department of Fisheries and Land Resources
ELC	ecological land classification
FNA	Flora of North America
GIS	geographic information system
GPS	global positioning system
NL	Newfoundland and Labrador
NL ESA	Newfoundland and Labrador *Endangered Species Act*
QMS	Quality Management System
RPS	Rare Plant Survey
SAR	Species at Risk
SARA	*Species at Risk Act*
S Rank	Sub-national (provincial) rarity ranking for a species
SOCC	species of conservation concern
SSAC	Species Status Advisory Committee
VASCAN	Database of Canadian Vascular Plants

Glossary

Anthropogenic	Resulting from or produced by human beings.
Classification	A taxonomic activity involving the aggregation of samples into a logical framework.
Ecosystem Mapping	A system used to delineate map units that are internally consistent and sufficiently different from adjacent areas to enable separation of a landscape continuum into ecologically meaningful units.
Ecosystem	An integrated association of living and non-living resources functioning within a defined physical location. A community of organisms and its environment functioning as an ecological unit. For the purposes of assessment, the ecosystem must be defined according to a particular unit and scale.
Element Occurrences	An area of land and/or water where a species or ecological community is or was present and has practical conservation value. Element occurrences for species commonly reflect populations or subpopulations.
Fen	Wetland with sedge peat materials derived primarily from sedges with inclusions of partially decayed stems of shrubs formed in a eutrophic environment due to the close association of the material with mineral rich waters. Minerotrophic peat-forming wetlands that receive surface moisture from precipitation and groundwater. Fens are less acidic than bogs, deriving most of their water from groundwater rich in calcium and magnesium.
Floristic	As in flora, it is a subdomain of botany and biogeography that studies distribution and relationships of plant species over geographic areas.
Map Unit	The division and description of a landscape into units that are distinct from neighbouring map units. Map units may be simple (one element) or complex (two or more elements expressed as proportions of a polygon).
Mesic	A moderate soil moisture regime value whereby water is removed somewhat slowly in relation to supply; neither wet nor dry. Available soil water reflects climatic inputs.
S Rank	Sub-national (provincial) rarity ranking for a species.

Executive Summary

The 2017 Rare Plant Survey (RPS) is one of a small number of technical studies initiated by Stantec Consulting Limited (Stantec) as part of the Vegetation discipline, and was conducted to establish the floristic diversity, with emphasis on the identification and verification of at-risk vascular plant species that may be present at the Valentine Lake mine development (the Project), and in the surrounding area. The results of the baseline study will be used to support the Environmental Assessment (EA) Registration for the Project. The Project is located in central Newfoundland, approximately 55 km south of the Town of Buchans (Figure 1-1). Field surveys to assess the presence and condition of at-risk vascular plant species were conducted mid-summer of 2017, across key habitats encompassed by the Project.

In the context of the RPS, a rare or at-risk species is generally defined as a native species that, because of its biological characteristics, or because it occurs at the periphery of its range, or for some other reason, exists in low numbers or in restricted areas, in Canada and/or Newfoundland and Labrador. The terms Species at Risk (SAR) and Species of Conservation Concern (SOCC) are used in this report when discussing rare vascular plants.

Data obtained from the AC CDC (AC CDC 2015) indicate there are no known SAR or SOCC within the vicinity of the Project. The RPS program, in conjunction with vegetation data collected as part of the 2015 Ecological Land Classification (ELC), resulted in a list of approximately 293 vascular plant species, distributed into 175 genera and 69 families, with the *Cyperaceae* (49 species) *Poaceae* (22 species), and *Asteraceae* (22 species) the largest families. Three of the 293 vascular plant species (accounting for just one percent of the total) are considered SOCC. This list includes species with a provincial status rank [S-ranks] of *S2* (imperiled). One *S2* ranked species: the nodding water nymph (*Najas flexilis*) was observed from a single location within the Project Area. Two additional records: short-scaled sedge (*Carex deweyana*, *S2*) and perennial bentgrass (*Agrostis perennans*, *S2*), are within the Project Area; however, these species were not observed within the potential footprint of the Project during the RPS survey conducted in 2017, but during detailed vegetation surveys performed as part of the ELC in 2015.

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by Marathon Gold Corporation (Marathon) to conduct a number of environmental surveys at the Valentine Lake Project site, including rare plant survey (RPS) (i.e., botanical survey), with emphasis on the identification and verification of at-risk vascular plant species The Vegetation Program was conducted to characterize the existing natural environments at the Valentine Lake site in support of mine development (the Project). The results of the baseline surveys will be used to support the Environmental Assessment (EA) Registration for the Project.

At the time of this study (summer 2017), Marathon's Valentine Lake Project includes four near-surface, mainly pit-shell constrained, gold deposits: Marathon Deposit, Leprechaun Deposit, Sprite Deposit, and Victory Deposit (Figure 1-1). Additional gold-mineralized zones have been identified immediately to the southwest of the Leprechaun deposit (J. Frank zone) and approximately 1 km northeast of the Victory deposit. The overall site includes a gold system approximately 20 km long and 240 km^2 in central Newfoundland, approximately 57 km south of Buchans.

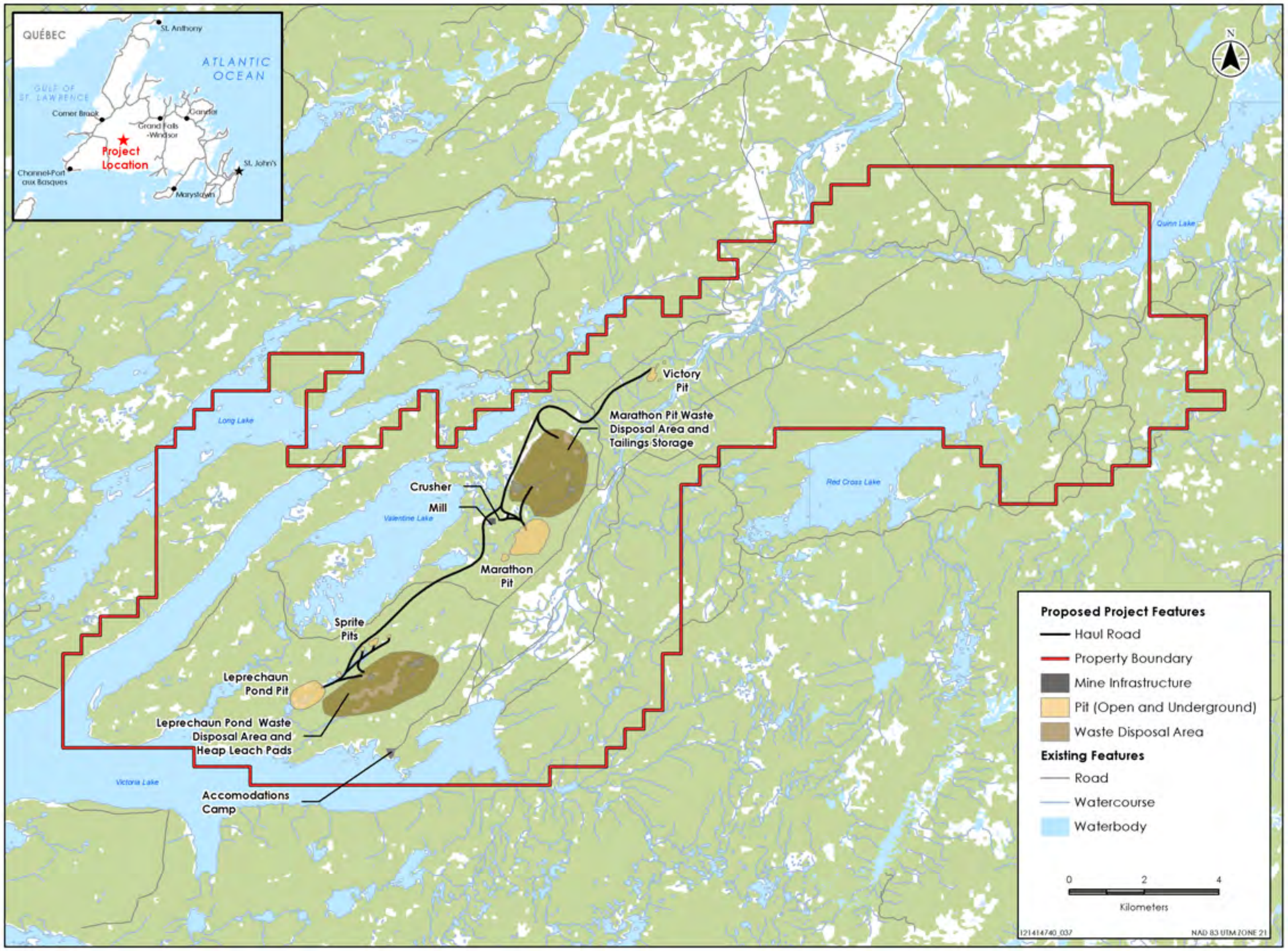

Figure 1-1 Valentine Lake Project Site Plan – May 2017

2.0 RARE PLANTS BACKGROUND AND REGULATORY CONTEXT

2.1 Project Objectives

The RPS program is intended to determine, quantify, and present information on key aspects of the environment (e.g., rare vascular plant taxa). Objectives of the RPS program are to:

- Establish the floristic diversity and develop a list of vascular plant species for the Project Area
- Determine whether provincially rare species of plants, as determined by the Atlantic Canada Conservation Data Center (AC CDC), were present in the Project Area
- Provide information on the location (spatial distribution), population size, and habitat of rare vascular plant taxa occurring within the Project Area
- Provide information to Marathon Gold for consideration in Project planning

2.2 Overview of Rare Plants

The concept of rarity is seemingly simple; a species is rare because it has relatively few individuals, it is uncommon or scarce, or it occurs within a limited geographical range. The rarity of a plant species may also be a matter of scale, meaning that a species may not be rare in Canada, but may be considered “regionally rare” in a respective province or territory. The rarest species are those with small geographic ranges, few occurrences, and few individuals in each occurrence.

Although an understanding of rare plant species and their protection is important for a variety of reasons, the protection of the rarest such species is also a legal requirement for species listed under Schedule 1 of the federal *Species at Risk Act* (SARA) and the Newfoundland and Labrador *Endangered Species Act* (NL ESA). There are a presently several plant species designated or listed under the federal and provincial legislation in Newfoundland and Labrador.

In the context of the proposed Project, a rare plant species is generally defined as a native species that, because of its biological characteristics, or because it occurs at the periphery of its range, or for some other reason, exists in low numbers or in very restricted areas, in Canada and/or Newfoundland and Labrador. The terms Species at Risk (SAR) and Species of Conservation Concern (SOCC) are used in this report when discussing rare vascular plants and are defined in the following sections.

2.2.1 Species at Risk

In Canada and in Newfoundland and Labrador, SAR include those plant species listed as *extirpated*, *endangered, threatened, vulnerable* or *special concern* under the Newfoundland and Labrador *Endangered Species Act* (NL ESA; Government of Newfoundland and Labrador 2001), the federal *Species at Risk Act* (SARA; Government of Canada 2002), or by the Status of Endangered Wildlife Species in Canada (COSEWIC) (COSEWIC 2017).

2.2.2 Species of Conservation Concern

For this RPS program, SOCC include SAR as well as those plant species:

- recommended for listing by the Species Status Advisory Committee (SSAC) as *endangered*, *threatened*, *vulnerable* or *special concern* but not yet listed under NL ESA or SARA
- considered provincially rare (those species with provincial status ranks [S-ranks][1], of *S1* (critically imperiled), *S2* (imperiled)[2], or combinations thereof (e.g., *S1/S2*)[3] upon review by the Atlantic Canada Conservation Data Centre (AC CDC)

Unlike some SAR, SOCC are not protected by either federal or provincial legislation. Rather, they are included as a precautionary measure, reflecting observations and trends in their provincial population status. SOCC may be important indicators of ecosystem health and regional biodiversity, thus their presence in a particular area may warrant mitigation, given their rarity or importance. They are also often indicators of the presence of unusual and/or sensitive habitat, and their protection as umbrella species could possibly result in protection on their associated unusual habitats and co-existing species.

A summary of the ranking systems outlined by the SARA, COSEWIC, NL ESA and AC CDC are provided in Appendix A. The flora (including common and scientific names) identified in the Project Area is provided in Appendix B.

2.3 Regulation

2.3.1 Federal

The status of plant species is assessed and designated by COSEWIC, which then recommends a designation for legal protection by being officially listed under Schedule 1 of SARA. One of the key considerations under SARA for protection of listed SAR is protection of the species' habitat.

SARA is one part of a three-part Government of Canada strategy for the protection of plant SAR, and applies to *extirpated*, *endangered* or *threatened* species listed as being at risk and their critical habitat. SARA-listed species designated as *special concern* are not protected by the prohibitions of Sections 32-36 of SARA; however; it is required that provincial or regional management plans be developed to protect the species. The other two parts of this strategy include commitments under the *Accord for the Protection of Species at Risk* and activities under the Habitat Stewardship Program for SAR, which protect SAR on federal land.

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[1] S-ranks are defined in detail at http://explorer.natureserve.org/ranking.htm#globalstatus, with *S1* = critically imperiled, *S2* = imperiled, *S3* = vulnerable, *S4* = Secure with some cause for long term concern, and *S5* = Demonstrably secure.
[2] While *S3* species may be of concern from a provincial biodiversity perspective, they are often not included, as their populations are considered less sensitive. This determination is typically at the discretion of the Department of Fisheries and Land Resources – Wildlife Division.
[3] The first rank indicates the rarity status given current documentation, and the second rank indicates the rarity status that will most likely be assigned after all historical data and likely habitats have been checked.

There are three main prohibitions in SARA relevant to *extirpated*, *endangered* or *threatened* plant SAR and their critical habitat:

- Section 32, which prohibits killing, harming, or taking SAR
- Section 33, which prohibits damage or destruction of residences of SAR
- Subsection 58(1), which prohibits destruction of critical habitat of SAR

Definitions of COSEWIC and SARA species status categories are summarized in Appendix A.

2.3.2 Provincial

In addition to SARA, each province and territory has a regulatory body that determines what species are rare in each of their respective jurisdictions. In Newfoundland and Labrador, vascular plants SAR are protected under the NL ESA (Government of Newfoundland and Labrador 2001). Designation under the Act follows the recommendations of the Species Status Advisory Committee (SSAC) on the appropriate assessment of a species and referring concerns about the status of species to COSEWIC, where the species is of national importance.

The purpose of NL ESA is to:

- Prevent listed species from being extirpated from Newfoundland and Labrador
- Provide for the recovery of species listed as *extirpated*, *endangered*, or *threatened* as a result of human activity
- Conserve species listed as *special concern* to prevent them from becoming *endangered* or *threatened*

Prohibitions of NL ESA include Section 16, which states "a person shall not disturb, harass, injure, or kill an individual of a species designated as *threatened*, *endangered* or *extirpated*". The associated *Prohibitions Regulation* of SARA identifies those species to which Section 28 applies, and includes eight vascular plant species. Section 29 states that an area or site designated by regulation as survival habitat or recovery habitat may be identified by a description or plan of the specific boundaries or features of the area or site.

3.0 METHODS

3.1 Pre-Survey Planning

Project planning and initial survey design included: defining the objectives and the purpose of the work; conducting a review of prior vegetation and ecosystem classification studies (Stantec 2015) performed within the Project Area and/or the region; and developing a field sampling plan and appropriate survey intensity.

3.2 Information Sources

3.2.1 Literature Review

Information to support the identification of rare plants, including SAR and SOCC, characterize the Project Area, and identify data to be collected during field surveys was obtained from a variety of sources. The primary sources used to characterize existing conditions include:

- Google Earth® and Bing® imagery (2017)
- Databases that include information on rare plant species (e.g., SARA Public Registry, AC CDC database); used to identify previously documented occurrences of SAR and/or SOCC within or in proximity of the Project Area (AC CDC 2017)
- Technical manuals and regional floras (e.g. Atlas of the Vascular Plants of the Island of Newfoundland and of the Island of Saint-Pierre-et-Miquelon (Rouleau and Lamoureux 1992), Gray's Manual of Botany (Fernald 1950), Flora of Canada (Scoggan 1978) and available volumes of the Flora of North America (FNA 1993+)) for familiarization of identifying characteristics of rare species that could be encountered
- Information from other published literature, including peer-reviewed academic journals, research project reports, government publications, and current federal legislation and regulations, where available
- A review of the SARA Public Registry (COSEWIC 2017)

3.2.2 Existing Spatial Reference Data

Existing spatial data and ecosystem mapping (Stantec 2015) formed part of the literature review and desktop analysis. Available ecological land classification (vegetation type and ecosystem maps), or land use maps, satellite imagery, aerial photographs, and topographical and hydrological mapping such as watershed mapping, were reviewed.

Geospatial reference data related to known element occurrences of rare or otherwise unusual vascular plant species were acquired from the AC CDC through queries of its existing plant database. Element occurrences were overlain on existing geospatial data layers (e.g., National Topographic System maps at 1:50,000 scale or larger, aerial photographs / photo mosaics, at a resolution appropriate for facilitating ground-based surveys) of the Project Area and larger region, as reasonably required. GIS layers were then used to produce a base map (botanical surveyor's map) upon which the survey design was focused, and included biophysical and geospatial data to stratify the landscape into habitats with increased likelihood of occurrence for rare species. This included transect or sample point locations, access routes, and information related to natural hazards in the Project Area.

3.2.3 Conservation Data Centre

An AC CDC data request was made in 2015 (as part of the Ecological Land Classification program) for an area within 5 km (i.e., the radius for which AC CDC typically supplies information when requested) of the Project Area. Conservation Data Centres across Canada maintain databases on rare species in each province and territory; the rarity of a species is defined based on a classification system developed by the Conservation Data Centres, in conjunction with NatureServe. Species in Newfoundland and Labrador are given a sub national code (S) and ranked from 1 to 5 according to their status, where *S1* indicates the species is "*critically imperilled*" and susceptible to extirpation (very few individuals remaining), *S2* means the species are "*imperilled*" throughout their range in Newfoundland and Labrador and may be vulnerable to extirpation, *S3* indicates that the species is "*vulnerable*" throughout their range in the province, *S4* means the species is abundant, widespread and "*apparently secure*" although it may be of long term concern, and *S5* indicates the species is abundant, widespread, "*secure*", and currently of no special concern.

3.3 Field Protocols

3.3.1 Survey Standards

Standardized guidelines for rare plant surveys have not been adopted on a national scale; however, several provinces and associated regulating agencies do follow guidelines from within their respective regions. For the purposes of this RPS, focused field surveys were conducted in accordance with the standardized guidelines issued by the Alberta Native Plant Council (ANPC) (ANPC 2012 Update). Requirements for a thorough RPS include:

- The RPS must be floristic in nature
- It must provide reasonable geographic coverage of the survey area, including:
  - Sampling of representative plant communities or habitat types
  - All unique or uncommon plant associations
  - All features or biotic patterns with high probability of supporting rare plants
- Surveys must be conducted during the appropriate season. Timing surveys to occur during periods when potential rare species are most visible (when diagnostic features are most identifiable), and when the probability of encountering both cool and warm season perennials is highest. Surveys will not target a single species, but rather aim to identify a majority of rare species and rare plant communities in the area
- Revisit an adequate number of sites where rare plant element occurrences have been previously recorded

Although surveys can confirm the presence of rare plant species on a site, negative results do not guarantee that rare plant species are absent. For practical purposes, surveys that adhere to the aforementioned ANPC 2012 Update guidelines should provide reasonable evidence that the specified plant taxa do not occur in the survey area.

3.3.1.1 Study Team

Experienced professionals were responsible for the design, logistical planning, and data collection of this RPS program. Plant verification, data analysis, and interpretation was performed by qualified professionals (i.e., biologist/botanist(s), with knowledge and experience in these areas.

Table 1.1 Study Team – Rare Plant Study

Role	Personnel
Task Manager / Lead Project Scientist	Sean Bennett, P.Biol., RPF
Project Scientist	Sean Bennett, P.Biol., RPF
	Rich LaPaix, M.Sc.
Senior / Quality Review	Elizabeth Way, M.Sc.
Data Analysis and Report Preparation	Sean Bennett, P.Biol., RPF
	Rich LaPaix, M.Sc.
Information Management / GIS	Heather Ward, M.Sc.

3.3.1.2 Search Effort

In consultation with Marathon Gold and the Department of Fisheries and Land Resources (DFLR) – Wildlife Division (C. Hanel, Provincial Botanist, pers comm., May 2017), Stantec developed a plan for executing a well-timed vascular plant survey of the Project Area. The level of confidence in locating rare plants is considered a function of the time spent searching, plus appropriate season with which to conduct a survey. On this basis, the RPS allowed for a single site visit (i.e., mid to late summer) based on the phenology (timing of germination, flowering, maturity) of those rare plants with the potential of being encountered, and thus enabling botanists to investigate vascular plant species during the primary flowering season for a majority of species expected.

Search effort focused on inspecting as many fine-scale biotic habitats, unusual plant communities, and biophysical features as possible. In addition, portions of the most dominant natural community types were also inspected. The size of the area sampled within each site varied according to the size of the community and ranged from approximately ten to several hundred square metres. Depending on the size of the area being sampled, field crews searched a site for several minutes to a number of hours.

A survey of key habitats was completed, and a list of observed plant taxa complied. Plant taxa were recorded using a Trimble Juno™ hand-held data logger, which included pre-loaded, current AC CDC status ranks.

3.3.1.3 Timing

The RPS program was completed between July 17 to July 21, 2017, with surveys of key habitats occurring July 18 to July 20, 2017, coinciding with the period when the probabilities of encountering a majority of target vascular plant species was highest (e.g., flowering periods for both cool and warm season perennials) and the detectability of the majority of species is high. Emphasis was placed on accessing high-priority sites as identified from the Google Earth® and Bing® imagery (2017), although surveys were influenced by the ability to safely and efficiently access the large survey area and by the dictates of weather. Specific communities (e.g., riparian areas, flood plains, wetlands) were studied more extensively, as most dominant herbaceous and graminoid (i.e., sedges and grasses) plant species were expected to be mature and readily identified at that time.

3.3.1.4 Equipment

Specialized equipment is typically not required in the delivery of botanical surveys of this nature. Rather, the importance of using field personnel having substantial taxonomic field experience, who are comfortable with taxonomically complex vascular plant groups (i.e., *Cyperaceae*) and familiar with the identification of local flora cannot be overstated.

Using the latest in hand-held data collection and mobile GIS device technology, each potential vascular plant species encountered was identified to species (see Section 3.4.1) using nomenclature compiled by the AC CDC (Newfoundland and Labrador). Waypoints (points) were recorded via a Trimble Juno GPS to obtain accurate location data (UTM 1983; North American Datum [NAD 83] coordinates) for occurrences, in addition to depicting survey areas and routes / tracks throughout the Project Area. The use of these devices provided an additional level of rigour to the survey, enabling surveyors to record the location of particular plant taxa directly into a Project-specific database while also allowing verification of the status rank for that species.

3.3.1.5 Permits and Approvals

No permits were required in the delivery of this RPS program.

3.3.2 Survey Method

Surveys were undertaken in 2017 to describe the overall floristic diversity and to determine the presence / absence (not detected) of rare plants (i.e., SAR and/or SOCC) throughout the Project Area.

Surveys were comprehensive over the entire site, with focus placed on those areas with potential to be directly or indirectly affected by the Project (i.e., deposits, dry stack tailings, waste rock storage facility, heap leach pad).

3.3.2.1 Procedure

In accordance with the ANPC 2012 Update, field surveys were floristic in nature and completed through random meander searches (Figure 3-1) of the Project Area, with surveyors walking transects through each of the plant communities / habitat types identified. Survey effort focused on those plant communities with elevated potential to harbour *endangered*, *threatened*, rare, or otherwise unusual results.

Floristic habitat sampling involved a survey of identified natural plant community types, with the greatest search effort applied to those areas (i.e., microhabitats) having the highest potential to support rare vascular plant species. This method was used to account for different areas (or strata) that are identified within a larger habitat polygon. Individual plant associations or plant communities were rarely uniform throughout their extent, and there were often smaller, identifiable areas within a habitat that were substantially different from that of the larger habitat polygon. These strata were inclusions within the larger habitat matrix; as such, they were sampled separately from the main body of the habitat type. If sufficient biodiversity information was available on the habitat requirements of potentially occurring species (plant community, substrate), and portions of the survey location were believed to be potentially suitable for those species, the stratified sample technique was used to document and validate the assumptions regarding species presence or absence (no detection) within the Project Area.

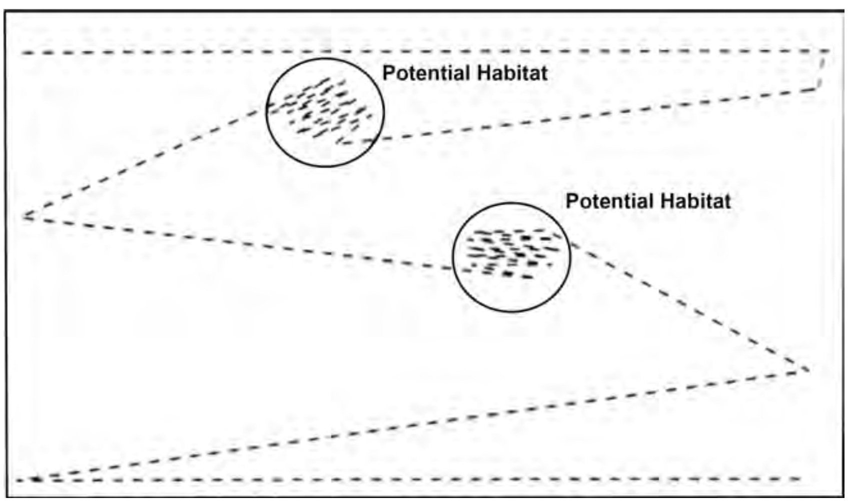

Figure 3-1 Illustration of Floristic Habitat Sampling Method

A list of target species for survey were identified prior to the field surveys in an effort to help direct the field effort. Within the Project Area, sites were selected by assessing the potential for finding populations of rare plants. Criteria included the existence of suitable habitat, the geology of the area, proximity to documented occurrences of rare plants, and historical records of rare plants in an area that may need to be substantiated. Species selection was based upon the known, historical, or reported occurrences within the Project Area. Identification of potential habitat was determined through reviews of Google Earth® and Bing® imagery (2017), consultation with DFLR (C. Hanel, Provincial Botanist, pers. comm., May 2017), and experience of the surveyors.

It should be noted that techniques to identify rare plants targeting habitat types or specific plant communities are often only effective for those species that have well-defined habitat requirements, and/or that prefer distinctive and mappable habitat types. Species typically associated found in small patches or microsites nested within wider ranging habitats (e.g., fresh meadow areas within expanses of mesic scrub woodland), or for generalist species often require broader based surveys of commonly occurring plant communities.

3.3.2.2 Data Collection

The relative abundance and distribution of vascular plant species, including potentially *endangered, threatened*, rare, or otherwise unusual vascular plant species were recorded, along with a brief description of their habitat affinities. Immature plants or plants missing structures (e.g., fruiting bodies) that could not be identified to species-level were identified to genus or family or noted as unknown.

When a potentially rare species was encountered, the survey team delineated the population and habitat boundaries, recording the number of individuals (in most instances the numbers of stems or clumps were counted) within the population. Point location data were considered suitable for plant species / population occurrences that are less than 10 m in diameter, and greater than 10 m apart from the next nearest occurrence of the same species. Where species of interest occurred in high densities, were greater than 10 m in diameter, or in clusters / smaller patches less than 10 m apart, and collectively occupy a patch greater than 10 m in diameter. In those instances, GPS polygon information was considered suitable. Polygons of different species can overlap and the area of occupancy may extend for large distances.

3.3.2.3 Voucher Specimens

An important part of a thorough RPS program involves the collection and preparation (and deposition to major herbariums) of voucher specimens in order to document a permanent record of a particular plant from a specific location. This is particularly important in those instances in which the identity of a species could not be confirmed in the field, or where field personnel disagreed as to the identity of a species. A sample (voucher specimen) was collected for post-field identification. In particular, difficult genera and families (e.g., *Cyperaceae*, *Juncaceae*, Poaceae, *Ranunculaceae*, *Asteraceae*, and aquatic plants – e.g., *Potamogeton*); as well as *endangered, threatened*, rare, or otherwise unusual plants, were often collected for confirmation.

Of note, voucher specimens were only collected where populations were sufficient to allow their collection (i.e., their removal would not lead to an immediate loss of greater than 5 percent of the observed population). Vouchers collected included the smallest amount of material (leaves, seeds, twigs) needed for proper identification. Whole plants were collected only if the population was large enough. Collected specimens were labelled and prepared for identification, verification, and/or archiving.

3.4 Post-Survey Data Management and Analysis

3.4.1 Taxonomic Nomenclature and Ranking

Taxonomical nomenclature for vascular plant species collected during RPS program in 2017 generally subscribes to that prescribed by the AC CDC (2015), however two other authorities: the *Database of Canadian Vascular Plants* (VASCAN) (Brouillet et al. 2010+) and the *Integrated Taxonomic Information System Database* (2017) were also consulted during report preparation.

Vascular plant species are discussed in this report by their accepted colloquial or common names; their scientific name is also provided the first time they are referenced in the text. Some plants have no common names, in which case only the scientific name was used. Where several species in the same genus were identified in order, this report followed the commonly used procedure of using the genus name first, and only the initial for that genus in the rest of the text (e.g., "*Carex limosa,* C. *disperma*, and *C. trisperma*").

The population status of vascular plant species encountered were evaluated through a review of the designations provided by SARA, the NL ESA-listed plant species, and the rankings maintained by the AC CDC (2015).

3.4.2 Analysis of Vegetation Data

Upon completion of the survey(s), field data were entered into a digital database(s) (i.e., Microsoft Excel) for summary and analysis. The database was subsequently queried to extract relevant information for further analyses.

Potential and confirmed *endangered, threatened*, rare, or otherwise unusual plants vascular plant species were mapped using the UTM coordinates taken from GPS waypoints at each rare plant location to depict the distribution of these plants within the Project Area.

3.4.3 ArcGIS

ArcGIS software was used to manage spatial data collected for both the RPS program, and previously prepared Project Ecological Land Classification (ELC) (Stantec 2016). Data are stored in geodatabase format in accordance with the established Project information management standards. Data were stored in a Geographic NAD 83 system, while mapping is created using UTM NAD 83. Sampling location databases, ELC polygons, and associated base map information and imagery were managed in ArcGIS. ArcGIS was also used for data analysis and cartographic output.

3.5 Quality Assurance / Quality Control Procedures

A number of quality assurance and control measures were employed to facilitate correct identification and naming of recorded plant species. Those measures include:

- A relational database program was used to verify S Ranks and alternate names (synonyms) for collected species as provided by the AC CDC
- Synonyms were cross-checked with the VASCAN (Brouillet et al. 2010), FNA (FNA 1993+) and the Annotated Checklist of the Vascular Plants of Newfoundland and Labrador (Meades et al. 2010 [Updated 2015])
- Consultation with recognized and established herbaria throughout North America
- Timely submission of voucher specimens to DFLR – Wildlife Division (where applicable)

Stantec has developed and implemented a Quality Management System (QMS) within its operations. The QMS is registered to International Organization for Standardization (ISO) 9001:2000 (QMS - Requirements) by QMI Management Systems. Registration (CERT-0011312:026332). As such, an in-house technical review process was conducted by senior technical reviewers to confirm this report adequately addresses the work scope and conforms to the quality requirements stipulated by Stantec.

4.0 RESULTS

4.1 Summary of Existing Knowledge from Reviewed Information Sources

To establish the floristic diversity in the Project Area, and as described above, a literature review of readily available botanical studies previously undertaken in the region, in addition to a review of historical rare plant records maintained by the AC CDC was completed.

4.1.1 Previous Botanical Studies

A literature review of ecological studies overlapping the Project Area was completed. The most recent and relevant botanical survey data available was that of the Project ELC, a separate and yet related technical study undertaken by Stantec in 2015. The ELC, while aimed at the identification of ecological communities occupying the local and regional area, included a detailed vegetation survey of those habitats with potential to identify SAR and SOCC within an area of interest which also overlaps that of the Project Area. A complete listing of vascular plant species observed during the 2015 studies was reviewed and included two SOCC:

- *Carex deweyana* (Dewey's sedge, short-scale sedge) - S2
- *Agrostis perennans* (upland bentgrass, perennial bentgrass) - S2

4.1.2 AC CDC Data

Based on the available ACCDC (2015) data, there have been no reported occurrences of vascular plant SAR or SOCC within five kilometers of the proposed Project Area. Although the AC CDC database did indicate the possibility for the occurrence of boreal felt lichen (*Erioderma pedicellatum*), an epiphytic lichen growing primarily on balsam fir (*Abies balsamea*) trees, its occurrence in the Project Area was unlikely.

4.2 Field Studies

4.2.1 Survey Effort

The Project is located within the Central Newfoundland Forest ecoregion. Habitats within this ecoregion with high potential for rare plants (i.e., wetlands and floodplains of streams and rivers) were surveyed for rare plants with early phenology. Based on consultation with DFLR – Wildlife Division (C. Hanel, Provincial Botanist, pers. comm., May 2017), AC CDC database, and the experience of the survey team, a hierarchy of priority habitats and/or rare plant species potentially occurring near the Project Area were identified. Coniferous forest habitats (except forests in flood plains) typical of the Central Newfoundland Forest ecoregion are estimated to have medium to low potential for rare plants, a limited number of parcels of such habitat, representing different forest types, were surveyed for rare plants. While these forest habitats make important contributions to landscape diversity, species diversity is considered limiting and resulting in greater attention given to priority habitats in high quality ecosystems. To that end, a single mid-season was performed in order to survey for rare plants with optimal phenology (including late flowering plants, aquatic plants, many grasses and sedges) in the season. Additional habitats, plant communities or unusual features encountered while in deliver of the in-field surveys were also examined.

In an effort to attain improved visual coverage and species detection within each priority habitat, surveys were performed by a single team of two qualified individuals. The RPS program consisted of not less than 6 combined field-team-days of surveys, each averaging approximately 10 hours/person/day; therefore, the entire survey effort totalled approximately 60 person-hours on the ground. In total, just over 44 linear km or 39 ha surveyed (based on 5 m-wide transect) (Figure 4-1) of survey transects were searched in the Project Area during the 2017 RPS program. The surveyed areas included the Leprechaun, Marathon Gold, Sprite and Victory deposits, in addition that of areas proposed for future dry stack tailings, waste rock storage facility, and heap leach pad.

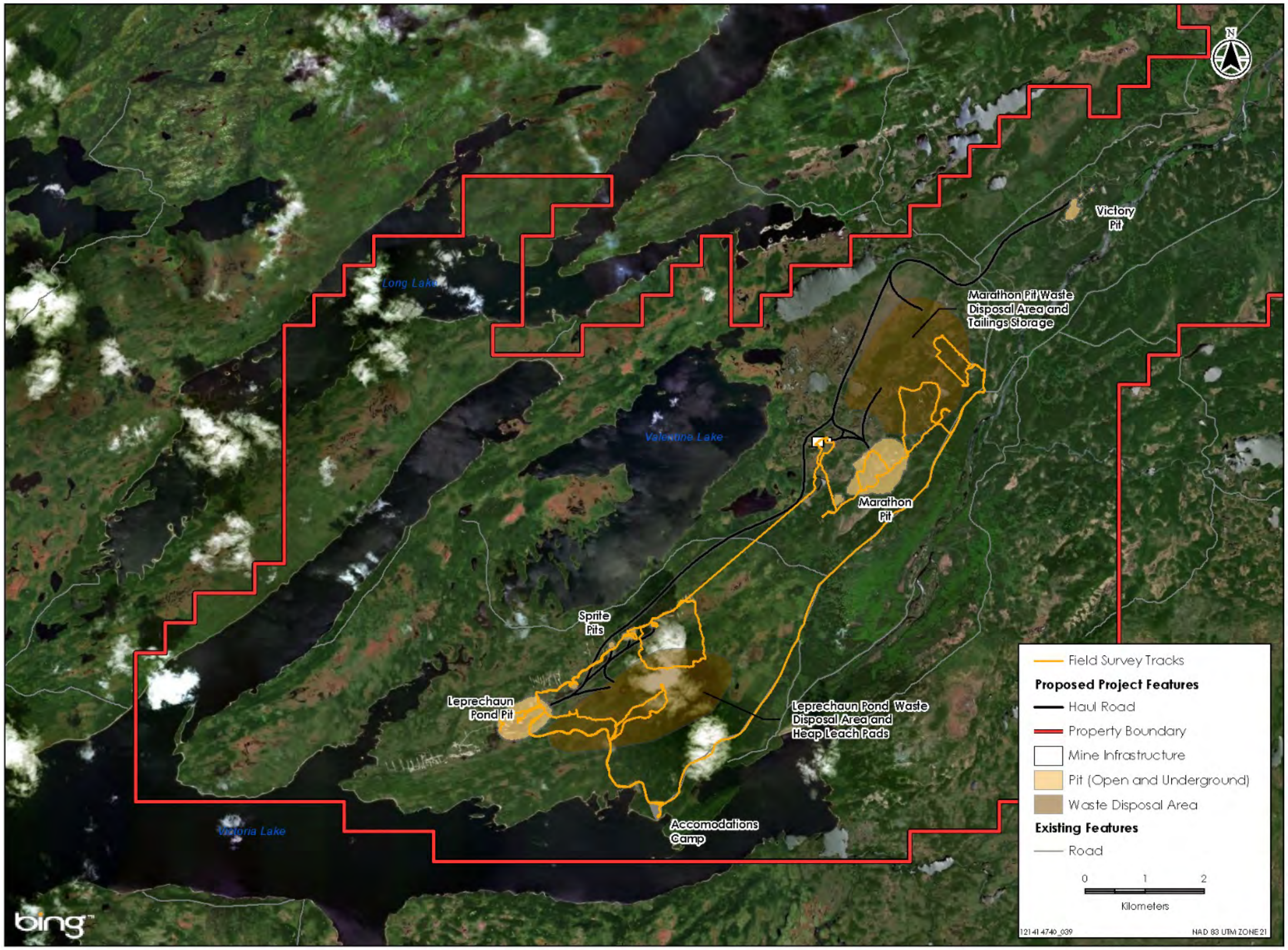

Figure 4-1 Rare Plant Survey Search Effort

4.2.2 Vegetation Communities of the Project Area

Based on the ELC as prepared for the Project (Stantec 2015), twelve vegetation communities (or land cover classes) comprise the proposed Project Area. Of these, nine are vegetated and three are sparsely vegetated, naturally non-vegetated and/or anthropogenic. They include:

- Balsam Fir Forest
- Black Spruce Forest
- Kalmia-Black Spruce Woodland
- Mixedwood Forest
- Regenerating Forest
- Alder Thicket
- Riparian Thicket
- Wet Coniferous Forest
- Open Wetlands
- Open Water
- Exposed Sand / Gravel Shoreline
- Anthropogenic

4.2.3 Species at Risk / Species of Conservation Concern

The 2017 RPS program (mid-season survey), in conjunction with vegetation data collected as part of the 2015 ELC, resulted in a list of approximately 293 vascular plant species, distributed into 175 genera and 69 families, with the *Cyperaceae* (49 species) *Poaceae* (22 species) and *Asteraceae* (22 species) the largest families. Three of the 293 vascular plant species (accounting for one percent of the total) are considered SOCC (Table 4.1; Appendix A).

No COSEWIC or SARA-listed species were found during the survey. Similarly, there were no species listed by the Province in Schedule A of the *Endangered Species List Regulations* observed. Field surveys performed during the 2017 RPS program identified one *S2* ranked species: the nodding water nymph (*Najas flexilis*). Nodding water nymph was observed at one location within the Project Area (Figure 4-2) in association with shallow fresh water. No additional S1 or S2 plant species were identified during 2017 field surveys. Two additional vascular plant species with S-Rankings of S2 were identified during vegetation surveys performed as part of the 2015 ELC program: short-scaled sedge (*Carex deweyana*) and perennial bentgrass (*Agrostis perennans*).

Nine species ranked *S3* were also recorded and consultation with DFLR – Wildlife Division may be required to determine those potentially deemed "of conservation concern" to the Province. They include: sparse-flowered sedge (*Carex tenuiflora*); Wiegand's sedge (*C. wiegandii*); purple false melic (*Schizachne purpurascens*); Arctic yellow-rattle (*Rhinanthus minor* subsp. *groenlandicus*) green addersmouth (*Malaxis unifolia*); Arctic bramble or plumboy (*Rubus arcticus* subsp. *acaulis*), northern blackberry (*Rubus arcticus*), American burred (*Sparganium americanum*), and northern yelloweyed grass (*Xyris montana*).

Very little data exist in the Province concerning the location and habitat preference for a number of these species. With habitat requirements and conditions not fully understood in many parts of the province, the ability to predict where a species may occur is limited. A listing of rare plant species and their associated habitat type(s) is provided in Table 4.1. A list of vascular plant species observed in the Rare Plant Project Area and general vicinity (regionally) is provided in Appendix B.

Table 4.1 List of Rare Plant Species Present within the Project Area or Vicinity

Scientific Name	Common Name	SRank	Habitat / Plant Community Types	Number of Observations	Potential to Occur in Vicinity of the Proposed Project
Najas flexilis ex Willd	nodding water nymph	S2	Known to inhabit wetlands (fens, bogs, shallow ponds), quiet waters of lakes and streams (Porsild and Cody 1980). Observed in shallow wetland pool during on-site surveys.	1	High
Carex deweyana Schwein.	short-scale sedge	S2	Prefers dry to moist forests, woodlands and thickets of dense, structurally diverse riparian habitat (Porsild and Cody 1980).	2	Moderate
Agrostis perennans (Walter) Tuck.	upland bentgrass	S2	Alder and riparian thicket habitats occurring along the banks of lakes, rivers, and streams; moist woodlands (Hinds 2000). Observed along the floodplain of the Victoria River during on-site surveys.	2	High

Due to the frequent observation of some rare species, in particular those *S3* ranked species, UTMs were not always taken for each occurrence encountered. Priority was given to collecting UTM coordinates for sparse populations, specimens that occurred in small inclusion communities or unusual habitat areas, and where their occurrence deviated from the norm.

4.2.4 Rare Vascular Plant Descriptions and their Distribution

The following section details the information collected for each rare plant observed during the 2015 Rare Plant Survey, providing: a brief description of the species; their distribution in the Project Area and elsewhere; observed habitat affinities; an outline of their global, national and provincial (sub-national) status ranks; as well as other relevant information gathered from Project surveys. The locations of the rare plants encountered during field surveys are illustrated on Figure 4-2.

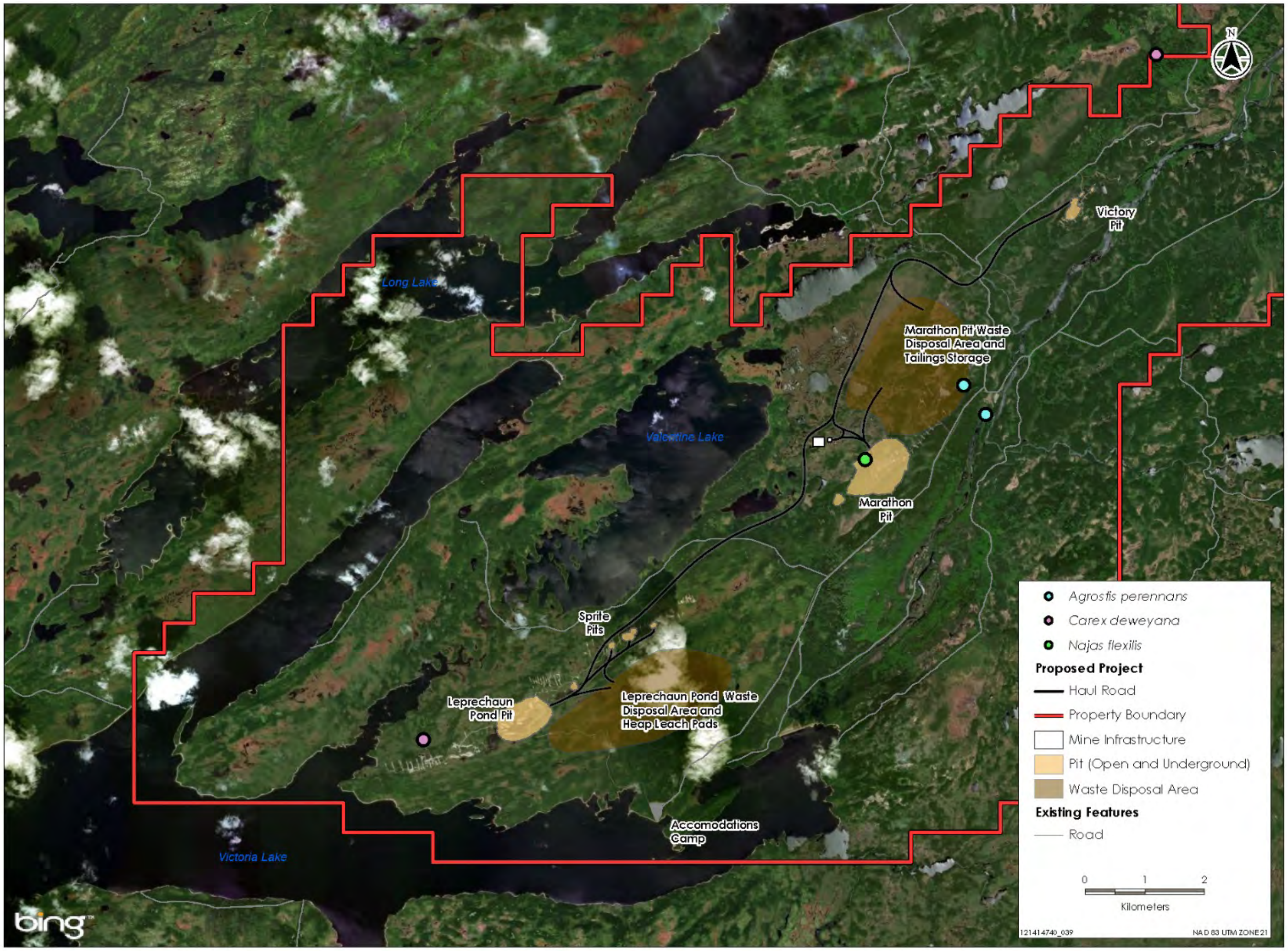

Figure 4-2 Species of Conservation Concern in the Project Area

4.2.4.1 Hydrocharitaceae: *Najas flexilis* (Willdenow) Rostkovius & W.L.E. Schmidt (nodding water nymph) – *S2*

Photo 1 ***Najas flexilis* (nodding water nymph) in habitat**

Nodding water nymph is a slender, delicately branched aquatic annual herb (submerged rooted macrophyte) from a fibrous root system; stems much branched, 30-150 cm long, about 1 mm thick and easily broken (Photo 1). Glossy, green, and finely toothed leaves are oppositely arranged, but appear to be whorled near ends of the stems. Leaves are long and narrow with broad bases that clasp the stem. These plants possess tiny (2-3 mm), inconspicuous flowers and fruits that form clusters that are almost completely hidden by the leaf bases. Each fruit contains one seed that is approximately 3 mm long. Pollination takes place underwater. Water-nymphs are considered an important food source for a variety of waterfowl.

Nodding water nymph is an Amphi-Atlantic plant native to parts of North America (temperate disjunct population) and Europe. It is considered native throughout much of Canada and the northern United States, with disjunct populations extending to the southern United States. In Newfoundland and Labrador, its range includes northwestern, southwestern and central Newfoundland (Meades et al. 2015). AC CDC data obtained for this Project do not indicate this species as previously having been reported from within 5 km of the Project Area (AC CDC 2015).

According to information in the literature regarding its habitat associations, nodding water nymph is an obligate wetland species growing as a submersed aquatic in shallow waters of ponds, protected lake bays, and quiet stream (Porsild and Cody 1980). It is also considered tolerant of brackish conditions, and thus may occupy coastal areas. In the Project Area, nodding water nymph was observed at one location (Figure 4-2), where it occupied a small wetland pool, in association with other floating and submergent vegetation, including bog buckbean (*Menyanthes trifoliata*), yellow pondlily (*Nuphar variegata*), bladderworts (*Utricularia vulgaris, U. cornuta, U. intermedia*), and pondweeds (*Potamogeton* spp.). Nodding water-nymph is ranked as *S2* (AC CDC 2015a). It is ranked as *G5* and *N5* (NatureServe 2014), indicating a taxon that is widespread, abundant, and secure globally and nationally, though it may be quite rare in parts of its range.

4.2.4.2 Cyperaceae: *Carex deweyana* Schwein. (short-scale sedge or Dewey's sedge) – *S2*

Photo 2 ***Carex deweyana*** **(short-scale sedge) stock photo**

Short-scale sedge is a perennial (Cyperaceae family) grass-like sedge with small seed heads, growing in a densely tufted or loosely clumped manner from a short, upright rootstalk (Photo 2). Fertile culms (flowering stems) to 20 to 120 cm tall. Leaves are very soft and flat and generally not more than 5 mm wide. The pistillate scales are very pale and translucent (except for the green along the midvein) giving a characteristic silvery appearance to the inflorescence. Female flowers sit atop the terminal spike. Hultén (1968) emphasized dry to moist coniferous forests were its typical habitats. It is also found in forest openings, moist woodlands, stream bank thickets, and clearings (Porsild and Cody 1980). It is usually found in at least partial shade.

In North America, this boreal species has been reported from all Canadian provinces and territories (except Nova Scotia and Prince Edward Island), and five mid-west and northwestern states. In Newfoundland and Labrador, its range includes western, southwestern, northwestern and eastern Newfoundland, north to near L'Anse au Loup, Labrador (C. Hanel 2005). AC CDC data obtained for this Project do not indicate this species as previously reported from within 5 km of the Project Area (AC CDC 2015). However, as indicated, this boreal species is generally observed from forested settings (Gleason and Cronquist 1991) and historical records indicate that it is known to occur in Central Newfoundland (Flora of North America Association 2008). Short-scale sedge was initially observed in 2015 while in delivery of the ELC program for the Project. It was noted from two locations (Figure 4-2), both within areas of alder thicket, where it was present in trace amounts. No additional populations were observed or located during the 2017 survey suggesting that plants may be abundant, though restricted to a very small range.

Short-scale sedge is ranked as *S2* (AC CDC 2015a). Although this designation may indicate that it is considered rare within the province, its population at the national and global level is secure, being identified as *N5* and *G5T5*, respectively (NatureServe 2014), indicating a taxon that is widespread, abundant, and secure globally and nationally, though it may be quite rare in parts of its range. It is considered common throughout many of the Maritime provinces and beyond.

4.2.4.3 Poaceae: *Agrostis perennans* (Walter) Tuck. (perennial bentgrass) – *S2*

Photo 3 ***Agrostis perennans*** **(perennial bentgrass) in habitat**

Perennial bentgrass is a caespitose, 50 to 100 cm tall perennial grass (Poaceae family) that develops either individually or in loose tufts of unbranched leafy culms and without rhizomes or stolons (Photo 3). They may appear in both sunny and shaded habitats.

The leaf sheaths are medium green or grayish green, ribbed smooth; glabrous on surface. The ligules at the junctions of leaf blades and sheaths are white and short-membranous. The longer blades of lower leaves have a tendency to droop, while the shorter blades of upper leaves are more stiff and straight. The leaf blades are 6–13 cm long; 1.5–3 mm wide with ribbed; scaberulous surface. The nodes along each culm are green and swollen. Reaching 50 to 100 cm in height, the culms (flowering stems) are typically light green, terete, slender, and glabrous. The culm of each fertile shoot terminates in a 11–15 cm long; 6–11 cm wide panicle inflorescence. The blooming period usually occurs during the late summer or early fall. Cross-pollination of the florets is by wind.

The species is widespread across eastern Canada, eastern, western and central USA and Mexico, extending north to the island of Newfoundland, where its range includes the western and central parts of the province (Meades et al. 2015). Perennial bentgrass is ranked *S2* (ACCDC 2015a). At the global and national level, it is considered common, widespread and abundant and has been assigned statuses of *G5* and *N5*, respectively. Records for this species are available throughout western, northern and eastern Newfoundland, but are relatively absent from more central parts of the Island’s interior (Flora of North America Association 2008). On the Island, it is known from a variety of habitats including anthropogenic (man-made or disturbed habitats), forests, shores of rivers or lakes. AC CDC data obtained for this project do not indicate this species as having previously been reported from within 5 km of the Project Area (AC CDC 2015b). During surveys of the Project Area in 2015 (ELC program), perennial bentgrass was observed from two locations and within alder thicket habitat, one of which was adjacent the Victoria River (Figure 4-2). No additional populations were observed or located during the 2017 RPS.

5.0 SUMMARY

This report provides the results of botanical surveys carried out on Marathon Gold's Valentine Lake Gold Property situated in Central Newfoundland and comprised of the Leprechaun, Marathon Gold, Sprite and Victory Deposits.

Botanical surveys (e.g., rare plant surveys) as performed during the summer of 2017, were intended to document the location, population size, and habitat for rare vascular plant taxa occurring within the Valentine Lake Project Area, as well as providing an inclusive listing of vascular plant species encountered throughout the RPS program.

The RPS was carried out by Stantec botanists over a 5-day period (July 17 to 21, 2017), believed the optimum sampling period (most species in bloom) from which to conduct botanical surveys of this type. Based on consultation with the provincial regulating agency and knowledge of the survey team, early season surveys to capture ephemeral blooming species (e.g., fairy slipper (*Calypso bulbosa*)) were not conducted. Rather, a mid-season survey was carried out to capture mid- to late-season blooming species. Many species have a long blooming period that extends from the spring through the fall, encompassing both the typical early and late season survey periods and would have been detectable, if present, during the mid-season survey. Time spent in a given habitat was depended on potential for rare plant species to occur, based on consultation with DFLR – Wildlife Division (C. Hanel, Provincial Botanist. pers. comm., May 2017), as well as element occurrence information obtained from the AC CDC (2017).

The DFLR – Wildlife Division, together with the AC CDC, are responsible for assigning rarity rankings (S-Ranks) for known vascular species in the province. A query of the AC CDC Conservation Status ranks indicated that just three of the 293 vascular plant species identified during the field surveys (combined 2017 RPS and 2015 ELC) could be considered rare (S-Rank of *S1*, *S2*, or combinations thereof (e.g., *S1S2*)). The abundance of some of those potentially rare species, a literature review of other plant surveys, and consultation with DFLR representatives, as well as authorities in this field in Newfoundland and Labrador, suggests that the current S-Ranks may be conservative. That is, some species thought to be rare may in fact not be rare; the scarcity ranking may be the result of the lack of information on the distribution of plant species in the region, and/or is currently under review by the DFLR – Wildlife Division and the AC CDC. Through delivery of these surveys it was confirmed that the Project Area:

- does not support COSEWIC or *SARA*-listed species
- does not support species listed under the NL ESA
- supports populations of provincially rare vascular plant taxa

The majority of the Project Area is not considered to have high potential for rare species due to habitat type, tree species composition, stand age and/or microclimatic conditions. Coniferous trees strongly dominate forest cover throughout the Central Newfoundland Forest ecoregion, with much of that habitat consisting of combination of regenerating clear cuts and homogenous forest stands of various ages and structural composition. While the importance of coniferous forests to the Central Newfoundland Forest ecoregion cannot be overstated at the landscape level, previous experience and professional knowledge of this type of habitat indicate that it does not generally support habitat for rare plants within the Project Area.

A list of plant species encountered during the site visit is provided in Table B1, Appendix B. No additional vascular plant SAR or SOCC were historically reported to occur within 5 km of the Project Area by the AC CDC (2017). Although none of the plant species observed during 2017 field surveys are listed under the federal *SARA or NL ESA*, the Project Area does support three provincially rare vascular plant species that may be of conservation concern to the Province, and may potentially require species-specific mitigation. They include: nodding water nymph (*S2* AC CDC), short-scaled sedge (*S2* AC CDC) and perennial bentgrass (*S2* AC CDC). If development should encroach on one of these plant populations, efforts should be made to evaluate potential mitigation options available. Marathon Gold will contact and consult with DFLR – Wildlife Division for approval of mitigation strategy prior to disturbing rare vascular plant taxa.

Many of the rare vascular plant taxa, including some SOCC, occurring within the Project Area have known occurrences outside the Project Area, and are considered widespread. Knowledge about these occurrences is limited, as many are based on historic reports that have not been verified. Additionally, surveys are considered lacking in some areas of the Province, including remote central Newfoundland, and would need to be expanded to estimate the provincial importance more accurately (S-Rank).

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APPENDIX A

Explanation of Global, National and Provincial Species at Risk and General Status Ranking

Committee on the Status of Endangered Wildlife in Canada and *Species at Risk Act* Wildlife Species Status Categories

COSEWIC and *SARA* wildlife species status categories are described in Table A.1.

Table A.1 Committee on the Status of Endangered Wildlife in Canada and Species at Risk *Act* Species Status Category Descriptions

Rank*	Description*
Extinct (X)	A wildlife species that no longer exists
Extirpated (XT)	A wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild
Endangered (E)	A wildlife species that is facing imminent extirpation or extinction in Canada
Threatened (T)	A wildlife species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction
Special Concern (SC)	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats
Data Deficient (DD)	A category that applies when the available information is insufficient (a) to resolve a wildlife species' eligibility for assessment or (b) to permit an assessment of the wildlife species' risk of extinction
Not At Risk (NAR)	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances
*COSEWIC 2015. Excerpt from web site - http://www.speciesatrisk.gc.ca/legislation/default_e.cfm	

Wildlife Species – "a species, subspecies, variety or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years" (COSEWIC 2015).

NatureServe Conservation Status Ranks

The NatureServe Conservation Status Rank is used to rank rare plant species across North America. Rare species are those species that occur in only a few localities and/or are represented by relatively few individuals. The system is consistent with all conservation data centres across North America to facilitate tracking of rare plant occurrences and, where known, threat on global, national (federal), and subnational (provincial) levels. Conservation status ranks range from critically imperiled (G1) to demonstrably secure (G5). Status is assessed and documented at three distinct geographic scales: global (G); national (N); and subnational (S) (i.e., state / province / municipal) (Table A.2.). These status assessments are based on the best available information and consider a variety of factors, such as species abundance, distribution, population trends, and threats (NatureServe 2015).

Table A.2 NatureServe National and Subnational Conservation Status Ranks

Status	Rank	Definition
GX NX	Presumed Extinct / Eliminated	Species not located despite intensive searches and virtually no likelihood of rediscovery. Ecological community or system eliminated throughout its range, with no restoration potential
GH NH	Possibly Extinct / Eliminated	Known from only historical occurrences but still some hope of rediscovery. There is evidence that the species may be extinct or the ecosystem may be eliminated throughout its range, but not enough to state this with certainty
G1 N1	Critically Imperilled	At very high risk of extinction due to extreme rarity (often five or fewer populations), very steep declines, or other factors
G2 N2	Imperilled	At high risk of extinction or elimination due to very restricted range, very few populations, steep declines, or other factors
G3 N3	Vulnerable	At moderate risk of extinction or elimination due to a restricted range, relatively few populations, recent and widespread declines, or other factors
G4 N4	Apparently Secure	Uncommon but not rare; some cause for long-term concern due to declines or other factors
N5 S5	Secure	Common; widespread and abundant
G#/G# N#/N#	Range Rank	A numeric range rank (e.g., S2/S3 or S1/S3) is used to indicate any range of uncertainty about the status of the species or ecosystem. Ranges cannot skip more than two ranks (e.g., SU is used rather than S1/S4)
G#? N#?	Inexact Numeric Rank	Denotes inexact numeric rank

Atlantic Canada Conservation Data Centre Rankings

The AC CDC status ranks for Newfoundland were used to assess the rankings for vascular plant species. Definitions of the AC CDC rankings are provided in Table A.3.

Table A.3 Definitions of the Atlantic Canada Conservation Data Centre S-Rankings

Provincial Ranking	Frequency / Comments
S1	**Critically Imperiled** - Critically imperiled in the province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
S2	**Imperiled** - Imperiled in the province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
S3	**Vulnerable** - Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation
S4	**Apparently Secure** - Uncommon but not rare; some cause for long-term concern due to declines or other factors
S5	**Secure** - Common, widespread, and abundant in the province.
S#/S#	**Range Rank** - A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4)
SU	**Unrankable** - Possibly in peril, but status is uncertain - more information is needed
SNR	**Unranked** - Nation or state/province conservation status not yet assessed.
SNA	**Not Applicable** - A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
Hybrid	Hybrid of two similar species
?	Inexact or uncertain: for numeric ranks, denotes inexactness (e.g., SE? denotes uncertainty of exotic status). (The? Qualifies the character immediately preceding it in the S Rank)
Source: AC CDC 2015	

APPENDIX B

Scientific and Common Names of Observed Plant Species in the Project Area

Table B.1 Vascular Plant Species Observed within the Valentine Lake Project Area

Family	Scientific Name	Common Name	Conservation Status Rank	Survey (2017 RPS / 2015 ELC)	
TREES					
Aceraceae	*Acer rubrum*	Red Maple	S5	RPS	ELC
Betulaceae	*Betula papyrifera*	Paper Birch	S5	RPS	ELC
Pinaceae	*Abies balsamea*	Balsam Fir	S5	RPS	ELC
Pinaceae	*Larix laricina*	Tamarack	S5	RPS	ELC
Pinaceae	*Picea glauca*	White Spruce	S5	RPS	ELC
Pinaceae	*Picea mariana*	Black Spruce	S5	RPS	ELC
SHRUBS					
Aquifoliaceae	*Ilex mucronata*	Mountain Holly	S5	RPS	ELC
Adoxaceae	*Viburnum nudum*	Northern Wild Raisin	S5	RPS	ELC
Adoxaceae	*Viburnum trilobum*	Highbush Cranberry	S5	RPS	ELC
Adoxaceae	*Sambucus racemosa*	Red Elderberry	S4	RPS	ELC
Adoxaceae	*Sambucus sp.*	Elderberry		RPS	
Betulaceae	*Alnus incana*	Speckled Alder	S5	RPS	ELC
Betulaceae	*Alnus alnobetula subsp. crispa*	Mountain Alder	S5	RPS	ELC
Betulaceae	*Betula cordifolia*	Heartleaf Birch	S4S5	RPS	
Betulaceae	*Betula michauxii*	Michaux's Dwarf Birch	S5	RPS	ELC
Betulaceae	*Betula papyrifera*	Paper Birch	S5	RPS	ELC
Betulaceae	*Betula pumila*	Bog Birch	S5	RPS	ELC
Caprifoliaceae	*Linnaea borealis*	Twinflower	S5	RPS	ELC
Caprifoliaceae	*Lonicera villosa*	Mountain Fly-Honeysuckle	S5	RPS	ELC
Cornaceae	*Cornus sericea*	Silky Dogwood	S5	RPS	ELC
Cupressaceae	*Juniperus communis var. depressa*	Ground Juniper	S4S5	RPS	ELC
Cupressaceae	*Juniperus horizontalis*	Creeping Juniper	S5	RPS	ELC
Empetraceae	*Empetrum atropurpureu*	Purple Crowberry	S3S4	RPS	
Empetraceae	*Empetrum eamesii*	Rock Crowberry	S4		ELC
Empetraceae	*Empetrum nigrum*	Black Crowberry	S5	RPS	ELC
Ericaceae	*Andromeda polifolia*	Glaucous-leaf Bog Rosemary	S5	RPS	ELC
Ericaceae	*Chamaedaphne calyculata*	Leatherleaf	S5	RPS	ELC
Ericaceae	*Epigaea repens*	Trailing Arbutus	S3S4	RPS	ELC
Ericaceae	*Gaultheria hispidula*	Creeping Snowberry	S5	RPS	ELC
Ericaceae	*Kalmia angustifolia*	Sheep-Laurel	S5	RPS	ELC
Ericaceae	*Kalmia polifolia*	Bog Laurel	S5	RPS	ELC
Ericaceae	*Moneses uniflor*	Oneflower Wintergreen	S5	RPS	

Family	Scientific Name	Common Name	Conservation Status Rank	Survey (2017 RPS / 2015 ELC)	
Ericaceae	*Pyrola chlorantha*	Greenflowered Wintergreen	S3S4	RPS	
Ericaceae	*Pyrola minor*	Greenflowered Wintergreen	S4	RPS	
Ericaceae	*Rhododendron groenlandicum*	Labrador Tea	S5	RPS	ELC
Ericaceae	*Rhododendron canadense*	Rhodora	S5	RPS	ELC
Ericaceae	*Vaccinium angustifolium*	Late Lowbush Blueberry	S5	RPS	ELC
Ericaceae	*Vaccinium boreale*	Northern Blueberry	S4S5	RPS	ELC
Ericaceae	*Vaccinium macrocarpon*	Large Cranberry	S5	RPS	ELC
Ericaceae	*Vaccinium oxycoccos*	Small Cranberry	S5		ELC
Ericaceae	*Vaccinium uliginosum*	Bog Bilberry	S5	RPS	ELC
Ericaceae	*Vaccinium vitis-idaea*	Partridgeberry	S5	RPS	ELC
Grossulariaceae	*Ribes glandulosum*	Skunk Currant	S5	RPS	ELC
Grossulariaceae	*Ribes hirtellum*	Smooth Gooseberry	S3S4	RPS	
Grossulariaceae	*Ribes lacustre*	Bristly Black Currant	S4	RPS	ELC
Rhamnaceae	*Rhamnus alnifolia*	Alderleaf Buckthorn	S5	RPS	ELC
Rosaceae	*Amelanchier bartramiana*	Bartram's Chuckleypear	S5	RPS	ELC
Rosaceae	*Dasiphora fruticosa*	Shrubby Cinquefoil	S4S5	RPS	ELC
Rosaceae	*Photinia sp.*	Chokeberry			
Rosaceae	*Prunus pensylvanica*	Fire Cherry	S4S5	RPS	ELC
Rosaceae	*Rosa nitida*	Shining Rose	S4S5	RPS	ELC
Rosaceae	*Rubus idaeus*	Red Raspberry	S5	RPS	ELC
Rosaceae	*Sorbus americana*	American Mountain-Ash	S4S5	RPS	ELC
Rosaceae	*Sorbus decora*	Showy Mountain-Ash	S5	RPS	ELC
Rosaceae	*Spiraea alba*	Narrow-Leaved Meadow-Sweet	S3S5		ELC
Rosaceae	*Spiraea latifolia*	Broadleaf Meadow-Sweet	S3S5		ELC
Sapindaceae	*Acer spicatum*	Mountain Maple	S5	RPS	ELC
Taxaceae	*Taxus canadensis*	Canada Yew	S3S4	RPS	ELC
FORBS					
Apiaceae	*Conioselinum chinense*	Hemlock Parsley	S5	RPS	ELC
Apiaceae	*Heracleum maximum*	Cow Parsnip	S5	RPS	ELC
Araliaceae	*Aralia hispida*	Bristly Sarsaparilla	S4S5		ELC
Araliaceae	*Aralia nudicaulis*	Wild Sarsaparilla	S5	RPS	ELC
Asteraceae	*Achillea millefolium*	Common Yarrow	SNA	RPS	
Asteraceae	*Anaphalis margaritacea*	Pearly Everlasting	S5	RPS	ELC
Asteraceae	*Aster sp.*	unknown aster		RPS	ELC

Family	Scientific Name	Common Name	Conservation Status Rank	Survey (2017 RPS / 2015 ELC)	
Asteraceae	*Cirsium muticum*	Swamp Thistle	S5	RPS	ELC
Asteraceae	*Doellingeria umbellata*	Parasol White-Top	S5		ELC
Asteraceae	*Eurybia radula*	Rough-Leaved Aster	S5	RPS	ELC
Asteraceae	*Euthamia graminifolia*	Flat-Top Fragrant-Golden-Rod	S5	RPS	ELC
Asteraceae	*Eutrochium maculatum*	Spotted Joe-Pye Weed	S4S5	RPS	ELC
Asteraceae	*Leucanthemum vulgare*	Oxeye Daisy	SNA	RPS	
Asteraceae	*Matricaria discoidea*	Pineappleweed	SNA	RPS	
Asteraceae	*Oclemena nemoralis*	Bog Aster	S5	RPS	ELC
Asteraceae	*Packera aurea*	Golden Ragwort	S3S4	RPS	ELC
Asteraceae	*Packera paupercula*	Balsam Groundsel	S4	RPS	ELC
Asteraceae	*Petasites frigidus* var. *palmatus*	Palmate Sweet Coltsfoot	S3S4	RPS	
Asteraceae	*Prenanthes trifoliolata*	Three-Leaved Rattlesnake-root	S5		ELC
Asteraceae	*Solidago macrophylla*	Large-Leaf Goldenrod	S5	RPS	
Asteraceae	*Solidago rugosa*	Rough-Leaf Goldenrod	S5		ELC
Asteraceae	*Solidago uliginosa*	Bog Goldenrod	S5		ELC
Asteraceae	*Symphyotrichum novi-belgii*	New York Aster	S5	RPS	
Asteraceae	*Symphyotrichum puniceum*	Purplestem Aster	S5	RPS	ELC
Asteraceae	*Taraxacum officinale*	Common Dandelion	SNA	RPS	ELC
Asteraceae	*Tussilago farfara*	Coltsoot	SNA	RPS	
Boraginaceae	*Myosotis laxa*	Small Forget-Me-Not	S4	RPS	ELC
Callitrichaceae	*Callitriche palustris*	Vernal Water-starwort	S4S5	RPS	
Campanulaceae	*Lobelia dortmanna*	Water Lobelia	S5	RPS	
Caryophyllaceae	*Cerastium arvense*	Field Chickweed	S4S5	RPS	
Caryophyllaceae	*Cerastium fontanum*	Chickweed	SNA	RPS	
Caryophyllaceae	*Sagina procumbens*	Procumbent Pearlwort	SNA	RPS	
Caryophyllaceae	*Spergularia canadensis*	Northern Sandspurry	S5	RPS	
Caryophyllaceae	*Spergularia rubra*	Red Sandspurry	SNA	RPS	
Caryophyllaceae	*Stellaria graminea*	Lesser Stitchwort	SNA	RPS	
Chenopodiaceae	*Chenopodium album*	Lamb's Quarters	SNA	RPS	
Clusiaceae	*Triadenum fraseri*	Marsh St. John's-Wort	S5	RPS	ELC
Cornaceae	*Cornus canadensis*	Bunchberry	S5	RPS	ELC
Cornaceae	*Cornus stolonifera*	Red Osier Dogwood	S5	RPS	ELC
Cornaceae	*Cornus suecica*	Swedish Bunchberry	S5	RPS	ELC
Dennstaedtiaceae	*Pteridium aquilinum* var. *latiusculum*	Bracken Fern	S4S5	RPS	ELC
Droseraceae	*Drosera intermedia*	Spoon-Leaved Sundew	S5	RPS	ELC
Droseraceae	*Drosera rotundifolia*	Roundleaf Sundew	S5	RPS	ELC
Dryopteridaceae	*Athyrium filix-femina*	Lady Fern	S5	RPS	ELC

Family	Scientific Name	Common Name	Conservation Status Rank	Survey (2017 RPS / 2015 ELC)	
Dryopteridaceae	*Dryopteris carthusiana*	Spinulose Wood-Fern	S4	RPS	
Dryopteridaceae	*Dryopteris campyloptera*	Mountain Wood-Fern	S5		ELC
Dryopteridaceae	*Dryopteris intermedia*	Evergreen woodfern	S5	RPS	ELC
Dryopteridaceae	*Gymnocarpium dryopteris*	Northern Oak Fern	S5	RPS	ELC
Dryopteridaceae	*Matteucia struthiopteris*	Ostrich Fern	S3S4		ELC
Dryopteridaceae	*Onoclea sensibilis*	Sensitive Fern	S4S5	RPS	ELC
Equisetaceae	*Equisetum arvense*	Field Horsetail	S5	RPS	ELC
Equisetaceae	*Equisetum fluviatile*	Water Horsetail	S4	RPS	ELC
Equisetaceae	*Equisetum palustre*	Marsh Horsetail	S3S4	RPS	
Equisetaceae	*Equisetum sylvaticum*	Woodland Horsetail	S5	RPS	ELC
Eriocaulaceae	*Eriocaulon aquaticum*	Seven-Angled Pipewort	S5	RPS	ELC
Fabaceae	*Melilotus officinalis*	Yellow Sweetclover	SNA	RPS	
Fabaceae	*Trifolium aureum*	Hop Clover	SNA	RPS	ELC
Fabaceae	*Trifolium campestre*	Low Hop Clover	SNA	RPS	
Fabaceae	*Trifolium pratense*	Red Clover	SNA	RPS	
Fabaceae	*Trifolium repens*	White Clover	SNA	RPS	
Hydrocharitaceae	*Najas flexilis*	Nodding Water Nymph	S2	RPS	
Hypericaceae	*Hypericum canadense*	Canada St. Johnswort	S4	RPS	
Iridaceae	*Iris versicolor*	Blueflag	S5	RPS	ELC
Iridaceae	*Sisyrinchium montanum* var. *crebrum*	Darker Mountain blue-eyed Grass	S5	RPS	
Isoetaceae	*Isoetes lacustris*	Lake Quillwort	S3S4	RPS	
Juncaginaceae	*Triglochin palustris*	Marsh Arrowgrass	S4S5	RPS	
Lamiaceae	*Galeopsis tetrahit*	Brittle-Stem Hempnettle	SNA	RPS	ELC
Lamiaceae	*Lycopus uniflorus*	Northern Bugleweed	S5	RPS	ELC
Lamiaceae	*Mentha arvensis*	Corn Mint	S5		ELC
Lamiaceae	*Prunella vulgaris*	Self-Heal	S3S5	RPS	ELC
Lentibulariaceae	*Utricularia cornuta*	Horned Bladderwort	S5	RPS	ELC
Lentibulariaceae	*Utricularia intermedia*	Flatleaf Bladderwort	S5	RPS	ELC
Lentibulariaceae	*Utricularia vulgaris*	Common Bladderwort	S5	RPS	ELC
Liliaceae	*Clintonia borealis*	Yellow clintonia	S5	RPS	ELC
Liliaceae	*Maianthemum trifolium*	Three-Leaf Solomon's-Plume	S5	RPS	ELC
Liliaceae	*Streptopus amplexifolius*	Claspingleaf Twistedstalk	S5	RPS	
Liliaceae	*Streptopus lanceolatus*	Rose Mandarine	S4	RPS	
Liliaceae	*Tofieldia pusilla*	Scotch False-Asphodel	S4	RPS	ELC
Lycopodiaceae	*Diphasiastrum tristachyum*	Blue Groundcedar	S5	RPS	
Lycopodiaceae	*Lycopodiella inundata*	Bog Clubmoss	S5	RPS	ELC
Lycopodiaceae	*Lycopodium annotinum*	Stiff Clubmoss	S5	RPS	ELC

Family	Scientific Name	Common Name	Conservation Status Rank	Survey (2017 RPS / 2015 ELC)	
Lycopodiaceae	*Lycopodium dendroideum*	Treelike Clubmoss	S4	RPS	ELC
Menyanthaceae	*Menyanthes trifoliata*	Bog Buckbean	S5	RPS	ELC
Monotropaceae	*Monotropa uniflora*	Indian-Pipe	S5	RPS	ELC
Myricaceae	*Myrica gale*	Sweet Gale	S5	RPS	ELC
Nymphaeaceae	*Nuphar variegata*	Yellow Pondlily	S5	RPS	ELC
Orobanchaceae	*Euphrasia nemorosa*	Common Eyebright	S4S5	RPS	
Orobanchaceae	*Rhinanthus minor* subsp. *groenlandicus*	Arctic Yellow Rattle	S3	RPS	
Orobanchaceae	*Rhinanthus minor* subsp. *minor*	Common Yellow Rattle	SNA	RPS	
Onagraceae	*Chamerion angustifolium*	Fireweed	S5		ELC
Onagraceae	*Circaea alpina*	Small Enchanter's Nightshade	S5	RPS	ELC
Onagraceae	*Epilobium ciliatum*	Hairy Willow-Herb	S5	RPS	ELC
Onagraceae	*Epilobium palustre*	Marsh Willow-Herb	S5	RPS	ELC
Orchidaceae	*Arethusa bulbosa*	Dragon's MoutH	S4S5	RPS	
Orchidaceae	*Calopogon tuberosus*	Tuberous Grasspink	S4S5	RPS	
Orchidaceae	*Corallorhiza trifida*	Early Coralroot	S4	RPS	
Orchidaceae	*Malaxis unifolia*	Green Adder's-Mouth	S3	RPS	ELC
Orchidaceae	*Platanthera aquilonis*	northern green orchid	S4	RPS	
Orchidaceae	*Platanthera clavellata*	Club-Spur Orchid	S5	RPS	ELC
Orchidaceae	*Platanthera dilatata*	Leafy White Orchis	S5	RPS	ELC
Orchidaceae	*Platanthera lacera*	Ragged Fringed Orchid	S3S4	RPS	ELC
Orchidaceae	*Platanthera obtusata*	Bluntleaf Bog Orchid	S4	RPS	ELC
Orchidaceae	*Pogonia ophioglossoides*	Snakemouth	S4	RPS	ELC
Orchidaceae	*Spiranthes romanzoffiana*	Hooded Ladies'-Tresses	S4S5	RPS	ELC
Osmundaceae	*Osmunda cinnamomea*	Cinnamon Fern	S5	RPS	ELC
Osmundaceae	*Osmunda claytoniana*	Interrupted Fern	S5	RPS	ELC
Osmundaceae	*Osmunda regalis*	Royal Fern	S4		ELC
Plantaginaceae	*Chelone glabra*	White Turtlehead	S4	RPS	
Plantaginaceae	*Plantago major*	Common Plantain	SNA	RPS	
Polygonaceae	*Polygonum hydropiper*	Marsh pepper Smartweed	SNA		ELC
Polygonaceae	*Rumex acetosa*	Garden Sorrel	SNA		
Polygonaceae	*Rumex acetosella*	Sheep Sorrel	SNA		
Potamogetonaceae	*Potamogeton alpinus*	Alpine Pondweed	S3S4	RPS	ELC
Potamogetonaceae	*Potamogeton natans*	Floatingleaf Pondweed	S4	RPS	
Potamogetonaceae	*Potamogeton oakesianus*	Oake's Pondweed	S4	RPS	

Family	Scientific Name	Common Name	Conservation Status Rank	Survey (2017 RPS / 2015 ELC)	
Primulaceae	*Primula mistassinica*	Mistassini primrose	S4	RPS	
Primulaceae	*Trientalis borealis*	Northern Starflower	S5	RPS	ELC
Pyrolaceae	*Orthilia secunda*	One-Side Wintergreen	S5	RPS	ELC
Ranunculaceae	*Actaea rubra*	Red Baneberry	S5	RPS	
Ranunculaceae	*Coptis trifolia*	Goldthread	S5	RPS	ELC
Ranunculaceae	*Ranunculus acris*	Tall Butter-Cup	SNA	RPS	ELC
Ranunculaceae	*Ranunculus flammula*	Lesser Spearwort	S5	RPS	
Ranunculaceae	*Ranunculus flammula var. reptans*	Creeping Spearwort	S5	RPS	
Ranunculaceae	*Ranunculus repens*	Creeping Butter-Cup	SNA		ELC
Ranunculaceae	*Thalictrum alpinum*	Alpine Meadow-Rue	S4S5	RPS	ELC
Ranunculaceae	*Thalictrum pubescens*	Tall Meadow-Rue	S5	RPS	ELC
Rosaceae	*Fragaria virginiana*	Virginia Strawberry	S5	RPS	ELC
Rosaceae	*Geum macrophyllum*	Large-Leaved Avens	S4S5		ELC
Rosaceae	*Geum rivale*	Purple Avens	S4S5	RPS	
Rosaceae	*Potentilla norvegica*	Rough Cinquefoil	S4S5	RPS	
Rosaceae	*Rubus arcticus*	Northern Blackberry	S3		ELC
Rosaceae	*Rubus arcticus subsp. acaulis*	Arctic Bramble	S3	RPS	ELC
Rosaceae	*Rubus chamaemorus*	Cloudberry	S5	RPS	ELC
Rosaceae	*Rubus pubescens*	Dewberry	S5	RPS	ELC
Rosaceae	*Sanguisorba canadensis*	Bottlebrush	S3S5	RPS	ELC
Rubiaceae	*Galium mollugo*	False Baby's Breath	SNA	RPS	
Rubiaceae	*Galium palustre*	Marsh Bedstraw	S4S5	RPS	
Rubiaceae	*Galium triflorum*	Fragrant Bedstraw	S5		
Santalaceae	*Geocaulon lividum*	Northern Comandra	S5	RPS	
Sarraceniaceae	*Sarracenia purpurea*	Northern Pitcher-Plant	S5	RPS	ELC
Saxifragaceae	*Mitella nuda*	Naked Bishop's-Cap	S5	RPS	ELC
Scrophulariaceae	*Chelone glabra*	White Turtlehead	S4		ELC
Scrophulariaceae	*Veronica americana*	American Speedwell	S4	RPS	ELC
Scrophulariaceae	*Veronica officinalis*	Common Speedwell	SNA	RPS	
Scrophulariaceae	*Veronica serpyllifolia*	Speedwell	S3S4	RPS	
Selaginellaceae	*Selaginella selaginoides*	Low Spike-Moss	S4S5	RPS	ELC
Thelypteridaceae	*Phegopteris connectilis*	Northern Beech Fern	S5	RPS	ELC
Tofieldiaceae	*Tofieldia pusilla*	Small Tofieldia	S4	RPS	ELC
Tofieldiaceae	*Triantha glutinosa*	Sticky Tofieldia	S5	RPS	ELC
Typhaceae	*Sparganium americanum*	American Burreed	S3	RPS	ELC
Typhaceae	*Sparganium americanum*	Small Burreed	S3S4	RPS	
Typhaceae	*Typha latifolia*	Broad-leaved cat-tail	SNA	RPS	

Family	Scientific Name	Common Name	Conservation Status Rank	Survey (2017 RPS / 2015 ELC)	
Violaceae	*Vicia cracca*	Cow Vetch	SNA	RPS	
Violaceae	*Viola macloskeyi*	Northern White Violet	S5	RPS	
Xyridaceae	*Xyris montana*	Northern Yelloweyed Grass	S3	RPS	
GRAMINOIDS					
Cyperaceae	*Carex atlantica*	Atlantic Sedge			ELC
Cyperaceae	*Carex brunnescens*	Brownish Sedge	S5	RPS	ELC
Cyperaceae	*Carex buxbaumii*	Buxbaum's Sedge	S4S5	RPS	ELC
Cyperaceae	*Carex canescens*	Hoary Sedge	S5	RPS	ELC
Cyperaceae	*Carex capillaris*	Hair Sedge	S4	RPS	
Cyperaceae	*Carex castanea*	Chestnut Sedge	S3S4	RPS	
Cyperaceae	*Carex crawfordii*	Crawford's Sedge	S4S5	RPS	
Cyperaceae	*Carex debilis*	White-Edge Sedge	S3S5		ELC
Cyperaceae	*Carex deweyana*	Short-Scale Sedge	S1S2		ELC
Cyperaceae	*Carex disperma*	Softleaf Sedge	S4S5		ELC
Cyperaceae	*Carex echinata*	Little Prickly Sedge	S5	RPS	ELC
Cyperaceae	*Carex exilis*	Coast Sedge	S5	RPS	ELC
Cyperaceae	*Carex flava*	Yellow Sedge	S3S5	RPS	ELC
Cyperaceae	*Carex gynocrates*	Northern Bog Sedge	S3S4	RPS	
Cyperaceae	*Carex interior*	Inland Sedge	S3S4	RPS	ELC
Cyperaceae	*Carex intumescens*	Bladder Sedge	S4S5	RPS	ELC
Cyperaceae	*Carex lasiocarpa*	Slender Sedge	S5	RPS	ELC
Cyperaceae	*Carex leptalea*	Bristlestalk Sedge	S4S5	RPS	ELC
Cyperaceae	*Carex leptonervia*	Nerveless Woodland Sedge	S4S5	RPS	ELC
Cyperaceae	*Carex limosa*	Mud Sedge	S5	RPS	ELC
Cyperaceae	*Carex livida*	Livid Sedge	S5	RPS	
Cyperaceae	*Carex magellanica*	Boreal Bog Sedge	S5	RPS	ELC
Cyperaceae	*Carex michauxiana*	Michaux Sedge	S4S5	RPS	ELC
Cyperaceae	*Carex nigra*	Smooth Black Sedge	S5	RPS	
Cyperaceae	*Carex oligosperma*	Few-Seeded Sedge	S5	RPS	ELC
Cyperaceae	*Carex pauciflora*	Few-Flowered Sedge	S4S5	RPS	ELC
Cyperaceae	*Carex sp.*	a sedge			
Cyperaceae	*Carex rostrata*	Beaked Sedge	S3S4	RPS	
Cyperaceae	*Carex saxatilis*	Russet Sedge	S4S5	RPS	
Cyperaceae	*Carex scirpoidea*	Scirpus Sedge	S4S5	RPS	
Cyperaceae	*Carex stipata*	Stalk-Grain Sedge	S4S5	RPS	ELC
Cyperaceae	*Carex tenuiflora*	Sparse-Flowered Sedge	S3	RPS	ELC
Cyperaceae	*Carex trisperma*	Threefruit sedge	S5	RPS	ELC
Cyperaceae	*Carex utriculata*	Bottle Sedge	S4S5	RPS	ELC
Cyperaceae	*Carex vaginata*	Sheathed Sedge	S3S4	RPS	

Family	Scientific Name	Common Name	Conservation Status Rank	Survey (2017 RPS / 2015 ELC)	
Cyperaceae	*Carex vesicaria*	Little Green Sedge	S4S5	RPS	ELC
Cyperaceae	*Carex viridula*	Inflated Sedge	S4S5	RPS	
Cyperaceae	*Carex wiegandii*	Wiegand's Sedge	S3	RPS	ELC
Cyperaceae	*Eriophorum angustifolium*	No Common Name In Tracker	S4S5	RPS	ELC
Cyperaceae	*Eriophorum vaginatum*	Tussock Cotton-Grass	S5	RPS	ELC
Cyperaceae	*Eriophorum virginicum*	Tawny Cotton-Grass	S4S5	RPS	ELC
Cyperaceae	*Eriophorum viridicarinatum*	Green-Keel Cottongrass	S4S5	RPS	ELC
Cyperaceae	*Rhynchospora alba*	White Beakrush	S4S5	RPS	ELC
Cyperaceae	*Schoenoplectus subterminalis*	Water Bulrush	S3S5		ELC
Cyperaceae	*Scirpus atrocinctus*	Black-Girdle Bulrush	S3S5		ELC
Cyperaceae	*Scirpus cyperinus*	Cottongrass Bulrush	S2S3		ELC
Cyperaceae	*Scirpus microcarpus*	Red-Tinged Bulrush	S4S5	RPS	ELC
Cyperaceae	*Trichophorum alpinum*	Alpine Cotton-Grass	S4S5	RPS	ELC
Cyperaceae	*Trichophorum caespitosum*	Deergrass	S5	RPS	ELC
Gramineae	*Anthoxanthum odoratum*	Sweet Vernalgrass	SNA	RPS	ELC
Juncaceae	*Luzula multiflora*	Common Woodrush	S5	RPS	ELC
Juncaceae	*Juncus brevicaudatus*	Short-tail Rush	S5	RPS	ELC
Juncaceae	*Juncus canadensis*	Canada Rush	S4		ELC
Juncaceae	*Juncus effusus*	Soft Rush	S5	RPS	ELC
Juncaceae	*Juncus pelocarpus*	Brown-Fruited Rush	S4		ELC
Juncaceae	*Juncus stygius*	Moor Rush	S3S4	RPS	ELC
Juncaceae	*Juncus tenuis*	Slender Rush	S3S4	RPS	
Poaceae	*Agrostis capillaris*	Colonial Bentgrass	SNA	RPS	ELC
Poaceae	*Agrostis gigantea*	Black Bentgrass	SNA	RPS	ELC
Poaceae	*Agrostis perennans*	Perennial Bentgrass	S2		ELC
Poaceae	*Agrostis scabra*	Rough Bentgrass	S5	RPS	ELC
Poaceae	*Bromus ciliatus*	Fringed Brome	S5	RPS	ELC
Poaceae	*Calamagrostis canadensis*	Bluejoint Reedgrass	S5	RPS	ELC
Poaceae	*Calamagrostis pickeringii*	Pickering's Reedgrass	S5	RPS	ELC
Poaceae	*Cinna latifolia*	Wood Reedgrass	S5	RPS	ELC
Poaceae	*Danthonia spicata*	Poverty Oatgrass	S5	RPS	ELC
Poaceae	*Elymus repens*	Quackgrass	SNA	RPS	
Poaceae	*Festuca rubra subsp. rubra*	Red Fescue	SNA	RPS	ELC
Poaceae	*Festuca trachyphlla*	Hard Fescue	SNA	RPS	
Poaceae	*Glyceria canadensis*	Canada Manna-Grass	S5	RPS	ELC

Family	Scientific Name	Common Name	Conservation Status Rank	Survey (2017 RPS / 2015 ELC)	
Poaceae	*Glyceria striata*	Fowl Manna-Grass	S5	RPS	ELC
Poaceae	*Muhlenbergia glomerata*	Marsh Muhly	S3S5		ELC
Poaceae	*Muhlenbergia uniflora*	Fall Dropseed Muhly	S3S5		ELC
Poaceae	*Phalaris arundinacea*	Fowl Bluegrass	SNA	RPS	
Poaceae	*Phleum pratense*	Common Timothy	SNA	RPS	
Poaceae	*Poa compressa*	Canada Bluegrass	SNA	RPS	
Poaceae	*Poa palustris*	Fowl Bluegrass	SNA	RPS	ELC
Poaceae	*Poa saltuensis*	Forest Bluegrass	S3S4	RPS	ELC
Poaceae	*Schizachne purpurascens*	Purple False Melic	S3	RPS	ELC
Scheuchzeriaceae	*Scheuchzeria palustris*	Pod Grass	S3S4	RPS	ELC

ATTACHMENT 7-G

Newfoundland Marten (2018)

Valentine Lake Project: Newfoundland Marten Baseline Study

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Final Report

August 24, 2018

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Executive Summary

To contribute to Marathon Gold Corporation's efforts to develop baseline information in anticipation of a formal Environmental Assessment submission, during the winter of 2018 Stantec established three Newfoundland marten hair snag stations. The objective of the program was to confirm the presence of this threatened species within the Project footprint.

Newfoundland marten hair was successfully collected at two of the three hair snag stations in 2018. The results of genetic analysis of collected hair samples revealed five individual marten using the Project area. These results contribute to a clearer understanding of the use of the area by Newfoundland marten and contributes to the overall understanding of the range of the species in central Newfoundland.

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by Marathon Gold Corporation (Marathon) to conduct a number of environmental surveys at the Valentine Lake Project site, including a Newfoundland Marten Hair Snag Study. The Newfoundland Marten Hair Snag Program was conducted to confirm the existence of Newfoundland Marten Species at Risk environments at the Valentine Lake site in support of mine development (the Project). The results of the baseline surveys will be used to support the Environmental Assessment (EA) Registration for the Project.

At the time of this study (winter 2018), Marathon's Valentine Lake Project includes four near-surface, mainly pit-shell constrained, gold deposits: Marathon Deposit, Leprechaun Deposit, Sprite Deposit, and Victory Deposit (Figure 1-1). Additional gold-mineralized zones have been identified immediately to the southwest of the Leprechaun deposit (J. Frank zone) and approximately 1 km northeast of the Victory deposit. The overall site includes a gold system approximately 20 km long and 240 km² in central Newfoundland, approximately 57 km south of Buchans.

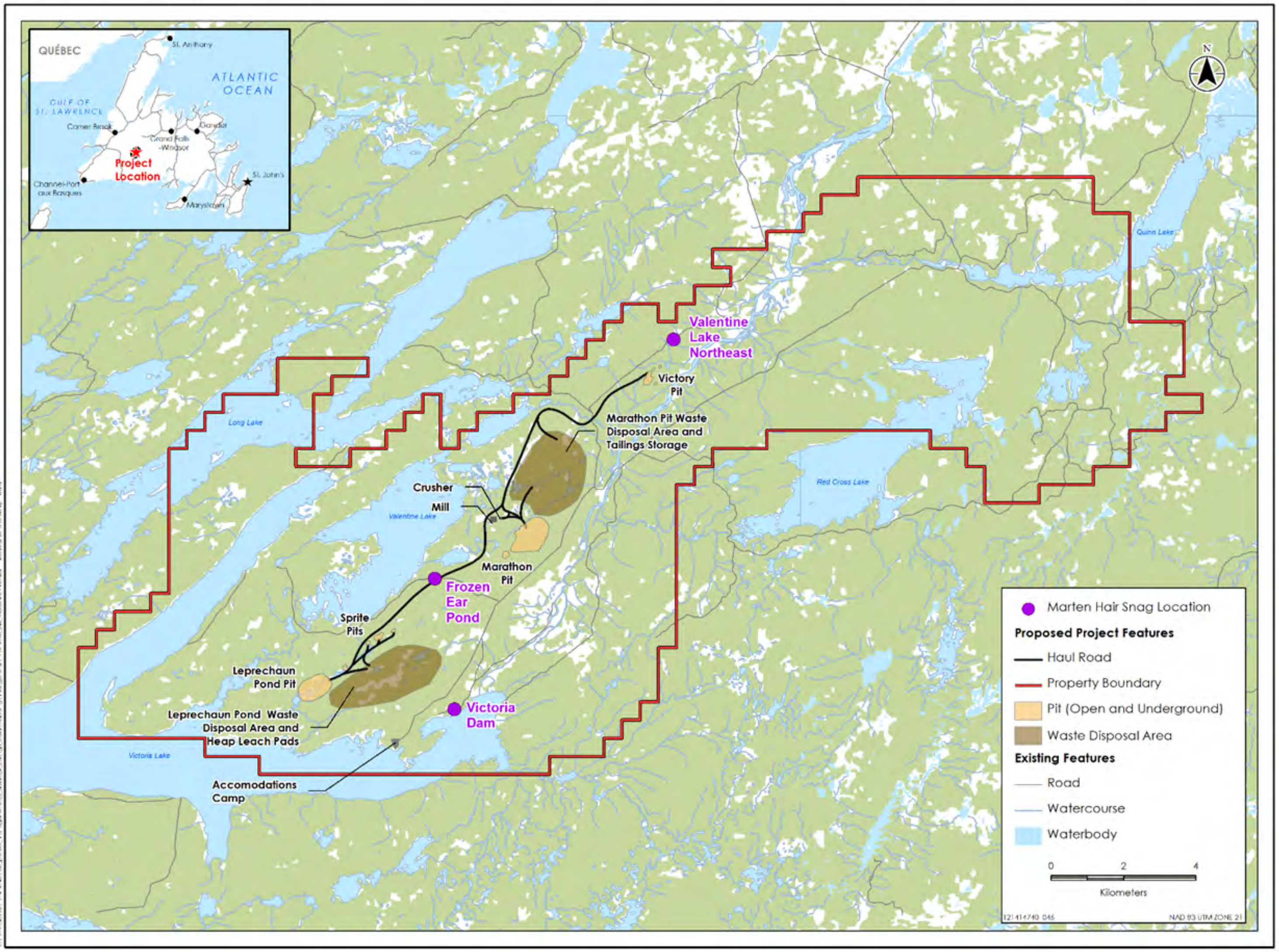

Figure 1-1 Valentine Lake Project Site Plan with Marten Hair Snag Stations

2.0 NEWFOUNDLAND MARTEN BACKGROUND AND REGULATORY CONTEXT

Baseline work to support the anticipated EA of the mine has been ongoing for anticipated valued ecosystem components (e.g., waterfowl, and freshwater fish). This study aimed to gather information to complement other baseline work. The Newfoundland marten is a threatened species (Government of Canada 2007) at both the provincial (NLESA) and federal (SARA) levels (The Newfoundland Marten Recovery Team 2010). The Newfoundland Marten Recovery Team (2010) identified breeding individuals in the Red Indian Lake Area which overlaps portions of Marathon's mineral claim area.

Winter track surveys (aerial and ground) were conducted in 2013 and identified the presence of Newfoundland Marten (*Martes americana atrata*). The presence of the Newfoundland marten and it's protected status lead Marathon to continue to assess the activity of the species within the claim area. The 2013 hair snag program resulted in a single individual being identified, the 2018 effort was to supplement what had been confirmed previously. The 2018 work was covered under Endangered Species Permit Number: 2017/18 - 15 issued by the Government of Newfoundland and Labrador's Department of Fisheries and Land Resources – Forestry and Wildlife Branch (NLFLR – FWB) (Appendix A).

3.0 METHODS

3.1 Study Area

The Study Area for the Newfoundland marten study is defined as Marathon's mineral claim area. This is shown on Figure 1 as the "property boundary".

Marathon's mineral claim area is composed of the Central Newfoundland Forest Ecoregion and the Red Indian Lake Subregion (Damman 1983, NLDEC 2008). The landscape is characterized by remote upland forests interspersed by wetlands (bogs/fens), krummholtz, barrens and waterbodies. The dense forests are composed of balsam fir (*Abies balsamea*) and black spruce (*Picea mariana*), which are common to Central Newfoundland Forests. Stands of hardwood and mixedwood are also present, with the dominant species being white birch (*Betula papyrifera*) and trembling aspen (*Populus tremuloides*). While the majority of the region is in a relatively natural state, timber harvesting and mining activity have occurred in the past and are visible on the landscape.

Banfield (1984) describes a variety of Newfoundland mammal species, small mammals (mice, voles, and shrews) upland game birds, large ungulates (moose and caribou) and large carnivores (lynx, coyote, red fox) that would be expected to occur in the area. Many of those species were detected within the Study Area during the winter 2013 surveys (Stantec 2014).

3.2 Hair Snag Trapping

To build on the knowledge of Newfoundland marten within the Study Area, we replicated efforts from the 2013 winter field season. The main objective of this program was to determine the presence of Newfoundland marten in the Study Area.

Following the guidance provided by NLFLR - FWB (Herdman 2012) three Newfoundland marten hair snag stations / traps were established in locations proximate to those for the 2013 efforts to replicate that study (Stantec 2014). Triangular shaped hair snag traps were constructed using three boards joined with 12-gauge wire (two 2.5 cm x 15.4 cm x 61.0 cm boards for the top and one 2.5 cm x 15.4 cm x 81.3 cm for the base), as described in Herdman (2012). This design allowed the trap to fold out flat for ease of transportation, efficient trap set-up, and provided a quick release for trap baiting and sample removal. Traps were mounted horizontally as high as feasible in relatively large (≥ 22-cm diameter), living black spruce or balsam fir trees, and placed marten lure (Hawbaker's Marten Lure, S. Stanley Hawbaker and Sons) on adjacent trees to attract marten. Four sticky pads made from mouse glue boards (cut to approximately 2.5 cm x 6.5 cm) were placed in each trap and baited with sardines. Sardines were pushed into the corners of the sardine can, to increase the chance the marten would move around in the trap and contact the sticky pads.

Hair snag traps were set-up on February 26, 2018 and were in place until March 27, 2018. The traps were checked and rebaited approximately every eight to ten days. This allowed for a total of 78 trap nights [number of traps (n=3) multiplied by the number of nights the baited traps were available for trapping (n=26)]. After each trapping period (i.e., trap checks each 8-10 days), the sticky pads were replaced, and bait was recharged. When traps were successful in obtaining hair samples, the sticky pads were collected and placed in labeled envelopes with the location and date of collection. At the completion of the collection period, the hair snag samples were shipped to the Memorial University of Newfoundland (MUN) CREAIT Network laboratory for analyses.

The Genomics and Proteomics Facility of the CREAIT Network at MUN received a total of 5 envelopes containing hair samples. Each of the envelopes contained 1-2 sticky pads. One sticky pad per envelope, the one with the most abundant sampling of hair, was processed. A single sample was analysed to identify the species of the hair donor. All 5 hair samples were screened with 11 microsatellite loci to identify individual Newfoundland marten, and the sex of each individual was determined. Complete methods for hair analysis are presented in Appenidx B.

4.0 RESULTS

Two of the three sites (Table 4.1) yielded Newfoundland marten hair samples. In 2013, one marten was identified in the area when hair samples were collected from the Frozen Ear Pond site.

Table 4.1 Trap Success 2018 Marathon Newfoundland Marten Study

Sampling Chronology		**Trap Location**		
Traps set-up	February 25, 2018	Valentine Lake NE N48.44536° W57.04102°	Frozen Ear Pond N48.38516° W57.13015°	Victoria Dam N48.35285° W57.12917°
1st Trap Check	March 6, 2018	Hair Collected	Hair Collected	No sample
2nd Trap Check	March 16, 2018	Hair Collected	Hair Collected	No sample
3rd Trap Check	March 25, 2018	Hair Collected	No sample	No sample

Based on analysis of the hair samples, five individual marten were identified. Two of the five were determined to be female, the sex of the other three was undetermined. As this lab has extensive experience with Newfoundland marten, they have a complete database of individual marten genomic markers. None of the marten captured in this study have been previously documented at this facility.

5.0 SUMMARY

Newfoundland marten presence in the study area was confirmed through the observation of tracks and analysis of collected hair samples. This species was expected in the area, based on the habitat available and proximity to identified core and critical habitat ranges and previous efforts in the area (The Newfoundland Marten Recovery Team 2010, Stantec 2014). The detection of five new individual marten through the genetic analysis of the hair sample was added to the Newfoundland database and may be used by the NLFLR-FWD to help monitor Newfoundland marten abundance throughout its range in the Province.

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APPENDIX A

Research Permit

Newfoundland
Labrador

GOVERNMENT OF
NEWFOUNDLAND AND LABRADOR

Department of
Fisheries and Land Resources
Forestry & Wildlife Branch

A PERMIT TO CONDUCT RESEARCH ON, AND POSSESS AND TRANSPORT SPECIMENS OF AN ENDANGERED SPECIES UNDER THE *ENDANGERED SPECIES ACT* OF NEWFOUNDLAND AND LABRADOR

Date: February 16, 2018

Endangered Species Permit Number: **2017/18 -15**

Issued To: Wayne Tucker, Stantec Consulting Ltd., 19 Union St. Corner Brook, NL A2H 6G7

Permit To: Collect and possess hair specimens from American marten (*Martes americana atrata*)

As permitted under Section 18(1) and 18(2) of the *Endangered Species Act.*

Expiry Date: December 31, 2018

CONDITIONS:
Nominees under this permit include: Tony Parr, Stacey Camus, Karen Rashleigh, and possibly 2 Marathon Gold employees.

1. The permit holder may designate other individuals to collect and possess hair specimens on his/her behalf. The permit holder is responsible for the training of any designated individuals and must ensure designated individuals follow all regulations related to this permit.

2. Information about the location of collection and any other relevant information must be transferred to the Forestry and Wildlife Branch, Department of Fisheries and Land Resource as soon as possible following hair collection.

3. All marten hair samples are to be transferred to the Wildlife Division, Department of Environment and Conservation or to the CREAIT Laboratory at Memorial University of Newfoundland. Any remaining hair samples after analysis are to be transferred to the Forestry and Wildlife Branch, Department of Fisheries and Land Resources.

4. Names and contact information for all individuals participating in research activities shall be provided to the Forestry and Wildlife Branch prior to commencement of field work. Additional names or deletion of names can be provided on an ongoing basis. Approval of any additional individuals participating in research is at the sole discretion of the Forestry and Wildlife Branch.

5. All individuals listed in relation to condition 4 must be advised that their information will be provided to the Forestry and Wildlife Branch and may be further disclosed as permitted or required by law.

6. A final report including the methods and results of the study and including full genetic results must be provided to the Forestry and Wildlife Branch, Department of Fisheries and Land Resources by **December 31, 2018**.

7. This permit does not absolve or relieve the permit holder from any other laws, permits, regulations or orders.

8. This permit does not relieve the permit holder from the requirement to acquire permission to access private property.

9. A copy of this permit shall be retained in the field at all times and is to be provided to an Enforcement Officer or other person of delegated authority upon request.

10. All conditions of this permit must be adhered to and data and results from this project submitted to the Forestry and Wildlife Branch prior to another permit being issued. The permit holder must provide the Forestry and Wildlife Branch with copies of all reports or publications generated as a result of this research.

11. Any unusual wildlife observations or any adverse effects observed during the project are to be reported immediately to the Forestry and Wildlife Branch.

12. Under the discretion of the Senior Manager of Wildlife Research, this permit can be revoked without notice.

<Original signed by>

BLAIR ADAMS
Director
Forestry & Wildlife Research

cc:
Shelley Moores - Senior Manager of Wildlife Research
shelleymoores@gov.nl.ca

APPENDIX B

Lab Analysis

Species, Microsatellite and Sex Identification of Hair Donors From Newfoundland Marten (*Martes americana atrata*) Hair Traps (Stantec)

Prepared for: Wayne Tucker, MEDes (ES) and Tony Parr
Team Lead, Terrestrial Ecology
Newfoundland and Labrador
Stantec

Prepared by: Danielle French

Genomics and Proteomics Facility
CREAIT Network
Memorial University of Newfoundland

August 8, 2018

Summary

The Genomics and Proteomics Facility of the CREAIT Network at Memorial University of Newfoundland received a total of 5 envelopes containing hair samples on May 30, 2018. Envelopes contained 1-2 sticky pads; we processed one sticky pad per envelope. A single sample was analysed to identify species of the hair donor. All 5 hair samples were screened with 11 microsatellite loci to identify individual Newfoundland marten, and the sex of each individual was determined.

Findings

- The five samples that required species confirmation was identified as a Newfoundland marten.
- Of the 5 complete microsatellite genotypes generated, 5 individual Newfoundland marten were identified.
- No individuals were recaptured from previous reports in our facility database.

The purpose of this work was twofold: i) identify donor species of hair samples that could not be identified by visual inspection; ii) identify individual Newfoundland marten by screening DNA extracted from hair samples with a suite of microsatellite loci, and in addition determine sex of each individual.

On May 30, 2018 the Genomics and Proteomics (GaP) Facility of the CREAIT Network at Memorial University of Newfoundland received 5 hair samples (detailed in Table 1).

One sticky pad per envelope was processed. DNA was extracted from 2 – 20 roots using the Qiagen DNeasy Blood and Tissue Kit (Qiagen Inc., Toronto, Ontario, Canada) following the manufacturer's tissue protocol, except that DNA was re-suspended in two consecutive 75 μL elutions, for a total volume of 150 μL of DNA. Hair roots were digested overnight.

We identified species of all five hair donors by sequencing a fragment of the cytochrome b gene, found in the mitochondrial DNA. DNA was analysed using standard operating protocols developed in the GaP Facility. We identified the donor species of the five samples as a Newfoundland marten (*Martes americana atrata)* with 99-100% sequence identity matches (data presented in Table 1).

In order to identify individuals, DNA from the 5 hair samples were screened twice at the following 11 microsatellite loci using standard operating protocols developed in the GaP Facility: Ma1, Ma2, Ma7, Ma9, Ma10, Ma11, Ma14, Ma18, Ma19 (Davis and Strobeck 1998); MP0085, MP0114 (Jordan et al. 2007). Alleles were called independently using GeneMapper v4.0.

Complete microsatellite genotypes were run through GENECAP version 1.3 (Wilberg and Dreher 2004) to identify individuals within the set of samples, and against our existing database of Newfoundland Marten samples to ID them as unique individuals or recapture. No samples from this study were in the database, therefore they represent unique individuals. The count of individual Newfoundland Martens was 229, these 5 samples brings the total count up to 234.

Sex determination of samples was carried out by amplifying an intron within the zinc-finger gene that is present on both sex chromosomes using primers LGL331 and LGL335 (Shaw et al. 2003) with standard operating protocols developed in the GaP Facility. Samples with two bands (zinc finger X and Y) were identified as male, and those with one band (two copies of zinc finger X) as female.

Complete microsatellite genotypes were generated for 5 Newfoundland marten hair samples (Table 2).

The overall probability that two first order relatives shared the same genotype by chance (P_{SIB}) was p = 0.006, and therefore, we are confident in an analysis that screens at 11 microsatellite loci to identify individuals.

Based on complete genotypes, we determined that these samples represent 5 individual Newfoundland marten of which 2 are female and 3 unknown (Table 2).

GaP ID	Sample Collection Date	Hair Snag ID	Species ID
Marten 1	March 16, 2018	VNE	*Martes americana atrata-99%*
Marten 2	March 6, 2018	FEP	*Martes americana atrata-100%*
Marten 3	March 6, 2018	VNE	*Martes americana atrata-100%*
Marten 4	March 27,2018	VNE	*Martes americana atrata-99%*
Marten 5	March 16, 2018	FEP	*Martes americana atrata 100%*

Table 2. Microsatellite alleles and sex identification results for hair samples (N = 5) detailed in Table 1. '-' indicates missing data.

Sample ID	Sex	Microsatellite Alleles (base pairs):																					
		Ma1		Ma10		Ma11		Ma14		Ma18		Ma19		Ma2		Ma7		Ma9		MP0085		MP0114	
Marten 1	-	225	228	179	180	108	108	199	209	165	169	212	212	175	179	204	205	146	147	134	134	162	162
Marten 2	Female	225	228	179	180	108	108	199	209	169	169	214	214	181	181	204	204	145	146	134	134	162	162
Marten 3	-	222	228	180	181	108	108	199	201	167	169	210	214	177	177	204	208	146	147	134	136	162	162
Marten 4	-	225	228	179	180	108	108	199	203	167	169	210	214	177	177	204	206	145	146	134	136	162	162
Marten 5	Female	225	228	179	180	108	108	199	209	169	169	214	214	181	181	206	206	145	146	134	134	162	162

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ATTACHMENT 7-H

Forest Songbird Survey (2019)

Valentine Gold Project: 2019 Avifauna Baseline Study

Results of the 2019 Songbird and Common Nighthawk Surveys

Final Report

December 18, 2019

Prepared for:

Marathon Gold Corporation
Suite 1505, 33 Bay Street
Toronto, ON

Prepared by:

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File No: 121416288

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Executive Summary

Avifauna surveys were carried out at the Valentine Gold Project Site by Stantec Consulting Ltd between 26 and 28 June 2019 to document the bird species present and provide insight regarding populations of songbirds and common nighthawks (*Chordeiles minor*) in the Project Development Area (PDA). Avifauna surveys were first conducted in the PDA in 2011. The 2011 avifauna survey areas were established in locations where mine infrastructure and features (e.g., pit locations, waste rock disposal areas, tailings management facility) were proposed to be situated. Between completion of the 2011 avifauna surveys and 2019, the locations of some of the mine infrastructure and features changed. The 2019 avifauna surveys were developed to provide avifauna data for the locations where mine infrastructure had been relocated which had not previously been surveyed.

Songbirds, members of the Order *Passeriformes*, are defined as ‘perching birds’. They help manage insect populations, resulting in benefits to forests and crops. Songbirds have been in decline in recent years and this may be attributed to multiple, complex environmental factors including pesticide use, insect declines, a decline in winter habitat, and breeding habitat fragmentation (Rosenberg et al. 2019). Some of these species have been listed as Species at Risk (SAR) under the federal *Species at Risk Act* (SARA) or the Newfoundland and Labrador *Endangered Species Act* (NL ESA). The protection of these species is a legal requirement under these Acts.

Most songbird species are protected under the *Migratory Birds Convention Act* (MBCA). The MBCA by way of the *Migratory Birds Regulations and Migratory Birds Sanctuary Regulations*, defines the provisions by which an estimated 450 native species of migratory birds (including their nests and eggs) are protected in Canada. Under the MBCA, the killing, harming, harassing, or injury of migratory birds and their nests and young is prohibited.

Songbirds in the PDA were surveyed using point counts. Fifty-two songbird point counts were completed over three mornings, conducted by two observers working separately. Bird species detected during point count surveys were recorded, and new species encountered incidentally between points were also noted.

Forty-nine species (including species observed incidentally) were identified during the point counts. One of these (olive-sided flycatcher (*Contopus cooperi*)) is considered a SAR, and two are considered Species of Conservation Concern (Nashville warbler (*Leiothlypis ruficapilla*) and bay-breasted warbler (*Setophaga castanea*)). Two species listed as S3 by the Atlantic Canada Conservation Data Centre were also encountered during the survey (blue-headed vireo (*Vireo solitarius*) and greater yellowlegs (*Tringa melanoleuca*)).

Excluding incidental observations, the most abundant species observed across the point counts were white-throated sparrow (*Zonotrichia albicollis*) (59 individuals), yellow-bellied flycatcher (*Empidonax flaviventris*) (52 individuals), and ruby-crowned kinglet (*Regulus calendula*) (35 individuals).

In 2011, a common nighthawk was recorded incidentally during songbird surveys. The common nighthawk is an SAR and is listed as *threatened* under both the Federal SARA and the NL ESA. Suitable common nighthawk nesting habitat is present in the PDA; consequently, common nighthawk surveys were conducted to determine if this species was nesting there. Common nighthawk surveys were conducted at eight locations in the PDA; however, no common nighthawks were observed during the surveys.

Abbreviations

AC CDC	Atlantic Canada Conservation Data Centre
Marathon Gold	Marathon Gold Corporation
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
GPS	global positioning system
Marathon Gold	Marathon Gold Corporation
MBCA	*Migratory Birds Convention Act*
NL	Newfoundland and Labrador
NL ESA	Newfoundland and Labrador *Endangered Species Act*
PDA	Project Development Area
SAR	Species at Risk
SARA	*Species at Risk Act*
S-rank	Sub-national (provincial) rarity ranking for a species
SOCC	Species of Conservation Concern

Glossary

Avifauna	The birds of a particular region, habitat, or geological period.
S-rank	Sub-national (provincial) rarity ranking for a species.
Songbird	A bird belonging to the clade *Passeri* of the perching birds (*Passeriformes*) in which the vocal organ typically is developed in such a way as to produce a diverse and elaborate bird song.
Point Count	A method for estimating bird populations in which an observer records all the birds seen or heard from a point count site for a set period of time.

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by Marathon Gold Corporation (Marathon) to conduct a variety of environmental surveys at the Valentine Gold Project Site (the Project), including avifauna surveys for songbirds and common nighthawk (*Chordeiles minor*). The results of the baseline surveys will be used to support the environmental assessment (EA) of the Project.

At the time of this study (summer 2019), Marathon's Valentine Gold Project includes four near-surface, mainly pit-shell constrained, gold deposits: Marathon Deposit, Leprechaun Deposit, Sprite Deposit, and Victory Deposit (Figure 1.1). Additional gold-mineralized zones have been identified immediately to the southwest of the Leprechaun deposit (J. Frank zone) and approximately 1 km northeast of the Victory deposit. The overall site includes a gold system approximately 20 km long, covering an area 240 km^2. The Project is located in central Newfoundland, approximately 57 km south of Buchans.

The 2019 avifauna surveys build on previous work conducted in support of the Valentine Gold Project which include a Forest Songbird Breeding Survey conducted in 2011 (Stantec 2011). The configuration of the Project infrastructure has changed somewhat since the 2011 surveys. The layout of survey sites used in the 2019 forest songbird surveys was designed to provide survey coverage for as much of the new areas where Project infrastructure will be established as possible.

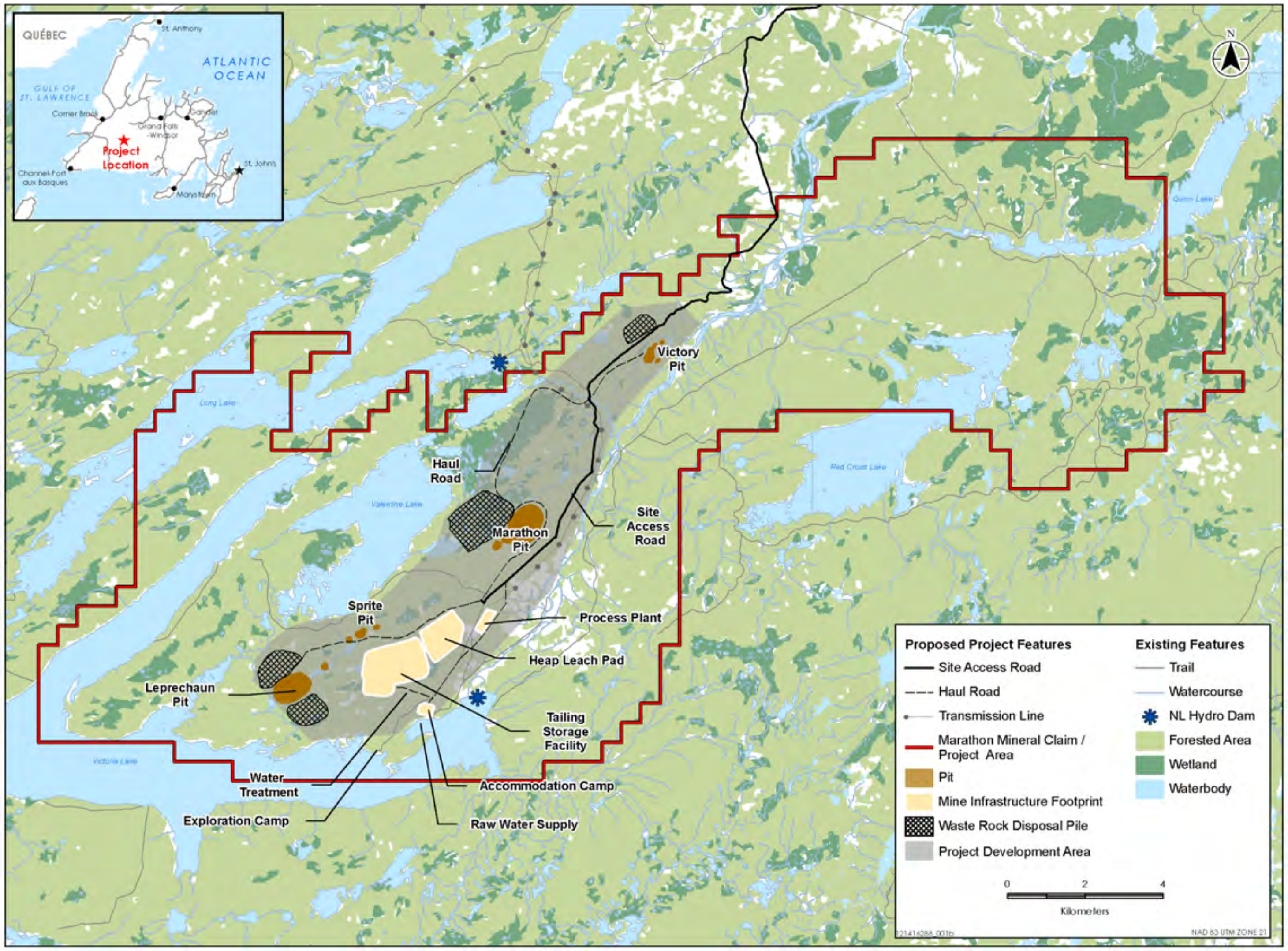

Figure 1.1 Valentine Gold Project Site Plan

2.0 AVIFAUNA BACKGROUND AND REGULATORY CONTEXT

2.1 PROJECT OBJECTIVES

The Avifauna surveys are intended to determine, quantify, and present information on key aspects of the environment (e.g., rare or sensitive bird taxa). The avifauna surveys consist of breeding bird surveys for songbirds and common nighthawk. Objectives of the avifauna survey program are to:

- Establish the avifauna diversity and develop a list of bird species for the Project Development Area (PDA)
- Determine whether provincially rare species of birds, as determined by the Atlantic Canada Conservation Data Center (AC CDC), are present in the PDA
- Provide information on the location (spatial distribution), population size, and habitat of rare bird taxa occurring within the PDA
- Provide information to Marathon Gold for consideration in Project planning

2.2 OVERVIEW OF RARE OR SENSITIVE BIRDS

A species is rare because it has relatively few individuals, it is uncommon or scarce, or it occurs within a limited geographical range. The rarity of a species may also be a matter of scale, meaning that a species may not be rare in Canada, but may be considered “regionally rare” in a respective province or territory. The rarest species are those with small geographic ranges, few occurrences, and few individuals in each occurrence.

Although an understanding of rare or sensitive bird species and their protection is important for a variety of reasons, the protection of the rarest or most sensitive species is also a legal requirement for species listed under Schedule 1 of the federal *Species at Risk Act* (SARA) and the Newfoundland and Labrador *Endangered Species Act* (NL ESA). There are a variety of bird species designated or listed under the federal and provincial legislation in Newfoundland and Labrador.

In the context of the Valentine Gold Project, a rare or sensitive bird species is generally defined as a native species that, because of its biological characteristics, or because it occurs at the periphery of its range, or for some other reason, exists in low numbers or in very restricted areas, in Canada and / or Newfoundland and Labrador. The terms Species at Risk (SAR) and Species of Conservation Concern (SOCC) are used in this report when discussing rare or sensitive birds and are defined in the following sections.

2.2.1 Species at Risk

In Canada and in Newfoundland and Labrador, SAR include those bird species listed as *extirpated*, *endangered*, *threatened*, *vulnerable,* or *special concern* under the NL ESA, the federal SARA, or by the Committee on the Status of Endangered Wildlife Species in Canada (COSEWIC).

2.2.2 Species of Conservation Concern

For this avifauna survey program, SOCC include those bird species:

- recommended for listing by the Species Status Advisory Committee as *endangered*, *threatened*, *vulnerable*, or *special concern* but not yet listed under NL ESA or SARA
- considered provincially rare, i.e., those species with provincial status ranks (S-ranks), of S1 (*critically imperiled*), S2 (*imperiled*)[1], or combinations thereof (e.g., S1S2) upon review by the Atlantic Canada Conservation Data Centre (AC CDC 2019)

Unlike some SAR, SOCC are not protected by federal or provincial legislation. Rather, they are included as a precautionary measure, reflecting observations and trends in their provincial population status. SOCC may be important indicators of ecosystem health and regional biodiversity, thus their presence in an area may warrant mitigation, given their rarity or importance. They are also often indicators of the presence of unusual and / or sensitive habitat, and their protection as umbrella species could possibly result in protection on their associated unusual habitats and co-existing species.

A summary of the ranking systems outlined by SARA, COSEWIC, NL ESA, and AC CDC are provided in Appendix A.

2.3 REGULATION

2.3.1 Federal

The status of bird species is assessed and designated by COSEWIC, which then recommends a designation for legal protection by being officially listed under Schedule 1 of *SARA*. One of the key considerations under SARA for protection of listed SAR is protection of the species' habitat.

SARA is one part of a three-part Government of Canada strategy for the protection of bird SAR, and applies to *extirpated*, *endangered* or *threatened* species listed as being at risk and their critical habitat. SARA-listed species designated as *special concern* are not protected by the prohibitions of Sections 32-36 of SARA; however; it is required that provincial or regional management plans be developed to protect the species. The other two parts of this strategy include commitments under the Accord for the Protection of Species at Risk and activities under the Habitat Stewardship Program for SAR, which protect SAR on federal land.

There are three main prohibitions in SARA relevant to *extirpated*, *endangered* or *threatened* bird SAR and their critical habitat:

- Section 32, which prohibits killing, harming, or taking SAR
- Section 33, which prohibits damage or destruction of residences of SAR
- Subsection 58(1), which prohibits destruction of critical habitat of SAR

Definitions of COSEWIC and SARA species status categories are summarized in Appendix A.

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[1] While *S3* species may be of concern from a provincial biodiversity perspective, they are often not included, as their populations are considered less sensitive. This determination is typically at the discretion of the Newfoundland and Labrador Department of Fisheries and Land Resources (NL FLR) – Wildlife Division.

2.3.2 Provincial

In addition to SARA, each province and territory has a regulatory body that determines what species are rare in each of their respective jurisdictions. In Newfoundland and Labrador, bird SAR are protected under the NL ESA. Designation under the Act follows the recommendations of the Species Status Advisory Committee on the appropriate assessment of a species and referring concerns about the status of species to COSEWIC, where the species is of national importance.

The purpose of NL ESA is to:

- Prevent listed species from being extirpated from Newfoundland and Labrador
- Provide for the recovery of species listed as *extirpated*, *endangered*, or *threatened* as a result of human activity
- Conserve species listed as *special concern* to prevent them from becoming *endangered* or *threatened*

Prohibitions of NL ESA include Section 16, which states “a person shall not disturb, harass, injure, or kill an individual of a species designated as *threatened*, *endangered* or *extirpated*”. Species are listed under the *Endangered Species List Regulations.*

3.0 METHODS

3.1 STUDY TEAM

Experienced professionals were responsible for the design, logistical planning, and data collection of this avifauna program. Species identification, data analysis, and interpretation was performed by qualified professionals (i.e., biologists / ornithologists) with knowledge and experience in these areas. The members of the study team are provided in Table 3.1.

Table 3.1 Study Team – 2019 Avifauna Program

Role	Personnel
Project Manager	Barry Wicks, B.Sc.
Project Scientist	Michael Crowell, M.Sc.
Quality / Independent Review	Michael Crowell, M.Sc.
	Elizabeth Way, M.Sc.
Data Analysis and Report Preparation	Heather Button, B.Sc.
Information Management / GIS	Megan Blackwood, B.Sc., Dip. GIS

3.2 PRE-SURVEY PLANNING

Project planning and initial survey design included: defining the objectives and the purpose of the work; conducting a review of prior terrestrial and avifauna studies performed within the PDA (Stantec 2011); and developing a field sampling plan and appropriate survey intensity. The field sampling plan was created by overlaying the current Project footprint with previously surveyed areas to identify spatial gaps in surveyed areas.

3.3 SONGBIRDS SURVEY METHOD

Songbird surveys were conducted on June 26-28, 2019 to provide an overview of breeding bird species present in the areas within the PDA where proposed mine infrastructure and features will be located on the site. Survey stations were selected in various habitat types within the PDA and placed to sample various land cover types present. Survey stations were established with a distance of at least 300 m between points, and 100 m from edges of other habitat types, where possible.

The surveys were conducted by two ornithologists, each working in separate areas. Data collection and navigation were facilitated using an ArcGIS Collector-based data collection tool developed by Stantec and a Bluetooth-paired GPS. Sites were accessed each morning by truck and by foot. While the focus of these surveys was on songbirds, other incidental observations of avifauna and other wildlife species were recorded.

Songbird survey sites were visited once during the field program, and observers conducted a 10-minute morning point count at each site, following a protocol based on a modified fixed-radius point count sampling procedure (Bibby et al. 2000). Bird species detected during the point count surveys were recorded. Surveys began near dawn and continued until approximately 10:00 am each survey morning. Data collected included date and time of survey, and environmental conditions.

Point count surveys rely largely on auditory cues so surveys were conducted only during appropriate environmental conditions (light winds and little to no precipitation) when birds are most apt to sing and can be heard at a distance. Surveys were not conducted on mornings with high winds or during heavy precipitation. Bibby et al. (2000) recommend the restriction of point counts to wind conditions of Beaufort 3 and below, with a preference for 2 and below if possible, and to avoid conducting point counts in precipitation exceeding occasional light drizzle or brief showers.

Vegetation data were collected at each point count site including the dominant species of trees, shrubs and ground vegetation. Four photographs of habitat (oriented in the cardinal directions) were taken at each point count site.

3.4 COMMON NIGHTHAWK SURVEY METHOD

The 2011 breeding bird surveys recorded a single common nighthawk which was found in roadside habitat. The common nighthawk is listed as *threatened* under both the federal SARA and the NL ESA.

In order to determine if common nighthawk were nesting in the PDA, surveys focused on identifying the presence of common nighthawk, were conducted on the evening of June 28, 2019. Eight survey stations were established along roads through the PDA. These survey sites were established near areas with potential to provide nesting or foraging habitat for common nighthawk, including open forest, recent clear-cuts exposed sand and gravel, and other open anthropogenic habitats such as borrow pits and lay down areas. The common nighthawk surveys were conducted starting approximately 60 minutes before sunset and continued until up to two hours after sunset. Surveys followed a 6-minute passive point count sampling procedure (Canadian Nightjar Survey Protocol 2018). Data collected included date and time of survey, environmental conditions, and background noise level.

3.5 INCIDENTAL WILDLIFE OBSERVATIONS

Incidental observations of other wildlife species or their sign were made during the avian and vegetation surveys conducted in June. Recorded species are included in Section 4.6.

4.0 RESULTS

The survey effort for the 2019 songbird surveys was approximately 163 ha based on a 100 m point count survey radius and 52 point count sites. The area surveyed during the common nighthawk surveys cannot be estimated since the point count radius for these surveys is unlimited. The areas surveyed during the 2019 songbird surveys and common nighthawk surveys as well as the 2011 forest songbird surveys are shown on Figure 4.1.

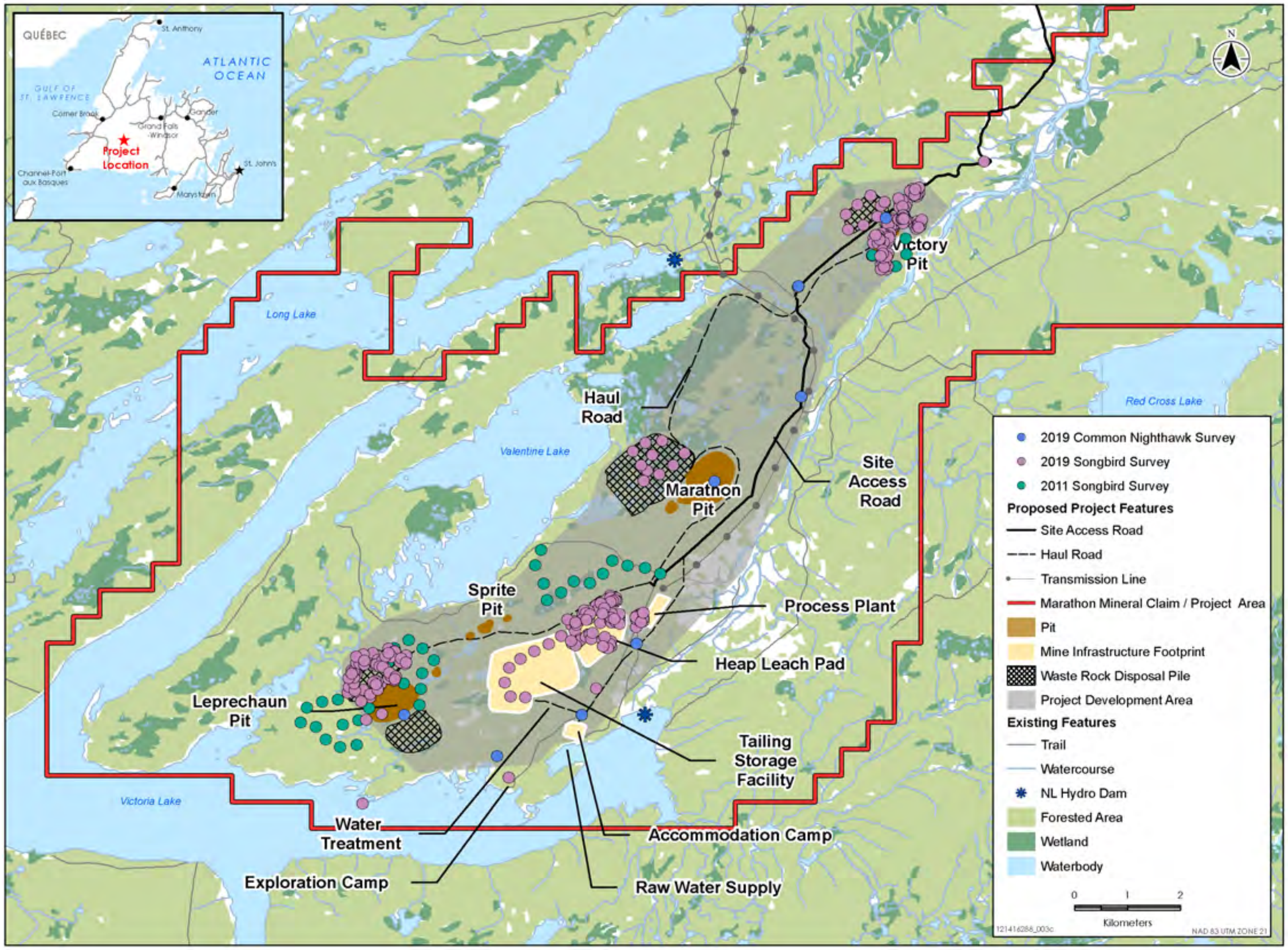

Figure 4.1 Avifauna Program Survey Effort

4.1 FOREST SONGBIRD SURVEY RESULTS

The Valentine Gold Project Site is located entirely within the Central Barrens Subregion of the Maritime Barrens Ecoregion (Heritage Newfoundland 2018). This ecoregion is characterized by foggy weather with cool summer temperatures. Snow cover in the Central Barrens Subregion is relatively heavy compared with the rest of the ecoregion. Vegetation cover consists of a mosaic of forests and barrens. Forested areas are typically composed of nearly pure stands of stunted balsam fir (*Abies balsamea*). The barrens have developed as a result of frequent fires caused by human activities (Heritage Newfoundland 2018).

Songbird point counts were conducted in the PDA between June 26 and June 28, 2019. Fifty-two point counts were completed in various habitat types including forested and wetland habitats (Figure 4.1). The most abundant habitat types included sparse coniferous forest (barrens), coniferous treed swamp and dense coniferous forest. Together these three habitat types accounted for 67% of the point count sites. Other habitat types surveyed included wetland habitats such as bogs, fens, and tall shrub swamps. Table 4.1 provides information on the habitats, including the number of point counts conducted in each habitat type.

Forty-nine species (including two species observed only incidentally, common tern (*Sterna hirundo*) and tree swallow (*Tachycineta bicolor*)) were identified during the point counts. Excluding incidental observations, the most abundant species observed across the point counts was white-throated sparrow (*Zonotrichia albicollis*) (59 individuals), yellow-bellied flycatcher (*Empidonax flaviventris*) (52 individuals), and ruby-crowned kinglet (*Regulus calendula*) (35 individuals).

Table B.1 in Appendix B presents the species recorded during the point count surveys, and their highest breeding status (as collected in the field).

The number of species observed within a given habitat type (species richness) was calculated for each of the habitat types sampled within the PDA (Table 4.1).

Table 4.1 Sampled Habitats and Species Richness

Habitat	Number of Points Completed	Species Richness
Dense Coniferous Forest	8	22
Open Coniferous Forest	4	22
Open Mixedwood Forest	1	7
Sparse Coniferous Forest (Barrens)	18	34
Wetland – Bog	5	21
Wetland – Coniferous Treed Swamp	9	27
Wetland – Fen	3	18
Wetland – Tall Shrub Swamp	2	13
Wetland – Treed Bog	2	9

The largest avian communities, ranging from 27 to 34 species (Table 4.1), were observed in sparse coniferous forest (barrens) and coniferous treed swamp habitats respectively. Treed bog and open mixed wood forest habitat types had notably smaller avian communities with a total of nine and seven species, respectively. The larger number of species recorded in the sparse coniferous forest and coniferous treed swamp habitats and the lower number of species in the treed bog and open mixedwood forest are likely partially attributable to differences in sampling effort in these habitats.

4.2 COMMON NIGHTHAWK SURVEY RESULTS

Passive point count surveys focused on detecting common nighthawks were conducted at eight roadside locations located near potentially suitable nesting and foraging habitat for common nighthawk on the evening of June 28, 2019 (Figure 4.1). No common nighthawks were observed or heard during the field surveys.

4.3 SPECIES AT RISK

One bird SAR, olive-sided flycatcher (*Contopus cooperi*), was observed within the PDA during breeding bird surveys. The olive-sided flycatcher is a stout, medium-sized passerine which breeds in scattered locations throughout most of forested Canada (COSEWIC 2018). The population of this species is in decline in Canada, and the main factors thought to be associated with the decline include habitat loss and alteration (COSEWIC 2018). Declining insect populations on breeding and wintering grounds may also be a contributing factor. This species is listed as *threatened* under Schedule 1 of the federal SARA, and the NL ESA. It is listed as *special concern* by COSEWIC. The AC CDC lists the olive-sided flycatcher as *S3B, SUM*, indicating that the breeding population of this species is considered vulnerable and the migrating population is considered unrankable on the island of Newfoundland.

Olive-sided flycatchers are most often associated with open areas, where they are found foraging for flying insects, and perching in tall live trees (COSEWIC 2018). Suitable habitat for this species is found within the PDA. Olive-sided flycatchers were typically found in areas where there was an interspersion of small to medium sized coniferous forest stands and bogs or fens of similar size. These areas provide a combination of suitable nesting sites (islands of coniferous forest), open foraging areas (small to medium sized bogs and fens) and perch sites (tall trees and snags).

Up to six olive-sided flycatchers were recorded in the PDA during field surveys in 2019. The distribution of olive-sided flycatcher records in the PDA is presented in Figure 4.2. An estimated four individuals were recorded in the proposed Waste Rock Disposal Area for the Marathon Pit. An estimated two individuals were recorded adjacent to the Victory Pit.

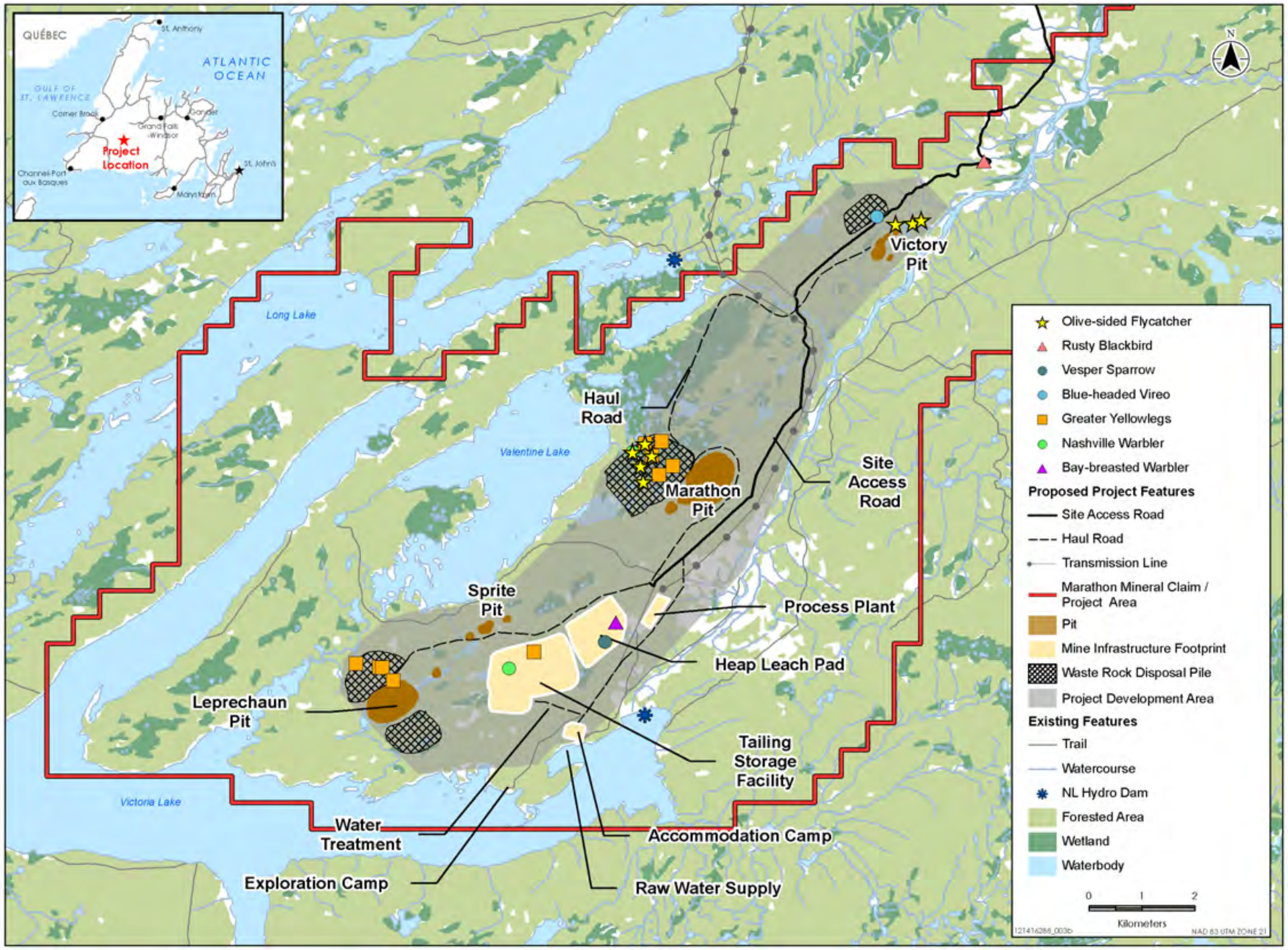

Figure 4.2 2019 Species at Risk and Species of Conservation Concern Observations

A second bird SAR, rusty blackbird (*Euphagus carolinus*), was found within the Marathon Mineral Claim Project Area but outside of the PDA. Rusty blackbirds are listed as a species of *special concern* under the federal SARA and as *vulnerable* under the NL ESA. A male rusty blackbird was heard singing in a tall shrub swamp near the edge of the site access road approximately 1 km northeast of the northern end of the PDA.

4.4 SPECIES OF CONSERVATION CONCERN

Two bird species of conservation concern, Nashville warbler (*Leiothlypis ruficapilla*) and bay-breasted warbler (*Setophaga castanea*) were encountered in the PDA. Both species are listed as S2B by the AC CDC, indicating that their breeding populations are imperiled on the island of Newfoundland. For both species, the low numbers of individuals present in the Newfoundland population may be attributable to the fact that Newfoundland represents the northern most distribution of their breeding ranges. Global populations of Nashville warbler and bay-breasted warbler are relatively stable.

Nashville warblers typically inhabit open coniferous woodlands and brushy habitats. During the songbird survey, Nashville warblers were recorded in point count sites situated in coniferous forest. Nashville warblers were recorded at two locations in the PDA (Figure 4.2), with one in the proposed Tailings Storage Facility and one in the proposed Waste Rock Disposal Area for the Marathon Pit. The first Nashville warbler was found in a relatively open balsam fir stand. The second was found in a mature forest stand dominated by black spruce (*Picea mariana*) and tamarack (*Larix laricina*).

Bay-breasted warblers typically nest in mature forest stands dominated by spruce and fir. One bay-breasted warbler was recorded during the breeding bird surveys. It was found in a mature coniferous forest stand located within the proposed Heap Leach Pad (Figure 4.2).

4.5 UNCOMMON BIRD SPECIES

Three uncommon bird species were recorded during the breeding bird surveys including blue-headed vireo (*Vireo solitarius*), greater yellowlegs (*Tringa melanoleuca*), and vesper sparrow (*Pooectes gramineus*). Blue-headed vireo and greater yellowlegs are both listed as S3B (vulnerable breeding species). One blue-headed vireo was recorded in the proposed Waste Rock Disposal Area for the Victory Pit (Figure 4.2). It was found in a dense mature balsam fir (*Abies balsamea*) dominated forest stand. Greater yellowlegs were encountered at a variety of locations in the PDA including the northern Waste Rock Disposal Area for the Leprechaun Pit, the Waste Rock Disposal Area for the Marathon Pit, and the Tailings Storage Facility (Figure 4.2). Greater yellowlegs were typically found in areas where bogs and fens were interspersed with patches of coniferous forest.

A single vesper sparrow was encountered in a fen at the proposed Heap Leach Pad (Figure 4.2). Vesper sparrows are typically found in areas with sparse grass and scattered shrubs. In the Maritime Provinces, vesper sparrows are typically found in blueberry fields or potato fields. This species is generally not associated with wetland habitats. The vegetation structure of the fen where this species was found would be similar to the upland habitats where this species typically nests. Vesper sparrows are listed as an accidental species on the island of Newfoundland and there are no breeding records for this species in the province. It has been recorded at various sites on the Avalon Peninsula during late fall and winter. The vesper sparrow recorded in the PDA was a singing male. There was no evidence to confirm that a pair of nesting vesper sparrows was present at this site. It is likely that the male had been blown off course during spring migration and had attempted to nest at this site. The probability that nesting will be attempted at this site in the future is low.

4.6 OTHER WILDLIFE

Two mammal SAR were observed incidentally during the course of the field survey program. Two woodland caribou (*Rangifer tarandus caribou*), ranked as *threatened* under both the NL ESA and the SARA, were observed during the field program. One was observed feeding on the side of the site access road several hundred meters north of the Marathon camp. The second caribou was observed foraging in the proposed northern Waste Rock Disposal Area for Leprechaun Pit.

A single American marten (*Martes americana atrata*) was briefly observed traveling along the edge of the site access road near the proposed Heap Leach Pad. The Newfoundland population of America marten is species is ranked as *threatened* under the NL ESA.

Incidental observations of other, common, wildlife species were made by field staff while conducting surveys, including vegetation surveys. Excluding birds and the caribou and American marten mentioned above, six wildlife species (or evidence thereof) were observed in the PDA, including:

- eastern coyote (*Canis latrans*)
- snowshoe hare (*Lepus americanus)*
- red squirrel (*Tamiasciurus hudsonicus*)
- moose (*Alces alces*)
- American toad (*Anaxyrus americanus*)
- green frog (*Lithobates clamitans*)

Each of these species are listed as S5 or SNA (Exotic) by the AC CDC, which is considered secure, or “common, widespread, and abundant in the province” or exotic within the Province (AC CDC 2019).

5.0 SUMMARY

Avifauna surveys were carried out at the Valentine Gold Project Site by Stantec Consulting Ltd between 26 and 28 June 2019 to document the species present and provide insight regarding populations of songbirds and common nighthawks in the PDA. Avifauna surveys were first conducted in the PDA in 2011. The 2011 avifauna survey areas were established in locations where mine infrastructure and features (e.g., pit locations, waste rock disposal areas, tailings management facility) were proposed to be situated. Between completion of the 2011 avifauna surveys and 2019, the locations of some of the mine infrastructure and features changed. The 2019 avifauna surveys were developed to provide avifauna data for the locations where mine infrastructure had been relocated which had not previously been surveyed.

Songbird surveys were conducted using 52 point counts which were completed over three mornings. Bird species detected during point count surveys were recorded, and new species encountered incidentally between points were also noted.

Forty-nine species (including species observed incidentally) were identified during the point counts. One of these (olive-sided flycatcher) is considered SAR, and two are considered SOCC (Nashville warbler and bay-breasted warbler). Two species listed as S3 by the Atlantic Canada Conservation Data Centre were also encountered during the survey (blue-headed vireo and greater yellowlegs). Excluding incidental observations, the most abundant species observed across the point counts was white-throated sparrow (59 individuals), yellow-bellied flycatcher (52 individuals), and ruby-crowned kinglet (35 individuals).

In 2011, a common nighthawk was recorded incidentally the songbird surveys. The common nighthawk is a Species at Risk and is listed as *threatened* under both the Federal Species at Risk Act and the Newfoundland and Labrador *Endangered Species Act.* Suitable common nighthawk nesting habitat is present in the PDA; consequently, common nighthawk surveys were conducted in the Project Development Area to determine if this species was nesting there. Common nighthawk surveys were conducted at eight locations in the PDA; however, no common nighthawks were observed during the surveys.

6.0 REFERENCES

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APPENDIX A

EXPLANATION OF NATIONAL AND PROVINCIAL SPECIES AT RISK AND GENERAL STATUS RANKING

A.1 COMMITTEE ON THE STATUS OF ENDANGERED WILDLIFE IN CANADA AND *SPECIES AT RISK ACT* WILDLIFE SPECIES STATUS CATEGORIES

COSEWIC and SARA wildlife species status categories are described in Table 5.1.

Table A.1 Committee on the Status of Endangered Wildlife in Canada and *Species at Risk Act* Species Status Category Descriptions

Status Category	Description*
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species that no longer exists in the wild in Canada, but exists elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.
Special Concern (SC)	A wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)	A category that applies when the available information is insufficient (a) to resolve a wildlife species' eligibility for assessment or (b) to permit an assessment of the wildlife species' risk of extinction.

COSEWIC 2016. Excerpt from https://www.canada.ca/en/environment-climate-change/services/committee-status-endangered-wildlife/wildlife-species-status-categories-definition.html

A.2 DESIGNATIONS UNDER THE NEWFOUNDLAND AND LABRADOR *ENDANGERED SPECIES ACT*

Species assessment and listings under the Newfoundland and Labrador *Endangered Species Act* (NL *ESA*) are coordinated by the Wildlife Division of the Newfoundland and Labrador Fisheries and Land Resources Department. Designations under the NL *ESA* are described in Table 5.2.

Table A.2 Newfoundland and Labrador *Endangered Species Act* Designations and Descriptions

Designation	Description*
Extinct	A wildlife species that no longer exists.
Extirpate	A wildlife species that no longer exists in the wild but exists elsewhere.
Endangered	A wildlife species facing imminent extirpation or extinction.
Threatened	A wildlife species that is likely to become endangered if nothing is done to reverse the factors limiting its survival.
Vulnerable	A wildlife species that has characteristics which make it particularly sensitive to human activities or natural events, or restricted habitat or food requirements that are themselves under threat.
Data Deficient (DD)	A category that applies when all sources of available information have been investigated but the information in the status report is insufficient to determine risk of extinction based on distribution and/or population status.
Not at Risk (NAR)	Generally applied to widespread and abundant taxa.

NL FLR 2019. Excerpt from https://www.flr.gov.nl.ca/wildlife/endangeredspecies/Designations.pdf

A.3 ATLANTIC CANADA CONSERVATION DATA CENTRE RANKINGS

The AC CDC status ranks (S-rank) for the Island of Newfoundland were used to assess the rankings for vascular plant species. Definitions of the AC CDC rankings are provided in Table 5.3.

Table A.3 Definitions of the Atlantic Canada Conservation Data Centre S-Ranks

Provincial Ranking (S-rank)	Definition
SX	Presumed Extirpated - Species or community is believed to be extirpated from the province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
S1	Critically Imperiled - Critically imperiled in the province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the province.
S2	Imperiled - Imperiled in the province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or province.
S3	Vulnerable - Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4	Apparently Secure - Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5	Secure - Common, widespread, and abundant in the province.
SNR	Unranked - Provincial conservation status not yet assessed.
SU	Unrankable - Possibly in peril, but status is uncertain - more information is needed
SNA	Not Applicable - A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

Table A.3 Definitions of the Atlantic Canada Conservation Data Centre S-Ranks

Provincial Ranking (S-rank)	Definition
S#/S#	Range Rank - A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4)
SH	Possibly Extirpated (Historical)—Species or community occurred historically in the province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become SH without such a 20-40 year delay if the only known occurrences in a province were destroyed or if it had been extensively and unsuccessfully looked for. The SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences.
Not Provided	Species is not known to occur in the province.

AC CDC 2019. Excerpt from http://accdc.com/en/rank-definitions.html

APPENDIX B

Breeding Bird Survey Results

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
19bb1	28-Jun-19	mjc	yes	Swainson's thrush	*Catharus ustulatus*	1		1		1	1	2	2	Singing	Possible			S5B,S5M	
19bb1	28-Jun-19	mjc	yes	Wilson's warbler	*Cardellina pusilla*		1					1	0	Singing	Possible			S5B,S5M	
19bb1	28-Jun-19	mjc	yes	white-throated sparrow	*Zonotrichia albicollis*		1	1				1	1	Singing	Possible			S5B,S5M	
19bb1	28-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1	1	1	1		3	1	Singing	Possible			S5B,S5M	
19bb1	28-Jun-19	mjc	yes	black-and-white warbler	*Mniotilta varia*	1			1			2	0	Singing	Possible			S5B,S5M	
19bb1	28-Jun-19	mjc	yes	fox sparrow	*Passerella iliaca*		1			1		2	0	Singing	Possible			S5B,S5M	
19bb1	28-Jun-19	mjc	yes	northern waterthrush	*Parkesia noveboracensis*		1		2			3	0	Singing	Possible			S5B,S5M	
19bb1	28-Jun-19	mjc	yes	swamp sparrow	*Melospiza georgiana*		1					1	0	Singing	Possible			S5B,S5M	
19bb1	28-Jun-19	mjc	yes	yellow-rumped warbler	*Setophaga coronata*					1		1	0	Singing	Possible			S5B,S5M	
19bb1	28-Jun-19	mjc	yes	blue-headed vireo	*Vireo solitarius*					1		1	0	Singing	Possible			S3B,SUM	
19bb2	28-Jun-19	mjc	yes	common raven	*Corvus corax*			1			3	0	4	Family group	Confirmed			S5	
19bb2	28-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1	1		1		2	1	Singing	Possible			S5B,S5M	
19bb2	28-Jun-19	mjc	yes	northern waterthrush	*Parkesia noveboracensis*	1		1	1			2	1	Singing	Possible			S5B,S5M	
19bb2	28-Jun-19	mjc	yes	fox sparrow	*Passerella iliaca*		1				1	1	1	Singing	Possible			S5B,S5M	
19bb2	28-Jun-19	mjc	yes	mourning warbler	*Geothlypis philadelphia*		1			1		2	0	Singing	Possible			S4B,SUM	
19bb2	28-Jun-19	mjc	yes	Swainson's thrush	*Catharus ustulatus*			1	1	1		2	1	Singing	Possible			S5B,S5M	
19bb2	28-Jun-19	mjc	yes	white-throated sparrow	*Zonotrichia albicollis*						1	0	1	Singing	Possible			S5B,S5M	
19bb2	28-Jun-19	mjc	yes	Wilson's warbler	*Cardellina pusilla*					1		1	0	Singing	Possible			S5B,S5M	
19bb3	28-Jun-19	mjc	yes	blackpoll warbler	*Setophaga striata*	1			1			2	0	Singing	Possible			S5B,S5M	
19bb3	28-Jun-19	mjc	yes	Swainson's thrush	*Catharus ustulatus*		1					1	0	Singing	Possible			S5B,S5M	
19bb3	28-Jun-19	mjc	yes	magnolia warbler	*Setophaga magnolia*	1			1			2	0	Singing	Possible			S4B,SUM	
19bb3	28-Jun-19	mjc	yes	white-throated sparrow	*Zonotrichia albicollis*		1		1			2	0	Singing	Possible			S5B,S5M	

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
19bb3	28-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1				1	1	1	Singing	Possible			S5B,S5M	
19bb3	28-Jun-19	mjc	yes	northern waterthrush	*Parkesia noveboracensis*			1		1		1	1	Singing	Possible			S5B,S5M	
19bb3	28-Jun-19	mjc	yes	Wilson's warbler	*Cardellina pusilla*			1			1	0	2	Singing	Possible			S5B,S5M	
19bb3	28-Jun-19	mjc	yes	fox sparrow	*Passerella iliaca*						1	0	1	Singing	Possible			S5B,S5M	
19bb3	28-Jun-19	mjc	yes	common raven	*Corvus corax*						1	0	1	Calling	Confirmed			S5	
19bb4	28-Jun-19	mjc	yes	fox sparrow	*Passerella iliaca*		1			1		2	0	Singing	Possible			S5B,S5M	
19bb4	28-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*	1						1	0	Singing	Possible			S5B,S5M	
19bb4	28-Jun-19	mjc	yes	common loon	*Gavia immer*			1				0	1	Calling	Observed		Not at Risk	S5B, S4N	
19bb4	28-Jun-19	mjc	yes	white-winged crossbill	*Loxia leucoptera*	1					1	1	1	Calling/Fly Over	Possible			S5	
19bb4	28-Jun-19	mjc	yes	common raven	*Corvus corax*						1	0	1	Calling	Confirmed			S5	
19bb5	28-Jun-19	mjc	yes	common loon	*Gavia immer*			1				0	1	Calling	Observed		Not at Risk	S5B, S4N	
19bb5	28-Jun-19	mjc	yes	Wilson's snipe	*Gallinago delicata*			1				0	1	Singing	Possible			S5B,S5M	
19bb5	28-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*					1		1	0	Singing	Possible			S5B,S5M	
19bb5	28-Jun-19	mjc	yes	white-winged crossbill	*Loxia leucoptera*						1	0	1	Calling/Fly Over	Possible			S5	
19bb5	28-Jun-19	mjc	yes	northern waterthrush	*Parkesia noveboracensis*					1		1	0	Singing	Possible			S5B,S5M	
19bb6	28-Jun-19	mjc	yes	fox sparrow	*Passerella iliaca*			1				0	1	Singing	Possible			S5B,S5M	
19bb6	28-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*			1				0	1	Singing	Possible			S5B,S5M	
19bb6	28-Jun-19	mjc	yes	ruby-crowned kinglet	*Regulus calendula*					1		1	0	Singing	Possible			S5B,S5M	
19bb7	28-Jun-19	mjc	yes	northern waterthrush	*Parkesia noveboracensis*		1			1		2	0	Singing	Possible			S5B,S5M	
19bb7	28-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1		1			2	0	Singing	Possible			S5B,S5M	
19bb7	28-Jun-19	mjc	yes	white-throated sparrow	*Zonotrichia albicollis*		1				1	1	1	Singing	Possible			S5B,S5M	
19bb7	28-Jun-19	mjc	yes	black-and-white warbler	*Mniotilta varia*		1		1			2	0	Singing	Possible			S5B,S5M	
19bb7	28-Jun-19	mjc	yes	ruby-crowned kinglet	*Regulus calendula*		1				1	1	1	Singing	Possible			S5B,S5M	
19bb7	28-Jun-19	mjc	yes	American robin	*Turdus migratorius*	1			1			2	0	Calling	Confirmed			S5B,S5M	

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
19bb7	28-Jun-19	mjc	yes	black-throated green warbler	*Setophaga virens*		1					1	0	Calling	Possible			S5B,S5M	
19bb7	28-Jun-19	mjc	yes	Wilson's warbler	*Cardellina pusilla*					1		1	0	Singing	Possible			S5B,S5M	
19bb7	28-Jun-19	mjc	yes	mourning warbler	*Geothlypis philadelphia*						1	0	1	Singing	Possible			S4B,SUM	
19bb7	28-Jun-19	mjc	yes	pine siskin	*Spinus pinus*					1		1	0	Calling/Fly Over	Possible			S4S5	
19bb11	27-Jun-19	mjc	yes	black-and-white warbler	*Mniotilta varia*	1						1	0	Singing	Possible			S5B,S5M	
19bb11	27-Jun-19	mjc	yes	palm warbler	*Setophaga palmarum*	1				1		2	0	Singing	Possible			S5B,S5M	
19bb11	27-Jun-19	mjc	yes	white-throated sparrow	*Zonotrichia albicollis*		2	1		1		3	1	Singing	Possible			S5B,S5M	
19bb11	27-Jun-19	mjc	yes	greater yellowlegs	*Tringa melanoleuca*			1			1	0	2	Calling	Probable			S3B, S4M	
19bb11	27-Jun-19	mjc	yes	yellow-rumped warbler	*Setophaga coronata*		1					1	0	Singing	Possible			S5B,S5M	
19bb11	27-Jun-19	mjc	yes	ruby-crowned kinglet	*Regulus calendula*		1			1	1	2	1	Singing	Possible			S5B,S5M	
19bb11	27-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1			1	1	2	1	Singing	Possible			S5B,S5M	
19bb11	27-Jun-19	mjc	yes	white-winged crossbill	*Loxia leucoptera*					2	4	2	4	Calling/Fly Over	Possible			S5	
19bb12	27-Jun-19	mjc	yes	common yellowthroat	*Geothlypis trichas*		1			1		2	0	Singing	Possible			S5B,S5M	
19bb12	27-Jun-19	mjc	yes	Swainson's thrush	*Catharus ustulatus*			1				0	1	Singing	Possible			S5B,S5M	
19bb12	27-Jun-19	mjc	yes	white-throated sparrow	*Zonotrichia albicollis*	1		1	1		1	2	2	Singing	Possible			S5B,S5M	
19bb12	27-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*			1				0	1	Singing	Possible			S5B,S5M	
19bb12	27-Jun-19	mjc	yes	palm warbler	*Setophaga palmarum*		1		1			2	0	Singing	Possible			S5B,S5M	
19bb12	27-Jun-19	mjc	yes	Wilson's snipe	*Gallinago delicata*			1				0	1	Singing	Possible			S5B,S5M	
19bb12	27-Jun-19	mjc	yes	Lincoln's sparrow	*Melospiza lincolnii*		1					1	0	Singing	Possible			S5B,S5M	
19bb12	27-Jun-19	mjc	yes	yellow-rumped warbler	*Setophaga coronata*		1					1	0	Singing	Possible			S5B,S5M	
19bb12	27-Jun-19	mjc	yes	white-winged crossbill	*Loxia leucoptera*						2	0	2	Calling/Fly Over	Possible			S5	

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
19bb12	27-Jun-19	mjc	yes	greater yellowlegs	*Tringa melanoleuca*						1	0	1	Calling	Probable			S3B, S4M	
19bb13	27-Jun-19	mjc	yes	olive-sided flycatcher	*Contopus cooperi*			1			1	0	2	Singing	Possible	Schedule 1, Threatened	Special Concern	S3B,SUM	Threatened
19bb13	27-Jun-19	mjc	yes	white-throated sparrow	*Zonotrichia albicollis*	1	1	2		1	1	3	3	Singing	Possible			S5B,S5M	
19bb13	27-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1			1		2	0	Singing	Possible			S5B,S5M	
19bb13	27-Jun-19	mjc	yes	ruby-crowned kinglet	*Regulus calendula*		1			1		2	0	Singing	Possible			S5B,S5M	
19bb13	27-Jun-19	mjc	yes	Swainson's thrush	*Catharus ustulatus*		1			1	1	2	1	Singing	Possible			S5B,S5M	
19bb13	27-Jun-19	mjc	yes	palm warbler	*Setophaga palmarum*					1		1	0	Singing	Possible			S5B,S5M	
19bb14	27-Jun-19	mjc	yes	olive-sided flycatcher	*Contopus cooperi*		1				1	1	1	Singing	Possible	Schedule 1, Threatened	Special Concern	S3B,SUM	Threatened
19bb14	27-Jun-19	mjc	yes	dark-eyed junco	*Junco hyemalis*		1			1		2	0	Singing	Confirmed			S5	
19bb14	27-Jun-19	mjc	yes	white-throated sparrow	*Zonotrichia albicollis*		1	1		1	1	2	2	Singing	Possible			S5B,S5M	
19bb14	27-Jun-19	mjc	yes	ruby-crowned kinglet	*Regulus calendula*	1			1			2	0	Singing	Possible			S5B,S5M	
19bb14	27-Jun-19	mjc	yes	Swainson's thrush	*Catharus ustulatus*						1	0	1	Calling	Possible			S5B,S5M	
19bb14	27-Jun-19	mjc	yes	red-breasted nuthatch	*Sitta canadensis*					1		1	0	Calling	Observed			S5	
19bb14	27-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*				1			1	0	Singing	Possible			S5B,S5M	
19bb8	27-Jun-19	mjc	yes	greater yellowlegs	*Tringa melanoleuca*	2			1			3	0	agitated	Probable			S3B, S4M	
19bb8	27-Jun-19	mjc	yes	palm warbler	*Setophaga palmarum*	1			1			2	0	Singing	Possible			S5B,S5M	
19bb8	27-Jun-19	mjc	yes	common yellowthroat	*Geothlypis trichas*	1				1		2	0	Singing	Possible			S5B,S5M	
19bb8	27-Jun-19	mjc	yes	white-throated sparrow	*Zonotrichia albicollis*	1			1			2	0	Calling	Possible			S5B,S5M	
19bb8	27-Jun-19	mjc	yes	Wilson's snipe	*Gallinago delicata*			1				0	1	Singing	Possible			S5B,S5M	
19bb8	27-Jun-19	mjc	yes	ruby-crowned kinglet	*Regulus calendula*		1			1		2	0	Singing	Possible			S5B,S5M	

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
19bb8	27-Jun-19	mjc	yes	savannah sparrow	*Passerculus sandwichensis*				1			1	0	Calling	Possible			S5B,S5M	
19bb8	27-Jun-19	mjc	yes	olive-sided flycatcher	*Contopus cooperi*						1	0	1	Singing	Possible	Schedule 1, Threatened	Special Concern	S3B,SUM	Threatened
19bb8	27-Jun-19	mjc	yes	swamp sparrow	*Melospiza georgiana*					1		1	0	Singing	Possible			S5B,S5M	
19bb15	27-Jun-19	mjc	yes	palm warbler	*Setophaga palmarum*		1			1		2	0	Singing	Possible			S5B,S5M	
19bb15	27-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1			1		2	0	Singing	Possible			S5B,S5M	
19bb15	27-Jun-19	mjc	yes	white-throated sparrow	*Zonotrichia albicollis*			1		1	1	1	2	Singing	Possible			S5B,S5M	
19bb15	27-Jun-19	mjc	yes	olive-sided flycatcher	*Contopus cooperi*			1		1		1	1	Singing	Possible	Schedule 1, Threatened	Special Concern	S3B,SUM	Threatened
19bb15	27-Jun-19	mjc	yes	ruby-crowned kinglet	*Regulus calendula*			1			1	0	2	Singing	Possible			S5B,S5M	
19bb15	27-Jun-19	mjc	yes	Lincoln's sparrow	*Melospiza lincolnii*		1					1	0	Singing	Possible			S5B,S5M	
19bb15	27-Jun-19	mjc	yes	Nashville warbler	*Leiothlypis ruficapilla*			1				0	1	Singing	Possible			S2B,SUM	
19bb15	27-Jun-19	mjc	yes	black-backed woodpecker	*Picoides arcticus*		1			1		2	0	Calling	Confirmed			S4	
19bb15	27-Jun-19	mjc	yes	black-and-white warbler	*Mniotilta varia*				1			1	0	Singing	Possible			S5B,S5M	
19bb16	27-Jun-19	mjc	yes	yellow-rumped warbler	*Setophaga coronata*	1			1			2	0	Singing	Possible			S5B,S5M	
19bb16	27-Jun-19	mjc	yes	greater yellowlegs	*Tringa melanoleuca*	2		1	1			3	1	agitated	Probable			S3B, S4M	
19bb16	27-Jun-19	mjc	yes	ruby-crowned kinglet	*Regulus calendula*	1				1		2	0	Singing	Possible			S5B,S5M	
19bb16	27-Jun-19	mjc	yes	white-throated sparrow	*Zonotrichia albicollis*			1			1	0	2	Singing	Possible			S5B,S5M	
19bb16	27-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1					1	0	Singing	Possible			S5B,S5M	
19bb16	27-Jun-19	mjc	yes	golden-crowned kinglet	*Regulus satrapa*	1				1		2	0	Singing	Possible			S5B, S4N, SUM	
19bb16	27-Jun-19	mjc	yes	olive-sided flycatcher	*Contopus cooperi*					1		1	0	Singing	Possible	Schedule 1, Threatened	Special Concern	S3B,SUM	Threatened
19bb16	27-Jun-19	mjc	yes	Wilson's snipe	*Gallinago delicata*						1	0	1	Singing	Possible			S5B,S5M	

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
19bb9	27-Jun-19	mjc	yes	ruby-crowned kinglet	*Regulus calendula*		1			1		2	0	Singing	Possible			S5B,S5M	
19bb9	27-Jun-19	mjc	yes	greater yellowlegs	*Tringa melanoleuca*			1				0	1	Calling	Probable			S3B, S4M	
19bb9	27-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*	1						1	0	Singing	Possible			S5B,S5M	
19bb9	27-Jun-19	mjc	yes	black-and-white warbler	*Mniotilta varia*		1			1		2	0	Singing	Possible			S5B,S5M	
19bb9	27-Jun-19	mjc	yes	American robin	*Turdus migratorius*		1					1	0	Calling	Confirmed			S5B,S5M	
19bb9	27-Jun-19	mjc	yes	palm warbler	*Setophaga palmarum*		1		1			2	0	Singing	Possible			S5B,S5M	
19bb9	27-Jun-19	mjc	yes	Wilson's snipe	*Gallinago delicata*						1	0	1	Singing	Possible			S5B,S5M	
19bb10	27-Jun-19	mjc	yes	palm warbler	*Setophaga palmarum*	1						1	0	Singing	Possible			S5B,S5M	
19bb10	27-Jun-19	mjc	yes	black-and-white warbler	*Mniotilta varia*		1					1	0	Singing	Possible			S5B,S5M	
19bb10	27-Jun-19	mjc	yes	yellow-rumped warbler	*Setophaga coronata*			1				0	1	Singing	Possible			S5B,S5M	
19bb10	27-Jun-19	mjc	yes	Wilson's snipe	*Gallinago delicata*			1			1	0	2	Singing	Possible			S5B,S5M	
19bb10	27-Jun-19	mjc	yes	magnolia warbler	*Setophaga magnolia*		1				1	1	1	Singing	Possible			S4B,SUM	
19bb10	27-Jun-19	mjc	yes	golden-crowned kinglet	*Regulus satrapa*					1		1	0	Calling	Possible			S5B, S4N, SUM	
19bb32	26-Jun-19	mjc	yes	white-throated sparrow	*Zonotrichia albicollis*		1			2		3	0	Singing	Possible			S5B,S5M	
19bb32	26-Jun-19	mjc	yes	Wilson's snipe	*Gallinago delicata*			1			1	0	2	Calling	Possible			S5B,S5M	
19bb32	26-Jun-19	mjc	yes	Swainson's thrush	*Catharus ustulatus*		1				1	1	1	Singing	Possible			S5B,S5M	
19bb32	26-Jun-19	mjc	yes	Lincoln's sparrow	*Melospiza lincolnii*		1			1		2	0	Singing	Possible			S5B,S5M	
19bb32	26-Jun-19	mjc	yes	American goldfinch	*Spinus tristis*		1					1	0	Calling/Fly Over	Observed			S5	
19bb32	26-Jun-19	mjc	yes	blackpoll warbler	*Setophaga striata*		1					1	0	Singing	Possible			S5B,S5M	
19bb32	26-Jun-19	mjc	yes	Wilson's warbler	*Cardellina pusilla*		1			1		2	0	Singing	Possible			S5B,S5M	
19bb32	26-Jun-19	mjc	yes	northern waterthrush	*Parkesia noveboracensis*		1				1	1	1	Singing	Possible			S5B,S5M	

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
19bb32	26-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*			1			1	0	2	Singing	Possible			S5B,S5M	
19bb32	26-Jun-19	mjc	yes	magnolia warbler	*Setophaga magnolia*		1			1	1	2	1	Singing	Possible			S4B,SUM	
19bb31	26-Jun-19	mjc	yes	Lincoln's sparrow	*Melospiza lincolnii*	1						1	0	Singing	Possible			S5B,S5M	
19bb31	26-Jun-19	mjc	yes	northern waterthrush	*Parkesia noveboracensis*		1		1			2	0	Singing	Possible			S5B,S5M	
19bb31	26-Jun-19	mjc	yes	Wilson's warbler	*Cardellina pusilla*	1		1	1			2	1	Singing	Possible			S5B,S5M	
19bb31	26-Jun-19	mjc	yes	white-throated sparrow	*Zonotrichia albicollis*			1			1	0	2	Singing	Possible			S5B,S5M	
19bb31	26-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1			1		2	0	Singing	Possible			S5B,S5M	
19bb31	26-Jun-19	mjc	yes	Wilson's snipe	*Gallinago delicata*			1			1	0	2	Calling	Possible			S5B,S5M	
19bb31	26-Jun-19	mjc	yes	fox sparrow	*Passerella iliaca*		1			1		2	0	Singing	Possible			S5B,S5M	
19bb31	26-Jun-19	mjc	yes	swamp sparrow	*Melospiza georgiana*				1			1	0	Singing	Possible			S5B,S5M	
19bb30	26-Jun-19	mjc	yes	white-throated sparrow	*Zonotrichia albicollis*			1			1	0	2	Singing	Possible			S5B,S5M	
19bb30	26-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1		1			2	0	Singing	Possible			S5B,S5M	
19bb30	26-Jun-19	mjc	yes	Swainson's thrush	*Catharus ustulatus*	1		1				1	1	Singing	Possible			S5B,S5M	
19bb30	26-Jun-19	mjc	yes	pine grosbeak	*Pinicola enucleator*		1				1	1	1	Singing	Possible			S5	
19bb30	26-Jun-19	mjc	yes	ruby-crowned kinglet	*Regulus calendula*		1					1	0	Singing	Possible			S5B,S5M	
19bb30	26-Jun-19	mjc	yes	Canada jay	*Perisoreus canadensis*		1					1	0	Calling	Possible			S5	
19bb30	26-Jun-19	mjc	yes	blackpoll warbler	*Setophaga striata*		1		1			2	0	Singing	Possible			S5B,S5M	
19bb30	26-Jun-19	mjc	yes	Lincoln's sparrow	*Melospiza lincolnii*			1			1	0	2	Singing	Possible			S5B,S5M	
19bb30	26-Jun-19	mjc	yes	Nashville warbler	*Leiothlypis ruficapilla*					1		1	0	Singing	Possible			S2B,SUM	
19bb30	26-Jun-19	mjc	yes	American goldfinch	*Spinus tristis*						1	0	1	Calling/Fly Over	Observed			S5	
19bb30	26-Jun-19	mjc	yes	white-winged crossbill	*Loxia leucoptera*				2			2	0	Calling/Fly Over	Possible			S5	
19bb29	26-Jun-19	mjc	yes	northern waterthrush	*Parkesia noveboracensis*		1			2		3	0	Singing	Possible			S5B,S5M	

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
19bb29	26-Jun-19	mjc	yes	ruby-crowned kinglet	*Regulus calendula*		1			1		2	0	Singing	Possible			S5B,S5M	
19bb29	26-Jun-19	mjc	yes	American robin	*Turdus migratorius*		1	1		1	1	2	2	Calling	Confirmed			S5B,S5M	
19bb29	26-Jun-19	mjc	yes	white-throated sparrow	*Zonotrichia albicollis*	2	1		2	1		6	0	Singing	Possible			S5B,S5M	
19bb29	26-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1				1	1	1	Singing	Possible			S5B,S5M	
19bb29	26-Jun-19	mjc	yes	Wilson's warbler	*Cardellina pusilla*		1				1	1	1	Singing	Possible			S5B,S5M	
19bb29	26-Jun-19	mjc	yes	common loon	*Gavia immer*						1	0	1	Calling	Observed		Not at Risk	S5B, S4N	
19bb34	26-Jun-19	mjc	yes	magnolia warbler	*Setophaga magnolia*	1			1			2	0	Singing	Possible			S4B,SUM	
19bb34	26-Jun-19	mjc	yes	greater yellowlegs	*Tringa melanoleuca*			1				0	1	Calling	Probable			S3B, S4M	
19bb34	26-Jun-19	mjc	yes	Wilson's snipe	*Gallinago delicata*			1			1	0	2	Calling	Possible			S5B,S5M	
19bb34	26-Jun-19	mjc	yes	American robin	*Turdus migratorius*		1					1	0	Singing	Confirmed			S5B,S5M	
19bb34	26-Jun-19	mjc	yes	northern waterthrush	*Parkesia noveboracensis*	1	1		1	1		4	0	Singing	Possible			S5B,S5M	
19bb34	26-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*	1			1			2	0	Singing	Possible			S5B,S5M	
19bb34	26-Jun-19	mjc	yes	white-throated sparrow	*Zonotrichia albicollis*		1				1	1	1	Singing	Possible			S5B,S5M	
19bb34	26-Jun-19	mjc	yes	Swainson's thrush	*Catharus ustulatus*		1			1		2	0	Singing	Possible			S5B,S5M	
19bb34	26-Jun-19	mjc	yes	Wilson's warbler	*Cardellina pusilla*					1		1	0	Singing	Possible			S5B,S5M	
19bb34	26-Jun-19	mjc	yes	ruby-crowned kinglet	*Regulus calendula*					1		1	0	Singing	Possible			S5B,S5M	
19bb17	26-Jun-19	mjc	yes	northern waterthrush	*Parkesia noveboracensis*	1						1	0	Singing	Possible			S5B,S5M	
19bb17	26-Jun-19	mjc	yes	black-backed woodpecker	*Picoides arcticus*		1			1	1	2	1	Singing	Confirmed			S4	
19bb17	26-Jun-19	mjc	yes	American robin	*Turdus migratorius*					1		1	0	Calling	Confirmed			S5B,S5M	
19bb17	26-Jun-19	mjc	yes	yellow-rumped warbler	*Setophaga coronata*				1			1	0	Singing	Possible			S5B,S5M	
19bb28	26-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*	1			1			2	0	Singing	Possible			S5B,S5M	
19bb28	26-Jun-19	mjc	yes	white-throated sparrow	*Zonotrichia albicollis*		1				1	1	1	Singing	Possible			S5B,S5M	

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
19bb28	26-Jun-19	mjc	yes	blackpoll warbler	*Setophaga striata*	1						1	0	Singing	Possible			S5B,S5M	
19bb28	26-Jun-19	mjc	yes	ruby-crowned kinglet	*Regulus calendula*		1				1	1	1	Singing	Possible			S5B,S5M	
19bb28	26-Jun-19	mjc	yes	white-winged crossbill	*Loxia leucoptera*						1	0	1	Calling/Fly Over	Possible			S5	
19bb28	26-Jun-19	mjc	yes	northern flicker	*Colaptes auratus*	1				1		2	0	Singing	Possible			S4	
19bb28	26-Jun-19	mjc	yes	Swainson's thrush	*Catharus ustulatus*				1			1	0	Singing	Possible			S5B,S5M	
19bb28	26-Jun-19	mjc	yes	Wilson's snipe	*Gallinago delicata*						1	0	1	Singing	Possible			S5B,S5M	
19bbmjc01	26-Jun-19	mjc	yes	Canada jay	*Perisoreus canadensis*		1			1		2	0	Calling	Possible			S5	
19bbmjc01	26-Jun-19	mjc	yes	magnolia warbler	*Setophaga magnolia*	1				1		2	0	Singing	Possible			S4B,SUM	
19bbmjc01	26-Jun-19	mjc	yes	white-throated sparrow	*Zonotrichia albicollis*	1				1		2	0	Singing	Possible			S5B,S5M	
19bbmjc01	26-Jun-19	mjc	yes	yellow-bellied flycatcher	*Empidonax flaviventris*	1				1	1	2	1	Singing	Possible			S5B,S5M	
19bbmjc01	26-Jun-19	mjc	yes	yellow-rumped warbler	*Setophaga coronata*		1					1	0	Singing	Possible			S5B,S5M	
19bbmjc01	26-Jun-19	mjc	yes	black-and-white warbler	*Mniotilta varia*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-27	26-Jun-19	HKB	Yes	common yellowthroat	*Geothlypis trichas*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-27	26-Jun-19	HKB	Yes	fox sparrow	*Passerella iliaca*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-27	26-Jun-19	HKB	Yes	Swainson's thrush	*Catharus ustulatus*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-27	26-Jun-19	HKB	Yes	magnolia warbler	*Setophaga magnolia*		1					1	0	Singing	Possible			S4B,SUM	
bb2019-27	26-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-27	26-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*	1						1	0	Singing	Possible			S5B,S5M	
bb2019-27	26-Jun-19	HKB	Yes	fox sparrow	*Passerella iliaca*	1						1	0	Singing	Possible			S5B,S5M	
bb2019-27	26-Jun-19	HKB	Yes	hairy woodpecker	*Leuconotopicus villosus*		1					1	0	Calling	Observed			S4	
bb2019-27	26-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-27	26-Jun-19	HKB	Yes	northern waterthrush	*Parkesia noveboracensis*					1		1	0	Singing	Possible			S5B,S5M	

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
bb2019-27	26-Jun-19	HKB	Yes	American robin	*Turdus migratorius*					1		1	0	Calling	Confirmed			S5B,S5M	
bb2019-27	26-Jun-19	HKB	Yes	ruby-crowned kinglet	*Regulus calendula*					1		1	0	Singing	Possible			S5B,S5M	
bb2019-27	26-Jun-19	HKB	Yes	American crow	*Corvus brachyrhynchos*						1	0	1	Calling	Observed			S5	
bb2019-20	26-Jun-19	HKB	Yes	magnolia warbler	*Setophaga magnolia*		1					1	0	Singing	Possible			S4B,SUM	
bb2019-20	26-Jun-19	HKB	Yes	blackpoll warbler	*Setophaga striata*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-20	26-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-20	26-Jun-19	HKB	Yes	northern waterthrush	*Parkesia noveboracensis*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-20	26-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-20	26-Jun-19	HKB	Yes	Swainson's thrush	*Catharus ustulatus*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-20	26-Jun-19	HKB	Yes	bay-breasted warbler	*Setophaga castanea*		1					1	0	Singing	Possible			S2B,SUM	
bb2019-20	26-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-20	26-Jun-19	HKB	Yes	northern flicker	*Colaptes auratus*			1				0	1	Calling	Possible			S4	
bb2019-20	26-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*						1	0	1	Singing	Possible			S5B,S5M	
bb2019-20	26-Jun-19	HKB	Yes	ruby-crowned kinglet	*Regulus calendula*						1	0	1	Singing	Possible			S5B,S5M	
bb2019-20	26-Jun-19	HKB	Yes	Canada jay	*Perisoreus canadensis*					1		1	0	Calling	Possible			S5	
bb2019-20	26-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*				1			1	0	Visual	Possible			S5B,S5M	
bb2019-21	26-Jun-19	HKB	Yes	Canada jay	*Perisoreus canadensis*	2						2	0	Visual and Singing/Calling	Possible			S5	
bb2019-21	26-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-21	26-Jun-19	HKB	Yes	blackpoll warbler	*Setophaga striata*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-21	26-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-21	26-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1					1	0	Singing	Possible			S5B,S5M	

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
bb2019-21	26-Jun-19	HKB	Yes	Swainson's thrush	*Catharus ustulatus*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-21	26-Jun-19	HKB	Yes	American robin	*Turdus migratorius*		1					1	0	Calling	Confirmed			S5B,S5M	
bb2019-21	26-Jun-19	HKB	Yes	pine siskin	*Spinus pinus*		1					1	0	Flyover Singing/Calling	Possible			S4S5	
bb2019-21	26-Jun-19	HKB	Yes	magnolia warbler	*Setophaga magnolia*					1		1	0	Singing	Possible			S4B,SUM	
bb2019-21	26-Jun-19	HKB	Yes	ruby-crowned kinglet	*Regulus calendula*				1			1	0	Singing	Possible			S5B,S5M	
bb2019-21	26-Jun-19	HKB	Yes	boreal chickadee	*Poecile hudsonicus*				1			1	0	Calling	Observed			S4	
bb2019-22	26-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-22	26-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-22	26-Jun-19	HKB	Yes	American robin	*Turdus migratorius*		1					1	0	Calling	Confirmed			S5B,S5M	
bb2019-22	26-Jun-19	HKB	Yes	ruby-crowned kinglet	*Regulus calendula*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-22	26-Jun-19	HKB	Yes	Swainson's thrush	*Catharus ustulatus*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-22	26-Jun-19	HKB	Yes	northern waterthrush	*Parkesia noveboracensis*						1	0	1	Singing	Possible			S5B,S5M	
bb2019-24	26-Jun-19	HKB	Yes	blackpoll warbler	*Setophaga striata*	1						1	0	Singing	Possible			S5B,S5M	
bb2019-24	26-Jun-19	HKB	Yes	Swainson's thrush	*Catharus ustulatus*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-24	26-Jun-19	HKB	Yes	Swainson's thrush	*Catharus ustulatus*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-24	26-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*			1				0	1	Singing	Possible			S5B,S5M	
bb2019-24	26-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*			1				0	1	Singing	Possible			S5B,S5M	
bb2019-24	26-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*	1						1	0	Singing	Possible			S5B,S5M	
bb2019-24	26-Jun-19	HKB	Yes	yellow-rumped warbler	*Setophaga coronata*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-24	26-Jun-19	HKB	Yes	magnolia warbler	*Setophaga magnolia*		1					1	0	Singing	Possible			S4B,SUM	
bb2019-24	26-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*				1			1	0	Singing	Possible			S5B,S5M	

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
bb2019-24	26-Jun-19	HKB	Yes	ruby-crowned kinglet	*Regulus calendula*				1			1	0	Calling	Possible			S5B,S5M	
bb2019-23	26-Jun-19	HKB	Yes	ruby-crowned kinglet	*Regulus calendula*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-23	26-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*			1				0	1	Singing	Possible			S5B,S5M	
bb2019-23	26-Jun-19	HKB	Yes	Swainson's thrush	*Catharus ustulatus*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-23	26-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*						1	0	1	Singing	Possible			S5B,S5M	
bb2019-23	26-Jun-19	HKB	Yes	magnolia warbler	*Setophaga magnolia*					1		1	0	Singing	Possible			S4B,SUM	
bb2019-25	26-Jun-19	HKB	Yes	common yellowthroat	*Geothlypis trichas*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-25	26-Jun-19	HKB	Yes	black-and-white warbler	*Mniotilta varia*	1						1	0	Singing	Possible			S5B,S5M	
bb2019-25	26-Jun-19	HKB	Yes	Wilson's snipe	*Gallinago delicata*		1					1	0	Calling	Possible			S5B,S5M	
bb2019-25	26-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-25	26-Jun-19	HKB	Yes	northern waterthrush	*Parkesia noveboracensis*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-25	26-Jun-19	HKB	Yes	ruby-crowned kinglet	*Regulus calendula*					1		1	0	Singing	Possible			S5B,S5M	
bb2019-26	26-Jun-19	HKB	Yes	hermit thrush	*Catharus guttatus*	1						1	0	Calling	Possible			S5B,S5M	
bb2019-26	26-Jun-19	HKB	Yes	hermit thrush	*Catharus guttatus*	1						1	0	Calling	Possible			S5B,S5M	
bb2019-26	26-Jun-19	HKB	Yes	common yellowthroat	*Geothlypis trichas*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-26	26-Jun-19	HKB	Yes	Canada jay	*Perisoreus canadensis*	1						1	0	Visual and Singing/Calling	Possible			S5	
bb2019-26	26-Jun-19	HKB	Yes	Swainson's thrush	*Catharus ustulatus*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-26	26-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-hb1	26-Jun-19	HKB	Yes	vesper sparrow	*Pooecetes gramineus*		1					1	0	Singing	Possible			SNA	
bb2019-hb1	26-Jun-19	HKB	Yes	ruby-crowned kinglet	*Regulus calendula*			1				0	1	Singing	Possible			S5B,S5M	
bb2019-hb1	26-Jun-19	HKB	Yes	common yellowthroat	*Geothlypis trichas*		1					1	0	Singing	Possible			S5B,S5M	

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
bb2019-hb1	26-Jun-19	HKB	Yes	American robin	*Turdus migratorius*		1					1	0	Singing	Confirmed			S5B,S5M	
bb2019-hb1	26-Jun-19	HKB	Yes	fox sparrow	*Passerella iliaca*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-hb1	26-Jun-19	HKB	Yes	Wilson's snipe	*Gallinago delicata*		2					2	0	Visual and Singing/Calling	Possible			S5B,S5M	
bb2019-hb1	26-Jun-19	HKB	Yes	yellow warbler	*Setophaga petechia*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-hb1	26-Jun-19	HKB	Yes	black-throated green warbler	*Setophaga virens*			1				0	1	Singing	Possible			S5B,S5M	
bb2019-hb1	26-Jun-19	HKB	Yes	Canada jay	*Perisoreus canadensis*		1					1	0	Visual and Singing/Calling	Possible			S5	
bb2019-39	27-Jun-19	HKB	Yes	savannah sparrow	*Passerculus sandwichensis*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-39	27-Jun-19	HKB	Yes	blackpoll warbler	*Setophaga striata*	1						1	0	Singing	Possible			S5B,S5M	
bb2019-39	27-Jun-19	HKB	Yes	black-and-white warbler	*Mniotilta varia*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-39	27-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-39	27-Jun-19	HKB	Yes	magnolia warbler	*Setophaga magnolia*			1				0	1	Singing	Possible			S4B,SUM	
bb2019-39	27-Jun-19	HKB	Yes	dark-eyed junco	*Junco hyemalis*			1				0	1	Singing	Confirmed			S5	
bb2019-39	27-Jun-19	HKB	Yes	common yellowthroat	*Geothlypis trichas*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-39	27-Jun-19	HKB	Yes	American robin	*Turdus migratorius*			1				0	1	Singing	Confirmed			S5B,S5M	
bb2019-39	27-Jun-19	HKB	Yes	palm warbler	*Setophaga palmarum*			1				0	1	Singing	Possible			S5B,S5M	
bb2019-39	27-Jun-19	HKB	Yes	American robin	*Turdus migratorius*					1		1	0	Calling	Confirmed			S5B,S5M	
bb2019-40	27-Jun-19	HKB	Yes	hermit thrush	*Catharus guttatus*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-40	27-Jun-19	HKB	Yes	common yellowthroat	*Geothlypis trichas*			1				0	1	Singing	Possible			S5B,S5M	
bb2019-40	27-Jun-19	HKB	Yes	Wilson's snipe	*Gallinago gallinago*			1				0	1	Singing	Possible			S5B,S5M	
bb2019-40	27-Jun-19	HKB	Yes	magnolia warbler	*Setophaga magnolia*					1		1	0	Singing	Possible			S4B,SUM	
bb2019-40	27-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*						1	0	1	Singing	Possible			S5B,S5M	

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
bb2019-40	27-Jun-19	HKB	Yes	ruby-crowned kinglet	*Regulus calendula*					1		1	0	Singing	Possible			S5B,S5M	
bb2019-38	27-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1					1	0	Calling	Possible			S5B,S5M	
bb2019-38	27-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-38	27-Jun-19	HKB	Yes	ruby-crowned kinglet	*Regulus calendula*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-38	27-Jun-19	HKB	Yes	American robin	*Turdus migratorius*		1					1	0	Singing	Confirmed			S5B,S5M	
bb2019-38	27-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*						1	0	1	Singing	Possible			S5B,S5M	
bb2019-19	27-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-19	27-Jun-19	HKB	Yes	magnolia warbler	*Setophaga magnolia*	1						1	0	Singing	Possible			S4B,SUM	
bb2019-19	27-Jun-19	HKB	Yes	downy woodpecker	*Dryobates pubescens*		1					1	0	Calling	Possible			S4	
bb2019-19	27-Jun-19	HKB	Yes	Canada jay	*Perisoreus canadensis*	1						1	0	Calling	Possible			S5	
bb2019-19	27-Jun-19	HKB	Yes	black-and-white warbler	*Mniotilta varia*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-19	27-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-19	27-Jun-19	HKB	Yes	savannah sparrow	*Passerculus sandwichensis*			1				0	1	Singing	Possible			S5B,S5M	
bb2019-19	27-Jun-19	HKB	Yes	black-capped chickadee	*Poecile atricapillus*				1			1	0	Calling	Possible			S5	
bb2019-37	27-Jun-19	HKB	Yes	savannah sparrow	*Passerculus sandwichensis*	1						1	0	Singing	Possible			S5B,S5M	
bb2019-37	27-Jun-19	HKB	Yes	greater yellowlegs	*Tringa melanoleuca*		1					1	0	Calling	Probable			S3B, S4M	
bb2019-37	27-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-37	27-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-37	27-Jun-19	HKB	Yes	dark-eyed junco	*Junco hyemalis*		1					1	0	Singing	Confirmed			S5	
bb2019-37	27-Jun-19	HKB	Yes	American robin	*Turdus migratorius*			1				0	1	Singing	Confirmed			S5B,S5M	
bb2019-37	27-Jun-19	HKB	Yes	Wilson's snipe	*Gallinago delicata*		1					1	0	Calling	Possible			S5B,S5M	

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
bb2019-37	27-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*			1				0	1	Singing	Possible			S5B,S5M	
bb2019-37	27-Jun-19	HKB	Yes	blackpoll warbler	*Setophaga striata*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-35	27-Jun-19	HKB	Yes	common yellowthroat	*Geothlypis trichas*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-35	27-Jun-19	HKB	Yes	blackpoll warbler	*Setophaga striata*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-35	27-Jun-19	HKB	Yes	American redstart	*Setophaga ruticilla*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-35	27-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-35	27-Jun-19	HKB	Yes	Swainson's thrush	*Catharus ustulatus*			1				0	1	Singing	Possible			S5B,S5M	
bb2019-35	27-Jun-19	HKB	Yes	black-and-white warbler	*Mniotilta varia*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-35	27-Jun-19	HKB	Yes	common yellowthroat	*Geothlypis trichas*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-35	27-Jun-19	HKB	Yes	greater yellowlegs	*Tringa melanoleuca*					1		1	0	Flyover Singing/Calling	Probable			S3B, S4M	
bb2019-35	27-Jun-19	HKB	Yes	greater yellowlegs	*Tringa melanoleuca*					1		1	0	Calling	Probable			S3B, S4M	
bb2019-36	27-Jun-19	HKB	Yes	common yellowthroat	*Geothlypis trichas*	1						1	0	Singing	Possible			S5B,S5M	
bb2019-36	27-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*			1				0	1	Singing	Possible			S5B,S5M	
bb2019-36	27-Jun-19	HKB	Yes	ruby-crowned kinglet	*Regulus calendula*			1				0	1	Singing	Possible			S5B,S5M	
bb2019-36	27-Jun-19	HKB	Yes	black-and-white warbler	*Mniotilta varia*			1				0	1	Singing	Possible			S5B,S5M	
bb2019-36	27-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-36	27-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-36	27-Jun-19	HKB	Yes	white-winged crossbill	*Loxia leucoptera*	5						5	0	Flyover Singing/Calling	Possible			S5	
bb2019-18	27-Jun-19	HKB	Yes	black-and-white warbler	*Mniotilta varia*	1						1	0	Visual	Possible			S5B,S5M	
bb2019-18	27-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*			1				0	1	Singing	Possible			S5B,S5M	
bb2019-18	27-Jun-19	HKB	Yes	Swainson's thrush	*Catharus ustulatus*		1					1	0	Calling	Possible			S5B,S5M	

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
bb2019-18	27-Jun-19	HKB	Yes	hermit thrush	*Catharus guttatus*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-18	27-Jun-19	HKB	Yes	palm warbler	*Setophaga palmarum*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-18	27-Jun-19	HKB	Yes	ruby-crowned kinglet	*Regulus calendula*				1			1	0	Singing	Possible			S5B,S5M	
bb2019-41	27-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*	1						1	0	Singing	Possible			S5B,S5M	
bb2019-41	27-Jun-19	HKB	Yes	greater yellowlegs	*Tringa melanoleuca*		2					2	0	Visual and Singing/Calling	Probable			S3B, S4M	
bb2019-41	27-Jun-19	HKB	Yes	hermit thrush	*Catharus guttatus*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-41	27-Jun-19	HKB	Yes	black-and-white warbler	*Mniotilta varia*	1						1	0	Visual and Singing/Calling	Possible			S5B,S5M	
bb2019-41	27-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
bb2019-41	27-Jun-19	HKB	Yes	hermit thrush	*Catharus guttatus*					1		1	0	Singing	Possible			S5B,S5M	
bb2019-41	27-Jun-19	HKB	Yes	blackpoll warbler	*Setophaga striata*					1		1	0	Singing	Possible			S5B,S5M	
2011-374-rpt2019	28-Jun-19	HKB	Yes	magnolia warbler	*Setophaga magnolia*		1					1	0	Singing	Possible			S4B,SUM	
2011-374-rpt2019	28-Jun-19	HKB	Yes	northern waterthrush	*Parkesia noveboracensis*		1					1	0	Singing	Possible			S5B,S5M	
2011-374-rpt2019	28-Jun-19	HKB	Yes	mourning warbler	*Geothlypis philadelphia*		1					1	0	Singing	Possible			S4B,SUM	
2011-374-rpt2019	28-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
2011-374-rpt2019	28-Jun-19	HKB	Yes	ruby-crowned kinglet	*Regulus calendula*		1					1	0	Singing	Possible			S5B,S5M	
2011-374-rpt2019	28-Jun-19	HKB	Yes	American redstart	*Setophaga ruticilla*		1					1	0	Singing	Possible			S5B,S5M	
2011-374-rpt2019	28-Jun-19	HKB	Yes	Swainson's thrush	*Catharus ustulatus*		1					1	0	Singing	Possible			S5B,S5M	
2011-374-rpt2019	28-Jun-19	HKB	Yes	hermit thrush	*Catharus guttatus*		1					1	0	Singing	Possible			S5B,S5M	
2011-374-rpt2019	28-Jun-19	HKB	Yes	black-capped chickadee	*Poecile atricapillus*	1						1	0	Singing	Possible			S5	
2011-374-rpt2019	28-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*			1				0	1	Singing	Possible			S5B,S5M	
2011-374-rpt2019	28-Jun-19	HKB	Yes	fox sparrow	*Passerella iliaca*				1			1	0	Singing	Possible			S5B,S5M	

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
2011-374-rpt2019	28-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*					1		1	0	Calling	Possible			S5B,S5M	
2011-372-2019rpt	28-Jun-19	HKB	Yes	black-throated green warbler	*Setophaga virens*	1						1	0	Singing	Possible			S5B,S5M	
2011-372-2019rpt	28-Jun-19	HKB	Yes	mourning warbler	*Geothlypis philadelphia*		1					1	0	Singing	Possible			S4B,SUM	
2011-372-2019rpt	28-Jun-19	HKB	Yes	Swainson's thrush	*Catharus ustulatus*		1					1	0	Singing	Possible			S5B,S5M	
2011-372-2019rpt	28-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1					1	0	Singing	Possible			S5B,S5M	
2011-372-2019rpt	28-Jun-19	HKB	Yes	American robin	*Turdus migratorius*		1					1	0	Calling	Confirmed			S5B,S5M	
2011-372-2019rpt	28-Jun-19	HKB	Yes	dark-eyed junco	*Junco hyemalis*		1					1	0	Singing	Confirmed			S5	
2011-372-2019rpt	28-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*			1				0	1	Singing	Possible			S5B,S5M	
2011-372-2019rpt	28-Jun-19	HKB	Yes	northern waterthrush	*Parkesia noveboracensis*			1				0	1	Singing	Possible			S5B,S5M	
2011-372-2019rpt	28-Jun-19	HKB	Yes	American robin	*Turdus migratorius*				1			1	0	Carrying Food	Confirmed			S5B,S5M	
11bb363-2019rpt	28-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*	1						1	0	Singing	Possible			S5B,S5M	
11bb363-2019rpt	28-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1					1	0	Singing	Possible			S5B,S5M	
11bb363-2019rpt	28-Jun-19	HKB	Yes	black-throated green warbler	*Setophaga virens*	1						1	0	Singing	Possible			S5B,S5M	
11bb363-2019rpt	28-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
11bb363-2019rpt	28-Jun-19	HKB	Yes	olive-sided flycatcher	*Contopus cooperi*		1					1	0	Singing	Possible	Schedule 1, Threatened	Special Concern	S3B,SUM	Threatened
11bb363-2019rpt	28-Jun-19	HKB	Yes	northern waterthrush	*Parkesia noveboracensis*		1					1	0	Singing	Possible			S5B,S5M	
11bb363-2019rpt	28-Jun-19	HKB	Yes	Swainson's thrush	*Catharus ustulatus*		1					1	0	Singing	Possible			S5B,S5M	
11bb363-2019rpt	28-Jun-19	HKB	Yes	magnolia warbler	*Setophaga magnolia*		1					1	0	Singing	Possible			S4B,SUM	
11bb363-2019rpt	28-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
11bb363-2019rpt	28-Jun-19	HKB	Yes	American robin	*Turdus migratorius*		1					1	0	Calling	Confirmed			S5B,S5M	
11bb363-2019rpt	28-Jun-19	HKB	Yes	mourning warbler	*Geothlypis philadelphia*		1					1	0	Singing	Possible			S4B,SUM	

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
11bb363-2019rpt	28-Jun-19	HKB	Yes	magnolia warbler	*Setophaga magnolia*		1					1	0	Singing	Possible			S4B,SUM	
11bb363-2019rpt	28-Jun-19	HKB	Yes	common raven	*Corvus corax*			2				0	2	Calling	Confirmed			S5	
11bb363-2019rpt	28-Jun-19	HKB	Yes	fox sparrow	*Passerella iliaca*		1					1	0	Singing	Possible			S5B,S5M	
11bb363-2019rpt	28-Jun-19	HKB	Yes	ruby-crowned kinglet	*Regulus calendula*					1		1	0	Singing	Possible			S5B,S5M	
bb2011-hs1-2019rpt	28-Jun-19	HKB	Yes	olive-sided flycatcher	*Contopus cooperi*		1					1	0	Singing	Possible	Schedule 1, Threatened	Special Concern	S3B,SUM	Threatened
bb2011-hs1-2019rpt	28-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
bb2011-hs1-2019rpt	28-Jun-19	HKB	Yes	northern waterthrush	*Parkesia noveboracensis*	1						1	0	Singing	Possible			S5B,S5M	
bb2011-hs1-2019rpt	28-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
bb2011-hs1-2019rpt	28-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
bb2011-hs1-2019rpt	28-Jun-19	HKB	Yes	Swainson's thrush	*Catharus ustulatus*		1					1	0	Singing	Possible			S5B,S5M	
bb2011-hs1-2019rpt	28-Jun-19	HKB	Yes	ruby-crowned kinglet	*Regulus calendula*	1						1	0	Singing	Possible			S5B,S5M	
bb2011-hs1-2019rpt	28-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1					1	0	Singing	Possible			S5B,S5M	
bb2011-hs1-2019rpt	28-Jun-19	HKB	Yes	magnolia warbler	*Setophaga magnolia*	1						1	0	Singing	Possible			S4B,SUM	
bb2011-hs1-2019rpt	28-Jun-19	HKB	Yes	black-backed woodpecker	*Picoides arcticus*				1			1	0	Carrying Food	Confirmed			S4	
bb2011-hs1-2019rpt	28-Jun-19	HKB	Yes	olive-sided flycatcher	*Contopus cooperi*						1	0	1	Singing	Possible	Schedule 1, Threatened	Special Concern	S3B,SUM	Threatened
bb2011-hs1-2019rpt	28-Jun-19	HKB	Yes	magnolia warbler	*Setophaga magnolia*					1		1	0	Singing	Possible			S4B,SUM	
11bb-371-2019rpt	28-Jun-19	HKB	Yes	mourning warbler	*Geothlypis philadelphia*	1						1	0	Singing	Possible			S4B,SUM	

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
11bb-371-2019rpt	28-Jun-19	HKB	Yes	American redstart	*Setophaga ruticilla*		1					1	0	Singing	Possible			S5B,S5M	
11bb-371-2019rpt	28-Jun-19	HKB	Yes	northern waterthrush	*Parkesia noveboracensis*		1					1	0	Singing	Possible			S5B,S5M	
11bb-371-2019rpt	28-Jun-19	HKB	Yes	Swainson's thrush	*Catharus ustulatus*		1					1	0	Singing	Possible			S5B,S5M	
11bb-371-2019rpt	28-Jun-19	HKB	Yes	black-and-white warbler	*Mniotilta varia*		1					1	0	Singing	Possible			S5B,S5M	
11bb-371-2019rpt	28-Jun-19	HKB	Yes	black-throated green warbler	*Setophaga virens*		1					1	0	Singing	Possible			S5B,S5M	
11bb-371-2019rpt	28-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
11bb-371-2019rpt	28-Jun-19	HKB	Yes	downy woodpecker	*Dryobates pubescens*		1					1	0	Calling	Possible			S4	
11bb-371-2019rpt	28-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*	1						1	0	Singing	Possible			S5B,S5M	
11bb-371-2019rpt	28-Jun-19	HKB	Yes	downy woodpecker	*Dryobates pubescens*	1						1	0	Flyover Singing/Calling	Possible			S4	
11bb-371-2019rpt	28-Jun-19	HKB	Yes	magnolia warbler	*Setophaga magnolia*				1			1	0	Visual and Singing/Calling	Possible			S4B,SUM	
11bb-371-2019rpt	28-Jun-19	HKB	Yes	American robin	*Turdus migratorius*				1			1	0	Carrying Food	Confirmed			S5B,S5M	
11bb-365-2019rpt	28-Jun-19	HKB	Yes	white-winged crossbill	*Loxia leucoptera*	1						1	0	Visual and Singing/Calling	Possible			S5	
11bb-365-2019rpt	28-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1					1	0	Singing	Possible			S5B,S5M	
11bb-365-2019rpt	28-Jun-19	HKB	Yes	northern waterthrush	*Parkesia noveboracensis*			1				0	1	Singing	Possible			S5B,S5M	
11bb-365-2019rpt	28-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
11bb-365-2019rpt	28-Jun-19	HKB	Yes	fox sparrow	*Passerella iliaca*		1					1	0	Singing	Possible			S5B,S5M	
11bb-365-2019rpt	28-Jun-19	HKB	Yes	Swainson's thrush	*Catharus ustulatus*		1					1	0	Singing	Possible			S5B,S5M	
11bb-365-2019rpt	28-Jun-19	HKB	Yes	ruby-crowned kinglet	*Regulus calendula*		1					1	0	Singing	Possible			S5B,S5M	
11bb-365-2019rpt	28-Jun-19	HKB	Yes	common loon	*Gavia immer*		1					1	0	Flyover Singing/Calling	Observed		Not at Risk	S5B, S4N	
11bb-361-2019rpt	28-Jun-19	HKB	Yes	hermit thrush	*Catharus guttatus*	1						1	0	Singing	Possible			S5B, S5M	
11bb-361-2019rpt	28-Jun-19	HKB	Yes	ruby-crowned kinglet	*Regulus calendula*	1						1	0	Singing	Possible			S5B,S5M	

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
11bb-361-2019rpt	28-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1					1	0	Singing	Possible			S5B,S5M	
11bb-361-2019rpt	28-Jun-19	HKB	Yes	northern waterthrush	*Parkesia noveboracensis*		1					1	0	Singing	Possible			S5B,S5M	
11bb-361-2019rpt	28-Jun-19	HKB	Yes	Wilson's snipe	*Gallinago delicata*			1				0	1	Singing	Possible			S5B,S5M	
11bb-361-2019rpt	28-Jun-19	HKB	Yes	fox sparrow	*Passerella iliaca*		1					1	0	Singing	Possible			S5B,S5M	
11bb-361-2019rpt	28-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*			1				0	1	Singing	Possible			S5B,S5M	
11bb-361-2019rpt	28-Jun-19	HKB	Yes	hairy woodpecker	*Leuconotopicus villosus*					1		1	0	Calling	Observed			S4	
11bb-361-2019rpt	28-Jun-19	HKB	Yes	white-winged crossbill	*Loxia leucoptera*				2			2	0	Flyover Singing/Calling	Possible			S5	
11bb-361-2019rpt	28-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*					1		1	0	Singing	Possible			S5B,S5M	
11bb-361-2019rpt	28-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*					1		1	0	Singing	Possible			S5B,S5M	
11bb-359-2019rpt	28-Jun-19	HKB	Yes	dark-eyed junco	*Junco hyemalis*		1					1	0	Carrying Food	Confirmed			S5	
11bb-359-2019rpt	28-Jun-19	HKB	Yes	fox sparrow	*Passerella iliaca*		1					1	0	Singing	Possible			S5B,S5M	
11bb-359-2019rpt	28-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1					1	0	Singing	Possible			S5B,S5M	
11bb-359-2019rpt	28-Jun-19	HKB	Yes	American robin	*Turdus migratorius*		1					1	0	Singing	Confirmed			S5B,S5M	
11bb-359-2019rpt	28-Jun-19	HKB	Yes	northern waterthrush	*Parkesia noveboracensis*		1					1	0	Singing	Possible			S5B,S5M	
11bb-359-2019rpt	28-Jun-19	HKB	Yes	ruby-crowned kinglet	*Regulus calendula*		1					1	0	Singing	Possible			S5B,S5M	
11bb-359-2019rpt	28-Jun-19	HKB	Yes	black-throated green warbler	*Setophaga virens*					1		1	0	Singing	Possible			S5B,S5M	
11bb-359-2019rpt	28-Jun-19	HKB	Yes	mourning warbler	*Geothlypis philadelphia*					1		1	0	Singing	Possible			S4B,SUM	
11bb-362-2019rpt	28-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
11bb-362-2019rpt	28-Jun-19	HKB	Yes	magnolia warbler	*Setophaga magnolia*	1						1	0	Singing	Possible			S4B,SUM	
11bb-362-2019rpt	28-Jun-19	HKB	Yes	black-throated green warbler	*Setophaga virens*		1					1	0	Singing	Possible			S5B,S5M	
11bb-362-2019rpt	28-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*		1					1	0	Singing	Possible			S5B,S5M	

Table B.4 Breeding Bird Survey Results

Point Count ID	Survey Date	Surveyor	Suitable Weather Conditions	Common Name	Scientific Name	0 - 50 m first 5 minutes	50 - 100 first 5 minutes	100 m plus first 5 minutes	0 - 50 m second 5 minutes	50 - 100 second 5 minutes	100 m plus second 5 minutes	Total Observed (0-100)	Total Observed Incidentally (+100)	Breeding Evidence	Species Highest Breeding Status	SARA	COSEWIC	AC CDC (2015)	NL ESA
11bb-362-2019rpt	28-Jun-19	HKB	Yes	Swainson's thrush	*Catharus ustulatus*		1					1	0	Singing	Possible			S5B,S5M	
11bb-362-2019rpt	28-Jun-19	HKB	Yes	black-and-white warbler	*Mniotilta varia*		1					1	0	Singing	Possible			S5B,S5M	
11bb-362-2019rpt	28-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*						1	0	1	Singing	Possible			S5B,S5M	
11bb-362-2019rpt	28-Jun-19	HKB	Yes	pine siskin	*Spinus pinus*				1			1	0	Flyover Singing/Calling	Possible			S4S5	
11bb-366-2019rpt	28-Jun-19	HKB	Yes	downy woodpecker	*Dryobates pubescens*		1					1	0	Singing	Possible			S4	
11bb-366-2019rpt	28-Jun-19	HKB	Yes	white-throated sparrow	*Zonotrichia albicollis*		1					1	0	Singing	Possible			S5B,S5M	
11bb-366-2019rpt	28-Jun-19	HKB	Yes	American robin	*Turdus migratorius*		1					1	0	Calling	Confirmed			S5B,S5M	
11bb-366-2019rpt	28-Jun-19	HKB	Yes	ruby-crowned kinglet	*Regulus calendula*		1					1	0	Singing	Possible			S5B,S5M	
11bb-366-2019rpt	28-Jun-19	HKB	Yes	mourning warbler	*Geothlypis philadelphia*	1						1	0	Singing	Possible			S4B,SUM	
11bb-366-2019rpt	28-Jun-19	HKB	Yes	yellow-bellied flycatcher	*Empidonax flaviventris*					1		1	0	Calling	Possible			S5B,S5M	

ATTACHMENT 7-I

Vegetation Baseline Study (2019)

Valentine Gold Project: 2019 Vegetation Baseline Study

Results of the 2019 Rare Plant Survey

Final Report

December 19. 2019

Prepared for:

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Executive Summary

Stantec Consulting Ltd. conducted a rare plant survey (RPS) in 2019 at the Valentine Gold Project Site (Project site) located in central Newfoundland. This survey emphasized identifying and verifying at-risk vascular plants, and built upon previous work completed in the area, including an Ecological Land Classification (ELC) in 2015 and an RPS in 2017.

Rare plant species are native species that exist in low numbers or in very restricted areas, in Canada and / or Newfoundland and Labrador. Species at Risk (SAR) are those species listed as *extirpated*, *endangered*, *threatened*, *vulnerable,* or *special concern* under the Newfoundland and Labrador *Endangered Species Act* (NL ESA), the federal *Species at Risk Act* (SARA), or by the Status of Endangered Wildlife Species in Canada (COSEWIC). Most species listed under NL ESA or SARA are protected by these acts and their regulations. Species of Conservation Concern (SOCC) are those species considered rare by the Species Status Advisory Committee (SSAC) or ranked S1 through S2 by the Atlantic Canada Conservation Data Centre (AC CDC), but not listed under NL ESA or SARA.

The 2017 RPS was completed in areas where mine infrastructure and features (e.g., pit locations, waste rock disposal areas, tailings management facility) were proposed to be situated. Between completion of the 2017 survey and 2019, the locations of some of the mine infrastructure changed. The 2019 surveys focused on locations where mine infrastructure had been relocated, which had not previously been surveyed. The survey, which was conducted between June 25 and 29, 2019, covered approximately 51 linear km, or 25.5 ha (based on 5 m-wide transect). During the survey, 176 vascular plants were observed, including 29 species that were not previously recorded in 2017 or 2015 surveys. The total number of vascular plant species observed during all three surveys is 290. Of the species observed in 2019, none are SAR or SOCC. Several uncommon species, ranked S3, were observed, and one species, common water-primrose, was observed, which is outside of its distribution in official records (AC CDC 2015; USDA no date; VASCAN 2019).

The majority of the Project site is not considered to have high potential for rare vascular plant species due to habitat type, tree species composition, stand age and/or microclimatic conditions.

Abbreviations

AC CDC	Atlantic Canada Conservation Data Centre
Marathon	Marathon Gold Corporation
ANPC	Alberta Native Plant Council
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
NLFLR	Newfoundland and Labrador Department of Fisheries and Land Resources
ELC	ecological land classification
FNA	Flora of North America
GIS	geographic information system
GPS	global positioning system
NL	Newfoundland and Labrador
NL ESA	Newfoundland and Labrador *Endangered Species Act*
RPS	Rare Plant Survey
SAR	Species at Risk
SARA	*Species at Risk Act*
S-rank	Sub-national (provincial) rarity ranking for a species
SOCC	Species of Conservation Concern
SSAC	Species Status Advisory Committee
VASCAN	Database of Canadian Vascular Plants

Glossary

Classification	A taxonomic activity involving the aggregation of samples into a logical framework.
Ecosystem	An integrated association of living and non-living resources functioning within a defined physical location. A community of organisms and its environment functioning as an ecological unit. For the purposes of assessment, the ecosystem must be defined according to a particular unit and scale.
Element Occurrences	An area of land and / or water where a species or ecological community is or was present and has practical conservation value. Element occurrences for species commonly reflect populations or subpopulations.
Floristic	As in flora, it is a subdomain of botany and biogeography that studies distribution and relationships of plant species over geographic areas.
Mesic	A moderate soil moisture regime value whereby water is removed somewhat slowly in relation to supply; neither wet nor dry. Available soil water reflects climatic inputs.
S-rank	Sub-national (provincial) rarity ranking for a species.

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by Marathon Gold Corporation (Marathon) to conduct a number of environmental surveys at the Valentine Gold Project Site (the Project), including rare plant surveys (RPSs) (i.e., botanical surveys), with emphasis on the identification and verification of at-risk vascular plant species. The results of the baseline surveys will be used to support the environmental assessment (EA) of the Project.

At the time of this study (summer 2019), Marathon's Valentine Gold Project includes four near-surface, mainly pit-shell constrained, gold deposits: Marathon Deposit, Leprechaun Deposit, Sprite Deposit, and Victory Deposit (Figure 1.1). Additional gold-mineralized zones have been identified immediately to the southwest of the Leprechaun deposit (J. Frank zone) and approximately 1 km northeast of the Victory deposit. The overall site includes a gold system approximately 20 km long, covering an area of 240 km^2. The Project is located in central Newfoundland, approximately 57 km south of Buchans.

The 2019 RPS builds on previous work conducted in support of the Valentine Gold Project: an Ecological Land Classification (ELC) was completed for the area in 2015 (Stantec 2015) and an RPS was conducted in 2017 (Stantec 2017) to characterize the existing natural environments at the Valentine Gold site in support of mine development.

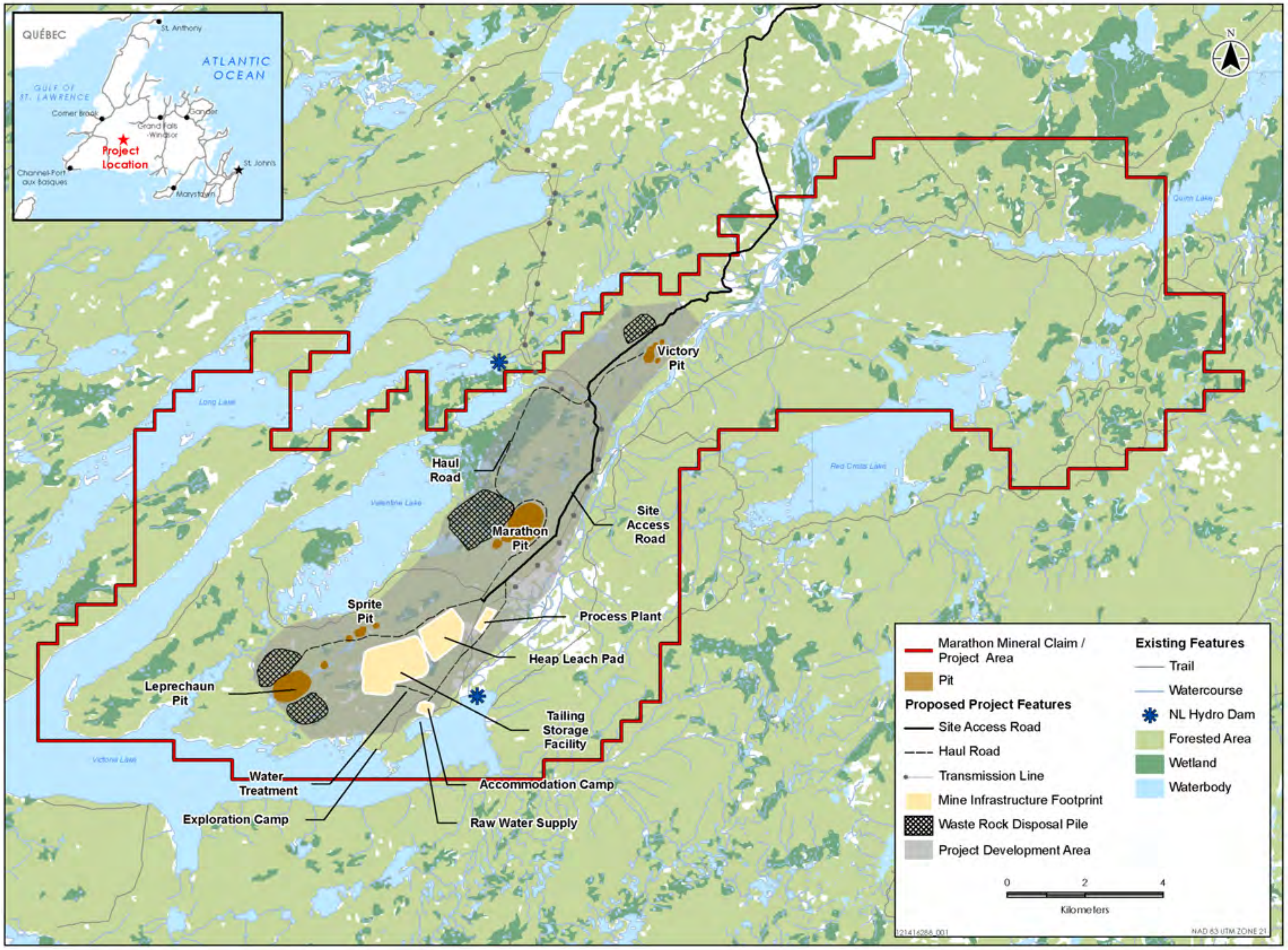

Figure 1.1 Valentine Gold Project Site Plan

2.0 RARE PLANTS BACKGROUND AND REGULATORY CONTEXT

2.1 PROJECT OBJECTIVES

The RPS program is intended to determine, quantify, and present information on key aspects of the environment (e.g., rare vascular plant taxa). Objectives of the RPS program are to:

- Establish the floristic diversity and develop a list of vascular plant species for the Project Area
- Determine whether provincially rare species of vascular plants, as determined by the Atlantic Canada Conservation Data Center (AC CDC), are present in the Project Area
- Provide information on the location (spatial distribution), population size, and habitat of rare vascular plant taxa occurring within the Project Area
- Provide information to Marathon for consideration in Project planning

2.2 OVERVIEW OF RARE PLANTS

A species is rare because it has relatively few individuals, it is uncommon or scarce, or it occurs within a limited geographical range. The rarity of a species may also be a matter of scale, meaning that a species may not be rare in Canada, but may be considered "regionally rare" in a respective province or territory. The rarest species are those with small geographic ranges, few occurrences, and few individuals in each occurrence.

Although an understanding of rare plant species and their protection is important for a variety of reasons, the protection of the rarest species is also a legal requirement for species listed under Schedule 1 of the federal *Species at Risk Act* (SARA) and the Newfoundland and Labrador *Endangered Species Act* (NL ESA). There are presently several plant species designated or listed under the federal and provincial legislation in Newfoundland and Labrador.

In the context of the Valentine Gold Project, a rare plant species is generally defined as a native species that, because of its biological characteristics, or because it occurs at the periphery of its range, or for some other reason, exists in low numbers or in very restricted areas, in Canada and / or Newfoundland and Labrador. The terms Species at Risk (SAR) and Species of Conservation Concern (SOCC) are used in this report when discussing rare vascular plants and are defined in the following sections.

2.2.1 Species at Risk

In Canada and in Newfoundland and Labrador, SAR include those plant species listed as *extirpated*, *endangered*, *threatened*, *vulnerable,* or *special concern* under the NL ESA, SARA, or by the Status of Endangered Wildlife Species in Canada (COSEWIC).

2.2.2 Species of Conservation Concern

For this RPS program, SOCC include those plant species:

- recommended for listing by the Species Status Advisory Committee (SSAC) as *endangered*, *threatened*, *vulnerable*, or *special concern* but not yet listed under NL ESA or SARA
- considered provincially rare, i.e., those species with provincial status ranks (S-ranks), of S1 (*critically imperiled*), S2 (*imperiled*)[1], or combinations thereof (e.g., S1S2) upon review by the Atlantic Canada Conservation Data Centre (AC CDC 2019)

Unlike some SAR, SOCC are not protected by federal or provincial legislation. Rather, they are included as a precautionary measure, reflecting observations and trends in their provincial population status. SOCC may be important indicators of ecosystem health and regional biodiversity, thus their presence in an area may warrant mitigation, given their rarity or importance. They are also often indicators of the presence of unusual and / or sensitive habitat, and their protection as umbrella species could possibly result in protection on their associated unusual habitats and co-existing species.

A summary of the ranking systems outlined by SARA, COSEWIC, NL ESA, and AC CDC are provided in Appendix A.

2.3 REGULATION

2.3.1 Federal

The status of plant species is assessed and designated by COSEWIC, which then recommends a designation for legal protection by being officially listed under Schedule 1 of SARA. One of the key considerations under SARA for protection of listed SAR is protection of the species' habitat.

SARA is one part of a three-part Government of Canada strategy for the protection of plant SAR, and applies to *extirpated*, *endangered*, or *threatened* species listed as being at risk and their critical habitat. SARA-listed species designated as *special concern* are not protected by the prohibitions of Sections 32-36 of SARA; however; it is required that provincial or regional management plans be developed to protect the species. The other two parts of this strategy include commitments under the Accord for the Protection of Species at Risk and activities under the Habitat Stewardship Program for SAR, which protect SAR on federal land.

There are three main prohibitions in SARA relevant to *extirpated*, *endangered* or *threatened* plant SAR and their critical habitat:

- Section 32, which prohibits killing, harming, or taking SAR
- Section 33, which prohibits damage or destruction of residences of SAR
- Subsection 58(1), which prohibits destruction of critical habitat of SAR

[1] While *S3* species may be of concern from a provincial biodiversity perspective, they are often not included, as their populations are considered less sensitive. This determination is typically at the discretion of the Newfoundland and Labrador Department of Fisheries and Land Resources (NLFLR) – Wildlife Division.

Definitions of COSEWIC and SARA species status categories are summarized in Appendix A.

2.3.2 Provincial

In addition to SARA, each province and territory has a regulatory body that determines what species are rare in each of their respective jurisdictions. In Newfoundland and Labrador, vascular plant SAR are protected under the NL ESA. Designation under the Act follows the recommendations of the Species Status Advisory Committee (SSAC) on the appropriate assessment of a species and referring concerns about the status of species to COSEWIC, where the species is of national importance.

The purpose of NL ESA is to:

- Prevent listed species from being extirpated from Newfoundland and Labrador
- Provide for the recovery of species listed as *extirpated*, *endangered*, or *threatened* as a result of human activity
- Conserve species listed as special concern to prevent them from becoming *endangered* or *threatened*

Prohibitions of NL ESA include Section 16, which states "a person shall not disturb, harass, injure, or kill an individual of a species designated as *threatened*, *endangered* or *extirpated*". Species are listed under the *Endangered Species List Regulations.*

3.0 METHODS

3.1 PRE-SURVEY PLANNING

Project planning and initial survey design included: defining the objectives and the purpose of the work; conducting a review of prior vegetation and ecosystem classification studies performed within the Project Area and / or the region (Stantec 2015; Stantec 2017); and developing a field sampling plan and appropriate survey intensity. The field sampling plan was created by overlaying the current Project footprint with previously surveyed areas to identify spatial gaps in surveyed areas.

3.2 FIELD SURVEYS

3.2.1 Survey Standards

Standardized guidelines for rare plant surveys have not been adopted on a national scale; however, several provinces and associated regulating agencies do follow guidelines from within their respective regions. For the purposes of this RPS, focused field surveys were conducted in accordance with the standardized guidelines issued by the Alberta Native Plant Council (ANPC) (ANPC 2012 Update). Requirements for a thorough RPS include:

- The RPS must be floristic in nature
- It must provide reasonable geographic coverage of the survey area, including:
  - Sampling of representative plant communities or habitat types
  - All unique or uncommon plant associations
  - All features or biotic patterns with high probability of supporting rare plants

- Surveys must be conducted during the appropriate season. Timing surveys to occur during periods when potential rare species are most visible (when diagnostic features are most identifiable), and when the probability of encountering both cool and warm season perennials is highest. Surveys will not target a single species, but rather aim to identify most rare species and rare plant communities in the area
- Revisit an adequate number of sites where rare plant element occurrences have been previously recorded

Although surveys can confirm the presence of rare plant species on a site, negative results do not guarantee that rare plant species are absent. For practical purposes, surveys that adhere to the aforementioned ANPC 2012 Update guidelines should provide reasonable evidence that the specified plant taxa do not occur in the survey area.

3.2.1.1 Study Team

Experienced professionals were responsible for the design, logistical planning, and data collection of this RPS program. Plant verification, data analysis, and interpretation was performed by qualified professionals (i.e., biologists / botanists) with knowledge and experience in these areas. The members of the study team are provided in Table 3.1.

Table 3.1 Study Team – Rare Plant Survey

Role	Personnel
Project Manager	Barry Wicks, B.Sc.
Project Scientist	Michael Crowell, M.Sc.
Quality / Independent Review	Michael Crowell, M.Sc.
	Greg Johnson, M.Sc.
Data Analysis and Report Preparation	Krystal Mathieson, M.Sc.
	Heather Button, B.Sc.
Information Management / GIS	Megan Blackwood, B.Sc., Dip. GIS

3.2.2 Survey Methods

The field survey plan for the 2019 RPS repeated the plan developed for the 2017 surveys, which was created in consultation with Marathon and the Newfoundland and Labrador Department of Fisheries and Land Resources (NLFLR) – Wildlife Division (C. Hanel, Provincial Botanist, pers comm., May 2017). The level of confidence in locating rare plants is considered a function of the time spent searching, plus appropriate season in which to conduct a survey. On this basis, the RPS allowed for a single site visit based on the phenology (timing of germination, flowering, maturity) of those rare plants with the potential of being encountered, and thus enabling botanists to investigate vascular plant species during the primary flowering season for a majority of species expected.

A survey of key habitats was completed from June 25 to 29, 2019, and a list of observed plant taxa complied. Surveys focused on the planned locations of Leprechaun Pit and northern associated waste rock disposal pile, the Heap Leach Pad, the Tailing Storage Facility, the Marathon Pit and associated waste rock disposal pile, and the Victory Pit and associated waste rock disposal pile (Figure 1.1). Plant taxa were recorded using an ArcGIS Collector-based data collection tool developed by Stantec and a Bluetooth-paired submeter GPS. All encountered species were recorded once, and all encounters of rare plants (i.e., SAR or SOCC) were recorded. In accordance with the ANPC 2012 Update, field surveys were floristic in nature and completed through random meander searches (Figure 2.1) of the Project Area, with surveyors walking transects through each of the plant communities / habitat types identified. Plants that could not be identified in the field were collected for later identification using floristic identification keys and dissecting scopes, as necessary.

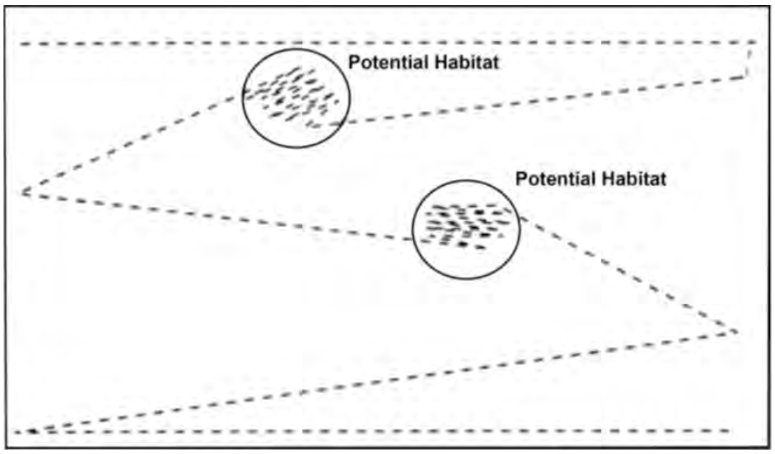

Figure 2.1 Illustration of Floristic Habitat Sampling Method

Floristic habitat sampling involves a survey of identified natural plant community types, with the greatest search effort applied to those areas (i.e., microhabitats) having the highest potential to support rare vascular plant species. This method was used to account for different areas (or strata) that are identified within a larger habitat polygon. Individual plant associations or plant communities were rarely uniform throughout their extent, and there were often smaller, identifiable areas within a habitat that were substantially different from that of the larger habitat polygon. These strata were inclusions within the larger habitat matrix; as such, they were sampled separately from the main body of the habitat type. If sufficient biodiversity information was available on the habitat requirements of potentially occurring species (plant community, substrate), and portions of the survey location were believed to be potentially suitable for those species, the stratified sample technique was used to document and validate the assumptions regarding species presence or absence (no detection) within the Project Area.

It should be noted that techniques to identify rare plants targeting habitat types or specific plant communities are often only effective for those species that have well-defined habitat requirements, and/or that prefer distinctive and mappable habitat types. Species typically found in small patches or microsites nested within wider ranging habitats (e.g., fresh meadow areas within expanses of mesic scrub woodland), or for generalist species often require broader based surveys of commonly occurring plant communities.

No permits were required in the delivery of this RPS program.

4.0 RESULTS

The survey effort for the 2019 RPS resulted in approximately 51 linear km, or 25.5 ha surveyed (based on 5 m-wide transect) (Figure 4.1). The areas surveyed during 2017 RPS are also presented in Figure 4.1.

The 2019 RPS, in conjunction with vegetation data collected during the 2017 RPS and 2015 ELC survey work, resulted in a list of 290 vascular plant species found in the Project Area. In 2019, 176 vascular plants were observed during surveys, including 29 species that were not previously recorded in 2017 or 2015 surveys. The full list of species observed in 2019 is provided in Table B.1, Appendix B. The list of species observed in 2015 and 2017 surveys are provided in Table B.2, Appendix B.

Of the species observed in 2019, none are SAR or SOCC. Several vascular plants ranked S3 were observed, including russet cotton-grass (*Eriophorum russeolum*), little yellow-rattle (*Rhinanthus minor*), twin-stemmed bladderwort (*Utricularia geminiscapa*), and northern yellow-eyed-grass (*Xyris montana*). While S3 species are of concern from a provincial biodiversity perspective, they are often not included because their populations are considered less sensitive. This determination is typically at the discretion of NLFLR – Wildlife Division, and their exclusion here is consistent with the approach taken in the 2017 RPS (Stantec 2017).

In addition to these species, common water-primrose (*Ludwigia palustris*) was identified within the Project Area (Figure 4.1). The province of Newfoundland and Labrador is not considered part of this species' distribution in official records (AC CDC 2015; USDA no date; VASCAN 2019), however, it was unofficially identified on the island of Newfoundland in 2012 (iNaturalist no date). Although this species does not have an assigned S-rank in Newfoundland and Labrador, it is typically common throughout its range, and there are no limiting factors or other reasons to suspect it will be rare once it becomes established in Newfoundland.

The majority of the Project Area is not considered to have high potential for rare vascular plant species due to habitat type, tree species composition, stand age and/or microclimatic conditions. Coniferous trees strongly dominate forest cover throughout the Central Newfoundland Forest ecoregion, with much of that habitat consisting of combination of regenerating clear cuts and homogenous forest stands of various ages and structural composition. Although coniferous forests are important to the Central Newfoundland Forest ecoregion at the landscape level, previous experience and professional knowledge of this type of habitat indicate that it does not generally support habitat for rare plants within the Project Area.

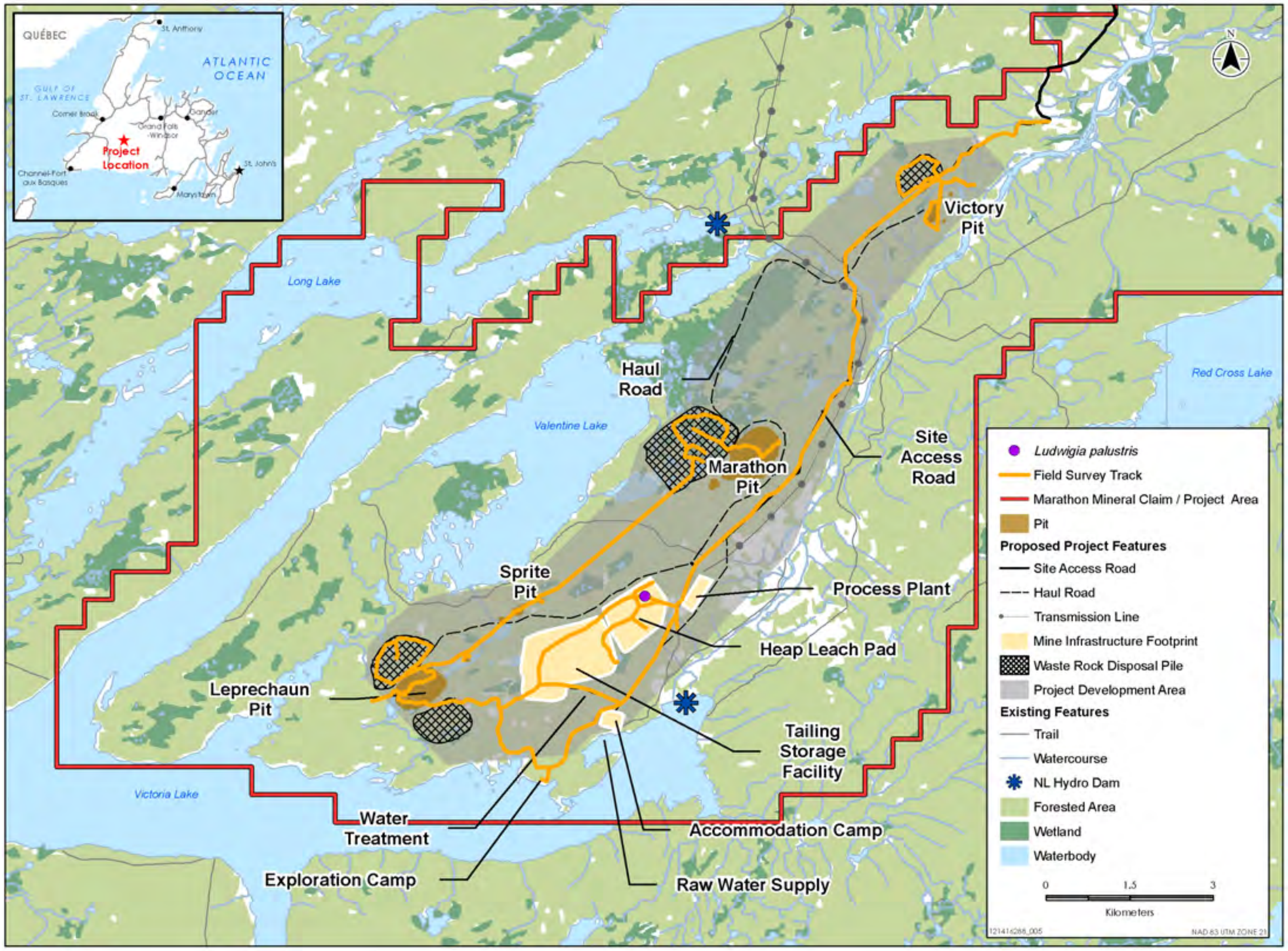

Figure 4.1 Rare Plant Survey Search Effort

5.0 SUMMARY

This report provides the results of the 2019 RPS that was conducted in portions of Valentine Gold Project site. Botanical surveys were conducted in late June 2019, and documented the presence of vascular plants, focusing on rare plant SAR and SOCC. This survey builds on previous work conducted in support of the Project: an Ecological Land Classification program in 2015 (Stantec 2015) and an RPS in 2017 (Stantec 2017).

During the 2019 surveys, 176 vascular plants were observed, none of which are SAR or SOCC.

The Valentine Gold site is not generally considered to have high potential for rare vascular plants.

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APPENDIX A

Explanation of National and Provincial Species at Risk and General Status Ranking

A.1 COMMITTEE ON THE STATUS OF ENDANGERED WILDLIFE IN CANADA AND *SPECIES AT RISK ACT* WILDLIFE SPECIES STATUS CATEGORIES

COSEWIC and SARA wildlife species status categories are described in Table 5.1.

Table A.1 Committee on the Status of Endangered Wildlife in Canada and *Species at Risk Act* Species Status Category Descriptions

Status Category	Description*
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species that no longer exists in the wild in Canada, but exists elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.
Special Concern (SC)	A wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)	A category that applies when the available information is insufficient (a) to resolve a wildlife species' eligibility for assessment or (b) to permit an assessment of the wildlife species' risk of extinction.

COSEWIC 2016. Excerpt from https://www.canada.ca/en/environment-climate-change/services/committee-status-endangered-wildlife/wildlife-species-status-categories-definition.html

A.2 DESIGNATIONS UNDER THE NEWFOUNDLAND AND LABRADOR *ENDANGERED SPECIES ACT*

Species assessment and listings under the Newfoundland and Labrador *Endangered Species Act* (NL *ESA*) are coordinated by the Wildlife Division of the Newfoundland and Labrador Fisheries and Land Resources Department. Designations under the NL *ESA* are described in Table 5.2.

Table A.2 Newfoundland and Labrador *Endangered Species Act* Designations and Descriptions

Designation	Description*
Extinct	A wildlife species that no longer exists.
Extirpate	A wildlife species that no longer exists in the wild, but exists elsewhere.
Endangered	A wildlife species facing imminent extirpation or extinction.
Threatened	A wildlife species that is likely to become endangered if nothing is done to reverse the factors limiting its survival.
Vulnerable	A wildlife species that has characteristics which make it particularly sensitive to human activities or natural events, or restricted habitat or food requirements that are themselves under threat.
Data Deficient (DD)	A category that applies when all sources of available information have been investigated but the information in the status report is insufficient to determine risk of extinction based on distribution and/or population status.
Not at Risk (NAR)	Generally applied to widespread and abundant taxa.

NLFLR 2019. Excerpt from https://www.flr.gov.nl.ca/wildlife/endangeredspecies/Designations.pdf

A.3 ATLANTIC CANADA CONSERVATION DATA CENTRE RANKINGS

The AC CDC status ranks (S-rank) for the Island of Newfoundland were used to assess the rankings for vascular plant species. Definitions of the AC CDC rankings are provided in Table 5.3.

Table A.3 Definitions of the Atlantic Canada Conservation Data Centre S-Ranks

Provincial Ranking (S-rank)	Definition
SX	Presumed Extirpated - Species or community is believed to be extirpated from the province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
S1	Critically Imperiled - Critically imperiled in the province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the province.
S2	Imperiled - Imperiled in the province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or province.
S3	Vulnerable - Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4	Apparently Secure - Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5	Secure - Common, widespread, and abundant in the province.
SNR	Unranked - Provincial conservation status not yet assessed.

Table A.3 Definitions of the Atlantic Canada Conservation Data Centre S-Ranks

Provincial Ranking (S-rank)	Definition
SU	Unrankable - Possibly in peril, but status is uncertain - more information is needed
SNA	Not Applicable - A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
S#/S#	Range Rank - A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4)
SH	Possibly Extirpated (Historical)—Species or community occurred historically in the province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become SH without such a 20-40 year delay if the only known occurrences in a province were destroyed or if it had been extensively and unsuccessfully looked for. The SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences.
Not Provided	Species is not known to occur in the province.

AC CDC 2019. Excerpt from http://accdc.com/en/rank-definitions.html

APPENDIX A

Scientific and Common Names of Observed Plant Species in the Project Area

Table B.4 Vascular Plant Species Observed in the Valentine Gold Project Area in 2019

Family	Scientific Name	Common Name	Conservation Status Rank (S-rank)
TREES			
Betulaceae	*Betula papyrifera*	paper birch	S5
Pinaceae	*Abies balsamea*	balsam fir	S5
Pinaceae	*Larix laricina*	American larch	S5
Pinaceae	*Picea glauca*	white spruce	S5
Pinaceae	*Picea mariana*	black spruce	S5
SHRUBS			
Adoxaceae	*Sambucus racemosa*	red elderberry	S4
Adoxaceae	*Viburnum cassinoides*	witherod viburnum	S5
Adoxaceae	*Viburnum edule*	squashberry	S5
Aquifoliaceae	*Ilex mucronata*	mountain holly	S5
Betulaceae	*Alnus incana*	speckled alder	S5
Betulaceae	*Betula cordifolia*	heartleaf birch	S4S5
Betulaceae	*Betula michauxii*	Newfoundland dwarf birch	S5
Betulaceae	*Betula pumila*	swamp birch	S5
Caprifoliaceae	*Linnaea borealis*	twinflower	S5
Caprifoliaceae	*Lonicera villosa*	mountain fly-honeysuckle	S5
Cupressaceae	*Juniperus communis*	ground juniper	S5
Cupressaceae	*Juniperus horizontalis*	creeping juniper	S5
Empetraceae	*Empetrum nigrum*	black crowberry	S5
Ericaceae	*Andromeda polifolia*	bog rosemary	S5
Ericaceae	*Chamaedaphne calyculata*	leatherleaf	S5
Ericaceae	*Epigaea repens*	trailing arbutus	S3S4
Ericaceae	*Gaultheria hispidula*	creeping snowberry	S5
Ericaceae	*Kalmia angustifolia*	sheep-laurel	S5
Ericaceae	*Kalmia polifolia*	pale laurel	S5
Ericaceae	*Rhododendron canadense*	rhodora	S5
Ericaceae	*Rhododendron groenlandicum*	Labrador tea	S5
Ericaceae	*Vaccinium angustifolium*	late lowbush blueberry	S5
Ericaceae	*Vaccinium boreale*	northern blueberry	S4S5

Table B.4 Vascular Plant Species Observed in the Valentine Gold Project Area in 2019

Family	Scientific Name	Common Name	Conservation Status Rank (S-rank)
Ericaceae	*Vaccinium oxycoccos*	small cranberry	S5
Ericaceae	*Vaccinium vitis-idaea*	mountain cranberry	S5
Grossulariaceae	*Ribes glandulosum*	skunk currant	S5
Rhamnaceae	*Rhamnus alnifolia*	alderleaf buckthorn	S5
Rosaceae	*Amelanchier bartramiana*	bartram shadbush	S5
Rosaceae	*Amelanchier interior*	shadbush	SU
Rosaceae	*Aronia melanocarpa*	black chokeberry	S2S4
Rosaceae	*Dasiphora fruticosa*	golden-hardhack	S4S5
Rosaceae	*Rosa nitida*	shining rose	S4S5
Rosaceae	*Rubus idaeus*	red raspberry	S5
Rosaceae	*Sorbus decora*	northern mountain-ash	S5
Salicaceae	*Salix discolor*	pussy willow	S5
Taxaceae	*Taxus canadensis*	Canadian yew	S3S4
FORBS			
Asteraceae	*Achillea millefolium*	common yarrow	SNA
Asteraceae	*Anaphalis margaritacea*	pearly everlasting	S5
Asteraceae	*Cirsium muticum*	swamp thistle	S5
Asteraceae	*Eurybia radula*	rough-leaved aster	S5
Asteraceae	*Euthamia graminifolia*	flat-top fragrant-golden-rod	S5
Asteraceae	*Leontodon autumnalis*	autumn hawkbit	SNA
Asteraceae	*Matricaria discoidea*	pineapple-weed chamomile	SNA
Asteraceae	*Nabalus trifoliolatus*	three-leaved rattlesnake-root	S5
Asteraceae	*Oclemena nemoralis*	bog aster	S5
Asteraceae	*Packera aurea*	golden groundsel	S3S4
Asteraceae	*Petasites frigidus*	arctic butter-bur	S3S4
Asteraceae	*Pilosella caespitosa*	meadow hawkweed	SNA
Asteraceae	*Solidago macrophylla*	large-leaf goldenrod	S5
Asteraceae	*Solidago rugosa*	rough-leaf goldenrod	S5
Asteraceae	*Solidago uliginosa*	bog goldenrod	S5
Asteraceae	*Symphyotrichum novi-belgii*	New Belgium American-aster	S5
Asteraceae	*Symphyotrichum puniceum*	swamp aster	S5

Table B.4 Vascular Plant Species Observed in the Valentine Gold Project Area in 2019

Family	Scientific Name	Common Name	Conservation Status Rank (S-rank)
Asteraceae	*Taraxacum officinale*	common dandelion	SNA
Asteraceae	*Tussilago farfara*	colt's-foot	SNA
Campanulaceae	*Lobelia dortmanna*	water lobelia	S5
Caryophyllaceae	*Cerastium fontanum*	common mouse-ear chickweed	SNA
Cornaceae	*Cornus canadensis*	dwarf dogwood	S5
Cornaceae	*Cornus stolonifera*	red osier dogwood	S5
Dennstaedtiaceae	*Pteridium aquilinum*	bracken	S4S5
Droseraceae	*Drosera intermedia*	spoon-leaved sundew	S4S5
Droseraceae	*Drosera rotundifolia*	roundleaf sundew	S5
Dryopteridaceae	*Athyrium filix-femina*	lady-fern	S5
Dryopteridaceae	*Dryopteris campyloptera*	mountain wood-fern	S5
Dryopteridaceae	*Dryopteris carthusiana*	spinulose shield fern	S4
Dryopteridaceae	*Dryopteris intermedia*	glandular wood fern	S5
Dryopteridaceae	*Gymnocarpium dryopteris*	northern oak fern	S5
Dryopteridaceae	*Onoclea sensibilis*	sensitive fern	S4S5
Equisetaceae	*Equisetum arvense*	field horsetail	S5
Equisetaceae	*Equisetum fluviatile*	water horsetail	S4
Equisetaceae	*Equisetum sylvaticum*	woodland horsetail	S5
Eriocaulaceae	*Eriocaulon aquaticum*	seven-angled pipewort	S5
Fabaceae	*Trifolium arvense*	rabbit-foot clover	SNA
Iridaceae	*Iris versicolor*	blueflag	S5
Juncaginaceae	*Triglochin palustris*	slender bog arrow-grass	S4S5
Lentibulariaceae	*Utricularia geminiscapa*	twin-stemmed bladderwort	S3
Lentibulariaceae	*Utricularia intermedia*	flatleaf bladderwort	S5
Liliaceae	*Clintonia borealis*	Clinton lily	S5
Liliaceae	*Maianthemum trifolium*	three-leaf Solomon's-plume	S5
Liliaceae	*Streptopus amplexifolius*	clasping twisted-stalk	S5
Lycopodiaceae	*Diphasiastrum sitchense*	tufted groundceder	S3S4
Lycopodiaceae	*Lycopodiella inundata*	bog clubmoss	S5
Lycopodiaceae	*Lycopodium annotinum*	stiff clubmoss	S5
Menyanthaceae	*Menyanthes trifoliata*	bog buckbean	S5

Table B.4 Vascular Plant Species Observed in the Valentine Gold Project Area in 2019

Family	Scientific Name	Common Name	Conservation Status Rank (S-rank)
Monotropaceae	*Monotropa uniflora*	Indian-pipe	S5
Myricaceae	*Myrica gale*	sweet bayberry	S5
Nymphaeaceae	*Nuphar variegata*	yellow cowlily	S5
Onagraceae	*Chamerion angustifolium*	fireweed	S5
Onagraceae	*Circaea alpina*	small enchanter's nightshade	S5
Onagraceae	*Epilobium ciliatum*	hairy willow-herb	S5
Onagraceae	*Epilobium palustre*	marsh willow-herb	S5
Onagraceae	*Ludwigia palustris*	common water-primrose	Not Provided
Orchidaceae	*Arethusa bulbosa*	swamp-pink	S4S5
Orchidaceae	*Corallorhiza trifida*	early coralroot	S4
Orchidaceae	*Neottia cordata*	heart-leaved twayblade	S5
Orobanchaceae	*Rhinanthus minor*	little yellow-rattle	S3
Osmundaceae	*Osmundastrum cinnamomeum*	cinnamon fern	S5
Plantaginaceae	*Callitriche sp.*	a water starwort	-
Plantaginaceae	*Hippuris vulgaris*	common mare's-tail	S4S5
Plantaginaceae	*Plantago major*	nipple-seed plantain	SNA
Polygonaceae	*Rumex acetosella*	sheep sorrel	SNA
Polygonaceae	*Rumex obtusifolius*	bitter dock	SNA
Potamogetonaceae	*Potamogeton natans*	floating pondweed	S4
Primulaceae	*Primula mistassinica*	bird's-eye primrose	S4
Primulaceae	*Trientalis borealis*	northern starflower	S5
Pyrolaceae	*Orthilia secunda*	one-side wintergreen	S5
Ranunculaceae	*Coptis trifolia*	goldthread	S5
Ranunculaceae	*Ranunculus acris*	tall butter-cup	SNA
Ranunculaceae	*Ranunculus repens*	creeping butter-cup	SNA
Ranunculaceae	*Thalictrum alpinum*	alpine meadow-rue	S5
Ranunculaceae	*Thalictrum pubescens*	tall meadow-rue	S5
Rosaceae	*Fragaria virginiana*	Virginia strawberry	S5
Rosaceae	*Geum macrophyllum*	large-leaved avens	S4S5
Rosaceae	*Geum rivale*	purple avens	S4S5

Table B.4 Vascular Plant Species Observed in the Valentine Gold Project Area in 2019

Family	Scientific Name	Common Name	Conservation Status Rank (S-rank)
Rosaceae	*Rubus arcticus ssp. acaulis*	arctic bramble	S3S4
Rosaceae	*Rubus chamaemorus*	cloudberry	S5
Rosaceae	*Rubus pubescens*	dwarf red raspberry	S5
Rosaceae	*Sanguisorba canadensis*	Canada burnet	S5
Rubiaceae	*Galium triflorum*	sweet-scent bedstraw	S5
Ruscaceae	*Maianthemum canadense*	wild lily-of-the-valley	S5
Sarraceniaceae	*Sarracenia purpurea*	northern pitcher-plant	S5
Saxifragaceae	*Mitella nuda*	naked bishop's-cap	S5
Scrophulariaceae	*Veronica serpyllifolia*	thyme-leaved speedwell	S3S4
Thelypteridaceae	*Phegopteris connectilis*	northern beech fern	S5
Typhaceae	*Sparganium angustifolium*	narrow-leaf burreed	S5
Typhaceae	*Sparganium sp.*	a burreed	-
Typhaceae	*Typha latifolia*	broad-leaf cattail	SNA
Violaceae	*Viola cucullata*	marsh blue violet	S4S5
Violaceae	*Viola labradorica*	Labrador violet	S4S5
Violaceae	*Viola macloskeyi*	smooth white violet	S5
Xyridaceae	*Xyris montana*	northern yellow-eyed-grass	S3
GRAMINOIDS			
Cyperaceae	*Carex aquatilis*	water sedge	S4S5
Cyperaceae	*Carex buxbaumii*	Buxbaum's sedge	S4S5
Cyperaceae	*Carex canescens*	hoary sedge	S5
Cyperaceae	*Carex exilis*	coast sedge	S5
Cyperaceae	*Carex gynocrates*	northern bog sedge	S3S4
Cyperaceae	*Carex lasiocarpa*	slender sedge	S5
Cyperaceae	*Carex leptalea*	bristly-stalk sedge	S4S5
Cyperaceae	*Carex leptonervia*	finely-nerved sedge	S4S5
Cyperaceae	*Carex limosa*	mud sedge	S5
Cyperaceae	*Carex livida*	livid sedge	S5
Cyperaceae	*Carex magellanica*	a sedge	S5
Cyperaceae	*Carex michauxiana*	Michaux sedge	S4S5
Cyperaceae	*Carex nigra*	black sedge	S5

Table B.4 Vascular Plant Species Observed in the Valentine Gold Project Area in 2019

Family	Scientific Name	Common Name	Conservation Status Rank (S-rank)
Cyperaceae	*Carex rostrata*	beaked sedge	S3S4
Cyperaceae	*Carex stipata*	stalk-grain sedge	S4S5
Cyperaceae	*Carex trisperma*	three-seed sedge	S5
Cyperaceae	*Carex utriculata*	bear sedge	S4S5
Cyperaceae	*Carex vaginata*	sheathed sedge	S3S4
Cyperaceae	*Eriophorum angustifolium*	narrow-leaved cotton-grass	S4S5
Cyperaceae	*Eriophorum russeolum*	russet cotton-grass	S3
Cyperaceae	*Eriophorum vaginatum*	tussock cotton-grass	S5
Cyperaceae	*Scirpus cyperinus*	cottongrass bulrush	S3S4
Cyperaceae	*Scirpus microcarpus*	small-fruit bulrush	S4S5
Cyperaceae	*Trichophorum alpinum*	alpine cotton-grass	S4S5
Cyperaceae	*Trichophorum cespitosum*	deergrass	S5
Juncaceae	*Juncus brevicaudatus*	narrow-panicled rush	S5
Juncaceae	*Juncus canadensis*	Canada rush	S4S5
Juncaceae	*Juncus effusus*	soft rush	S5
Juncaceae	*Juncus tenuis*	slender rush	S4
Poaceae	*Agrostis capillaris*	colonial bentgrass	SNA
Poaceae	*Agrostis gigantea*	black bentgrass	SNA
Poaceae	*Calamagrostis canadensis*	blue-joint reedgrass	S5
Poaceae	*Calamagrostis pickeringii*	Pickering's reed bent-grass	S5
Poaceae	*Danthonia spicata*	poverty oat-grass	S5
Poaceae	*Festuca rubra ssp. rubra*	red fescue	SNA
Poaceae	*Glyceria canadensis*	Canada manna-grass	S5
Poaceae	*Glyceria striata*	fowl manna-grass	S5
Poaceae	*Muhlenbergia glomerata*	marsh muhly	S3S4
Poaceae	*Phleum pratense*	meadow timothy	SNA
Poaceae	*Poa pratensis ssp. pratensis*	Kentucky bluegrass	SNA

Table B.5 Vascular Plant Species Previously Observed within the Valentine Gold Project Area (2017 RPS or 2015 ELC)

Family	Scientific Name	Common Name	Conservation Status Rank (S-rank)	Survey (2017 RPS / 2015 ELC)	
TREES					
Aceraceae	*Acer rubrum*	Red Maple	S5	RPS	ELC
Betulaceae	*Betula papyrifera*	Paper Birch	S5	RPS	ELC
Pinaceae	*Abies balsamea*	Balsam Fir	S5	RPS	ELC
Pinaceae	*Larix laricina*	Tamarack	S5	RPS	ELC
Pinaceae	*Picea glauca*	White Spruce	S5	RPS	ELC
Pinaceae	*Picea mariana*	Black Spruce	S5	RPS	ELC
SHRUBS					
Aquifoliaceae	*Ilex mucronata*	Mountain Holly	S5	RPS	ELC
Adoxaceae	*Viburnum cassinoides*	witherod viburnum	S5	RPS	ELC
Adoxaceae	*Viburnum trilobum*	Highbush Cranberry	S5	RPS	ELC
Adoxaceae	*Sambucus racemosa*	Red Elderberry	S4	RPS	ELC
Adoxaceae	*Sambucus sp.*	Elderberry	-	RPS	
Betulaceae	*Alnus incana*	Speckled Alder	S5	RPS	ELC
Betulaceae	*Alnus alnobetula ssp. crispa*	Mountain Alder	S5	RPS	ELC
Betulaceae	*Betula cordifolia*	Heartleaf Birch	S4S5	RPS	
Betulaceae	*Betula michauxii*	Michaux's Dwarf Birch	S5	RPS	ELC
Betulaceae	*Betula pumila*	Bog Birch	S5	RPS	ELC
Caprifoliaceae	*Linnaea borealis*	Twinflower	S5	RPS	ELC
Caprifoliaceae	*Lonicera villosa*	Mountain Fly-Honeysuckle	S5	RPS	ELC
Cornaceae	*Cornus sericea*	Silky Dogwood	S5	RPS	ELC
Cupressaceae	*Juniperus communis var. depressa*	Ground Juniper	S4S5	RPS	ELC
Cupressaceae	*Juniperus horizontalis*	Creeping Juniper	S5	RPS	ELC
Empetraceae	*Empetrum atropurpurea*	Purple Crowberry	S3S4	RPS	
Empetraceae	*Empetrum eamesii*	Rock Crowberry	S4		ELC
Empetraceae	*Empetrum nigrum*	Black Crowberry	S5	RPS	ELC
Ericaceae	*Andromeda polifolia*	Glaucous-leaf Bog Rosemary	S5	RPS	ELC

Table B.5 Vascular Plant Species Previously Observed within the Valentine Gold Project Area (2017 RPS or 2015 ELC)

Family	Scientific Name	Common Name	Conservation Status Rank (S-rank)	Survey (2017 RPS / 2015 ELC)	
Ericaceae	*Chamaedaphne calyculata*	Leatherleaf	S5	RPS	ELC
Ericaceae	*Epigaea repens*	Trailing Arbutus	S3S4	RPS	ELC
Ericaceae	*Gaultheria hispidula*	Creeping Snowberry	S5	RPS	ELC
Ericaceae	*Kalmia angustifolia*	Sheep-Laurel	S5	RPS	ELC
Ericaceae	*Kalmia polifolia*	Bog Laurel	S5	RPS	ELC
Ericaceae	*Moneses uniflora*	Oneflower Wintergreen	S5	RPS	
Ericaceae	*Pyrola chlorantha*	Greenflowered Wintergreen	S3S4	RPS	
Ericaceae	*Pyrola minor*	Greenflowered Wintergreen	S4	RPS	
Ericaceae	*Rhododendron groenlandicum*	Labrador Tea	S5	RPS	ELC
Ericaceae	*Rhododendron canadense*	Rhodora	S5	RPS	ELC
Ericaceae	*Vaccinium angustifolium*	Late Lowbush Blueberry	S5	RPS	ELC
Ericaceae	*Vaccinium boreale*	Northern Blueberry	S4S5	RPS	ELC
Ericaceae	*Vaccinium macrocarpon*	Large Cranberry	S5	RPS	ELC
Ericaceae	*Vaccinium oxycoccos*	Small Cranberry	S5		ELC
Ericaceae	*Vaccinium uliginosum*	Bog Bilberry	S5	RPS	ELC
Ericaceae	*Vaccinium vitis-idaea*	Partridgeberry	S5	RPS	ELC
Grossulariaceae	*Ribes glandulosum*	Skunk Currant	S5	RPS	ELC
Grossulariaceae	*Ribes hirtellum*	Smooth Gooseberry	S3S4	RPS	
Grossulariaceae	*Ribes lacustre*	Bristly Black Currant	S4	RPS	ELC
Rhamnaceae	*Rhamnus alnifolia*	Alderleaf Buckthorn	S5	RPS	ELC
Rosaceae	*Amelanchier bartramiana*	Bartram's Chuckleypear	S5	RPS	ELC
Rosaceae	*Dasiphora fruticosa*	Shrubby Cinquefoil	S4S5	RPS	ELC
Rosaceae	*Photinia sp.*	Chokeberry	-		
Rosaceae	*Prunus pensylvanica*	Fire Cherry	S4S5	RPS	ELC
Rosaceae	*Rosa nitida*	Shining Rose	S4S5	RPS	ELC
Rosaceae	*Rubus idaeus*	Red Raspberry	S5	RPS	ELC

Table B.5 Vascular Plant Species Previously Observed within the Valentine Gold Project Area (2017 RPS or 2015 ELC)

Family	Scientific Name	Common Name	Conservation Status Rank (S-rank)	Survey (2017 RPS / 2015 ELC)	
Rosaceae	*Sorbus americana*	American Mountain-Ash	S4S5	RPS	ELC
Rosaceae	*Sorbus decora*	Showy Mountain-Ash	S5	RPS	ELC
Rosaceae	*Spiraea alba*	Narrow-Leaved Meadow-Sweet	S3S5		ELC
Rosaceae	*Spiraea latifolia*	Broadleaf Meadow-Sweet	S3S5		ELC
Sapindaceae	*Acer spicatum*	Mountain Maple	S5	RPS	ELC
Taxaceae	*Taxus canadensis*	Canada Yew	S3S4	RPS	ELC
FORBS					
Apiaceae	*Conioselinum chinense*	Hemlock Parsley	S5	RPS	ELC
Apiaceae	*Heracleum maximum*	Cow Parsnip	S5	RPS	ELC
Araliaceae	*Aralia hispida*	Bristly Sarsaparilla	S4S5		ELC
Araliaceae	*Aralia nudicaulis*	Wild Sarsaparilla	S5	RPS	ELC
Asteraceae	*Achillea millefolium*	Common Yarrow	SNA	RPS	
Asteraceae	*Anaphalis margaritacea*	Pearly Everlasting	S5	RPS	ELC
Asteraceae	*Aster sp.*	unknown aster	-	RPS	ELC
Asteraceae	*Cirsium muticum*	Swamp Thistle	S5	RPS	ELC
Asteraceae	*Doellingeria umbellata*	Parasol White-Top	S5		ELC
Asteraceae	*Eurybia radula*	Rough-Leaved Aster	S5	RPS	ELC
Asteraceae	*Euthamia graminifolia*	Flat-Top Fragrant-Golden-Rod	S5	RPS	ELC
Asteraceae	*Eutrochium maculatum*	Spotted Joe-Pye Weed	S4S5	RPS	ELC
Asteraceae	*Leucanthemum vulgare*	Oxeye Daisy	SNA	RPS	
Asteraceae	*Matricaria discoidea*	Pineappleweed	SNA	RPS	
Asteraceae	*Oclemena nemoralis*	Bog Aster	S5	RPS	ELC
Asteraceae	*Packera aurea*	Golden Ragwort	S3S4	RPS	ELC
Asteraceae	*Packera paupercula*	Balsam Groundsel	S4	RPS	ELC
Asteraceae	*Petasites frigidus* var. *palmatus*	Palmate Sweet Coltsfoot	S3S4	RPS	
Asteraceae	*Nabalus trifoliolatus*	Three-Leaved Rattlesnake-root	S5		ELC

Table B.5 Vascular Plant Species Previously Observed within the Valentine Gold Project Area (2017 RPS or 2015 ELC)

Family	Scientific Name	Common Name	Conservation Status Rank (S-rank)	Survey (2017 RPS / 2015 ELC)	
Asteraceae	*Solidago macrophylla*	Large-Leaf Goldenrod	S5	RPS	
Asteraceae	*Solidago rugosa*	Rough-Leaf Goldenrod	S5		ELC
Asteraceae	*Solidago uliginosa*	Bog Goldenrod	S5		ELC
Asteraceae	*Symphyotrichum novi-belgii*	New York Aster	S5	RPS	
Asteraceae	*Symphyotrichum puniceum*	Purplestem Aster	S5	RPS	ELC
Asteraceae	*Taraxacum officinale*	Common Dandelion	SNA	RPS	ELC
Asteraceae	*Tussilago farfara*	Coltsoot	SNA	RPS	
Boraginaceae	*Myosotis laxa*	Small Forget-Me-Not	S4	RPS	ELC
Callitrichaceae	*Callitriche palustris*	Vernal Water-starwort	S4S5	RPS	
Campanulaceae	*Lobelia dortmanna*	Water Lobelia	S5	RPS	
Caryophyllaceae	*Cerastium arvense*	Field Chickweed	S4S5	RPS	
Caryophyllaceae	*Cerastium fontanum*	Chickweed	SNA	RPS	
Caryophyllaceae	*Sagina procumbens*	Procumbent Pearlwort	SNA	RPS	
Caryophyllaceae	*Spergularia canadensis*	Northern Sandspurry	S5	RPS	
Caryophyllaceae	*Spergularia rubra*	Red Sandspurry	SNA	RPS	
Caryophyllaceae	*Stellaria graminea*	Lesser Stitchwort	SNA	RPS	
Chenopodiaceae	*Chenopodium album*	Lamb's Quarters	SNA	RPS	
Clusiaceae	*Triadenum fraseri*	Marsh St. John's-Wort	S5	RPS	ELC
Cornaceae	*Cornus canadensis*	Bunchberry	S5	RPS	ELC
Cornaceae	*Cornus stolonifera*	Red Osier Dogwood	S5	RPS	ELC
Cornaceae	*Cornus suecica*	Swedish Bunchberry	S5	RPS	ELC
Dennstaedtiaceae	*Pteridium aquilinum* var. *latiusculum*	Bracken Fern	S4S5	RPS	ELC
Droseraceae	*Drosera intermedia*	Spoon-Leaved Sundew	S5	RPS	ELC
Droseraceae	*Drosera rotundifolia*	Roundleaf Sundew	S5	RPS	ELC
Dryopteridaceae	*Athyrium filix-femina*	Lady Fern	S5	RPS	ELC
Dryopteridaceae	*Dryopteris carthusiana*	Spinulose Wood-Fern	S4	RPS	
Dryopteridaceae	*Dryopteris campyloptera*	Mountain Wood-Fern	S5		ELC
Dryopteridaceae	*Dryopteris intermedia*	Evergreen woodfern	S5	RPS	ELC

Table B.5 Vascular Plant Species Previously Observed within the Valentine Gold Project Area (2017 RPS or 2015 ELC)

Family	Scientific Name	Common Name	Conservation Status Rank (S-rank)	Survey (2017 RPS / 2015 ELC)	
Dryopteridaceae	*Gymnocarpium dryopteris*	Northern Oak Fern	S5	RPS	ELC
Dryopteridaceae	*Matteucia struthiopteris*	Ostrich Fern	S3S4		ELC
Dryopteridaceae	*Onoclea sensibilis*	Sensitive Fern	S4S5	RPS	ELC
Equisetaceae	*Equisetum arvense*	Field Horsetail	S5	RPS	ELC
Equisetaceae	*Equisetum fluviatile*	Water Horsetail	S4	RPS	ELC
Equisetaceae	*Equisetum palustre*	Marsh Horsetail	S3S4	RPS	
Equisetaceae	*Equisetum sylvaticum*	Woodland Horsetail	S5	RPS	ELC
Eriocaulaceae	*Eriocaulon aquaticum*	Seven-Angled Pipewort	S5	RPS	ELC
Fabaceae	*Melilotus officinalis*	Yellow Sweetclover	SNA	RPS	
Fabaceae	*Trifolium aureum*	Hop Clover	SNA	RPS	ELC
Fabaceae	*Trifolium campestre*	Low Hop Clover	SNA	RPS	
Fabaceae	*Trifolium pratense*	Red Clover	SNA	RPS	
Fabaceae	*Trifolium repens*	White Clover	SNA	RPS	
Hydrocharitaceae	*Najas flexilis*	Nodding Water Nymph	S2	RPS	
Hypericaceae	*Hypericum canadense*	Canada St. John's-wort	S4	RPS	
Iridaceae	*Iris versicolor*	Blueflag	S5	RPS	ELC
Iridaceae	*Sisyrinchium montanum* var. *crebrum*	Darker Mountain blue-eyed Grass	S5	RPS	
Isoetaceae	*Isoetes lacustris*	Lake Quillwort	S3S4	RPS	
Juncaginaceae	*Triglochin palustris*	Marsh Arrowgrass	S4S5	RPS	
Lamiaceae	*Galeopsis tetrahit*	Brittle-Stem Hempnettle	SNA	RPS	ELC
Lamiaceae	*Lycopus uniflorus*	Northern Bugleweed	S5	RPS	ELC
Lamiaceae	*Mentha arvensis*	Corn Mint	S5		ELC
Lamiaceae	*Prunella vulgaris*	Self-Heal	S3S5	RPS	ELC
Lentibulariaceae	*Utricularia cornuta*	Horned Bladderwort	S5	RPS	ELC
Lentibulariaceae	*Utricularia intermedia*	Flatleaf Bladderwort	S5	RPS	ELC
Lentibulariaceae	*Utricularia vulgaris*	Common Bladderwort	S5	RPS	ELC
Liliaceae	*Clintonia borealis*	Yellow clintonia	S5	RPS	ELC
Liliaceae	*Maianthemum trifolium*	Three-Leaf Solomon's-Plume	S5	RPS	ELC

Table B.5 Vascular Plant Species Previously Observed within the Valentine Gold Project Area (2017 RPS or 2015 ELC)

Family	Scientific Name	Common Name	Conservation Status Rank (S-rank)	Survey (2017 RPS / 2015 ELC)	
Liliaceae	*Streptopus amplexifolius*	Claspingleaf Twistedstalk	S5	RPS	
Liliaceae	*Streptopus lanceolatus*	Rose Mandarine	S4	RPS	
Lycopodiaceae	*Diphasiastrum tristachyum*	Blue Groundcedar	S5	RPS	
Lycopodiaceae	*Lycopodiella inundata*	Bog Clubmoss	S5	RPS	ELC
Lycopodiaceae	*Lycopodium annotinum*	Stiff Clubmoss	S5	RPS	ELC
Lycopodiaceae	*Lycopodium dendroideum*	Treelike Clubmoss	S4	RPS	ELC
Menyanthaceae	*Menyanthes trifoliata*	Bog Buckbean	S5	RPS	ELC
Monotropaceae	*Monotropa uniflora*	Indian-Pipe	S5	RPS	ELC
Myricaceae	*Myrica gale*	Sweet Gale	S5	RPS	ELC
Nymphaeaceae	*Nuphar variegata*	Yellow Pondlily	S5	RPS	ELC
Orobanchaceae	*Euphrasia nemorosa*	Common Eyebright	S4S5	RPS	
Orobanchaceae	*Rhinanthus minor* ssp. *groenlandicus*	Arctic Yellow Rattle	S3	RPS	
Orobanchaceae	*Rhinanthus minor* ssp. *minor*	Common Yellow Rattle	SNA	RPS	
Onagraceae	*Chamerion angustifolium*	Fireweed	S5		ELC
Onagraceae	*Circaea alpina*	Small Enchanter's Nightshade	S5	RPS	ELC
Onagraceae	*Epilobium ciliatum*	Hairy Willow-Herb	S5	RPS	ELC
Onagraceae	*Epilobium palustre*	Marsh Willow-Herb	S5	RPS	ELC
Orchidaceae	*Arethusa bulbosa*	Dragon's MoutH	S4S5	RPS	
Orchidaceae	*Calopogon tuberosus*	Tuberous Grasspink	S4S5	RPS	
Orchidaceae	*Corallorhiza trifida*	Early Coralroot	S4	RPS	
Orchidaceae	*Malaxis unifolia*	Green Adder's-Mouth	S3	RPS	ELC
Orchidaceae	*Platanthera aquilonis*	northern green orchid	S4	RPS	
Orchidaceae	*Platanthera clavellata*	Club-Spur Orchid	S5	RPS	ELC
Orchidaceae	*Platanthera dilatata*	Leafy White Orchis	S5	RPS	ELC
Orchidaceae	*Platanthera lacera*	Ragged Fringed Orchid	S3S4	RPS	ELC
Orchidaceae	*Platanthera obtusata*	Bluntleaf Bog Orchid	S4	RPS	ELC

Table B.5 Vascular Plant Species Previously Observed within the Valentine Gold Project Area (2017 RPS or 2015 ELC)

Family	Scientific Name	Common Name	Conservation Status Rank (S-rank)	Survey (2017 RPS / 2015 ELC)	
Orchidaceae	*Pogonia ophioglossoides*	Snakemouth	S4	RPS	ELC
Orchidaceae	*Spiranthes romanzoffiana*	Hooded Ladies'-Tresses	S4S5	RPS	ELC
Osmundaceae	*Osmundastrum cinnamomeum*	Cinnamon Fern	S5	RPS	ELC
Osmundaceae	*Osmunda claytoniana*	Interrupted Fern	S5	RPS	ELC
Osmundaceae	*Osmunda regalis*	Royal Fern	S4		ELC
Plantaginaceae	*Plantago major*	Common Plantain	SNA	RPS	
Polygonaceae	*Polygonum hydropiper*	Marsh pepper Smartweed	SNA		ELC
Polygonaceae	*Rumex acetosa*	Garden Sorrel	SNA		
Polygonaceae	*Rumex acetosella*	Sheep Sorrel	SNA		
Potamogetonaceae	*Potamogeton alpinus*	Alpine Pondweed	S3S4	RPS	ELC
Potamogetonaceae	*Potamogeton natans*	Floatingleaf Pondweed	S4	RPS	
Potamogetonaceae	*Potamogeton oakesianus*	Oake’s Pondweed	S4	RPS	
Primulaceae	*Primula mistassinica*	Mistassini primrose	S4	RPS	
Primulaceae	*Trientalis borealis*	Northern Starflower	S5	RPS	ELC
Pyrolaceae	*Orthilia secunda*	One-Side Wintergreen	S5	RPS	ELC
Ranunculaceae	*Actaea rubra*	Red Baneberry	S5	RPS	
Ranunculaceae	*Coptis trifolia*	Goldthread	S5	RPS	ELC
Ranunculaceae	*Ranunculus acris*	Tall Butter-Cup	SNA	RPS	ELC
Ranunculaceae	*Ranunculus flammula*	Lesser Spearwort	S5	RPS	
Ranunculaceae	*Ranunculus flammula var. reptans*	Creeping Spearwort	S5	RPS	
Ranunculaceae	*Ranunculus repens*	Creeping Butter-Cup	SNA		ELC
Ranunculaceae	*Thalictrum alpinum*	Alpine Meadow-Rue	S4S5	RPS	ELC
Ranunculaceae	*Thalictrum pubescens*	Tall Meadow-Rue	S5	RPS	ELC
Rosaceae	*Fragaria virginiana*	Virginia Strawberry	S5	RPS	ELC
Rosaceae	*Geum macrophyllum*	Large-Leaved Avens	S4S5		ELC
Rosaceae	*Geum rivale*	Purple Avens	S4S5	RPS	
Rosaceae	*Potentilla norvegica*	Rough Cinquefoil	S4S5	RPS	

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Family	Scientific Name	Common Name	Conservation Status Rank (S-rank)	Survey (2017 RPS / 2015 ELC)	
Rosaceae	*Rubus arcticus*	Northern Blackberry	S3		ELC
Rosaceae	*Rubus arcticus ssp. acaulis*	Arctic Bramble	S3	RPS	ELC
Rosaceae	*Rubus chamaemorus*	Cloudberry	S5	RPS	ELC
Rosaceae	*Rubus pubescens*	Dewberry	S5	RPS	ELC
Rosaceae	*Sanguisorba canadensis*	Bottlebrush	S3S5	RPS	ELC
Rubiaceae	*Galium mollugo*	False Baby's Breath	SNA	RPS	
Rubiaceae	*Galium palustre*	Marsh Bedstraw	S4S5	RPS	
Rubiaceae	*Galium triflorum*	Fragrant Bedstraw	S5		
Santalaceae	*Geocaulon lividum*	Northern Comandra	S5	RPS	
Sarraceniaceae	*Sarracenia purpurea*	Northern Pitcher-Plant	S5	RPS	ELC
Saxifragaceae	*Mitella nuda*	Naked Bishop's-Cap	S5	RPS	ELC
Scrophulariaceae	*Chelone glabra*	White Turtlehead	S4	RPS	ELC
Scrophulariaceae	*Veronica americana*	American Speedwell	S4	RPS	ELC
Scrophulariaceae	*Veronica officinalis*	Common Speedwell	SNA	RPS	
Scrophulariaceae	*Veronica serpyllifolia*	Speedwell	S3S4	RPS	
Selaginellaceae	*Selaginella selaginoides*	Low Spike-Moss	S4S5	RPS	ELC
Thelypteridaceae	*Phegopteris connectilis*	Northern Beech Fern	S5	RPS	ELC
Tofieldiaceae	*Tofieldia pusilla*	Scotch False-Asphodel	S4	RPS	ELC
Tofieldiaceae	*Triantha glutinosa*	Sticky Tofieldia	S5	RPS	ELC
Typhaceae	*Sparganium americanum*	American Burreed	S3	RPS	ELC
Typhaceae	*Sparganium natans*	Small Burreed	S2S4	RPS	
Typhaceae	*Typha latifolia*	Broad-leaved cat-tail	SNA	RPS	
Violaceae	*Vicia cracca*	Cow Vetch	SNA	RPS	
Violaceae	*Viola macloskeyi*	Northern White Violet	S5	RPS	
Xyridaceae	*Xyris montana*	Northern Yelloweyed Grass	S3	RPS	

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Family	Scientific Name	Common Name	Conservation Status Rank (S-rank)	Survey (2017 RPS / 2015 ELC)	
GRAMINOIDS					
Cyperaceae	*Carex atlantica*	Atlantic Sedge	Not Provided		ELC
Cyperaceae	*Carex brunnescens*	Brownish Sedge	S5	RPS	ELC
Cyperaceae	*Carex buxbaumii*	Buxbaum's Sedge	S4S5	RPS	ELC
Cyperaceae	*Carex canescens*	Hoary Sedge	S5	RPS	ELC
Cyperaceae	*Carex capillaris*	Hair Sedge	S4	RPS	
Cyperaceae	*Carex castanea*	Chestnut Sedge	S3S4	RPS	
Cyperaceae	*Carex crawfordii*	Crawford's Sedge	S4S5	RPS	
Cyperaceae	*Carex debilis*	White-Edge Sedge	S3S5		ELC
Cyperaceae	*Carex deweyana*	Short-Scale Sedge	S1S2		ELC
Cyperaceae	*Carex disperma*	Softleaf Sedge	S4S5		ELC
Cyperaceae	*Carex echinata*	Little Prickly Sedge	S5	RPS	ELC
Cyperaceae	*Carex exilis*	Coast Sedge	S5	RPS	ELC
Cyperaceae	*Carex flava*	Yellow Sedge	S3S5	RPS	ELC
Cyperaceae	*Carex gynocrates*	Northern Bog Sedge	S3S4	RPS	
Cyperaceae	*Carex interior*	Inland Sedge	S3S4	RPS	ELC
Cyperaceae	*Carex intumescens*	Bladder Sedge	S4S5	RPS	ELC
Cyperaceae	*Carex lasiocarpa*	Slender Sedge	S5	RPS	ELC
Cyperaceae	*Carex leptalea*	Bristlestalk Sedge	S4S5	RPS	ELC
Cyperaceae	*Carex leptonervia*	Nerveless Woodland Sedge	S4S5	RPS	ELC
Cyperaceae	*Carex limosa*	Mud Sedge	S5	RPS	ELC
Cyperaceae	*Carex livida*	Livid Sedge	S5	RPS	
Cyperaceae	*Carex magellanica*	Boreal Bog Sedge	S5	RPS	ELC
Cyperaceae	*Carex michauxiana*	Michaux Sedge	S4S5	RPS	ELC
Cyperaceae	*Carex nigra*	Smooth Black Sedge	S5	RPS	
Cyperaceae	*Carex oligosperma*	Few-Seeded Sedge	S5	RPS	ELC
Cyperaceae	*Carex pauciflora*	Few-Flowered Sedge	S4S5	RPS	ELC
Cyperaceae	*Carex sp.*	a sedge	-		
Cyperaceae	*Carex rostrata*	Beaked Sedge	S3S4	RPS	
Cyperaceae	*Carex saxatilis*	Russet Sedge	S4S5	RPS	

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Family	Scientific Name	Common Name	Conservation Status Rank (S-rank)	Survey (2017 RPS / 2015 ELC)	
Cyperaceae	*Carex scirpoidea*	Scirpus Sedge	S4S5	RPS	
Cyperaceae	*Carex stipata*	Stalk-Grain Sedge	S4S5	RPS	ELC
Cyperaceae	*Carex tenuiflora*	Sparse-Flowered Sedge	S3	RPS	ELC
Cyperaceae	*Carex trisperma*	Threefruit sedge	S5	RPS	ELC
Cyperaceae	*Carex utriculata*	Bottle Sedge	S4S5	RPS	ELC
Cyperaceae	*Carex vaginata*	Sheathed Sedge	S3S4	RPS	
Cyperaceae	*Carex vesicaria*	Little Green Sedge	S4S5	RPS	ELC
Cyperaceae	*Carex viridula*	Inflated Sedge	S4S5	RPS	
Cyperaceae	*Carex wiegandii*	Wiegand's Sedge	S3	RPS	ELC
Cyperaceae	*Eriophorum angustifolium*	Narrow-Leaved Cotton-Grass	S4S5	RPS	ELC
Cyperaceae	*Eriophorum vaginatum*	Tussock Cotton-Grass	S5	RPS	ELC
Cyperaceae	*Eriophorum virginicum*	Tawny Cotton-Grass	S4S5	RPS	ELC
Cyperaceae	*Eriophorum viridi-carinatum*	Green-Keel Cottongrass	S4S5	RPS	ELC
Cyperaceae	*Rhynchospora alba*	White Beakrush	S4S5	RPS	ELC
Cyperaceae	*Schoenoplectus subterminalis*	Water Bulrush	S3S5		ELC
Cyperaceae	*Scirpus atrocinctus*	Black-Girdle Bulrush	S3S5		ELC
Cyperaceae	*Scirpus cyperinus*	Cottongrass Bulrush	S2S3		ELC
Cyperaceae	*Scirpus microcarpus*	Red-Tinged Bulrush	S4S5	RPS	ELC
Cyperaceae	*Trichophorum alpinum*	Alpine Cotton-Grass	S4S5	RPS	ELC
Cyperaceae	*Trichophorum cespitosum*	Deergrass	S5	RPS	ELC
Gramineae	*Anthoxanthum odoratum*	Sweet Vernalgrass	SNA	RPS	ELC
Juncaceae	*Luzula multiflora*	Common Woodrush	S5	RPS	ELC
Juncaceae	*Juncus brevicaudatus*	Short-tail Rush	S5	RPS	ELC
Juncaceae	*Juncus canadensis*	Canada Rush	S4		ELC
Juncaceae	*Juncus effusus*	Soft Rush	S5	RPS	ELC
Juncaceae	*Juncus pelocarpus*	Brown-Fruited Rush	S4		ELC
Juncaceae	*Juncus stygius*	Moor Rush	S3S4	RPS	ELC

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Family	Scientific Name	Common Name	Conservation Status Rank (S-rank)	Survey (2017 RPS / 2015 ELC)	
Juncaceae	*Juncus tenuis*	Slender Rush	S3S4	RPS	
Poaceae	*Agrostis capillaris*	Colonial Bentgrass	SNA	RPS	ELC
Poaceae	*Agrostis gigantea*	Black Bentgrass	SNA	RPS	ELC
Poaceae	*Agrostis perennans*	Perennial Bentgrass	S2		ELC
Poaceae	*Agrostis scabra*	Rough Bentgrass	S5	RPS	ELC
Poaceae	*Bromus ciliatus*	Fringed Brome	S5	RPS	ELC
Poaceae	*Calamagrostis canadensis*	Bluejoint Reedgrass	S5	RPS	ELC
Poaceae	*Calamagrostis pickeringii*	Pickering's Reedgrass	S5	RPS	ELC
Poaceae	*Cinna latifolia*	Wood Reedgrass	S5	RPS	ELC
Poaceae	*Danthonia spicata*	Poverty Oatgrass	S5	RPS	ELC
Poaceae	*Elymus repens*	Quackgrass	SNA	RPS	
Poaceae	*Festuca rubra ssp. rubra*	Red Fescue	SNA	RPS	ELC
Poaceae	*Festuca trachyphylla*	Hard Fescue	SNA	RPS	
Poaceae	*Glyceria canadensis*	Canada Manna-Grass	S5	RPS	ELC
Poaceae	*Glyceria striata*	Fowl Manna-Grass	S5	RPS	ELC
Poaceae	*Muhlenbergia glomerata*	Marsh Muhly	S3S5		ELC
Poaceae	*Muhlenbergia uniflora*	Fall Dropseed Muhly	S3S5		ELC
Poaceae	*Phalaris arundinacea*	Reed Canary Grass	SNA	RPS	
Poaceae	*Phleum pratense*	Common Timothy	SNA	RPS	
Poaceae	*Poa compressa*	Canada Bluegrass	SNA	RPS	
Poaceae	*Poa palustris*	Fowl Bluegrass	SNA	RPS	ELC
Poaceae	*Poa saltuensis*	Forest Bluegrass	S3S4	RPS	ELC
Poaceae	*Schizachne purpurascens*	Purple False Melic	S3	RPS	ELC
Scheuchzeriaceae	*Scheuchzeria palustris*	Pod Grass	S3S4	RPS	ELC