APPENDIX B

2015 Rare Plant Survey and

Habitat Characterization Report

Atlantic Minerals Limited

Lower Cove Quarry Extension

2015 Rare Plant Survey and Habitat Characterization Report
Atlantic Minerals Limited
Lower Cove Quarry Extension

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Report

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2015 RARE PLANT SURVEY AND HABITAT CHARACTERIZATION REPORT
ATLANTIC MINERALS LIMITED
LOWER COVE QUARRY EXTENSION

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Abbreviations

AC CDC	Atlantic Canada Conservation Data Centre
AML	Atlantic Minerals Limited
ANPC	Alberta Native Plant Council
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
ELC	ecological land classification
FNA	Flora of North America
GIS	geographic information system
GPS	global positioning system
NL	Newfoundland and Labrador
NLDEC	Newfoundland and Labrador Department of Environment and Conservation
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.
Alpine	A biogeographic zone made up of slopes above timberline and characterized by the presence of rosette-forming herbaceous plants and slow-growing low shrubby woody plants. An ecological community term for high-elevation plant communities.
Barrens	Barren habitats (also called heathlands) are relatively unproductive, have poorly developed organic soils and are dominated by plants in the *Ericaceae* family. Habitats with <2 percent total vegetation cover and <10 percent cover by tree or shrub species may be defined this way.
Classification	A taxonomic activity involving the aggregation of samples into a logical framework.
Calcicolous	A calcicole, calciphyte, or calciphile is a plant that thrives in lime rich soil.
Chionophilic	A plant or animal capable of surviving a snow cover. Chionophiles belong to the group of snow plants, in which growth processes and photosynthesis occur at temperatures around 0°C in late winter and early spring, when the plants are covered with snow.
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. 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.

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 areas where two patches meet that have different ecological composition. The ecotone contains elements of both bordering communities as well as species which 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.
Element occurrences	An element occurrence is defined as 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.
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. 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.

LFH	Organic layers developed primarily from leaves, twigs, and wood materials with minor components of mosses. The forest floor that accumulates on the mineral soil surface under forest vegetation, and which includes dead vegetation and organic matter, including litter and unincorporated humus.
Lowlands	Areas with ground slopes of less than 0.5 percent and typically poorly drained.
Mapping	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.
MASL	A standard metric measurement in metres of the elevation of a location in reference to historic mean sea level.
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.
Oligotrophic	Surface fed directly and exclusively by precipitation.
Organic Soil	A soil order that have developed primarily on organic deposits. Soils containing high percentages of organic matter (fibric and humic inclusions).
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.
S Rank	Sub-national (provincial) rarity ranking for a species.

Soligenous	Wetness induced by lateral water movement i.e. sideways through the soil or rock, as on seepage slopes. Also, soligenous water or water in contact with mineral soil.
Subgroup	A category in the Canadian system of soil classification. These soils are subdivisions of the great groups, and therefore are defined more specifically.
Tuckamoor	A typical Newfoundland term for the stunted balsam fir and spruce trees that grow and flourish despite harsh conditions in some alpine areas and along the coast.
Uplands	Areas where the soil is not saturated for extended periods as indicated by vegetation and soils.
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.

1.0 INTRODUCTION

Atlantic Minerals Limited (AML) is a wholly owned subsidiary of Newfoundland Cement Company Limited, a Newfoundland based enterprise, which is the parent company of Atlantic Ready Mix, a Division of AML, C.R.M. Ready Mix Limited and Bay St. George Ready Mix Limited. AML has been mining, processing, and exporting chemical grade Calcium Costa Bay Limestone and construction aggregates at the Lower Cove Quarry on the Port au Port Peninsula since 1996. In response to the existing and projected demand for high calcium limestone and dolomite from consumers in North and South America, Europe and Africa, AML is proposing to extend and enhance their existing facilities and operations to encompass portions of the While Hills and Mainland mineral lease areas (Figure 1-1).

1.1 Project Description

The proposed Lower Cove Quarry Extension Project ("the Project") would involve construction and operation of extended quarry operations within AML's current Mineral Exploration License and Mining Lease holdings; in addition to rehabilitation and closure planning of existing mining infrastructure presently in operation. Accordingly, a subsequent review and evaluation of those lands within and adjacent to the proposed AML extension footprint and with the potential to support plant species of interest[1] is required.

Under the *Canadian Environmental Assessment Act, 2012*, the Project is not considered a Designated Project pursuant to Section 15(a) *Regulations Designating Physical Activities.* The Project will require approvals from the Government of Newfoundland and Labrador and is subject to environmental assessment under the *Newfoundland and Labrador Environmental Protection Act* and associated *Environmental Assessment Regulations*. The environmental assessment process was initiated in January 2015 and is in progress. An enhanced Registration is being prepared by AML, which will be submitted for review by government departments, and other interested parties.

This report presents the results of a rare plant survey (RPS) of the Project. Stantec Consulting Limited (Stantec) conducted a botanical survey of the higher elevation areas of AML's While Hills and Mainland mineral claims area to determine the occurrence of vascular plants, with emphasis on the identification of Species at Risk (SAR) and Species of Conservation Concern (SOCC). Field surveys were conducted during the late spring and mid-summer of 2015 over approximately 760 ha of AML's White Hills and Mainland mineral claims area (herein referred to as the Study Area).

[1] "Species of interest" include any species afforded special recognition by federal, and/or provincial departments, agencies (e.g., Newfoundland and Labrador Department of Environment and Conservation [NLDEC]) and/or resource conservation organizations (e.g., Atlantic Canada Conservation Data Centre [AC CDC]).

Figure 1-1 Project Location for the Atlantic Minerals Limited Port au Port Extension Project

1.2 Project Objectives

This RPS report forms one aspect of the Projects environmental study program. The RPS program is intended to provide the primary means to determine, quantify, and present information on key aspects of the environment (i.e., rare vascular plant taxa) and the potential for Project-induced change in the surrounding environment. Where such change occurs, the program enables the evaluation of effects and the identification of appropriate mitigations to Project activities.

Objectives to be met by the RPS program are to:

- Establish the floristic diversity of the Study Area and compare local flora to the regional context
- Provide a list of vascular plant species for the Study Area
- Determine whether provincially rare species of plants, as determined by the Atlantic Canada Conservation Data Center (AC CDC), were present in the area
- Provide information on the location (spatial distribution), population size, and habitat of rare vascular plant taxa occurring within the Study Area
- Prepare a comprehensive geographic information system (GIS) database, including mapping products, that will serve as the basis for understanding ecological relationships with respect to rare plant species diversity and the potential environmental effects of the Project on the natural environment
- Provide feedback to AML for project management decisions requiring modification of proposed development and operational practices where / when necessary

1.3 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 under the federal *Species at Risk Act* (SARA) and the Newfoundland and Labrador *Endangered Species Act* (NL ESA). There are a presently a number of plant species designated or listed under the federal and provincial legislation in Newfoundland and Labrador.

1.3.1 Legislation

1.3.1.1 Federal

The status of plant species is assessed and designated by the Committee on the Status of Endangered Wildlife Species in Canada (COSEWIC), which then recommends a designation for legal protection by being officially listed under 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 all *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; they do require 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

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

1.3.1.2 Provincial

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.

1.3.2 Rare Plants

In the context of the proposed Project, a rare plant species is generally defined as any 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 SAR and SOCC are referred to frequently in this report when discussing rare plants and are defined in the following sections.

1.3.2.1 Species at Risk

In Canada and in Newfoundland and Labrador, SAR include those plant species listed as extirpated, endangered or threatened under the NL ESA (Government of Newfoundland and Labrador 2001), SARA (Government of Canada 2002), or by COSEWIC.

1.3.2.2 Species of Conservation Concern

For the purpose of this assessment, SOCC include SAR as well as those plant species that are:

- recommended for listing by the COSEWIC as *endangered*, *threatened*, or *special concern* (COSEWIC 2015);
- recommended for listing by the SSAC as *endangered*, *threatened*, or *vulnerable*, but not yet listed under NL ESA or SARA;
- listed by AC CDC (2010) as *S1* (critically imperiled), *S2* (imperiled), *S3* (vulnerable)[2], or combinations thereof (e.g., *S1/S2*)[3].

Unlike SAR, SOCC are not afforded protection 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 can confer protection on their associated unusual habitats and co-existing species.

[2] While S3 species are 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 NLDEC 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.

A summary of the ranking systems outlined by the SARA, NL ESA and AC CDC are provided in Appendix A. A complete list of the flora (including common and scientific names) identified in the Rare Plant Study Area is provided in Appendix B.

1.4 Study Team

The Rare Plant Survey was conducted by Stantec. The Study Team included a Task Manager / Lead Project Scientist, Senior / Quality Reviewer(s), Project Scientists, and IM / 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 – Rare Plant Study

Role	Personnel
Task Manager / Lead Project Scientist	Sean Bennett
Project Scientist	Sean Bennett
	Rich LaPaix
Senior / Quality Review	Sue Meades
	Colleen Leeder or Ellen Tracy
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 is 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, Nova Scotia, and is primarily involved with environmental assessment and monitoring initiatives which 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 ecological land classification (ELC) for the Labrador-Island Transmission Link Project.

Susan J. Meades, M.Sc. | Plant Taxonomist | Senior Review

Sue is field botanist and plant taxonomist with over 35 years' experience working in Newfoundland and Labrador. She has conducted a number of rare plant and vegetation surveys in both Labrador and on the Island, including work on the Lower Churchill Hydroelectric Generation Project, Trans-Labrador Highway, Aurora Uranium Mine Site, several Newfoundland Peatland Surveys, and the Bay d'Espoir Hydroelectric Project. Most recently, Sue was the Lead author of the updated Annotated Checklist of the Vascular Plants of Newfoundland and Labrador (Meades et al. 2015) and has begun work writing a Flora of Newfoundland and Labrador with the Province's Centre for Forest Science and Innovation. Ms. Meades served in the capacity of Senior Reviewer for this Project.

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

Heather Ward is a GIS Coordinator with the Information Management team in Stantec's St. John's office. Mrs. Ward started working with Stantec in January 2012. Mrs. Ward 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. Mrs. Ward also teaches GIS sciences at Memorial University of Newfoundland.

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 STUDY AREA OVERVIEW

2.1 Project Location and Surrounding Land Use

AML's Project is located at Port au Port Peninsula, Newfoundland and Labrador, approximately 2.5 km from the communities of Lower Cove in the east and Sheaves Cove to the west (Figure 1-1). Access to the site is by way of Route 460, which leaves the Trans-Canada Highway (Highway 1) at Harry's River, west through the Town of Stephenville, and along the south shore of the Port au Port Peninsula.

For the purposes of this assessment, the "Study Area" is defined as AML's entire mineral lease holdings (White Hills and Mainland deposits) and incorporates AML's 25-Year Master Plan - proposed physical ground disturbance footprint, plus an approximately 100 m buffer to account for potential engineering modifications, where practical (Figure 2-1).

The predominant land use in the Study Area is forest harvesting (domestic cutting) and other public uses of Crown land such as outdoor recreational activities including hunting, trapping, and off-road vehicle use. These land uses, particularly road infrastructure (Mainland Resource Road) and forest resource harvesting, may affect the extent and character of the Study Area.

Boundaries for the Rare Plant Survey were selected using the following criteria:

- All features and infrastructure associated with the proposed Port au Port Quarry Extension site will be within the Study Area
- Includes habitat(s) of key flora (i.e., "species of concern") that could potentially interact with the proposed Project
- Encompasses key areas used for resource harvesting, recreation and cultural activities

The boundaries of the Study Area encompass an area of approximately 760, whereas the proposed extension (25-year Plan) comprises an area of approximately 140 ha. The Study Area fully encompasses the proposed area, in addition to all or portions of the existing high-grade access road and associated ancillary infrastructure (Figure 2-1).

Rare plant surveys at this scale are considered appropriate and will provide detailed information on presence / absence (not detected) of rare vascular plants and their distribution, which can in turn be used to assess potential environmental effects of the Project in the Enhanced Registration.

STUDY AREA OVERVIEW
April 26, 2016

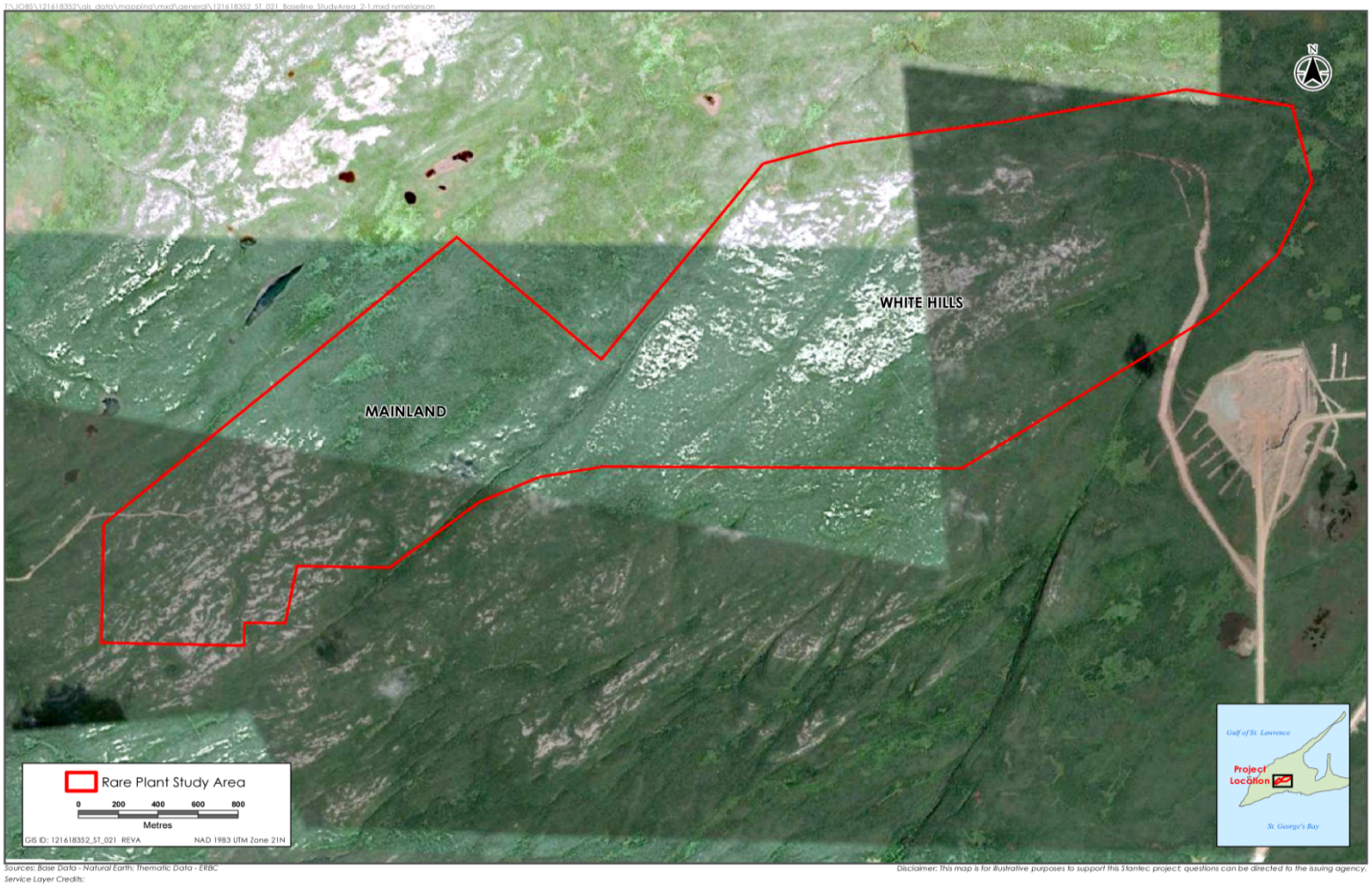

Figure 2-1 Rare Plant Study Area

2.2 Site Geology

Based on the available surficial geology mapping for the area by Batterson (2001a, 2001b, 2001c), as well as descriptions of surficial geology provided in Greenlee and Heringa (1984) and Hender (1989), till deposits are widespread throughout the Port au Port Peninsula, occurring as both thin veneer less than 2 m thick, and more extensive deposits with local thicknesses up to 20 m. The till compositions are bedrock-controlled, but generally consists of stony, silt loam to loam sand derived from dolomite, limestone, and minor siliciclastic sedimentary rocks. The veneer and moraine tills are locally eroded along stream and river channels. A small isolated area of sand and gravel deposits of glacial outwash and fluvial origin is also present on the peninsula, and occurs along the unnamed pond and brook system that flows into Lower Cove, located approximately 5 km southeast of the Project. Along with glacial units, the peninsula also contains areas of organic soils overlying either till or bedrock. In large portions of the peninsula's interior upland region, including in the White Hills area, bedrock is exposed within the till and various other surficial deposits. These bedrock outcrops may be partially or fully concealed by a thin mat of vegetation and sparse forest.

Regional 1:250,000-scale compilation bedrock geology mapping by Colman-Sadd and Crisby-Whittle (2005), as well as a description of bedrock geology provided in Boyce et al. (2000) and Knight, et al. (2008), indicates that the Port au Port Peninsula lies within the Humber (Tectonostratigraphic) Zone and is underlain by Late Precambrian siliciclastic basinal rift sedimentary rocks, Cambrian to Late Ordovician shallow marine sedimentary rocks, overthrusted Precambrian to Ordovician deepwater basinal sedimentary rocks, melange and ophilitic rocks, and Late Silurian to Carboniferous sedimentary cover rocks. The majority of the peninsula, including the Study Area is underlain by a succession of Middle Cambrian to Late Ordovician carbonate platformal sedimentary rocks belonging to the Labrador Group, Port au Port Group, St. George's Group, Table Head Group and Goose Tickle Group. This sedimentary sequence typically referred to as the Humber Arm autochthon (non-transported) sequence is structurally overlain by an allochthon (transported) complex of deep water sedimentary, igneous and metamorphic rocks (Humber Arm Allochthon intermediate structural slices, and Humber Arm Allochthon low structural slices) present north of the Project area between the communities of Tea Cove and Boswarlos. Locally on the Peninsula, an overlap sequence of Late Silurian to Carboniferous sedimentary rocks comprising siliciclastic and minor carbonate and evaporitic sedimentary rocks and coal beds unconformably overlie the Cambrian to Ordovican rocks of the Humber Zone.

The allochthonous and autochonous rocks of the Humber Zone, including bedrock underlying the Project area have undergone complex, multiphase deformation associated with Ordovician Taconic and Devonian Acadian orogenesis, and are characterized by northeast-trending folds with a penetrative crenulation cleavage, as well as thrust faulting, and faulting with dextral strike-slip movement. The Round Head Thrust, which resulted in structural thickening of the

Humber Arm autochthonous sequence, is located in the northern portion of the peninsula approximately 10 km north of the Project area.

Locally, the Project area is underlain by thin, discontinuous, till veneer (typically less than 2 m thick), with localized areas of organic soils (bog). Beneath the overburden, or exposed at surface in areas of higher elevation, the bedrock consists of massive to well-bedded, grey to beige limestone and dolostone belonging to the lower Ordovician-aged St. George Group (Catoche Formation and Aquathuna Formation). The productive units mined at the existing quarries belong to the older Catoche Formation, and include the upper, massive, and chemically-pure Costa Bay Member limestone (mined in the High-Cal Quarry), the middle Catoche Dolomite (mined in the Dolomite #1 and Dolomite #2 quarries), and the lower Catoche Limestone (previously mined in the former Pigeon Head quarry). Quarry mapping and exploration drilling completed by AML in support of both existing and proposed quarry extension developments indicates that stratigraphic bedding is near horizontal in the Project area, with bedding angles ranging from 5° to 15° and dipping to the north. The proposed extension area occurs along strike of the existing High Cal quarry and will produce from Costa Bay Member Limestone. The youngest rocks in the Project area are light brown to grey dolomitic limestone belonging to the Aquathuna Formation and overlie the Costa Bay Member Limestone (Catoche Formation) in the northern portion of the site.

A number of high-angle northeast-southwest-trending faults are present in the Project area due to regional orogenic processes and are defined by locally intense shearing and fracturing in the limestones and dolostones, respectively. In the quarry extension area, these are represented surficially as well-defined topographic lineaments.

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 Study Area and/or the region; and developing a field sampling plan and appropriate survey intensity.

The primary sources of background information on rare plants came from unpublished accounts as identified in previous studies of the Port au Port Peninsula (PDI Production Inc. 2007). Based on these accounts, the Project is in proximity to PDI Production Inc.'s Garden Hill Seismic Exploration Program as undertaken in 2007; that project's seismic survey areas overlap higher elevation habitats (White Hills and Mainland mineral claim) associated with the Project. Targeted rare vascular plant studies for the provincially listed Lindley's aster (*Symphyotrichum ciliolatum*), as well as other potential *endangered, threatened*, rare, or otherwise unusual vascular plant species, were conducted and a report prepared on the regional distribution of those plant species.

3.2 Information Sources

3.2.1 Literature Review

Baseline studies were informed by the literature review and desktop analysis. This section identifies those information sources used to establish baseline conditions and to describe existing conditions related to rare plants and their habitats in the Study Area.

Information to support the identification of rare plants, including SAR and SOCC, characterize the Study 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 (2015);
- Government databases that include information on rare plant species (e.g., SARA Public Registry, ACCDC database); used to identify previously documented occurrences of SAR and/or SOCC in the vicinity of the Study Area (AC CDC 2015);
- 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 all 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;
- Third-party baseline studies (e.g., PDI Production Inc. 2007); and
- Field surveys to assess rare plant presence and potential.

The SARA Public Registry (COSEWIC 2015) was also reviewed to identify SAR with potential to occur in the Study Area.

3.2.2 Existing Spatial Reference Data

Existing spatial data and ecosystem mapping (where available) formed part of the literature review and desktop analysis. This included land classification and land use maps, satellite imagery or aerial photographs, vegetation type and ecosystem maps, and topographical and hydrological mapping such as watershed mapping.

Geospatial reference data related to known element occurrences of rare or otherwise unusual vascular plant species were acquired from the provincial AC CDC 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 Study 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 all biophysical and geospatial data needed to stratify the landscape into habitats with increased likelihood of occurrence for rare species. This included transect or sample point locations, access routes, and any information related to natural hazards in the Study Area.

3.2.3 Regulatory Data

Relevant data from provincial and federal government databases, such as the SARA Public Registry, the AC CDC, as well as other non-governmental and provincial conservation programs, were used to assess the potential for *endangered*, *threatened*, rare, or otherwise unusual vascular plant species in or near the Study Area.

An AC CDC data request was made in 2015 for an area within 5 km (i.e., the radius for which AC CDC typically supplies information when requested) of the Study Area. Conservation Data Centres across Canada maintains 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

The survey protocol provided instruction related to survey techniques and data collection intended to determine occupancy (presence / not detected) of rare vascular plant species in the Study Area. It also provided information on the experience and capabilities of personnel, timing, survey conditions, and permit requirements.

3.3.1 Survey Standards

At present, standardized guidelines for RPS have not been adopted by any government or regulating agency in eastern Canada. Focused field surveys will be conducted in accordance with the standardized guidelines issued by the Alberta Native Plant Council (ANPC 2012). Minimum requirements for a thorough rare plant survey (ANPC 2012) include:

- The RPS should provide reasonable geographic coverage of the Study 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
- 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
- Revisit an adequate number of sites where rare plant element occurrences have been previously recorded

Some of the requirements specified in ANPC's standardized survey guidelines (ANPC 2012) include: surveys must be conducted during the appropriate season; and be floristic in nature. Thus, surveys will not target a single species, but rather aim to identify a majority rare species and rare plant communities in the area.

Of particular note, while 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) guidelines should provide reasonable evidence that the specified plant taxa do not occur in the Study Area.

3.3.1.1 Survey Team

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

3.3.1.2 Search Effort

In consultation with AML and NLDEC – Wildlife Division (C. Hanel, NLDEC, pers comm., 2015), Stantec developed a plan for executing a well-timed vascular plant survey effort, which called for multiple visits (i.e., late spring and mid to late summer) through the Study Area based on the phenology (timing of germination, flowering, maturity) of those rare plants with the potential of being encountered, essentially enabling botanists to investigate vascular plant species during flowering seasons for a majority of species.

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 approximately one hour.

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

3.3.1.3 Timing

Early season surveys were completed June 16 to 19, 2015, with late season surveys occurring July 27 to August 4, 2015, coinciding with the period when the probabilities of encountering a majority of target species was highest (e.g., flowering periods for both cool and warm season perennials) and the detectability of the majority of species maximized. Emphasis is placed on accessing high-priority sites as identified from the Google Earth® and Bing® imagery (2015), 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., limestone barren) were studied more extensively during the second phase of the surveys, as most of the dominant herbaceous and graminoid (i.e., sedges and grasses) plant species were expected to be mature and readily identified at that time. GIS/ global positioning system (GPS) technology was used to conduct the survey and map any rare vascular plant species detected, as well as to identify those habitats that may support late season rare species.

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 significant taxonomic field experience, comfortable with taxonomically complex vascular plant groups and familiar with the identification 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 / polygons) were recorded via a Trimble Juno™ hand-held device / GPS unit 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 Study 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 identifying the status rank for that species.

GPS accuracy (measurement error) of each species occurrence was monitored to establish accuracy of the unit at or below ±5 m. Careful attention was paid to the measured point or polygon such that it was not simply a small portion of a much larger polygon less than 10 m away, thus representing a separate occurrence.

3.3.1.5 Permits and Approvals

Key environmental permits / approvals necessary to conduct field work and comply with the Government of Newfoundland and Labrador regulatory agencies include Scientific Research Permit as issued by the NLDEC - Wildlife Division (Appendix C).

3.3.2 Survey Method

Surveys were undertaken in 2015 to describe dominant plant communities, the overall floristic diversity and to determine the presence / absence (not detected) of rare plants (i.e., SAR and/or SOCC) throughout the Study Area.

Surveys were comprehensive over the entire site, including areas that may be directly or indirectly affected by the Project. The timing and number of visits was determined by geographic location, the natural communities present, and the weather patterns of the year(s) in which the surveys are conducted.

3.3.2.1 Procedure

Field surveys were floristic in nature and completed through random meander searches (Figure 3-1) of the Study Area, with surveyors walking transects through each of the plant communities / habitat types that was identified. A floristic habitat sampling, in the context of this report, focused survey effort on those plant communities with elevated potential to harbour *endangered*, *threatened*, rare, or otherwise unusual results, which provided information on the distribution and abundance of those species within the area surveyed.

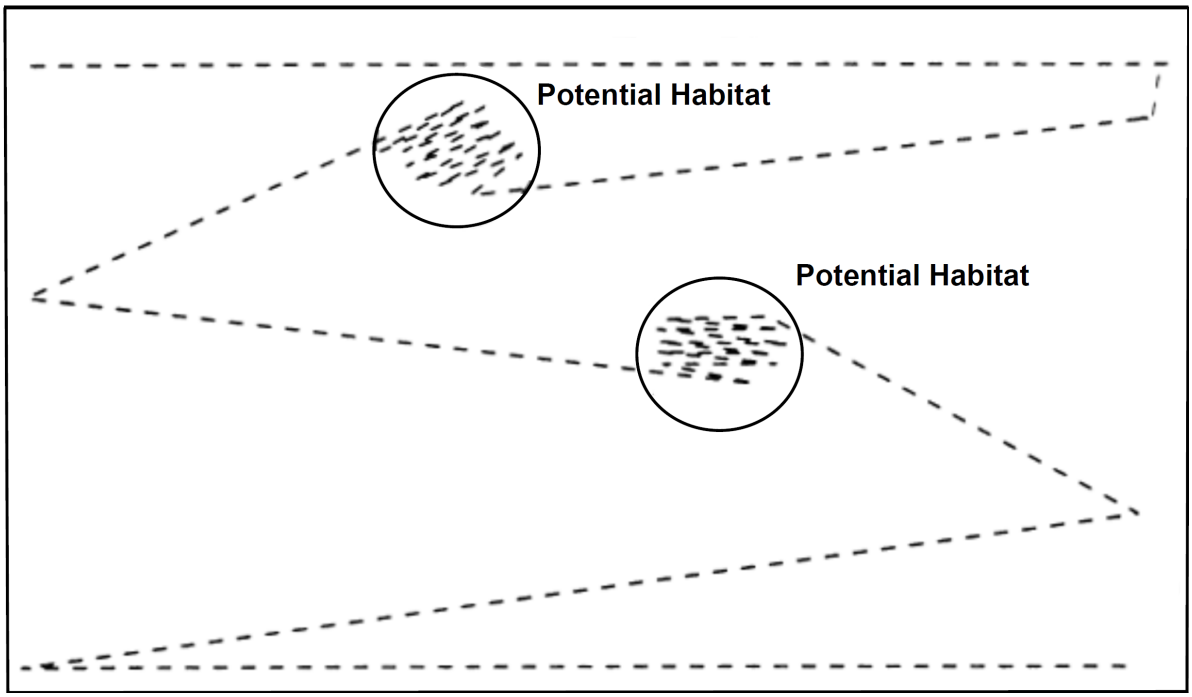

Figure 3-1 Illustration of Floristic Habitat Sampling Method

Floristic habitat sampling involved a survey of all 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, etc.), 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 Study Area.

Target species for survey were identified prior to the field surveys in an effort to help direct the field effort. Within the target areas, 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 (a number of existing element occurrences of rare plants are calciphiles, occurring in association with specific geology or soil types), proximity to documented occurrences of rare plants, and historical records of rare plants in an area that needed to be substantiated. Species selection was based upon the known, historical, or reported occurrences within the Port au Port area, and focused primarily on the occurrence of the provincially-listed Lindley's aster. Additional species were included for which suitable habitat appeared to be present (e.g., calypso orchid (*Calypso bulbosa*)), as determined through reviews of Google Earth® and Bing® imagery (2015), consultation with NLDEC botanist (C. Hanel, NLDEC, pers. comm., 2015), and experience of the surveyors. With extensive experience in habitats throughout Atlantic Canada, all surveyors were prepared to gather data on any other *endangered, threatened*, rare, or otherwise unusual vascular plant species for the region.

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. Those species were 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 all vascular plant species, including potentially *endangered, threatened*, rare, or otherwise unusual vascular plant species were recorded, along with a description of their habitat affinities. Immature plants or plants missing structures (e.g., fruiting bodies, etc.) 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 within the population. In most instances, the numbers of stems were counted. 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, it was sometimes necessary to estimate numbers or coverage (%) as an indicator of abundance. 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.

Observations of an individual or grouping of plant species of interest were recorded in accordance with typically collected information outlined in Table 3.1.

Table 3.1 Typical Rare Plant Species Occurrence Information

Plant Information	Definition
Site ID	The name assigned to the survey site
Date	Date of observation
Observer	Observer's name
Survey Location #	The survey number for the site (e.g., Rare Plant Survey1)
Plant GPS Waypoint	The survey number for the site in coordination with a unique identifier for each species found at that site (e.g., Rare Plant Survey #1; RL1 for - observer name, plant #)
Species	Plant species observed
# Individuals	The number of individual plants (or groups if it is difficult to identify individuals of a species); estimate if >50 individuals
# Groups	The number of groups only if it was not possible to easily identify individuals for this species - estimate if >50
Distribution	The approximate distribution: widely scattered; evenly distributed; or densely clumped
Area of Distribution	The approximate area (m^2) within which the species is distributed
Phenology	The approximate percentage of the individuals that are: in leaf (0 to 100%); in bud (0 to 100%); in flower (0 to 100%); in fruit (0 to 100%); dispersing seed (0 to 100%); or dormant (0 to 100%)
Unique ID	If there are >20 individuals and identification is not certain, a single specimen may be collected (necessary permits are required) and deposited in a designated herbarium (e.g., Herbarium of the Provincial Museum of Newfoundland and Labrador). In such an event, the specimen was given a unique code or collection number: YYMMDD + 6-character GPS point
Habitat	Biodiversity information regarding natural plant association / plant community type, soil, slope, aspect, soil moisture regime, and soil nutrient regime
Photos	Digital photographs were taken of each encountered rare plant species and of the general landscape in which the occurrence was recorded

3.3.2.3 Voucher Specimens

An important part of a vegetation survey was 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 was 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), and necessary permits were in place. Vouchers collected included the minimum amount of material (leaf, seeds, twigs) needed to ensure 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 all vascular plant species collected during in-field surveys in 2015 generally subscribes to that prescribed by the AC CDC (2010), however two other authorities: the *Database of Canadian Vascular Plants* (VASCAN) (Brouillet et al. 2010+) and the *Integrated Taxonomic Information System Database* (2015) were also consulted during report preparation.

Vascular plant species in this report were identified using their accepted colloquial or common names; their scientific name was 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., "*Symphyotrichum ciliolatum,* S. *novi-belgii*, and *S. puniceum*").

All vascular plant species encountered along with their population status in Newfoundland and Labrador were evaluated through a review of SARA- and NL ESA-listed plant species, in addition to those rankings maintained by the AC CDC (2010).

3.4.2 Verification by Taxonomic Experts

The identification of rare plant species ultimately requires both the use of taxonomic keys, and follow-up confirmation of the identification by a recognized taxonomic expert. These specialists are aware of any new developments in their particular areas of expertise. Taxonomic expertise for the Project was provided by Sue Meades (Scientific Authority - vascular plants).

3.4.3 Analysis of Vegetation Data

Upon completion of the survey(s), all field data were entered into a digital database(s) (i.e., Microsoft Excel / Microsoft Access) 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 Study Area.

3.4.4 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.

3.5 Quality Assurance / Quality Control Procedures

A number of quality assurance and control measures were employed to facilitate correct identification and naming of all recorded plant species. Those measures include:

- Consultation with botanists recognized as experts within specific taxonomic groups for verification of species identification
- A relational database program was used to verify S Ranks and alternate names (synonyms) for all 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 the NLDEC (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 Study 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 for the local and regional area was completed. The most recent and relevant botanical survey data available is that undertaken as part of the Garden Hill Seismic Exploration Project in 2007. That project, a collaboration of PDI Production Inc. and representatives of the NLDEC - Wildlife Division aimed to identify SAR and SOCC within the area of interest which overlaps the Study Area. While a complete listing of vascular plant species observed during the 2007 studies was not available, summary data of known plant specimens within the Garden Hill project area was identified, has been verified by provincial botanical experts, and includes a number of S-ranked species:

- Lindley's aster - *S1 / may be at risk*;
- Mackenzie's sweet vetch (*Hedysarum boreale* subsp. *mackenziei*) - *S1 / may be at risk*;
- Crantz's cinquefoil (*Potentilla crantzii*) - *S1 / may be at risk*; and
- dwarf tansy (*Tanacetum bipinnatum* subsp. *huronense*) - *S1 / sensitive*.

4.1.2 AC CDC Data

An initial review of historical rare plant records (AC CDC data request - May 22, 2015) indicated the occurrence of a single SAR, the Lindley's aster, listed as *endangered* under the NL ESA.

Additionally, six provincially tracked species have also been identified in the Study Area (AC CDC 2015). Along with their respective designations and/or conservation rankings, these include:

- western thread-leaf pondweed (*Stuckenia filiformis* subsp. *occidentalis*) - S1; *may be at risk*;
- giant bur reed (*Sparganium eurycarpum*; *S2 / may be at risk*;
- northern holly fern (Polystichum lonchitis; *S2 / may be at risk*;
- pulvinate pussytoes (*Antennaria rosea* subsp. *pulvinata*) - *S2 / unranked*;
- forest bluegrass (*Poa saltuensis*) - *S2S3* / sensitive; and
- limestone oak fern (*Gymnocarpium robertianum*) - *S2S3*; *sensitive*.

Additionally, queries of the AC CDC database returned six occurrences of plants having an S-rank of SNR, indicating they were u*nrankable*. These plants could be rare, but not enough was known about their distribution at the time of plant ranking.

4.2 Field Studies

4.2.1 Survey Effort

Early season surveys were completed during the week of June 16 to19, 2015, with late season surveys delivered the week of July 27 to August 4, 2015. Surveys were performed by two botanists and consisted of not less than 10 combined field-team-days of surveys, averaging approximately 10 hours/person/day; therefore the entire survey effort totalled approximately 200 person-hours on the ground. The distance and area traversed during early season field surveys was 30.90 linear km or 27.21 ha surveyed (based on 5 m-wide transect) (Figure 4-1). Similarly, late season surveys resulted in 40.25 linear km or 33.21 ha surveyed (Figure 4-1).

In addition to surveys of the Study Area, important field data for Lindley's aster were also collected regionally. Regional surveys were primarily reconnaissance-level and undertaken at select locations across the Port au Port Peninsula and beyond (historical records at Harry's River, Romaines Brook and Table Mountain). Placing the results of the RPS within a regional context, knowledge of the regional distribution of Lindley's aster appears limited. As such, regional surveys provided surveyors with more detailed data on population size, habitat, and spatial extent of Lindley's aster; and were used primarily to augment information contained within existing historical records. Regional data were used to: refine criteria for determining sites of significance for rare vascular plants species, particularly the distribution and relative abundance of Lindley's aster in the region; include of these sites in future land management decisions; and evaluate the potential effectiveness of in situ and ex situ mitigation strategies.

In future, systematic surveys of Lindley's aster and its preferred habitat may reveal element occurrences from a larger range than is currently known in western Newfoundland and elsewhere. Additionally, more work may be required to clarify this group's taxonomy and range information in Newfoundland. At present, it still appears to be sporadic and uncommon within it.

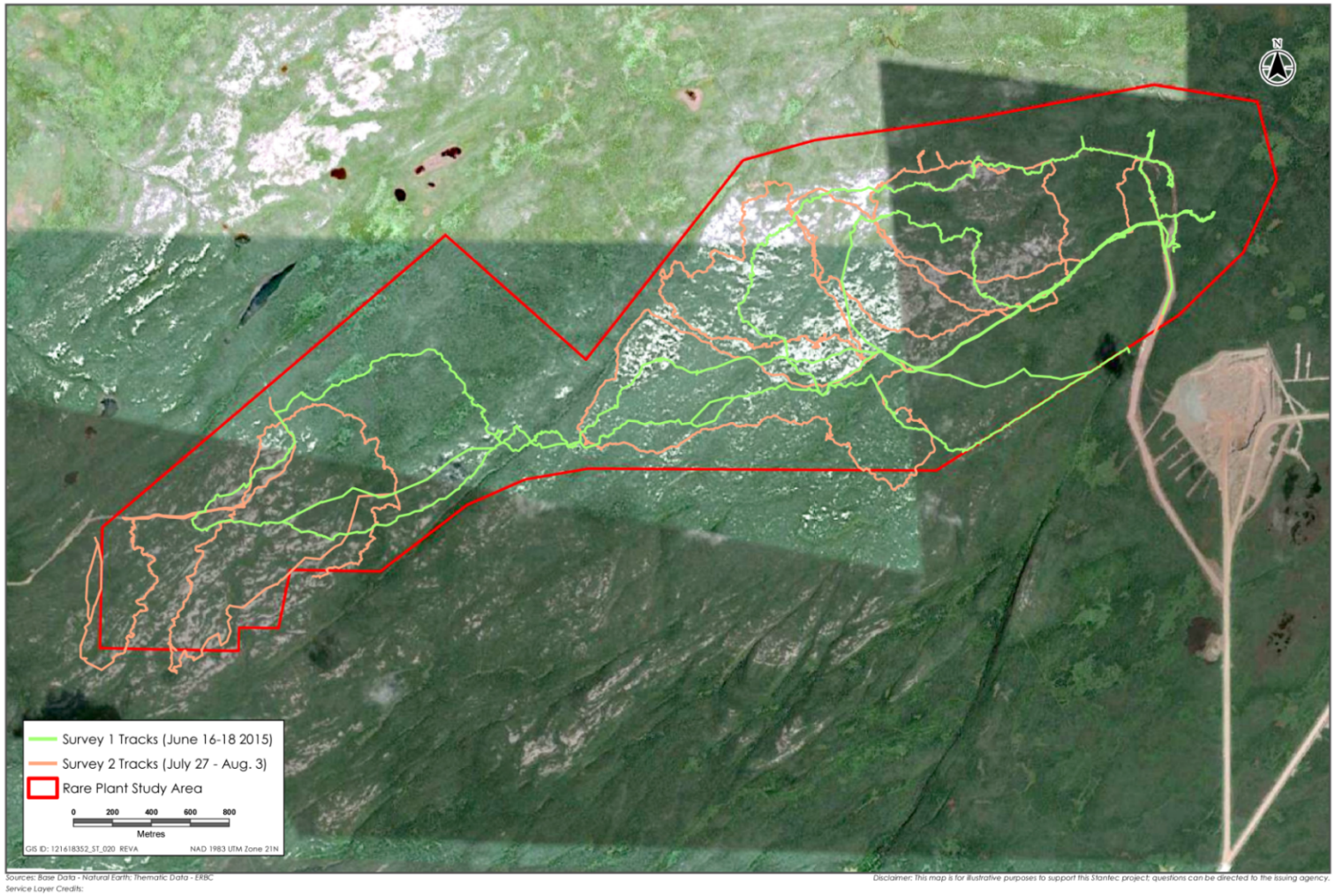

Figure 4-1 Early and Late Season Search Effort

4.2.2 Plant Communities of the Study Area

Eight general plant community types / subtypes were identified in the Study Area. They include:

- Weathered rock barrens
- Dry to moist / wet rock crevasses
- Dwarf shrub heath / Arctic-alpine
- Mesic scrub woodland (low tuckamoor)
- Fresh meadows
- Incised sheltered valleys, gullies, and ravines
- Upland conifer forest
- Coniferous treed fen

4.2.2.1 Weathered Rock Barrens

Weathered rock barrens habitat of the Study Area is characterized by Arctic-like climatic conditions, although typically occurring at lower elevations. The characteristic exposed limestone bedrock-pavement of the Study Area (Photo 1) formed when horizontally or gently inclined bedded sheets of limestone were exposed by glaciation and then chemically weathered by rain. The result is a distinctive level surface dissected into blocks and ridges by a series of eroded cracks.

Photo 1 Weathered rock barrens / bedrock-pavement

Topography, harsh weather conditions, and natural processes like scouring high winds and wide-ranging temperatures, typically limit plant growth in areas comprised of rock barren / bedrock pavement. Dominant vegetation associated with these environments are low and dwarf shrubs, with patches or clumps of graminoids and sedges interspersed with forbs, in addition to mats of cushion-forming plants (e.g., entireleaf mountain avens [*Dryas integrifolia*]) and scattered bryophytes. An absence or lack of trees in this habitat may be related to wind exposure and a lack of soil. The number of plant species in these habitats is often few and plant growth minimal.

Barren rocky areas support low and dwarf shrubs, including creeping juniper (*Juniperus horizontalis*), hairy willow (*Salix vestita*), shrubby cinquefoil (*Dasiphora fruticosa*), black crowberry (*Empetrum nigrum*) and various blueberry species, including bog bilberry (*Vaccinium uliginosum*) and northern blueberry (*V. boreale*). Ground cover varies from sparse to extensive, and consists mainly of grasses, mosses, and smaller berry plants. Woody plants form discontinuous patches of vegetation and include alpine bearberry (*Arctous alpina*) and partridgeberry (*Vaccinium* vitis-*idaea*), as well as entireleaf mountain avens, and threetooth cinquefoil (*Sibbaldia tridentata*). Northern anemone (*Anemone parviflora*), and bristleleaf sedge (*Carex eburnea*) are the dominant herbaceous species.

4.2.2.2 Dry to Moist / Wet Rock Crevices

A subtype of the weathered rock barren plant community, it includes dry to moist / wet cracks, crevasses, fissures, and sinkholes created by the dissolution of soluble limestone, dolomite, and gypsumn bedrock (Photo 2). Deep pockets of damp humus and soil can accumulate in the crevasses and contrast starkly with the dry surface cracks and well-drained surrounding soils. At the openings of these features, and clinging to the rock face or growing directly out of cracks, crevasses, and fissures, are green spleenwort (*Asplenium viride*), limestone oak fern, bladder fern (*Cystopteris* sp.), male fern (*Dryopteris filix-mas*), hemlock parsley (*Conioselinum chinense*), harebell (*Campanula gieseckeana*), hyssopleaf fleabane (*Erigeron hyssopifolius*), kidneyleaf violet (*Viola renifolia*), and northern holly fern.

Photo 2 Cracks, crevasses, fissures and sinkholes in weathered rock barrens

Alternatively, in the dark, moist recesses of numerous rock crevasses, fissures, and sinkholes, acidic organic matter collects and under influence of prolonged snow cover and neutral seepage water results in the establishment of such shrub species as bog birch (*Betula pumila*), shrubby cinquefoil, alderleaf buckthorn (*Rhamnus alnifolia*) and squashberry (*Viburnum edule*). Characteristic herbaceous species included cow parsnip (*Heracleum maximum*), New York aster (*Symphyotrichum novi-belgii*), bottlebrush (*Sanguisorba canadensis*), yellow clintonia

(*Clintonia borealis*), northern holly fern, northern beech fern (*Phegopteris connectilis*), red baneberry (*Actaea rubra*), and bluejoint reedgrass (*Calamagrostis canadensis*).

Weathered rock barrens, and indeed all habitats underlain by calcareous substrates derived predominantly from limestone and dolomitic bedrock, have a limited distribution in the region (i.e., Port au Port Peninsula, Table Mountain). Furthermore, owing to the low number of areas where calcium-rich base materials are known to occur province-wide, other possible range locations for the identified listed species may be limited. Substrate preference may therefore be an important factor in determining small and large-scale rare plant distributions in the Study Area, as most of the observed rare plant species appeared to be consistent in their association with calcareous or otherwise basic substrates (i.e., calciphiles). As such, targeted surveys included both the immediate area of weathered rock barrens habitat, as well as adjacent and extensive encompassing mats of transitional dwarf shrub heath and mesic scrub woodland habitat.

4.2.2.3 Dwarf Shrub Heath / Arctic-alpine

Dwarf shrub heath types are infertile, moist to dry sites typically exposed to desiccating winter winds that may also remove the protective snow cover during winter, and this is expressed in the sparse vegetation community that occurs. They occupy areas of hummocky terrain and thin poor soils with exposed bedrock (Photo 3). Plant community composition closely resembles that of Arctic-alpine plants typically growing in the alpine climates, and at high elevation and above the tree line. Tree cover is very low and stunted with low frequency of occurrence, comprised of small patches of prostrate balsam fir (*Abies balsamea*), black spruce (*Picea mariana*), and tamarack (*Larix laricina*), growing in sheltered microsites. The tall shrub layer is also very poorly represented by bog birch and alpine blueberry (*Vaccinium uliginosum*). Low shrubs such as bearberry (*Arctostaphylos uva-ursi*), alpine bearberry and black crowberry have generally higher coverage. The herb layer is also quite sparse and the most important herb species are entireleaf mountain avens and running club moss (*Lycopodium clavatum*), although cover is

Photo 3 Dwarf shrub heath (Arctic-alpine) habitat

generally low. Schreber's moss (*Pleurozium schreberi*) has the highest coverage of any moss species.

4.2.2.4 Mesic Scrub Woodland

The mesic scrub woodland (or low tuckamoor) plant community is composed primarily of stunted conifers, often found at the high elevation (alpine) treeline ecotone. The mesic scrub woodland occurs in the protected lee of ridgelines that are oriented perpendicular to the prevailing onshore winds. It is usually dominated by prostrate forms of balsam fir and black spruce, and scattered tamarack is also sometimes found. Throughout the region, mesic scrub woodland types provide shelter for a variety of other shrubs and herbaceous plants to grow beneath them, resulting in a diverse herbaceous understorey. (Photo 4). Ericaceous species and other shrubs, particularly sheep laurel (*Kalmia angustifolia*), mountain holly (*Ilex mucronata*), northern wild raisin (*Viburnum cassinoides*), alderleaf buckthorn, ground juniper (*Juniperus communis* var. *depressa*), bog laurel (*Kalmia polifolia*), bearberry, and creeping snowberry (*Gaultheria hispidula*) were also prevalent. The ground vegetation layer may be extensive and composed largely of largeleaf goldenrod (*Solidago macrophylla*), bottlebrush, yellow clintonia, bunchberry (*Cornus canadensis*), and running clubmoss. The moss layer reflects an important component of this community and includes the following: Schreber's feathermoss, plume moss (*Ptilium crista-castrensis*), stairstep moss (*Hylocomium splendens*), common haircap moss (*Polytrichum commune*), shaggy moss (*Rhytidiadelphus triquetrus*) and broom mosses (*Dicranum* spp.).

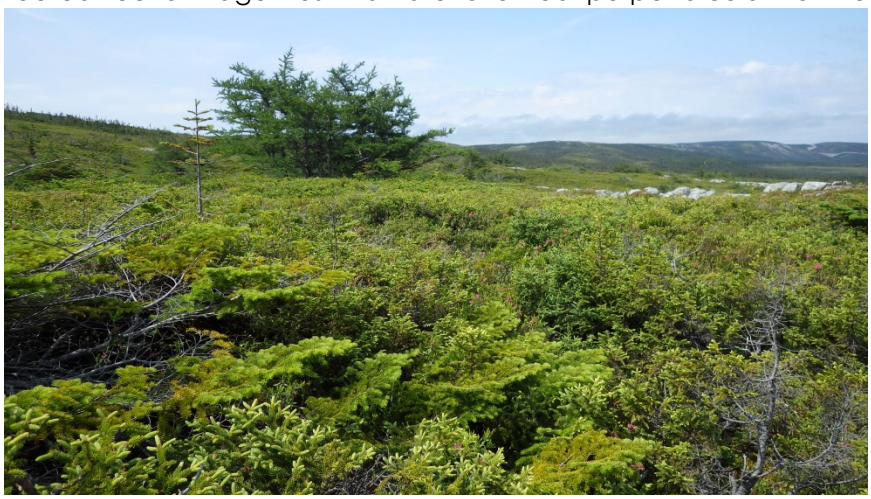

Photo 4 Mesic scrub woodland (low tuckamore) habitat

4.2.2.5 Fresh Meadows

Small fresh meadows distributed across the landscape, especially among expanses of mesic scrub woodland are characterized by a complex of fresh meadow and/or marginal shallow peatland (folisols) communities. This subtype of the mesic scrub woodland association is limited in extent, typically less than 10 m², with a diffuse or patchy distribution across the Study Area. Fresh meadows are found at higher elevations, and often in the frost pockets of valley bottoms and late snow areas where wet and cold conditions preclude the establishment of tree species.

The fresh meadow subtype is characterized by moist to saturated soils with standing water present for only brief to moderate periods during the growing season. Vegetation includes a wide variety of herbaceous species, from forbs and grasses to sedges and rushes (Photo 5). Woody vegetation, if present, accounts for less than 20 percent of the total cover. The forbs and grasses of these meadows tend to be less competitive, more nutrient demanding, and often shorter-lived species.

Photo 5 Fresh meadow habitat

This community typically has increased snowpack and increased moisture availability in spring and early summer, and remains moist to partially dry throughout the summer. Meadow vegetation is a mosaic of wet meadow, dwarf shrub heath, and fresh meadow bordered by mesic scrub woodland. Balsam fir, black spruce, sweet gale (*Myrica gale*), and shrubby cinquefoil, are the dominant shrubs on the edges of these openings. Beneath the edges of the shrubs is a lush understorey of herbs and grasses, many of which are shared with the adjacent fresh meadow association. Some of the more distinctive herbaceous species associated with the wet meadow type are bottlebrush, bog goldenrod (*Solidago uliginosa*), Hooker's orchid (*Platanthera hookeri*), small tofieldia (*Tofieldia pusilla*), Mistassini primrose (*Primula mistassinica*), common butterwort (*Pinguicula vulgaris*), deergrass (*Trichophorum cespitosum*), single-spike sedge (*Carex scirpoidea*), golden sedge (*C. aurea*), and sheathed sedge (*C. vaginata*). It is in or rather on the periphery of these open meadows, within the 'tucks' of balsam fir and black spruce that the listed vascular plant Lindley's aster is most likely to be encountered.

4.2.2.6 Incised Sheltered Valleys, Gullies, and Ravines

The entire site, including a majority of the limestone barren, dwarf shrub heath, and mesic scrub woodland habitat types described above, is dissected by numerous incised, sheltered valleys, gullies, and ravines (oriented northeast–southwest across the Study Area) and depressed areas (Photo 6). Vegetation cover in these areas is among the most floristically diverse of those habitats observed in the Study Area. Unlike the dwarf shrub heath and scrub forest habitats previously described, climatic conditions are somewhat less severe. In many cases, snow accumulation, where present, provides an insulating layer to the ground surface facilitating the

establishment of diverse snow bed (chionophilic) plant communities. The snow pack in this community lasts longer into the spring and early summer than surrounding vegetation, creating a short growing season but alternatively, conditions (e.g., shelter from desiccating winds, increased soil moisture, storage of organic matter) to facilitate increased plant growth. Stunted balsam fir are usually fairly dense along the valley walls, but because of the moist understorey and relatively sunny meadow valley bottom location, there is a well-developed herbaceous and graminoid layer. Many herbs are shared with the dwarf shrub heath and meadow associations, but several species are characteristic. These include: showy mountain ash (*Sorbus decora*), Canada yew (*Taxus canadensis*), claspingleaf twistedstalk (*Streptopus amplexifolius*), northern holly fern, tall meadowrue (*Thalictrum pubescens*), swamp thistle (*Cirsium muticum*), cow parsnip, dewberry (*Rubus pubescens*), and scentbottle (*Platanthera dilatata* var. *dilatata*). Lindley's aster is also likely to be regularly encountered in these areas. Clearly, these mesic to hygric snow bed associations are dependent on reliable, late-persisting snow cover found there.

Photo 6 Incised, sheltered valleys, gullies and ravines

4.2.2.7 Upland Conifer Forest

Photo 7 Upland conifer forest habitat

Upland conifer forest habitat is also quite limited in its distribution in the Study Area, primarily occurring on sloping terrain in association with valley features featured along the northern edge of the Study Area (Photo 7). This habitat type is composed of coniferous forest stands ranging in age from recently harvested (domestic cutting) pole saplings to mature, with the

majority of observed stands approximately 40 to 50 years old. The overstorey in these stands is dominated by balsam fir and black spruce, with some paper birch (*Betula papyrifera*). The woody understorey, depending on the age and openness, is typically dominated by regenerating balsam fir, black spruce, and some paper birch with chokecherry (*Prunus virginiana*), sheep laurel, mountain holly and wild red raspberry (*Rubus idaeus* subsp. *strigosus*). The herbaceous ground layer is dominated by wood ferns (primarily evergreen woodfern (*D. intermedia*), mountain woodfern (*D. campyloptera*), spinulose woodfern (*D. carthusiana*), wild sarsaparilla (*Aralia nudicaulis*), pink ladyslipper (*Cypripedium acaule*), trailing arbutus (*Epigaea repens*), bunchberry, and wild lily-of-the-valley (*Maianthemum canadense*), bluejoint reedgrass. The moss layer reflects an important component of this community and includes Schreber's feathermoss, plume moss, stairstep moss, common haircap moss, shaggy moss, and broom mosses.

4.2.2.8 Coniferous Treed Fen

Coniferous treed fen habitat has a restricted distribution in the Study Area, having a forest cover dominated by tamarack and black spruce, with lesser components of balsam fir. The understorey is dominated by ericaceous shrubs including northern wild raisin, sheep laurel, velvetleaf blueberry (*Vaccinium myrtilloides*), and twinflower (*Linnaea borealis*), with an herbaceous layer of cinnamon fern (*Osmundastrum cinnamomeum*), bunchberry, wild strawberry (*Fragaria virginiana*), wild lily-of-the-valley, threefruit sedge (*Carex trisperma*), hoary sedge (*C. canescens*), roughleaf mountain ricegrass (*Oryzopsis asperifolia*), as well as sphagnum mosses (*Sphagnum* spp.) (Photo 8).

Photo 8 Coniferous treed fen habitat

4.2.3 Species at Risk / Species of Conservation Concern

The 2015 rare plant survey (both early and late season surveys) resulted in a list of approximately 230 vascular plant species, distributed into 135 genera and 52 families, with the *Cyperaceae* (32 species) and *Asteraceae* (24 species) the largest families. Of the 230 vascular plant species, 12

(5 percent) of which are considered rare (S-Rank of *S1*, *S2*, or combinations thereof (e.g., *S1S2*) or SAR / SOCC (Table 4.1; Appendix A)).

No COSEWIC or SARA-listed species were found during the survey but one species, Lindley's aster, is listed by the province in Schedule A of *Endangered Species List Regulations*. One species, umbellate sedge (*Carex umbellata*) is ranked *S1S2*; seven are ranked *S2*, including Hooker's orchid, northern holly fern, Laurentian bladder fern (*Cystopteris laurentiana*), New England sedge (*Carex novae-angliae*), low northern sedge (*C. concinna*), blunt sweet cicely (*Osmorhiza depauperata*), wood valerian (*Valeriana* dioica var. *sylvatica*); and the remaining three - forest bluegrass, limestone oak fern, and dwarf white birch (*Betula minor*) are ranked *S2S3*.

An additional 18 species, presently ranked *S3* were also recorded and may require consultation with NLDEC to determine those potentially deemed "of conservation concern" to the Province. They include: brownish pussytoes (*Antennaria rosea* subsp. *confinis*); glandular birch (*Betula glandulosa*); bristleleaf sedge (*Carex eburnea*); glacier sedge (*C. glacialis*); Wiegand's sedge (*C. wiegandii*); golden sedge; Sitka ground-cedar (*Diphasiastrum sitchense*); trailing arbutus; checkered rattlesnake plantain (*Goodyera tesselata*); green addersmouth (*Malaxis unifolia*); interrupted fern (*Osmunda claytoniana*); roughleaf mountain ricegrass; palmate sweet coltsfoot (*Petasites frigidus* var. *palmatus*); plumboy (*Rubus arcticus* subsp. *acaulis*); Arctic yellow-rattle (*Rhinanthus minor* subsp. *groenlandicus*); purple false melic (*Schizachne purpurascens*); Canada yew; and kidneyleaf violet.

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 this part of the province, the ability to predict where a species may occur may be limited. Occurrences of *S1* and *S2* ranked species were most commonly associated with the limestone barren plant community types, in addition to incised valley, gulley, and ravine subtypes that intersect the Study Area.

A listing of all rare plant species and their associated habitat type(s) is provided in Table 4.1. A comprehensive list of all vascular plant species observed in the Rare Plant Study Area and general vicinity (regionally) is provided in Appendix B.

Table 4.1 List of Rare Plant Species Present within the Study Area or Vicinity

Scientific Name	Common Name	G Rank[1]	N Rank[2]	SRank[3]	General Status	Number of Observations	Observed Plant Community Types
Symphyotrichum ciliolatum (Lindley) (Lindl.) Á. Löve & D. Löve	Lindley's Aster	G5	N5	S1	*May be at risk*	87	In various coniferous woodland habitats throughout the Study Area and beyond (regionally); on subhygric soils; calcareous or basic substrates (calciphile)
Carex umbellata Schkuhr ex Willd.	umbellate sedge	G5	N5	S1S2	*Sensitive*	5	Moist to wet open woodlands, meadows
Valeriana dioica subsp. *sylvatica* (S.Watson) F.G.Mey.	wood valerian	G5T4 T5	N4N5	S2	-	3	Bogs, mossy woods and brooksides on limestone and calcareous or basic substrates (calciphiles) (Bouchard et al. 1991).
Platanthera hookeri (Torr. ex A.Gray) Lindl.	Hooker's orchid	G4	NNR	S2	*May be at risk*	30	Open mesic scrub woodland and open heath types; calcareous or basic substrates (calciphile)
Polystichum lonchitis (L.) Roth	northern hollyfern	G5	NNR	S2	*May be at risk*	57	Moist to wet numerous large crevasses, cracks, fissures, sinkholes, gullies, and ravines; calcareous or basic substrates (calciphile)
Cystopteris laurentiana (Weath.) Blasdell	Laurentian bladder fern	G3	N3	S2	*Maybe at risk*	2	Bare rock and narrow cracks and crevasses on shaded vertical surfaces of cliffs, ledges, and bedrock fractures; on high pH substrates
Carex concinna R. Br.	low northern sedge	G5	N5	S2	*May be at risk*	1	Moderately open, dry woods on outcrops; on exposed calcareous or basic substrates (calciphile)
Carex novae-angliae Schwein.	New England sedge	G5	N5	S2	*Sensitive*	2	Moderately shaded forest edges, paths, and dirt roads through forests and woodlands; rarely in wetter habitats. Thickets and open forest sites near the coast (Bouchard et al., 1991)

Scientific Name	Common Name	G Rank[1]	N Rank[2]	SRank[3]	General Status	Number of Observations	Observed Plant Community Types
Osmorhiza depauperata Philippi	blunt sweet cicely	G5	N5	S2	May be at risk	4	Moist, coniferous spruce-fir forest, woodland and scrub habitats, elsewhere from mixed forests and riparian thickets adjacent to small rivers and streams; in seepage areas, on subhygric soils
Poa saltuensis Fernald & Wiegand	forest bluegrass	G5	N4?	S2S3	Sensitive	15	Semi-shaded to open, dry or rocky habitat; on well-drained soil ranging from slightly acidic to slightly calcareous
Betula minor (Tuck.) Fernald	dwarf white birch	G4Q	N4	S2S3	Secure	3	Fairly exposed windy ridges; in the dry / mesic heath of alpine communities, at the edge of tuckamoor
Gymnocarpium robertianum (Hoffm.) Newman	limestone oak fern	G5	N3	S2S3	Sensitive	14	Moist to wet cliff face; on exposed calcareous or basic substrates (calciphile)

Due to the frequent observation of some rare 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 presence deviated from the norm. As a result, Figure 4-2 (illustrating occurrences of rare plants) does not necessarily provide a complete representation of species occurrence.

4.2.4 Rare Vascular Plant Descriptions and their Distribution

The following section details the significant information collected for each rare plant observed during the 2015 Rare Plant Survey, providing: a brief description of the species; their distribution in the Study Area and elsewhere; observed habitat affinities; an outlining the 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.

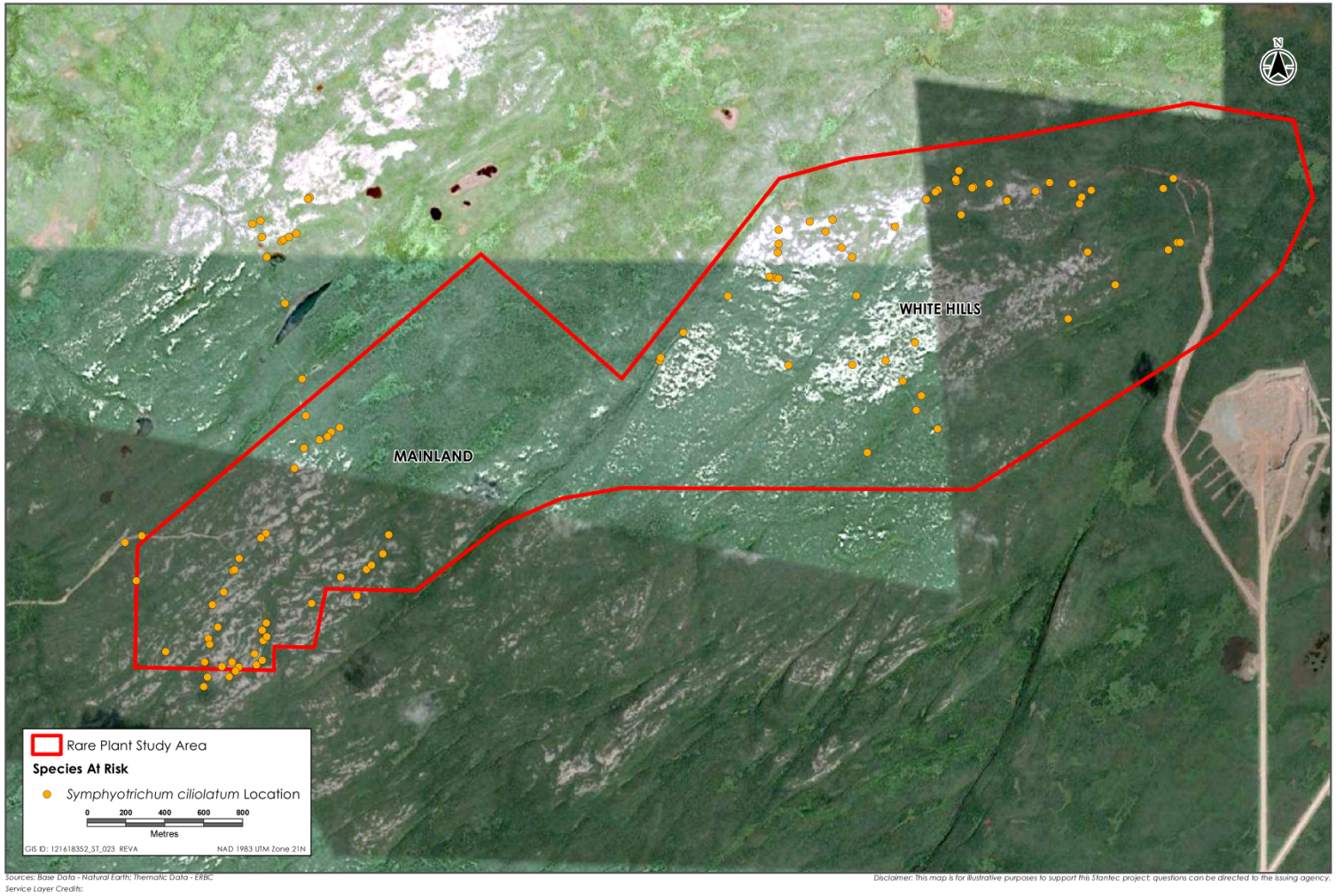

Figure 4-2 Observations of Lindley's aster in the Study Area

4.2.4.1 Asteraceae: Symphyotrichum ciliolatum (Lindl.) Á. Löve & D. Löve (Lindley's aster) – G5 / N5 / S1

Lindley's aster (Photo 9) was the only SAR found within the Study Area, listed[4] by the province of Newfoundland and Labrador in Schedule A of the *Endangered Species List Regulations* under the NL ESA. Listed as "*endangered*" under the Act, it is ranked *S1* by the AC CDC and "*at risk*" on the Island of Newfoundland, although it is considered to have a secure population at the national and global scale (i.e., ranked *G5* and *N5*).

Photo 9 Lindley's aster (in bud)

Lindley's aster is known to hybridize with other species, which leads to confusion in the taxonomic placement of certain populations. *Symphyotrichum ciliolatum* hybridizes with *S. novi-belgii* var. *novi-belgii* in the Gulf of St. Lawrence area, extending into Newfoundland and Labrador (Newfoundland), where *Symphyotrichum* × *subgeminatum* (Fernald) G.L. Nesom can frequently be found. As such, it is unclear whether those occurrences identified above are indeed Lindley's aster, a closely related aster species (i.e., New York aster (*Symphyotrichum novi-belgii*)), or a species possessing vegetative characteristics similar to that of Lindley's aster (i.e., *Solidago macrophylla*). They can typically be separated on involucral bract and leaf blade morphology. Lindley's aster has involucral bracts with a slender, elongate chlorophyllous zone, basal leaf blades that are usually truncate to subcordate (Photo 10), and stem leaves, when petioled, with winged petioles. During surveys performed in 2007 (PDI 2007), a number of voucher specimens (and photographs) were collected and sent to Dr. Luc Brouillet of the University of Montreal Herbarium - University of Montreal for taxonomic verification. Based on the review of these specimens by Dr. Brouillet, many were deemed to fit well with that of *Symphyotrichum ciliolatum*; however, a number of specimens with hybrid features were also identified (PDI Production Inc. 2007). Based on a review by Dr. Luc Brouillet, it should be noted that specimen identification and determination via photographs are tentative.

[4] Following assessments by the SSAC and the COSEWIC, Lindley's aster was listed under the NL ESA in 2013.

Lindley's aster is a widespread species (Photo 10); occupying rich, open, often calcareous, boreal forests and forest edges from across Canada (SSAC 2009). It has been collected previously from the Garden Hills area (SSAC 2009; PDI Production Inc. 2007) and is known from other locations on the Port au Port Peninsula (SSAC 2009; AC CDC 2015), as well as nearby Kippen's (in 2000) and at Romaine's Brook (in 1999 and 2000). The *Atlas of the Vascular Plants of the Island of Newfoundland and of the Island of Saint-Pierre-et-Miquelon* (Rouleau and Lamoureux 1992) also depict (one dot) Lindley's aster in the nearby Table Mountain area. ACCDC data obtained for the Project indicate that occurrences of this species have previously been reported at 72 locations from within a 5 km radius of the Study Area (AC CDC 2015). Lindley's aster was among the most abundant rare plants found during the 2015 surveys, with 87 recorded occurrences. The largest concentration of Lindley's aster observed during surveys of the Study Area was in a relatively unique area of karst terrain - a large circular sink or sinkhole (approximately 100 m x 100 m area) in the southwest corner of the Mainland deposit (Photo 11). The population of Lindley's aster within this feature was estimated to be in excess of 1,000 plants. This extensive population was observed in fresh meadow habitat along the south facing slope of the sink, extending from the lower edge of the mesic scrub woodland, approximately 20 m below the crest of the slope, to

Photo 10 ***Symphyotrichum ciliolatum*** **(Lindley's aster) - cordate leave base**

Photo 11 ***Symphyotrichum ciliolatum*** **(Lindley's aster) habitat - open meadow habitat**

approximately 50 m below the end of the mesic scrub woodland, and measuring 60 m across. The White Hills collection is at higher elevation, but also associated with possible snow bed communities and with similar plant species assemblages.

When observed, Lindley's aster was rarely present as a single, isolated occurrence. Rather, it was often common in its preferred habitat and occasionally dominating the understorey. More often than not, this species was present where suitable habitat or microhabitats existed.

Lindley's aster was found most often in association with open moist to fresh meadow communities. Although there was no evident association to canopy composition, substrate texture, elevation, slope, or aspect identified through literature reviews, a number of field observations were made in terms of its habitat affinity. Most specimens were encountered in relatively high elevation, open moist to fresh meadow subtypes, often in associated with turfy, late-melting snow bed communities. Open moist to fresh meadow at all elevations in the Study Area generally have a simple structure consisting primarily of a layer of herbaceous plants. Shrub or tree layers are usually absent or very sparse; however, they may be an important feature of the fresh meadow edge. Lindley's aster, either by virtue of moisture or shading, was in a majority of cases detected within ecotonal habitat between the meadow edge and the mesic scrub woodland community (see Figure 4-2; Appendix B, Photo 12). They occurred with a variety of plant species and it is therefore difficult to identify a specific vegetation community for which this species was associated within the Study Area. Common associate grass and grass like species included bluejoint reedgrass, wood reedgrass (*Cinna latifolia*), and deergrass. Other associated species include bottlebrush, bog goldenrod, gall-of-the-earth (*Nabalus trifoliolatus*), tall northern green orchid (*Platanthera aquilonis*), Hooker's orchid, small tofieldia, Mistassini primrose, common butterwort, and northern white violet (*Viola macloskeyi*). Shrubs that were typically found in association with Lindley's aster include black spruce and balsam fir, shrubby cinquefoil, chokeberry (*Aronia* sp.), and northern blueberry.

Photo 12 Ecotone between wet meadow edge and the mesic scrub woodland habitat

Lindley's aster were frequently encountered within their typical habitat, but were sometimes absent even when the microhabitat appeared appropriate. When detected in the open fresh meadow subtypes surveyed, relative abundance varied from several individuals to hundreds of plants in a 10 m x 10 m area.

Regionally, Lindley's aster is mentioned by Fernald (1933) and was found during the field surveys in the Table Mountain / Pine Tree area, as depicted by Rouleau and Lamoureux (1992). Calcareous outcrops in this area were visited, and exhibited a diverse and unique flora with a large number of calcicolous, chionophilic, and Arctic-alpine species, similar to that recorded in the Study Area. The only species that thrive occupying calcareous substrates, considered limiting within Newfoundland and Labrador.

On the Port au Port Peninsula and elsewhere in the region, habitats for Lindley's aster appear to be somewhat variable. Robust populations of the species have been identified in association with characteristic native plant communities on the highlands of the Port au Port (with localized populations scattered throughout peninsula), and elsewhere, including the Table Mountain / Pine Tree area, where native plant communities occur together with extensively disturbed sites (currently undergoing recolonization by native plants). An abundance of Lindley's aster within both native and non-native plant communities at this location suggests that this species is possibly more abundant; however, due to the lack of botanical studies and the difficulty separating vegetative specimens from other species, its distribution in the region may be underrepresented.

4.2.4.2 Apiaceae: Osmorhiza depauperata Philippi (blunt sweet cicely) – G5/ N5 / S2

Blunt sweet cicely is a slender, erect short-lived perennial herb with stems up to 80 cm tall (Photo 13). The green leaves have blades 4 to 12 cm wide, are widely ovate to round, and 2- to 3-ternate. Leaflets are 1.5 to 5 cm wide, lanceolate to ovate, coarsely serrate to deeply lobed. The blade is borne on a long petiole. The inflorescence consists of a small, inconspicuous, compound umbel of many tiny white flowers at the tip

Photo 13 ***Osmorhiza depauperata*** **(blunt sweet cicely)**

of a stem-like peduncle. The club-shaped fruit, measuring 1 to 2 cm long, are ribbed with upward pointing bristles, and an obtuse or beakless tip.

Blunt sweet cicely is a North American species with a disjunct range (Cordilleran disjunct population), occurring in northeastern, northwestern, western, and southwestern Newfoundland, with occurrences extending north to southern Labrador at Forteau (Meades et al. 2015). Rouleau and Lamoureux (1992) depict occurrences (14 dots) of blunt sweet cicely from southwestern Newfoundland north to Eddie's Cove on the Northern Peninsula, with disjunct populations in the Twillingate area. AC CDC data obtained for this Project do not indicate this species as previously having been reported from within 5 km of the Study Area (AC CDC 2015).

This species occupies moist, coniferous spruce-fir forest, woodland and scrub habitats, elsewhere from mixed forests and riparian thickets adjacent to streams. Soils are often cool and mesic, and comprised of turfy organics over mineral soil or rock. In the Study Area, blunt sweet cicely was observed at four locations, generally in lightly disturbed (e.g., adjacent cutline), partially shaded forest opening and often in association with tamarack, paper birch, balsam fir, wild lily-of-the-valley, wild sarsaparilla, rose twistedstalk (*Streptopus lanceolatus*), yellow clintonia, and bunchberry (see Figure 4-3; Appendix B). Blunt sweet cicely is ranked as "*S2*" (AC CDC 2010) and is considered "*may be at risk*" by NLDEC. 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.

4.2.4.3 Cyperaceae: Carex concinna R.Br. (low northern sedge) – G5 / N5 / S1S2

Low northern sedge is a slender, low-growing graminoid, with stems 5 to 15 cm tall, arising singly or a few together from a creeping rhizome (Photo 14). Hultén (1968) emphasized that dry coniferous forests in calcareous soils were its typical habitats.

Photo 14 *Carex concinna* (low northern sedge)

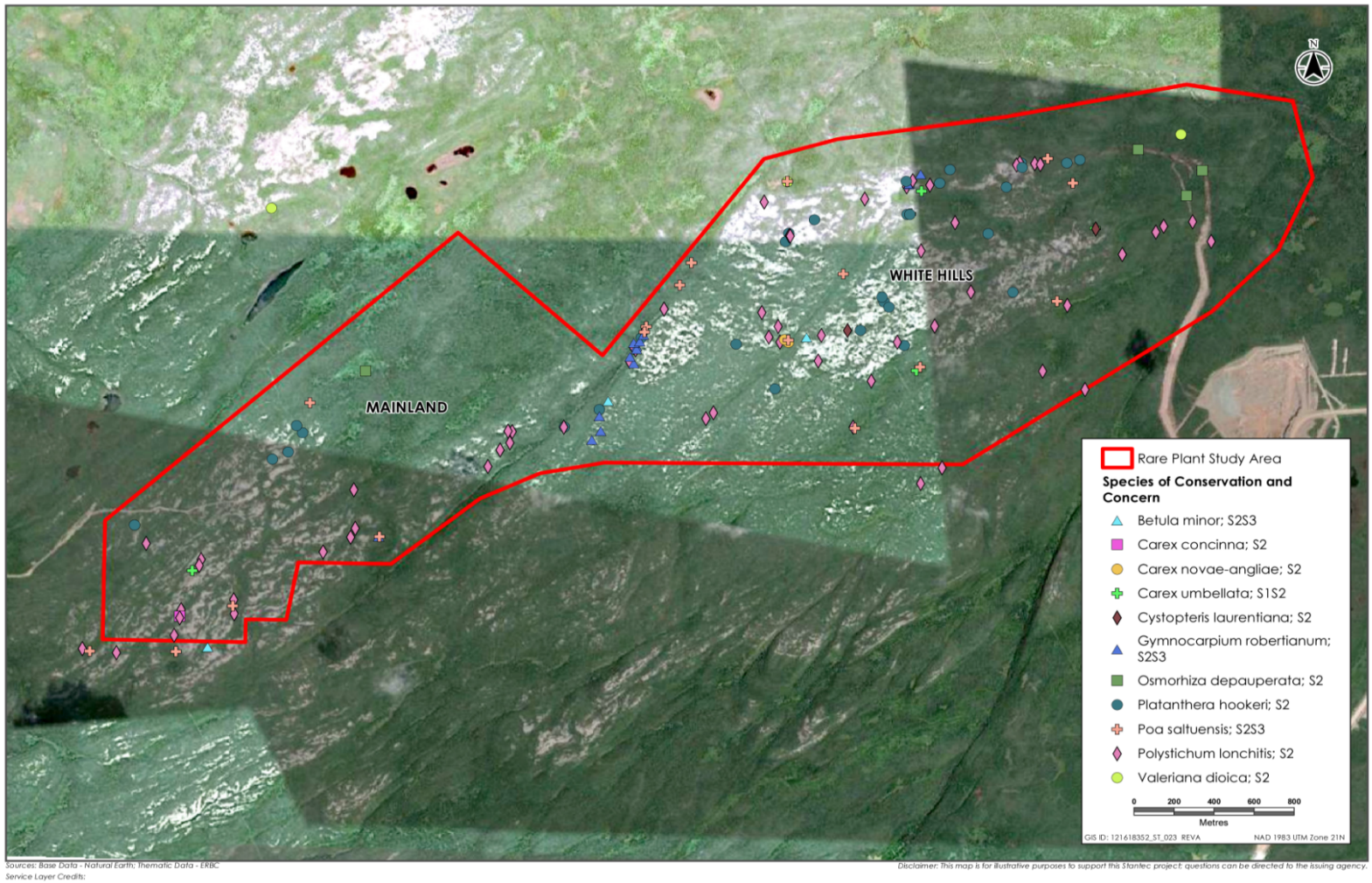

Figure 4-3 Species of Conservation Concern in the Study Area

In North America, this boreal species has been reported from all Canadian provinces and territories (except Nova Scotia and Prince Edward Island), and eight mid-west and northwestern states. In Newfoundland and Labrador, its range includes western and northwestern Newfoundland, north to western Labrador (Labrador City) (Meades et al. 2015). Scoggan (1978) showed a range that extends across Canada from Northwest Territories to Newfoundland and Labrador. Classified as rare on the Island of Newfoundland, low northern sedge is found on limestone barrens and ledges on the Great Northern and Port au Port peninsulas (Bouchard et al. 1991). Rouleau and Lamoureux (1992) depicts occurrences of low northern sedge from six locations: on the Port au Port Peninsula at Cape St. George; and on the Northern Peninsula, in the areas of Burnt Cape, Cook's Harbour, Englee, Englee-Barred Island, and Point Riche. AC CDC data obtained for this Project do not indicate this species as previously reported from within 5 km of the Study Area (AC CDC 2015). This species was observed from a single location, at the bottom of a small crevasse or sinkhole in the calcareous karstic bedrock (see Figure 4-3; Appendix B).

Low northern sedge is ranked as *S1S2* (AC CDC 2010) and is considered *may be at risk* by NLDEC. It is ranked as *G5* and *N5* (NatureServe 2011), indicating a taxon that is widespread, abundant, and secure globally and nationally, though it may be quite rare in parts of its range.

4.2.4.4 Cyperaceae: Carex novae-angliae Schwein. (New England sedge) – G5 / N5 / S2

New England sedge is a delicate, inconspicuous (even in fruit), loosely caespitose perennial sedge grouped within the Acrocystis section of the *Cyperaceae* family (Photo 15). The lowest bract is longer than the inflorescence; and leaves are glabrous and less than 2 mm wide. It has a small terminal spikelet (<20 mm long) that is staminate and two to three relatively short lateral spikes (each <7 mm long) that are pistillate (Gleason and Cronquist 1991). Perigynia are pale green, obovoid (longer than wide), have a bidentate beak, and have two distinct nerves.

Photo 15 *Carex novae-angliae* (New England sedge)

New England sedge is a temperate North American species with a range that includes, eastern, southern, southwestern and western

Newfoundland (Meades et al. 2015). In Newfoundland, New England sedge is found in thickets and open forest sites near the coast (Bouchard et al. 1991). Rouleau and Lamoureux (1992) depict occurrences (nine dots) of New England sedge from Bay Bulls, Crabbes Brook, Doyles, Guernsey Island, Bay of Islands, Tompkins, Little River, Rencontre West, Holyrood, and St. John's. It has not been found in the interior or northern parts of the island. Populations of New England sedge in Newfoundland occur in balsam fir forests that are stunted by the wind (tuckamore) (Robertson 1984). AC CDC data obtained for this Project do not indicate this species as previously having been reported from within 5 km of the Study Area (AC CDC 2015). New England sedge was recorded at two locations in the Study Area, from within areas of open, mesic balsam fir-spruce woodland / forest (see Figure 4-3; Appendix B).

New England sedge is ranked as "*S2*" (AC CDC 2010) and is considered "*sensitive*" by NLDEC. 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.

4.2.4.5 Cyperaceae: Carex umbellata Schkuhr ex Willd. (umbellate sedge) – G5 / N5 / S1S2

Umbellate sedge is small, low-growing tufted, perennial sedge arising from slender scaly rhizomes (Photo 16). The erect to ascending culms are 3 to 7.5 cm long, 3-angled, pale green, and glabrous. Alternate leaves are located toward the bottom of each culm. Spikes are solitary and borne on very short stalks (FNA Vol. 23 Page 538, 2002).

In North America, this boreal species has been reported from all Canadian provinces and territories (with the exception of Northwest Territories and Prince Edward Island), and from 35 states. In Newfoundland and Labrador, its range includes eastern, northeastern and central Newfoundland, north to central Labrador (Goose Bay) (Meades et al. 2015). Rouleau and Lamoureux's Atlas (1992) depict occurrences of umbellate

Photo 16 *Carex umbellata* (umbellate sedge) in habitat

sedge (mapped syn: *Carex abdita*) from six locations, including the Avalon Peninsula (three sites), Fleur de Lys, Grand Falls, and Twillingate. AC CDC data obtained for this project do not indicate this species as having previously been reported within 5 km of the Study Area. Umbellate sedge was observed infrequently during field surveys, from 5 locations throughout the Study Area (see Figure 4-3; Appendix B).

Within the Study Area, umbellate sedge occupied small, niche microhabitats, favourable to the growth of this species in an otherwise exposed, rocky, limestone barren landscape. It exhibited a low, dense growth often occupying small cracks and/or fissures in the karst limestone bedrock where soil and moisture accumulate. Associated species include: hairy willow, hemlock parsley, green spleenwort, fragile fern (*Cystopteris fragilis*), common oak fern (*Gymnocarpium dryopteris*), northern firmoss (*Huperzia selago*), alpine bluegrass (*Poa alpina*) and hard fescue (*Festuca trachyphylla*). Elsewhere in the province it is known from exposed siliceous (granitic) summits and along gravelly river terraces (Bouchard et al. 1991).

Umbellate sedge is ranked as "*S1S2*" (AC CDC 2010) and is considered "*sensitive*" by NLDEC. It is ranked as *G5* and *N5* (NatureServe 2010), indicating a taxon that is widespread, abundant, and demonstrably secure globally and nationally, though it may be rare in parts of its range.

4.2.4.6 Caprifoliaceae: Valeriana dioica subsp. sylvatica (S. Watson) F.G. Mey. (wood valerian) – G5T4T5 / N4N5 / S2

Wood valerian is a slender-stemmed, erect, 10 to 40 cm tall perennial herb from a stout branched rhizome or woody stem-base with fibrous roots (Photo 17). Its squared stems are erect, solitary, simple below the inflorescence, smooth or nearly so. Basal leaves are in the form of a rosette, spatulate to elliptical, up to 8 cm long and 3 cm wide. Leaves are mostly simple, smooth, long-stalked, with stem leaves opposite. They occur in pairs of two to four, up to 5 cm long and 2.5 cm wide, pinnately cleft with one to seven pairs of lateral lobes, the terminal lobe narrowly oblong, short-stalked or unstalked. Inflorescences are a compact, round-topped cluster of either male and female or only female flowers.

Photo 17 *Valeriana dioica* subsp. *sylvatica* (northern valerian) in habitat

In North America, this boreal species has been reported from all Canadian provinces and territories (except Prince Edward Island), and from some seven northwestern states. In Newfoundland and Labrador, its range includes western and northwestern Newfoundland, extending north to western and southwestern Labrador (Meades et al. 2015). On the Island of Newfoundland, it is known from a variety of wetted habitats over calcareous bedrock (Bouchard et al. 1991). Rouleau and Lamoureux (1992) depict occurrences (nine dots) of wood valerian from the Port au Port Peninsula to Serpentine Lake, and north to Englee (three dots) on the Northern Peninsula. AC CDC data obtained for this project do not indicate this species as having previously been reported from within 5 km of the Study Area (AC CDC 2015). During surveys of the Study Area in 2015, wood valerian was observed from two separate locations. Although the habitats are varied, occurrences of this species were primarily restricted to openings within the canopy, and most often in partly shaded areas with readily available moisture (i.e., moist to fresh soils) (see Figure 4-3; Appendix B).

Wood valerian is ranked *S2* and "*may be at risk*" (its population considered rare in Newfoundland and potentially vulnerable to extirpation on the Island of Newfoundland). It is globally and nationally secure, with rankings of *G5T5* and *N5* (NatureServe 2013), respectively.

4.2.4.7 Cystopteridaceae: Cystopteris laurentiana (Weatherby) Blasdell (Laurentian bladder fern) – G3 / N3 / S2

Laurentian bladder fern is an upright, perennial, herbaceous fern; with fronds growing up to 60 cm in length, including their stipes (Photo 18). The blades are bipinnate-pinnatifid, and are ovate to lanceolate, tapering abruptly to their tips. This uncommon species is a fertile hybrid between bulblet fern (*Cystopteris bulbifera*) and fragile fern (*C. fragilis*). Unlike bulblet fern, the Laurentian bladder fern stipe has sparse (vs. dense), glandular hairs. In addition, and perhaps more evident, it rarely has bulbils characteristic of the bulblet fern, and when present these are often few, misshapen and abortive.

Photo 18 ***Cystopteris laurentiana*** **(Laurentian bladder fern)**

In eastern North America, Laurentian bladder fern is a north temperate and southern boreal species, with scattered, apparently infrequent occurrences extending from Minnesota in the west, south to Pennsylvania and north to include disjunct populations in the southern Great Lakes area; and east through Quebec to Newfoundland (NatureServe 2015). In Atlantic Canada, Laurentian bladder fern is restricted to calcareous cliffs and slopes (mostly limestone or gypsum). In Newfoundland and Labrador, it has an affinity and range that includes northeastern, western and northwestern Newfoundland, and northward to southeastern Labrador (Meades et al. 2015). Laurentian bladder fern is known from limestone cliffs in western Newfoundland, the Great Northern Peninsula, and the Twillingate area (Bouchard et al. 1991). It is considered rare throughout its range. AC CDC data obtained for this project do not indicate this species as having previously been reported from within 5 km of the Study Area, though occurrences of the closely related fragile fern are on record (AC CDC 2015). Laurentian bladder fern was observed from two locations (although uncertainty regarding the proper identification of this species in the field suggest that additional occurrences may exist), at the bottom of a small, moist crevasse or sinkhole in the calcareous karstic bedrock (see Figure 4-3; Appendix B)

Laurentian bladder fern is characteristically found occupying bare rock and narrow cracks and crevasses on shaded vertical surfaces of cliffs, ledges, and bedrock fractures on high pH substrates, including limestone, dolomite, and other calcareous and alkaline rocks of the Port au Port Peninsula. Distinguishing various *Cystopteris* species in the field (such as *C. laurentiana*, *C. fragilis*, and *C. bulbifera*) may be difficult because many of the characteristics are not necessarily clear-cut (e.g., bulblets are frequent in *C. bulbifera* and occasional in *C. laurentiana*; usually densely covered by gland-tipped hairs in *C. bulbifera* and usually sparsely covered by glandular hairs in *C. laurentiana*); therefore, accurate estimates of the number of locations or population size for Laurentian bladder fern throughout the Study Area was deemed impractical. Rather occurrences may be considered scattered and infrequent to locally abundant.

Laurentian bladder fern is ranked as S2 (AC CDC 2010) and is considered *may be at risk* by NLDEC. It is ranked as *G3* and *N3* (NatureServe 2014), indicating a taxon that is either very rare or local throughout its range (21-100 occurrences or less than 10,000 individuals) or found locally in a restricted range or vulnerable to extinction from other factors.

4.2.4.8 Dryopteridaceae: Polystichum lonchitis (L.) Roth (northern hollyfern) - G5 / N4N5 / S2

Northern hollyfern is an Arctic-alpine species occupying crevasses or fissures in base-rich rocks such as limestone, calcareous schists and basalt. It is a glossy, rigid fern with thick evergreen fronds (leaf blades) growing in dense tufts, ranging from 20 to 60 cm long. Its shiny, leathery fronds are linear, once pinnately divided and tapering to a point. Each pinnae also terminates into a sharp bristly or spiny margin (see Figure 4-3; Appendix B, Photo 19).

Photo 19 ***Polystichum lonchitis*** **(northern hollyfern) centre**

Northern hollyfern has a circumboreal distribution. In North America it occurs form Alaska south to isolated populations in Arizona and east across the eastern Canadian provinces to the Atlantic Coast. This species has a fairly limited distribution in Newfoundland and Labrador, with occurrences in northeastern, western, and northwestern Newfoundland. The atlas prepared by Rouleau and Lamoureux (1992) indicate occurrences of northern hollyfern from six locations: on the Port au Port Peninsula at Cape St. George and South Head; Lewis Hills area, Serpentine Lake area; Tablelands-Gros Morne National Park area, Burnt Cape, Baie Verte Peninsula (Tilt Cove), Cape Norman, and St. John Bay at Point Riche and Barr'd Harbour. Cody and Britton (1989) show the distribution of northern hollyfern ranging from the Port au Port to the tip of the Northern and Baie Verte peninsulas (nine dots). Recent AC CDC reports reaffirm these observations, with occurrences reported from Garden Hills (1999); Hwy 463 (1999); Mainland (2007); Round Head (1999); and Three Rock Cove (2007) on the Port au Port Peninsula; to Serpentine Lake (1999) in western and extending north to Burnt Cape (1999) and Cape Norman (2000) on the Northern Peninsula. It has also been from western Labrador although those early reports remain unverified (Meades et al. 2015).

During the 2015 survey, the relatively common occurrence of northern hollyfern appeared consistent in its association with the calcareous or otherwise basic substrates of numerous large crevasses, cracks, fissures, sinkholes, gullies, and ravines that dissect the Study Area. Within the Study Area, it appeared to prefer fresh to moist soils and, when observed along slopes, it was often situated at mid to toe slope positions. The most consistent habitat requirement appeared to be moist forests and woodlands with exposed rock and topographic protection. Its growth habit of forming low, dense patches or clumps often made the counting of individual plants impractical, thus the number and size of patches was noted as an expression or estimate of population size. Northern hollyfern was recorded from 57 locations across the Study Area, often in association with the following species: shrubby cinquefoil; alderleaf buckthorn; cow parsnip; New York aster; northern beech fern; and red baneberry, in addition to various calcium-loving species (calciphiles) including the ferns green spleenwort, limestone oak fern, fragile fern, and various mosses.

Northern hollyfern is ranked as "*S2*" (AC CDC 2010) and is considered "*may be at risk*" by NLDEC. It is ranked as *G4* and *N4N5* (NatureServe 2011), indicating a taxon that is widespread, abundant, and secure globally and nationally, though it may be quite rare in parts of its range.

4.2.4.9 Orchidaceae: Platanthera hookeri (Torr. ex A. Gray) Lindl. (Hooker's orchid) – G4 / N4 / S2

Hooker's orchid is an uncommon, early blooming (early to mid-July) orchid found in the drier portions of black spruce and tamarack bogs and frequently on the turfy limestone barrens (western Newfoundland) (Bouchard et al. 1991) (Photo 20). The growth habit of Hooker's orchid can be confused with lesser roundleaf orchid (*Platanthera orbiculata*), both having two large rounded flat leaves at ground level and producing a tall (20 to 40 cm) erect inflorescence. However, floral characteristics are quite distinct. Racemes have 6 to 25 yellow-green flowers, with flower lips hooked and pointed or curving upwards. Hooker's orchid can be differentiated by its 9 to 13 mm spurs, compared to the longer 16 to 27 mm spurs of lesser roundleaf orchid. Also, scapes (flowering stems) of the Hooker's orchid do not have bracts, as are found on the scapes of lesser roundleaf orchid. In appropriate habitat (see Figure 4-3; Appendix B), Hooker's orchid forms colonies of 1 to 10 or more loosely associated plants.

Photo 20 ***Platanthera hookeri*** **(Hooker's orchid)**

Hooker's orchid is a north temperate to southern boreal species from eastern North American, with a southern affinity and range that includes eastern Canada and the Atlantic provinces. In Newfoundland and Labrador this includes western and northwestern Newfoundland (Zinck 1998; Hinds 2000; Meades et al. 2015;). Recent AC CDC reports revealed occurrences of Hooker's orchid from three locations on or in proximity to the Port au Port Peninsula - Cape St. George-Mainland (2000, 2001, and 2007), Garden Hills (1999), and Table Mountain (2007).

Hooker's orchids were observed from multiple locations (30 total) throughout the Study Area, and primarily during the late season survey. Hooker's orchids were found to be closely

associated with mesic scrub woodland types and open heath. They were found most often in openings within the scrub forest, where there was little understorey vegetation and moss / lichen substrates dominate. They preferred a moderate amount of sunlight and were mostly found growing in partly shaded areas where there was a break in the canopy to allow sunlight through.

Hooker's orchid is ranked as "*S2*" (AC CDC 2010) and is considered "*may be at risk*" by NLDEC. It is ranked as *G4* and *N4* (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.

4.2.4.10 Poaceae: Poa saltuensis Fernald & Wiegand (forest bluegrass) – G5/ N4? / S2S3

Forest bluegrass is a slender, graceful herbaceous perennial (*Poaceae* family) of rich, rocky woodlands and openings (Photo 21). Forest bluegrass grows in loose tufts from a fibrous root base. The soft, bluish green leaves are narrow (2 to 5 mm) and generally up to 10 cm in length. The leaf sheaths are nearly glabrous, closed for at least one-third of their length, compressed, and shorter than the internodes. Reaching 30 to 100 cm in height, the culms (flowering stems) are weak, and the inflorescence (flowering panicle) is loose, nodding or "drooping", with slender arching branches. The "drooping" flower panicle is 5 to 10 cm in length. The basal branches of the inflorescence are either single, arranged in pairs or groups of three at each node bearing few spikelets at the tips. The lemmas are webbed as is typical of a group of the *Poa* species, and glabrous on the keel.

Photo 21 *Poa saltuensis* (forest bluegrass)

Forest bluegrass is a north temperate and eastern North American species with occurrences extending north to central, western, and southwestern Newfoundland (Meades et al. 2015). Rouleau and Lamoureux (1992) depict occurrences of forest bluegrass from several locations, including: Bishop Falls-Wooddale; Glenwood; Grand Falls; Buchan's Junction; Deer Lake; Steady Brook; Humber Mouth; Corner Brook, Middle Brook-Bonne Bay; ~Sheffield Lake; ~Sir Richard Squires Provincial Park; Stephenville Crossing; Summerside (wNL); Table Mountain; and Tompkins.

Similarly, AC CDC data obtained for the Project indicate that this species has been previously recorded at Garden Hills and White Hills on the Port au Port (in 2000), Crabbes River (in 2000) east of Stephenville, and Killdevil and North Arm Mountain in Gros Morne National Park (in 1995). This species was observed from 15 locations throughout the Study Area, often occurring in forest woodland borders and/or recently disturbed lands with more affinity to semi-shaded to open, calcareous dry, or rocky habitat. Forest bluegrass is known to appear in woodlands following clearing or cutting (see Figure 4-3; Appendix B).

Forest bluegrass is ranked *G5* and *N4?* by NatureServe, indicating that it is generally widespread and secure, although there is possible cause for some concern at the national level as a result of local recent declines, threats, or other factors (NatureServe 2015). It is ranked as "S2S3" (AC CDC 2010) and "*sensitive*" by NLDEC.

4.2.4.11 Betulaceae: Betula minor (Tuck.) Fernald (dwarf white birch) – G4 / N4N5 / S2S3

Dwarf white birch is an erect, irregularly spreading or depressed shrub up to 5 m tall with reddish brown bark. Its branches are hairless, sparsely pubescent to glabrous (with a few soft hairs), often dotted with resinous glands, but some plants are intermediate in character between *B. glandulosa* and *B. cordifolia*, two species with which it overlaps in both range and habitats. The leaf blades are ovate, rounded to truncate at the base, with margins coarsely doubly serrate, teeth obtuse to rather sharp, toothed nearly to base, apex acute to obtuse; surfaces abaxially glabrous to moderately pubescent, usually more densely pubescent along major veins, and often covered with small resinous glands. Compared to *B. glandulosa*, the leaves are larger, relatively more pointed, and with a subcordate base. Compared to *B. cordifolia*, the catkins are longer, the wings of the samaras (fruit) are wider, and the flowers appear slightly earlier.

Dwarf white birch is a boreal North American species, known from throughout Newfoundland, extending north to western and northern Labrador (Makkovik), and often occupying calcareous habitats (Meades et al. 2015). Rouleau and Lamoureux (1992) depicts occurrences of dwarf white birch from several locations (10 dots) throughout western Newfoundland, with disjunct populations reaching the central part of the island at South Pond and near Tilt Cove on the Baie Verte Peninsula. Recent AC CDC reports have identified occurrences of dwarf white birch on the Port au Port (1999), and immediately east of the Port au Port at Table Mountain (1999). This species was observed at three locations throughout the Study Area, often occurring in well-drained, calcareous or rocky habitats characterized by weathered rock barrens or at the margins of mesic scrub spruce ecotypes (see Figure 4-3; Appendix B).

Dwarf white birch is found on fairly exposed windy ridges in alpine and alpine-like communities characterized by highly calcicolous heath, and elsewhere at the margins of dry to mesic scrub woodlands and barren rock.

Dwarf white birch is ranked *G4* and *N4N5* by NatureServe (2012), indicating that it is apparently secure (uncommon but not rare), although there is possible cause for some concern at both the

global and national level as a result of local recent declines, threats, or other factors (NatureServe 2005). It is ranked as "*S2S3*" (AC CDC 2010) and "*secure*" by NLDEC.

4.2.4.12 Cystopteridaceae: Gymnocarpium robertianum (Hoffm.) Newman (limestone oak fern) – G5/ N3 / S2S3

Limestone oak fern is a small, delicate fern of the woodfern (*Dryopteridaceae*) family (Photo 22). Three-part fronds, ranging from 10 to 50 cm in length, are borne from long, slender, sub-surface stems (rhizomes) on relatively long, glandular-hairy petioles (leafstalks). The petioles range to approximately 30 cm in height and are slightly scaly at the base. The broadly triangular leaf blade is a compound leaf divided into individual primary segments or pinnae (leaflets). These pinnae are similarly divided once to twice more into the ultimate segments of the leaf, which are strongly rounded with entire to crenate, mostly recurved margins. The undersides of the leaf, as well as the leaf axis (rachis), are covered with short, dense, glandular hairs. Fertile leaves produce small, round, well-spaced clusters of spores (sori) on their underside near the segment margins; these lack a covering (indusium). Limestone oak fern is similar in appearance to the wide-ranging common oak fern. It is distinguished from common oak fern by pubescence, it has glandular hairs on the petiole and blade, and has leaves with the terminal third longer than the two triangular basal pinnae, so the fronds appear less like an equilateral triangle.

Photo 22 ***Gymnocarpium robertianum*** **(limestone oakfern)**

Limestone oak fern has a southern boreal distribution that is known to extend over a broad range of eastern North America, with disjunct populations in Eurasia (Hultén 1968). Its provincial range extends north to northeastern, western, and northwestern Newfoundland, including the first, recently confirmed populations from western Labrador (Meades et al. 2015; Stassinu Stantec 2013). Rouleau and Lamoureux (1992) depict (14 dots) limestone oak fern in an area extending

from the Port au Port Peninsula to the area of Gros Morne National Park, with disjunct populations reported at Reefs Harbour. Considered rare in Newfoundland and Labrador, this species is known from talus slopes and ledges of limestone cliffs (Bouchard et al. 1991). Recent AC CDC reports have also confirmed the occurrence of limestone oak fern from within or in proximity to the Study Area (i.e., White Hills) (C. Hanel, NLDEC, pers. comm., 2015).

As indicated by the common name, this fern prefers alkaline or calcium-rich substrates, and it can be found colonizing cool rock crevasses in areas of limestone or dolomite pavement or bedrock outcrops. This species was observed at several locations (14 total) throughout the Study Area, often occurring in open, sunny, dry to moist crevasses or sinkholes in the calcareous bedrock (see Figure 4-3; Appendix B) and often in association with male fern, green spleenwort, and Laurentian bladder fern.

Limestone oak fern is ranked *G5* and *N3* by NatureServe (2014), indicating that it is generally widespread and secure, although there is possible cause for some concern at the national level as a result of local recent declines, threats, or other factors (NatureServe 2013). It is ranked as "*S2S3*" (AC CDC 2010) and "sensitive" by NLDEC.

4.2.5 Plant Communities with Elevated Potential for SAR or SOCC in the Study Area

In the Study Area, floristic diversity varies depending on the vegetation type encountered. Owing to the topographic relief of the Study Area, uplands plant communities predominate. Diversity is usually at its highest on open, gently sloping, and mineralized terrain, particularly that in association with the upland coniferous forest types and fresh meadow subtypes. Diversity is lowest in those areas characterized by high elevation, exposed bedrock, and weathered rock barrens. Limestone, dolomite, and other calcareous / alkaline bedrock occur throughout the Study Area and exhibit a diverse and unique flora with a large numbers of calcicolous and Arctic-alpine species. Late-lying snow is a common feature of these high elevation habitats and most plants occupying these areas are Arctic-alpine and chionophile species.

A mosaic of upland coniferous and Arctic-alpine environments and geological features are present in the area. Several valley, gullies, and small ravines occur intermittently across the Study Area and offer a mixture of various upland plant community types and subtypes encountered across the site and are capable of sheltering a multitude of plant species.

An excellent example of this occurs in sloping terrain at the lower reaches of the Study Area (bordering the north and northwestern boundaries of the White Hills mineral claim) (Photo 23), where the limestone barren community type grades into a relatively lush valley comprised of mesic scrub woodland, upland conifer forest, and fresh meadows. A rich, diverse herbaceous flora, including many of the rare plants (e.g., Lindley's aster, wood valerian, northern hollyfern, limestone oak fern, etc.) and other species observed elsewhere in the Study Area are present in association with this area.

Photo 23 Slope at the lower reaches of the Study Area

Weathered rock barrens occupy a substantial portion of the Study Area and are characterized by sparse and less-diverse calciphilic and Arctic-alpine species. Accumulation of mineral and organic debris (soil) was apparent on ledges but, because of erosion by wind and water, it was most evident in the small cracks, crevasses, fissures, and sinkholes.

In general, these features form the only situations in which plants have been successful in becoming established. The primary characteristic of the community was the sparseness of plant cover. In many areas much more bedrock was exposed (i.e., bedrock pavement) than was covered by vegetation (Photo 24). In the areas that appeared to be almost devoid of plants, the few plant species present were confined primarily to cracks, crevasses, fissures, and sinkholes of various sizes and to the ledges associated with small cliff faces that exist throughout the Study Area. The only sites with more or less solid mats of vegetation were on the extensive, low-lying, shallow depressional areas and small cracks, crevasses, fissures, and ledges. In both instances, moss carpets and areas of diffuse herbaceous plant growth, respectively, owe their existence to the calcium-enriched runoff and seepage water from above; the limited soils and moisture having accumulated in small cracks, crevasses, fissures, and ledges, and making the habitat more mesophytic. On the whole, however, the habitats available for plants and plant growth are extremely harsh.

Photo 24 Cracks, crevasses, and fissures in weathered rock barrens

Surveys also emphasized the effects of elevation and exposure in providing conditions (microclimatic) necessary for the persistence of Arctic and/or cordilleran species in these comparatively southern latitudes. Although limited in their extent, Arctic-alpine (or alpine-like) plant communities or vegetation was observed sporadically throughout the Study Area, particularly as part of the White Hills mineral lease. The White Hills rise abruptly from sea level to the high elevation areas of the Port au Port Peninsula and accounts for the cooler, exposed barren conditions that exist there. Severe exposure and a lack of vegetation cover prevent the accumulation of snow cover in winter, exposing the site to the effects of wind and freezing rain, thus effectively limiting both the number of plant species that can survive there and the number of plants which might compete with, and perhaps replace, Arctic species under less difficult circumstances. Vegetation in these areas was essentially characterized by exposed, weathered rock barrens, interrupted by extensive areas that supported small trees or saplings and other plants species characteristic of mesic scrub (i.e., tuckamoor) forests. These microhabitats were systematically investigated during the survey when encountered.

Photo 25 Snowbed or snowpatch (chionophile) communities

Similarly, snowbed or snowpatch communities in the Study Area are home to a number of low-growing plant species that have adapted to particular environmental conditions (i.e., long-lasting snow cover and short growing seasons). Differences between this plant community and that of the Arctic-alpine "like" community described above were due primarily to topographic discrepancies, particularly in relation to gullies, ravines, and extensive areas of fractured or dissolved karstic bedrock. The presence of most snowbed plant species is therefore dependent on a period of prolonged snow cover and so their conservation may well depend on their ability to adapt in the face of natural pressures, particularly changing climatic conditions. The fact that harsh microclimatic conditions prevail in this area was amply demonstrated by the discovery of an accumulation of snow and ice in late-June from the previous winter on the north-facing slopes of several protected gullies and ravines occurring throughout the White Hills area (Photo 25).

5.0 SUMMARY AND RECOMMENDATIONS

This report represents the results of botanical surveys carried out on AML's Mineral Lease area situated on the Port au Port Peninsula, between the communities of Lower Cove and Shoal Cove, Newfoundland. The property is located west of AML's existing operations and in an area known locally as the White Hills. Vehicle access is via of Highway 460 between the communities of Lower Cove and Shoal Cove, with access to the Study Area attained via an existing exploration access road linking AML's current operations to that of the proposed extension area.

The 2015 botanical surveys were intended to document the location, population size, and habitat for rare vascular plant taxa occurring within the Port au Port Quarry Extension Area, as well as providing a list of all vascular plant species encountered throughout the survey.

This plant survey was carried out by Stantec botanists over a combined 13 days (early season surveys: June 16 to 19, 2015; late season surveys: July 27 to August 4, 2015), believed the optimum sampling period (most species in bloom) from which to conduct botanical surveys of this type. Early season surveys were conducted to capture ephemeral blooming species (e.g., fairy slipper (*Calypso bulbosa*)). Late season surveys were conducted to capture mid- to late-season blooming species, which may not bloom in the spring but would have been observable during this survey window. Many species have a long blooming period that extends from the spring through the fall, encompassing both the early and late season survey periods and would have been detectable, if present, during both of these surveys. Time spent in a given habitat depended on potential for rare plant species to occur and was based on element occurrence information obtained from the AC CDC (2015), as well as consultation with the Provinces botanist (C. Hanel, NLDEC. pers. comm., 2015).

The Study Area is 761 ha in area and covers an elevational range from 133 m above sea level at Mainland to 312 m above sea level at the summit of the White Hills deposit. Eight general plant community types were identified in the Study Area. They include weather rock barrens, dry to moist / wet crevasses, dwarf shrub heath / Arctic-alpine, mesic scrub woodland, fresh meadows, incised sheltered valleys, gullies, ravines, upland conifer forest, and coniferous treed fen. The flora of the Study Area includes 230 vascular plant species, distributed into 135 genera and 52 families, with the *Cyperaceae* (32 species) and *Asteraceae* (24 species) as the largest families.

The NLDEC, together with the AC CDC, are responsible for assigning rarity rankings (S-Ranks) for all known vascular species in the province. A search of the AC CDC database indicated that at least 12 of the 230 species identified during the field surveys 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 NLDEC 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 NLDEC and the AC CDC.

Through delivery of these surveys it was confirmed that the Study Area:

- does not support any COSEWIC or SARA-listed species;
- supports provincially listed, "*endangered*" species, Lindley's aster;
- supports populations of at least 11 potentially rare vascular plant taxa in the province.

Although none of the plant species observed during 2015 field surveys are COSEWIC or *SARA*-listed species, the Study Area does support the provincially listed, "*endangered*" species, Lindley's aster. Lindley's aster has been documented as having a very narrow range in Newfoundland and Labrador, occupying an area of less than 50 km², and the centre of its known population is considered within or in the immediate vicinity of the Study Area (SSAC 2009) and has potential to be directly influenced by Project activities. Further studies aimed at identifying the locations of additional populations for these species within the region could be used to further evaluate the potential environmental effects of the Project on their populations.

Avoidance of direct and indirect alterations to the habitat for this species would be the most effective means of reducing the potential environmental effects of the Project on regional populations of Lindley's aster. Given the nature of the Project and overlapping demands for the resource (or habitat), other mitigation options, including the potential and likely success of moving the population to nearby suitable habitat, should be investigated with representatives of NLDEC. Transplanting could be considered where avoidance is not practical, but may be challenged by the specific habitat requirements (e.g., mildly calcareous [limestone] substrate) of this and many other rare plants observed from the area.

In consideration of these challenges, the following mitigation options are presently being evaluated:

- Avoidance of direct and indirect disturbance to the known populations of Lindley's aster by altering the affected area (i.e., Project footprint), where practicable
- Engage NLDEC in discussions regarding alternative mitigation options, including the development of transplantation trials for Lindley's aster
- Known occurrences of rare vascular plant taxa, in particular Lindley's aster, within and/or immediately adjacent the Study Area, should be monitored periodically to detect substantial changes in health and population size, with priority given to those populations most likely to be vulnerable as a result of being adjacent to existing or future Project activities.
- Maintaining wild populations through the establishment of new colonies in appropriate natural habitats using plants cultivated through seed collection, germination, and propagation.

An additional 11 rare or potentially rare vascular plant species (mostly calciphile, alpine, and chionophile) were also identified during the field work and may be of conservation concern to the Government of Newfoundland and Labrador, thus requiring species-specific mitigation. If development should encroach on one of these plant populations, efforts should be made to evaluate all potential mitigation options available.

AML will contact and consult with NLDEC Wildlife Division for approval of any mitigation strategy prior to disturbing rare vascular plant taxa.

Many of the rare vascular plant taxa occurring within the Study Area have known occurrences outside the Study Area. Knowledge about these occurrences is often limited, as many are based on historic reports that have not been verified. Additionally, surveys may be lacking in many areas and must be expanded to more accurately estimate the provincial significance (S-Rank) of those occurrences from within the Study Area.

6.0 CLOSURE

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

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 has been quality reviewed by Sue Meades and Ellen Tracy. 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

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 Study Area

Table B.1 Vascular Plant Species Observed within the AML Study Area

Family	Common Name	Scientific Name	Species Code	G Rank	N Rank	S Rank
Trees / Shrubs						
Betulaceae	paper birch	*Betula papyrifera*	BETUPAP	G5	N5	S5
Pinaceae	balsam fir	*Abies balsamea*	ABIEBAL	G4	N5	S5
Pinaceae	tamarack	*Larix laricina*	LARILAR	G4	N5	S5
Pinaceae	white spruce	*Picea glauca*	PICEGLA	G5T5	N5	S5
Pinaceae	black spruce	*Picea mariana*	PICEMAR	G4	N5	S5
Shrubs						
Adoxaceae	red elderberry	*Sambucus racemosa*	SAMBRAC	G5	N5	S4
Adoxaceae	squashberry	*Viburnum edule*	VIBUEDU	G5T5	NNR	S5
Adoxaceae	northern wild raisin	*Viburnum cassinoides*	VIBUNUD	G5	NNR	S5
Adoxaceae	highbush cranberry	*Viburnum trilobum*	VIBUOPU	G5	N5	S5
Aquifoliaceae	mountain holly	*Ilex mucronatus*	NEMOMUC	G5	N5	S5
Betulaceae	mountain alder	*Alnus viridis* subsp. *crispa*	ALNUVIR	G5	N5	S5
Betulaceae	heartleaf birch	*Betula cordifolia*	BETUCOR	G5	NNR	
Betulaceae	glandular birch	*Betula glandulosa*	BETUGLA	G5T5	N5	S3
Betulaceae	dwarf white birch	*Betula minor*	BETUMIN	G5	N4	S2S3
Betulaceae	paper birch	*Betula papyrifera*	BETUPAP	G5	N5	S5
Betulaceae	bog birch	*Betula pumila*	BETUPUM	G5T5	N5	S5
Betulaceae	beaked hazelnut	*Corylus cornuta*	CORYCOR	G4	NNR	S3S4
Caprifoliaceae	mountain fly-honeysuckle	*Lonicera villosa*	LONIVIL	G5	NNR	S5
Cornaceae	bunchberry	*Cornus canadensis*	CORNCAN	G5	N5	S5
Cornaceae	red-osier dogwood	*Cornus stolonifera*	CORNSER	G5T5	NNR	S5
Cornaceae	Swedish bunchberry	*Cornus suecica*	CORNSUE	G5T5	N3N 5	S4
Cupressaceae	ground juniper	*Juniperus communis* var. *depressa*	JUNICOM	G5	N5	S4S5
Cupressaceae	creeping juniper	*Juniperus horizontalis*	JUNIHOR	G5	N5	S5
Elaeagnaceae	soapberry	*Shepherdia canadensis*	SHEPCAN	G4	NNR	S4
Empetraceae	black crowberry	*Empetrum nigrum*	EMPTNIG	G4	NNR	S5
Ericaceae	glaucousleaf bog rosemary	*Andromeda polifolia* var. *latifolia*	ANDRPOL	G4	NNR	S5
Ericaceae	alpine bearberry	*Arctous alpina*	ARCTALP	G5T5	NNR	S4S5
Ericaceae	common bearberry	*Arctostaphylos uva-ursi*	ARCTUVA	G4	NNR	S4
Ericaceae	trailing arbutus	*Epigaea repens*	EPIGREP	G5T5	NNR	S3
Ericaceae	creeping snowberry	*Gaultheria hispidula*	GAULHIS	G5	NNR	S5

Family	Common Name	Scientific Name	Species Code	G Rank	N Rank	S Rank
Ericaceae	sheep laurel	*Kalmia angustifolia*	KALMANG	G5T5	NNR	S5
Ericaceae	bog laurel	*Kalmia polifolia*	KALMPOL	G5	NNR	S5
Ericaceae	rhodora	*Rhododendron canadense*	RHODCAN	G5	NNR	S5
Ericaceae	Labrador tea	*Rhododendron groenlandicum*	RHODGRO	G5	N5	S5
Ericaceae	lowbush blueberry	*Vaccinium angustifolium*	VACCANG	G5	N5	S5
Ericaceae	northern blueberry	*Vaccinium boreale*	VACCBOR	G5	N4	S4S5
Ericaceae	small cranberry	*Vaccinium oxycoccos*	VACCOXY	G5T5	N5	S5
Ericaceae	alpine bilberry	*Vaccinium uliginosum*	VACCULI	G5T5	NNR	S5
Ericaceae	partridgeberry	*Vaccinium vitis-idaea*	VACCVIT	G5	NNR	S5
Grossulariaceae	bristly black currant	*Ribes lacustre*	RIBELAC	G4	NNR	S3S4
Grossulariaceae	swamp red currant	*Ribes triste*	RIBETRI	G5T5	NNR	S4
Myricaceae	sweet gale	*Myrica gale*	MYRIGAL	G5T5	NNR	S5
Rhamnaceae	alderleaf buckthorn	*Rhamnus alnifolia*	RHAMALN	G5	NNR	S5
Rosaceae	shrubby cinquefoil	*Dasiphora fruticosa*	DASIFRU	G5T5	NNR	S3S5
Rosaceae	Bartram's chuckleypear	*Amelanchier bartramiana*	AMELBAR	G4	NNR	S5
Rosaceae	chokecherry	*Prunus virginiana*	PRUNVIR	G4	NNR	S4
Rosaceae	shining rose	*Rosa nitida*	ROSANIT	G5T5	N4N5	S4S5
Rosaceae	Virginia rose	*Rosa virginiana*	ROSAVIR	G5T5	NNR	S3S5
Rosaceae	plumboy	*Rubus arcticus* subsp. *acaulis*	RUBUARC	G5	NNR	S3
Rosaceae	wild red raspberry	*Rubus idaeus* subsp. *strigosus*	ACERSPI	G5	N5	S5
Rosaceae	dewberry	*Rubus pubescens*	RUBUPUB	G5	NNR	S5
Rosaceae	showy mountain ash	*Sorbus decora*	SORBDEC	G5	NNR	S3S5
Salicaceae	willow	*Salix* sp.		G5	NNR	S2
Salicaceae	hairy willow	*Salix vestita*	SALIVES	G5	NNR	S4
Sapindaceae	mountain maple	*Acer spicatum*	ACERSPI	G5	N5	S5
Sapindaceae	red maple	*Acer rubrum*	ACRERUB	G5	N5	S5
Taxaceae	Canada yew	*Taxus canadensis*	TAXUCAN	G4	N5	S3
Graminoids						
Cyperaceae	drooping woodland sedge	*Carex arctata*	CAREART	G4	N5	S3S5
Cyperaceae	scabrous black sedge	*Carex atratiformis*	CAREATR	G4	NNR	S3S5
Cyperaceae	golden sedge	*Carex aurea*	CAREAUR	G5	N5	S3
Cyperaceae	brownish sedge	*Carex brunnescens*	CAREBRU	G4	N5	S3S5

Family	Common Name	Scientific Name	Species Code	G Rank	N Rank	S Rank
Cyperaceae	Buxbaum's sedge	*Carex buxbaumii*	CAREBUX	G4	N5	S3S5
Cyperaceae	hoary sedge	*Carex canescens*	CARECAN	G5	N5	S3S5
Cyperaceae	hair sedge	*Carex capillaris*	CARECAP	G5	N5	S3S5
Cyperaceae	chestnut sedge	*Carex castanea*	CARECAS	G4	N5	S3S5
Cyperaceae	low northern sedge	*Carex concinna*	CARECON	G4	N5	S2
Cyperaceae	bristleleaf sedge	*Carex eburnea*	CAREEBU	G5	N5	S3
Cyperaceae	little prickly sedge	*Carex echinata* subsp. *echinata*	CAREECH	G5	N5	S3S5
Cyperaceae	yellow sedge	*Carex flava*	CAREFLA	G5	N5	S3S5
Cyperaceae	glacier sedge	*Carex glacialis*	CAREGRA	G4	NNR	S3
Cyperaceae	inland sedge	*Carex interior*	CAREINT	G5	N5	S3S5
Cyperaceae	American woollyfruit sedge	*Carex lasiocarpa* subsp. *americana*	CARELAS	G5T5	N5	S3S5
Cyperaceae	bristlestalk sedge	*Carex leptalea*	CARELEP	G4	N5	S3S5
Cyperaceae	nerveless woodland sedge	*Carex leptonervia*	CARELEP	G5	NNR	S3S5
Cyperaceae	boreal bog sedge	*Carex magellanica* subsp. *irrigua*	CAREMAG	G5	N5	S3S5
Cyperaceae	New England sedge	*Carex novae-angliae*	CARENOV	G5	NNR	S2
Cyperaceae	russet sedge	*Carex saxatilis*	CARESAX	G5	N5	S3S5
Cyperaceae	singlespike sedge	*Carex scirpoidea*	CARESCI	G4	N5	S3S5
Cyperaceae	awlfruit sedge	*Carex stipata* var. *stipata*	CARESTI	G5T5	N5	S3S5
Cyperaceae	threefruit sedge	*Carex trisperma*	CARETRI	G5T5	N5	S5
Cyperaceae	umbellate sedge	*Carex umbellata*	CARAUMB	G5	N5	S1S2
Cyperaceae	sheathed sedge	*Carex vaginata*	CAREVAG	G5T5	N5	S3S5
Cyperaceae	Wiegand's sedge	*Carex wiegandii*	CAREWIE	G5	N3N4	S3
Cyperaceae	hare's tail	*Eriophorum vaginatum* subsp. *spissum*	ERIOVAG	G5T5	N5	S3S5
Cyperaceae	green-keel cottongrass	*Eriophorum viridicarinatum*	ERIOVIR	G5	N5	S3S5
Cyperaceae	black-girdled bulrush	*Scirpus atrocinctus*	SCIRATR	G4	N5	S3S5
Cyperaceae	red-tinged bulrush	*Scirpus microcarpus*	SCIRMIC	G5T5	N5	S3S5
Cyperaceae	deergrass	*Trichophorum cespitosum*	TRICCES	G5T5	N5	S3S5
Juncaceae	short-tail rush	*Juncus brevicaudatus*	JUNCBREV	G5T3T5	N5	S5
Juncaceae	Eastern soft rush	*Juncus effusus* subsp. *solutus?*	JUNCEFF	G5T5	N5	S5
Juncaceae	thread rush	*Juncus filiformis*	JUNCFIL	G5T5	NNR	S5

Family	Common Name	Scientific Name	Species Code	G Rank	N Rank	S Rank
Poaceae	rough bentgrass	*Agrostis scabra*	AGROSCA	G5	N5	S3S5
Poaceae	bluejoint reedgrass	*Calamagrostis canadensis* var. *canadensis*	CALACAN	G4	N5	S5
Poaceae	Pickering's reedgrass	*Calamagrostis pickeringii*	CALAPIC	G5	NNR	S3S5
Poaceae	northern reedgrass	*Calamagrostis stricta* subsp. *inexpansa*	CALASTR	G5T5	N5	S4S5
Poaceae	wood reedgrass	*Cinna latifolia*	CINNLAT	G5T5	N5	S3S5
Poaceae	poverty oatgrass	*Danthonia spicata*	DANTSPI	G5	N5	S3S5
Poaceae	Wavy hairgrass	*Avenella flexuosa*	DESCFLE	G5	N5	S5
Poaceae	slender wildrye	*Elymus trachycaulus*	ELYMTRA	G5T5	N5	S3S5
Poaceae	fowl manna-grass	*Glyceria striata*	GLYCSTR	G5	N5	S3S5
Poaceae	roughleaf mountain rice	*Oryzopsis asperifolia*	ORYZASP	G5	N5	S3
Poaceae	timothy	*Phleum pratense*	PHLEPRA	GNR	NNA	SNA
Poaceae	alpine bluegrass	*Poa alpina*	POAALPI	G5	NNR	S3S5
Poaceae	fowl bluegrass	*Poa palustris*	POAPALU	G5	N5	SNA
Poaceae	forest bluegrass	*Poa saltuensis*	POASALT	G5	N4?	S2S3
Poaceae	purple false melic	*Schizachne purpurascens*	SCHIPUR	G5	N5	S3
Poaceae	narrow false oats	*Trisetum spicatum*	TRISSPI	G5T3T5	NNR	S3S5
Forbs						
Apiaceae	hemlock parsley	*Conioselinum chinense*	CONICHI	G5	N4	S4S5
Apiaceae	cow parsnip	*Heracleum maximum*	HERAMAX	G5	N5	S5
Apiaceae	blunt sweet cicely	*Osmorhiza depauperata*	OSMODEP	G4	NNR	S2
Apiaceae	black sanicle	*Sanicula marilandica*	SANIMAR	G4	N5	S3S4
Araliaceae	wild sarsaparilla	*Aralia nudicaulis*	ARALNUD	G5	N5	S5
Asparagaceae	wild lily-of-the-valley	*Maianthemum canadense*	MAIACAN	G5	N5	S5
Aspleniaceae	green spleenwort	*Asplenium viride*	ASPLTRI	G5	NNR	S3S4
Asteraceae	pearly everlasting	*Anaphalis margaritacea*	ANAPMAR	G5	N5	S5
Asteraceae	northern pussytoes	*Antennaria howellii* subsp. *neodioica*	ANTEHOW	G5T5	N5	SNR
Asteraceae	petaloid pussytoes	*Antennaria howellii* subsp. *petaloidea*	ANTEHOW	G5	N4N5	0
Asteraceae	brownish pussytoes	*Antennaria rosea* subsp. *confinis*	ANTEROS	G5	N5	S3
Asteraceae	narrowleaf arnica	*Arnica angustifolia* subsp. *angustifolia*	ARNIANG	G5T5	N5	S2S3
Asteraceae	longleaf arnica	*Arnica lonchophylla*	ARNILON	G5	N4	S3S4

Family	Common Name	Scientific Name	Species Code	G Rank	N Rank	S Rank
Asteraceae	chokeberry	*Aronia* sp.		G4	N4	S3S4
Asteraceae	swamp thistle	*Cirsium muticum*	CIRSMUT	G5T5	N5?	S5
Asteraceae	hyssopleaf fleabane	*Erigeron hyssopifolius*	ERIGHYS	G5	N5	S3S4
Asteraceae	fleabane	*Erigeron* sp.	PETAFRI	G5	N5	S3
Asteraceae	low rough aster	*Eurybia radula*	EURYRAD	G5	NNR	S5
Asteraceae	meadow hawkweed	*Pilosella Hieracium caespitosum*	HIERCAE	G5	NNA	SNA
Asteraceae	hawkweed (exotic)	*Pilosella* sp. (exotic)		G5	N2	SH
Asteraceae	oxeye daisy	*Leucanthemum vulgare*	LEUCVUL	G5	NNA	SNA
Asteraceae	golden ragwort	*Packera aurea*	PACKAUR	G5	N5	S4S5
Asteraceae	balsam ragwort	*Packera paupercula*	PACKPAU	G4	N5	S4
Asteraceae	palmate sweet coltsfoot	*Petasites frigidus* var. *palmatus*	PETAFRI	G5T5	N5	S3
Asteraceae	gall-of-the-earth	*Nabalus trifoliolata*	PRENVUL	G5T5	NNR	S5
Asteraceae	hairy goldenrod	*Solidago hispida*	SOLIHIS	G5	N5	S4S5
Asteraceae	largeleaf goldenrod	*Solidago macrophylla*	SOLIMAC	G5	NNR	S5
Asteraceae	roughleaf goldenrod	*Solidago rugosa*	SOLIRUG	G5	N5	S5
Asteraceae	bog goldenrod	*Solidago uliginosa*	SOLIULI	G4	N5	S5
Asteraceae	Lindley's aster	*Symphyotrichum ciliolatum*	SYMPCIL	G5	N5	S1
Asteraceae	New York aster	*Symphyotrichum novi-belgii*	SYMPNOV	G5T3T5	N3N5	S5
Asteraceae	two-head aster	*Symphyotrichum ×subgeminatum*				
Asteraceae	purplestem aster	*Symphyotrichum puniceum*	SYMPPUN	G5T5	N5	S5
Asteraceae	common dandelion	*Taraxacum officinale*	TARAOFF	G4	N5	SNA
Asteraceae	coltsoot	*Tussilago farfara*	TUSSFAR	G4	NNA	SNA
Araliaceae	wild sarsaparilla	*Aralia nudicaulis*	ARALNUD	G5	N5	S5
Campanulaceae	harebell	*Campanula gieseckeana*	CAMPROT	G4	N5	S5
Campanulaceae	Kalm's lobelia	*Lobelia kalmii*	LOBEKAI	G5	N5	S3S4
Caprifoliaceae	twinflower	*Linnaea borealis*	LINNBOR	G5T5	NNR	S5
Caryophyllaceae	sandwort	*Minuartia sp.*		G5	NNR	S3S4
Caryophyllaceae	bog sandwort	*Sabulina stricta*	MINUSTR	G5	NNR	SNA
Caryophyllaceae	grove sandwort	*Moehringia lateriflora*	MOEHLAT	G5	NNR	S5
Charadriidae	stonewort	*Charales* sp. (aquatic macrophyte)				

Family	Common Name	Scientific Name	Species Code	G Rank	N Rank	S Rank
Dennstaedtiaceae	bracken fern	*Pteridium aquilinum* var. *latiusculum*	PTERAQU	G4	N5	S4S5
Athyriaceae	northeastern lady fern	*Athyrium filix-femina* var. *angustum*	ATHRFIL	G5	N5	S5
Cystopteridaceae	fragile fern	*Cystopteris fragilis*	CYSTFRA	G5	N5	S3S4
Cystopteridaceae	Laurentian bladder fern	*Cystopteris laurentiana*	CYSTLAU	G5	N3?	S2
Cystopteridaceae	bladder fern	*Cystopteris sp.*		G5	NNR	S1
Cystopteridaceae	common oak fern	*Gymnocarpium dryopteris*	GYMNDRY	G5	N5	S5
Cystopteridaceae	limestone oak fern	*Gymnocarpium robertianum*	GYMNROB	G5	N3	S2S3
Dryopteridaceae	Mountain woodfern	*Dryopteris campyloptera*	DRYOCAM	G5T3T5	NNR	S5
Dryopteridaceae	Spinulose woodfern	*Dryopteris carthusiana*	DRYOCAR	G5T5	N5	S4
Dryopteridaceae	male fern	*Dryopteris filix-mas*	DRYOFIL	G5	N4N5	S4
Dryopteridaceae	evergreen woodfern	*Dryopteris intermedia*	DRYOINT	G5	N5	S5
Dryopteridaceae	Braun's hollyfern	*Polystichum braunii*	POLYBRA	G4	NNR	S3S4
Dryopteridaceae	northern hollyfern	*Polystichum lonchitis*	POLYLON	G5	NNR	S2
Equisetaceae	field horsetail	*Equisetum arvense*	EQUIARV	G5	N5	S5
Equisetaceae	woodland horsetail	*Equisetum sylvaticum*	EQUISYL	G5	N5	S5
Ericaceae	oneflower wintergreen	*Moneses uniflora*	MONEUNI	G5	NNR	S5
Ericaceae	onesided wintergreen	*Orthilia secunda*	ORTHSEC	G5	NNR	S5
Ericaceae	roundleaf pyrola	*Pyrola americana*	PYROAME	G4	NNR	S3S4
Fabaceae	red clover	*Trifolium pratense*	TRIFPRA	G5	NNA	SNA
Iridaceae	darker mountain blue-eyed grass	*Sisyrinchium montanum* var. *crebrum*	SISYMON	G5T5	N5	S5
Juncaginaceae	marsh arrowgrass	*Triglochin palustris*	TRIGPAL	G5T5	N5	S4S5
Lamiaceae	lanceleaf selfheal	*Prunella vulgaris* subsp. *lanceolata*	PRUNVUL	G5T5	N5	S3S4
Lentibulariaceae	common butterwort	*Pinguicula vulgaris*	PINGVUL	G4	NNR	S5
Liliaceae	yellow clintonia	*Clintonia borealis*	CLINBOR	G4	N5	S5
Liliaceae	claspingleaf twistedstalk	*Streptopus amplexifolius*	STREAMP	G4	NNR	S5
Liliaceae	rose twistedstalk	*Streptopus lanceolatus*	STRELAN	G5	N5	S5
Tofieldiaceae	small tofieldia	*Tofieldia pusilla*	TOPHPUS	G5T5	N5	S4
Lycopodiaceae	Sitka ground-cedar	*Diphasiastrum sitchense*	DIAPSIT	G5	NNR	S3

Family	Common Name	Scientific Name	Species Code	G Rank	N Rank	S Rank
Lycopodiaceae	mountain firmoss	*Huperzia appressa*	HUPEAPP	G4	N4N5	S4S5
Lycopodiaceae	shining firmoss	*Huperzia lucidula*	HUPELUC	G5T5	N5	S4
Lycopodiaceae	northern firmoss	*Huperzia selago*	HUPESEL	G5	N5	S3S4
Lycopodiaceae	firmoss	*Huperzia* sp.		G4	N5	S3S4
Lycopodiaceae	stiff clubmoss	*Lycopodium annotinum*	LYCOANN	G5T5	N5	S5
Lycopodiaceae	running clubmoss	*Lycopodium clavatum*	LYCOCLA	G5	N5	S5
Onagraceae	fireweed	*Chamerion angustifolium* subsp. *angustifolium*	CHAMANG	G5	NNR	S5
Onagraceae	fireweed	*Chamerion angustifolium* subsp. *circumvagum*	CHAMANG	G5	N5	SNR
Onagraceae	dwarf enchanter's nightshade	*Circaea alpina*	CIRCALP	G5T5	NNR	S5
Onagraceae	northern willowherb	*Epilobium ciliatum* subsp. *ciliatum*	EPILCIL	G5	NNR	S5
Orchidaceae	Pink ladyslipper	*Cypripedium acaule*	CYPRACU	G5	N5	S4
Orchidaceae	small yellow ladyslipper	*Cypripedium parviflorum* var. *pubescens*	CYPRPAR	G5T5	N5	S3S4
Orchidaceae	checkered rattlesnake-plantain	*Goodyera tesselata*	GOODTES	G4	NNR	S3
Orchidaceae	broadlip twayblade	*Neottia convallarioides*	LISTCON	G4	NNR	S3S4
Orchidaceae	heartleaf twayblade	*Neottia cordata*	LISTCOR	G5	N5	S5
Orchidaceae	green addersmouth	*Malaxis unifolia*	MALAUNI	G5	NNR	S3
Orchidaceae	tall northern green orchid	*Platanthera aquilonis*	PLATAQU	G5	N5	S4
Orchidaceae	clubspur orchid	*Platanthera clavellata*	PLATCLA	G4	NNR	S5
Orchidaceae	scent bottle	*Platanthera dilatata* var. *dilatata*	PLATDIL	G5	N5	S5
Orchidaceae	Hooker's orchid	*Platanthera hookeri*	PLATHOO	G5	NNR	S2
Orchidaceae	fragrant green orchid	*Platanthera huronensis*	PLATHUR	G5	NNR	S4
Orchidaceae	bluntleaf orchid	*Platanthera obtusata*	PLATOBT	G5T5	N5	S4
Orchidaceae	lesser roundleaf orchid	*Platanthera orbiculata*	PLATORB	G5	NNR	S3S4
Orchidaceae	small purple fringed orchid	*Platanthera psycodes*	PLATPSY	G5T5	N5	S3S5
Orchidaceae	hooded ladies-tresses	*Spiranthes romanzoffiana*	SPIRROM	G5	N5	S4S5

Family	Common Name	Scientific Name	Species Code	G Rank	N Rank	S Rank
Orobanchaceae	oneflower broomrape	*Orobanche uniflora*	OROBUNI	G5	N5	S3S4
Orobanchaceae	common eyebright	*Euphrasia nemorosa*	EUPHNEM	G5	NNA	SNA
Orobanchaceae	narrowleaf cow-wheat	*Melampyrum lineare*	MELALIN	G4	N5	S3S4
Orobanchaceae	Arctic yellow rattle	*Rhinanthus minor* subsp. *groenlandicus*	RHINMIN	G5	N5	S3
Osmundaceae	cinnamon fern	*Osmundastrum cinnamomeum*	OSMUCINN	G4	N5	S5
Osmundaceae	interrupted fern	*Osmunda claytoniana*	OSMUCLA	G5	N5	S3
Polygonaceae	sheep sorrel	*Rumex acetosella*	RUMEACE	G5T5	NNA	SNA
Primulaceae	Mistassini primrose	*Primula mistassinica*	PRIMMIS	G4	NNR	S4
Primulaceae	starflower	*Trientalis borealis*	TRIEBOR	G5	NNR	S3S5
Ranunculaceae	red baneberry	*Actaea rubra*	ACTARUB	G5	NNR	S5
Ranunculaceae	northern anemone	*Anemone parviflora*	ANEMPAR	G5T5	NNR	S5
Ranunculaceae	goldthread	*Coptis trifolia*	COPTTRI	G5	N5	S5
Ranunculaceae	common buttercup	*Ranunculus acris*	RANUACR	G5T5	NNA	SNA
Ranunculaceae	creeping buttercup	*Ranunculus repens*	RANUREP	G5	NNA	SNA
Ranunculaceae	alpine meadowrue	*Thalictrum alpinum*	THALALP	G5T5	NNR	S5
Ranunculaceae	tall meadowrue	*Thalictrum pubescens*	THALPUB	G5T5	NNR	S5
Rosaceae	entireleaf mountain avens	*Dryas integrifolia*	DRYAINT	G5	NNR	S3S5
Rosaceae	wild strawberry	*Fragaria virginiana*	FRAGVIR	G5T5	NNR	S4S5
Rosaceae	water avens	*Geum rivale*	GEUMRIV	G5	NNR	S4S5
Rosaceae	bottlebrush	*Sanguisorba canadensis*	SANGCAN	G4	NNR	S4
Rosaceae	threetooth cinquefoil	*sibbaldia tridentata*	SIBBTRI	G5T5	NNR	S3S5
Rubiaceae	wild madder	*Galium mollugo*	GALIMOL	G5	NNA	SNA
Rubiaceae	bedstraw	*Galium* sp.	GALISPP	G5	NNA	SNA
Rubiaceae	fragrant bedstraw	*Galium triflorum*	GALITRI	G5T5	NNR	S5
Santalaceae	bastard toadflax	*Comandra umbellata*	COMAUMB	G5T5	NNR	S3S4
Santalaceae	northern comandra	*Geocaulon lividum*	GEOCLIV	G5	NNR	S5
Saxifragaceae	naked miterwort	*Mitella nuda*	MITENUD	G5T3T5	NNR	S5
Selaginellaceae	northern spikemoss	*Selaginella selaginoides*	SELASEL	G5	NNR	S4S5

Family	Common Name	Scientific Name	Species Code	G Rank	N Rank	S Rank
Thelypteridaceae	northern beech fern	*Phegopteris connectilis*	PHEGCON	G5	N5	S5
Thelypteridaceae	New York fern	*Thelypteris noveboracensis*	THELNOV	G5	NNR	S4
Violaceae	sweet white violet	*Viola blanda*	VIOLBLA	G5T5	NNR	S3S4
Violaceae	Labrador violet	*Viola labradorica*	VIOLREN	G5	NNR	S4S5
Violaceae	northern white violet	*Viola macloskeyi*	VIOLMAC	G5T5	NNR	S5
Violaceae	kidneyleaf violet	*Viola renifolia*	VIOLREN	G5	NNR	S3
Violaceae	violet	*Viola* sp.		G5	NNR	S2
Mosses						
Aulacomniaceae	ribbed bog moss	*Aulacomnium palustre*		G5	NNR	
Dicranaceae	wavyleaf broom moss	*Dicranum polysetum*		G5	NNR	
Hylocomiaceae	stairstep moss	*Hylocomium splendens*		G5	NNR	
Hylocomiaceae	shaggy moss	*Rhytidiadelphus triquetrus*				
Hylocomiaceae	Schreber's feathermoss	*Pleurozium schreberi*		G5	NNR	
Hypnaceae	plume moss	*Ptilium crista-castrensis*		G5	NNR	
Lepidoziaceae	*threelobed bazzania*	*Bazzania trilobata*		G5	NNR	
Mniaceae	plagiomnium moss	*Plagiomnium* sp.				
Polytrichaceae	haircap moss	*Polytrichum* sp.				
Ptilidiaceae	ciliate fringewort	*Ptilidium ciliare*		G5	NNR	
Sphagnaceae	peatmoss	*Sphagnum* sp.				
Lichens						
Cladoniaceae	caribou lichen	*Cladina arbuscula*		G5		
Cladoniaceae	green caribou lichen	*Cladina mitis*		G5		
Cladoniaceae	gray caribou lichen	*Cladina rangiferina*		G5		
Cladoniaceae	caribou lichen	*Cladina* sp.				

APPENDIX C

Scientific Research Permit

Newfoundland
Labrador

GOVERNMENT OF
NEWFOUNDLAND AND LABRADOR

Department of
Environment and Conservation
Wildlife Division

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

Date: June 16, 2015

Endangered Species Permit Number: **2015/16-12**

Issued To: Sean Bennett, Stantec Consulting Ltd. 607 Torbay Rd. St. John's , NL A1A 4Y6

Permit To: Complete plant surveys of rare and listed plant species including the endangered Mackenzie's Sweetvetch (*Hedysarum boreale subsp. mackenzii*), threatened Lindley's Aster (*Symphyotrichum ciliolatum*) and endangered Low Northern Rockcress (*Neotorularia humilis*) as permitted under Section 18 (1) and 18 (2) of the *Endangered Species Act*.

Expiry Date: July 31, 2015

CONDITIONS:

1. Nominees also included under this permit:
   Elizabeth Way
   Rich LaPaix

2. The permit holder may designate other individuals to perform these actions on his behalf, with suitable supervision. The permit holder is responsible for the training of any designated individuals and must ensure designated individuals follow all regulations related to this permit.

3. Names and contact information for all individuals participating in research activities must be provided to the Wildlife Division prior to start of research.

4. The permit holder must consult with the Wildlife Division in preparing for and completing this project.

5. Any amendments to the methodology for this research must be provided to the Wildlife Division prior to research being conducted. Substantial changes to the

methodology may result in the permit being revoked or conditions amended.

6. The permit holder must minimize disturbance to the area and must inform the Wildlife Division immediately if any plants are damaged during surveys. Limestone barrens habitat is susceptible to damage from surveyors and surveys must not occur if the ground is soft due to rain.

7. No voucher specimens of listed species can be taken.

8. The permit holder must provide a report of activities carried out under this permit to the Wildlife Division by September 30, 2015. This report must include specific methodology used and a copy of the data collected as a result of this research.

9. The permit holder must provide the Wildlife Division with copies of all reports generated as a result of this research.

10. Under the discretion of the Director of Wildlife, this permit can be cancelled without notice.

JOHN BLAKE
Director