Appendix 2-C

Land Cover Classification and Rare Plants Technical Data Report – Port au Port Wind Farm

Land Cover Classification and Rare Plants Technical Data Report – Port au Port Wind Farm

Final Report

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Prepared for:

World Energy GH2 LP

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File: 121417575

LAND COVER CLASSIFICATION AND RARE PLANTS TECHNICAL DATA REPORT – PORT AU PORT WIND FARM

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Abbreviations

Abbreviation	Definition
AC CDC	Atlantic Canada Conservation Data Centre
ATV	all-terrain vehicle
COSEWIC	Committee on the Status of Endangered Species in Canada
DEM	Digital Elevation Model
FGDC	Federal Geographic Data Committee
GPS	Global Positioning System
ha	hectare
km	kilometre
km²	square kilometre
kV	kilovolt
LAA	Local Assessment Area.
LCC	Land Cover Class (classification)
LiDAR	Light Detecting and Ranging
m	metre
m²	square metre
NDMI	Normalized Difference Moisture Index
NIR	Near Infrared
NL	Newfoundland and Labrador
NLDFFA; WD	Newfoundland and Labrador Department of Fisheries, Forestry and Agriculture; Wildlife Division
NL ESA	*Newfoundland and Labrador Endangered Species Act*
OBIA	Object Based Image Analysis
RAA	Regional Assessment Area
RoW	Right-of-way
SAR	Species At Risk
SAR IMMP	Species at Risk Impacts Mitigation and Monitoring Plan
SARA	*Species at Risk Act*
SD	Standard deviation
SOCC	Species Of Conservation Concern
SSAC	Species Status Advisory Committee
SWIR	Shortwave Infrared
t	tonne
TDR	Technical Data Report
USDA	United States Department of Agriculture
VEC	Valued Ecological Component
WEGH2	World Energy GH2 LP

1.0 INTRODUCTION

World Energy GH2 LP (WEGH2) is proposing to construct and operate the Nujio'qonik commercial scale "green hydrogen" and ammonia production project (the Project) on the west coast of the Island of Newfoundland, Newfoundland and Labrador (NL). The Project involves the development, construction, operation and maintenance, and eventual decommissioning and rehabilitation of one of the first Canadian, commercial-scale, "green hydrogen" and ammonia production plants powered by renewable wind energy and will have a maximum production of up to approximately 206,000 tonnes (t) of green hydrogen per year. The hydrogen produced by the Project will be converted into ammonia and the resulting 1.17 Mt of ammonia exported to international markets by ship. The hydrogen / ammonia plant and associated storage and export facilities will be located at the Port of Stephenville (in the Town of Stephenville, NL) on a privately-owned brownfield site and at an adjacent existing marine terminal, both of which are zoned for industrial purposes.

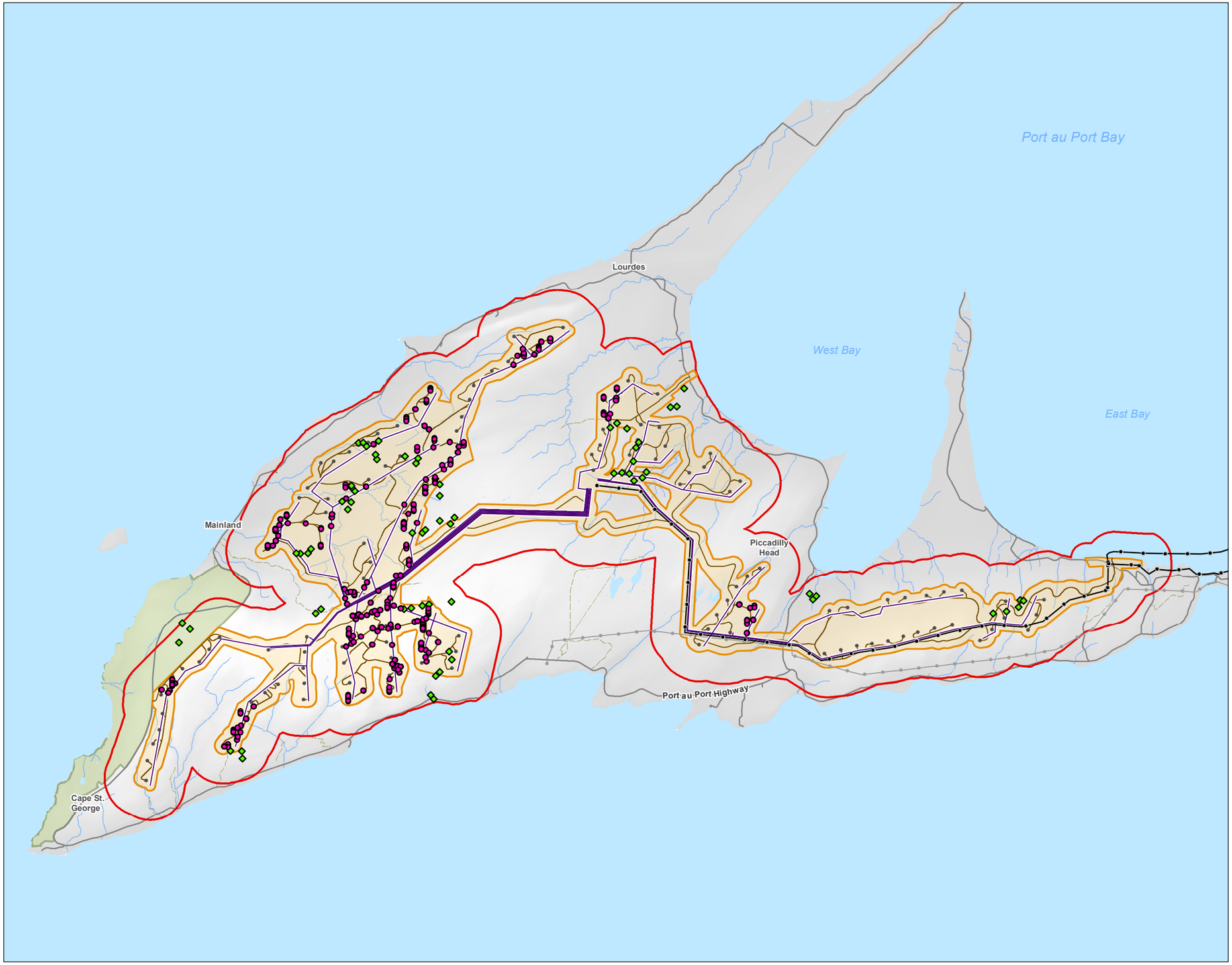
As part of the Project, up to 164 wind turbines and associated electrical collector lines and access roads will be constructed in the Port au Port Peninsula of southwestern Newfoundland (Figure 1-1). In support of the Project and environmental mitigation planning, Stantec Consulting Ltd. (Stantec) was retained by WEGH2 to collect data on land cover, including wetlands, and rare plants for the Port au Port Wind Farm portion of the project. This technical data report (TDR) details the data collection methods, results of desktop data review and field surveys conducted in 2023. Supplemental desktop review and field surveys will be conducted for the other portions of the Project (including additional turbines, Codroy Wind Farm, and supporting infrastructure) in subsequent years.

1.1 OBJECTIVES

Wetlands and Vegetation were selected as a valued ecological component (VEC) for the environmental assessment because they have their own intrinsic value and are essential to maintaining natural ecosystems, and because of the potential interactions with Project activities and regulatory considerations. They also provide habitat value for animal wildlife, and provide important social, cultural, aesthetic, recreational, and economic value to the public, Indigenous groups, governments, and other affected parties.

Objectives of the 2023 vegetation study were to collect site-specific baseline information on rare vascular plants, particularly species at risk (SAR), and land cover classification for the Port au Port Wind Farm site that can be used to:

1. Support the evaluation of potential Project interactions with rare plants beyond what was presented in the Project Environmental Impact Statement (EIS, requires final footprint, not discussed in this technical data report).
2. Support development of mitigation measures in areas with higher potential project interactions with rare plants, which will be included in future permit applications.
3. Support regulatory approvals



Stantec

Other Features

- Rare Plant Transect Location
- Land Cover Survey Location

Proposed Project Features

- Turbine Location
- Collector Line
- Access Road
- Transmission Line 230 kV
- Land Cover Classification and Rare Plants Project Area
- Land Cover Classification and Rare Plants Local Assessment Area

- Transmission Line, Existing
- Road / Highway
- Watercourse
- Waterbody
- Cape St. George - Transitional Reserve

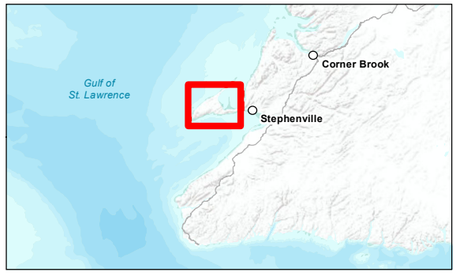
N

0 2 4 Kilometres

(At original document size of 11x17)
1:135,000

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Data Sources: World Energy GH2; NL ECC Water Resources Management Division; NL Fisheries, Forestry and Agriculture; NRCan CanVec; OpenStreetMap
3. Background: NRCan CanVec Sources: Esri, USGS, NOAA



Project Location
Stephenville
NL

Prepared by MB on 2024-01-26
QR by NDC on 2024-01-26

Client/Project
121417575_003

World Energy GH2
Project Nujio'qonik

Figure No.
1-1

Title
Project Location and Spatial Boundaries

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A similar set of vegetation studies are planned for the Codroy Wind Farm, to be completed pre-construction. Existing conditions were evaluated for the Project EIS using publicly available information (Stantec 2023). Additional land cover and rare plant information was obtained from further desktop review, field survey, and associated data analysis.

2.0 STUDY AREA

2.1 SPATIAL BOUNDARIES

Spatial boundaries for the Port au Port Wind Farm were selected in consideration of the geographic extent over which Project activities, and their effect on the VEC (wetlands and vegetation), are likely to occur. They are consistent with spatial boundaries for the Port au Port Wind Farm as presented in the EIS.

- Project Area: The Project Area as defined for the study encompasses the immediate area in which Project activities and components occur and is comprised of the Port au Port Wind Farm within the Port au Port Peninsula, 230 kilovolt (kV) Transmission Lines, and associated infrastructure including roads and substations. The Project Area is the anticipated area of direct physical disturbance associated with the construction, operation and decommissioning, and rehabilitation and closure of the Project. In addition to encompassing the immediate area in which Project components and activities will occur, the Project Area also includes a buffer of up to 300 metres (m) for access roads and turbines and a 350 m corridor to accommodate the 70 to 75 m wide right of way (RoW) for the transmission line. These buffers allow flexibility for the micro-siting of Project components during detailed design, based on technical considerations as well as the avoidance of environmentally sensitive areas, where practicable. The Project Area is 104.2 km² or 10,420.2 ha in size.
- Local Assessment Area (LAA): The LCC and Rare Plants LAA is defined for this technical data report as 1 km around the Port au Port Wind Farm footprint on the Port au Port Peninsula and 500 m around associated access roads and transmissions lines (Figure 1-1). The LAA has been selected to capture the area where the effects on wetlands and vegetation are likely to be most prevalent (e.g., effects to species/community diversity, wetland function). The LAA for the Port au Port Wind Farm on the Port au Port Peninsula is 253.9 km² or 25,392.6 ha in size.
- Regional Assessment Area (RAA): The LCC and Rare Plants RAA is defined for this technical data report as the Port au Port Subregion, including the Port au Port Peninsula extending east to the isthmus, within the Western Newfoundland Forest Ecoregion. The RAA is 555.0 km^2 or 55,000 ha in size.

The 2023 LCC and Rare Plants Study focused on the Port au Port Wind Farm portion of the LAA on the Port au Port Peninsula. The Port au Port Wind Farm is comprised of up to 164 turbines, each with a footprint of approximately 100 m x 100 m, over 400 kilometres (km) of access roads and collector lines, 49 km of electrical transmission line, and three substations.

2.2 ECOLOGICAL AND REGULATORY OVERVIEW

The Port au Port Wind Farm Local Assessment Area (LAA) occurs within the Western Newfoundland Forest Ecoregion (Damman 1983; Meades 1990), which is environmentally distinct in its geological diversity, humid climate, range in altitude, and relatively long growing season (Meades 1990). The ecoregion is primarily forested. Interspersed within the forested matrix are ecologically important wetland and barren ecosystems that provide habitat for vegetation and wildlife species. Globally rare limestone barrens and habitat for the provincially endangered Lindley's Aster (*Symphyotrichum ciliolatum*) are of ecological priority within the Port au Port LAA.

The Port au Port Peninsula, along with adjacent Table Mountain, contains the Island of Newfoundland's southern limestone barrens and associated habitats that are known to support rare species, including vascular plant Species At Risk (SAR) (Limestone Barrens Species at Risk Recovery Team 2021). The southern limestone barrens support species that do not occur in forested or wetland habitats, including numerous provincially rare vascular plants (discussed in section 4.2), and (SAR) such as MacKenzie's Sweetvetch (*Hedysarum boreale* subsp. *mackenziei*). Newfoundland's limestone barrens are a unique ecosystem type, and the distinct southern contingent of this ecosystem occurs entirely within the LAA of the Project.

In addition to SAR associated with limestone barrens, the Port au Port Peninsula supports the province's largest population of the provincially endangered Lindley's aster, which is widely distributed but particularly concentrated in coniferous scrub habitats (SSAC 2009). One of the leading threats to Lindley's aster in Newfoundland is genetic, resulting from hybridization with the common native species New York aster (*S. novi-belgii*). New York and Lindley's aster become capable of interacting and producing the hybrid species *Symphyotrichum x subgeminatum* in areas where habitat quality is degraded by land clearing and other anthropogenic activities. The landscape of the Port au Port Peninsula is influenced by anthropogenic disturbance to varied extents. Communities and towns are concentrated along the coastline of the peninsula. The interior of the peninsula is characterized by topographic extremes and dense vegetation. While the interior is largely undeveloped, roads and clearings are widespread, related to anthropogenic activities such as seismic exploration, logging (particularly, firewood harvest), and the creation and maintenance of trail systems for hunting and berry-picking. Anthropogenic habitat alteration and all-terrain vehicle (ATV) use on formal and non-formal trails throughout the Port au Port Peninsula is considered a threat to the SAR that inhabit these areas (Limestone Barrens Species at Risk Recovery Team 2021), and the introduction of New York aster through roads is considered a threat to Lindley's Aster (Species Status Advisory Committee [SSAC] 2009).

For this Project, Species at Risk (SAR) are defined as species that are:

- listed on Schedule 1 of the federal *Species at Risk Act* (SARA) as Extirpated, Endangered, Threatened or Special Concern
- listed as Extirpated, Endangered, Threatened, or Vulnerable under the Newfoundland and Labrador Endangered Species Act (NL ESA)

Species listed under Schedule 1 of the federal SARA are protected by prohibitions under that act and its associated regulations on federal lands, except for aquatic species and migratory birds which are protected throughout Canada by other acts and regulations.

Species designated under the NL ESA are protected by prohibitions under the act such as Section 16, which states “a person shall not disturb, harass, injure, or kill an individual of a species designated as Threatened, Endangered or Extirpated”. Species are listed under the *Endangered Species List Regulations*. Under Section 19 of the NL ESA, a permit can be obtained to engage in an economic activity that may affect “a designated species, the residence of a specimen of a designated species or critical or recovery habitat,” if the minister is of the opinion that the activity is economically beneficial to the province, has no reasonable alternative, and will not prevent the recovery or survival of the designated species. Section 19 permits typically have conditions attached with could include fees to enforce compliance with the permit conditions and a commitment to restore individuals or habitat of a designated species affected by the permitted activity. The permit application is required to include a SAR IMMP.

Species of Conservation Concern (SOCC) are defined for this assessment as those species that are not specified under federal or provincial legislation, but are considered rare in the province, or ones for which the long-term sustainability of their populations has been evaluated as tenuous. Following direction previously provided by the Newfoundland and Labrador Department of Fisheries, Forestry and Agriculture– Wildlife Division (NLDFFA-WD), vascular plant SOCC are defined as those species that are:

- assessed as Extirpated, Endangered, Threatened, or Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) but have not yet been added to Schedule 1 of SARA
- recommended for listing by the Species Status Advisory Committee (SSAC) as Endangered, Threatened or Vulnerable but are not yet listed under the NL ESA
- ranked as provincially rare by the Atlantic Canada Conservation Data Centre (AC CDC) including species with provincial status (S-ranks) of S1 (Critically Imperiled), S2 (Imperiled) or combinations thereof (e.g., S1S2) upon review by the AC CDC (AC CDC 2024a)

3.0 METHODS

The 2023 study was comprised of four components: reconnaissance-level surveys, Land Cover Classification (LCC), desktop review of pre-existing information, and rare plant and lichen surveys. Land Cover Classification employed Object Based Image Analysis (OBIA) to map land cover across the Port au Port Wind Farm LAA. Native upland forest, native wetland, native sparsely or non-vegetated, water, and anthropogenic land cover types were classified to 19 land cover classes. Field surveys were conducted to inventory vascular plant species following a random transect study design. Land cover classification plots were collected to quantitatively describe LCC units, and as field control points to assess the accuracy of LCC units. Data analysis examined relative density of rare species occurrences for each LCC class.

3.1 RECONNAISSANCE-LEVEL SURVEYS

The purpose of targeted reconnaissance surveys was to broadly gain an understanding of area occupancy of known populations within the Regional Assessment Area (RAA). This information was used to support detecting any additional populations and/or their associated fine-scale microhabitat conditions. Two days of reconnaissance surveys were conducted in June 2023 to assist in informing field survey planning. Surveyors noted logistical factors such as site accessibility and safety hazards and visited known populations of rare plants adjacent to the Project Area during the primary flowering season for arctic and alpine vascular plants.

Fairy slipper (*Calypso bulbosa*) is an S1-ranked vascular plant species previously known to occur within the overall Project RAA and blooms within a limited time window in June. Preliminary, reconnaissance level surveys were conducted for this rare plant species within targeted habitat, using the intelligent meander method.

3.2 LAND COVER CLASSIFICATION

3.2.1 Object Based Image Analysis

Upland and wetland vegetation communities within the Port au Port Wind Farm LAA were mapped using OBIA. OBIA is a remote sensing exercise that differentiates land cover by segmenting areas based on landscape and vegetation characteristics in imagery and Digital Elevation Model (DEM) data. OBIA is a form of artificial intelligence, automatically breaking down images into objects using reflectance (color/elevation), texture, shape, size, and proximity characteristics, clustering image pixels with similar properties to form a series of objects.

Stantec acquired WorldView-3 satellite imagery at 50-cm resolution in Blue, Green, Red, and Near Infrared (NIR) imagery bands. Imagery of the LAA was collected from June to September 2020. A sample of the imagery and segmentation into land cover polygons by OBIA (black polygons) processing is shown in Figure 3-1. DEM data had a 5 m resolution and 2 m accuracy and were collected in 2021 (ESRI 2021).

Figure 3-1 Sample WorldView-3 Satellite Imagery of the Port Au Port Wind Farm LAA

Normalized Difference Moisture Index (NDMI) was also used to assist in differentiating between upland and wetland areas. NDMI uses NIR and Shortwave Infrared (SWIR) to locate areas that are highly saturated using the following formula:

$$NDMI = (NIR – SWIR) / (NIR + SWIR)$$

Freely available Landsat satellite imagery at 30-m resolution was used for its SWIR image channels that were not available in WorldView-3 imagery. The results of the NDMI image and digital elevation model (DEM) data to separate wetlands from non-wetlands. NDMI results were not used in the final LU\LC classification but used strictly as a reference guide.

Land cover classes expected in the LAA were identified prior to conducting the OBIA using NLDFFA landcover data (NLDFFA 2018) and review of imagery by Stantec ecologists. Five native upland forest, four native wetland, four native sparsely/non-vegetated, three water, and three anthropogenic classes were identified in the LAA (Table 3-1). GPS control points of representative locations of each land cover class in the imagery were selected from this review and used to guide the OBIA. Control points were used to train the OBIA software to recognize the various land cover classes. Object metrics included spectral reflectance of surface vegetation, a texture measure of the vegetation canopy, and average size and shape of the land cover classes. Once a relationship for the land cover classes was established between the control points, satellite imagery, and DEM data, the OBIA mapped remaining areas based on the highest probability of an object's properties to the land cover classes.

Mapping results were reviewed in the field (Section 3.2.2) and land cover mapping revised where required by re-conducting the OBIA.

Table 3-1 Land Cover Type and Class for the Port au Port Wind Farm Local Assessment Area

Land Cover Type	Land Cover Class	Description
Native Upland Forest	Coniferous Forest – Dense	Continuous forest dominated by coniferous trees, with limited openings between trees.
Native Upland Forest	Coniferous Forest – Sparse	Forest dominated by coniferous trees with open spaces dominated by shrubs or herbaceous species present between scattered trees.
Native Upland Forest	Mixedwood Forest	Forest dominated by both coniferous and deciduous trees
Native Upland Forest	Tuckamore	Windswept and stunted coniferous trees, primarily balsam fir with black spruce. Beneath the stunted trees, the shrub layer is dominated by ericaceous shrubs and other shrub species such as mountain holly (*Ilex mucronata*) and northern wild raisin (*Viburnum cassinoides*).
Native Upland Forest	Regenerating Forest	Areas subject to stand replacing (i.e., not gap) disturbance, frequently anthropogenic. Includes regenerating old field habitat, and disturbed forest habitat here trees have been removed within approximately the last 10 years. Typically dominated by regenerating shrubs and herbaceous species with limited canopy cover.
Native Wetland	Bog	Peatlands, typically rain-fed and occurring in topographic depressions, dominated by Sphagnum spp. and with deep accumulations of Sphagnum peat. Bogs are frequently low nutrient and low pH environments.
Native Wetland	Fen	Graminoid-dominated peatland that received water from direct precipitation, surface run-off and groundwater discharge. Fens are frequently high pH.
Native Wetland	Flarks	Open water in the centre of bogs and fens, often supporting aquatic vegetation.
Native Wetland	Shrub Swamp	Swamps dominated by shrubs such as speckled alder (*Alnus incana*).
Native Sparsely/Non-vegetated	Rock Barrens	Open, wind exposed habitats characterized by limestone bedrock exposure and actively frost-affected patterned ground features, such as sorted gravels and pavements with grykes. Vegetation typical of these extreme environments is represented by discontinuous patches typically dominated by ericaceous shrubs, as well as herbs, and graminoids associated with boreal, arctic, and alpine communities.
Native Sparsely/Non-vegetated	Dwarf Shrub Heath	Associated with barrens, a community of low and dwarf shrubs, such as bearberry (*Arctostaphylos uva-ursi*), alpine bearberry (*Arctous alpina*), and crowberry (*Empetrum nigrum*). Tree species such as balsam fir and black spruce are stunted and sparse. Herbaceous cover is also sparse and is dominated by entire-leaved mountain-avens (*Dryas integrifolia*) and running club moss (*Lycopodium clavatum*).
Native Sparsely/Non-vegetated	Snowbed Meadow	Sheltered areas protected from winds, typically with later snowmelt and dominated by herbaceous vegetation.
Native Sparsely/Non-vegetated	Coast	Beaches and coastlines

Table 3-1 Land Cover Type and Class for the Port au Port Wind Farm Local Assessment Area

Land Cover Type	Land Cover Class	Description
Water	Ocean	Atlantic Ocean
Water	Open Water	Ponds
Water	Watercourse	Flowing water
Anthropogenic	Anthropogenic Vegetated	Lawns and other landscaped vegetated areas, and old-field areas
Anthropogenic	Unpaved Road	Gravel roads and ATV trails
Anthropogenic	Urban	Paved roads and anthropogenic structures
Note: Classes adapted from Wulder (2003).		

3.2.2 Field Survey

A subset of the mapped native upland, wetland, and sparsely/non-vegetated land cover polygons in the LAA were field assessed to evaluate and refine mapping accuracy. Survey locations were selected prior to field surveys using a stratified random method. The LAA was first divided into four quadrants: north, east, south, and west, to support geographic representation of sampling; these quadrants were divided into a 1 km x 1 km grid. Grids that were largely anthropogenic or only partially within the LAA were removed. An internal buffer of 20 m was created for each LCC polygon within each grid using a buffer wizard ArcGIS tool, to reduce edge effects. Centre points were created in remaining polygons that were greater than 1,600 m².

Eighty LCC plots were targeted and the final number of plots surveyed was 73. The number of LCC plots within each LCC class was intended to be proportional to the relative amount of each LCC class within the LAA but was adjusted so there were at least three plots targeted for each LCC class (proportionally, some LCC classes would have represented fewer than one plot out of a targeted 80). Grids containing uncommon LCC classes were preferentially selected, with three LCC plots selected within each targeted grid. Following the selection of grids containing uncommon LCC classes, relatively inaccessible grids (e.g., more than 2 km from a drivable road or area where a helicopter could safely land) were excluded. Random selection of grids and plots was completed using the ArcGIS Subset Features tool.

A representative, homogenous area of at least 400 m² of the mapped polygon was assessed at each of the 73 survey plots. At each survey plot, the following information was collected:

- Physical conditions
  - slope
  - aspect
  - Substrate presence and abundance (cover %), including: water, organic litter, bare ground. Bare ground substrates included exposed bedrock, soils, and frost-sorted gravel and stone.

- Vegetation
  - Percent cover of vascular plants occupying 1% or greater ground cover
  - vegetation cover by layer as follows:
    - Tree – woody plant taller than 5 m
    - Tall shrub – woody plant 2.0-5 m
    - Short shrub – woody plant 0.5-1.99 m
    - Herbaceous – non-woody forbs and graminoids, and woody plants shorter than 0.5 m

Each survey site was classified to land cover class in the field based on the observed site vegetation conditions. Following the surveys field data were quality reviewed and land cover classifications revised, where appropriate.

3.2.3 Analysis

Following land cover classification field surveys of the 73 field-verified LCC plots (described in Section 3.2.2), 40 were chosen through random stratified selection (as well as incidental habitat observation data points). These were used to update and refine the OBIA mapping, using the same methods described above. The remaining 33 LCC plots were used to evaluate the accuracy of the refined OBIA LCC mapping.

Field data were analyzed for species richness, evenness, and mean total ground cover by land cover class. Two measures of species diversity were determined for each Land Cover Type and vegetation layer (herbaceous, low shrub, tall shrub and tree layers):

- Mean Species Richness
- Shannon-Weiner Diversity Index

The Shannon-Weiner Index is a measure of both species richness and dominance/evenness. This index ranges from 0 to 5 (Oksanen 2022). If two similar sites have the same number of species, but one site is dominated by a single species, the site with greater species evenness (in this case measured by percent cover) would be more diverse. Mean Shannon-Weiner Diversity index was calculated for each land cover class and for each of the four structural vegetation layers.

3.3 RARE PLANT AND LICHEN SURVEYS

3.3.1 Desktop Review

Prior to commencing field surveys, a data request of vascular plant, lichen, and bryophyte species known from the LAA and surrounding areas was made to the Atlantic Canada Conservation Data Centre (AC CDC) in early 2023 (AC CDC 2023). These records were reviewed to determine which known locations of vascular plant, lichen, and bryophyte SAR and SOCC are within the Project Area, LAA, and RAA. Species ranges for provincial vascular plant, lichen, and bryophyte SAR not included in the AC CDC data request were also examined by reviewing available species status reports, recovery, and management plans, as well as information sheets available on the NLDFFA's SAR website for plants (NLDFFA no date). Species ranges were reviewed for the six vascular plant SAR, one bryophyte SAR,

and four lichen SAR occurring in Newfoundland and Labrador that are listed in Schedule 1 of the federal *Species at Risk Act* (SARA; Government of Canada 2023).

3.3.2 Field Survey

3.3.2.1 Vascular Plant Surveys

Vascular plant species occurrence data were collected to support further evaluation of potential Project effects and mitigation measures, including Project micro-siting. A systematic stratified random sample approach of the planned Project footprint was used to evaluate rare vascular plant occurrences. This approach follows recommendations of the Canadian Wildlife Service for federally protected plants in the prairie region of Canada (Henderson 2009), guidance from other provinces (Government of Saskatchewan 2021; Alberta Native Plant Council 2012; Resources Information Standards Committee 2018), and published scientific literature (e.g., Sutherland 2006; Elith and Graham 2009; Franklin 2009; Wang et al. 2019). Published rare plant survey method guidance is not available for Newfoundland and Labrador. Surveying the full preliminary Project footprint was prohibitive given the size of the Project Area (104.2 km^2). Evaluating rare plant observations in relation to land cover was used to help identify unsurveyed areas with higher potential for rare plant occurrence.

A subset of wind turbines, segments of access roads, and collector line routes were selected for rare plant surveys. Turbine footprints were initially prioritized into higher and lower priority categories for ecological importance. Prioritization was based on available literature and known species records and focused on the presence of Newfoundland's Southern Limestone Barrens on the Port au Port Peninsula. Higher priority turbine survey sites included areas with greater than 25% limestone bedrock exposure occurring within 100 m of proposed turbine location, identified using available landcover mapping from the Province of Newfoundland and Labrador and aerial imagery of the Project Area, and areas where existing data (i.e., AC CDC records, Species Status Advisory Committee (SSAC) reports) indicate presence of Lindley's aster (*Symphyotrichum ciliolatum*) within 200 m. Lower priority survey sites included forested habitats with no data about the distribution of Lindley's aster within 200 m, sheltered valleys, and wetlands except for fens. These footprints were further divided into transects, for a quantitative and repeatable survey approach.

Planned turbine footprints are approximately 1 ha (100 m x 100 m). A survey area for higher priority sites was developed by establishing a 250 m x 250 m area centered on the turbine location, i.e., including an additional 75 m buffer surrounding the turbine footprint. For each higher priority turbine survey area, transects were established every 3 m and 9 transects 2 m in width were selected, resulting in coverage of approximately 7% of the turbine footprint and buffer. In total, 16 turbine locations within the Project Area were considered higher priority and each of those turbine sites were surveyed, with a total of 144 250 m-long transects surveyed on higher priority turbine areas.

For a randomly selected subset of lower priority sites, 75 2 m-wide transects were established within the turbine footprint and four transects were randomly selected, resulting in coverage of approximately 5% of the turbine site. In total, 26 lower priority turbine locations, representing 104 transects, were sampled within the Project Area. The survey area was larger and survey intensity was higher for turbines classified as high priority because it was anticipated that there was a higher likelihood of encountering rare plants in these areas, and to allow for greater flexibility in future micrositing.

Roads and collector lines were sampled with two or three parallel 100 m long transects that were selected in a randomly stratified manner. In total, 187 access road transects and 106 collector line transects were sampled within the Project Area.

Data were recorded using ESRI Field Maps app on a mobile device paired with an external GPS to improve accuracy to ± 5 m horizontal accuracy or better. During transect surveys, the presence of vascular plant species detected was recorded at first encounter. A species list for each survey area (i.e., turbine footprint, or section of road, or transmission line corridor footprint) was collected digitally.

Fine scale species location and abundance data were collected for rare plants as they were encountered along transects. Rare species location data were collected to spatially associate rare species with LCCs, and to fulfill research permit commitments to NLFFA – Wildlife Division. Observations of plant SOCC and SAR outside of transects were documented incidentally as they were encountered while travelling between survey transects but were not used in the analysis described in Section 3.3.3.

Abundance data were also typically collected for rare species occurrences. The type of abundance estimate varied on the species and patch size. For small populations, stem counts or single occurrence points were collected. In several instances, especially of the species Lindley's aster, local population sizes were continuous along a transect, and spanned widths of multiple transects. The estimation of the extent of the population was limited to what could be visually evaluated from within the 2 m wide transect. Local population sizes were not constrained to transects and were often larger than reported. when safety hazards such as limestone sinkholes or physical obstacles such as high, steep cliffs were encountered in the field, surveyors deviated around the obstacle or hazard as necessary. The full extent of SAR populations outside of transects was not determined.

3.3.2.2 Lichen Surveys

Lichens were surveyed at each LCC plot location. At each plot, surveyors examined the microhabitats present (e.g., bare ground, downed woody debris, live trees) and collected samples representative of the different lichens observed, being careful to remove the smallest sample necessary to facilitate identification to species, limiting damage to local populations. Samples were separated by substrate, placed in paper bags, labeled with plot number, surveyor, and date and dried for later identification by a lichenologist. Crustose lichen species were not collected from rock substrates. Samples are being processed and results will be provided when available.

3.3.3 Analysis

In support of Project siting and application of mitigation measures, rare plant survey data was evaluated for observation density by LCC. Species modeling for ecological assessment is recommended (Baker et al. 2020) as species distributions in many areas are poorly understood and improved information can better support species management. Available information indicates limestone barrens are the required habitat for the two vascular plant SAR listed under the NL *Endangered Species Act*, Lindley's aster and MacKenzie's sweetvetch (*Hedysarum boreale* subsp. *mackenziei*), likely to occur in the Project Area. Information for the remaining 22 plant SOCC potentially occurring or known to occur in the Project Area indicates the habitat is broad (e.g., mature forest, coniferous forest) or is unknown for the province.

A variety of probabilistic methods (e.g., general linear model) (Elith and Franklin 2017; Franklin 2009) and Bayesian methods (Ellison 2004) can be used to evaluate species spatial distribution. Available methods were reviewed for applicability for the Port au Port Wind Farm using available literature on model performance and information requirements (Norberg et al. 2019; Carneiro et al. 2016; Elith and Graham 2009). Available regional information, particularly topography and surficial geology, was too coarse to support probabilistic modeling and insufficient species ecological information was available to support Bayesian modeling. Rare plant density by land cover relationship is a courser method but allows extrapolation of survey results to the larger Project assessment spatial boundaries and will help focus future Project activities. This approach allowed for a relative density of occurrence to be calculated for each LCC class that could then be extrapolated to the entire LAA. Major assumptions in this approach include:

- Acceptable accuracy of LCC classification
- Spatial scale of the classification is meaningful to the species under consideration (i.e., captures sufficient environmental gradients to differentiate occurrence by LCC)
- Transect locations randomly stratified by LCC capture the diversity of ecological variation in each LCC class
- Sufficient area of each LCC class is surveyed
- Accuracy of GPS locations relative to transect search area
- Equal detection between observers - equal searcher efficiency (i.e., all observers have an equal Ability to detect rare plant species
- Equal detection of rare plants between LCCs

Limitations of using relative occurrence density include:

- Only provides a likelihood of occurrence in a specific LCC and cannot resolve finer environmental gradients (e.g., slope, aspect, soil characteristics). This is a function of coarseness of available spatial data and field survey efficiency and logistics.

Model confidence is discussed in the results section (Section 4.2.1) and potential for additional evaluation is provided in the discussion section (Section 5).

3.3.3.1 Rare Plant Model

In total, 541 transects were surveyed during rare plants surveys in 2023. This accounted for approximately 0.07 % of the LAA and 0.16% of the Project Area (Table 3-2). At turbine locations, 248 transects were completed, 144 in high priority locations and 104 in low priority locations, 187 along proposed access roads, and 106 along proposed collector routes.

Using land cover mapping and rare plant transect location data, the area searched by land cover class was calculated by buffering transects by a 1 m radius (i.e., the search area on each side of the transect) and calculating total area searched per land cover class for each transect. This was done by a spatial intersection of the two data layers. This data was then amalgamated for all surveyed rare plant transects to provide a total area searched for each land cover class within the LAA (Table 3-2). This data provided search effort by land cover class for rare plant surveys.

Table 3-2 Area of Landcover Class Searched During Rare Plant Surveys

Land Cover Class	Area Searched (ha)[1]	Area within Project Area (ha)	% Cover Class in Project Area Surveyed	Area within LAA (ha)[2]	% Cover Class in LAA Surveyed
Bog	0.111	310.9	0.04	502.3	0.022
Coniferous Dense	1.714	1,980.4	0.09	5,477.9	0.031
Coniferous Sparse	2.167	1,612.4	0.13	3,998.5	0.054
Coniferous Treed Swamp	5.518	4533.2	0.12	10,010.3	0.055
Dwarf Shrub Heath	3.909	499.7	0.78	1,025.7	0.381
Fen	0.633	506.4	0.12	812.0	0.078
Flarks	0.004	19.1	0.02	36.9	0.011
Tuckamore	0.324	113.3	0.29	631.9	0.051
Mixedwood	0.010	96.4	0.01	271.7	0.004
Regenerating Forest	0.736	291.4	0.25	646.4	0.114
Rock Barrens	0.929	174.7	0.53	711.6	0.130
Shrub Swamp	0.095	164.3	0.06	327.6	0.029
Unpaved Roads	0.026	8.8	0.30	32.1	0.081
Water	0.001	31.5	0.00	68.5	0.001
Total	**16.178**	**10,343.7**	**0.156**	**24,553.4**	**0.065**

Notes:
[1] One metre search area on each side of transect.
[2] 541 rare plant transects were completed in 2023.

Rare plant record locations were plotted and associated with a transect. Distance to the nearest transect was calculated and the distribution of this data was examined. This was completed because of variance in GPS accuracy (averaging 3 to 6 m) and associated uncertainty in transect location. Rare plant records within 15 m of a transect were included for further analysis (Figure 3-2). This captured 68% of rare plant records in the LAA as there were several incidental records found during other surveys, or when traveling between survey locations that could not be used in the analysis because they were not part of the rare plant survey effort.

It was considered that the combination of search effort and search results provided suitable level of information for a conservative rare plant density estimation by land cover class (i.e., lower search effort area plus higher search results while considering uncertainty in location of both transect and rare plant locations).

From search effort and search results, relative density of rare plant occurrences could be calculated for each rare plant species by land cover class. This was expressed as number of occurrences per hectare.

For land cover classes where no rare plant observations were made, no inference about detection or relative density could be made. No detections does not mean that the species does not occur in the land cover class, just that none were detected during surveys.

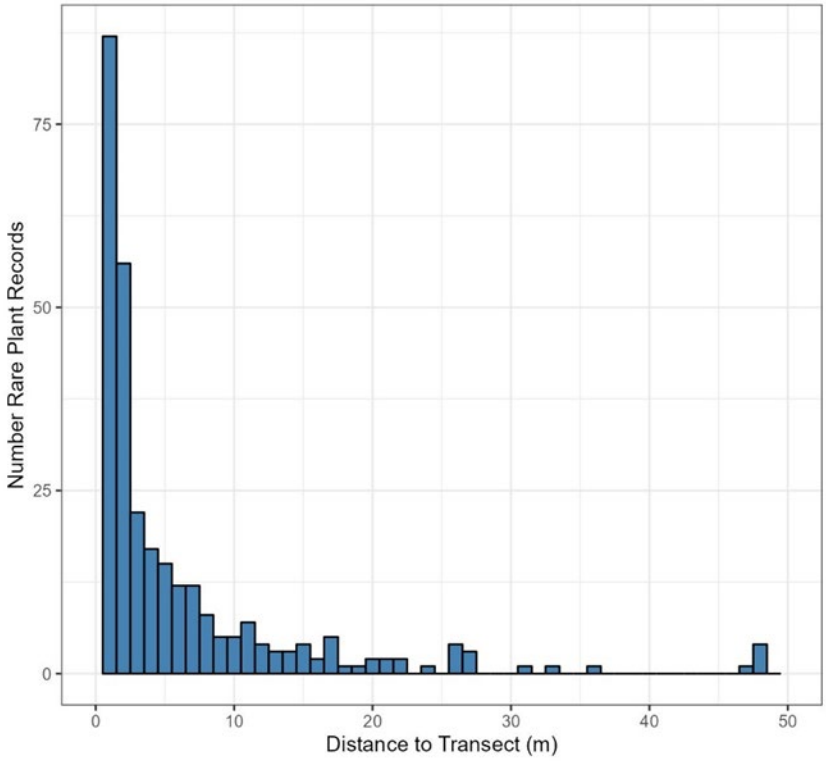


Figure 3-2 Distribution of Rare Plant Records from Transects

3.4 DATA REVIEW AND QUALITY CONTROL

Field data was collected digitally, removing transcription errors, and supporting data review. Plant samples were collected in the field, if more than 25 individuals were present and collection would not threaten the occurrence. Plant samples were identified through discussion with other botanists conducting surveys and familiar with Newfoundland and Labrador flora and using regionally relevant botanical manuals (Gleason and Cronquist 1991; Aiken et al. 2011; Arsenault et al. 2013; Burzynski et al. 2016; Mittlehouser et al. 2019; Hinds 2000; Haines 2011; Meades and Meades 2024). Data was reviewed by survey crews when in the field and collected data summarized and checked for gaps and potentially inappropriate classification and plant identification following completion of the surveys.

4.0 RESULTS

4.1 LAND COVER CLASSIFICATION

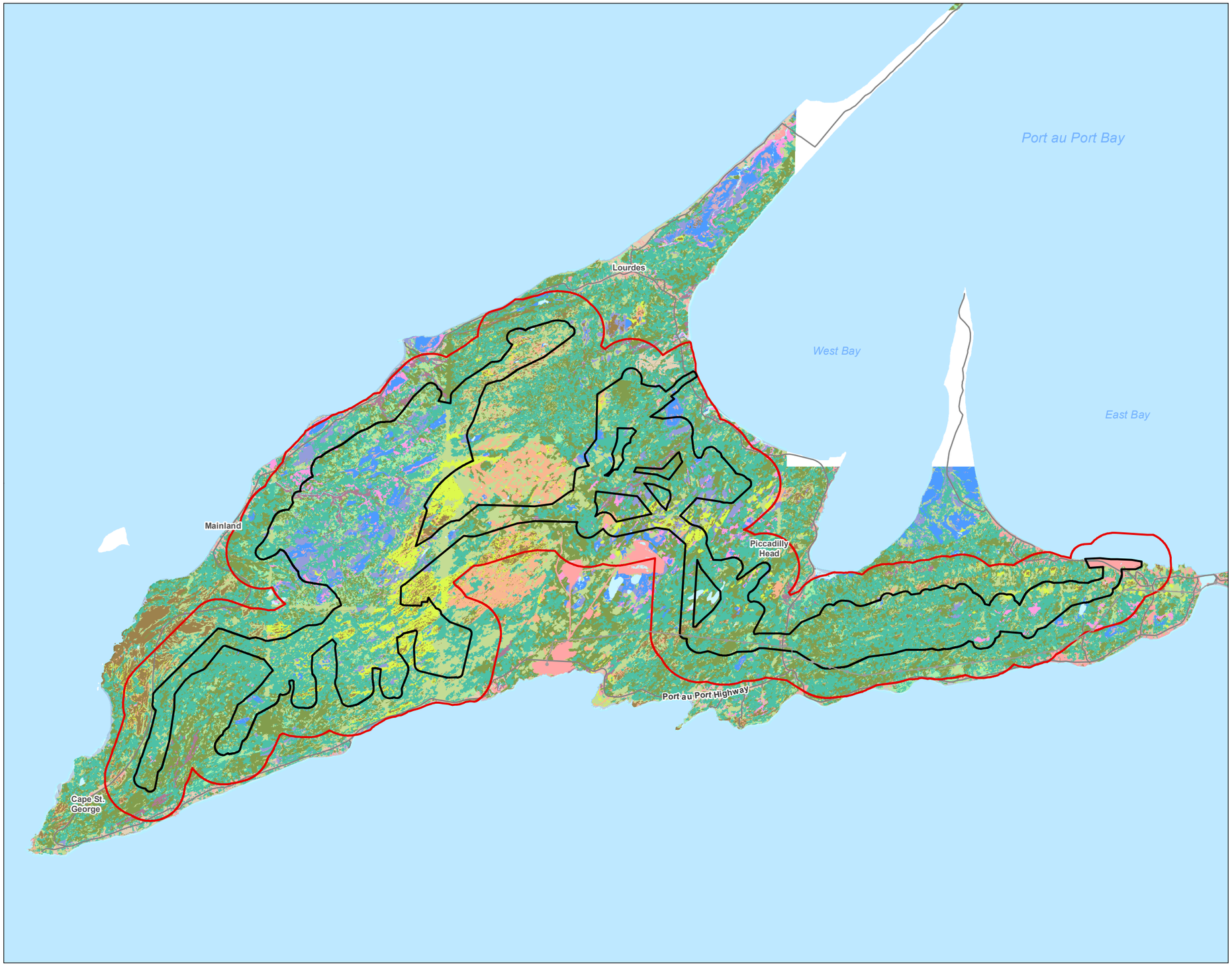
The LAA is 25,149.1 ha and is composed mainly of native wetland, 11,689.1 ha (46.5%) and native upland forest, 11,026.4 ha (43.8%) (Table 4-1). Coniferous treed swamp is the most common land cover class, 10,010.3 ha (39.8%) and is widely dispersed across the LAA (Figure 4-1). Native upland sparsely/non-vegetated land cover classes occupy a total of 1,764.9 ha (7.0%). Areas of standing or flowing water are relatively uncommon occupying 127.3 ha (0.5%), with ponds covering 68.5 ha (0.3%) and watercourses covering 21.7 ha (0.1%). Anthropogenic areas, mainly urban developments, occupy 526.6 ha (2.1%). A total of 14.8 ha (0.1%) could not be classified due to cloud cover.

The pattern of Land Cover type abundance in the Project Area is similar to that of the LAA with native wetland, 5,534.1 ha (53.1%), and native upland forest, 4,094.1 ha (39.3%), the most common land cover types and coniferous treed swamp the most common land cover class, 4,533.2 ha (43.5%) (Table 4-1). Coniferous forest dense, 1,980.6 ha (19.0%) and coniferous forest sparse, 1,612.3 ha (15.5%) are the most abundant native upland forest land cover classes in the Project Area. Both are widely disturbed in the Project Area (Appendix B). Other native upland forest land cover classes, including the mixedwood forest, tuckamore, and regenerating forest classes are also mapped in the Project Area. Regenerating forest occupies 291.5 ha (2.8%), tuckamore occupies 113.3 ha (1.1%), and mixedwood forest occupies 96.4 ha (0.9%). Fens were the most abundant wetland class, following coniferous treed swamp, occupying 506.5 ha (4.9%). Native upland sparsely / non-vegetated land cover type occupies 1,764.9 ha or 7.0% of the LAA, with dwarf shrub heath occupying 1,025.7 ha or 4.1% of the LAA. Open water and anthropogenic areas are uncommon, occupying less than 1% of the Project Area, 34.0 ha (0.3%), and 78.0 ha (0.7%), respectively. A total of 3.7 ha (<0.1%) could not be classified due to cloud cover and shadow.

Table 4-1 Land Cover Types and Classes Mapped in the Port au Port Wind Farm Project Area and LAA

Land Cover Type	Land Cover Class	Project Area		LAA	
		ha	%	ha	%
Native Upland Forest	Coniferous Dense	1,980.6	19.0	5,477.9	21.8
	Coniferous Sparse	1,612.3	15.5	3,998.5	15.9
	Mixedwood	96.4	0.9	271.7	1.1
	Tuckamore	113.3	1.1	631.9	2.5
	Regenerating Forest	291.5	2.8	646.4	2.6
	Subtotal	**4,094.1**	**39.3**	**11,026.4**	**43.8**
Native Upland Sparsely / Non-Vegetated	Rock Barrens	174.6	1.7	711.6	2.8
	Dwarf Shrub Heath	499.6	4.8	1,025.7	4.1
	Snowbed Meadow	1.3	<0.1	1.4	0.0
	Coast	1.0	<0.1	26.2	0.1
	Subtotal	**676.5**	**6.5**	**1,764.9**	**7.0**
Native Wetland	Bog	311.0	3.0	502.3	2.0
	Fen	506.5	4.9	812.0	3.2
	Flark	19.1	0.2	36.9	0.1
	Coniferous Treed Swamp	4,533.2	43.5	10,010.3	39.8
	Shrub Swamp	164.3	1.6	327.6	1.3
	Subtotal	**5,534.1**	**53.1**	**11,689.1**	**46.5**
Water	Ocean	2.4	<0.1	37.1	0.1
	Water	23.3	0.2	68.5	0.3
	Watercourse	8.3	0.1	21.7	0.1
	Subtotal	**34.0**	**0.3**	**127.3**	**0.5**
Anthropogenic	Anthropogenic Vegetated	4.2	<0.1	174.4	0.7
	Unpaved Roads	8.8	0.1	32.1	0.1
	Urban	65.0	0.6	320.1	1.3
	Subtotal	**78.0**	**0.7**	**526.6**	**2.1**
Unclassified[1]	N/A	3.7	<0.1	14.8	0.1
Total		**10,420.4**	**100.0**	**25,149.1**	**100.0**

Notes:
[1] Not classified due to cloud cover or shadow.
N/A – not applicable.



Stantec

Land Cover Classification and Rare Plants Project Area

Land Cover Classification and Rare Plants Local Assessment Area

Land Cover

Forest
- Coniferous Dense
- Coniferous Sparse
- Mixedwood
- Tuckamore
- Regenerating Forest

Barrens
- Snowbed Meadow
- Dwarf Shrub Heath
- Rock Barrens

Wetlands
- Bog
- Coniferous Treed Swamp
- Fen
- Flarks
- Shrub Swamp

Other
- Anthropogenic Vegetated
- Coast
- Urban
- Unpaved Roads
- Water
- Unclassified / Clouds and Shadows

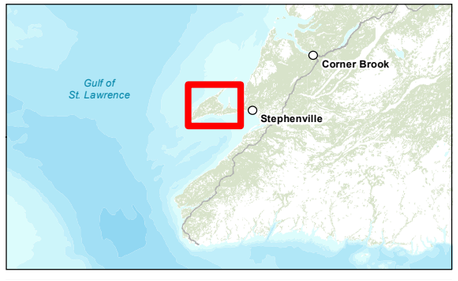
Other Features
- Transmission Line, Existing
- Road / Highway

N

0 2 4 Kilometres

(At original document size of 11x17)
1:135,000

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Data Sources: World Energy GH2; NL ECC Water Resources Management Division; NL Fisheries, Forestry and Agriculture; NRCan CanVec; OpenStreetMap
3. Background: NRCan CanVec



Project Location
Stephenville
NL

Prepared by MB on 2024-01-26
QR by NDC on 2024-01-26

Client/Project
121417575_004

World Energy GH2
Project Nujio'qonik

Figure No.
4-1

Title
Land Cover Classes in the Port au Port Wind Farm LAA

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4.1.1 Species Diversity

Including incidental observations, the 2023 field surveys documented a total species richness of 415 within the LAA, including subspecies, varieties, and hybrids separately (Appendix A, Table A.1). Many generalist vegetation species occurred across multiple LCC units. Photos of each LCC unit are provided in Appendix C.

Mean species richness is provided by land cover class for plot data related to land cover class in Table 4-2. Mean species richness by land cover class and structural plant layer (i.e., herbaceous, short shrub, tall shrub and tree) is provide in Figure 4-2. Mean species richness by land cover class and structural plant layer can be greater than mean species richness by land cover class as species can occur in more than one layer. Mean ground cover by plant structural layers for each land cover class is provided in Figure 4-3.

Mean species richness of land cover classes ranged from 2.0 to 24.5, with coniferous treed swamp, snowbed meadow, and rock barren land cover classes having the highest average species richness (Table 4-2). For every LCC unit, the herbaceous layer consistently supported the greatest number of species (Figure 4-2), in comparison with low shrub, tall shrub, and tree canopy layers.

Table 4-2 Mean Species Richness by Land Cover Type and Land Cover Class

Land Cover Type	Land Cover Class	Total Species Richness	Mean Species Richness
Native Upland Forest	Coniferous Dense	55	14.3
	Coniferous Sparse	59	18.9
	Mixedwood	21	18.0
	Tuckamore	81	20.9
	Regenerating Forest	47	22.3
Native Upland Sparsely / Non-Vegetated	Rock Barren	61	23.8
	Snowbed Meadow	38	24.5
Native Wetland	Bog	60	19.2
	Fen	49	17.6
	Coniferous Treed Swamp	70	24.5
	Shrub Swamp	62	19.0
Water	Water	2	2.0
Anthropogenic	Anthropogenic Vegetated	50	17.6

The land cover class with greatest species richness was tuckamore, which supported 81 vascular plant species in total, and a mean of 20.9 plants per sample plot, primarily in the herbaceous layer (Figure 4-2). Coniferous treed swamps were the second most species rich land cover class, supporting 70 plant species and a mean of 24.5 species across surveyed plots.

Shrub swamps, rock barrens, bogs, and coniferous sparse forest LCC units were similarly species rich, supporting 62, 61, 60, and 59 species respectively. Coniferous dense forests supported 55 species. Anthropogenic vegetation land cover supported 50 species. Fens supported a total of 49 species. The snowbed meadow LCC unit supported only 38 species.

Regenerating forest plots supported 47 plant species and a mean species richness of 22.3. Although herbaceous layer diversity was highest for regenerating forest plots, the species diversity of the low shrub layer was greater for this unit than others (Figure 4-2). The mixedwood forest unit was low in overall richness, supporting 21 species and a mean of 18.0 plant species across sample plots.

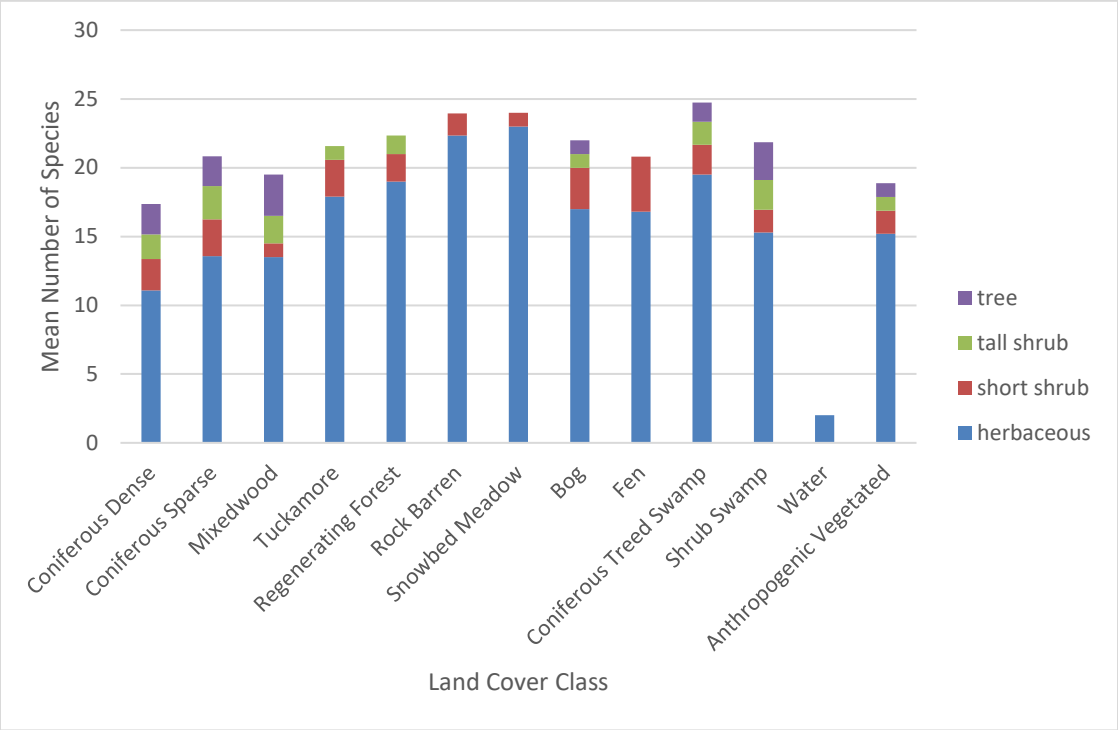

Figure 4-2 Comparison of Mean Plant Richness by Vegetation Layer and Land Cover Class within the LAA

Ground cover was predominately herbaceous at surveyed sites, except for coniferous dense forest (Figure 4-3). Total bryophyte cover exceeded 50% in coniferous dense forest and was uncommon in surveyed regenerating forest and anthropogenic plots. Lichen cover was greatest in tuckamore and bare ground was uncommon, except in rock barrens.

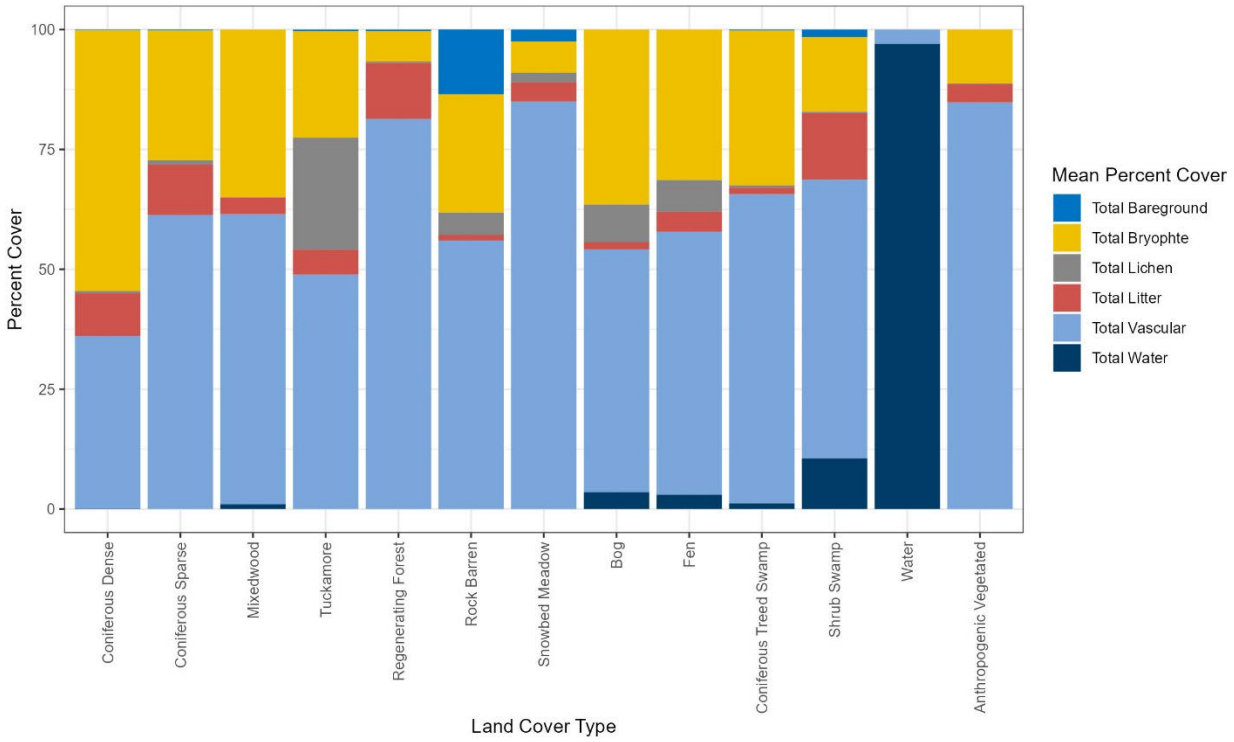

Figure 4-3 Comparison of Mean Percent Ground Cover of Vegetation Layers by Land Cover Classes within the LAA

Species diversity was further described using the Shannon-Weiner Index by vegetation layer. For every LCC unit, the herbaceous layer consistently supported the greatest abundance (Table 4-3) and richness (Figure 4-2) across the survey area, in comparison with low shrub, tall shrub, and tree canopy layers. Coniferous dominated LCC units including coniferous swamps, as well as dense and sparse coniferous forests supported more Shannon diversity in shrub and tree layers than open habitats with limited tree cover, such as rock barrens. The mixedwood and coniferous sparse LCC Type had the highest diversity (0.568 and 0.497, respectively). Tall shrub includes tree and shrub species 2.5 m to 5 m in height. Again, both coniferous sparse and mixedwood had the highest mean diversity indices (0.533 and 0.461). Low shrub includes shrubby plants 0.5 to 2.5 m in height. The fen LLC unit had the highest diversity index (1.058). followed by coniferous sparse (0.614), bog (0.607) and shrubland (0.576).

The herbaceous layer (i.e., graminoids, forbs and herbs as well as shrubby plants less than 0.5 m in height), had the highest overall diversity (Table 4-3). Coniferous treed swamp had the highest diversity (2.448) followed by regenerating forest (2.227) and mixedwood (2.091).

Table 4-3 Mean Shannon-Weiner Diversity by Land Cover Class and Vegetation Layer

Land Cover Type	Land Cover Class	Herbaceous[1]	Low Shrub[2]	Tall Shrub[3]	Tree[4]
Native Upland Forest	Coniferous Dense	1.714	0.513	0.262	0.316
	Coniferous Sparse	1.572	0.614	0.533	0.497
	Mixedwood	2.091	0.000	0.461	0.568
	Tuckamore	1.814	0.445	-	-
	Regenerating Forest	2.227	0.359	0.078	-
Native Upland Sparsely / Non-Vegetated	Rock Barren	2.083	0.159	-	-
	Snowbed Meadow	1.963	-	-	-
Native Wetland	Bog	2.184	0.607	-	-
	Fen	1.608	1.058	-	-
	Coniferous Treed Swamp	2.448	0.463	0.380	0.251
	Shrub Swamp	2.155	0.264	0.363	0.154
Water	Water	0.673	-	-	-
Anthropogenic	Anthropogenic Vegetated	1.902	0.359	-	-

Notes:
[1] Herbaceous layer 0-0.5 m
[2] Low shrub 0.5-2.5 m
[3] Tall shrub 2.5 - 5.0 m
[4] Tree >5 m

4.1.2 LCC Unit Descriptions

4.1.2.1 Barrens

Of ecological importance within this subregion are the southernmost occurrences of Newfoundland's globally rare limestone barrens (Jones and Wiley 2012; Burzynski et al. 2016; Limestone Barrens Species at Risk Recovery Team 2021). Limestone barrens plant communities across the Project Area are characterized by sparsely vegetated weathered limestone gravel and limestone pavements, and dwarf heathlands in areas with shallow soils and sometimes humus accumulations (Appendix C, Photo 1 and Photo 2). The distribution and maintenance of these plant communities is associated with a combination of edaphic and climatic environmental factors. The limestone barrens are subject to extreme winds and harsh winter conditions. The underlying limestone bedrock is soluble and actively weathered (e.g., through erosion), creating nutrient poor and high pH soils inhabited by specialist plants tolerant of basic soils (calciphiles). These soils and the coarser gravel and rock substrates in the area are frost-disturbed (cryosolic). Processes of active freezing and thawing regularly establish patterned ground features such as frost boils and rock crevices (grykes) (Meades 1983, 1990; Jones and Wiley 2012; Stantec 2016; Limestone Barrens Species at Risk Recovery Team 2021). The harsh conditions of the limestone barrens of the Port au Port Peninsula support specialist plant species with coastal, arctic, and alpine affinities, despite their relatively low elevation (to a maximum of approximately 340-350 m (Meades 1983; Jones and Wiley 2012; Limestone Barrens Species at Risk Recovery Team 2021; Natural Resources Canada

2021; AC CDC 2023)). A defining characteristic of the Port au Port subregion is the presence of disjunct Cordilleran (Arctic) species (Meades 1990).

Rock Barrens

Six sample plots were located in rock barrens. All vegetation occurred within the herbaceous and low shrub layers (Table 4-4; Appendix C, Photo 1 and Photo 2). Sparse and dwarfed trees were present on the barrens, represented in sample plots by two tree species within the short shrub layer. Black spruce (*Picea mariana)* occurred in four of the six plots (66.6%) with a mean cover of 5.3%, and balsam fir (*Abies balsamea*) occurred within just two of the sample plots (33.3%), with a mean cover of 12.5%. Other vegetation present in the plots occurred within the herbaceous vegetation layer.

The shrub species golden-hardhack (*Dasiphora fruticosa*) and ground juniper (*Juniperus communis*) were ubiquitous, occurring in the six sample plots. Golden-hardhack was relatively less abundant, comprising a mean of 2% cover, whereas ground juniper had a mean cover of 16% in plots. Creeping juniper (*Juniperus horizontalis*) was present in all but one plot, and was the most abundant species where it occurred, with a mean cover of 21.2% across these plots. The dwarf heath species black crowberry (*Empetrum nigrum*) was also present in five out of six (83.3%) plots and had the second greatest mean cover where it occurred, with a mean of 17.8% cover.

Herbaceous graminoid and forb species were frequently present in low abundance. Bulrush sedge (*Carex scirpoidea*) and hairy goldenrod (*Solidago hispida*) occurred in five of the six (83.3%) plots. Dwarf dogwood (*Cornus canadensis*), and three-toothed cinquefoil (*Sibbaldia tridentata*), present in the herbaceous layer, were equally as frequent within sample plots.

Several species present within the rock barrens plots were not present within other LCC units, and the unique assemblage of common species present on the rock barrens contribute to their distinction from other habitat classes. Aside from the differences in dominant and abundant plants as discussed, less frequently occurring barrens specialists such as daisy fleabane (*Erigeron hyssopifolius*) and alpine manzanita (*Arctous alpina*) do not occur in other land cover types within the LAA.

Table 4-4 Species Composition, Frequency, and Abundance of Rock Barren Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Short Shrub Layer					
Picea mariana	black spruce	4	66.7	5.3	4.7
Abies balsamea	balsam fir	2	33.3	12.5	10.6
Herbaceous Layer					
Juniperus communis	ground juniper	6	100.0	16.0	17.1
Dasiphora fruticosa	golden-hardhack	6	100.0	2.0	1.8
Juniperus horizontalis	creeping juniper	5	83.3	21.2	33.2
Empetrum nigrum	black crowberry	5	83.3	17.8	20.3

Table 4-4 Species Composition, Frequency, and Abundance of Rock Barren Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Arctostaphylos uva-ursi	bearberry	5	83.3	5.0	6.4
Sibbaldia tridentata	three-toothed cinquefoil	5	83.3	3.7	6.3
Cornus canadensis	dwarf dogwood	5	83.3	2.4	2.0
Solidago hispida	hairy goldenrod	5	83.3	1.6	1.3
Carex scirpoidea	bulrush sedge	4	66.7	3.0	2.3
Kalmia angustifolia	sheep-laurel	4	66.7	2.0	1.2
Rhododendron groenlandicum	common Labrador-tea	4	66.7	1.8	1.0
Erigeron hyssopifolius	daisy fleabane	4	66.7	1.3	0.5
Myrica gale	sweet bayberry	3	50.0	6.0	7.8
Picea mariana	black spruce	3	50.0	4.0	1.7
Spinulum annotinum	stiff clubmoss	3	50.0	3.4	3.5
Carex eburnea	ebony sedge	3	50.0	3.0	3.5
Vaccinium angustifolium	late lowbush blueberry	3	50.0	3.0	1.0
Oryzopsis asperifolia	white-grained mountain-ricegrass	3	50.0	1.0	0.0
Vaccinium vitis-idaea	mountain cranberry	3	50.0	0.4	0.5
Epigaea repens	trailing arbutus	2	33.3	4.5	4.9
Danthonia spicata	poverty oat-grass	2	33.3	2.0	1.4
Ilex mucronata	mountain holly	2	33.3	2.0	1.4
Abies balsamea	balsam fir	2	33.3	1.5	0.7
Arctous alpina	alpine manzanita	2	33.3	1.5	0.7
Sanguisorba canadensis	Canada burnet	2	33.3	1.5	0.7
Shepherdia canadensis	Canada buffalo-berry	2	33.3	1.5	0.7
Cypripedium parviflorum	small yellow lady's-slipper	2	33.3	1.0	0.0
Larix laricina	American larch	2	33.3	1.0	0.0
Nabalus trifoliolatus	threeleaf rattlesnake-root	2	33.3	1.0	0.0
Packera paupercula	balsam groundsel	2	33.3	1.0	0.0
Rubus pubescens	dwarf red raspberry	2	33.3	1.0	0.0
Viola sp.	a violet. (unknown species)	2	33.3	1.0	0.0
Chamerion angustifolium	fireweed	2	33.3	0.8	0.4
Linnaea borealis	twinflower	2	33.3	0.6	0.6
Maianthemum canadense	wild lily-of-the-valley	2	33.3	0.6	0.6

Notes:
N – Number of plots in which a species occurred
[1] Values for species present in two or more of the survey plots are reported.
[2] SD = standard deviation.

Rock barrens plots were characterized by low growing vegetation and open expanses of bare ground, including bedrock and soil exposures, frost sorted gravel and stone (Table 4-5). Total vascular plant cover across the plots was represented by a mean of 56%, with substantial bryophyte cover represented by a mean of 24.7% and lichen cover represented by a mean of 4.7% cover. Bare ground substrates, including exposed rock and soil was represented by a mean of 13.5% cover.

Table 4-5 Ground Cover of Rock Barren Survey Locations in the Port au Port LAA

Parameter	Mean Cover (%)[1]	SD[2]
Total Vascular Plant	56.0	28.7
Total Bryophyte	24.7	33.7
Total Lichen	4.7	5.7
Total Litter	1.2	1.2
Total Bare Ground	13.5	12.1
Total Water	0.0	0.0

Notes:
[1] Sample size (n) = 6.
[2] SD = standard deviation.

Snowbed Meadows

Snowbed meadows occur across the Port au Port Peninsula in sheltered and moist depressions and ravines where deep snow accumulates (Stantec 2016; Limestone Barrens Recovery Team 2021). These, and a variety of other habitats within the Port au Port subregion, provide habitat for Lindley's aster (*Symphyotrichum ciliolatum*), a provincially Endangered vascular plant (SSAC 2009). Snowbed meadows are typically dominated by herbaceous vegetation, and all vegetation within the two sample plots occurred within the herbaceous layer (Table 4-6, Appendix C, Photo 3). Canada burnet (*Sanguisorba canadensis*) and fringed brome (*Bromus ciliatus*) were the most abundant species within sample plots.

Table 4-6 Species Composition, Frequency and Abundance of Snowbed Meadow Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Herbaceous Layer					
Bromus ciliatus	fringed brome	2	100	40	28.3
Sanguisorba canadensis	Canada burnet	2	100	37.5	3.5
Agrostis scabra	rough bentgrass	2	100	9	8.5
Cornus canadensis	dwarf dogwood	2	100	3	2.8
Rubus pubescens	dwarf red raspberry	2	100	2	0
Fragaria virginiana	Virginia strawberry	2	100	1.5	0.7
Sibbaldia tridentata	three-toothed cinquefoil	2	100	1.1	1.3

Table 4-6 Species Composition, Frequency and Abundance of Snowbed Meadow Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Clintonia borealis	Clinton lily	2	100	0.6	0.6
Epigaea repens	trailing arbutus	2	100	0.6	0.6
Spinulum annotinum	stiff clubmoss	2	100	0.6	0.6

Notes:
[1] Values for species present in two or more of the survey plots are reported.
[2] SD = standard deviation

Ground cover of snowbed meadow sample plots (Table 4-7) consisted primarily of vascular plants (85% cover). Bryophytes and lichens were less abundant ground cover, comprising 6.5% and 2% respectively. Litter and bare ground substrates comprised 4% and 2.5% cover respectively.

Table 4-7 Ground Cover of Snowbed Meadow Survey Locations in the Port au Port LAA

Parameter	Mean Cover (%)[1]	SD[2]
Total Vascular Plant	85.0	0.0
Total Bryophyte	6.5	5.0
Total Lichen	2.0	0.0
Total Litter	4.0	1.4
Total Bare Ground	2.5	3.5
Total Water	0.0	0.0

Notes:
[1] Sample size (n) = 2.
[2] SD = standard deviation.

Dwarf Shrub Heath

Dwarf shrub heaths were included within LCC mapping effort due to their known presence within the LAA. However, accuracy of detecting dwarf shrub heath using OBIA methods was low. Plot data and an accuracy analysis exercise reveal that areas mapped as Dwarf Shrub Heath are better characterized as tuckamore. These habitats typically fringed open barrens and were dominated by short (<50 cm) black spruce (*Picea mariana*).

Meades (1983) describes heathland plant communities in detail; at a finer scale than the resolution of LCC mapping. Two of the dwarf shrub heath LCC plots were dominated by taller shrubs, particularly sheep-laurel (*Kalmia angustifolia)*, and are better characterized as belonging to Kalmia heaths (Meades 1983). Meades (1983) also maps the broad provincial scale distribution of heathlands across the province. Yet there remains limited spatial data on the distribution of heathland plant communities across Atlantic Canada, including on the Island of Newfoundland.

Field surveyors incidentally observed from transect surveys that dwarf heath plant communities occurred across the LAA in association with open rock barrens. Surveyors also incidentally observed tall shrub and dwarf heaths in patch habitats within forested contexts on prominent, wind-exposed topography with shallow soils, and on actively frost patterned, hummocky, and extremely mounded microtopography. Each of these features occurred at a finer scale than was technically feasible with the resolution of LCC mapping.

4.1.2.2 Forests

Forests comprise the greatest area of the Port au Port Subregion (Meades and Moores 1994). Forested communities are boreal and frequently dominated primarily by balsam fir. Black spruce is reportedly less common, described as dominant on poorly drained sites (Meades 1990; Meades and Moores 1994). Deciduous tree species such as red maple (*Acer rubrum*) are at their northern geographical limit (Meades 1990) and are relatively uncommonly within the LAA in this subecoregion. Mixedwood forests are thus relatively uncommon, but a notable component of paper birch (*Betula papyrifera*) is present on sheltered valley slopes of riparian areas (Meades and Moores 1994). Surveyors casually observed that heart-leaved birch (*Betula cordifolia*) was equally or more common as paper birch across Port au Port peninsula.

Preliminary review of aerial imagery, and observations made during 2023 field surveys conducted in support of this Project have noted substantial areas of forest within the Project Area have been harvested or partially harvested. Firewood harvesting is common in proximity to existing roads and ATV or snowmobile paths. Forests within the Project Area represent by the full spectrum of successional stages and states of regeneration post-harvesting, including areas best characterized as old-field.

Coniferous Dense

Eleven sample plots were assessed for the coniferous dense LCC (Table 4-8). Dense coniferous forests were dominated by balsam fir (*Abies balsamea*), which was present in all 11 sample plots, with a mean abundance of 16.5% (Appendix C, Photo 4). Balsam fir was structurally diverse, occurring across the range of woody vegetation layers. Black spruce (*Picea mariana*) was also frequently present, relatively abundant where occurring, and structurally diverse across vegetation layers. Heart-leaved birch was a notable constituent species, present in about half of sample plots (five of 11, or 45.5% of plots), though it typically occupied low mean abundance; 1.6%, with limited variation from the mean. In addition to structurally diverse canopy species, the short shrub layer occasionally featured mountain maple (*Acer spicatum*), squashberry (*Viburnum edule*), and northern mountain ash (*Sorbus decora*).

Herbaceous vegetation most frequently included the species twinflower (*Linnaea borealis*), and dwarf dogwood (*Cornus canadensis*), respectively occurring in 100% of plots with a mean of 3.1% cover and 90.9% of plots with a mean cover of 17.9%. Clinton lily (*Clintonia borealis*) was also relatively common, represented in 7/11 (63.6%) of plots, with a mean cover of 2.2%. Dwarf red raspberry (*Rubus pubescens*) was also relatively frequent and abundant, present in 54.5% of plots and occupying a mean cover of 2.2% area. Other relatively common species (i.e., occurring in more than half of plots) in the herbaceous layer included mountain holly (*Ilex mucronata*), wild lily-of-the-valley (*Maianthemum canadense*), and northern starflower *(Lysimachia borealis*).

Table 4-8 Species Composition, Frequency and Abundance of Coniferous Dense Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Tree Layer					
Abies balsamea	balsam fir	11	100.0	16.5	11.0
Betula cordifolia	heartleaf birch, mountain white birch	5	45.5	1.6	1.3
Picea mariana	black spruce	4	36.4	15.5	11.4
Tall Shub Layer					
Abies balsamea	balsam fir	9	81.8	16.8	22.2
Picea mariana	black spruce	4	36.4	19.3	12.2
Short Shrub Layer					
Abies balsamea	balsam fir	11	100.0	6.5	5.3
Picea mariana	black spruce	4	36.4	10.8	13.5
Acer spicatum	mountain maple	3	27.3	0.4	0.5
Viburnum edule	squashberry	2	18.2	1.5	0.7
Sorbus decora	northern mountain-ash	2	18.2	0.6	0.6
Herbaceous Layer					
Linnaea borealis	twinflower	11	100.0	3.1	1.8
Cornus canadensis	dwarf dogwood	10	90.9	17.9	10.6
Clintonia borealis	Clinton lily	7	63.6	2.3	2.2
Rubus pubescens	dwarf red raspberry	6	54.5	2.2	1.7
Maianthemum canadense	wild lily-of-the-valley	6	54.5	1.7	0.5
Ilex mucronata	mountain holly	6	54.5	1.2	1.1
Lysimachia borealis	northern starflower	6	54.5	0.6	0.5
Aralia nudicaulis	wild sarsaparilla	5	45.5	3.8	6.3
Gaultheria hispidula	creeping snowberry	5	45.5	2.6	1.5
Epigaea repens	trailing arbutus	4	36.4	5.8	9.5
Abies balsamea	balsam fir	4	36.4	1.8	1.2
Dryopteris carthusiana	spinulose shield fern	3	27.3	16.7	7.6
Solidago rugosa	rough-leaf goldenrod	3	27.3	2.7	2.1
Solidago macrophylla	large-leaf goldenrod	3	27.3	1.3	0.6
Equisetum sylvaticum	woodland horsetail	3	27.3	1.0	0.0
Phegopteris connectilis	northern beech fern	3	27.3	0.7	0.5
Dryopteris campyloptera	mountain wood-fern	2	18.2	5.5	6.4
Dryopteris intermedia	glandular wood fern	2	18.2	4.5	4.9
Dryopteris sp.	a wood fern (unknown species)	2	18.2	4.0	1.4

Table 4-8 Species Composition, Frequency and Abundance of Coniferous Dense Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Vaccinium angustifolium	late lowbush blueberry	2	18.2	3.0	0.0
Mitella nuda	naked bishop's-cap	2	18.2	2.0	1.4
Osmundastrum cinnamomeum	cinnamon fern	2	18.2	2.0	1.4
Taxus canadensis	Canadian yew	2	18.2	1.5	0.7
Sorbus decora	northern mountain ash	2	18.2	1.0	0.0

Notes:
[1] Values for species present in two or more of the survey plots are reported.
[2] SD = standard deviation.

Within the 11 sample plots, vascular plants comprised 36% ground cover, bryophytes comprised 54.5%, and lichens covered less than one percent in ground cover. Litter was relatively abundant, comprising 8.9% cover (Table 4-9).

Table 4-9 Ground Cover of Coniferous Dense Survey Locations in the Port au Port LAA

Parameter	Mean Cover (%)[1]	SD[2]
Total Vascular Plant	36.0	22.3
Total Bryophyte	54.5	20.7
Total Lichen	0.5	0.7
Total Litter	8.9	9.7
Total Bare Ground	0.1	0.3
Total Water	0.1	0.3

Notes:
[1] Sample size (n) = 11.
[2] SD = standard deviation.

Coniferous Sparse

Seven locations were field evaluated for mapped coniferous sparse forest conditions (Table 4-10). Coniferous sparse surveyed locations were characterized by widely spaced trees (Appendix C, Photo 5) and low average cover, ranging from a mean of 3.0% to 7.5% (Table 4-10). Balsam fir occurred in each surveyed plot and mean percent cover equaled 5.6%. White spruce and black spruce were also observed in two surveyed plots.

Tall (2.5-5 m) and short shrub layers (0.5-1.99 m) were also present, with tall shrubs present in each of the surveyed plots and short shrubs present in five of the surveyed plots (Table 4-10). Five shrub species were observed with balsam fir observed most frequently and with the greatest mean percent cover, 12.7% tall shrub layer and 5.8% short shrub layer.

Herbaceous forbs, ferns and fern allies, shrubs, and graminoid species were present in the herbaceous layer. Shrubs shorter than 0.5 m, primarily prostrate shrubs such as dwarf dogwood (*Cornus canadensis*) and twinflower (*Linnaea borealis*), were most frequently observed and had the greatest cover. Dwarf dogwood was the most abundant species observed, mean 36.3% cover, and creeping snowberry (*Gaultheria hispidula*), spinulose shield fern (*Dryopteris carthusiana*), and a non-native colt's-foot species (*Tussilago farfara*) also each had mean percent cover greater than 10%. Colt's foot is an exotic herb in newfoundland that can be invasive in cobbly riparian habitat and floodplains. It is more typically associated with disturbance. Its presence in the sparse coniferous sample plots likely reflects disturbance associated with ATV access, wood cutting, and proximity to associated roads.

In comparison with dense coniferous land cover, the relatively lower density of canopy closure, the greater frequency and abundance of black spruce in woody vegetation layers, and the greater frequency and abundance of herbaceous ground cover (vs. bryophyte cover) may be explained by ecological factors, such as wet conditions, wind exposure (e.g., windfall, stunted development, a continuum with the tuckamore LCC unit), and also by selective or historic (i.e., >5 years) cutting activities.

Table 4-10 Species Composition, Frequency and Abundance of Coniferous Sparse Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Tree Layer					
Abies balsamea	balsam fir	7	100.0	5.6	4.2
Picea glauca	white spruce	2	28.6	3.0	0.0
Picea mariana	black spruce	2	28.6	7.5	3.5
Tall Shrub Layer					
Abies balsamea	balsam fir	7	100.0	12.7	10.4
Sorbus decora	northern mountain-ash	2	28.6	4.5	4.9
Picea glauca	white spruce	2	28.6	4	4.2
Picea mariana	black spruce	2	28.6	5	0
Short Shrub Layer					
Abies balsamea	balsam fir	5	71.4	5.8	4.0
Ilex mucronata	mountain holly	3	42.9	0.4	0.5
Herbaceous Layer					
Solidago rugosa	rough-leaf goldenrod	7	100	2.9	2.9
Cornus canadensis	dwarf dogwood	6	85.7	36.3	27.2
Rubus pubescens	dwarf red raspberry	6	85.7	3	2.6
Linnaea borealis	twinflower	5	71.4	6	8
Anaphalis margaritacea	pearly everlasting	4	57.1	3	2.7
Acer spicatum	mountain maple	4	57.1	0.8	0.5
Gaultheria hispidula	creeping snowberry	3	42.9	10.1	17.3

Table 4-10 Species Composition, Frequency and Abundance of Coniferous Sparse Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Calamagrostis canadensis	blue-joint reedgrass	3	42.9	5	2
Clintonia borealis	Clinton lily	3	42.9	2	2.6
Osmundastrum cinnamomeum	cinnamon fern	3	42.9	2	1
Equisetum arvense	field horsetail	3	42.9	0.7	0.5
Tussilago farfara	colt's-foot	2	28.6	15.1	21.1
Dryopteris carthusiana	spinulose shield fern	2	28.6	10.5	13.4
Epigaea repens	trailing arbutus	2	28.6	9	8.5
Thelypteris noveboracensis	New York fern	2	28.6	4	1.4
Dryopteris campyloptera	mountain wood-fern	2	28.6	2.5	0.7
Betula cordifolia	heartleaf birch, mountain white birch	2	28.6	1.5	0.7
Dryopteris sp.	a wood fern (unknown species)	2	28.6	1.5	0.7
Chamerion angustifolium	fireweed	2	28.6	1	0
Ilex mucronata	mountain holly	2	28.6	1	0
Cornus sericea	red-osier dogwood	2	28.6	0.6	0.6
Juncus effusus	soft rush	2	28.6	0.6	0.6
Ribes lacustre	bristly black currant	2	28.6	0.6	0.6

Notes:
[1] Values for species present in two or more of the survey plots are reported.
[2] SD = standard deviation.

Ten sample plots were assessed in the coniferous sparse LCC. Within these ten plots, vascular plant cover occupied 61.3% cover, bryophytes comprised 27.1%, and lichens comprised nearly one percent of vegetation cover (Table 4-11). Litter comprised 10.6% cover.

Table 4-11 Ground Cover of Coniferous Sparse Survey Locations in the Port au Port LAA

Parameter	Mean Cover (%)[1]	SD[2]
Total Vascular Plant	61.3	33.0
Total Bryophyte	27.1	28.1
Total Lichen	0.9	1.1
Total Litter	10.6	21.9
Total Bare Ground	0.1	0.4
Total Water	0.0	0.0

Notes:
[1] Sample size (n) = 7. [2] SD = standard deviation.

Mixedwood

Mixedwood forest sample plots were co-dominated by balsam fir (*Abies balsamea*) and paper birch (*Betula papyrifera*) (Table 4-12; Appendix C, Photo 6). The herbaceous layer within mixedwood forest sample plots was comprised of five species consistently occurring in the herbaceous layer, including: dwarf red raspberry (*Rubus pubescens*), dwarf dogwood (*Cornus canadensis*), cinnamon fern (*Osmundastrum cinnamomeum*), creeping butter-cup (*Ranunculus repens*), and rough-leaf goldenrod (*Solidago rugosa*), listed in order of their relative frequency and abundance with dwarf red raspberry the most frequent and abundant across the two plots. Although there is no formal list of invasive species for Newfoundland, creeping butter-cup is sometimes considered invasive, and is discussed further in Section 4.3.

Table 4-12 Species Composition, Frequency and Abundance of Mixedwood Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Tree Layer					
Abies balsamea	balsam fir	2	100.0	12.7	15.0
Betula papyrifera	paper birch	2	100.0	6.0	2.8
Herbaceous Layer					
Rubus pubescens	dwarf red raspberry	2	100	13	17
Cornus canadensis	dwarf dogwood	2	100	5	2.8
Osmundastrum cinnamomeum	cinnamon fern	2	100	4	1.4
Ranunculus repens	creeping butter-cup	2	100	3	2.8
Solidago rugosa	rough-leaf goldenrod	2	100	2	0

Notes:
[1] Values for species present in two or more of the survey plots are reported.
[2] SD = standard deviation.

Within the mixedwood forest plots, vascular plant species comprised a mean of 60.5% cover, and bryophytes occupied 35% cover (Table 4-13). Litter was sparse, comprising a mean of 3.5%.

Table 4-13 Ground Cover of Mixedwood Survey Locations in the Port au Port LAA

Parameter	Mean Cover (%)[1]	SD[2]
Total Vascular Plant	60.5	0.7
Total Bryophyte	35.0	0.0
Total Lichen	0.0	0.0
Total Litter	3.5	2.1
Total Bare Ground	0.0	0.0
Total Water	1.0	1.4

Notes: [1] Sample size (n) = 2. [2] SD = standard deviation.

Regenerating Forest

Forests in the LAA were frequently disturbed by logging, particularly for local firewood harvesting (Appendix C, Photo 7). Three sample plots were collected to represent regenerating forests. Balsam fir (*Abies balsamea*) was the dominant tree species, present in various states of succession as reflected in its occurrence in the tall shrub, short shrub, and herbaceous layers across the sample plots. Young white spruce (*Picea glauca*) were observed in two of the three sample plots (Table 4-14).

The herbaceous layer of regenerating forest sample plots was represented by the most common forest plants of both coniferous dense and coniferous sparse stands, including dwarf dogwood (*Cornus canadensis*) and twinflower (*Linnaea borealis*), and by species of disturbed and/or open areas, including for example, pearly everlasting (*Anaphalis margritacea*), rough-leaved goldenrod (*Solidago rugosa*), rough bentgrass (*Agrostis scabra*), and wild red raspberry (*Rubus idaeus* subsp. *strigosus*).

Table 4-14 Species Composition, Frequency and Abundance of Regenerating Forest Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Tall Shrub Layer					
Abies balsamea	balsam fir	3	100.0	7.7	6.4
Short Shrub Layer					
Abies balsamea	balsam fir	2	66.7	2.5	0.7
Herbaceous Layer					
Solidago rugosa	rough-leaf goldenrod	3	100.0	16.7	11.5
Anaphalis margaritacea	pearly everlasting	3	100.0	11.0	12.2
Cornus canadensis	dwarf dogwood	3	100.0	8.0	6.6
Gaultheria hispidula	creeping snowberry	3	100.0	2.0	2.6
Fragaria virginiana	Virginia strawberry	2	66.7	6.0	5.7
Rubus idaeus subsp. *strigosus*	wild red raspberry	2	66.7	3.5	0.7
Abies balsamea	balsam fir	2	66.7	2.5	0.7
Rubus pubescens	dwarf red raspberry	2	66.7	2.5	0.7
Linnaea borealis	twinflower	2	66.7	1.6	2.1
Picea glauca	white spruce	2	66.7	1.5	0.7
Kalmia angustifolia	sheep-laurel	2	66.7	1.0	0.0
Agrostis scabra	rough bentgrass	2	66.7	0.6	0.6

Notes:
[1] Values for species present in two or more of the survey plots are reported.
[2] SD = standard deviation.

Ground cover of regenerating forest plots was predominantly vascular plants (81.3%), with a limited mean 6.3% bryophyte cover, likely due to disturbed microenvironmental conditions (Table 4-15). Litter occupied 11.7% ground cover and bare ground was not common, equaling a mean ground cover of 0.3%.

Table 4-15 Ground Cover of Regenerating Forest Survey Locations in the Port au Port LAA

Parameter	Mean Cover (%)[1]	SD[2]
Total Vascular Plant	81.3	7.6
Total Bryophyte	6.3	7.5
Total Lichen	0.3	0.6
Total Litter	11.7	2.9
Total Bare Ground	0.3	0.6
Total Water	0.0	0.0

Notes:
[1] Sample size (n) = 3.
[2] SD = standard deviation.

Tuckamore

Subalpine tuckamore stands dominated by balsam fir and green alder (*Alnus alnobetula*) occur on exposed sites at higher elevations and in depressions between wind-exposed alpine heathlands, and along the coast (Jones and Wiley 2012). Beneath the stunted trees, the shrub layer is typically dominated by ericaceous shrubs and other shrub species such as mountain holly (*Ilex mucronata*) and northern wild raisin (*Viburnum nudum*) (Appendix C, Photo 8).

Tall shrub layer trees were uncommon (Table 4-16). Black spruce (*Picea mariana*) was present in two of ten (20%) sample plots. Trees comprising the tuckamore canopy occurred in the short shrub layer, and typically included black spruce. Of lesser frequency and abundance, balsam fir (*Abies balsamea*) comprised a mean of 2.3% of cover within 9/10 (90%) of sample plots. American larch was occasionally present, represented in 30% of sample plots with mean abundance of four percent.

The most frequent and abundant species in herbaceous layer included dwarf dogwood (*Cornus canadensis*), creeping snowberry (*Gaultheria hispidula*), sheep-laurel (*Kalmia angustifolia*), and black crowberry (*Empetrum nigrum*), all present in at least 70% of plots and listed in order of relative mean abundance within the sample plots. Common barrens and forest floor species comprised the reminder of constituent species of the tuckamore LCC. Canada yew (*Taxus canadensis*) was casually observed by surveyors across the LAA, but of LCC sample plots, was most frequent within the tuckamore unit, present in half of the ten plots. Trailing arbutus (*Epigaea repens*), occurring in 40% of plots was also more frequent in the tuckamore plots than for other LCC units.

Table 4-16 Species Composition, Frequency and Abundance of Tuckamore Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Tall Shrub Layer					
Picea mariana	black spruce	2	20.0	8.0	9.9
Short Shrub Layer					
Picea mariana	black spruce	9	90	34.8	18.5
Abies balsamea	balsam fir	6	60	2.3	1.5
Larix laricina	American larch	3	30	4	3.6
Kalmia angustifolia	sheep-laurel	2	20	3	0
Herbaceous Layer					
Cornus canadensis	dwarf dogwood	9	90	3.5	3.9
Gaultheria hispidula	creeping snowberry	8	80	1.8	2.7
Kalmia angustifolia	sheep-laurel	7	70	11.4	9.7
Empetrum nigrum	black crowberry	7	70	4.1	5
Vaccinium angustifolium	late lowbush blueberry	6	60	2	2.5
Vaccinium vitis-idaea	mountain cranberry	6	60	1	0.9
Picea mariana	black spruce	5	50	40	34.4
Dasiphora fruticosa	golden-hardhack	5	50	3.4	3.8
Juniperus communis	ground juniper	5	50	2.8	2
Kalmia polifolia	pale laurel	5	50	2.6	2.5
Taxus canadensis	Canadian yew	5	50	1.2	0.8
Rhododendron groenlandicum	common Labrador-tea	5	50	0.6	0.5
Epigaea repens	trailing arbutus	4	40	3.3	3.3
Linnaea borealis	twinflower	4	40	1.5	1
Sanguisorba canadensis	Canada burnet	4	40	1.3	0.5
Bromus ciliatus	fringed brome	3	30	6.3	7.6
Viburnum sp.	a viburnum (unknown species)	3	30	1	0
Arctostaphylos uva-ursi	bearberry	3	30	0.7	0.5
Coptis trifolia	goldthread	3	30	0.1	0
Carex sp.	a sedge (unknown species)	2	20	32.6	45.9
Andromeda polifolia	bog rosemary	2	20	12.5	10.6
Abies balsamea	balsam fir	2	20	9	8.5
Packera aurea	golden groundsel	2	20	7.5	3.5
Trichophorum cespitosum	deergrass	2	20	1.6	2.1
Danthonia spicata	poverty oat-grass	2	20	1.5	0.7

Table 4-16 Species Composition, Frequency and Abundance of Tuckamore Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Fragaria virginiana	Virginia strawberry	2	20	1.5	0.7
Juniperus horizontalis	creeping juniper	2	20	1.5	0.7
Rubus pubescens	dwarf red raspberry	2	20	1.5	0.7
Carex trisperma	three-seed sedge	2	20	1.1	1.3
Solidago hispida	hairy goldenrod	2	20	1.1	1.3
Avenella flexuosa	wavy hairgrass	2	20	1	0
Clintonia borealis	Clinton lily	2	20	1	0
Spinulum annotinum	stiff clubmoss	2	20	1	0
Carex scirpoidea	bulrush sedge	2	20	0.6	0.6
Cornus sericea	red-osier dogwood	2	20	0.6	0.6
Maianthemum canadense	wild lily-of-the-valley	2	20	0.6	0.6
Mitella nuda	naked bishop's-cap	2	20	0.6	0.6
Sibbaldia tridentata	three-toothed cinquefoil	2	20	0.6	0.6
Lysimachia borealis	northern starflower	2	20	0.6	0.6
Thalictrum pubescens	tall meadow-rue	2	20	0.1	0

Notes:
[1] Values for species present in two or more of the survey plots are reported.
[2] SD = standard deviation.

Vascular plants within tuckamore survey plots occupied a mean of 53.1% cover (Table 4-17). Bryophytes and Lichens were abundant relative to other LCC units, making up means of 23.1% and 18.9% cover respectively. Litter was present with a mean of 4.6%. Bare ground comprised less than one percent ground cover.

Table 4-17 Ground Cover of Tuckamore Survey Locations in the Port au Port LAA

Parameter	Mean Cover (%)[1]	SD[2]
Total Vascular Plant	53.1	35.6
Total Bryophyte	23.1	27.4
Total Lichen	18.9	27.4
Total Litter	4.6	6.6
Total Bare Ground	0.3	0.7
Total Water	0.0	0.0

Notes:
[1] Sample size (n) = 8.
[2] SD = standard deviation.

4.1.2.3 Wetlands

The Port au Port LAA contains a large proportion of wetlands, primarily peatlands (Meades 1990), but coniferous treed swamps and alder (*Alnus* spp.) dominated shrub swamps are also common. Peatlands are poorly drained wetlands with organic soil (Pollett and Wells 1980). The distribution and composition of peatlands on the Island of Newfoundland is affected by latitude, distance from the coast (Davis 1984), and other climatic factors such as precipitation rates and seasonal temperatures (Pollett and Wells 1980). Pollet (1968) states that conditions in the surrounding region favour bog formation, though this reference seems to frequently equate fens with bogs and is focused heavily on economic development, and also did not evaluate wetlands on the Port au Port Peninsula in detail.

Bog wetlands are common and occupy a large proportion of the LAA on flat terrain and low depressions where rainwater accumulates. Bogs typically receive water from precipitation (Vitt 2013) and are dominated by vertical water movement. Large bog complexes are located between the barrens at the top of Port au Port Peninsula and the western coast of the peninsula. Although bogs are generally acidic and nutrient-poor, underlying limestone bedrock lends a calcareous influence in the flora present within the Project Area. Related soil characteristics are important to vegetation community composition and differentiation (Wells 1996).

Fens receive water from direct precipitation, surface run-off, and groundwater discharge (Vitt 2013). Water movement is vertical and horizontal. Fen habitats within the Project Area are dominated by graminoids including a diversity of sedges, and sparse shrubs. Slope fens, which are common in areas with limestone bedrock, are considered the major peatland type of the Port au Port area by Pollett and Wells (1980). Slope fens, Atlantic ribbed fens, ladder fens, and stream fens occur in association with calcareous soils and stream margins on slopes and in valleys across the Port au Port Peninsula (Meades 1990). Scanned, hand-drawn maps of peatlands within the province contained in the “Peatland Inventory - Newfoundland” are available on a webmap (Newfoundland and Labrador Geological Survey 2022), but no data is visible on the webmap for the Port au Port peninsula.

Forested wetlands (i.e., treed swamps) are frequently considered biodiversity hotspots (e.g., by Sjöberg and Ericson 1997; Hörnberg et al. 1998; Morissette et al. 2013; Padgett and Wiersma 2020; Brazner et al. 2023). The distribution of forested wetlands (including coniferous swamps) is a knowledge gap in Atlantic Canada (Harper et al. 2021).

Bog

Trees were sparse and dwarfed in the open bog wetland sample plots (Table 4-18; Appendix C, Photo 9). The tree species black spruce (*Picea mariana*) occurred in the short shrub layer of two of six (33.3%) plots where it comprised a mean cover of 10.5%. Black spruce was more frequent in the herbaceous layer, present in five of six plots (83.3%) where it comprised a mean cover of 5.2%. Balsam fir (*Abies balsamea*) was present in the short shrub layer of two of six (33.3%) plots, where it occupied just one percent cover in each plot. American larch (*Larix laricinia*) occurred in half of the six sample plots, where it occupied a mean of 3.7% cover.

Shrubs were short and more frequent in the herbaceous layer. Sheep-laurel (*Kalmia angustifolia*) was the only species present within the short shrub layer, where it occurred in only two plots. It also occurred within the herbaceous layer. The most frequent and abundant shrubs in the bog sample plots all occurred in the herbaceous layer and include small cranberry (*Vaccinium oxycoccos*), common Labrador-tea (*Rhododendron groenlandicum*), bog rosemary (*Andromeda polifolia*), leatherleaf (*Chamadaphne calyculata*), black crowberry (*Empetrum nigrum*), and ground juniper (*Juniperus communis*).

The most frequently occurring species across the bog sample plots was the graminoid deergrass (*Trichophorum cespitosum*), which was present in four of six (66.7%) of plots and occupied a mean cover of 31.8% across the plots where it occurred (Appendix C, Photo 11).

Table 4-18 Species Composition, Frequency and Abundance of Bog Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Short Shrub Layer					
Kalmia angustifolia	sheep-laurel	2	33.3	25.0	21.2
Picea mariana	black spruce	2	33.3	10.5	13.4
Abies balsamea	balsam fir	2	33.3	1.0	0.0
Herbaceous Layer					
Picea mariana	black spruce	5	83.3	5.2	4.5
Trichophorum cespitosum	deergrass	4	66.7	31.8	36.7
Cornus canadensis	dwarf dogwood	4	66.7	3.3	4.6
Vaccinium oxycoccos	small cranberry	4	66.7	1.8	0.5
Rhododendron groenlandicum	common Labrador-tea	4	66.7	1.3	1.2
Solidago uliginosa	bog goldenrod	4	66.7	1.0	0.0
Andromeda polifolia	bog rosemary	3	50.0	5.0	3.5
Chamaedaphne calyculata	leatherleaf	3	50.0	3.7	1.5
Larix laricina	American larch	3	50.0	3.7	1.2
Empetrum nigrum	black crowberry	3	50.0	3.3	3.2
Juniperus communis	ground juniper	3	50.0	2.0	1.0
Sarracenia purpurea	northern pitcher-plant	3	50.0	1.7	1.5
Coptis trifolia	goldthread	3	50.0	1.7	1.2
Oclemena nemoralis	bog aster	3	50.0	0.7	0.5
Osmundastrum cinnamomeum	cinnamon fern	2	33.3	31.5	40.3
Juncus effusus	soft rush	2	33.3	15.5	20.5
Gaylussacia sp.	a huckleberry (unknown species)	2	33.3	13.5	9.2
Linnaea borealis	twinflower	2	33.3	8.5	9.2
Kalmia angustifolia	sheep-laurel	2	33.3	5.5	2.1

Table 4-18 Species Composition, Frequency and Abundance of Bog Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Gaultheria hispidula	creeping snowberry	2	33.3	3.5	2.1
Equisetum sylvaticum	woodland horsetail	2	33.3	2.0	1.4
Vaccinium angustifolium	late lowbush blueberry	2	33.3	2.0	1.4
Kalmia polifolia	pale laurel	2	33.3	1.5	0.7
Rubus chamaemorus	cloudberry	2	33.3	1.5	0.7
Carex exilis	coast sedge	2	33.3	1.0	0.0
Carex trisperma	three-seed sedge	2	33.3	1.0	0.0
Juncus canadensis	Canada rush	2	33.3	1.0	0.0

Notes:
[1] Values for species present in two or more of the survey plots are reported.
[2] SD = standard deviation.

Total vascular plant species cover represented 50.7% of sample plots (Table 4-19). Bryophyte and lichen cover represented 36.5 and 7.8% cover of bog plots respectively. Litter was represented by a mean of 1.5% cover. Open water was relatively abundant, represented by a mean of 3.5% cover.

Table 4-19 Ground Cover of Bog Survey Locations in the Port au Port LAA

Parameter	Mean Cover (%)[1]	SD[2]
Total Vascular Plant	50.7	22.6
Total Bryophyte	36.5	21.1
Total Lichen	7.8	13.5
Total Litter	1.5	1.9
Total Bare Ground	0.0	0.0
Total Water	3.5	6.0

Notes:
[1] Sample size (n) = 6
[2] SD = standard deviation.

Fen

Vegetation across the five fen sample plots occurred in the herbaceous layer (Table 4-20; Appendix C, Photo 10). The tree species American larch (*Larix laricinia*) was present in low abundance (mean of one percent) in four of five (80%) plots. Shrubs were sparse and included Leatherleaf (*Chamadaphne calyculata*) and common Labrador tea (*Rhododendron groenlandicum*) in every sample plot, with means of 9.4 and one percent cover respectively. Other shrub species present in the fen plots included primarily sweet bayberry (*Myrica gale*), small cranberry (*Vaccinium oxycoccos*), black crowberry (*Empetrum*

nigrum), bog rosemary (*Andromeda polifolia*), pale laurel (*Kalmia polifolia*), each present in at least 60% of sample plots.

The most abundant species across the sample plots were deergrass (*Trichophorum cespitosum*) with a mean of 27.5% cover in the four of five (80%) sample plots where it occurred, and white beakrush (*Rhynchospora alba*) with a mean of 30.5% in the two of four plots where it occurred (Appendix C, Photo 12). The rush *Juncus alpinoarticulatus* was relatively abundant where sampled (two plots), having a mean cover value of 16%.

Wetland herbs present in the fens included northern pitcherplant (*Sarracenia purpurea*) most frequently (60% of plots). Roundleaf sundew (*Drosera rotundifolia*), rough-leaved aster (*Eurybia radula*), and bog aster (*Oclemena nemoralis*), and bog goldenrod (*Solidago uliginosa*) each occurred in 40% of plots.

Table 4-20 Species Composition, Frequency and Abundance of Fen Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Herbaceous layer					
Chamaedaphne calyculata	leatherleaf	5	100.0	9.4	17.1
Rhododendron groenlandicum	common Labrador-tea	5	100.0	1.2	0.4
Trichophorum cespitosum	deergrass	4	80.0	27.5	25.3
Myrica gale	sweet bayberry	4	80.0	2.8	1.5
Larix laricina	American larch	4	80.0	1.0	0.8
Vaccinium oxycoccos	small cranberry	3	60.0	4.3	3.1
Empetrum nigrum	black crowberry	3	60.0	2.7	2.1
Andromeda polifolia	bog rosemary	3	60.0	1.4	1.5
Kalmia polifolia	pale laurel	3	60.0	1.0	1.0
Sarracenia purpurea	northern pitcher-plant	3	60.0	0.7	0.5
Rhynchospora alba	white beakrush	2	40.0	30.5	41.7
Juncus alpinoarticulatus	a rush	2	40.0	16.0	19.8
Gaylussacia bigeloviana	dwarf huckleberry	2	40.0	7.5	3.5
Drosera rotundifolia	roundleaf sundew	2	40.0	1.0	0.0
Eurybia radula	rough-leaved aster	2	40.0	1.0	0.0
Kalmia angustifolia	sheep-laurel	2	40.0	1.0	0.0
Oclemena nemoralis	bog aster	2	40.0	0.6	0.6
Solidago uliginosa	bog goldenrod	2	40.0	0.6	0.6

Notes:
[1] Values for species present in two or more of the survey plots are reported.
[2] SD = standard deviation

Vascular plants are represented across fen plots (Table 4-21) with 54.8% mean cover, bryophytes by a mean of 31.4% cover, and lichens a mean of 6.6% cover. Open water was represented by a mean of three percent cover.

Table 4-21 Ground Cover of Fen Survey Locations in the Port au Port LAA

Parameter	Mean Cover (%)[1]	SD[2]
Total Vascular Plant	54.8	13.6
Total Bryophyte	31.4	12.6
Total Lichen	6.6	10.5
Total Litter	4.2	6.1
Total Bare Ground	0.0	0.0
Total Water	3.0	2.8

Notes:
[1] Sample size (n) = 5
[2] SD = standard deviation.

Flarks

This LCC unit occurred at a small patch scale, finer than the resolution of other units. Three flarks were selected for surveys, but these plots were reclassified as fen and bog during field surveys. It is possible that the size of flarks can fluctuate depending on seasonal water levels of the surrounding wetland habitat.

Flarks were included as an LCC because they were readily detectable by remote sensing methods, and because they provide a distinct habitat within bog peatland complexes. These small pools are important for biodiversity and ecosystem functioning of bogs (Beadle et al. 2015; Arsenault 2019).

Coniferous Treed Swamp

Canopy cover in the six coniferous treed swamp sample plots was dominated by balsam fir (*Abies balsamea*), which was present in every plot to varying degrees of abundance (Table 4-22; Appendix C, Photo 11). Balsam fir was structurally diverse, occurring across the tree, tall shrub, and short shrub layers. Paper birch (*Betula papyrifera*) was present in half of the sample plots and had a mean abundance of 9.3% cover. American larch (*Larix laricinia*) was present in the tall shrub layer of two (33%) sample plots where it comprised 20% cover in each. The tree species black spruce (*Picea mariana*) was also present in the tall shrub layer (33% of plots), and in the short shrub layer (50% of plots), where it represented a mean of 7.5% and 14% cover respectively. Black spruce was also present in the herbaceous layer of two plots.

Speckled alder (*Alnus incana*) was present in the tall shrub layer was shrub layer of two plots, where it represented a mean of 32% cover between them. Mountain holly (*Ilex mucronata*) also occurred in two sample plots but was not abundant – was represented by one percent cover in each of the two plots. Dwarf red raspberry (*Rubus pubescens*) was present in the herbaceous layer of every sample plot.

Forest floor vegetation in the herbaceous layer was typically comprised of the most common species of forested habitats, and plants frequently occurring in wetland habitats. Dwarf dogwood (*Cornus canadensis*) and twinflower (*Linnaea borealis*) were present in every sample plot. Commonly occurring wetland associated herbaceous plants included for example, cinnamon fern (*Osmundastrum cinnamomeum*), swamp aster (*Symphyotrichum puniceum*), naked bishop's cap (*Mitella nuda*), and bog goldenrod (*Solidago uliginosa*).

Table 4-22 Species Composition, Frequency and Abundance of Coniferous Swamp Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Tree Layer					
Abies balsamea	balsam fir	3	50.0	17.0	9.8
Betula papyrifera	paper birch	3	50.0	9.3	13.6
Tall Shrub Layer					
Abies balsamea	balsam fir	3	50.0	5.0	2.0
Alnus incana	speckled alder	2	33.3	32.5	10.6
Larix laricina	American larch	2	33.3	20.0	0.0
Picea mariana	black spruce	2	33.3	7.5	3.5
Short Shrub Layer					
Abies balsamea	balsam fir	6	100.0	4.7	5.2
Picea mariana	black spruce	3	50.0	14.0	1.7
Ilex mucronata	mountain holly	2	33.3	1.0	0.0
Herbaceous Layer					
Cornus canadensis	dwarf dogwood	6	100.0	5.0	2.8
Linnaea borealis	twinflower	6	100.0	4.3	3.4
Rubus pubescens	dwarf red raspberry	5	83.3	8.8	12.0
Viola sp.	a violet (unknown species)	5	83.3	1.0	0.0
Solidago rugosa	rough-leaf goldenrod	4	66.7	6.0	3.4
Juncus effusus	soft rush	4	66.7	4.0	4.1
Equisetum sylvaticum	woodland horsetail	4	66.7	3.3	2.1
Ranunculus repens	creeping butter-cup	4	66.7	2.3	1.0
Osmundastrum cinnamomeum	cinnamon fern	4	66.7	1.5	1.0
Symphyotrichum puniceum	swamp aster	4	66.7	1.5	1.0
Carex sp.	a sedge	3	50.0	17.3	24.0
Calamagrostis canadensis	blue-joint reedgrass	3	50.0	4.7	4.7
Dryopteris intermedia	glandular wood fern	3	50.0	3.0	1.7
Mitella nuda	naked bishop's-cap	3	50.0	2.3	2.3

Table 4-22 Species Composition, Frequency and Abundance of Coniferous Swamp Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Equisetum arvense	field horsetail	3	50.0	2.0	1.7
Gaultheria hispidula	creeping snowberry	3	50.0	1.3	0.6
Maianthemum trifolium	three-leaf Solomon's-plume	3	50.0	1.3	0.6
Galium triflorum	sweet-scent bedstraw	3	50.0	1.0	0.0
Rhododendron groenlandicum	common Labrador-tea	2	33.3	16.5	19.1
Geum rivale	purple avens	2	33.3	4.5	3.5
Packera aurea	golden groundsel	2	33.3	4.0	0.0
Picea mariana	black spruce	2	33.3	2.0	0.0
Thalictrum pubescens	tall meadow-rue	2	33.3	2.0	1.4
Sanguisorba canadensis	Canada burnet	2	33.3	1.5	0.7
Solidago uliginosa	bog goldenrod	2	33.3	1.5	0.7
Acer spicatum	mountain maple	2	33.3	1.0	0.0
Prunella vulgaris	self-heal	2	33.3	1.0	0.0
Scirpus atrocinctus	black-girdle bulrush	2	33.3	1.0	0.0
Viburnum edule	squashberry	2	33.3	1.0	0.0

Notes:
[1] Values for species present in two or more of the survey plots are reported.
[2] SD = standard deviation.

Coniferous swamp plots feature mean cover values (Table 4-23) of 64.5% for vascular plants and 32.3% cover for bryophytes. Lichens represented a mean of 0.5% cover. Open water was notably present, representing a mean of 1.2% cover.

Table 4-23 Ground Cover of Coniferous Swamp Survey Locations in the Port au Port LAA

Parameter	Mean Cover (%)[1]	SD[2]
Total Vascular Plant	64.5	17.3
Total Bryophyte	32.3	16.2
Total Lichen	0.5	0.6
Total Litter	1.3	1.0
Total Bare Ground	0.2	0.4
Total Water	1.2	0.8

Notes:
[1] Sample size (n) = 6
[2] SD = standard deviation.

Shrub Swamp

Shrub swamp plots were characterized by a mix of forest canopy and shrub species (Table 4-24). Black spruce (*Picea mariana*) was present in the tall shrub layer of 57.1% of sample plots, with low mean cover of 4.3%. Although alder dominated swamps (Meades 1990) are common in western Newfoundland, speckled alder (*Alnus incana*) was present in less than half of sample plots (42.9%). Speckled alder was sometimes abundant when present (Appendix C, Photo 12), represented by a mean cover of 31.7%, but relatively variable, as represented by its high standard deviation. In two sample plots (28.6%), white spruce (*Picea glauca*), and balsam fir *(Abies balsamea*) occurred in the tree layer.

Herbaceous cover of shrub swamp plots consisted of a diversity of forest floor, wetland, and riparian associated species. Dwarf red raspberry (*Rubus pubescens*) was the most frequently occurring species however, occurring in six (85.7%) of sample plots.

Table 4-24 Species Composition, Frequency and Abundance of Shrub Swamp Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Tree Layer					
Picea glauca	white spruce	2	28.6	2	1.4
Abies balsamea	balsam fir	2	28.6	1	0
Tall Shrub Layer					
Picea mariana	black spruce	4	57.1	4.3	3.9
Alnus incana	speckled alder	3	42.9	31.7	33.3
Short Shrub Layer					
Abies balsamea	balsam fir	3	42.9	1.4	1.5
Herbaceous Layer					
Rubus pubescens	dwarf red raspberry	6	85.7	5.3	3.4
Equisetum sylvaticum	woodland horsetail	4	57.1	5.8	6.9
Cornus canadensis	dwarf dogwood	4	57.1	3	2.7
Solidago rugosa	rough-leaf goldenrod	4	57.1	1.8	1
Glyceria striata	fowl manna-grass	4	57.1	1.5	1
Linnaea borealis	twinflower	4	57.1	1.3	0.9
Osmundastrum cinnamomeum	cinnamon fern	3	42.9	4.4	5.1
Rubus idaeus	red raspberry	3	42.9	1.7	2.8
Clintonia borealis	Clinton lily	3	42.9	1.4	1.5
Eurybia radula	rough-leaved aster	3	42.9	1.3	0.6
Maianthemum canadense	wild lily-of-the-valley	3	42.9	1	0
Acer spicatum	mountain maple	3	42.9	0.7	0.5
Phegopteris connectilis	northern beech fern	3	42.9	0.7	0.5

Table 4-24 Species Composition, Frequency and Abundance of Shrub Swamp Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Lysimachia borealis	northern starflower	3	42.9	0.7	0.5
Dryopteris campyloptera	mountain wood-fern	2	28.6	26	33.9
Thelypteris noveboracensis	New York fern	2	28.6	13	17
Juncus effusus	soft rush	2	28.6	8	9.9
Carex sp.	a sedge (unknown species)	2	28.6	5.1	7
Dryopteris intermedia	glandular wood fern	2	28.6	3.5	2.1
Viola sp.	a violet (unknown species)	2	28.6	2.5	0.7
Ilex mucronata	mountain holly	2	28.6	2	0
Caltha palustris	marsh marigold	2	28.6	1.5	0.7
Equisetum arvense	field horsetail	2	28.6	1.5	0.7
Maianthemum trifolium	three-leaf Solomon's-plume	2	28.6	1.5	0.7
Scirpus atrocinctus	black-girdle bulrush	2	28.6	1.5	0.7
Thalictrum pubescens	tall meadow-rue	2	28.6	1	0
Symphyotrichum puniceum	swamp aster	2	28.6	0.6	0.6

Notes:
[1] Values for species present in two or more of the survey plots are reported.
[2] SD = standard deviation.

Shrub swamp plots had mean cover values of 58.1% for vascular plants and 15.6% cover for bryophytes (Table 4-25). Lichens represented a mean of 0.3% cover. Open water was notably present, representing a mean of 10.6% cover.

Table 4-25 Ground Cover of Shrub Swamp Survey Locations in the Port au Port LAA

Parameter	Mean Cover (%)[1]	SD[2]
Total Vascular Plant	58.1	24.9
Total Bryophyte	15.6	18.2
Total Lichen	0.3	0.5
Total Litter	13.9	16.2
Total Bare Ground	1.6	3.7
Total Water	10.6	8.2

Notes:
[1] Sample size (n) = 6
[2] SD = standard deviation.

4.1.2.4 Anthropogenic Vegetation

Five sample plots were collected within the LAA to represent vegetation associated with anthropogenic disturbance (Table 4-26). Vegetation species composition reflects disturbance, open, and frequently old field condition (Appendix C, Photo 13). Species of open habitats with limited canopy cover were frequent. Exotic species of old field and disturbed habitats such as meadow timothy (*Phleum pratense*), and red clover (*Trifolium pratense*) were most frequent and abundant in this LCC unit relative to others.

Although there is no formal list of invasive species in Newfoundland, creeping buttercup (*Ranunculus repens*) is sometimes considered invasive of cobbly riparian and floodplain habitats. No other invasive species were observed in the anthropogenic vegetation sample plots. A discussion of exotic and invasive species is provided in Section 4.3

Table 4-26 Species Composition, Frequency and Abundance of Anthropogenic Vegetated Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Tree Layer					
Picea glauca	white spruce	2	40.0	4.5	4.9
Tall Shrub Layer					
Abies balsamea	balsam fir	2	40.0	1.5	0.7
Short Shrub Layer					
Abies balsamea	balsam fir	2	40.0	1.5	0.7
Herbaceous Layer					
Solidago rugosa	rough-leaf goldenrod	5	100	31	23.2
Fragaria virginiana	Virginia strawberry	5	100	7	8.1
Agrostis scabra	rough bentgrass	4	80	27	21.7
Ranunculus repens	creeping butter-cup	3	60	9	13.9
Bromus ciliatus	fringed brome	3	60	8.7	6
Phleum pratense	meadow timothy	3	60	8.3	10.1
Anaphalis margaritacea	pearly everlasting	3	60	2.3	2.3
Elymus trachycaulus	slender wheatgrass	3	60	2	1
Trifolium pratense	red clover	3	60	1.4	1.5
Cirsium arvense	creeping thistle	3	60	1.3	0.6
Taraxacum sp.	a dandelion (unknown species)	3	60	0.7	1.1
Centaurea nigra	black starthistle	2	40	6	5.7
Taraxacum officinale	common dandelion	2	40	5.5	6.4
Dactylis glomerata	orchard grass	2	40	3	2.8
Dryopteris intermedia	glandular wood fern	2	40	3	0

Table 4-26 Species Composition, Frequency and Abundance of Anthropogenic Vegetated Survey Locations in the Port au Port LAA

Scientific Name	Common Name	Frequency		Abundance (% Cover)[1]	
		N	%	Mean	SD[2]
Symphyotrichum novi-belgii	New York aster	2	40	2.5	0.7
Rubus idaeus	red raspberry	2	40	2	0
Poa pratensis	Kentucky bluegrass	2	40	1	0
Rubus pubescens	dwarf red raspberry	2	40	1	0

Notes:
[1] Values for species present in two or more of the survey plots are reported.
[2] SD = standard deviation.

Ground cover of the anthropogenic vegetation plots (Table 4-27) was dominated by vascular plants, comprising a mean of 84.8% cover. Bryophytes were represented by a mean of 11.2% cover across the plots. Litter was present, of variable abundance, represented by a mean of 3.8% cover.

Table 4-27 Ground Cover of Anthropogenic Vegetation Survey Locations in the Port au Port LAA

Parameter	Mean Cover (%)[1]	SD[2]
Total Vascular Plant	84.8	24.3
Total Bryophyte	11.2	24.5
Total Lichen	0.2	0.5
Total Litter	3.8	3.9
Total Bare Ground	0.0	0.0
Total Water	0.0	0.0

Notes:
[1] Sample size (n) = 5
[2] SD = standard deviation.

4.1.3 Classification Accuracy Analysis

Land cover class mapping accuracy analysis was done using 33 LCC of the 73 field survey plots. Overall accuracy was low based on the field survey plots; 11/33 (33%) of plots were correctly assigned to land cover class. Accuracy by individual LCC varied widely, ranging from 0% to 100% accuracy (Table 4-28). The detection of regenerating forest, rock barrens, and coniferous treed swamp were the most successful. Although coniferous treed swamp field survey locations were correctly mapped, the area of coniferous treed swamp, and shrub swamp, are likely underestimated because several polygons mapped as coniferous sparse or coniferous dense forest proved to be swamp wetlands from field survey data. There is limited knowledge of the spatial distribution of forested wetlands in Atlantic Canada (Harper et al 2021), due in part with the logistical challenge of differentiating wetland and upland boundaries in continuous forested cover using aerial imagery.

The LAA of the Port au Port Peninsula is large, 251.49 km^2, and the LCCs had many ecological similarities to one another. Nearly half, or 14 of 33 (42%) of the sample plots used to evaluate mapping accuracy, were matched to ecologically related LCCs (e.g., bog and coniferous treed swamp) (Appendix D). Field survey data revealed that the species composition of canopy cover between forested LCC units was dominated by the tree species balsam fir (*Abies balsamea*) and black spruce (*Picea mariana*) across forested units. The OBIA methods used relied on spectral signatures that would be consistent to species between the coniferous dense, coniferous sparse, and tuckamore units. Overlap in LCC units suggests that additional spatial data (e.g., LiDAR [Light Detecting and Ranging] data) that are not currently available for the Port au Port LAA could support further discernment of LCCs.

Table 4-28 Land Cover Mapping Accuracy by Land Cover Type

Land Cover Type	Land Cover Class	Number of Plots	Accuracy	
			Number of Plots	%
Native Upland Forest	Coniferous Forest - Dense	4	0/4	0
	Coniferous Forest - Sparse	3	1/3	33.3
	Mixedwood Forest	2	0/2	0
	Tuckamore	3	1/3	33.3
	Regenerating Forest	1	1/1	100
	Shrubland	1	0/1	0
Native Upland Sparsely / Non-Vegetated	Rock Barrens	3	3/3	100
	Snowbed Meadow	2	0/2	0
Native Wetland	Bog	3	1/3	33.3
	Fen	2	0/2	0
	Flarks	0	-	-
	Coniferous Treed Swamp	3	3/3	100
	Shrub Swamp	4	0/4	0
Water	Water	1	-	-
Anthropogenic	Anthropogenic Vegetated	2	1/2	50

Note:
Although targeted, flarks were not assessed in the field and therefore mapping accuracy could not be determined (Section 4.1.5.4). The one field assessed water location was used to further train the mapping and therefore was not available for evaluating mapping accuracy.

4.2 RARE PLANTS

In total, 450 observations of 16 rare vascular plant species (SAR and SOCC), including 14 SOCC and two SAR, were previously documented within the LAA (Table 4-29, AC CDC 2023, Appendix B). This study detected an additional 10 rare vascular plant species that were not previously observed, and four that were previously known from the LAA (Table 4-30, Appendix B). In previously recorded data, the three most frequently documented rare species included 345 Lindley's aster (*Symphyotrichum ciliolatum)* observations, 42 MacKenzie's sweetvetch (*Hedysarum boreale* subsp. *mackenziei)* observations, and 41 Hooker's orchid (*Platanthera hookeri)* observations (Table 4-30). The relative frequency of Lindley's aster reflects that the Port au Port Peninsula supports the largest population of this species in Newfoundland (SSAC 2009) The relative frequency of MacKenzies sweetvetch and Hooker's orchid among these observations likely reflect previous survey efforts focused on the limestone barrens within the LAA.

This study documented 107 vascular plant SOCC occurrences within the Project Area and 124 in the LAA (Table 4-30). SOCC with the greatest number of observations include slender-leaved sundew (*Drosera linearis*), with 49 occurrences in the Project Area and in the LAA, and Hooker's orchid (*Platanthera hookeri*) with 18 observations in the Project Area and 30 in the LAA. Slender-leaved sundew observations were not widespread, but densely aggregated along several pond margins within fen wetland complexes. Hooker's orchid was restricted to limestone barrens habitats. These species are both provincially ranked S2, meaning either they have a very restricted range, possibly 20 or fewer populations in the province, have experienced steep population declines, or are otherwise very vulnerable to extirpation from the province (AC CDC 2024a). Rare plants were observed in 11 of the 18 mapped land cover classes during the stratified random rare plant survey, excluding coast and ocean, with most species observed in more than one land cover class (Table 4-31, Table 4-32).

Known populations of fairy slipper (*Calypso bulbosa)* were observed within the adjacent Cape St. George Protected Area on June 13 as a part of reconnaissance-level surveys. Adjacent limestone barrens were surveyed using the intelligent meander and neither similar dwarf heath habitat nor additional populations of fairy slipper were detected within the area surveyed. Sample plot data on the plant communities supporting fairy slipper at the site will be subsequently provided to NLDFFA - Wildlife Division as per requirements of the research permit.

Table 4-29 Rare Plant Records Documented in the Port au Port Wind Farm LAA by the Atlantic Canada Conservation Data Centre

Scientific Name	Common Name	Date Last Observed	Number of Observations	NL ESA Rank	Provincial Rank NF S Rank	National Rank NatureServe N Rank	Global Rank NatureServe G Rank
Arnica angustifolia subsp. *tomentosa*	wooly arnica	7/22/1999	1	Endangered	S1S2	N5	G5T5
Symphyotrichum ciliolatum	Lindley's aster	9/2/2021	345	Endangered	S2	N5	G5
Hedysarum boreale subsp. *mackenziei*	MacKenzie's sweetvetch	7/26/2018	42	Threatened	S1	N5	G5T5
Astragalus alpinus	alpine milkvetch	7/13/2017	1	-	S2S3	N5	G5
Betula minor	dwarf white birch	-/-/2015	1	-	S2S3	N4	G4G5Q
Boechera stricta	Drummond's rockcress	7/9/2007	2	-	S2	N5	GNR
Calypso bulbosa	fairy slipper	6/9/2001	4	-	S1	N5	G5T5
Carex concinna	beautiful sedge	-/-/2015	1	-	S2	N5	G5
Carex umbellata	hidden sedge	-/-/2015	4	-	S2	N5	G5
Cystopteris bulbifera	bulblet bladder fern	7/19/1999	1	-	S2S3	N5	G5
Cystopteris laurentiana	Laurentian bladder fern	7/31/2015	2	-	S2	N3	G3
Festuca brachyphylla subsp. *brachyphylla*	shortleaf fescue, alpine fescue	7/22/1999	1	-	S2S3	N5	G5T5
Festuca rubra	red fescue	7/13/2017	2	-	S2S3	NNR	G5
Platanthera hookeri	Hooker's orchid	8/17/2018	41	-	S2	N4	G4
Potentilla litoralis	coastal cinquefoil	7/19/1997	1	-	S2S3	N5	G5
Ranunculus macounii	Macoun buttercup	7/19/1999	1	-	S2S3	N5	G5
Source: AC CDC (2023)							

Table 4-30 Vascular Plant Species of Conservation Concern Observations in the Port au Port Wind Farm LAA

Scientific Name	Common Name	Number of Observations		Provincial Rank NF S Rank [2]	National Rank NatureServe N Rank [3]	Global Rank NatureServe G Rank [3]
		Project Area	LAA[1]			
Betula minor	dwarf white birch	7	8	S2S3	N4	G4G5Q
Calypso bulbosa	fairy slipper	0	2	S1	N5	G5
Carex crawei	Crawe sedge	2	2	S1	N4	G5
Carex hostiana	Host's sedge	9	9	S2	N3	G5
Cystopteris laurentiana	Laurentian bladder fern	1	1	S2	N3	G3
Drosera linearis	slender-leaved sundew	49	49	S2	N4	G4G5
Graphephorum melicoides	purple false oats	2	2	S2S3	N4	G4G5
Juncus nodosus	knotted rush	8	9	S2	N5	G5
Liparis loeselii	bog twayblade	2	2	S1	N4	G5
Luzula acuminata	pointed woodrush	1	2	S1	N5	G5
Mitchella repens	partridge-berry	1	1	S2S3	N5	G5
Platanthera hookeri	Hooker's orchid	18	30	S2	N4	G4
Platanthera macrophylla	Goldie's roundleaf orchid	2	2	S2S3	N5	G5T4
Sabulina dawsonensis	rock stitchwort	5	5	S2S3	N5	G5

Notes:
[1] Records are cumulative (i.e., records in the Project Area are also in the LAA).
[2] S Ranks provided by ACCDC 2024b
[3] N ranks and G ranks provided by ACCDC 2024c, follows NatureServe 2024

Table 4-31 Number of Land Cover Classes where Rare Plants were Observed

Scientific Name	Common Name	Provincial S Rank [1]	No. Land Cover Classes [2]	% Land Cover Classes [3]
Betula minor	dwarf white birch	S2S3	4	36
Platanthera macrophylla	Goldie's roundleaf orchid	S2S3	1	9
Platanthera hookeri	Hooker's orchid	S2	3	27
Carex hostiana	Host's sedge	S2	3	27
Juncus nodosus	knotted rush	S2	4	36
Cystopteris laurentiana	Laurentian bladder fern	S2	1	9
Symphyotrichum ciliolatum	Lindley's aster	S2	11	100
Mitchella repens	partridge-berry	S2S3	1	9
Luzula acuminata	pointed woodrush	S1	1	9
Graphephorum melicoides	purple false oats	S2S3	2	18
Sabulina dawsonensis	rock stitchwort	S2S3	3	27

Notes:
[1] AC CDC (2023).
[2] Rare plants were observed in 11 LCC units during stratified random searches.
[3] Percentages are the number of LCC units observed out of 11.

Table 4-32 Observed Rare Plant Occurrence by Land Cover Class

Scientific Name	Common Name	Provincial S Rank [1]	Number of Occurrences per Hectare										
			Coniferous Dense	Coniferous Sparse	Coniferous Treed Swamp	Tuckamore	Regenerating Forest	Rock Barrens	Dwarf Shrub Heath	Bog	Fen	Shrub Swamp	Unpaved Roads
Betula minor	dwarf white birch	S2S3	ND	ND	0.18	3.09	ND	1.08	0.26	ND	ND	ND	ND
Carex hostiana	Host's sedge	S2	ND	ND	ND	ND	ND	ND	1.02	27.03	1.58	ND	ND
Platanthera macrophylla	Goldie's roundleaf orchid	S2S3	ND	ND	0.36	ND	ND	ND	ND	ND	ND	ND	ND
Platanthera hookeri	Hooker's orchid	S2	ND	ND	ND	ND	ND	4.31	0.77	ND	1.58	ND	ND
Juncus nodosus	knotted rush	S2	ND	0.46	0.54	ND	ND	ND	0.51	ND	1.58	ND	ND
Cystopteris laurentiana	Laurentian bladder fern	S2	ND	ND	0.18	ND	ND	ND	ND	ND	ND	ND	ND
Symphyotrichum ciliolatum	Lindley's aster	S2	5.83	11.54	20.66	24.69	6.79	9.69	21.49	9.01	53.71	21.05	38.46
Mitchella repens	partridge-berry	S2S3	ND	ND	ND	ND	ND	1.08	ND	ND	ND	ND	ND
Luzula acuminata	pointed woodrush	S1	ND	ND	ND	ND	1.36	ND	ND	ND	ND	ND	ND
Graphephorum melicoides	purple false oats	S2S3	0.58	ND	ND	ND	ND	ND	ND	ND	1.58	ND	ND
Sabulina dawsonensis	rock stitchwort	S2S3	0.58	ND	ND	ND	ND	3.23	0.26	ND	ND	ND	ND

Notes:
ND = no data
[1] AC CDC (2023).

4.2.1 Species at Risk

4.2.1.1 Lindley's Aster (*Symphyotrichum ciliolatum*)

Lindley's aster (*Symphyotrichum ciliolatum*) was observed at 350 locations in the Project Area and 11 in the LAA, including incidental observations. The species was detected in all 11 land cover classes for which rare plants were observed (Table 4-33). Fen and unpaved roads land cover classes are considered to have high potential for this species based on the Project observed occurrences in these LCC units (Figure 4-4). Tuckamore and shrub swamp are considered high moderate potential (Table 4-33). Areas of high potential equal 515.3 ha in the Project Area and 844.1 ha in the LAA and are widely dispersed in the LAA (Figure 4-5). Areas of high moderate potential equal 777.2 ha in the Project Area and 1,985.2 ha in LAA and occur throughout the LAA.

Lindley's aster (*Symphyotrichum ciliolatum*) is a perennial forb that is listed as Endangered under the NL ESA (SSAC 2009). Though relatively common throughout most of its range, this species is known from five locations on the Island of Newfoundland, only three of which are extant: restricted localities on the southern end of Table Mountain (within the LAA) and at Romaines Brook (outside of the LAA), and an extensive population in the central portion of Port au Port Peninsula (SSAC 2009). An updated 2019 provincial status report for Lindley's aster is pending (NLDFFA nd).

Preexisting AC CDC data contains 480 records of Lindley's Aster within the RAA, 192 of which are in the LAA, and 69 of which are within the Project Area (Figure 4-5). During field surveys conducted in 2023, 350 observations of Lindley's aster were recorded within the Project Area, and an additional 11 observations were recorded within the surrounding LAA. Similar to existing records, the majority of records are from the central portion of the Port au Port Peninsula (Appendix B.2).

On the Island of Newfoundland, Lindley's aster occurs on the Port au Port Peninsula within a broad range of often calcareous habitats, including coniferous and mixedwood forests and forest edges, tuckamore, and in sheltered microsites associated with limestone barrens. Outside of the Port au Port Peninsula, it is also found in gravel substrates along the shores of watercourses. It has been found frequently within areas that have been searched within the Port au Port Peninsula (SSAC 2009; AC CDC 2023; Stantec observations).

Three main threats to Lindley's aster have been described: seismic exploration, hybridization, and riverbed modification (SSAC 2009). The species is expected to be able to recover quickly from temporary disturbance related to seismic exploration activities, such as disturbance from heavy machinery (SSAC 2009). The species hybridizes readily with New York aster (*Symphyotrichum novi-belgii*) to form the hybrid *Symphyotrichum x subgeminatum*. Infiltration of central areas of the Port au Port Peninsula by New York aster is a concern for Lindley's aster conservation, though New York aster is not known from barrens habitat, as it requires more moisture than this habitat provides (SSAC 2009). Hybrid asters are least common in barrens habitat and most common in "softwood scrub habitat" (or tuckamore) (SSAC 2009). Riverbed modification is not likely an issue within the Project Area. During field surveys, New York aster and the hybrid *Symphyotrichum x subgeminatum* were recorded each time they were observed. Thus, it will be possible to compare the current distributions of these species within surveyed areas.

Table 4-33 Lindley's Aster Estimated Density Classes by Land Cover Class

Scientific Name	Common Name	Provincial S Rank [1]	Land Cover Class	Number Detections	Total Area Searched (ha)	Occurrence Density per Hectare	Quartile	Occurrence Density Class
Symphyotrichum ciliolatum	Lindley's Aster	S2	Coniferous Dense	10	1.714	5.834	1	Low
			Regenerating Forest	5	0.736	6.793	1	Low
			Bog	1	0.111	9.009	1	Low
			Rock Barrens	9	0.929	9.688	2	Low Moderate
			Coniferous Sparse	25	2.167	11.537	2	Low Moderate
			Coniferous Treed Swamp	114	5.518	20.66	2	Low Moderate
			Shrub Swamp	2	0.095	21.053	3	High Moderate
			Dwarf Shrub Heath	84	3.909	21.489	3	High Moderate
			Tuckamore	8	0.324	24.691	3	High Moderate
			Unpaved Roads	1	0.026	38.462	4	High
			Fen	34	0.633	53.712	4	High

Note:
[1] AC CDC (2023).

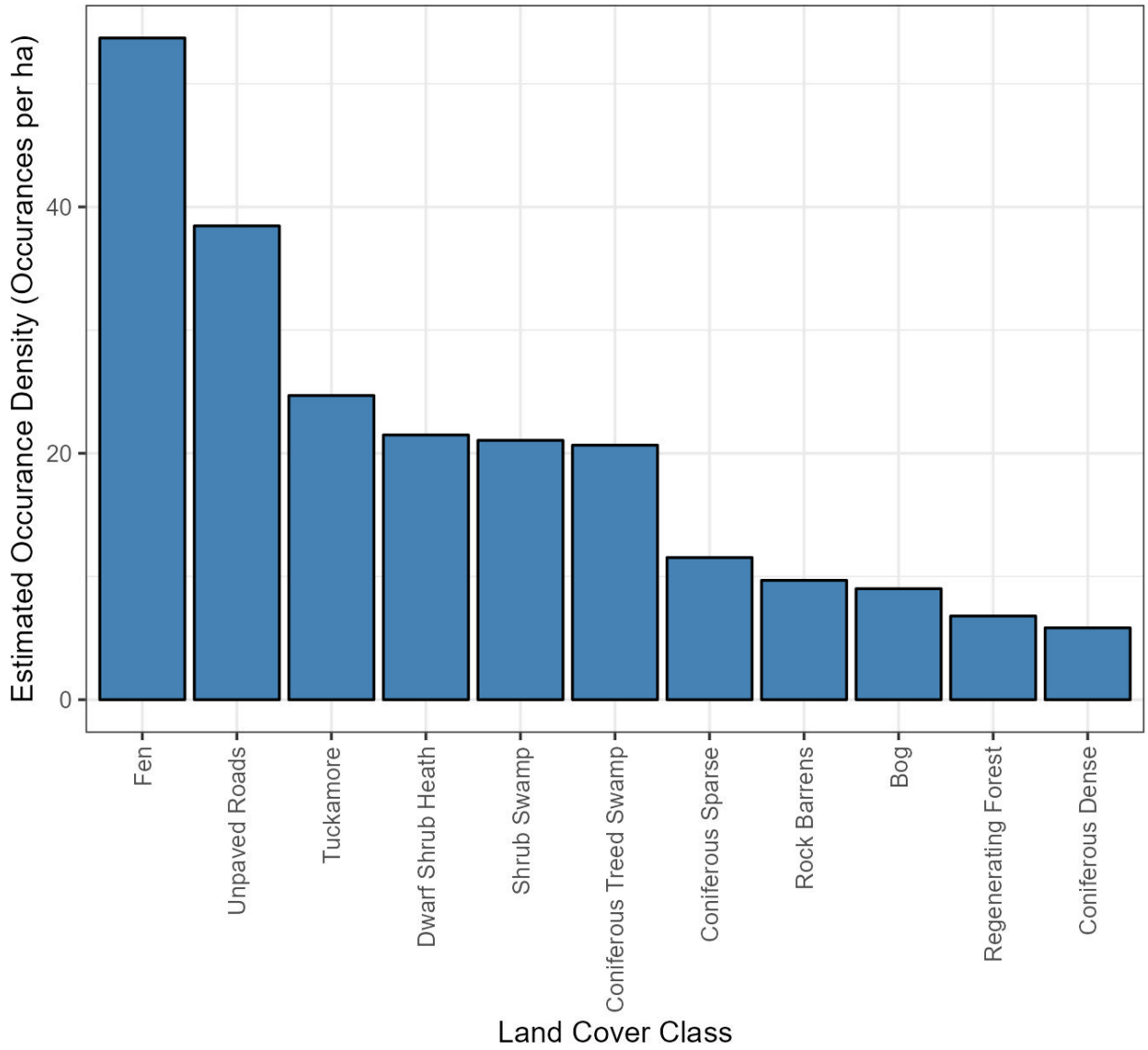

Figure 4-4 Relative Occurrence Density for Lindley's Aster by Land Cover Class

Local Assessment Area (LAA)

Occurrence Density

- High
- High Moderate
- Low Moderate
- Low

0 2 4 Kilometres

(At original document size of 11x17)
1:120,000

N

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Data Sources: Stantec, Government of Canada
3. Background: Earthstar Geographics, Esri, TomTom, Garmin, FAO, NOAA, USGS, NRCan, Parks Canada

Stantec

Project Location
Port au Port Peninsula,
Newfoundland and Labrador

Prepared by AYiu on 2024-01-25
TR by XXX on 2024-XX-XX
IR by XXX on 2024-XX-XX

Client/Project 121417575
World Energy GH2 Limited Partnership
Nujio'qonik GH2 BiologicalBats
Land Cover Classification and Rare Plants Technical Data Report

Figure No.
4-5

Title
Lindley's Aster Occurrence Density in Local Assessment Area

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4.2.1.2 MacKenzie's Sweetvetch (*Hedysarum boreale* subsp. *mackenziei*)

MacKenzie's sweetvetch (*Hedysarum boreale* subsp. *mackenziei*), which is ranked Threatened under the NL ESA (SSAC 2006), occurs on the Port-au-Port peninsula within the Cape St. George Transitional Reserve. Within this area, it occurs along the west side of Cape St. George and extending along the limestone barrens to the north toward Mainland in an area unofficially called Garden Hills (SSAC 2006). The AC CDC data request for the Project returned 162 records of MacKenzie's sweetvetch in the LAA. Mackenzie's sweetvetch is most closely associated with ericaceous heath habitats, but occasionally occupies bare substrate and vegetation islands in open limestone barren habitats (Limestone Barrens Species at Risk Recovery Team 2021). No observations of MacKenzie's sweetvetch were made during the rare plant surveys conducted during the 2023 field season, but four observations of this species were recorded incidentally within the LAA. Due to the lack of observations of MacKenzie's sweetvetch during the stratified random rare plant survey, densities by LCC unit and an estimate of potential occurrences could not be determined.

4.3 EXOTIC AND INVASIVE VASCULAR PLANT SPECIES

Within the LAA, 46 exotic vascular plant species were documented (Table 4-34). Although there is no publicly available invasive species list for Newfoundland, two exotic vascular plants detected in the LAA can be invasive in riparian habitats: creeping buttercup (*Ranunculus repens*) and colt's foot (*Tussilago farfara*) (Hill and Blaney 2010; Invasive Plant Atlas of the United States 2018; Halifax Regional Municipality no date). Both species were widespread across the LAA. Their occurrence with LCC units is discussed in corresponding sections for coniferous sparse, mixedwood, and anthropogenic vegetation units where they were observed. Other exotic species present within the LAA are not documented to be invasive according to available literature. Many of the exotic species documented have been observed to disperse alongside roadsides (e.g., creeping thistle [Zohar 2001], great hedge bedstraw [Mersereau and DiTommaso 2002]) and were observed on existing roadsides within the LAA. Closed canopy forested habitats within the LAA are not likely to support exotic species that are dependent on open conditions. The harsh environment of the limestone barrens (e.g., wind exposure, shallow soils, active frost processes) and of wetlands (e.g., saturated soils) are not anticipated to be suitable to support many of these exotic species, although climatic conditions in the future may have influence on habitat suitability of exotic species.

Table 4-34 Exotic Vascular Plant Species Identified Within the Port au Port LAA

Scientific Name	Common Name
Agrostis canina	brown bentgrass
Agrostis capillaris	colonial bentgrass
Agrostis gigantea	black bentgrass
Agrostis stolonifera	spreading bentgrass
Anthoxanthum odoratum	sweet vernal grass
Aquilegia vulgaris	european columbine
Bromus inermis	awnless brome

Table 4-34 Exotic Vascular Plant Species Identified Within the Port au Port LAA

Scientific Name	Common Name
Centaurea nigra	black starthistle
Cerastium fontanum	common mouse-ear chickweed
Cirsium arvense	creeping thistle
Cirsium palustre	marsh thistle
Cirsium vulgare	bull thistle
Crepis tectorum	narrowleaf hawk's-beard
Dactylis glomerata	orchard grass
Elymus repens	quackgrass
Galeopsis tetrahit	brittle-stem hempnettle
Galium mollugo	great hedge bedstraw
Gnaphalium uliginosum	low cudweed
Hypericum perforatum	common St. Johns wort
Juncus compressus	flattened rush
Leucanthemum vulgare	oxeye daisy
Linum catharticum	fairy flax
Malva neglecta	dwarf cheeseweed
Myosotis arvensis	rough forget-me-not
Phleum pratense	meadow timothy
Pilosella aurantiaca	orange hawkweed
Pilosella caespitosa	meadow hawkweed
Pilosella officinarum	mouse-ear hawkweed
Pilosella piloselloides subsp. *praealta*	king devil
Plantago major	nipple-seed plantain
Poa annua	annual bluegrass
Poa compressa	Canada bluegrass
Ranunculus acris	tall butter-cup
Ranunculus repens	creeping butter-cup
Rumex acetosa	garden sorrel
Rumex acetosella	sheep sorrel
Scorzoneroides autumnalis	autumn hawkbit
Sonchus arvensis	field sowthistle
Stellaria graminea	little starwort
Taraxacum officinale	common dandelion
Trifolium pratense	red clover
Trifolium repens	white clover
Tussilago farfara	colt's-foot

Table 4-34 Exotic Vascular Plant Species Identified Within the Port au Port LAA

Scientific Name	Common Name
Valeriana officinalis	common valerian
Veronica officinalis	gypsy-weed
Viola arvensis	small wild pansy
Note: Considered exotic on the Island of Newfoundland by NatureServe (2024).	

5.0 DISCUSSION

Vegetation desktop work and field surveys conducted in support of the Port au Port Wind Farm will help direct future Project work, including focusing additional field surveys and mitigation.

LCC accuracy was lower than expected or ideal (Section 4.1.3). Overlap in species composition between LCC units suggests that additional spatial data (e.g., LiDAR [Light Detecting and Ranging] data) which are not currently available for the Port au Port Peninsula could support further discernment of LCCs. LiDAR data would make it possible to determine relative vegetation heights. Pre-existing literature and the 2023 field surveys revealed the Port au Port peninsula to be rich in species and their respective microhabitats. Habitat heterogeneity across a large area presents a challenge for generalizing species habitat relationships.

Much of the Port au Port LAA had not been previously botanized despite the presence of communities of ecological importance. While challenges were encountered, the 2023 vegetation surveys have expanded knowledge of the flora of the Port au Port peninsula, including areas where no pre-existing botanical studies had been conducted. Many new observations of the provincially Endangered SAR Lindley's aster (*Symphyotrichum ciliolatum*) have been recorded, some in previously unsurveyed areas.

Given the distribution and extent of Lindley's aster on the Port au Port peninsula, despite micrositing and other mitigation measures, it is assumed the Project has a high likelihood to interact with Lindley's aster. WEGH2 has committed to adaptive management, which includes applying for Section 19 permit under the NL ESA, which requires the development and approval of a SAR IMMP for Lindley's and other SAR that may be affected by the Project. WEGH2 will engage the NLDFFA - Wildlife Division in the development of the SAR IMMP.

The potential for Lindley's aster to hybridize with New York aster (*Symphyotrichum novi-belgii*) is a conservation concern for the species (SSAC 2009). Because of this, the locations of encountered New York aster and suspected hybrids (*Symphyotrichum* x *subgeminatum*) were recorded at every observation, similar to Lindley's aster. The distribution of Lindley's aster observations relative to New York aster and hybrids on the Port au Port will be discussed in the SAR IMMP for the species. These data can be used to identify conservation targets, or other mitigation strategies, following consultation with the NLDFFA - Wildlife Division to determine a minimum buffer distance.

Following the finalization of clearing footprints for the Port au Port Wind Farm, WEGH2 will discuss mitigation for limestone barrens loss with NLDFFA-Wildlife Division that may further the goals of the Limestone Barrens Species at Risk Recovery Plan. As indicated in the EIS (Stantec 2023), WEGH2 is committed to and is in the process of conducting the site-specific environmental field programs identified in the EIS Guidelines and further defined through consultation with regulators prior to Project construction.

Baseline field data collection is planned in the Stephenville, Codroy, and connecting transmission line areas in subsequent field studies, along with continued baseline data collection on the Port au Port Peninsula where required. Results from the Port au Port Wind Farm will be applied to support future Project work at Port au Port and other Project locations.

6.0 REFERENCES

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APPENDIX A

Species Inventory

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Tree	*Abies balsamea*	balsam fir	S5	-	G5
Tree	*Acer rubrum*	red maple	S5	-	G5
Tree	*Betula alleghaniensis*	yellow birch	S3	-	G5
Tree	*Betula cordifolia*	heartleaf birch, mountain white birch	S4S5	-	G5T5
Tree	*Betula papyrifera*	paper birch	S5	-	G5
Tree	*Larix laricina*	American larch	S5	-	G5
Tree	*Picea glauca*	white spruce	S5	-	G5
Tree	*Picea mariana*	black spruce	S5	-	G5
Tree, Shrub	*Acer spicatum*	mountain maple	S5	-	G5
Tree, Shrub	*Amelanchier bartramiana*	Bartram shadbush	S5	-	G5
Tree, Shrub	*Amelanchier* sp.	a serviceberry	-	-	-
Tree, Shrub	*Amelanchier spicata*	running serviceberry	S3S4	-	G5
Tree, Shrub	*Prunus pensylvanica*	fire cherry	S4S5	-	G5
Tree, Shrub	*Prunus* sp.	a cherry	-	-	-
Tree, Shrub	*Prunus virginiana*	choke cherry	S4	-	G5
Tree, Shrub	*Salix discolor*	pussy willow	S5	-	G5
Tree, Shrub	*Salix pyrifolia*	balsam willow	S4	-	G5
Tree, Shrub	*Salix* sp.	a willow	-	-	-
Tree, Shrub	*Sambucus racemosa*	red elderberry	S4	-	G5
Tree, Shrub	*Sorbus americana*	American mountain-ash	S4S5	-	G5
Tree, Shrub	*Sorbus decora*	northern mountain-ash	S5	-	G5
Tree, Shrub	*Sorbus* sp.	a mountain-ash	-	-	-

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Shrub	*Alnus alnobetula*	green alder	S5	-	G5
Shrub	*Alnus incana*	speckled alder	S5	-	G5
Shrub	*Aronia melanocarpa*	black chokeberry	S2S4	-	G5
Shrub	*Aronia* x *prunifolia*	purple chokeberry	X*	-	GNA
Shrub	*Betula michauxii*	Newfoundland dwarf birch	S5	-	G5
Shrub	*Betula pumila*	swamp birch	S5	-	G5
Shrub	*Chamaedaphne calyculata*	leatherleaf	S5	-	G5
Shrub	*Cornus alternifolia*	alternate-leaf dogwood	S3S4	-	G5
Shrub	*Cornus sericea* subsp. *sericea*	red osier dogwood	S5	-	G5T5
Shrub	*Corylus cornuta*	beaked hazelnut	S4	-	G5
Shrub	*Dasiphora fruticosa*	golden-hardhack	S4S5	-	G5
Shrub	*Endotropis alnifolia*	alderleaf buckthorn	S5	-	G5
Shrub	*Gaylussacia baccata*	black huckleberry	S3	-	G5
Shrub	*Ilex mucronata*	mountain holly	S5	-	G5
Shrub	*Ilex verticillata*	black holly	S3	-	G5
Shrub	*Kalmia angustifolia*	sheep-laurel	S5	-	G5
Shrub	*Kalmia polifolia*	pale laurel	S5	-	G5
Shrub	*Lonicera villosa*	mountain fly-honeysuckle	S5	-	G5
Shrub	*Myrica gale*	sweet bayberry	S5	-	G5
Shrub	*Rhododendron canadense*	rhodora	S5	-	G5
Shrub	*Rhododendron groenlandicum*	common Labrador-tea	S5	-	G5
Shrub	*Ribes glandulosum*	skunk currant	S5	-	G5

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Shrub	*Ribes hirtellum*	smooth gooseberry	S3S4	-	G5
Shrub	*Ribes lacustre*	bristly black currant	S4	-	G5
Shrub	*Ribes* sp.	a currant	-	-	-
Shrub	*Ribes triste*	swamp red currant	S4	-	G5
Shrub	*Salix uva-ursi*	bearberry willow	S4	-	G5
Shrub	*Salix vestita*	rock willow	S4	-	G5
Shrub	*Shepherdia canadensis*	Canada buffalo-berry	S4	-	G5
Shrub	*Taxus canadensis*	Canadian yew	S3S4	-	G5
Shrub	*Viburnum cassinoides*	northern wild raisin	S5	-	G5T5
Shrub	*Viburnum edule*	squashberry	S5	-	G5
Shrub	*Viburnum opulus*	guelder-rose viburnum	S5	-	G5
Shrub	*Viburnum* sp.	a viburnum	-	-	-
Subshrub, Shrub	*Betula glandulosa*	tundra dwarf birch	S3	-	G5
Subshrub, Shrub	***Betula minor***	**dwarf white birch**	**S2S3**	**-**	**G4G5Q**
Subshrub, Shrub	*Betula* sp.	a birch	-	-	-
Subshrub, Shrub	*Empetrum atropurpureum*	purple crowberry	S3S4	-	G5T5
Subshrub, Shrub	*Empetrum nigrum*	black crowberry	S5	-	G5
Subshrub, Shrub	*Epigaea repens*	trailing arbutus	S3S4	-	G5
Subshrub, Shrub	*Gaultheria hispidula*	creeping snowberry	S5	-	G5
Subshrub, Shrub	*Gaylussacia bigeloviana*	dwarf huckleberry	S3S4	-	G4G5
Subshrub, Shrub	*Gaylussacia* sp.	a huckleberry	-	-	-
Subshrub, Shrub	*Vaccinium angustifolium*	late lowbush blueberry	S5	-	G5

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Subshrub	*Andromeda polifolia*	bog rosemary	S5	-	G5
Subshrub	*Arctostaphylos uva-ursi*	bearberry	S4S5	-	G5
Subshrub	*Arctous alpina*	alpine manzanita	S4	-	G5
Subshrub	*Cornus suecica*	Swedish dwarf dogwood	S4	-	G5
Subshrub	*Juniperus communis*	ground juniper	S5	-	G5
Subshrub	*Juniperus horizontalis*	creeping juniper	S5	-	G5
Subshrub	*Orthilia secunda*	one-side wintergreen	S5	-	G5
Subshrub	*Pyrola americana*	American wintergreen	S3S4	-	G5
Subshrub	*Pyrola minor*	lesser wintergreen	S4	-	G5
Subshrub	*Rosa nitida*	shining rose	S4S5	-	G5
Subshrub	*Rosa* sp.	a rose	-	-	-
Subshrub	*Rosa virginiana*	Virginia rose	S4S5	-	G5
Subshrub	*Rubus idaeus*	red raspberry	S5	-	G5
Subshrub	*Rubus idaeus subsp. strigosus*	wild red raspberry	S5	-	G5T5
Subshrub	*Sibbaldia tridentata*	three-toothed cinquefoil	S4S5	-	G5
Subshrub	*Vaccinium boreale*	northern blueberry	S4S5	-	G4G5
Subshrub	*Vaccinium macrocarpon*	large cranberry	S4S5	-	G5
Subshrub	*Vaccinium ovalifolium*	oval-leaf huckleberry	S3?	-	G5
Subshrub	*Vaccinium oxycoccos*	small cranberry	S5	-	G5
Subshrub	*Vaccinium uliginosum*	alpine blueberry	S5	-	G5
Subshrub	*Vaccinium vitis-idaea*	mountain cranberry	S5	-	G5
Subshrub, Forb	*Aralia hispida*	bristly sarsaparilla	S3S4	-	G5

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Subshrub, Forb	*Aralia nudicaulis*	wild sarsaparilla	S5	-	G5
Subshrub, Forb	*Cornus canadensis*	dwarf dogwood	S5	-	G5
Subshrub, Forb	*Dryas integrifolia*	entire-leaved mountain-avens	S4S5	-	G5
Subshrub, Forb	*Linnaea borealis*	twinflower	S5	-	G5
Subshrub, Forb	***Mitchella repens***	**partridge-berry**	**S2S3**	**-**	**G5**
Subshrub, Forb	*Potentilla nivea*	snow cinquefoil	S3	-	G5
Subshrub, Forb	*Rubus arcticus*	northern blackberry	S3S4	-	G5
Subshrub, Forb	*Rubus chamaemorus*	cloudberry	S5	-	G5
Subshrub, Forb	*Rubus pubescens*	dwarf red raspberry	S5	-	G5
Forb/herb	*Achillea lanulosa*	woolly yarrow	S3S4	-	G5
Forb/herb	*Achillea millefolium*	common yarrow	SNA	-	G5
Forb/herb	*Actaea rubra*	red baneberry	S5	-	G5
Forb/herb	*Agrimonia striata*	woodland agrimony	S3	-	G5
Forb/herb	*Alchemilla filicaulis*	thin-stem lady's-mantle	S3	-	G4
Forb/herb	*Anaphalis margaritacea*	pearly everlasting	S5	-	G5
Forb/herb	*Anemone parviflora*	small-flower anemone	S4S5	-	G5
Forb/herb	*Angelica atropurpurea*	great angelica	S4	-	G5
Forb/herb	*Angelica lucida*	angelica	S3S5	-	G5
Forb/herb	*Angelica* sp.	an angelica	-	-	-
Forb/herb	*Antennaria alpina*	alpine pussy-toes	S3	-	G5
Forb/herb	*Antennaria howellii*	small pussy-toes	S3S4	-	G5
Forb/herb	*Antennaria* sp.	a pussy-toes	-	-	-

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Forb/herb	*Aquilegia vulgaris*	European columbine	SNA	-	GNR
Forb/herb	*Arethusa bulbosa*	swamp-pink	S4S5	-	G5
Forb/herb	*Asplenium viride*	green spleenwort	S3S4	-	G5
Forb/herb	*Athyrium filix-femina*	lady-fern	S5	-	G5
Forb/herb	*Athyrium filix-femina* var. *angustum*	lady fern	S5	-	G5T5
Forb/herb	*Bartonia paniculata*	twining bartonia	S3S4	-	G5
Forb/herb	*Callitriche heterophylla*	large water-starwort	S4	-	G5
Forb/herb	*Callitriche palustris*	vernal water starwort	S4S5	-	G5
Forb/herb	*Callitriche* sp.	a starwort	-	-	-
Forb/herb	*Calopogon tuberosus*	tuberous grass-pink	S4S5	-	G5
Forb/herb	*Caltha palustris*	marsh marigold	S4S5	-	G5
Forb/herb	***Calypso bulbosa***	**fairy slipper**	**S1**	**-**	**G5**
Forb/herb	*Campanula gieseckeana*	Giesecke's bellflower	S5	-	G5
Forb/herb	*Centaurea nigra*	black starthistle	SNA	-	GNR
Forb/herb	*Cerastium alpinum*	alpine chickweed	S3S4	-	G5
Forb/herb	*Cerastium fontanum*	common mouse-ear chickweed	SNA	-	GNR
Forb/herb	*Cerastium* sp.	a chickweed	-	-	-
Forb/herb	*Chamerion angustifolium*	fireweed	S5	-	G5
Forb/herb	*Circaea alpina*	small enchanter's nightshade	S5	-	G5
Forb/herb	*Cirsium arvense*	creeping thistle	SNA	-	G5
Forb/herb	*Cirsium muticum*	swamp thistle	S5	-	G5
Forb/herb	*Cirsium palustre*	marsh thistle	SNA	-	G5

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Forb/herb	*Cirsium vulgare*	bull thistle	SNA	-	GNR
Forb/herb	*Clinopodium vulgare*	field basil	S3	-	G5
Forb/herb	*Clintonia borealis*	Clinton lily	S5	-	G5
Forb/herb	*Conioselinum chinense*	hemlock parsley	S5	-	G5
Forb/herb	*Coptis trifolia*	goldthread	S5	-	G5
Forb/herb	*Corallorhiza maculata*	spotted coralroot	S3S4	-	G5
Forb/herb	*Corallorhiza* sp.	a coralroot	-	-	-
Forb/herb	*Corallorhiza trifida*	early coralroot	S4	-	G5
Forb/herb	*Crepis tectorum*	narrowleaf hawk's-beard	SNA	-	GNR
Forb/herb	*Cypripedium acaule*	pink lady's-slipper	S4	-	G5
Forb/herb	*Cypripedium parviflorum*	small yellow lady's-slipper	S4	-	G5
Forb/herb	*Cypripedium parviflorum* var. *pubescens*	large yellow lady's-slipper	S4	-	G5T5
Forb/herb	*Cypripedium reginae*	showy lady's-slipper	S3	-	G4G5
Forb/herb	*Cystopteris fragilis*	fragile fern	S4	-	G5
Forb/herb	***Cystopteris laurentiana***	**Laurentian bladder fern**	**S2**	**-**	**G3**
Forb/herb	*Diphasiastrum complanatum*	northern running-pine, groundcedar	S3S4	-	G5
Forb/herb	*Diphasiastrum sitchense*	Sitka clubmoss, tufted groundceder	S3S4	-	G5
Forb/herb	*Doellingeria umbellata*	parasol white-top	S5	-	G5
Forb/herb	***Drosera linearis***	**slender-leaved sundew**	**S2**	**-**	**G4G5**
Forb/herb	*Drosera intermedia*	spoon-leaved sundew	S4S5	-	G5
Forb/herb	*Drosera rotundifolia*	roundleaf sundew	S5	-	G5
Forb/herb	*Dryopteris campyloptera*	mountain wood-fern	S5	-	G5

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Forb/herb	*Dryopteris carthusiana*	spinulose shield fern	S4	-	G5
Forb/herb	*Dryopteris cristata*	crested wood fern	S3S4	-	G5
Forb/herb	*Dryopteris filix-mas*	male fern	S4	-	G5
Forb/herb	*Dryopteris intermedia*	glandular wood fern	S5	-	G5
Forb/herb	*Dryopteris* sp.	a wood fern	-	-	-
Forb/herb	*Epilobium ciliatum*	hairy willow-herb	S5	-	G5
Forb/herb	*Epilobium leptophyllum*	linear-leaved willow-herb	S3	-	G5
Forb/herb	*Epilobium palustre*	marsh willow-herb	S5	-	G5
Forb/herb	*Epilobium* sp.	a willow-herb	-	-	-
Forb/herb	*Equisetum arvense*	field horsetail	S5	-	G5
Forb/herb	*Equisetum fluviatile*	water horsetail	S4	-	G5
Forb/herb	*Equisetum palustre*	marsh horsetail	S3S4	-	G5
Forb/herb	*Equisetum pratense*	meadow horsetail	S3	-	G5
Forb/herb	*Equisetum scirpoides*	dwarf scouring rush	S3S4	-	G5
Forb/herb	*Equisetum sylvaticum*	woodland horsetail	S5	-	G5
Forb/herb	*Erigeron hyssopifolius*	daisy fleabane	S4	-	G5
Forb/herb	*Eriocaulon aquaticum*	seven-angled pipewort	S5	-	G5
Forb/herb	*Euphrasia disjuncta*	disjunct eyebright	SU	-	G5
Forb/herb	*Euphrasia nemorosa*	common eyebright	S4S5	-	G5
Forb/herb	*Euphrasia randii*	small eyebright	S4S5	-	GNR
Forb/herb	*Euphrasia* sp.	an eyebright	-	-	-
Forb/herb	*Eurybia radula*	rough-leaved aster	S5	-	G5

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Forb/herb	*Euthamia graminifolia*	flat-top fragrant-golden-rod	S5	-	G5
Forb/herb	*Eutrochium maculatum*	spotted Joe-Pye weed	S4S5	-	G5
Forb/herb	*Fragaria virginiana*	Virginia strawberry	S5	-	G5
Forb/herb	*Galeopsis tetrahit*	brittle-stem hempnettle	SNA	-	GNR
Forb/herb	*Galium mollugo*	great hedge bedstraw	SNA	-	GNR
Forb/herb	*Galium palustre*	marsh bedstraw	S4S5	-	G5
Forb/herb	*Galium* sp.	a bedstraw	-	-	-
Forb/herb	*Galium tinctorium*	stiff marsh bedstraw	S3S4	-	G5
Forb/herb	*Galium trifidum*	small bedstraw	S4S5	-	G5
Forb/herb	*Galium triflorum*	sweet-scent bedstraw	S5	-	G5
Forb/herb	*Geocaulon lividum*	northern comandra	S5	-	G5
Forb/herb	*Geum macrophyllum*	large-leaved avens	S4S5	-	G5
Forb/herb	*Geum rivale*	purple avens	S4S5	-	G5
Forb/herb	*Geum* sp.	an avens	-	-	-
Forb/herb	*Gnaphalium uliginosum*	low cudweed	SNA	-	G5
Forb/herb	*Goodyera repens*	dwarf rattlesnake-plantain	S4	-	G5
Forb/herb	*Goodyera tesselata*	checkered rattlesnake-plantain	S3S4	-	G5
Forb/herb	*Gymnocarpium dryopteris*	northern oak fern	S5	-	G5
Forb/herb	*Gymnocarpium robertianum*	limestone polypody	S3	-	G5
Forb/herb	***Hedysarum boreale* subsp. *mackenziei***	**Mackenzie's sweetvetch**	**S1**	**Threatened**	**G5T5**
Forb/herb	*Heracleum maximum*	cow parsnip	S5	-	G5

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Forb/herb	*Hieraceum* sp.	a hawkweed	-	-	-
Forb/herb	*Hieracium umbellatum*	umbellate hawkweed	S4	-	G5
Forb/herb	*Huperzia selago*	fir clubmoss	S3S4	-	G5
Forb/herb	*Huperzia* sp.	a clubmoss	-	-	-
Forb/herb	*Hypericum canadense*	Canadian St. John's-wort	S4	-	G5
Forb/herb	*Hypericum perforatum*	Common St. Johnswort	SNA	-	GNR
Forb/herb	*Hypopitys monotropa*	American pinesap	S3	-	#N/A
Forb/herb	*Iris versicolor*	blueflag	S5	-	G5
Forb/herb	*Lactuca biennis*	tall blue lettuce	S4	-	G5
Forb/herb	*Leucanthemum vulgare*	oxeye daisy	SNA	-	GNR
Forb/herb	*Linum catharticum*	fairy flax	SNA	-	G5
Forb/herb	***Liparis loeselii***	**bog twayblade**	**S1**	**-**	**G5**
Forb/herb	*Lobelia kalmii*	Kalm's lobelia	S3S4	-	G5
Forb/herb	*Lycopodium clavatum*	running pine	S5	-	G5
Forb/herb	*Lycopodium dendroideum*	treelike clubmoss	S4	-	G5
Forb/herb	*Lycopus* sp.	a bugleweed	-	-	-
Forb/herb	*Lycopus uniflorus*	northern bugleweed	S5	-	G5
Forb/herb	*Lysimachia borealis*	northern starflower	S5	-	G5
Forb/herb	*Maianthemum canadense*	wild lily-of-the-valley	S5	-	G5
Forb/herb	*Maianthemum stellatum*	starflower Solomon's-plume	S5	-	G5
Forb/herb	*Maianthemum trifolium*	three-leaf Solomon's-plume	S5	-	G5
Forb/herb	*Malaxis unifolia*	green adder's-mouth	S3	-	G5

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Forb/herb	*Malva neglecta*	dwarf cheeseweed	SNA	-	GNR
Forb/herb	*Matteuccia struthiopteris*	ostrich fern	S3S4	-	G5
Forb/herb	*Melampyrum lineare*	American cow-wheat	S3S4	-	G5
Forb/herb	*Mentha canadensis*	Canada mint	S5	-	G5
Forb/herb	*Menyanthes trifoliata*	bog buckbean	S5	-	G5
Forb/herb	*Mitella nuda*	naked bishop's-cap	S5	-	G5
Forb/herb	*Moneses uniflora*	one-flower wintergreen	S5	-	G5
Forb/herb	*Monotropa uniflora*	ghost pipe	S5	-	G5
Forb/herb	*Myosotis arvensis*	rough forget-me-not	SNA	-	GNR
Forb/herb	*Nabalus trifoliolatus*	threeleaf rattlesnake-root	S5	-	G5
Forb/herb	*Neottia cordata*	heartleaf twayblade	S5	-	G5
Forb/herb	*Neottia* sp.	a twayblade	-	-	-
Forb/herb	*Oclemena nemoralis*	bog aster	S5	-	G5
Forb/herb	*Oclemena* sp.	an aster	-	-	-
Forb/herb	*Omalotheca sylvatica*	woodland cudweed	S3S4	-	G4G5
Forb/herb	*Onoclea sensibilis*	sensitive fern	S4S5	-	G5
Forb/herb	*Orobanche uniflora*	one-flowered broomrape	S3S4	-	G5
Forb/herb	*Osmorhiza depauperate*	blunt-fruited sweet-cicely	S3	-	G5
Forb/herb	*Osmunda claytoniana*	interrupted fern	S4	-	G5
Forb/herb	*Osmundastrum cinnamomeum*	cinnamon fern	S5	-	G5
Forb/herb	*Oxytropis campestris*	northern yellow point-vetch	S3	-	G5
Forb/herb	*Packera aurea*	golden groundsel	S3S4	-	G5

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Forb/herb	*Packera paupercula*	balsam groundsel	S4	-	G5
Forb/herb	*Packera* sp.	a groundsel	-	-	-
Forb/herb	*Petasites frigidus*	arctic butter-bur	S3S4	-	G5
Forb/herb	*Phegopteris connectilis*	northern beech fern	S5	-	G5
Forb/herb	*Physaria arctica*	arctic bladderpod	S3	-	G4G5
Forb/herb	*Pilosella aurantiaca*	orange hawkweed	SNA	-	GNR
Forb/herb	*Pilosella caespitosa*	meadow hawkweed	SNA	-	GNR
Forb/herb	*Pilosella officinarum*	mouse-ear hawkweed	SNA	-	GNR
Forb/herb	*Pilosella piloselloides* subsp. *praealta*	king devil	SNA	-	GNRTNR
Forb/herb	*Pilosella* sp.	a hawkweed	-	-	-
Forb/herb	*Pinguicula vulgaris*	common butterwort	S5	-	G5
Forb/herb	*Plantago major*	nipple-seed plantain	SNA	-	G5
Forb/herb	*Plantago maritima*	seaside plantain	S5	-	G5
Forb/herb	*Platanthera aquilonis*	leafy northern green orchis	S4	-	G5
Forb/herb	*Platanthera blephariglottis*	white fringed orchid	S4	-	G5
Forb/herb	*Platanthera clavellata*	club-spur orchid	S5	-	G5
Forb/herb	*Platanthera dilatata*	leafy white orchid	S5	-	G5
Forb/herb	*Platanthera grandiflora*	large purple-fringed orchid	S3	-	G5
Forb/herb	***Platanthera hookeri***	**hooker's orchid**	**S2**	**-**	**G4**
Forb/herb	*Platanthera huronensis*	green orchid	S4	-	G5T5?
Forb/herb	*Platanthera lacera*	ragged-fringed orchid	S3S4	-	G5
Forb/herb	***Platanthera macrophylla***	**Goldie's roundleaf orchid**	**S2S3**	**-**	**G5T4**

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Forb/herb	*Platanthera obtusata*	small northern bog-orchid	S4	-	G5
Forb/herb	*Platanthera orbiculata*	large roundleaf orchid	S3S4	-	G5
Forb/herb	*Platanthera psycodes*	small purple fringed orchid	S4S5	-	G5
Forb/herb	*Platanthera* sp.	an orchid	-	-	-
Forb/herb	*Pogonia ophioglossoides*	snakemouth	S4	-	G5
Forb/herb	*Polystichum braunii*	Braun's holly-fern	S3S4	-	G5
Forb/herb	*Polystichum lonchitis*	northern holly-fern	S3	-	G5
Forb/herb	*Potentilla anserina*	silverweed	S5	-	G5
Forb/herb	*Potentilla norvegica*	Norwegian cinquefoil	S4S5	-	G5
Forb/herb	*Primula laurentiana*	bird's-eye primrose	S4	-	G5
Forb/herb	*Primula mistassinica*	bird's-eye primrose	S4	-	G5
Forb/herb	*Prunella vulgaris*	self-heal	S3S5	-	G5
Forb/herb	*Pteridium aquilinum*	bracken	S4S5	-	G5
Forb/herb	*Ranunculus acris*	tall butter-cup	SNA	-	G5
Forb/herb	*Ranunculus flammula* var. *reptans*	lesser spearwort	S5	-	G5T5
Forb/herb	*Ranunculus repens*	creeping butter-cup	SNA	-	GNR
Forb/herb	*Ranunculus* sp.	a butter-cup	-	-	-
Forb/herb	*Rhinanthus minor*	little yellow-rattle	S3	-	G5
Forb/herb	*Rumex acetosa*	garden sorrel	SNA	-	G5
Forb/herb	*Rumex acetosella*	sheep sorrel	SNA	-	GNR
Forb/herb	***Sabulina dawsonensis***	**rock stitchwort**	**S2S3**	**-**	**G5**
Forb/herb	*Sanguisorba canadensis*	Canada burnet	S5	-	G5

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Forb/herb	*Sanicula marilandica*	black snake-root	S3S4	-	G5
Forb/herb	*Sarracenia purpurea*	northern pitcher-plant	S5	-	G5
Forb/herb	*Saxifraga aizoides*	yellow mountain saxifrage	S4	-	G5
Forb/herb	*Saxifraga oppositifolia*	purple mountain saxifrage	S3S4	-	G5
Forb/herb	*Saxifraga paniculata*	white mountain saxifrage	S3S4	-	G5
Forb/herb	*Saxifraga* sp.	a saxifrage	-	-	-
Forb/herb	*Scorzoneroides autumnalis*	autumn hawkbit	SNA	-	GNR
Forb/herb	*Scutellaria lateriflora*	mad dog skullcap	S3	-	G5
Forb/herb	*Selaginella selaginoides*	low spike-moss	S4S5	-	G5
Forb/herb	*Silene acaulis*	moss campion	S3S4	-	G5
Forb/herb	*Sisyrinchium montanum*	strict blue-eyed-grass	S5	-	G5
Forb/herb	*Solidago brendae*	Brenda's goldenrod	S3	-	GNR
Forb/herb	*Solidago hispida*	hairy goldenrod	S4S5	-	G5
Forb/herb	*Solidago macrophylla*	large-leaf goldenrod	S5	-	G5
Forb/herb	*Solidago multiradiata*	alpine goldenrod	S3S4	-	G5
Forb/herb	*Solidago rugosa*	rough-leaf goldenrod	S5	-	G5
Forb/herb	*Solidago* sp.	a goldenrod	-	-	-
Forb/herb	*Solidago uliginosa*	bog goldenrod	S5	-	G5
Forb/herb	*Sonchus arvensis*	field sowthistle	SNA	-	GNR
Forb/herb	*Spinulum annotinum*	stiff clubmoss	S5	-	G5
Forb/herb	*Spiranthes romanzoffiana*	hooded ladies'-tresses	S4S5	-	G5
Forb/herb	*Stellaria graminea*	little starwort	SNA	-	GNR

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Forb/herb	*Streptopus amplexifolius*	clasping twisted-stalk	S5	-	G5
Forb/herb	*Streptopus lanceolatus*	rosy twistedstalk	S4	-	G5
Forb/herb	***Symphyotrichum ciliolatum***	**Lindley's aster**	**S2**	**Endangered**	**G5**
Forb/herb	*Symphyotrichum novi-belgii*	New York aster, New Belgium American-aster	S5	-	G5
Forb/herb	*Symphyotrichum puniceum*	swamp aster	S5	-	G5
Forb/herb	*Symphyotrichum* sp.	an aster	-	-	-
Forb/herb	*Symphyotrichum x subgeminatum*	a hybrid aster	X*	-	-
Forb/herb	*Taraxacum ceratophorum*	common dandelion	S3	-	-
Forb/herb	*Taraxacum officinale*	common dandelion	SNA	-	G5
Forb/herb	*Taraxacum* sp.	a dandelion	-	-	-
Forb/herb	*Thalictrum alpinum*	alpine meadow-rue	S5	-	G5
Forb/herb	*Thalictrum pubescens*	tall meadow-rue	S5	-	G5
Forb/herb	*Thelypteris noveboracensis*	New York fern	S4	-	G5
Forb/herb	*Thelypteris palustris*	marsh fern	S3S4	-	G5
Forb/herb	*Tofieldia pusilla*	scotch false-asphodel	S4	-	G5
Forb/herb	*Triantha glutinosa*	sticky false-asphodel	S5	-	G5
Forb/herb	*Trifolium pratense*	red clover	SNA	-	GNR
Forb/herb	*Trifolium repens*	white clover	SNA	-	GNR
Forb/herb	*Trillium cernuum*	nodding trillium	S4	-	G5
Forb/herb	*Tussilago farfara*	colt's-foot	SNA	-	GNR
Forb/herb	*Typha latifolia*	broad-leaf cattail	SNA	-	G5

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Forb/herb	*Utricularia cornuta*	horned bladderwort	S5	-	G5
Forb/herb	*Utricularia geminiscapa*	twin-stemmed bladderwort	S3	-	G4G5
Forb/herb	*Valeriana officinalis*	common valerian	SNA	-	GNR
Forb/herb	*Veronica americana*	American speedwell	S4	-	G5
Forb/herb	*Veronica officinalis*	gypsy-weed	SNA	-	G5
Forb/herb	*Viola arvensis*	small wild pansy	SNA	-	GNR
Forb/herb	*Viola blanda*	smooth white violet	S4	-	G5
Forb/herb	*Viola cucullata*	marsh blue violet	S4S5	-	G5
Forb/herb	*Viola labradorica*	Labrador violet	S4S5	-	G5
Forb/herb	*Viola renifolia*	kidney-leaf white violet	S3	-	G5
Forb/herb	*Viola* sp.	a violet	-	-	-
Forb/herb	*Xyris montana*	northern yellow-eyed-grass	S3	-	G5
Arrow-grass	*Triglochin maritima*	common bog arrow-grass	S5	-	G5
Grass	*Agrostis canina*	brown bentgrass	SNA	-	G5
Grass	*Agrostis capillaris*	colonial bentgrass	SNA	-	GNR
Grass	*Agrostis gigantea*	black bentgrass	SNA	-	G4G5
Grass	*Agrostis scabra*	rough bentgrass	S5	-	G5
Grass	*Agrostis* sp.	a bentgrass	-	-	-
Grass	*Agrostis stolonifera*	spreading bentgrass	SNA	-	G5
Grass	*Anthoxanthum odoratum*	sweet vernal grass	SNA	-	GNR
Grass	*Avenella flexuosa*	wavy hairgrass	S5	-	G5
Grass	*Bromus ciliatus*	fringed brome	S5	-	G5

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Grass	*Bromus inermis*	awnless brome	SNA	-	G5
Grass	*Calamagrostis canadensis*	blue-joint reedgrass	S5	-	G5
Grass	*Calamagrostis pickeringii*	Pickering's reed bent-grass	S5	-	G5
Grass	*Calamagrostis* sp.	a reedgrass	-	-	-
Grass	*Calamagrostis stricta*	slim-stem small-reedgrass	S5	-	G5
Grass	*Cinna latifolia*	slender wood reedgrass	S5	-	G5
Grass	*Dactylis glomerata*	orchard grass	SNA	-	GNR
Grass	*Danthonia sp.*	an oatgrass	-	-	-
Grass	*Danthonia spicata*	poverty oat-grass	S5	-	G5
Grass	*Deschampsia cespitosa*	tufted hairgrass	S3S5	-	G5
Grass	*Elymus repens*	quackgrass	SNA	-	GNR
Grass	*Elymus trachycaulus*	slender wheatgrass	S5	-	G5
Grass	*Festuca* sp.	a fescue	-	-	-
Grass	*Glyceria canadensis*	Canada manna-grass	S5	-	G5
Grass	*Glyceria striata*	fowl manna-grass	S5	-	G5
Grass	***Graphephorum melicoides***	**purple false oats**	**S2S3**	**-**	**G4G5**
Grass	*Muhlenbergia glomerata*	marsh muhly	S3S4	-	G5
Grass	*Muhlenbergia uniflora*	fall dropseed muhly	S3S4	-	G5
Grass	*Oryzopsis asperifolia*	white-grained mountain-ricegrass	S3	-	G5
Grass	*Phleum alpinum*	mountain timothy	S3	-	G5
Grass	*Phleum pratense*	meadow timothy	SNA	-	GNR
Grass	*Poa alpina*	alpine bluegrass	S4	-	G5

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Grass	*Poa annua*	annual bluegrass	SNA	-	GNR
Grass	*Poa compressa*	Canada bluegrass	SNA	-	GNR
Grass	*Poa palustris*	fowl bluegrass	S5	-	G5
Grass	*Poa pratensis*	Kentucky bluegrass	S3	-	G5
Grass	*Poa* sp.	a bluegrass	-	-	-
Grass	*Puccinellia pumila*	smooth alkali grass	S4S5	-	G4?
Grass	*Schizachne purpurascens*	purple oat	S3	-	G5
Rush	*Juncus alpinoarticulatus*	a rush	S3S4	-	G5
Rush	*Juncus articulatus*	jointed rush	S5	-	G5
Rush	*Juncus balticus*	Baltic rush	S5	-	G5
Rush	*Juncus bufonius*	toad rush	S5	-	G5
Rush	*Juncus canadensis*	Canada rush	S4S5	-	G5
Rush	*Juncus compressus*	flattened rush	SNA	-	G5
Rush	*Juncus conglomeratus*	compact rush	SNA	-	G5T5?
Rush	*Juncus effusus*	soft rush	S5	-	G5
Rush	*Juncus filiformis*	thread rush	S5	-	G5
Rush	***Juncus nodosus***	**knotted rush**	**S2**	**-**	**G5**
Rush	*Juncus pelocarpus*	brown-fruited rush	S4	-	G5
Rush	*Juncus* sp.	a rush	-	-	-
Rush	*Juncus tenuis*	slender rush	S4	-	G5
Rush	*Juncus tweedyi*	narrow-panicled rush	S5	-	G5
Rush	***Luzula acuminata***	**pointed woodrush**	**S1**	**-**	**G5**

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Rush	*Luzula multiflora*	common woodrush	S5	-	G5
Rush	*Oreojuncus trifidus*	highland rush	S4	-	G5
Sedge	*Carex adusta*	crowded sedge	S3	-	G5
Sedge	*Carex arctata*	black sedge	S3S5	-	G5
Sedge	*Carex atratiformis*	black sedge	S3S4	-	G5
Sedge	*Carex aurea*	golden-fruited sedge	S3S4	-	G5
Sedge	*Carex bigelowii*	Bigelow sedge	S3S4	-	G5
Sedge	*Carex billingsii*	three-seed sedge	SU	-	G5T4T5
Sedge	*Carex brunnescens*	brownish sedge	S5	-	G5
Sedge	*Carex buxbaumii*	Buxbaum's sedge	S4S5	-	G5
Sedge	*Carex canescens*	hoary sedge	S5	-	G5
Sedge	*Carex capillaris*	hair-like sedge	S4	-	G5
Sedge	*Carex castanea*	chestnut-colored sedge	S3S4	-	G5
Sedge	***Carex crawei***	**Crawe sedge**	**S1**	**-**	**G5**
Sedge	*Carex crawfordii*	Crawford sedge	S4S5	-	G5
Sedge	*Carex debilis*	white-edge sedge	S4S5	-	G5
Sedge	*Carex diandra*	lesser panicled sedge	S3S4	-	G5
Sedge	*Carex disperma*	softleaf sedge	S4S5	-	G5
Sedge	*Carex eburnea*	ebony sedge	S3	-	G5
Sedge	*Carex echinata*	little prickly sedge	S5	-	G5
Sedge	*Carex exilis*	coast sedge	S5	-	G5
Sedge	*Carex flava*	yellow sedge	S4S5	-	G5

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Sedge	*Carex gracillima*	graceful sedge	S3S4	-	G5
Sedge	***Carex hostiana***	**Host's sedge**	**S2**	**-**	**G5**
Sedge	*Carex interior*	inland sedge	S3S4	-	G5
Sedge	*Carex lasiocarpa*	slender sedge	S5	-	G5
Sedge	*Carex leptalea*	bristly-stalk sedge	S4S5	-	G5
Sedge	*Carex leptonervia*	finely-nerved sedge	S4S5	-	G5
Sedge	*Carex limosa*	mud sedge	S5	-	G5
Sedge	*Carex livida*	livid sedge	S5	-	G5
Sedge	*Carex magellanica*	boreal bog sedge	S5	-	G5
Sedge	*Carex michauxiana*	Michaux sedge	S4S5	-	G5
Sedge	*Carex nigra*	black sedge	S5	-	G5
Sedge	*Carex oligosperma*	few-seeded sedge	S5	-	G5
Sedge	*Carex pallescens*	pale sedge	S3	-	G5
Sedge	*Carex pauciflora*	few-flowered sedge	S4S5	-	G5
Sedge	*Carex pedunculata*	longstalk sedge	S3	-	G5
Sedge	*Carex rariflora*	loose-flowered sedge	S3	-	G5
Sedge	*Carex rostrata*	beaked sedge	S3S4	-	G5
Sedge	*Carex scirpoidea*	bulrush sedge	S4S5	-	G5
Sedge	*Carex scoparia*	pointed broom sedge	S3	-	G5
Sedge	*Carex* sp.	a sedge	-	-	-
Sedge	*Carex stipata*	stalk-grain sedge	S4S5	-	G5
Sedge	*Carex trisperma*	three-seed sedge	S5	-	G5

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Sedge	*Carex utriculata*	bear sedge	S4S5	-	G5
Sedge	*Carex vaginata*	sheathed sedge	S3S4	-	G5
Sedge	*Carex viridula*	little green sedge	S5	-	G5
Sedge	*Carex wiegandii*	Wiegand's sedge	S3	-	G4G5
Sedge	*Eriophorum angustifolium*	narrow-leaved cotton-grass	S4S5	-	G5
Sedge	*Eriophorum* sp.	a cotton-grass	-	-	-
Sedge	*Eriophorum vaginatum*	tussock cotton-grass	S5	-	G5
Sedge	*Eriophorum virginicum*	tawny cotton-grass	S4S5	-	G5
Sedge	*Eriophorum viridicarinatum*	green keeled cottongrass	S4S5	-	G5
Sedge	*Rhynchospora alba*	white beakrush	S4S5	-	G5
Sedge	*Rhynchospora fusca*	brown beakrush	S3S4	-	G4G5
Sedge	*Schoenoplectus subterminalis*	water bulrush	S3	-	G5
Sedge	*Scirpus atrocinctus*	black-girdle bulrush	S5	-	G5
Sedge	*Scirpus cyperinus*	cottongrass bulrush	S3S4	-	G5
Sedge	*Scirpus hattorianus*	a bulrush	S3S4	-	G5
Sedge	*Scirpus microcarpus*	small-fruit bulrush	S4S5	-	G5
Sedge	*Scirpus* sp.	a bulrush	-	-	-

Table A-1 Vascular Plant Species Observed During Land Cover and Rare Plant Surveys of the Port au Port Wind Farm LAA

Growth Form [1]	Scientific Name [2]	Common Name [2]	Provincial Rank		National Rank [3]
			NF S Rank [2]	NL ESA Rank	NatureServe G Rank
Sedge	*Trichophorum alpinum*	alpine cotton-grass	S4S5	-	G5
Sedge	*Trichophorum cespitosum*	deergrass	S5	-	G5

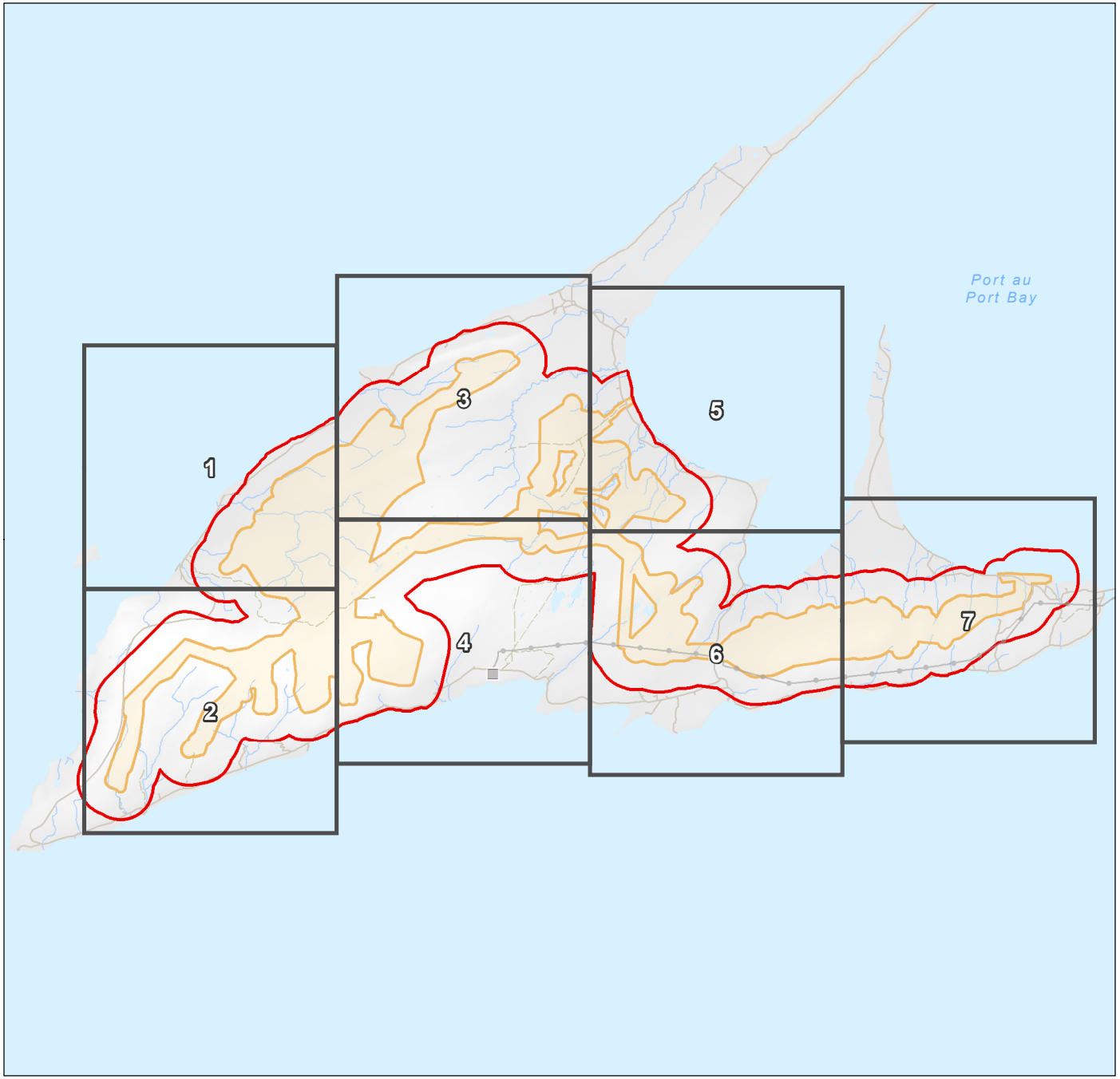
Notes:
Species at Risk (SAR) and Species of Conservation Concern (SOCC) are in **bold text**
[1] Growth forms for species detected in the LAA are provided, adapted from United States Department of Agriculture USDA). No date to reflect local observations (Table A-2). Some species can have more than one growth form. Graminoids have been further classified into grasses, rushes, sedges, and arrow-grasses.
[2] Species naming convention for Scientific and Common Names and NF (Island of Newfoundland) S Ranks follow AC CDC (2024b), except in the case of *Symphyotrichum novi-belgii*, which is referred to as New York Aster, as follows SSAC (2009)
- indicates no rank
X* The hybrid species *Aronia* x *prunifolia* and *Symphyotrichum x subgeminatum* were found in the LAA but are not listed within AC CDC (2024b)
[3] No species observed within the Port au Port Wind Farm LAA had Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or SARA rankings. NatureServe Global Ranks (G Rank) provided by the AC CDC (2024c)

Table A-2 USDA Growth Form Definitions USDA Growth Form Definitions

Growth Form	Growth Form Definition	Notes
Forb/herb	Vascular plant without significant woody tissue above or at the ground. Forbs and herbs may be annual, biennial, or perennial but always lack significant thickening by secondary woody growth and have perennating buds borne at or below the ground surface. In PLANTS, graminoids are excluded but ferns, horsetails, lycopods, and whisk-ferns are included.	Applies to vascular plants only. Federal Geographic Data Committee (FGDC) definition includes graminoids, forbs, and ferns.
Graminoid	Grass or grass-like plant, including grasses (*Poaceae*), sedges (*Cyperaceae*), rushes (*Juncaceae*), arrow-grasses (*Juncaginaceae*), and quillworts (*Isoetes*).	Applies to vascular plants only. An herb in the FGDC classification.
Lichenous	Organism generally recognized as a single "plant" that consists of a fungus and an alga or cyanobacterium living in symbiotic association. Often attached to solid objects such as rocks or living or dead wood rather than soil.	Applies to lichens only, which are not true plants.
Nonvascular	Nonvascular, terrestrial green plant, including mosses, hornworts, and liverworts. Always herbaceous, often attached to solid objects such as rocks or living or dead wood rather than soil.	Applies to non-vascular plants only; in PLANTS system this is groups HN (Hornworts), LV (Liverworts), and MS (Mosses).
Shrub	Perennial, multi-stemmed woody plant that is usually less than 4 to 5 m (13 to 16 feet) in height. Shrubs typically have several stems arising from or near the ground but may be taller than 5 m or single-stemmed under certain environmental conditions.	Applies to vascular plants only.
Subshrub	Low-growing shrub usually under 0.5 m (1.5 feet) tall, never exceeding 1 m (3 feet) tall at maturity.	Applies to vascular plants only. A dwarf-shrub in the FGDC classification.
Source: USDA (United States Department of Agriculture). No Date. PLANTS Help Document. Available online: https://plants.usda.gov/assets/docs/PLANTS_Help_Document.pdf. Last Accessed: January 2024.		

APPENDIX B

Land Cover Class and Rare Plant Observation Mapbooks



Stantec

Land Cover Classification and Rare Plants Project Area

Land Cover Classification and Rare Plants Local Assessment Area

Other Features

Substation

Transmission Line, Existing

Road

Resource Road / Trail

Watercourse

Waterbody

N

0 2 4 Kilometres
(At original document size of 8.5x11)
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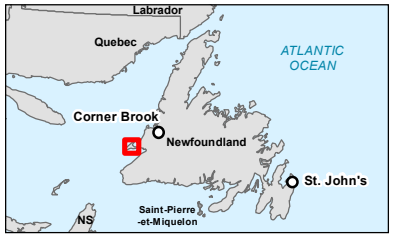
Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Data Sources: World Energy GH2, NRCan CanVec, Openstreetmap
3. Background: NRCan CanVec



Project Location
Stephenville
NL

Prepared by MB on 2024-01-26

Client/Project
World Energy GH2
Project Nujio'qonik

121417575_008

Figure No.
Appendix B

Mapbook Index - Land Cover Classes and Rare Plant Observations in the Port au Port Wind Farm LAA

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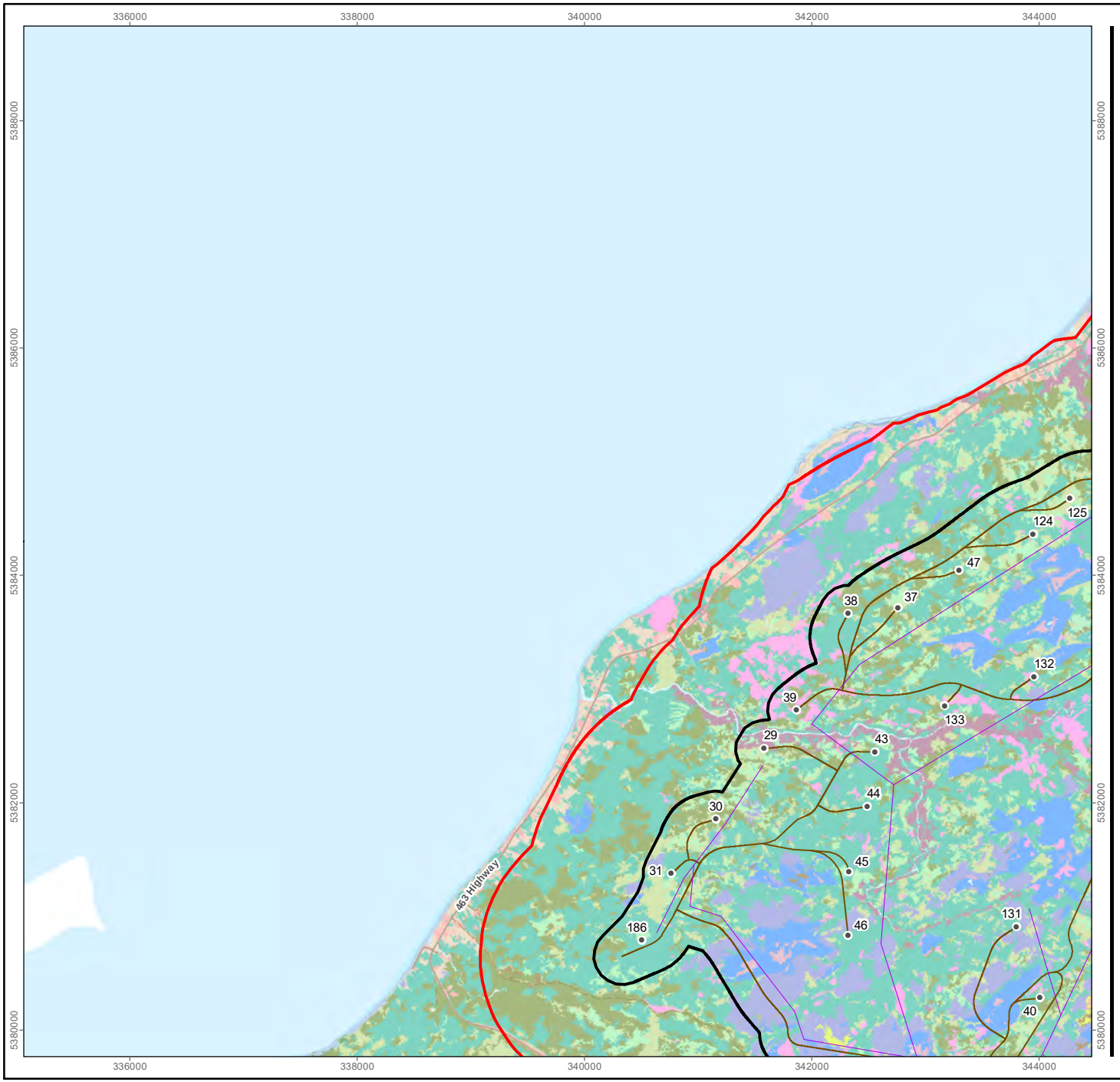
B.1 LAND COVER CLASSES AND SPECIES OF CONSERVATION CONCERN OBSERVATIONS IN THE PORT AU PORT WIND FARM



Stantec

Proposed Project Features

- Turbine Location
- Collector Line
- Access Road
- Land Cover Classification and Rare Plants Project Area
- Land Cover Classification and Rare Plants Local Assessment Area (LAA)

Land Cover

Forest
- Coniferous Dense
- Coniferous Sparse
- Mixedwood
- Tuckamore
- Regenerating Forest

Barrens
- Dwarf Shrub Heath
- Rock Barrens

Wetlands
- Bog
- Coniferous Treed Swamp
- Fen
- Flarks
- Shrub Swamp

Other
- Anthropogenic Vegetated
- Coast
- Urban
- Unpaved Roads
- Water

N

0 0.5 1 Kilometres
(At original document size of 8.5x11)
1:51,000

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Data Sources: World Energy GH2, NRCan CanVec, OpenStreetMap, ACCDC, Stantec
3. Background: NRCan CanVec

Project Location
Stephenville
NL

Prepared by MB on 2024-01-22
QR by NDC on 2024-01-23

Client/Project
World Energy GH2
Project Nujio'qonik

121417575_006

Figure No.
B.1

Land Cover Classes and Species of Conservation Concern Observations in the Port au Port Wind Farm LAA

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Stantec

Species of Conservation Concern (SOCC) - Stantec Field 2023

- Goldie's Roundleaf Orchid *(Platanthera macrophylla)*
- Hooker's Orchid *(Platanthera hookeri)*
- Laurentian Bladder Fern *(Cystopteris laurentiana)*
- Dwarf White Birch *(Betula minor)*
- Fairy Slipper *(Calypso bulbosa)*
- Partridge-berry *(Mitchella repens)*
- Pointed Woodrush *(Luzula acuminata)*
- Rock Stitchwort *(Sabulina dawsonensis)*

SOCC - ACCDC

- Bulblet Bladder Fern *(Cystopteris bulbifera)*
- Coastal Cinquefoil *(Potentilla litoralis)*
- Crantz's Cinquefoil *(Potentilla crantzii)*
- Drummond's Rockcress *(Boechera stricta)*
- Fairy Slipper *(Calypso bulbosa var. americana)*
- Hooker's Orchid *(Platanthera hookeri)*
- Macoun Buttercup *(Ranunculus macounii)*
- Northern Rough Fescue *(Festuca altaica)*
- Purple False Oats *(Graphephorum melicoides)*
- Red Fescue *(Festuca rubra)*
- Rock Stitchwort
- Shortleaf Fescue *(Festuca brachyphylla)*
- Slender-Leaved Sundew *(Drosera linearis)*
- Western Threadleaf Pondweed *(Stuckenia filiformis subsp. occidentalis)*

Proposed Project Features

- Turbine Location
- Collector Line
- Access Road
- Land Cover Classification and Rare Plants Project Area
- Land Cover Classification and Rare Plants Local Assessment Area (LAA)

Land Cover

Forest
- Coniferous Dense
- Coniferous Sparse
- Mixedwood
- Tuckamore
- Regenerating Forest

Barrens
- Dwarf Shrub Heath
- Rock Barrens

Wetlands
- Bog
- Coniferous Treed Swamp
- Fen
- Flarks
- Shrub Swamp

Other
- Anthropogenic Vegetated
- Coast
- Urban
- Unpaved Roads
- Water

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Notes
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3. Background: NRCan CanVec

Project Location
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NL

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Figure No.
B.1

Land Cover Classes and Species of Conservation Concern Observations in the Port au Port Wind Farm LAA

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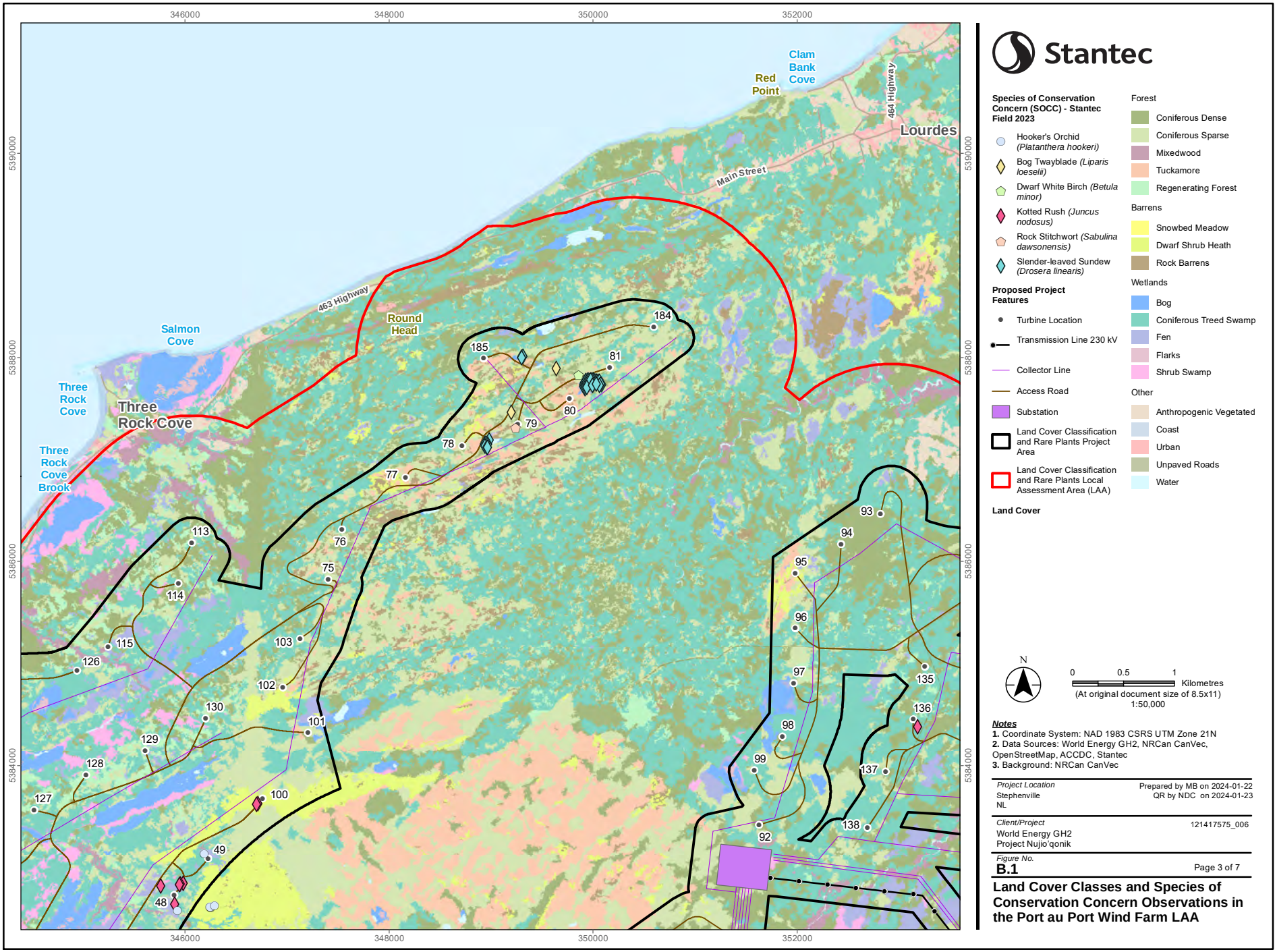

Stantec

Species of Conservation Concern (SOCC) - Stantec Field 2023

- Hooker's Orchid *(Platanthera hookeri)*
- Bog Twayblade *(Liparis loeselii)*
- Dwarf White Birch *(Betula minor)*
- Kotted Rush *(Juncus nodosus)*
- Rock Stitchwort *(Sabulina dawsonensis)*
- Slender-leaved Sundew *(Drosera linearis)*

Proposed Project Features

- Turbine Location
- Transmission Line 230 kV
- Collector Line
- Access Road
- Substation
- Land Cover Classification and Rare Plants Project Area
- Land Cover Classification and Rare Plants Local Assessment Area (LAA)

Land Cover

Forest
- Coniferous Dense
- Coniferous Sparse
- Mixedwood
- Tuckamore
- Regenerating Forest

Barrens
- Snowbed Meadow
- Dwarf Shrub Heath
- Rock Barrens

Wetlands
- Bog
- Coniferous Treed Swamp
- Fen
- Flarks
- Shrub Swamp

Other
- Anthropogenic Vegetated
- Coast
- Urban
- Unpaved Roads
- Water

N

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(At original document size of 8.5x11)
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Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Data Sources: World Energy GH2, NRCan CanVec, OpenStreetMap, ACCDC, Stantec
3. Background: NRCan CanVec

Project Location
Stephenville
NL

Prepared by MB on 2024-01-22
QR by NDC on 2024-01-23

Client/Project
World Energy GH2
Project Nujio'qonik

121417575_006

Figure No.
B.1

Page 3 of 7

Land Cover Classes and Species of Conservation Concern Observations in the Port au Port Wind Farm LAA

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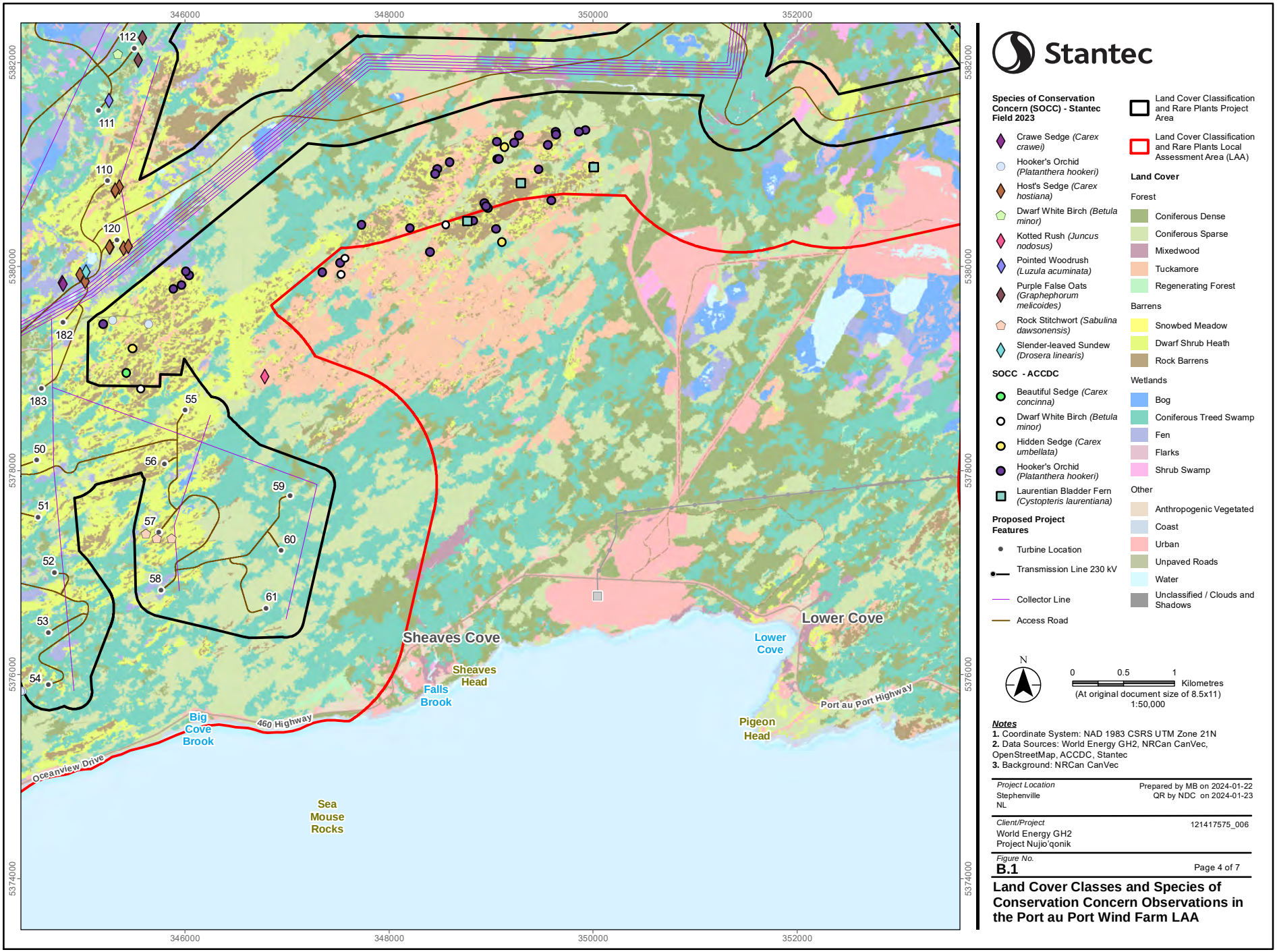

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Stantec

Species of Conservation Concern (SOCC) - Stantec Field 2023

- Crawe Sedge *(Carex crawei)*
- Hooker's Orchid *(Platanthera hookeri)*
- Host's Sedge *(Carex hostiana)*
- Dwarf White Birch *(Betula minor)*
- Kotted Rush *(Juncus nodosus)*
- Pointed Woodrush *(Luzula acuminata)*
- Purple False Oats *(Graphephorum melicoides)*
- Rock Stitchwort *(Sabulina dawsonensis)*
- Slender-leaved Sundew *(Drosera linearis)*

SOCC - ACCDC

- Beautiful Sedge *(Carex concinna)*
- Dwarf White Birch *(Betula minor)*
- Hidden Sedge *(Carex umbellata)*
- Hooker's Orchid *(Platanthera hookeri)*
- Laurentian Bladder Fern *(Cystopteris laurentiana)*

Proposed Project Features

- Turbine Location
- Transmission Line 230 kV
- Collector Line
- Access Road
- Land Cover Classification and Rare Plants Project Area
- Land Cover Classification and Rare Plants Local Assessment Area (LAA)

Land Cover

Forest
- Coniferous Dense
- Coniferous Sparse
- Mixedwood
- Tuckamore
- Regenerating Forest

Barrens
- Snowbed Meadow
- Dwarf Shrub Heath
- Rock Barrens

Wetlands
- Bog
- Coniferous Treed Swamp
- Fen
- Flarks
- Shrub Swamp

Other
- Anthropogenic Vegetated
- Coast
- Urban
- Unpaved Roads
- Water
- Unclassified / Clouds and Shadows

N

0 0.5 1 Kilometres
(At original document size of 8.5x11)
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Notes
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2. Data Sources: World Energy GH2, NRCan CanVec, OpenStreetMap, ACCDC, Stantec
3. Background: NRCan CanVec

Project Location
Stephenville
NL

Prepared by MB on 2024-01-22
QR by NDC on 2024-01-23

Client/Project
World Energy GH2
Project Nujio'qonik

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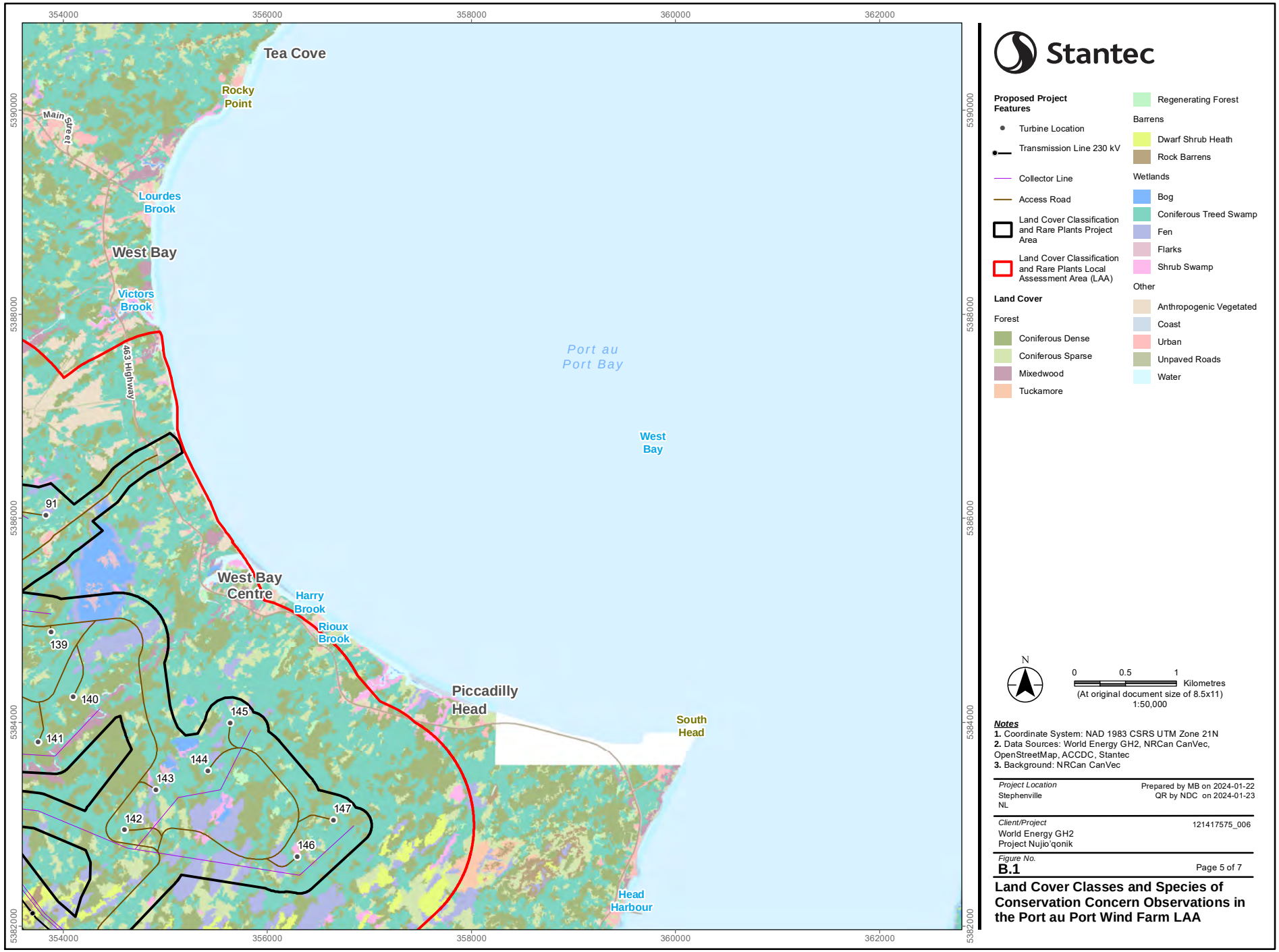
Figure No.
B.1

Land Cover Classes and Species of Conservation Concern Observations in the Port au Port Wind Farm LAA



Stantec

Proposed Project Features

- Turbine Location
- Transmission Line 230 kV
- Collector Line
- Access Road
- Land Cover Classification and Rare Plants Project Area
- Land Cover Classification and Rare Plants Local Assessment Area (LAA)

Land Cover

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Wetlands
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- Coniferous Treed Swamp
- Fen
- Flarks
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- Water

N

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3. Background: NRCan CanVec

Project Location
Stephenville
NL

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World Energy GH2
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Figure No.
B.1

Page 5 of 7

Land Cover Classes and Species of Conservation Concern Observations in the Port au Port Wind Farm LAA

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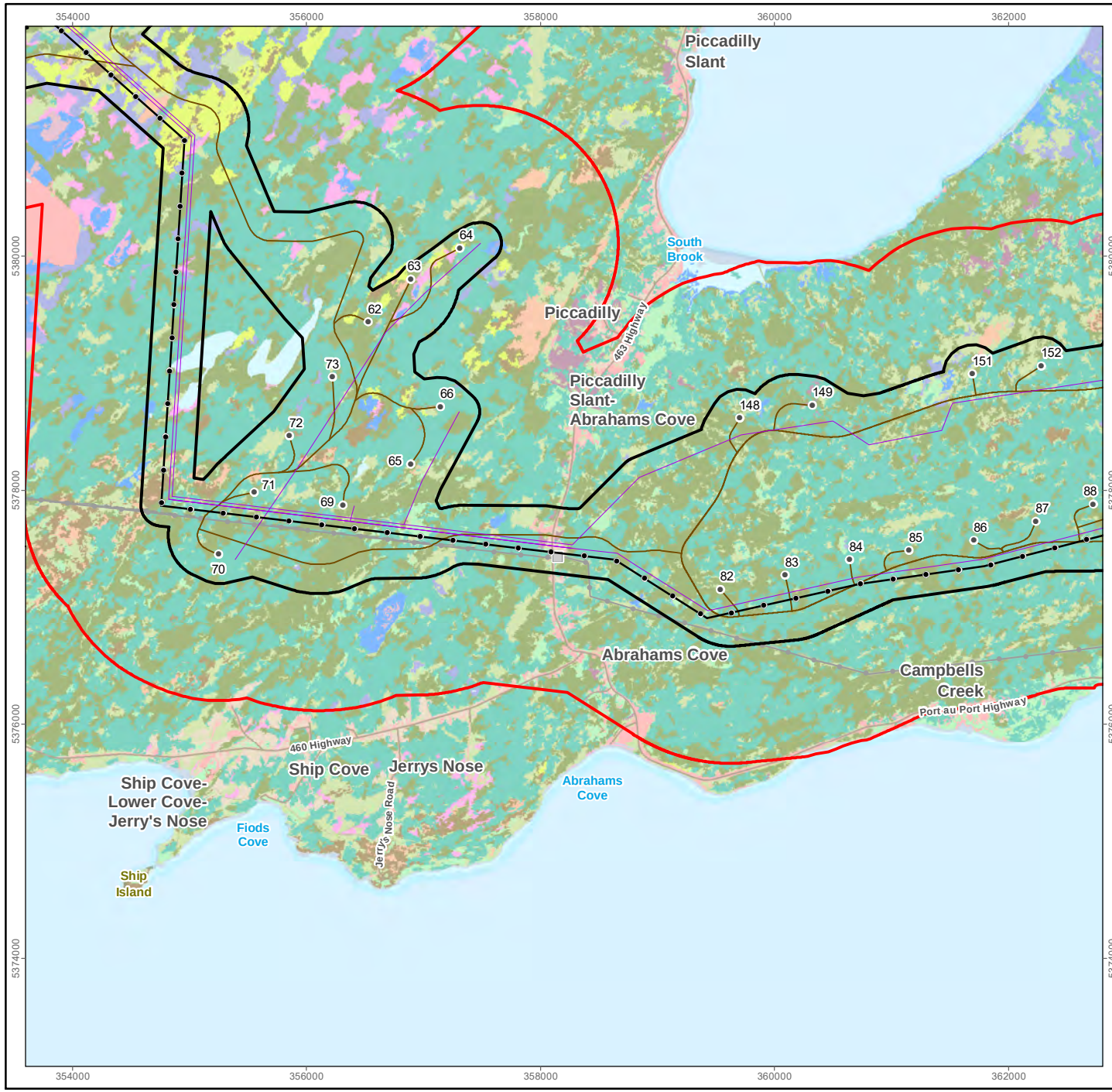

Stantec

Proposed Project Features

- Turbine Location
- Transmission Line 230 kV
- Collector Line
- Access Road
- Land Cover Classification and Rare Plants Project Area
- Land Cover Classification and Rare Plants Local Assessment Area (LAA)

Land Cover

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- Water
- Unclassified / Clouds and Shadows

N

0 0.5 1 Kilometres
(At original document size of 8.5x11)
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Notes

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2. Data Sources: World Energy GH2, NRCan CanVec, OpenStreetMap, ACCDC, Stantec
3. Background: NRCan CanVec

Project Location
Stephenville
NL

Prepared by MB on 2024-01-22
QR by NDC on 2024-01-23

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World Energy GH2
Project Nujio'qonik

121417575_006

Figure No.
B.1

Land Cover Classes and Species of Conservation Concern Observations in the Port au Port Wind Farm LAA

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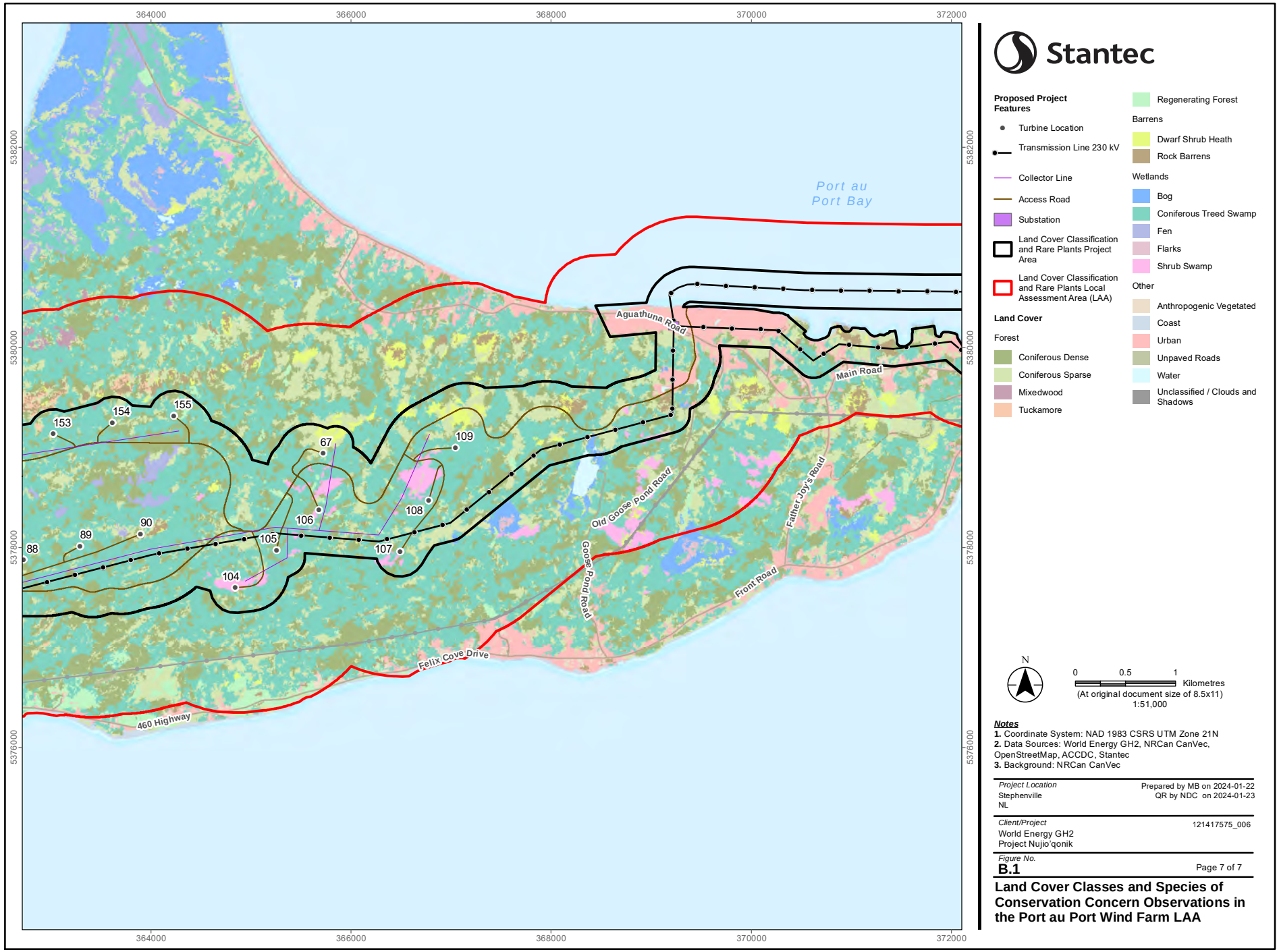

Stantec

Proposed Project Features

- Turbine Location
- Transmission Line 230 kV
- Collector Line
- Access Road
- Substation
- Land Cover Classification and Rare Plants Project Area
- Land Cover Classification and Rare Plants Local Assessment Area (LAA)

Land Cover

Forest
- Coniferous Dense
- Coniferous Sparse
- Mixedwood
- Tuckamore
- Regenerating Forest

Barrens
- Dwarf Shrub Heath
- Rock Barrens

Wetlands
- Bog
- Coniferous Treed Swamp
- Fen
- Flarks
- Shrub Swamp

Other
- Anthropogenic Vegetated
- Coast
- Urban
- Unpaved Roads
- Water
- Unclassified / Clouds and Shadows

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Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Data Sources: World Energy GH2, NRCan CanVec, OpenStreetMap, ACCDC, Stantec
3. Background: NRCan CanVec

Project Location
Stephenville
NL

Prepared by MB on 2024-01-22
QR by NDC on 2024-01-23

Client/Project
World Energy GH2
Project Nujio'qonik

121417575_006

Figure No.
B.1

Land Cover Classes and Species of Conservation Concern Observations in the Port au Port Wind Farm LAA

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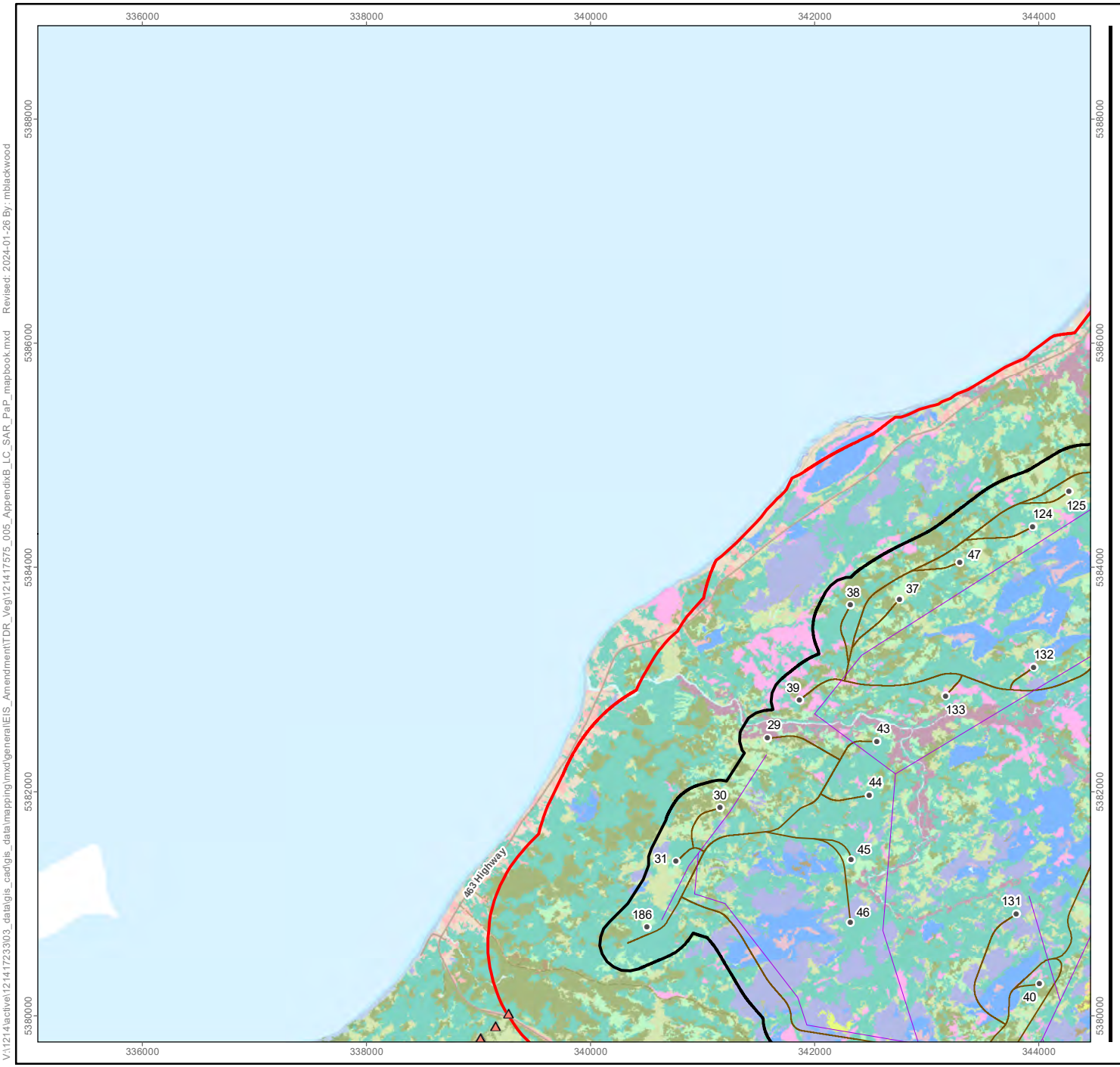
B.2 LAND COVER CLASSES AND SPECIES AT RISK OBSERVATIONS IN THE PORT AU PORT WIND FARM



Stantec

Species at Risk (SAR) - ACCDC

- Lindley's Aster *(Symphyotrichum ciliolatum)*

Proposed Project Features

- Turbine Location
- Collector Line
- Access Road
- Land Cover Classification and Rare Plants Project Area
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Land Cover

Forest
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3. Background: NRCan CanVec Sources: Esri, USGS, NOAA

Project Location
Stephenville
NL

Prepared by MB on 2024-01-26
QR by NDC on 2024-01-26

Client/Project
World Energy GH2
Project Nujio'qonik

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Figure No.
B.2

Land Cover Classes and Species at Risk Observations in the Port au Port Wind Farm LAA

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Stantec

Species at Risk (SAR) - Stantec Field 2023

- Lindley's Aster *(Symphyotrichum ciliolatum)*
- Mackenzie's Sweetvetch *(Hedysarum boreale subsp. mackenziei)*

Species at Risk (SAR) - ACCDC

- Lindley's Aster *(Symphyotrichum ciliolatum)*
- Mackenzie's Sweetvetch *(Hedysarum boreale subsp. mackenziei)*
- Woolly Arnica *(Arnica angustifolia subsp. tomentosa)*

Proposed Project Features

- Turbine Location
- Collector Line
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Land Cover

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Project Location
Stephenville
NL

Prepared by MB on 2024-01-26
QR by NDC on 2024-01-26

Client/Project
World Energy GH2
Project Nujio'qonik

121417575_005

Figure No.
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Land Cover Classes and Species at Risk Observations in the Port au Port Wind Farm LAA

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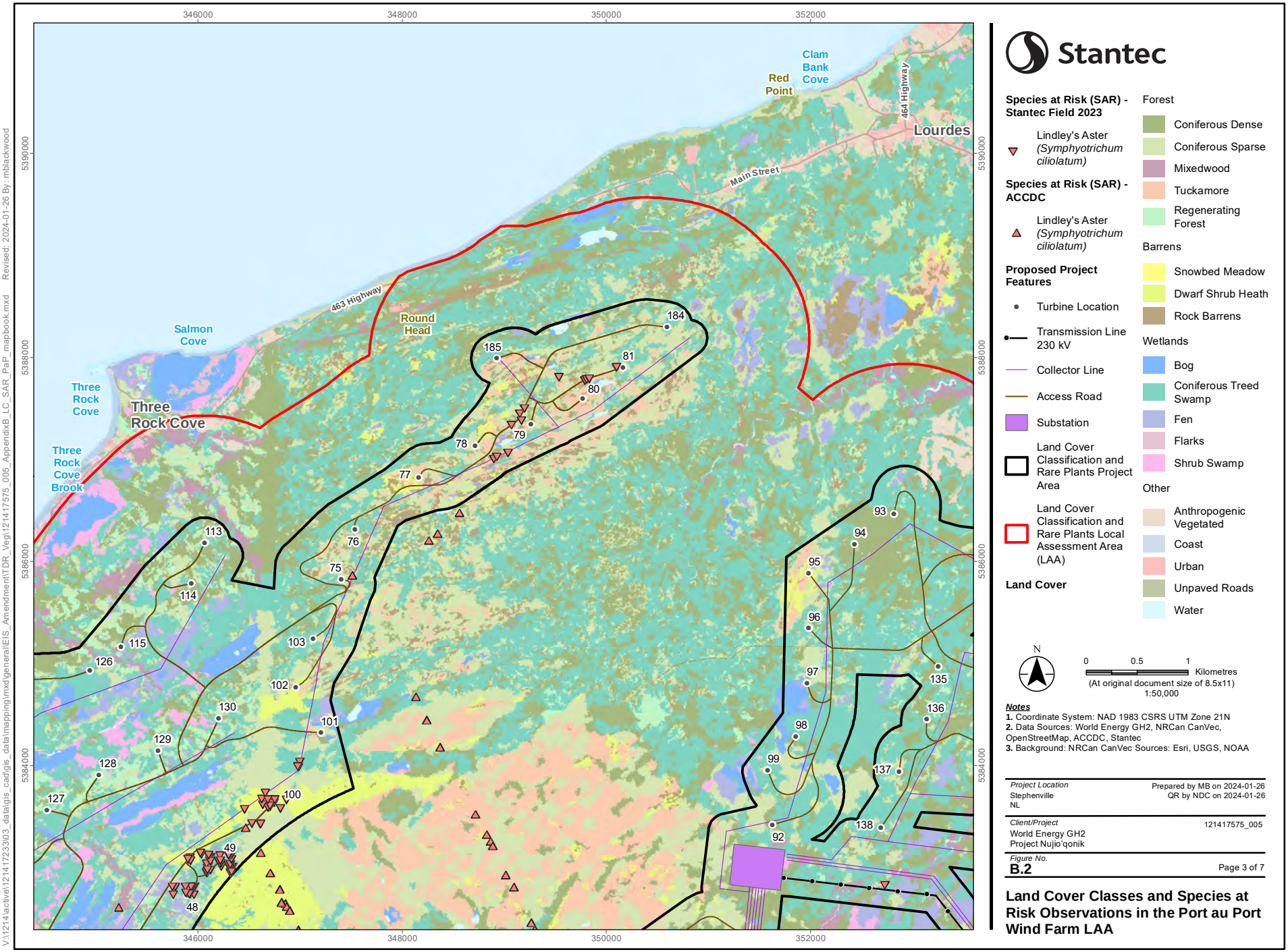

Stantec

Species at Risk (SAR) - Stantec Field 2023

- Lindley's Aster (*Symphyotrichum ciliolatum*)

Species at Risk (SAR) - ACCDC

- Lindley's Aster (*Symphyotrichum ciliolatum*)

Proposed Project Features

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Project Location
Stephenville
NL

Prepared by MB on 2024-01-26
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Client/Project
World Energy GH2
Project Nujio'qonik

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Figure No.
B.2

Land Cover Classes and Species at Risk Observations in the Port au Port Wind Farm LAA

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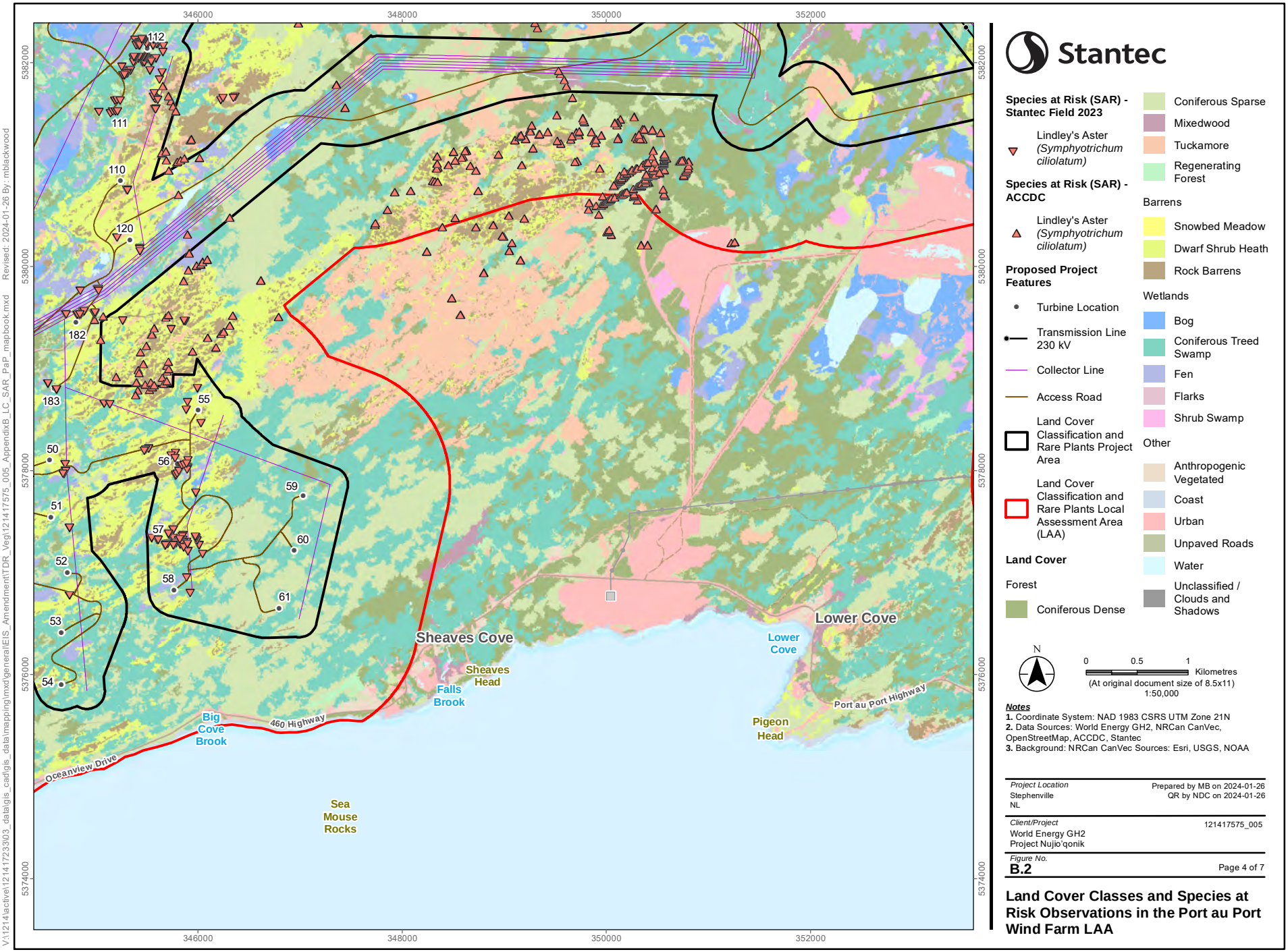

Stantec

Species at Risk (SAR) - Stantec Field 2023

- Lindley's Aster (*Symphyotrichum ciliolatum*)

Species at Risk (SAR) - ACCDC

- Lindley's Aster (*Symphyotrichum ciliolatum*)

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Project Location Stephenville NL	Prepared by MB on 2024-01-26 QR by NDC on 2024-01-26
Client/Project World Energy GH2 Project Nujio'qonik	121417575_005
Figure No. **B.2**	Page 4 of 7

Land Cover Classes and Species at Risk Observations in the Port au Port Wind Farm LAA

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Stantec

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Project Location
Stephenville
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Prepared by MB on 2024-01-26
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Client/Project
World Energy GH2
Project Nujio'qonik

121417575_005

Figure No.
B.2

Page 5 of 7

Land Cover Classes and Species at Risk Observations in the Port au Port Wind Farm LAA

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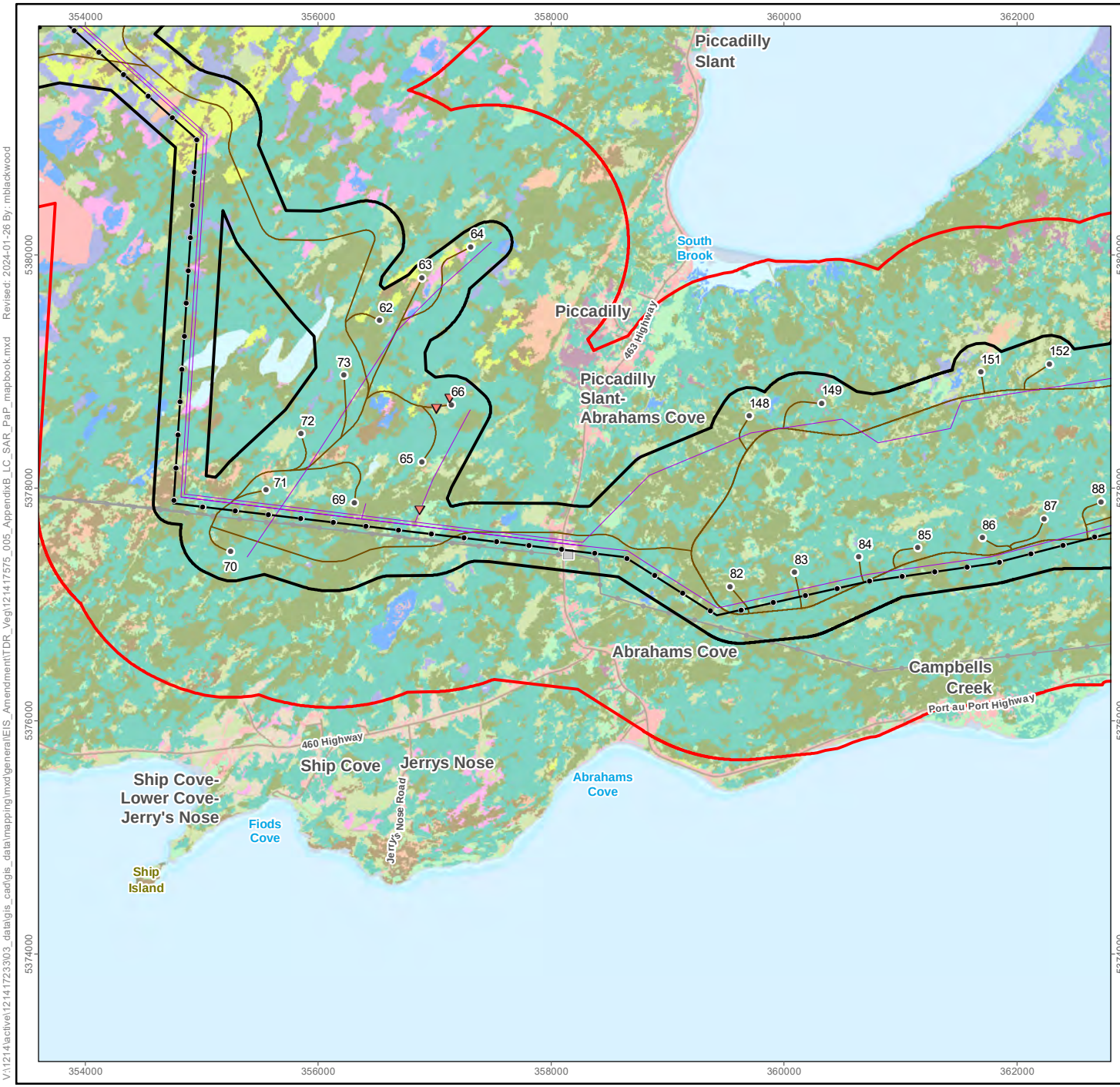

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Stantec

Species at Risk (SAR) - Stantec Field 2023

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Client/Project
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Project Nujio'qonik

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Figure No.
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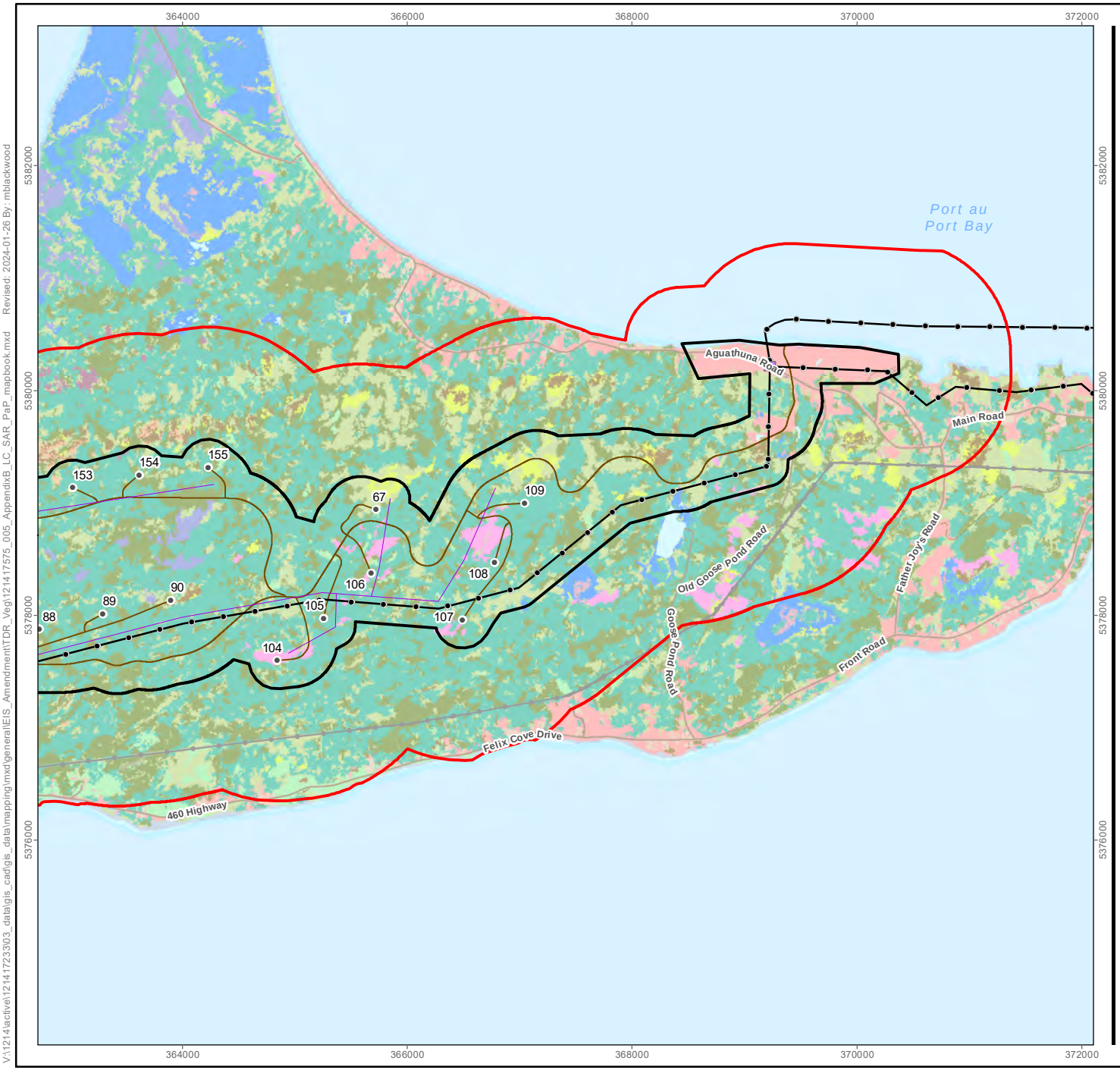
Land Cover Classes and Species at Risk Observations in the Port au Port Wind Farm LAA



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Stantec

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Project Location
Stephenville
NL

Prepared by MB on 2024-01-26
QR by NDC on 2024-01-26

Client/Project
World Energy GH2
Project Nujio'qonik

121417575_005

Figure No.
B.2

Land Cover Classes and Species at Risk Observations in the Port au Port Wind Farm LAA

APPENDIX C

Land Cover Survey Site Photographs

Photo 1 **Rock Barren (Plot T196-2)**

Photo 2 **Rock Barren (Plot T227-3)**

Photo 3 Snowbed Meadow (Plot T126-3)

Photo 4 Coniferous Dense (Plot T43-1)

Photo 5 Coniferous Sparse (Plot T14-2)

Photo 6 Mixedwood (Plot T269-3)

Photo 7 Regenerating Forest (Plot T142-2)

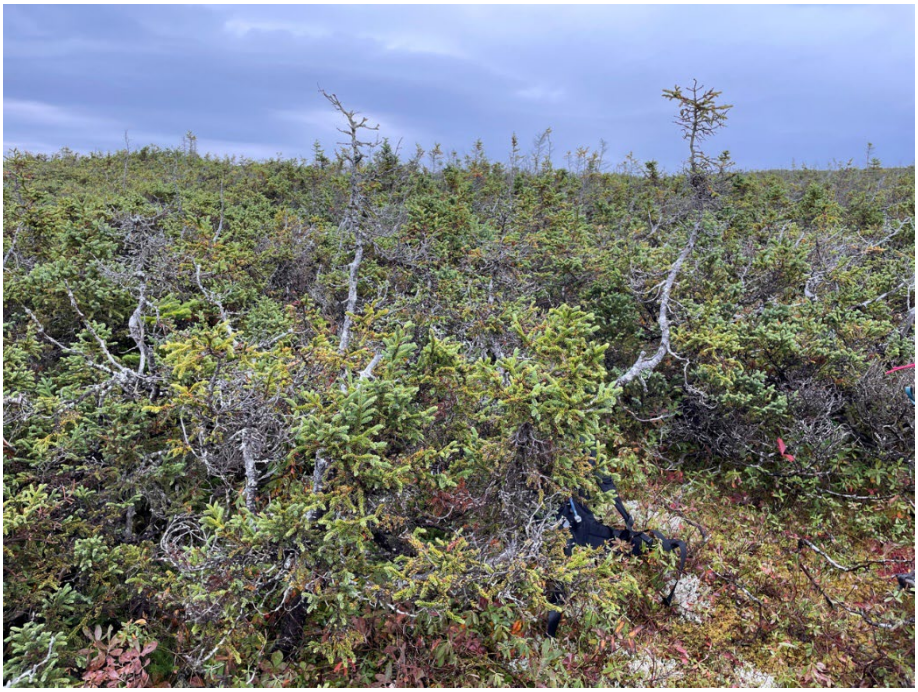

Photo 8 Tuckamore (Plot 127-3)

Photo 9 Bog (Plot T70-T1)

Photo 10 Fen (Plot T192-3)

Photo 11 Coniferous Treed Swamp (Plot T143-2)

Photo 12 Shrub Swamp (Plot T256-3)

Photo 13 Anthropogenic Vegetated (Plot T136-2)

APPENDIX D

Land Cover Accuracy

Table D-1 Land Cover Mapping Accuracy by Land Cover Type

Site ID	Field Determined Land Cover Class	Mapped Land Cover Class
T136-2	Anthropogenic Vegetated	Coniferous Treed Swamp
T270-3	Anthropogenic Vegetated	Regenerating Forest
T224-1	Bog	Bog
T269-1	Bog	Coniferous Treed Swamp
T296-3	Bog	Coniferous Treed Swamp
T126-1	Coniferous Dense	Coniferous Treed Swamp
T227-1	Coniferous Dense	Coniferous Sparse
T227-2	Coniferous Dense	Coniferous Sparse
T246-1	Coniferous Dense	Mixedwood
T69-1-ND	Coniferous Dense	Coniferous Treed Swamp
T14-1	Coniferous Sparse	Coniferous Dense
T278-2	Coniferous Sparse	Coniferous Treed Swamp
T43-3	Coniferous Sparse	Coniferous Sparse
T143-2	Coniferous Treed Swamp	Coniferous Treed Swamp
T255-1	Coniferous Treed Swamp	Coniferous Treed Swamp
T268-1	Coniferous Treed Swamp	Coniferous Treed Swamp
T192-1	Fen	Bog
T192-3	Fen	Flarks
T269-3	Mixedwood	Shrub Swamp
T142-2	Regenerating Forest	Regenerating Forest
T196-2	Rock Barren	Rock Barrens
T196-3	Rock Barren	Rock Barrens
T227-3	Rock Barren	Rock Barrens
T255-3	Shrub Swamp	Coniferous Treed Swamp
T256-2	Shrub Swamp	Coniferous Treed Swamp
T256-3	Shrub Swamp	Coniferous Treed Swamp
T312-1	Shrub Swamp	Coniferous Treed Swamp
T126-2	Snowbed Meadow	Coniferous Treed Swamp
T126-3	Snowbed Meadow	Coniferous Treed Swamp
T249-1	Tall Shrub	Fen
T127-3-ND	Tuckamore	Tuckamore
T249-2	Tuckamore	Coniferous Treed Swamp
T69-3	Tuckamore	Coniferous Sparse