



North Atlantic

Appendix D5: Rare Lichens Baseline Study

Prepared for:

North Atlantic Refining Corp.
29 Pippy PI, St. John's, NL
A1B 3X2

Prepared by:

Sikumiut Environmental Management Ltd.
79 Mews PI, St. John's, NL
A1B 4N2



Table of Contents

1.0	Introduction	1
2.0	Methods	3
2.1	Desktop Study	3
2.2	Habitat Suitability Mapping	3
2.3	Field Surveys.....	4
3.0	Results	8
3.1	Desktop Study	8
3.2	Habitat Suitability Mapping	10
3.3	Field Surveys.....	12
3.3.1	Project Area.....	12
3.3.2	LAA and RAA.....	14
4.0	Discussion.....	16
5.0	References.....	17

List of Tables

Table D5-3.1-1	Conservation status of lichen Species at Risk in Newfoundland.	8
----------------	----------------------------------------------------------------------	---

List of Figures

Figure D5-1.0-1	Project location and preliminary infrastructure layout.....	2
Figure D5-2.3-1	Abundant <i>Coccocarpia palimcola</i> growth on a mature balsam fir in the RAA.....	7
Figure D5-3.2-1	Rare lichens habitat suitability map.	11
Figure D5-3.3-1	Rare lichens survey locations – Project Area.....	13
Figure D5-3.3-2	Rare lichens survey locations – LAA/RAA.	15

List of Appendices

Appendix D5-1: Lichen Survey Data for the PA

Appendix D5-2: Lichen Survey Data for the LAA and RAA

List of Acronyms and Abbreviations

AC CDC	Atlantic Canada Conservation Data Centre
cm	centimetre
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DBH	diameter at breast height
ECCC	Environment and Climate Change Canada
ELC	Ecological Land Classification
GPS	Global Positioning System
HGP	Hydrogen Generation Plant
HP	Hydrogenation Plant
IUCN	International Union for Conservation of Nature
kV	kilovolt
LAA	Local Assessment Area
LOHC	Liquid Organic Hydrogen Carrier
m	metre
MW	megawatts
NL	Newfoundland and Labrador
NL FFA	Newfoundland and Labrador Department of Fisheries, Forestry, and Agriculture
NL ESA	Endangered Species Act (Newfoundland and Labrador)
NL WD	Newfoundland and Labrador Wildlife Division
North Atlantic	North Atlantic Refining Corp.
PA	Project Area
RAA	Regional Assessment Area
SAR	Species at Risk
SARA	Species at Risk Act (Federal)
SCC	Species of Conservation Concern

1.0 Introduction

North Atlantic Refining Corp. (North Atlantic) is proposing to undertake the development of a Wind to Hydrogen project (the Project) on the Isthmus of Avalon Region in Newfoundland and Labrador (NL). This Project will entail the development, construction, operation and eventual decommissioning of a 324 MW Wind Farm consisting of 45 wind turbines on an undeveloped peninsula situated between Sunnyside and Deer Harbour. The Wind Farm will provide renewable electricity via a 138 kilovolt (kV) transmission line to a newly developed Hydrogen Generation Plant (HGP), from where generated hydrogen will be transported to a Hydrogenation Plant (HP) for transformation into a Liquid Organic Hydrogen Carrier (LOHC), which will then be shipped from North Atlantic's port facilities to international markets for use in various decarbonization technologies.

In support of the Project, North Atlantic has undertaken environmental baseline studies throughout the Project Area (PA). The Rare Lichens Baseline Study was conducted both opportunistically during other terrestrial field surveys and through lichen-specific surveys in suitable habitat. Lichen-specific surveys took place in September and October 2024, along with additional surveys in June 2025. Surveys were conducted throughout the PA, as well as the Local Assessment Area (LAA) and Regional Assessment Area (RAA). The PA required specific rare lichen surveys while lichen surveys within the LAA and RAA were conducted opportunistically.

Newfoundland is home to four globally rare Species at Risk (SAR) lichens: boreal felt lichen (*Erioderma pedicellatum*), vole ears lichen (*Erioderma mollissimum*, also known as graceful felt lichen), blue felt lichen (*Degelia plumbea*), and wrinkled shingle lichen (*Pannaria lurida*). These are all epiphytic lichens that depend on specific vegetative hosts (phorophytes), such as balsam fir or yellow birch to thrive (Schmitt & Slack, 1990). An exception is blue felt lichen, which can on occasion inhabit moist substrates or ground vegetation such as mosses (COSEWIC, 2010). These lichens are highly susceptible to airborne contaminants (Lauriault, 2020). They depend not only on air quality and humidity levels, but also on the overall maturity and structure of suitable phorophytes within mature forests, which are becoming increasingly scarce (Lauriault, 2020). The proximity to the Come By Chance Industrial Site and its associated air emissions may have affected habitat suitability for rare lichens in the PA and beyond, given that the refinery has been in operation over a period of five decades.

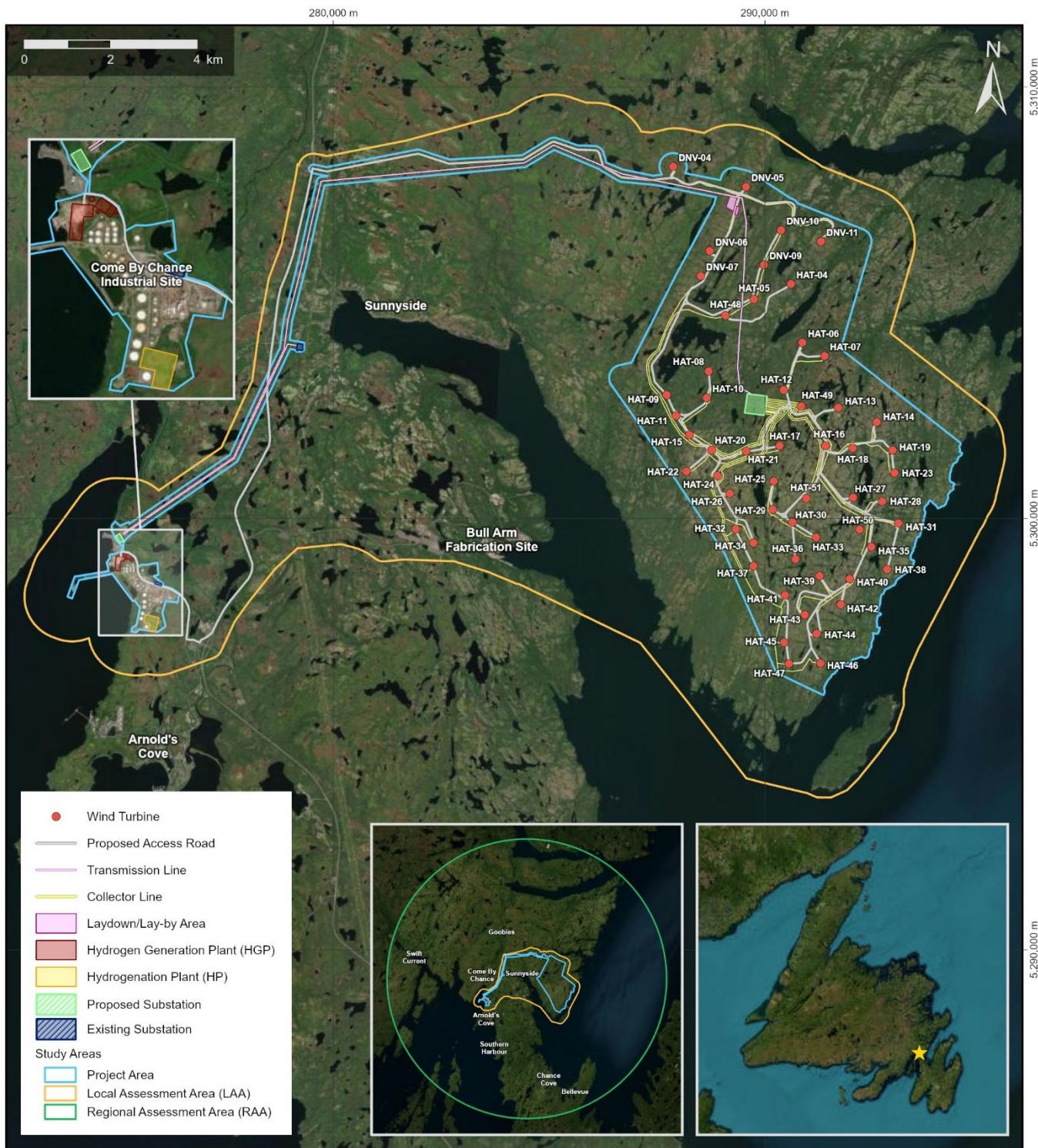


Figure D5-1.0-1 Project location and preliminary infrastructure layout.

2.0 Methods

2.1 Desktop Study

A comprehensive desktop review was conducted to confirm the ranges of the lichen SAR that may occur in the PA. This desktop study included a literature review of relevant material, like scientific articles, government reports and management plans, and open-source databases like iNaturalist. A review was also conducted of the SAR and Species of Conservation Concern (SCC) for the PA through an Atlantic Canada Conservation Data Centre (AC CDC) request. This request was made for the entire PA with a 5 km buffer which also included the LAA and part of the RAA.

2.2 Habitat Suitability Mapping

Mature forest in the PA was mapped via ArcGIS using high resolution aerial imagery. The primary dataset used was 30-centimetre (cm) resolution aerial imagery captured by the Government of NL during 2016/2020 forestry inventories, wherein habitats were classified based on tree species and other vegetation to assess the commercial value of land cover (NL FFA, 2025). Preliminary mapping products were useful in predicting the potential for rare lichens in the area based on the known preferences of the potential species, likely forest composition, and humidity levels surmised for these areas. Rare lichen species prefer humid, mature forests, thus potential habitat types can be identified based on aerial imagery with clear forest cover visible. Preliminary mapping was further refined using Ecological Land Classification (ELC) mapping and ground-truthing during terrestrial field surveys.

Areas of high potential for rare lichens can be identified generally from the classification of mature forests based on the clustering and large leafy growth in the canopy of forest stands. Regenerating forests, especially coniferous and intermediate aged forests, grow close together but are not wide in diameter as individuals, leading them to appear very dense. These trees have not yet begun to outcompete each other for resources and naturally space out. These stands are therefore at a stage where a population exists beyond what the area can support and may be referred to as a thicket. Young fir will begin to reduce in density up to 25% per year in a regenerating stand during this period (Sprugel, 1984). It is therefore possible to determine through aerial imagery which forests are mature enough to support rare lichens.

There are distinct characteristics between mature deciduous forests and mature coniferous forests that make them identifiable in aerial imagery, based on the level of clarity provided. Mature coniferous forests, specifically balsam fir forests, are distinct in both coloration and the appearance of large-leafy growth at a lower density than younger forest stands (Sprugel, 1984). Where applicable, autumn imagery can be used to determine if trees are evergreen or deciduous. Large deciduous tree stands identified in the

Maritime Barrens Ecoregion in natural areas will be comprised of yellow or white birch with sparse pincherry, and ash reaching into the canopy occasionally. Yellow birch forest stands will often appear larger in diameter than white birch when fully mature. Deciduous stands identified from aerial imagery can be assessed during ground-truthing to identify the dominant species.

Forestry inventories often provide generalized habitat information which can be used, in addition to imagery, to derive areas of high potential mature forests. The slope of the terrain and connectivity of elongated sloped terrain can provide information about the potential moisture regime of a particular area. Visuals on wet terrain, waterbodies, and wetlands in combination with slope data from topographic map layers were used to outline potential sites for rare lichens. The preliminary habitat suitability mapping, with inputs from habitat observations during terrestrial surveys, allowed surveyors to develop a refined search plan for rare lichens.

2.3 Field Surveys

Field surveys were undertaken to confirm the presence/absence, location, and number of individuals of lichen SAR in the PA. Additional surveys were undertaken in the LAA/RAA to provide further context on the habitat use of rare lichens in the region. In addition to lichen-specific surveys in areas identified through habitat suitability mapping, opportunistic surveys were conducted as part of other terrestrial field surveys. Lichen-specific surveys were conducted throughout the PA in September and October 2024, with additional surveys conducted in June 2025. All areas identified through habitat mapping as having a high potential to host rare lichens were surveyed. A dataset of Global Positioning System (GPS) points with habitat data and suitability rankings for rare lichens was collected and organized during these surveys.

When searching within areas of potential suitability for rare lichens, each tree (trunk and branches) was examined on all sides from base to approximately 4 metres (m) from the ground (i.e., as high as could be visually assessed by surveyors). High-quality optics allowed for the detection of any suspected thalli (e.g., white tipped undersides of boreal felt lichen) located high in trees. If thalli were identified, the following information was to be collected:

- Date and time;
- Coordinates;
- Tree species;
- Tree diameter (i.e., diameter at breast height);
- Location of lichen on tree (e.g., height above ground, side of tree, branch vs. trunk);
- Habitat description;
- Photographs; and
- Lichen species and abundance.

During all surveys, habitat type was identified first and later classified into an ecotype and sub-type. This was done to document habitat information related to lichen potential throughout the PA and LAA/RAA. Each habitat was then ranked according to its suitability for rare lichens as either low, moderate, or high:

- Low suitability: zero suitable habitat, or the conditions of potentially suitable habitats (e.g., balsam fir feathermoss and sphagnum forests) were not conducive to rare lichen growth (e.g., absence of *Frullania* or other indicators, dry conditions, age class).
- Moderate suitability: suitable but not fully supportive conditions for rare lichen growth (e.g., a low abundance of indicators or suitable conditions was observed).
- High suitability: conducive to rare lichen growth and has an adequate amount of indicators (e.g., indicator species growth/abundance, moisture regimes, humidity, closed-canopy, forest maturity level).

The following information was recorded at each site:

- Date and time;
- Coordinates;
- General habitat description;
- Dominant canopy vegetation;
- Vegetation inventory (including abundance percentages);
- Indicator species;
- Maturity level;
- Proximity to water and/or humidity conditions;
- Suitable phorophyte density; and
- Photographs.

Rare Lichen Indicators

Indicator species include relatively common lichens that are known to co-exist with rare lichens. Where mature forests with the environmental conditions suitable for rare lichens exist, they also provide these other lichens with suitable conditions to grow large and abundant, sometimes existing in a “showy” form. This indicates a healthy atmospheric environment that is likely suitable for rare lichen species (Sikumiut Environmental Management [SEM] Ltd., 2023). In addition, the general health and abundance of lichen growth in the PA was used as an indicator of habitat suitability.

The primary phorophyte for boreal felt lichen and vole ears lichen is mature balsam fir, which is the dominant tree species in forests throughout the PA, LAA, and RAA. For species like boreal felt lichen, the phorophyte alone cannot support the lichen without the existence of a liverwort (*Frullania*) (Cornejo & Scheidegger, 2016). The main species of *Frullania* in the PA is *Frullania asagrayana*. The water sacs

of *Frullania* host *Rhizonema*, the cyanobacteria partner which associates with the fungal hyphae of the boreal felt lichen to create a viable, synthesizing lichen and is essential for the existence of boreal felt lichen (Cornejo & Scheidegger, 2016). *Frullania* grows within closed canopy mature coniferous forests and was used as a primary indicator of the boreal felt lichen and vole ears lichen potential in a habitat (Cornejo & Scheidegger, 2016).

During a recent study of boreal felt lichen on the Avalon Peninsula, most thalli observed existed on balsam fir trees with a diameter at breast height (DBH) between 5.5 cm and 20 cm in mature balsam fir forests, where larger DBH trees (>20 cm) existed abundantly within the mature stand (SEM Ltd., 2023). This range of tree diameter was used as an indicator during surveys. Priority was given to trees with a highly suitable DBH first, followed by the adjacent larger trees.

Salted-shell lichen (*Coccocarpia palmicola*) is used as a secondary indicator species for boreal felt lichen as it occupies a similar niche and requires similar environmental conditions (see Figure D5-2.3-1 below – *Coccocarpia palmicola* is the slate-coloured foliose growth on the tree trunk). This species exists more abundantly than rare lichens and can often exist where rare lichens do not. However, it has been found to exist in almost all known boreal felt lichen sites and therefore is an effective indicator species. Other secondary indicator species include the healthy, large, or abundant growth of old man's beard lichens (*Usnea* spp.), tree coral (*Sphaerophorus* spp.), monkshood lichen (*Hypnogymnia physodes*), rag lichens (*Platismatia* spp.), veined lungwort (*Lobaria scrobiculata*), tree lungwort (*Lobaria pulmonaria*) tree coral (*Sphaerophorus globulus*), lobaria spp. (*Lobaria scrobiculata* & *Lobaria pulmonaria*) and various other lichens observed throughout mature coniferous forests.

Blue felt lichen is known to exist in areas of mature deciduous forest on yellow birch or non-native red maple (*Acer rubrum*) in Newfoundland (COSEWIC, 2010). Deciduous stands of sufficient size and age, proximal to humid conditions, and connected to intact mature forest stands, provide a good indicator of potential blue felt lichen presence. Indicator species such as those in the genus *Pannaria* can also indicate the presence of blue felt lichen (COSEWIC, 2010). Blue felt lichen may grow on the forest floor, on rock, and on substrate-level vegetation such as mosses. Consequently, while surveying for this species in deciduous habitats within the PA and opportunistically in the LAA/RAA, surveyors integrated substrate-level monitoring as well.



Figure D5-2.3-1 Abundant *Coccocarpia palimcola* growth on a mature balsam fir in the RAA.

3.0 Results

3.1 Desktop Study

Table D5-3.1-1 provides the conservation status of the four lichen SAR known for Newfoundland, according to the Newfoundland and Labrador **Endangered Species Act** (NL ESA), the federal **Species at Risk Act** (SARA), and the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (IUCN, 2024). Further information on the range of each species is provided below.

Table D5-3.1-1 Conservation status of lichen Species at Risk in Newfoundland.

Common Name	Scientific Name	NL ESA	SARA	IUCN Red List
Boreal felt lichen	<i>Erioderma pedicellatum</i>	Vulnerable	Special Concern	Critically Endangered
Vole ears lichen	<i>Erioderma mollissimum</i>	Endangered	Endangered	Not Evaluated
Blue felt lichen	<i>Pectenia plumbea</i>	Vulnerable	Special Concern	Not Evaluated
Wrinkled shingle lichen	<i>Pannaria lurida</i>	Vulnerable	Vulnerable	Not Evaluated

The AC CDC data request yielded two observations of boreal felt lichen in the RAA, both recorded in 2003, and demonstrated in Figure D5-3.2-1.

Boreal felt lichen

Boreal felt lichen prefers balsam fir (*Abies balsamea*) as its main phorophyte; however, in rare instances, it has been found on black spruce (*Picea mariana*), white spruce, red maple (*Acer rubrum*), or white birch (*Betula papyrifera*) (COSEWIC, 2014). Boreal felt lichen can typically be found in closed mature stands of forest, often on wetland margins, or in humid zones often where upland forested habitat meets lowland moist soils (COSEWIC, 2014). Most of the world's remaining boreal felt lichen occurs in Atlantic Canada, and the largest known population is in Newfoundland, representing more than 95% of its remaining global population (COSEWIC, 2014; Wiersma & Skinner, 2011). There are approximately 120 known locations of boreal felt lichen in Newfoundland, mostly concentrated on the Avalon Peninsula and near Bay D'Espoir (COSEWIC, 2014). AC CDC records contain two (2) observations of boreal felt lichen in the RAA, both recorded in 2003. These thalli are located on the western side of Come By Chance River, in a forest stand on a network of wetlands. The PA is within the species range for boreal felt lichen, and it is possible that thalli could be found here.

Blue felt lichen

Growing flat against phorophytes or occasionally on the ground, blue felt lichen is more like a crustose lichen; however, it is foliose (lobed and leaf-like) with flatter-growing and less dominant lobes. The known Newfoundland population exists on deciduous trees such as native yellow birch (*Betula alleghaniensis*) and on non-native maples. This species has also been found on white spruce (*Picea glauca*) in coastal zones on occasion where they occur next to abundant populations on deciduous trees (ECCC, 2022). Blue felt lichen, like other rare lichens, prefers a mature moist forest with high humidity, cool summer temperatures, and no airborne pollutants or acid rain (ECCC, 2022). The Canadian population of blue felt lichen is restricted to Atlantic Canada, and is most common in Nova Scotia (ECCC, 2022). There are several occurrences of blue felt lichen in Newfoundland, including populations on the Avalon Peninsula and to the northeast of Bay D'Espoir (ECCC, 2022). While there are no records in the PA, it is possible that blue felt lichen exists within Project boundaries.

Vole ears lichen (also known as “graceful felt lichen”)

Vole ears lichen has an extremely limited population of known thalli existing in Newfoundland. Much like boreal felt lichen, the preferred habitat of vole ears lichen includes humid forests with its exclusive host in Newfoundland, balsam fir (COSEWIC, 2021). Like boreal felt lichen, vole ears lichen most often occurs on balsam fir that are in or near wetlands on the transition line between mature upland and lowland forest with an enhanced moisture regime (Environment Canada, 2014). The Canadian population of vole ears lichen is concentrated in Nova Scotia and Newfoundland (COSEWIC, 2021). It is rarer in Newfoundland, with only thirty-two existing thalli known at four sites on the Avalon Peninsula, southeast of the PA (COSEWIC, 2021). However, the area of suitable habitat searched remains low (COSEWIC, 2021). Critical habitat for vole ears lichen in Newfoundland only includes portions of the Avalon Peninsula (ECCC, 2020); however, it is possible that suitable conditions for this lichen may exist within the PA.

Wrinkled shingle lichen

Wrinkled shingle lichen is rare in Canada, with only 56 known occurrences across the country (COSEWIC, 2016). There are only two known occurrences in Newfoundland, one on the Great Northern Peninsula and one in southwestern Newfoundland (COSEWIC, 2016). Additionally, these occurrences are on coastal white spruce on a cliff edge, an unusual habitat choice based on their preference to colonize mature deciduous trees such as red maple (COSEWIC, 2016). The PA is not within the species range for wrinkled shingle lichen (COSEWIC, 2016; NatureServe, 2020). There is a low likelihood that wrinkled shingle lichen exists within the PA.

3.2 Habitat Suitability Mapping

A habitat suitability map for rare lichens was generated through use of aerial imagery, Project ELC mapping, and the results of ground truthing exercises. This map is presented below as Figure D5-3.2-1.

The LAA, RAA, and PA contain coniferous forests dominated by balsam fir, alongside pockets of mixedwood forests of mainly white birch (*Betula papyrifera*). It is likely that stands of yellow birch exist to a lesser extent throughout the area, as is characteristic of the Maritime Barrens Ecoregion. These habitats may provide suitable conditions for blue felt lichen where environmental conditions allow. Based on the AC CDC request files, there are two (2) historic occurrences of boreal felt lichen north-northwest of Come By Chance and west of the PA. Proximity to other known populations further increases the likelihood of their presence. This indicates an elevated potential for boreal felt lichen thalli in the RAA. Additionally, known occurrences of blue felt lichen on yellow birch and non-native species on the Avalon increases the potential for this species to exist within similar habitat types in the LAA, RAA, and PA. However, the differing ecological conditions and poor habitat connectivity associated with much of the PA decreases its potential for rare lichen species. In another sense, it is likely that these same factors may lead to a lessened effect of diminished air quality from anthropogenic sources, thereby increasing the likelihood that these habitats may host rare lichens. The habitat suitability map in combination with knowledge of habitat preferences were used to direct survey efforts in high-potential habitat throughout the PA.

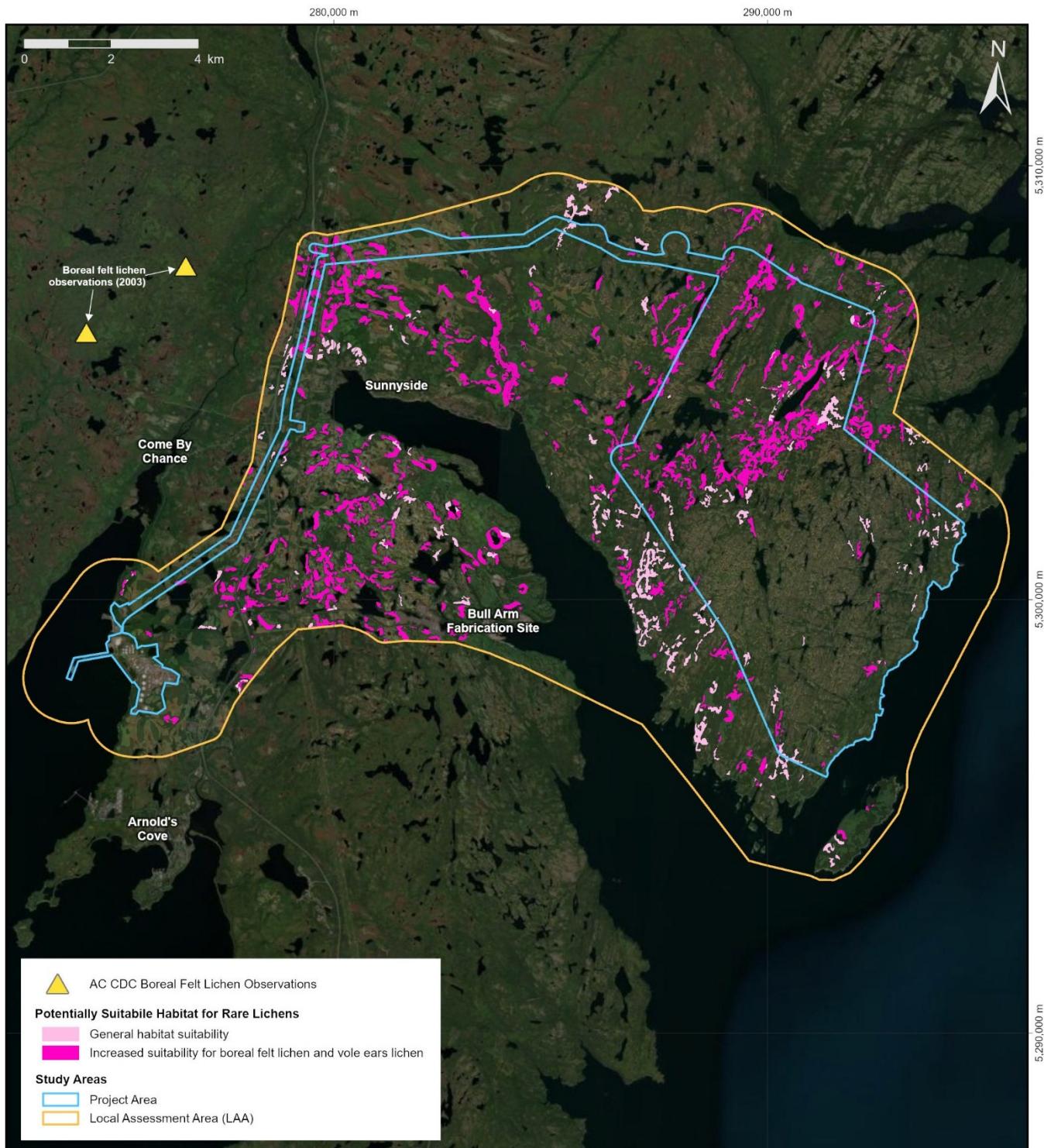


	FIGURE TITLE:	PREPARED BY: C. Burke DATE: 13/06/2025	
	Rare Lichens Habitat Suitability Map	REVIEWED BY: C. Bursey 13/06/2025	APPROVED BY: C. Collins 13/06/2025
PROJECT TITLE:		CRS: WGS 1984 UTM Zone 22N	
North Atlantic Wind to Hydrogen Project			
SEM MAP ID: 016-015-GIS-407-Rev0			

Figure D5-3.2-1 Rare lichens habitat suitability map.

3.3 Field Surveys

During devoted and opportunistic rare lichen surveys conducted in the PA, LAA, and RAA combined (n=142), 85% of lichen survey points were ranked at a low habitat suitability. Only 11% of survey points were ranked at a moderate habitat suitability, while 4% of the habitats surveyed were ranked at a high suitability.

Zero (0) boreal felt lichen, vole ears lichen, or blue felt lichen thalli were observed within the habitats surveyed, despite intensive surveys in each high and moderate ranked site identified. The two (2) known boreal felt lichen thalli indicated by AC CDC are positioned well outside of the PA and spillover likely does not expand into the zone of potential Project development. Areas west of the PA have higher potential based on the connectivity of suitable habitat to those known thalli, but during surveys along the proposed Project access road and transmission line corridor, suitable habitat was observed to be marginal in abundance and no thalli were observed. Areas of coastal white spruce were surveyed for the potential of wrinkled shingle lichen on an opportunistic basis, but zero (0) wrinkled shingle lichen thalli were observed.

3.3.1 Project Area

Zero (0) rare lichen thalli were observed at the 55 sites surveyed in the PA (Figure D5-3.3-1). For boreal felt lichen and vole ears lichen, 80% of habitats surveyed were ranked at a low habitat suitability, 11% were ranked moderate, and only 9% were ranked high. Several areas of pure birch or mixedwood forests were surveyed specifically for blue felt lichen in addition to boreal felt lichen and vole ears lichen. However, it was determined that white birch was the dominant species occupying the canopy in these zones, and not the yellow birch known to host this species. Thus, 100% of the potential sites for blue felt lichen were ranked at a low habitat suitability. Lichen survey locations, habitat type, and suitability rankings for the PA are presented as Appendix D5-1.

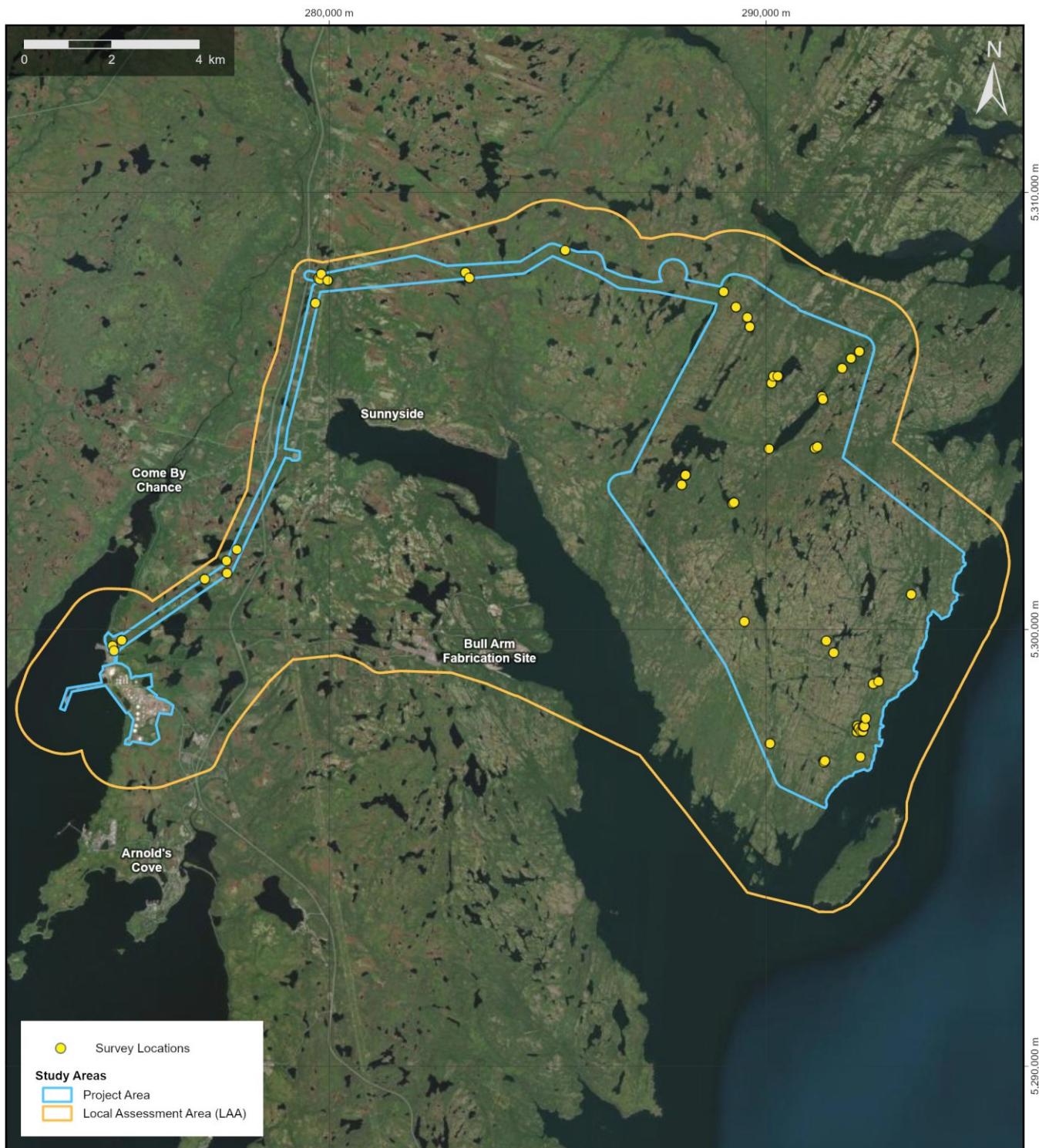


	FIGURE TITLE:	NOTES:	PREPARED BY:	DATE:
	Rare Lichen Survey Locations - PA		J. Crocker	10/07/2025
PROJECT TITLE:	North Atlantic Wind to Hydrogen Project		REVIEWED BY:	C. Bursey 10/07/2025
			APPROVED BY:	C. Collins 10/07/2025
			GRS:	WGS 1984 UTM Zone 22N
			sem	

SEM MAP ID: 016-015-GIS-526-Rev0

Figure D5-3.3-1 Rare lichens survey locations – Project Area.

3.3.2 LAA and RAA

Zero (0) rare lichen thalli were observed during surveys in the LAA and RAA, which represented 87 sites along the Isthmus of Avalon near Chance Cove, Southern Harbour, and Come By Chance (Figure D5-3.3-2). For boreal felt lichen and vole ears lichen, 89% of habitats surveyed were ranked at a low habitat suitability, 10% were ranked moderate, and only 1% were ranked high. Surveys were only conducted in the LAA and RAA opportunistically, with a focus on habitat types that had indicators for vole ears lichen and boreal felt lichen (e.g., balsam fir feathermoss forest).

Yellow birch stands likely exist throughout the RAA; however, no specific yellow birch sites were observed throughout terrestrial studies. All sites (100%) surveyed for blue felt lichen were ranked at a low habitat suitability. Numerous areas of coastal white spruce occur, but those surveyed were reduced in lichen growth in general, and no wrinkled shingle lichen was observed. Lichen survey locations, habitat type, and suitability rankings for the LAA/RAA are presented as Appendix D5-2.

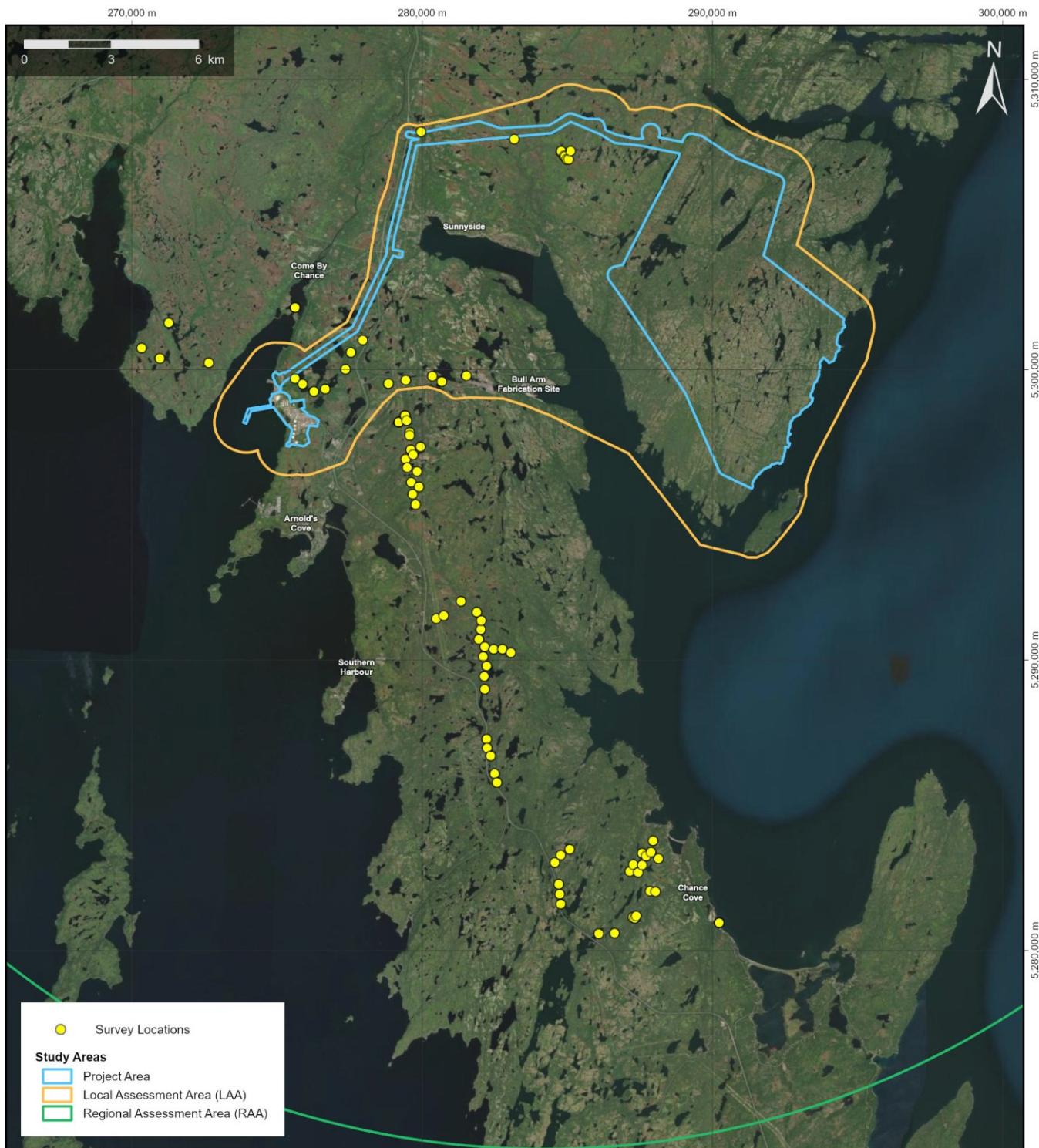


	FIGURE TITLE:	NOTES:	PREPARED BY:	DATE:
	Rare Lichen Survey Locations - RAA/LAA			
PROJECT TITLE:	North Atlantic Wind to Hydrogen Project		REVIEWED BY:	C. Bursey 10/07/2025
			APPROVED BY:	C. Collins 10/07/2025
			GRS:	WGS 1984 UTM Zone 22N
			sem	

SEM MAP ID: 016-015-GIS-526-Rev0

Figure D5-3.3-2 Rare lichens survey locations – LAA/RAA.

4.0 Discussion

A thorough program of habitat suitability mapping identified limited potential habitat, and extensive field surveys failed to identify any rare lichen thalli in the PA, LAA, or RAA. It is highly unlikely that rare lichens exist in the PA, and if present, they would be at a very low abundance.

On the Avalon Peninsula, known occurrences of boreal felt lichen often exist in mature balsam fir forests adjacent to wetlands. Where habitat connectivity exists between large boreal felt lichen populations and areas with suitable habitat and similar features, those sites will often also host thalli. This is evidenced in the Lockyer's Waters and Hall's Gullies populations, which are connected through a network of watersheds. Boreal felt lichen thalli may also exist quite randomly without much indication of spillover effects. This could be due to historical changes in habitat which fragmented the continuous suitable habitat likely connecting the extant thalli to a larger population at one time. The potential for boreal felt lichen on the Avalon Peninsula diminishes towards the coastlines. These areas tend to be fragmented by development, which often occurs along coastal areas.

The existing boreal felt lichen thalli near the Come By Chance River exist in a similar habitat type to the central Avalon Peninsula boreal felt lichen. Similar conditions are present leading east toward the PA, existing mainly as broad wetland networks on relatively flat terrain until the topography becomes hillier and rockier toward Centrehill and onward east toward the rocky upland areas of the PA. Several points along the proposed access road and transmission line corridor were examined during rare lichen surveys and no boreal felt lichen or vole ears lichen thalli were observed.

Yellow birch was not observed in the PA; in the absence of this phorophyte, it is unlikely that blue felt lichen is present.

5.0 References

Committee on the Status of Endangered Wildlife in Canada. (2010). *COSEWIC assessment and status report on the blue felt lichen (*Degelia plumbea*) in Canada*. Environment and Climate Change Canada. https://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_blue_felt_lichen_0911_eng.pdf

Committee on the Status of Endangered Wildlife in Canada. (2014). *COSEWIC assessment and status report on the boreal felt lichen (*Erioderma pedicellatum*), boreal population and Atlantic population, in Canada*. Environment and Climate Change Canada. https://wildlife-species.az.ec.gc.ca/species-risk-registry/virtual_sara/files/cosewic/sr_Boreal%20Felt%20Lichen_2014_e.pdf

Committee on the Status of Endangered Wildlife in Canada. (2016). *COSEWIC assessment and status report on the wrinkled shingle lichen (*Pannaria lurida*) in Canada*. Environment and Climate Change Canada. https://wildlife-species.az.ec.gc.ca/species-risk-registry/virtual_sara/files/cosewic/sr_Wrinkled%20Shingle%20Lichen_2016_e.pdf

Committee on the Status of Endangered Wildlife in Canada. (2021). *COSEWIC assessment and status report on the vole ears lichen (*Erioderma mollissimum*) in Canada*. Environment and Climate Change Canada. https://ecprccsarstacct.z9.web.core.windows.net/files/SARAFiles/legacy/cosewic/sr%20Vole%20Ears%20Lichen%202021_e.pdf

Cornejo, C., & Scheidegger, C. (2016). Cyanobacterial gardens: The liverwort *Frullania asagrayana* acts as a reservoir of lichen photobionts. *Environmental Microbiology Reports*, 8(3), 352-357. <https://doi.org/10.1111/1758-2229.12386>

NL Department of Fisheries, Forestry, and Agriculture. (2025). *FFA: Land cover: Newfoundland [Geospatial dataset]*. Government of Newfoundland and Labrador. <https://geohub-gnl.hub.arcgis.com/maps/ea86e8a2a296425bb4eff8fb8ee40f97/about>

Endangered Species Act (SNL 2001, c. E-10.1). <https://www.assembly.nl.ca/legislation/sr/statutes/e10-1.htm>

Environment and Climate Change Canada. (2020). *Action plan for the boreal felt lichen (*Erioderma pedicellatum*) (Atlantic population) and vole ears lichen (*Erioderma mollissimum*) in Canada*. https://ecprccsarstacct.z9.web.core.windows.net/files/SARAFiles/legacy/plans/ap_boreal_felt_lichen_atlantic_pop_and_vole_ears_lichen_e_final.pdf

Environment and Climate Change Canada. (2022). *Management plan for the blue felt lichen (*Degelia plumbea*) in Canada*. https://wildlife-species.az.ec.gc.ca/species-risk-registry/virtual_sara/files/plans/mp_blue_felt_lichen_e_final.pdf

Environment Canada. (2014). *Recovery strategy for the vole ears lichen (*Erioderma mollissimum*) in Canada*. https://wildlife-species.az.ec.gc.ca/species-risk-registry/virtual_sara/files/plans/rs_vole_ears_lichen_e_final.pdf

International Union for the Conservation of Nature. (2024). The IUCN red list of threatened species [Version 2024-1]. <https://www.iucnredlist.org/>

Lauriault, P. N. (2020). An effective detection strategy and determining critical habitat characteristics for boreal felt lichen (*Erioderma pedicellatum*) in Newfoundland, Canada [Master's thesis, Memorial University of Newfoundland]. Memorial University Research Repository. <https://research.library.mun.ca/14524/1/thesis.pdf>

NatureServe Canada. (2020). [Ecosystem-based Automated Range (EBAR) for *Pannaria lurida*, Version 1.0, Expert Reviewed (National) (Canadian Scope)]. Retrieved September 6, 2024 from <https://gis.natureserve.ca/download/EBAR123522N.pdf>

Schmitt, C.K., & Slack, N.G. (1990). Host specificity of epiphytic lichens and bryophytes: A comparison of the Adirondack Mountains (New York) and the southern Blue Ridge Mountains (North Carolina). *The Bryologist*, 93(3), 257-274. <https://doi.org/10.2307/3243509>

Sikumiut Environmental Management Ltd. (2023). *Boreal felt lichen field survey and mitigation 94L transmission line: J to K*. Internal SEM report: unpublished.

Species at Risk Act (S.C. 2002, c. 29). <https://laws.justice.gc.ca/eng/acts/s-15.3/page-10.html>

Sprugel, D. G. (1984). Density, biomass, productivity, and nutrient-cycling changes during stand development in wave-regenerated balsam fir forests. *Ecological Monographs*, 54(2), 165-186. <https://doi.org/10.2307/1942660>

Wiersma, Y. F., & Skinner, R. (2011). Predictive distribution model for the boreal felt lichen *Erioderma pedicellatum* in Newfoundland, Canada. *Endangered Species Research*, 15, 115-127. <http://dx.doi.org/10.3354/esr00374>

Appendix D5-1: Lichen Survey Data for the PA

Habitat Type	Habitat Suitability Ranking		Coordinates
	Boreal felt lichen & vole ears lichen	Blue felt lichen	
Balsam fir - feathermoss/sphagnum forest	High	Low	-53.775317, 47.793544
Anthropogenic shrub meadow	Low	Low	-54.0048935, 47.81063042
Black spruce - kalmia heathland	Low	Low	-54.00439301, 47.80964474
Anthropogenic shrub meadow	Low	Low	-54.00205745, 47.81186064
Balsam fir - feathermoss/sphagnum forest	Low	Low	-53.97757151, 47.82503929
Wetland bog	Low	Low	-53.97109079, 47.82900532
Wetland bog	Low	Low	-53.9707539, 47.82644626
Wetland bog	Low	Low	-53.96802378, 47.83143909
Balsam fir - feathermoss forest	Low	Low	-53.94699889, 47.88267302
Black spruce - feathermoss forest	Low	Low	-53.94637329, 47.88781911
Balsam fir - feathermoss forest	Low	Low	-53.94582127, 47.88759804
Balsam fir - feathermoss forest	Low	Low	-53.94543746, 47.88871502
Eastern larch stand	Low	Low	-53.94341787, 47.8874495
Balsam fir - feathermoss/sphagnum forest	Low	Low	-53.90147834, 47.89018008
Wetland bog	Low	Low	-53.90011821, 47.88905892
Balsam fir - sphagnum forest	Moderate	Low	-53.87114318, 47.89553174
Balsam fir - feathermoss forest	Low	Low	-53.83295304, 47.84816421
Balsam fir - feathermoss forest	Low	Low	-53.83201337, 47.85010026
Balsam fir - feathermoss forest	Low	Low	-53.83178341, 47.85021171
Balsam fir - feathermoss forest	Low	Low	-53.82228429, 47.88816933
Anthropogenic meadow	Low	Low	-53.81827825, 47.88511571
Balsam fir - feathermoss/sphagnum forest	Low	Low	-53.81716529, 47.84469629
Balsam fir - kalmia heathland	Low	Low	-53.81675569, 47.84487752
Balsam fir - feathermoss forest	Low	Low	-53.8147625, 47.88303451
Balsam fir - feathermoss forest	Low	Low	-53.81383991, 47.88111296
Balsam fir - feathermoss forest	Low	Low	-53.8122217, 47.82050511
Balsam fir - feathermoss forest	Low	Low	-53.80660364, 47.85625207
Balsam fir - feathermoss/sphagnum forest	Moderate	Low	-53.80657791, 47.86977615
White birch - fern	Low	Low	-53.80600098, 47.87120598
Wetland - valley stream pool	Low	Low	-53.80468006, 47.87123511
Balsam fir - feathermoss/sphagnum forest	High	Low	-53.80295251, 47.79559204
Balsam fir - kalmia heathland	Low	Low	-53.79259046, 47.85669421
Balsam fir - feathermoss forest	Moderate	Low	-53.79183079, 47.85694877
Black spruce - feathermoss forest	Low	Low	-53.7909952, 47.86736366
Mixedwood - feathermoss sphagnum forest	Low	Low	-53.79071506, 47.8667312
NA	Low	Low	-53.78700364, 47.81708924
Wetland - valley stream pool	Low	Low	-53.78633862, 47.79217118
Black spruce - kalmia heathland	Low	Low	-53.78617325, 47.7924386

Habitat Type	Habitat Suitability Ranking		Coordinates
	Boreal felt lichen & vole ears lichen	Blue felt lichen	
Balsam fir - feathermoss/sphagnum forest	Low	Low	-53.78508436, 47.87327801
Balsam fir - feathermoss/sphagnum forest	Low	Low	-53.78461549, 47.81470788
Black spruce - feathermoss forest	Low	Low	-53.78249729, 47.87540853
Wetland - fen	Low	Low	-53.7800075, 47.87686841
Balsam fir - sphagnum forest	Low	Low	-53.77667197, 47.79864636
Balsam fir - feathermoss forest	Low	Low	-53.77652468, 47.79990815
Balsam fir - feathermoss/sphagnum forest	Moderate	Low	-53.77605531, 47.79936447
Balsam fir - feathermoss/sphagnum forest	High	Low	-53.77605531, 47.79936447
Wetland - treed bog	High	Low	-53.77540682, 47.79884845
Balsam fir - feathermoss forest	Moderate	Low	-53.77489236, 47.79879439
Balsam fir - kalmia heathland	Low	Low	-53.77475186, 47.79981474
Balsam fir - feathermoss forest	High	Low	-53.77454539, 47.7998732
Black spruce scrub	Low	Low	-53.7743663, 47.79981968
Balsam fir - feathermoss/sphagnum forest	Moderate	Low	-53.7740786, 47.80143649
Balsam fir - feathermoss forest	Low	Low	-53.77215521, 47.80860468
Black spruce - kalmia heathland	Low	Low	-53.77062171, 47.80921298
Black spruce - feathermoss forest	Low	Low	-53.76157495, 47.82736059

Appendix D5-2: Lichen Survey Data for the LAA and RAA

Habitat Type	Habitat Suitability Ranking		Coordinates	Survey Area
	Boreal felt lichen & vole ears lichen	Blue felt lichen		
Anthropogenic shrub meadow	Low	Low	-53.99706954, 47.81141321	LAA
Anthropogenic shrub meadow	Low	Low	-53.99351638, 47.80989625	LAA
Wetland bog	Low	Low	-53.98837263, 47.80776282	LAA
Anthropogenic shrub meadow	Low	Low	-53.98320786, 47.80857845	LAA
Balsam fir - kalmia heathland	Low	Low	-53.97426362, 47.81495257	LAA
Balsam fir - feathermoss forest	Low	Low	-53.97186781, 47.82016521	LAA
Wetland bog	Low	Low	-53.96669045, 47.82416912	LAA
Anthropogenic shrub meadow	Low	Low	-53.9541334, 47.81105199	LAA
Wetland bog	Low	Low	-53.94630004, 47.81223912	LAA
Anthropogenic shrub meadow	Low	Low	-53.94350217, 47.88941171	LAA
Anthropogenic shrub meadow	Low	Low	-53.93401774, 47.81377279	LAA
Wetland - treed fen	Moderate	Low	-53.92962808, 47.81232893	LAA
Wetland bog	Low	Low	-53.91838508, 47.81436505	LAA
Balsam fir - feathermoss forest	Low	Low	-53.90049138, 47.88818504	LAA
Balsam fir - feathermoss/sphagnum forest	Low	Low	-53.87874627, 47.88466248	LAA
Beach	Low	Low	-53.87871123, 47.88502517	LAA
Balsam fir - feathermoss/sphagnum forest	Low	Low	-53.877213, 47.88359142	LAA
Balsam fir - feathermoss/sphagnum forest	Low	Low	-53.87680651, 47.88344673	LAA
Balsam fir - feathermoss/sphagnum forest	Moderate	Low	-53.87600172, 47.8825516	LAA
Balsam fir - feathermoss forest	Moderate	Low	-53.87508349, 47.88247426	LAA
Wetland - fen	Low	Low	-53.87436733, 47.88517205	LAA
Black spruce - kalmia heathland	Moderate	Low	-54.06821575, 47.81905396	RAA
Wetland - fen	Low	Low	-54.05965844, 47.8160692	RAA
Black spruce - feathermoss forest	Moderate	Low	-54.05624311, 47.82718606	RAA
Black spruce - kalmia heathland	Low	Low	-54.03721143, 47.81533921	RAA
Beach	Low	Low	-53.99832904, 47.8333897	RAA
Anthropogenic meadow	Low	Low	-53.94868143, 47.79924651	RAA
Balsam fir - feathermoss forest	Low	Low	-53.94865714, 47.79927415	RAA
Anthropogenic shrub meadow	Low	Low	-53.94606243, 47.80128894	RAA
Mixedwood forest	Low	Low	-53.94595189, 47.80125387	RAA
Mixedwood forest	Low	Low	-53.94518353, 47.79970427	RAA
Wetland bog	Low	Low	-53.94496706, 47.78787137	RAA
Wetland - fen	Low	Low	-53.94413926, 47.78526583	RAA
Mixedwood - sphagnum forest	Moderate	Low	-53.94364172, 47.79611079	RAA
Mixedwood forest	Low	Low	-53.94342658, 47.79526012	RAA
Anthropogenic shrub meadow	Low	Low	-53.94279776, 47.79074467	RAA
Black spruce - kalmia heathland	Low	Low	-53.94204567, 47.78078067	RAA
Black spruce - kalmia heathland	Low	Low	-53.94164124, 47.7893098	RAA
Wetland - fen	Low	Low	-53.94122244, 47.77709911	RAA

Habitat Type	Habitat Suitability Ranking		Coordinates	Survey Area
	Boreal felt lichen & vole ears lichen	Blue felt lichen		
Wetland - fen	Low	Low	-53.93960515, 47.77383814	RAA
Mixedwood forest	Low	Low	-53.93945336, 47.78422456	RAA
Balsam fir regen	Low	Low	-53.9383112, 47.77947621	RAA
Black spruce scrub	Low	Low	-53.93820115, 47.79182014	RAA
Anthropogenic shrub meadow	Low	Low	-53.92796726, 47.7388755	RAA
Wetland - fen	Low	Low	-53.92482925, 47.73992338	RAA
Wetland - fen	Low	Low	-53.91703167, 47.7445244	RAA
Wetland - fen	Low	Low	-53.90971882, 47.74131988	RAA
Balsam fir - kalmia heathland	Low	Low	-53.9082024, 47.73297905	RAA
Balsam fir - feathermoss forest	Low	Low	-53.90746696, 47.73607568	RAA
Mixedwood forest	Low	Low	-53.90742577, 47.73873755	RAA
Anthropogenic meadow	Low	Low	-53.90584371, 47.7276718	RAA
Wetland - fen	Low	Low	-53.90545816, 47.73066622	RAA
Wetland - fen	Low	Low	-53.90516077, 47.72158572	RAA
Anthropogenic shrub meadow	Low	Low	-53.90460181, 47.71753415	RAA
Wetland - fen	Low	Low	-53.9040739, 47.72470057	RAA
Balsam fir - feathermoss forest	Low	Low	-53.90298591, 47.70213446	RAA
Anthropogenic shrub meadow	Low	Low	-53.90253592, 47.69946462	RAA
Anthropogenic meadow	Low	Low	-53.90122918, 47.73008973	RAA
Balsam fir - kalmia heathland	Low	Low	-53.90078791, 47.69696982	RAA
Balsam fir - feathermoss forest	Low	Low	-53.89859355, 47.69160016	RAA
Balsam fir - feathermoss/sphagnum forest	Low	Low	-53.89733942, 47.68879629	RAA
Mixedwood - feathermoss sphagnum forest	Low	Low	-53.89718345, 47.73010649	RAA
Mixedwood forest	Low	Low	-53.89330855, 47.72924382	RAA
Anthropogenic shrub meadow	Low	Low	-53.86961114, 47.66477302	RAA
Balsam fir - feathermoss/sphagnum forest	Low	Low	-53.86741768, 47.65800156	RAA
Wetland - hilltop pond	Low	Low	-53.86686237, 47.66706996	RAA
Anthropogenic heathland	Low	Low	-53.86670114, 47.65500903	RAA
Anthropogenic shrub meadow	Low	Low	-53.86621104, 47.65193241	RAA
Wetland bog	Low	Low	-53.86295082, 47.66904565	RAA
Wetland - hilltop pond	Low	Low	-53.84814528, 47.64319656	RAA
Wetland bog	Low	Low	-53.84091905, 47.64359914	RAA
Balsam fir - feathermoss/sphagnum forest	High	Low	-53.83511972, 47.6628573	RAA
Balsam fir regen	Low	Low	-53.83365534, 47.66508668	RAA
Wetland - hilltop pond	Low	Low	-53.83281709, 47.64863303	RAA
Balsam fir - feathermoss/sphagnum forest	Moderate	Low	-53.83201209, 47.6483902	RAA
N/A	Moderate	Low	-53.83121793, 47.64912934	RAA
Black spruce - kalmia heathland	Low	Low	-53.83109276, 47.66264999	RAA
Balsam fir - feathermoss forest	Moderate	Low	-53.8296172, 47.66859231	RAA

Habitat Type	Habitat Suitability Ranking		Coordinates	Survey Area
	Boreal felt lichen & vole ears lichen	Blue felt lichen		
Black spruce - kalmia heathland	Low	Low	-53.82957946, 47.66502995	RAA
Black spruce scrub	Low	Low	-53.82775684, 47.66778438	RAA
Black spruce - kalmia heathland	Low	Low	-53.82552247, 47.66910955	RAA
Black spruce scrub	Low	Low	-53.82542387, 47.65697663	RAA
Wetland - fen	Low	Low	-53.82495891, 47.67259679	RAA
Wetland bog	Low	Low	-53.82290838, 47.65684106	RAA
Wetland bog	Low	Low	-53.82212287, 47.66721018	RAA
White birch - fern	Low	Low	-53.79333014, 47.64796541	RAA
Beach	Low	Low	-53.79332061, 47.64797381	RAA