



**DILLON**  
CONSULTING

NATURAL FORCES DEVELOPMENTS LP

## **Wetland Surveys**

Benjamins Mill Wind Project - Appendix G

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**1.0**

## Introduction

The Proponent engaged the expertise of Dillon Consulting Limited (Dillon) to complete the biophysical surveys for the Benjamins Mill Wind Project (Project), including wetland surveys. Surveys were completed by qualified wetland delineators with Nova Scotia Environment and Climate Change (NSECC formally NSE) approved wetland delineation certification. Dillon has been involved in several resource development projects in Atlantic Canada and has assisted many proponents through the provincial EA processes.

**1.1**

### Scope of Work

For the purposes of this EA registration document, the following definition of a wetland is adopted from the NSE Proponent guide:

Wetlands – Land commonly referred to as marshes, swamps, fens, bogs, and shallow water areas that are saturated with water long enough to promote wetland or aquatic processes. Salt marshes are also wetlands.

The scope of work included a desktop and field assessment of wetlands within the Terrestrial Local Assessment Area (LAA). Based on preliminary turbine sighting studies, Natural Forces identified lands where wetland surveys were required (i.e., within the LAA for the Terrestrial Environment Valued Ecosystem Component [VEC]), which are presented on Figure G-1 below and included the following:

- 50 m buffers along either side of the roads required to access turbine sites during construction and operation;
- 50 m buffers along powerline infrastructure;
- 150 m buffers around substations and ancillary equipment; and
- 150 m buffers around turbine bases.

**2.0**

## Desktop Survey

A wet areas model was developed using GIS (Geographical Information Systems) to predict potential watercourse and wetland crossings not mapped in provincial or wetland watercourse datasets. This process relies heavily upon the availability of LiDAR Digital Elevation Models (DEM), which are freely available in Nova Scotia. A flow accumulation analysis was completed to determine the area that flows into each cell within the study area. Using these data and applying a suitable threshold is a useful predictor of watercourses, potential watercourses, and drainage channels within a study area. The potential watercourses and drainage channels are then used as an input into potential wet areas modeling.

Wet areas modeling involves comparing the elevations of each cell in a study area against the elevation of the nearest known mapped water features (lakes, rivers, wetlands, etc.). Where there are small differences in the ground elevation against these features (i.e., less than 1 m) these areas can be good predictors of potential wet areas. The predicted watercourse crossings and wet areas were compared against aerial imagery and included as potential constraints in the preliminary layout design.

### 3.0 Field Survey

The wetland field survey included the field verification and preliminary delineation of wetlands within the LAA as predicted based on wet areas modeling. Field surveys of the wetlands in the LAA were conducted between August and September 30, 2021 by experienced biologists/scientists that are certified in wetland identification and delineation.

The methods of wetland determination and delineation are based upon established protocols for wetland delineation, which are outlined in the US Army Corps of Engineers Wetland Delineation Manual (Environmental Laboratory, 1987/2010). Wetland determination and delineation is primarily focused upon establishing the wetland-upland edge, and is based upon the presence of positive indicators for three parameters, including:

- Hydric (wet) soil conditions;
- Hydrophytic (wet adapted) vegetation; and
- Wetland hydrology.










The focus of the preliminary wetland assessment was to verify the delineation of the wetlands that were predicted during the desktop assessment within the LAA. For this, a two parameter system was established at representative locations within the field identified wetlands based on the presence of hydrophytic vegetation and wetland hydrology. Wetland edges were georeferenced using a handheld Global Positioning System (GPS) (3 to 5 m accuracy).

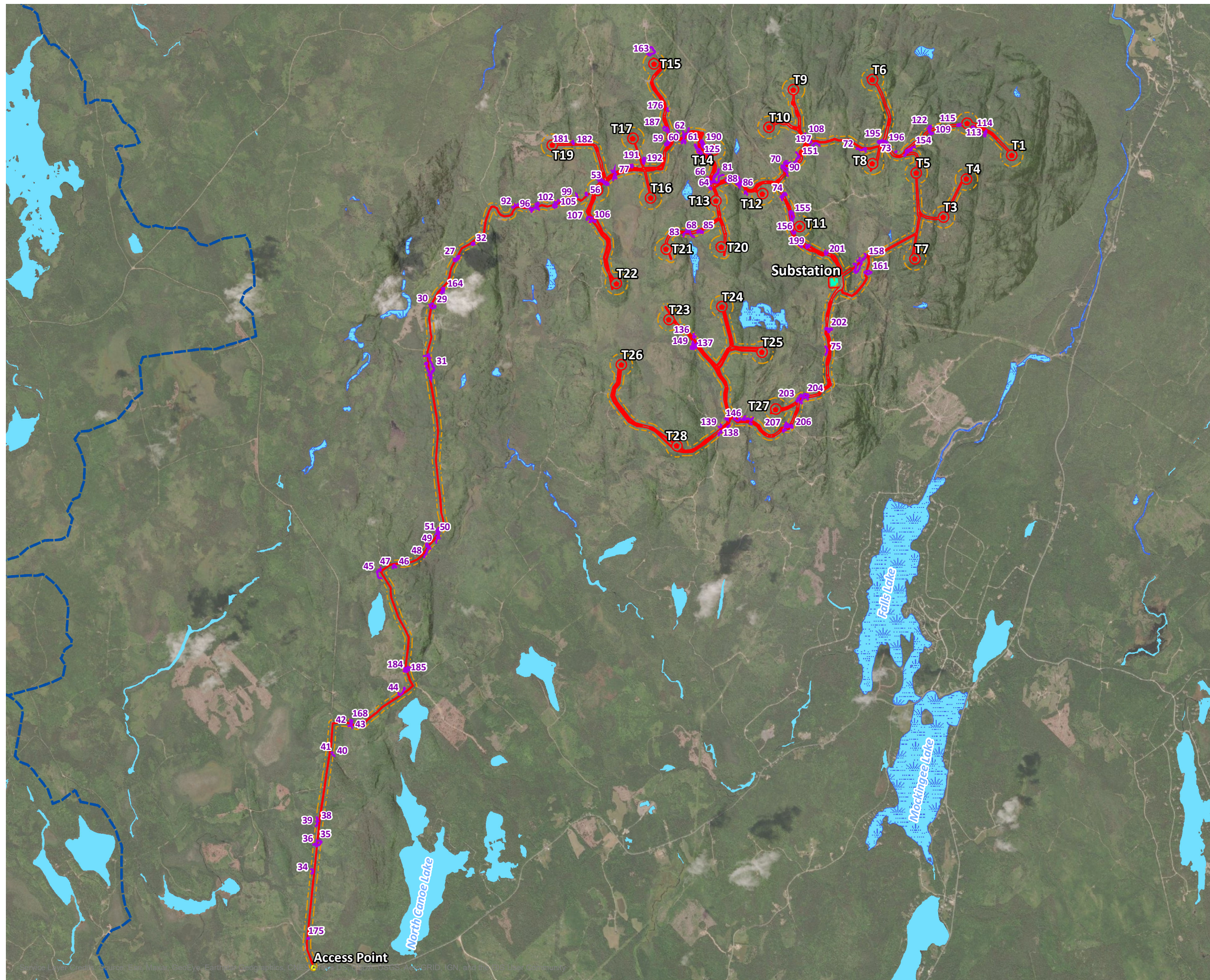
### 4.0 Results

Wetlands identified within the assessment area are shown in Figure G-1 and described in Table G-1. Over 107 wetlands were identified, approximately 32 ha of which are located within the LAA. Of these wetlands, the majority are treed and shrub swamps, however, many bogs and fens are also present on the landscape.

**TERRESTRIAL LOCAL ASSESSMENT  
AREA - WETLANDS**

FIGURE G-1

-  Proposed Access Point
-  Proposed Turbine Location
-  Substation
-  Project Development Area
-  Local Assessment Area
-  Preliminary Field Delineated Wetland
-  Wetland
-  Waterbody
-  Watershed Boundary



MAP DRAWING INFORMATION:  
DATA PROVIDED BY DILLON CONSULTING, GEONB, NATURAL FORCES

MAP CREATED BY: MEC  
MAP CHECKED BY: KB  
MAP PROJECTION: NAD 1983 UTM ZONE 20N

The proposed Project footprint was designed in consultation with biologists and the selected locations for the WTGs are in areas without wetlands and watercourses. Some wetlands will be impacted by road construction during Phase I of the project if the current road layout is selected; however, by utilization the existing road network, the possible impacts to wetlands from the Project activities will be greatly minimized. Approximately 94 of the wetlands included in the preliminary assessment were located adjacent to existing site roads and have likely experienced impacts from previous and current site activity. The existing conditions are to be confirmed prior to construction and the wetlands with the potential to be impacted will be functionally assessed using the WESP-AC protocol (outlined below).

## 5.0 Functional Assessment

Prior to the construction phase of the Project and once the Project layout is finalized, a functional assessment of wetlands on-site or downstream that may be impacted will be conducted. The Wetland Ecosystem Services Protocol-Atlantic Canada (WESP-AC) is a standardized approach to the way data is collected and interpreted to indirectly yield relative estimates of a wide variety of important wetland functions and their associated benefits.

WESP-AC generates scores (0 to 10 scale) and ratings (Lower, Moderate, Higher) for a variety of wetland functions using visual assessments of weighted ecological indicators. The number of indicators that is applied to estimate a particular wetland function depends on which function is being assessed. The indicators are then combined in a spreadsheet using logic-based, mathematical models to generate the score and rating for each wetland function and benefit. Together they provide a profile of “what a wetland does.” For each function, the scores and ratings represent a particular wetland’s standing relative to those in a statistical sample of non-tidal wetlands previously assessed in the Province (Adamus, 2018).

**Table G-1: 2021 Preliminary Wetland Assessment Summary**

**Wetlands 27 and 33**

Class: Swamp  
 Approximate Size: 0.14 ha  
 Delineated Size within the AA: 0.13 ha



**Wetland 28**

Class: Swamp  
 Approximate Size: 0.7 ha  
 Delineated Size within the AA: 0.04 ha



**Wetlands 29 and 30**

Class: Swamp (with wet meadow and shrub swamp elements)  
 Approximate Size: 0.31 ha  
 Delineated Size within the AA: 0.7 ha



**Wetland 31**

Class: Swamp (shrub)  
 Approximate Size: 13.3 ha  
 Delineated Size within the AA: 2.14 ha



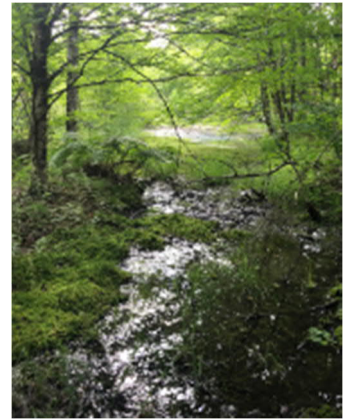
**Wetland 32**

Class: Swamp  
 Approximate Size: 0.07 ha  
 Delineated Size within the AA: 0.07 ha



**Wetland 35**

Class: Swamp  
 Approximate Size: 11.4 ha  
 Delineated Size within the AA: 0.34 ha



**Wetland 34**

Class: Swamp (mixed-wood treed)  
 Approximate Size: 3.6 ha  
 Delineated Size within the AA: 0.2 ha

**Wetlands 36 and 37**

Class: Swamp (mixed-wood treed)  
 Approximate Size: 0.44 ha  
 Delineated Size within the AA: 0.04 ha

**Wetlands 38 and 39**

Class: Swamp (mixed-wood treed)  
 Approximate Size: 2.5 ha  
 Delineated Size within the AA: 0.25 ha

**Wetland 40**

Class: Swamp (mixed-wood treed)  
 Approximate Size: 0.48 ha  
 Delineated Size within the AA: 0.18 ha

**Wetland 41**

Class: Swamp (mixed-wood treed)  
 Approximate Size: 0.12 ha  
 Delineated Size within the AA: 0.05 ha

**Wetland 45**

Class: Swamp (mixed-wood treed)  
 Approximate Size: 5.27 ha  
 Delineated Size within the AA: 0.6 ha

**Wetlands 42 and 43**

Class: Swamp

Approximate Size: 1.7 ha

Delineated Size within the AA: 0.15 ha



**Wetland 44**

Class: Swamp

Approximate Size: 3.15 ha

Delineated Size within the AA: 0.53 ha



**Wetlands 46 and 47**

Class: Swamp (mixed-wood treed)

Approximate Size: 6.86 ha

Delineated Size within the AA: 0.14 ha



**Wetland 48**

Class: Swamp (softwood treed)

Approximate Size: 10.1 ha

Delineated Size within the AA: 0.38 ha



**Wetland 49**

Class: Swamp (mixed-wood treed)

Approximate Size: 2.53 ha

Delineated Size within the AA: 0.27 ha



**Wetlands 50 and 51**

Class: Swamp (mixed-wood treed, mostly cut, dense shrub layer)

Approximate Size: 1.66 ha

Delineated Size within the AA: 0.55 ha



**Wetlands 52 and 53**

Class: Fen

Approximate Size: 0.29 ha

Delineated Size within the AA: 0.23 ha



**Wetlands 54 and 55**

Class: Bog

Approximate Size: 0.20 ha

Delineated Size within the AA: 0.19 ha

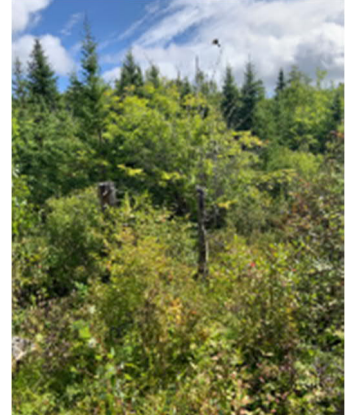


**Wetland 56**

Class: Bog (elements of disturbance)

Approximate Size: 0.06 ha

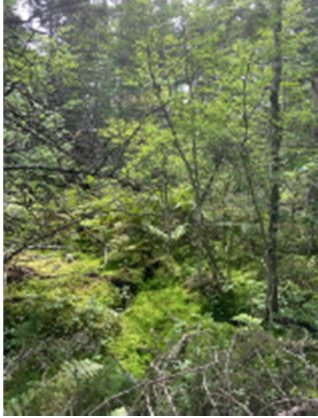
Delineated Size within the AA: 0.06 ha





**Wetland 59**

Class: Swamp (mixed-wood treed)  
Approximate Size: 3.15 ha  
Delineated Size within the AA: 0.18 ha



**Wetlands 60 and 61**

Class: Fen  
Approximate Size: 0.34 ha  
Delineated Size within the AA: 0.19 ha



**Wetland 62**

Class: Swamp (softwood treed)  
Approximate Size: 1.03 ha  
Delineated Size within the AA: 0.38 ha



**Wetland 63**

Class: Fen  
Approximate Size: 0.70 ha  
Delineated Size within the AA: 0.12 ha



**Wetlands 71 and 108**

Class: Swamp (mixed-wood treed)  
Approximate Size: 1.02 ha  
Delineated Size within the AA: 0.47 ha



**Wetland 88**

Class: Fen  
Approximate Size: 0.46 ha  
Delineated Size within the AA: 0.07 ha



**Wetlands 64 and 66**

Class: Bog  
Approximate Size: 1.37 ha  
Delineated Size within the AA: 0.52 ha



**Wetland 65**

Class: Bog  
Approximate Size: 3.16 ha  
Delineated Size within the AA: 0.04 ha



**Wetlands 67 and 84**

Class: Swamp (alder shrub)  
Approximate Size: 1.75 ha  
Delineated Size within the AA: 0.15 ha



**Wetlands 68 and 85**

Class: Swamp  
Approximate Size: 0.66 ha  
Delineated Size within the AA: 0.19 ha



**Wetland 69**

Class: Bog (Cutover, disturbed)  
Approximate Size: 2.2 ha  
Delineated Size within the AA: 0.12 ha



**Wetland 70**

Class: Bod (flooded by road)  
Approximate Size: 0.1 ha  
Delineated Size within the AA: 0.1 ha



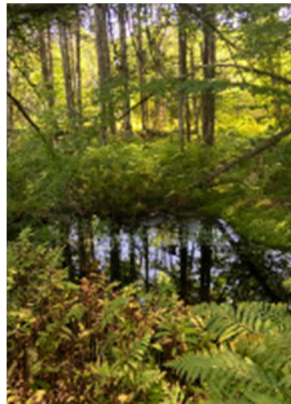
**Wetland 72**

Class: Swamp (mixed-wood treed, peat moss dominated, disturbed cutover section)  
Approximate Size: 3.5 ha  
Delineated Size within the AA: 0.37 ha



**Wetlands 73 and 91**

Class: Swamp (mixed-wood treed with an intermittent stream)  
Approximate Size: 1.2 ha  
Delineated Size within the AA: 0.03 ha



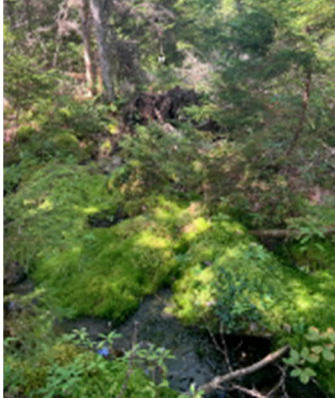
**Wetland 74**

Class: Bog (cut-over)  
Approximate Size: 0.56 ha  
Delineated Size within the AA: 0.16 ha



**Wetland 75**

Class: Swamp (shrub)  
Approximate Size: 6.25 ha  
Delineated Size within the AA: 0.32 ha



**Wetlands 76, 77 and 78**

Class: Swamp (shrub)  
Approximate Size: 40.6 ha  
Delineated Size within the AA: 0.49 ha



**Wetlands 79 and 80**

Class: Swamp (mixed-wood treed)  
Approximate Size: 0.55 ha  
Delineated Size within the AA: 0.53 ha



**Wetland 81**

Class: Bog

Approximate Size: 1.42 ha

Delineated Size within the AA: 1.14 ha



**Wetlands 82 and 83**

Class: Fen

Approximate Size: 7.9 ha

Delineated Size within the AA: 0.76 ha



**Wetland 86**

Class: swamp (Shrub with stream)

Approximate Size: 0.58 ha

Delineated Size within the AA: 0.15 ha

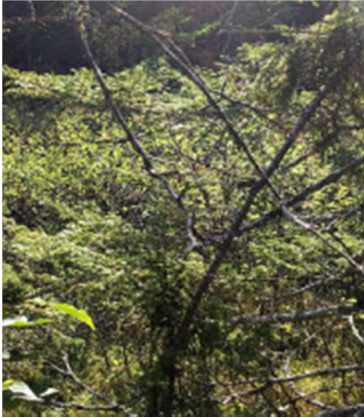


**Wetland 87**

Class: Swamp (shrub)

Approximate Size: 1.8 ha

Delineated Size within the AA: 0.27 ha

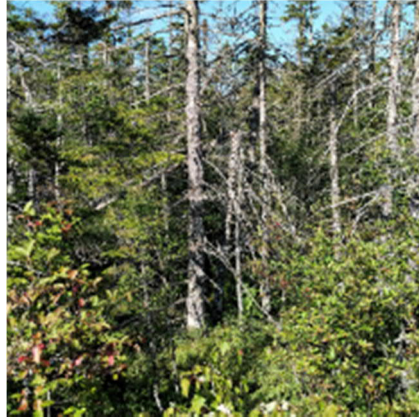


**Wetlands 89 and 90**

Class: Swamp (softwood treed)

Approximate Size: 0.7 ha

Delineated Size within the AA: 0.43 ha



**Wetland 96**

Class: Swamp

Approximate Size: 1.18 ha

Delineated Size within the AA: 0.43 ha



**Wetland 92**

Class: Swamp

Approximate Size: 0.44 ha

Delineated Size within the AA: 0.17 ha



**Wetland 93**

Class: Swamp

Approximate Size: 0.15 ha

Delineated Size within the AA: 0.14 ha



**Wetland 94**

Class: Swamp

Approximate Size: 0.1 ha

Delineated Size within the AA: 0.1 ha



**Wetland 95**

Class: Swamp

Approximate Size: 0.05 ha

Delineated Size within the AA: 0.05 ha

**Wetlands 11 and 102**

Class: Swamp

Approximate Size: 0.19 ha

Delineated Size within the AA: 0.19 ha

**Wetland 103**

Class: Swamp

Approximate Size: 0.69 ha

Delineated Size within the AA: 0.17 ha

**Wetland 97**

Class: Swamp

Approximate Size: 0.16 ha

Delineated Size within the AA: 0.16 ha



**Wetlands 98 and 99**

Class: Swamp

Approximate Size: 0.46 ha

Delineated Size within the AA: 0.16 ha



**Wetland 100**

Class: Bog

Approximate Size: 0.28 ha

Delineated Size within the AA: 0.14 ha



**Wetlands 104 and 105**

Class: Swamp

Approximate Size: 0.19 ha

Delineated Size within the AA: 0.19 ha



**Wetlands 106 and 107**

Class: Swamp

Approximate Size: 32.4 ha

Delineated Size within the AA: 0.63 ha



**Wetlands 109, 122 and 123**

Class: Swamp (mixed-wood shrubs, sparse tree layer, peaty)

Approximate Size: 6.13 ha

Delineated Size within the AA: 0.43 ha



**Wetland 110**

Class: Swamp

Approximate Size: 6.13 ha

Delineated Size within the AA: 0.01 ha

**Wetlands 129 and 145**

Class: Swamp

Approximate Size: 0.07 ha

Delineated Size within the AA: 0.07 ha

**Wetlands 165 and 166**

Class: Swamp

Approximate Size: 0.16 ha

Delineated Size within the AA: 0.19 ha

**Wetlands 111 and 112**

Class: Swamp  
Approximate Size: 6.13 ha  
Delineated Size within the AA: 0.28 ha



**Wetlands 113 and 124**

Class: Bog with some fen qualities)  
Approximate Size: 0.25 ha  
Delineated Size within the AA: 0.21 ha



**Wetland 114**

Class: Swamp (mixed-wood treed)  
Approximate Size: 0.11 ha  
Delineated Size within the AA: 0.11 ha



**Wetlands 115 and 116**

Class: Swamp (mixed-wood treed, with stream through flow, terrace swamp)  
Approximate Size: 0.08 ha  
Delineated Size within the AA: 0.08 ha



**Wetland 125**

Class: Bog  
Approximate Size: 0.53 ha  
Delineated Size within the AA: 0.53 ha



**Wetland 130**

Class: Swamp (alder dominated, stream through flow, peaty)  
Approximate Size: 2.66 ha  
Delineated Size within the AA: 0.5 ha



**Wetlands 131 and 132**

Class: Swamp (mixed-wood treed and shrub, peaty, stream through flow)  
Approximate Size: 2.06 ha  
Delineated Size within the AA: 0.52 ha



**Wetlands 133 and 147**

Class: Swamp  
Approximate Size: 6.39 ha  
Delineated Size within the AA: 0.19 ha



**Wetlands 134, 135, 148 and 149**

Class: Swamp (mixed-wood treed, stream through flow)  
Approximate Size: 10.9 ha  
Delineated Size within the AA: 0.64 ha



**Wetland 136**

Class: Swamp (mixed-wood treed– shrub, peaty)  
Approximate Size: 10.9 ha  
Delineated Size within the AA: 0.14 ha



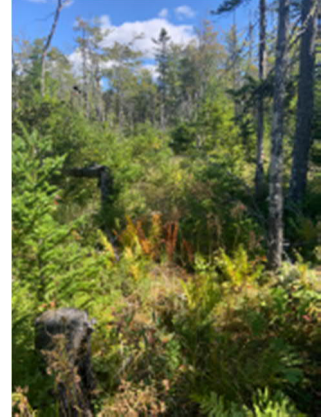
**Wetland 137**

Class: Swamp (disturbed shrub swamp)  
Approximate Size: 0.25 ha  
Delineated Size within the AA: 0.25 ha



**Wetlands 138 and 150**

Class: Bog (treed)  
Approximate Size: 4.31 ha  
Delineated Size within the AA: 0.20 ha



**Wetland 139**

Class: Swamp (mixed-wood treed with wool grass and peaty)  
Approximate Size: 4.32 ha  
Delineated Size within the AA: 0.54 ha



**Wetland 140**

Class: Swamp  
Approximate Size: 6.39 ha  
Delineated Size within the AA: 0.19 ha



**Wetland 151**

Class: Swamp/Bog (softwood treed swamp/treed bog)  
Approximate Size: 7.52 ha  
Delineated Size within the AA: 1.01 ha



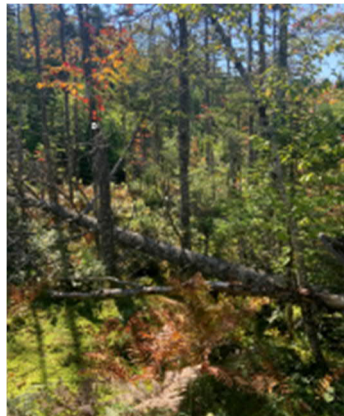
**Wetlands 152 and 153**

Class: Swamp  
Approximate Size: 0.24 ha  
Delineated Size within the AA: 0.24 ha



**Wetland 154**

Class: Swamp (mixed-wood treed with peaty and disturbed areas with ruts)  
Approximate Size: 0.62 ha  
Delineated Size within the AA: 00.62 ha



**Wetland 155**

Class: Swamp (mixed-wood treed, peaty, boggy areas)  
Approximate Size: 0.95 ha  
Delineated Size within the AA: 0.95 ha



**Wetland 156**

Class: Bog

Approximate Size: 0.07 ha

Delineated Size within the AA: 0.07 ha



**Wetland 157**

Class: Swamp (softwood treed, peaty)

Approximate Size: 0.62 ha

Delineated Size within the AA: 0.14 ha



**Wetlands 158 and 150**

Class: Bog (treed, shrubby)

Approximate Size: 4.98 ha

Delineated Size within the AA: 1.89 ha



**Wetland 160**

Class: Swamp

Approximate Size: 0.71 ha

Delineated Size within the AA: 0.11 ha



**Wetland 161**

Class: Bog

Approximate Size: 0.35 ha

Delineated Size within the AA: 0.35 ha



**Wetland 163**

Class: Bog

Approximate Size: 0.65 ha

Delineated Size within the AA: 0.11 ha



**Wetland 164**

Class: Swamp (hardwood treed)

Approximate Size: 0.23 ha

Delineated Size within the AA: 0.23 ha

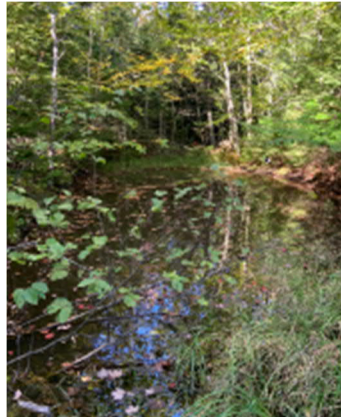


**Wetland 168**

Class: Swamp

Approximate Size: 0.12 ha

Delineated Size within the AA: 0.12 ha



**Wetland 175**

Class: Bog

Approximate Size: 0.04 ha

Delineated Size within the AA: 0.04 ha



**Wetland 176**

Class: Swamp

Approximate Size: 0.29 ha

Delineated Size within the AA: 0.11 ha

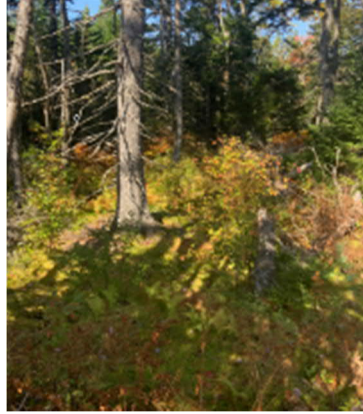


**Wetlands 181 and 182**

Class: Swamp (softwood treed)

Approximate Size: 0.71 ha

Delineated Size within the AA: 0.08 ha



**Wetlands 183 and 184**

Class: Swamp (softwood treed)

Approximate Size: 0.22 ha

Delineated Size within the AA: 0.22 ha



**Wetland 185**

Class: Swamp (mix-wood treed)

Approximate Size: 0.18 ha

Delineated Size within the AA: 0.18 ha



**Wetlands 186 and 187**

Class: Swamp (mixed-wood treed)

Approximate Size: 0.40 ha

Delineated Size within the AA: 0.40 ha

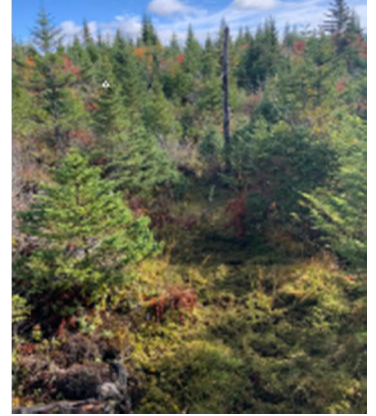


**Wetland 188**

Class: Bog

Approximate Size: 0.15 ha

Delineated Size within the AA: 0.15 ha



**Wetland 189**

Class: Bog

Approximate Size: 0.41 ha

Delineated Size within the AA: 0.41 ha



**Wetland 190**

Class: Bog

Approximate Size: 0.35 ha

Delineated Size within the AA: 0.35 ha



**Wetlands 191 and 192**

Class: Bog

Approximate Size: 1.21 ha

Delineated Size within the AA: 0.24 ha





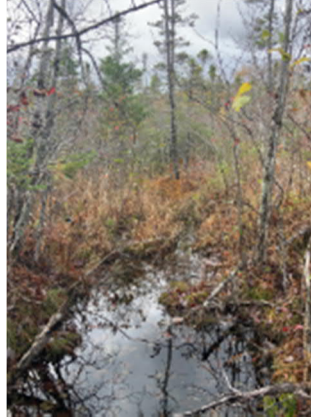
**Wetlands 195 and 196**

Class: Bog (disturbed, wool grass domination depression)  
Approximate Size: 0.43 ha  
Delineated Size within the AA: 0.43 ha



**Wetland 197**

Class: Bog (with dense shrubs)  
Approximate Size: 7.59 ha  
Delineated Size within the AA: 0.38 ha



**Wetland 198**

Class: Bog (some disturbance and a trash pile)  
Approximate Size: 0.1 ha  
Delineated Size within the AA: 0.1 ha



**Wetland 199**

Class: Swamp (some disturbance and ruts)  
Approximate Size: 0.13 ha  
Delineated Size within the AA: 0.13 ha



**Wetlands 200 and 201**

Class: Swamp (hardwood treed with peat)  
Approximate Size: 0.25 ha  
Delineated Size within the AA: 0.23 ha



**Wetland 202**

Class: Swamp  
Approximate Size: 3.57 ha  
Delineated Size within the AA: 0.28 ha



**Wetland 203**

Class: Bog  
Approximate Size: 0.12 ha  
Delineated Size within the AA: 0.12 ha



**Wetland 204**

Class: Bog (disturbed, hardwood swamp elements)  
Approximate Size: 0.31 ha  
Delineated Size within the AA: 0.31 ha



**Wetland 205**

Class: Bog (wool/cotton grass dominated, softwood drowned forest)  
Approximate Size: 3.16 ha  
Delineated Size within the AA: 0.32 ha



**Wetland 206**

Class: Bog (impounded water, wool grass dominated)

Approximate Size: 0.07 ha

Delineated Size within the AA: 0.07 ha

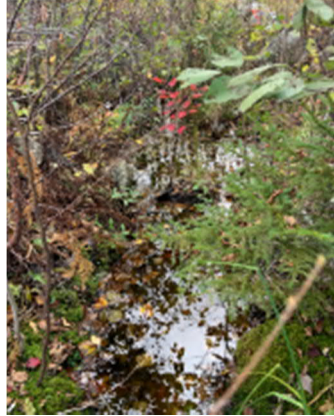


**Wetland 207**

Class: Swamp (shrub, disturbed by ruts and borrow pits)

Approximate Size: 0.26 ha

Delineated Size within the AA: 0.26 ha



**Wetlands 208 and 209**

Class: Swamp (shrub)

Approximate Size: 0.22 ha

Delineated Size within the AA: 0.12 ha



## References

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- Adamus, P.R. (2018). Wetland Ecosystem Services Protocol for Atlantic Canada (WESPAC). Calculator spreadsheet and manual. New Brunswick Department of Environment and Local Government, Government of New Brunswick, Fredericton, NB.
- U.S Army Corps of Engineers. 1987. Corps of Engineers Wetlands Delineation Manual. Prepared for U.S. Army Corps of Engineers Washington, DC 20314-1000. Available at: <https://www.nae.usace.army.mil/Portals/74/docs/regulatory/JurisdictionalLimits/wlman87.pdf>