Environmental Component	Description	VEC Assessed further?	Applicable Section in the Report
Visual Landscape	Wind farms create visual effects to the local landscape. A visual assessment was completed for the Project. Predicted view planes generated by the assessment are presented in Section 12.3. Effects to the visual landscape are considered minimal to non-existent due to the size and location of the wind farm, setback distances, and the significant tree cover in the vicinity of the Project site.	No	Section 12.3

Based on the preliminary assessment of potential interactions, summarized in Table 7.1, the VECs addressed in this EA are as follows:

- SOCI;
- Avifauna; and
- Bats.

8.0 BIOPHYSICAL ENVIRONMENT

8.1 Atmospheric Environment

8.1.1 Weather and Climate

Nova Scotia's climate is quite varied and is largely governed by coastal influences and elevation (Davis and Browne 1996). The Project site lies within the Eastern Ecoregion of Nova Scotia, which extends from Bedford Basin to the town of Guysborough (Neily *et al*. 2003). Removed from the immediate climatic influence of the Atlantic Ocean, the ecoregion is characterized by warmer summers and cooler winters (Neily *et al*. 2003). Mean annual temperature for the area is 5.9°C, with summer and winter temperatures averaging 16.8°C and -5.2°C, respectively (Webb and Marshall 1999). The typical growing season in the area of the Project site is 196 days (Webb and Marshall 1999).

Local temperature and precipitation data were obtained from the Halifax International Airport meteorological station (44°53'00.00N, 63°31'00.00W) located approximately 28 km northeast of the Project site. For the period from 1971-2000, the mean annual temperature was 6.3°C, with a mean daily high of 11°C and a mean daily low of 1.6°C (EC 2011a). January and February were the coldest months (-6 °C and -5.6°C, respectively), while the warmest months were July and August (18.6 °C and 18.4°C, respectively) (EC 2011a).

From 1971-2000, mean annual snowfall was 230.5 cm and rainfall was 1,238.9 mm (EC 2011a). Most snowfall is received in January and February (54.6 cm and 50.1 cm, respectively), while the rainiest months are May, October and November (106.2 mm, 126.4 mm, and 133 mm, respectively) (EC 2011a).

Environment Canada (EC) measures wind conditions in Nova Scotia at those meteorological stations that are under long term observation. The closest such station to the Project site is the Halifax International Airport

station mentioned above. The Canadian Climate Normals (1971-2000) for this station indicate an annual maximum wind speed of 16.8 km/h, most commonly out of the south (EC 2011a). The maximum hourly wind speed for this station was 89 km/h, recorded on February 10th, 1969, with the highest single wind gust measured at 132 km/h on December 26th, 1976 (EC 2011a). According to the Nova Scotia Wind Atlas (NSDE 2007), average wind speeds at 30 m and 50 m above the ground at the Project site range from 16.2-21.6 km/h, and range from 19.8-27 km/h at 80 m above the ground.

8.1.2 Air Quality

Currently in Nova Scotia, 42% of total greenhouse gas (GHG) emissions come from electricity use and 89% of electricity comes from fossil fuels (NSDE 2012.) Because of this heavy reliance on coal and other fossil fuels for electricity, every megawatt of wind power installed reduces GHG emissions by as much as 2,500 tonnes per year (NSDE 2009). By reducing Nova Scotia's reliance on fossil fuels, wind energy will therefore contribute to improving local air quality (NSDE 2009).

Nova Scotia monitors air quality at six stations throughout the province. Measured parameters include ground-level ozone (O_3), particulate matter (PM2.5), and nitrogen dioxide (NO_2), and these values are used to calculate a score on the Air Quality Health Index (AQHI) (EC, 2011b). The AQHI is a scale from 1-10+, in which scores represent the following health risk categories: Low (1-3), Moderate (4-6), High (7-10), and Very High (10+).

The AQHI monitoring station closest to the Project site is located at Halifax, approximately 22 km southeast of the Project site. The AQHI at this site is usually low to moderate at all times of the year (EC 2011b).

Mitigation measures related to the atmospheric environment are outlined in Section 4.0.

8.2 Geophysical Environment

8.2.1 Physiography and Topography

The Project site lies within the Eastern Interior Ecodistrict occupying an area from Pockwock Lake in the west to the Town of Guysborough in the east. The bedrock is highly visible in those areas where the glacial till is very thin, exposing the ridge topography (Neily *et al*. 2003). Where the till is thicker, the ridged topography is masked and thick softwood forests occur. The ecodistrict is heavily covered with freshwater lakes. Topography in the area is flat to rolling with many surface boulders. Project site elevations range from 119 m at the northwestern and southeastern boundaries and rise to 160 m in the centre of the Project site.

8.2.2 Surficial Geology

The surficial geology of the Project site is characterized as a stony till plain otherwise referred to as ground moraine (Drawing 8.1). The predominant soils are well drained stony-sandy loams derived from local quartzite bedrock (Stea *et al*. 1992). Till thickness is quite variable across the ecodistrict, ranging from 1–10 m but averaging less than 3 m. Large portions of the ecodistrict have been scraped clean by glaciers exposing large areas of bedrock. There are few drumlins and hills scattered throughout the ecodistrict with fine textured soils derived from slates (Neily *et al*. 2003).

8.2.3 Bedrock Geology

The Project site is underlain by two Meguma Group geological formations designated as the Goldenville Formation and Halifax Formation (Keppie 2000). The northern portion of the site is underlain by the Goldenville Formation bedrock which generally consists of greenish grey metagreywackes, with minor interbedded green laminated metasiltstone and dark grey-black slate. The southern portion of the site is underlain by the Halifax Formation bedrock which generally consists of sloped outer shelf slates, greywacke, and minor sandstones (Drawing 8.2).

According to the NSE Well Log Database (NSE 2011a), there are seven drilled wells located within a 250 m radius of the Project site boundary, ranging in depths from 20.7 m to 109.6 m. All seven wells were drilled through varying surficial materials including clay, overburden, and gravel ranging from 0.9 m to 33.5 m in thickness, followed by slate bedrock.

Bedrock containing sulphide bearing minerals (e.g., pyrite, pyrrhotite) can potentially generate acid run-off if fresh surfaces are exposed to oxygen and water. The physical disruption of such bedrock leads to oxidation of iron-sulphide minerals and the generation of ARD (Fox *et al*. 1997). Construction activities in the presence of ARD can result in the acidification of surface and groundwater and promote the mobilization and leaching of toxic contaminants into the environment, including heavy metals. The likelihood of ARD to occur will be determined following the results of the geotechnical evaluation (see Section 4).

8.2.4 Hydrogeology and Groundwater

Groundwater Quantity

Water supplies near the Project site are both municipally supplied (surface water), as well as derived from individually drilled wells. A summary of the pertinent (within 2 km of the Project footprint) well properties included in the drilled well logs is presented in Table 8.1.

Table 8.1: Summary of Drilled Well Records

	Drilled Date (yr)	Well Depth (m)	Casing Length (m)	Estimated Yield (Lpm)	Water Level (m)	Overburden Thickness (m)	Water Bearing Fractures (m)
Minimum	1975	20.7	5.2	4.5	12.2	0.9	13.7
Maximum	2000	109.6	33.5	22.7	12.2	33.5	106.7
Average	1993	55.3	12.4	11.8	12.2	10.2	54.0
Geomean	1993	48.8	9.3	10.4	12.2	5.3	44.4
Number of well records	7	7	7	7	1	7	6

Source: NSE 2011a

Based on short term driller's estimates for the seven drilled wells identified in Table 8.1, the average yield is approximately 11.8 liters per minute (Lpm) or 3.1 gallons per minute (Gpm) and average well depth is approximately 55.3 m (181.4 ft). These measurements represent very short term yields estimated by the driller

at the completion of well construction. Fracture depths ranged from 13.7 m (44.9 ft) to 106.7 m (349.9 ft). The closest drilled well to a proposed turbine is located approximately 900 m to the west, along Pockwock Road.

The NSE Pump Test Database (NSDNR 2011) provides longer term yields for select wells throughout the province. Two regional wells drilled through metamorphic bedrock of the Halifax Formation and located within a 5 km radius of the Project site indicate long term safe yields (Q_{20}) of 11.36 Lpm (3.0 gpm) and 18.18 Lpm (4.8 gpm), and apparent transmissivity (T) values of 1.5 and 1.25 m^2/d. Storativity values were not available from the two pump tests.

Observation well No. 079, from the NSE Nova Scotia Groundwater Observation Well Network, is located in Lewis Lake (within HRM), approximately 5.5 km south of the Project site (NSE 2011b). This observation well was drilled to a depth of 77.0 m through granite bedrock and has been monitored since November 2008. In 2010, the average water level elevation was 69.34 m above sea level and the annual water level fluctuation was 0.73 m. The average depth to water in this well was approximately 2.5 m below ground surface.The groundwater levels appear to have decreased slightly between 1971 and 1991. There is a data gap between 1991 and 2002 when no monitoring was carried out at this well; however, sometime after 1991 the groundwater levels in this well increased and have remained relatively consistent since 2003 when monitoring began again (NSE 2011b).

Groundwater Quality

The water quality in the Goldenville Formation is expected to be good, with most parameters meeting the Canadian Drinking Water Guidelines (Health Canada 2010). The presence of arsenic is a common naturally-occurring water quality parameter, along with others including iron and manganese.

Mitigation measures for potential effects to the geophysical environment are provided in Section 4.0.

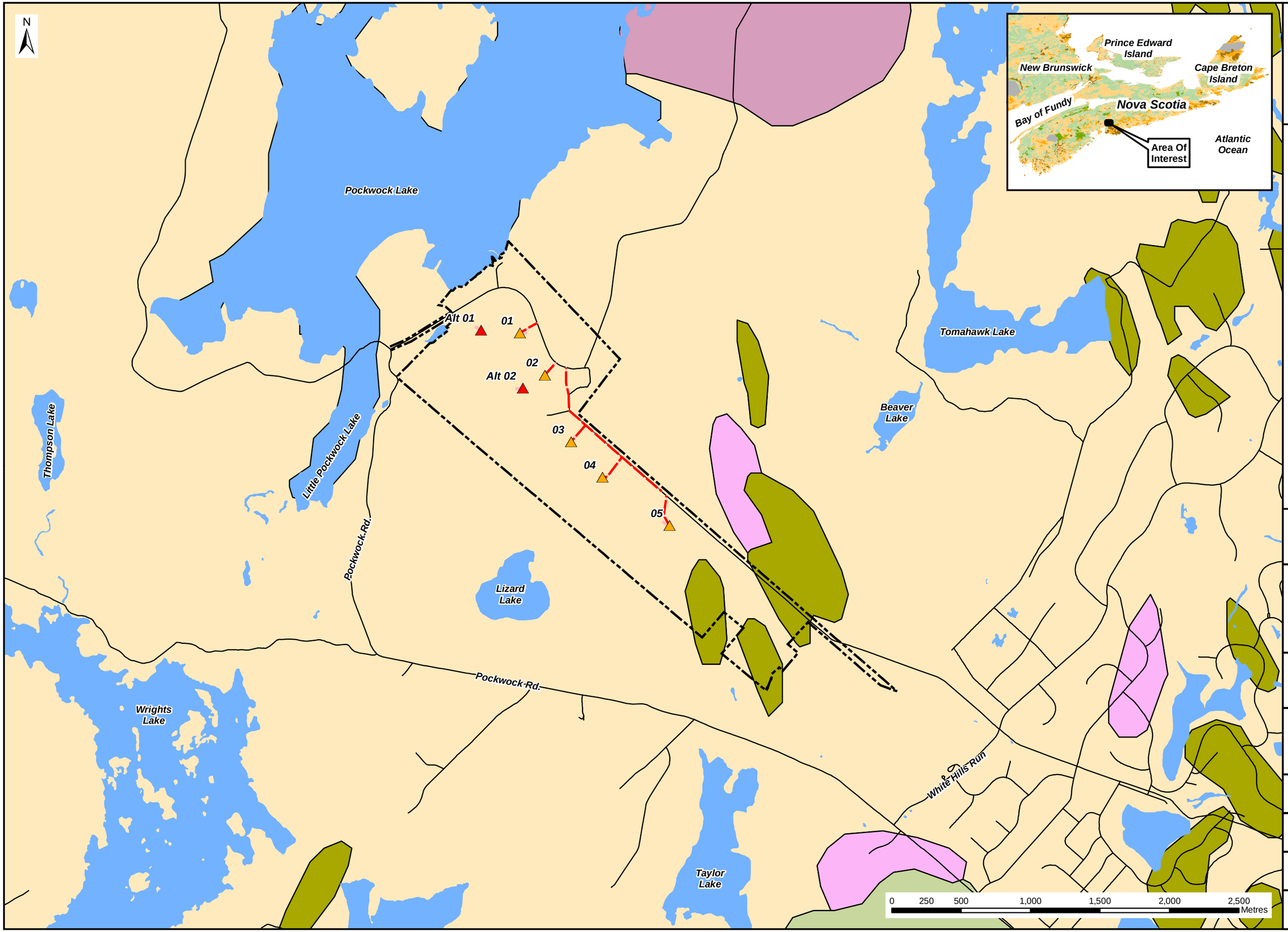
8.3 Freshwater Environment

The Project site lies within the St. Margaret's Bay Ecodistrict, which extends from Pockwock Lake in the east, to Sherbrooke Lake in the west. The Project site straddles the border between the East/Indian River Watershed and the Sackville River Watershed, both of which flow towards the Atlantic Ocean (Neily *et al.* 2003).

There are no substantial water bodies within the Project site (Drawing 8.3); however, the northwestern boundary borders the southern extent of Pockwock Lake and overlaps with the Pockwock Lake and Tomahawk Lake PWAs. Pockwock Lake is the primary drinking water source for Halifax and surrounding areas and Tomahawk Lake has been designated as the secondary (future) source. The Pockwock and Tomahawk watersheds and PWAs are discussed in greater detail in Section 1.3.2.

Several additional lakes are located within 2 km of the Project site, including: Little Pockwock Lake (280 m to the west/southwest), Lizard Lake (280 m to the west), Taylor Lake (570 m to the south), Beaver Lake (1.2 km to the northeast), and Tomahawk Lake (1.9km to the northeast).

The Nova Scotia Lake Inventory Program records baseline biophysical attributes of lakes throughout the province (NSE 2012b). Water chemistry data was collected during two separate sampling events (in 1984 and 2005) from three lakes that lie within 5 km of the Project site: McCabe Lake, Wrights Lake and



Notes:

1. Reference: Nova Scotia Department Of Natural Resources Map ME 1992-3, Surficual Geology Map Of The Province Of Nova Scotia, 1:500,000, by R. R. Stea, H. Conley and Y. Brown, 1992. Digital Product Compiled by R. R. Stea and B. E. Fisher.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Legend:

- Proposed Turbine
- Alternate Turbine
- Proposed Access Road
- Permanent Disturbance Area
- Project Site Boundary
- Roads
- Water Bodies

Surficial Geology By Unit

- Bedrock
- Organic Deposits
- Silty Drumlin
- Silty Till Plain
- Stony Till Plain

Surficial Geology

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Strum CONSULTING

Date: April 2013	Project #: 12-4326
Scale: 1:25,000	Drawing #: **8.1**
Drawn By: H. Serhan	
Checked By: M. Smith	

N

M-LDgd

M-LDgd

Pockwock Lake

COMg

Alt 01

01

02

Alt 02

03

04

05

Tomahawk Lake

Beaver Lake

COMh

Thompson Lake

M-LDbmg

Little Pockwock Lake

Pockwock Rd.

Lizard Lake

Pockwock Rd.

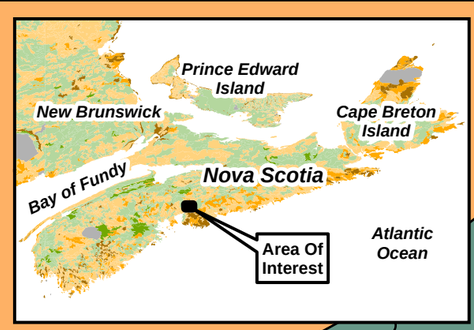
COMh

White Hills Run

M-LDlmg

M-LDgd

Taylor Lake



Legend:

- Proposed Turbine
- Alternate Turbine
- Proposed Access Road
- Permanent Disturbance Area
- Project Site Boundary
- Roads
- Water Bodies

Bedrock Geology By Formation

- Halifax Formation
- Goldenville Formation
- Middle - Late Devonian granodiorite
- Middle - Late Devonian biotite monzogranite
- Middle - Late Devonian leucomonzogranite

0 250 500 1,000 1,500 2,000 2,500 Metres

Notes:

1. Reference: Nova Scotia Department of Natural Resources (NS DNR), Minerals and Energy Branch. Map ME 2000-1, Geological Map of the Province of Nova Scotia, Compiled by J. D. Keppie.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Bedrock Geology

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Date:	Project #:
April 2013	12-4326
Scale: 1:25,000	Drawing #: **8.2**
Drawn By: H. Serhan	
Checked By: M. Smith	

N

Pockwock Lake

Hamilton Pond

Alt 01

01

02

Alt 02

03

04

05

Little Pockwock Lake

Lizard Lake

Tomahawk Lake

Beaver Lake

Pockwock Rd

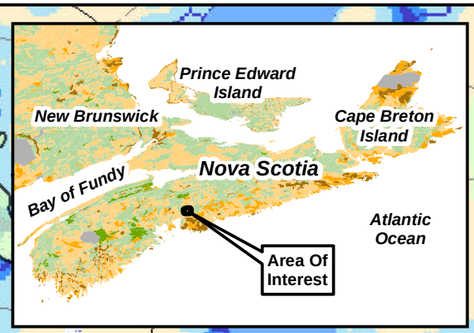
Anderson Rd

Orchard Dr

Daisywood Dr

Slate Dr

Rockcrest Dr



Legend:

- Proposed Turbine
- Alternate Turbine
- Proposed Access Road
- Permanent Disturbance Area
- Project Site Boundary
- Roads
- Access Roads / Trails
- Water Bodies
- Mapped Wet Area

NS DNR Wetland Inventory

Wetland Type

- Bog or Fen
- Fen
- Marsh
- Salt Marsh
- Swamp
- Water

Depth to Water Table (m)

- 0 - 0.10 m
- 0.11 - 0.50 m
- 0.51 - 2 m
- 2.01 - 10 m
- > 10 m

0 100 200 400 600 800 1,000 Metres

Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre. Wet Areas Mapping and Wetland Inventory By Nova Scotia Department Of Natural Resources (NS DNR).
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Wetland and Watercourse Desktop Review Results

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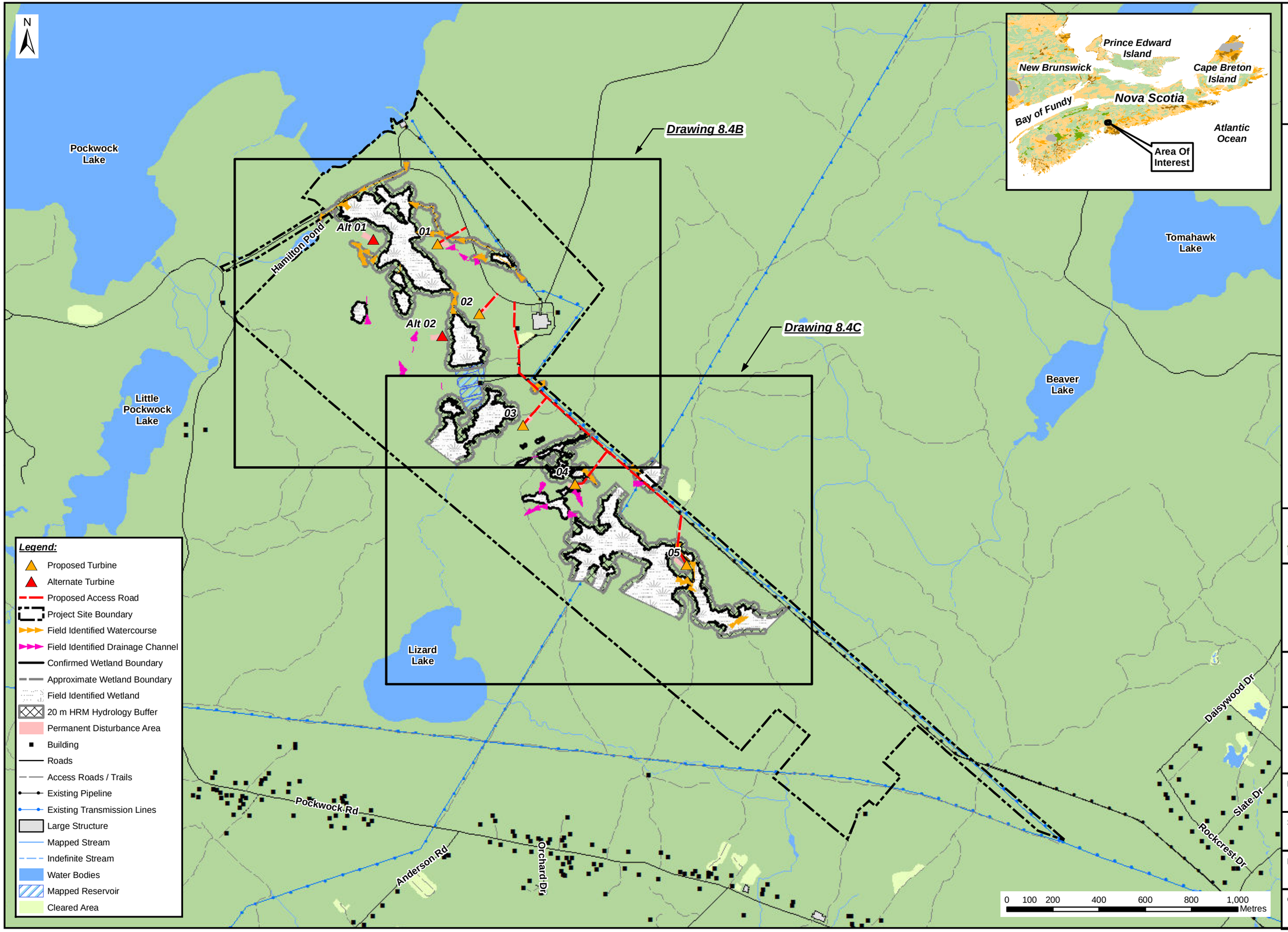
Date: April 2013	Project #: 12-4326
Scale: 1:15,000	Drawing #: **8.3**
Drawn By: H. Serhan	
Checked By: M. Smith	



Legend:

- Proposed Turbine
- Alternate Turbine
- Proposed Access Road
- Project Site Boundary
- Field Identified Watercourse
- Field Identified Drainage Channel
- Confirmed Wetland Boundary
- Approximate Wetland Boundary
- Field Identified Wetland
- 20 m HRM Hydrology Buffer
- Permanent Disturbance Area
- Building
- Roads
- Access Roads / Trails
- Existing Pipeline
- Existing Transmission Lines
- Large Structure
- Mapped Stream
- Indefinite Stream
- Water Bodies
- Mapped Reservoir
- Cleared Area

Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. GPS Points Taken Are Typically To +/-5m Accuracy.

Wetland and Watercourse Survey Results

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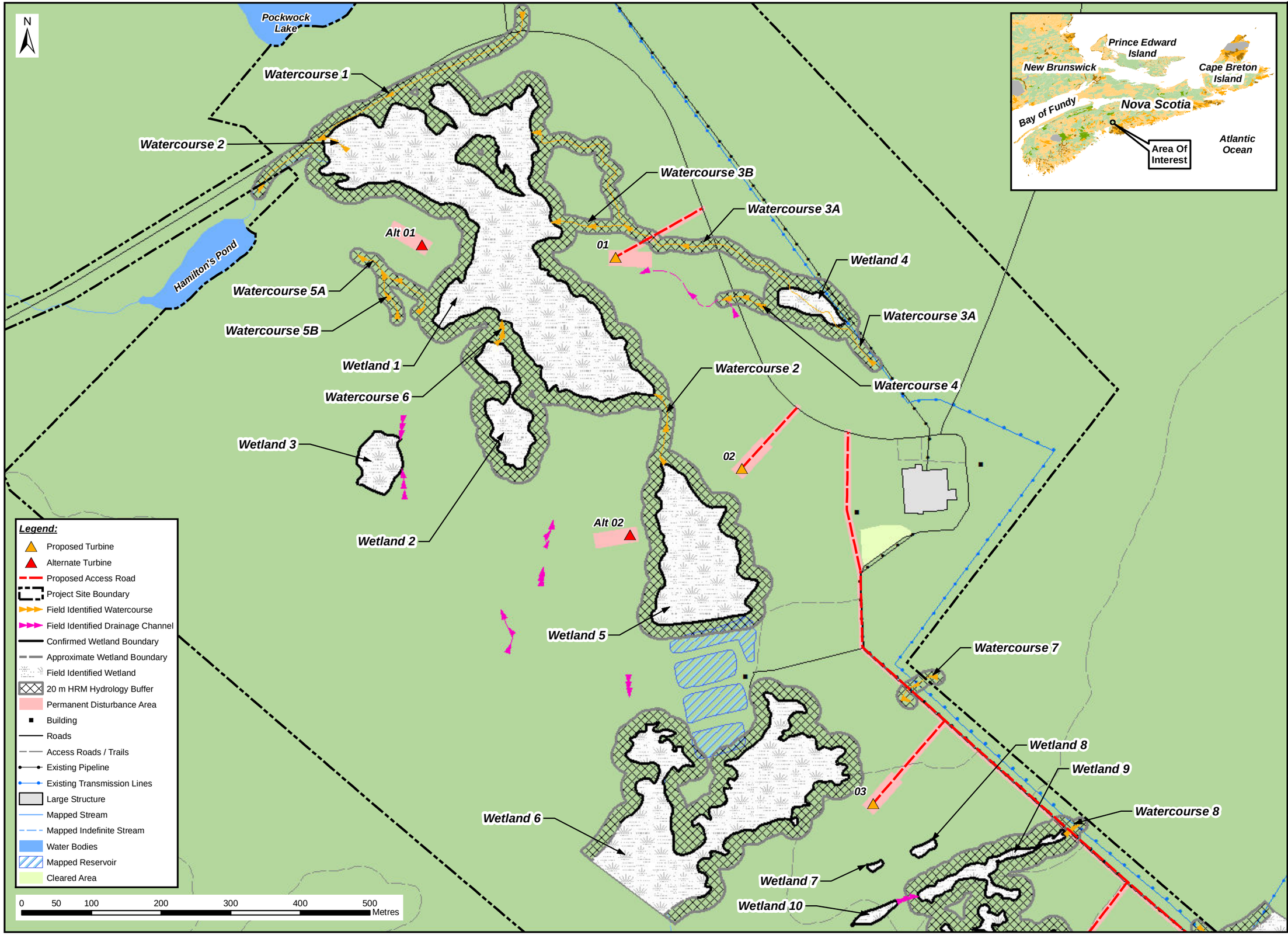
Date:	Project #:
April 2013	12-4326
Scale: 1:15,000	Drawing #: **8.4A**
Drawn By: H. Serhan	
Checked By: M. Smith	



Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
2. Projection: WGS84, UTM Zone 20 North.
3. GPS Points Taken Are Typically to +/-5m Accuracy.

Wetland and Watercourse Survey Results

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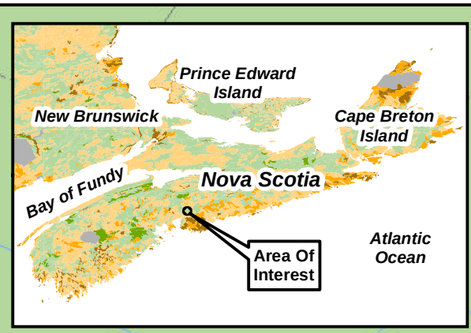
Date: April 2013	Project #: 12-4326
Scale: 1:5000	Drawing #: **8.4B**
Drawn By: H. Serhan	
Checked By: M. Smith	

N

Watercourse 7
Wetland 8
Wetland 9
03
Watercourse 8
Wetland 11
Wetland 7
Watercourse 9
Watercourse 10
Wetland 6
Wetland 10
Wetland 13
04
Wetland 15
Wetland 12
Wetland 14
Watercourse 11
Watercourse 12
05
Watercourse 13
Lizard Lake



Legend:

- Proposed Turbine
- Alternate Turbine
- Proposed Access Road
- Project Site Boundary
- Field Identified Watercourse
- Field Identified Drainage Channel
- Confirmed Wetland Boundary
- Approximate Wetland Boundary
- Field Identified Wetland
- 20 m HRM Hydrology Buffer
- Permanent Disturbance Area
- Building
- Roads
- Access Roads / Trails
- Existing Pipeline
- Existing Transmission Lines
- Large Structure
- Mapped Stream
- Indefinite Stream
- Water Bodies
- Mapped Reservoir
- Cleared Area

0 50 100 200 300 400 500 Metres

Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
2. Projection: WGS84, UTM Zone 20 North.
3. GPS Points And Tracks Taken Are Typically to +/-5 m Accuracy.

Wetland and Watercourse Survey Results

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Strum Consulting

Date:	Project #:
April 2013	12-4326
Scale: 1:5000	Drawing #: 8.4C
Drawn By: H. Serhan	
Checked By: M. Smith	

Pockwock Lake. The data collected indicate that the water quality of these lakes falls within acceptable limits for both community water supplies, and the protection of aquatic life based on the guidelines prescribed by the Canadian Council of Ministers of the Environment (CCME).

A Pockwock Lake Study was conducted from 1999 to 2004 in partnership with Halifax Water, EC, NSDNR, Canadian Forestry Service, and Nova Forest Alliance. The purpose of this study was to evaluate the potential effects of forestry activities on various components of terrestrial and aquatic ecosystems within the watershed, including water quality. NSE and Halifax Water collected water samples at various depths from mid-lake and outlet locations for physical and chemical analysis. The final report on this study's findings concludes that while water chemistry results indicate some variation following harvesting, these changes are likely attributed to seasonal hydrological changes rather than forestry activities (Scott 2004). The study also indicates that water quality results generally comply with the guidelines provided by the CCME for community water supplies, and for the protection of freshwater aquatic life, including during times of active forestry activity (Scott 2004).

Drainage from eastern portions of the Project site flows into the Sackville River via Tomahawk Lake. The western portions of the Project site drain south to St. Margaret's Bay via Little Pockwock Lake, then Wrights Lake and Mill Lake. The central portion of the Project site also drains into St. Margaret's Bay, but via Lizard Lake, then Stillwater Lake, then Hubley-Mill Lake. None of the watercourses within the Project site drain into Pockwock Lake. All drainage from the northern and western portions of the Project site is intercepted by the drainage ditch associated with the road to the J.D. Klein Water Treatment Plant, which is subsequently directed into Little Pockwock Lake via Watercourse 1 and Hamilton's Pond.

Thirteen watercourses were identified during field surveys (Drawings 8.4 A-C), as shown in Table 8.2.

Table 8.2 Watercourse Characteristics

Feature ID	Wetted Width (m)	Depth (cm)		Substrate	Drainage Direction
		Observed	Bankfull		
Watercourse 1	1 to 2	40	20	Gravel	Northeast to southwest
Watercourse 2	2 to 3	40	20	Organic	South to north
Watercourse 3a	1	30	20	Gravel	Southeast to northwest
Watercourse 3b	0.4	20	15	Sand	East to west
Watercourse 4[1]	2 to 5	40	20	Organics	East to west
Watercourse 5a	1 to 1.5	28	10	Sand and small boulders	Southeast to northwest
Watercourse 5b	0.5	23	Dry at time of observation	Sand and cobble	Southeast to northwest
Watercourse 6	0.4	23	12	Organic	South to north
Watercourse 7	2-5	45	20	Organic	Northwest to southeast (along road)
Watercourse 8	2 to 4	30	20	Organic	Southwest to northeast
Watercourse 9	1	20	10	Organic	Northwest to southeast
Watercourse 10	2 to 3	20	10	Sand	Northwest to southeast
Watercourse 11	0.9	35	15	Gravel and cobble	West to east
Watercourse 12	1	35	20	Muck and cobble	West to east
Watercourse 13	0.5	25	20	Organic	Southwest to northeast

1. water pools after exiting from culvert, then converts to underground drainage

8.3.1 Watercourse Crossings

The upgrading and construction of access roads will require the replacement of two culverts (Watercourse 8 and Watercourse 7) and three new culvert crossings (Watercourses 3A, 9, and 11).

Any required watercourse crossings will comply with the "Nova Scotia Watercourse Alteration Specifications" (NSE 2010), the PWA Regulations (NS Reg 12/95), and the "Pockwock Lake and Tomahawk Lake Watersheds Source Water Protection Plan" (Halifax Water 2009).

8.3.2 Fish and Fish Habitat

For the purposes of the EA, all watercourses within the Project site have been assumed to be 'fish bearing' and shall be treated as such throughout Project site development plans.

Fish species known to inhabit lakes and rivers with proximity to the Project site include American eel (*Anguilla rostrata*), smallmouth bass (*Micropterus dolmieui*), white sucker (*Catostomus commersonii*), alewife (*Alosa pseudoharengus*), and brook trout (*Salvelinus fontinalis*) (Conrad 2007). In addition, an ongoing fish stocking initiative in the Sackville River introduces Atlantic salmon (*Salmo salar*) and brook trout annually to the watershed (SRA 2012).

A review of the Atlantic Canada Conservation Data Center (ACCDC) database for fish species recorded within a 100 km radius of the Project site was completed. All species, including status rankings, are provided in Table 8.3.

Table 8.3: Fish Species Recorded within a 100 km radius of the Project site

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
Atlantic Sturgeon	*Acipenser oxyrinchus*	Not Listed	Not Listed	Threatened	Red
Atlantic Whitefish	*Coregonus huntsmani*	Endangered	Endangered	Endangered	Red
Atlantic Salmon [Inner Bay of Fundy (IBoF) population]	*Salmo salar*	Endangered	Not Listed	Endangered	Red
Atlantic Salmon (NS Southern Upland population)	*Salmo Salar*	Not Listed	Not Listed	Endangered	Red
Striped Bass	*Morone saxatilis*	Not Listed	Not Listed	Endangered	Red

Source: ACCDC 2011

[1] Government of Canada 2012; [2] NS ESA 2007; [3] COSEWIC 2012; [4]NSDNR 2010

Fish species recorded within a 100 km radius of the Project site were screened against the criteria outlined in the document "Guide to Addressing Wildlife Species and Habitat in an EA Registration Document" (NSE 2009b) to develop a list of priority species (e.g. SOCI), which are assessed further as a VEC.
In the context of this EA, SOCI include those that are:

- Listed under *SARA* as "Endangered", "Threatened", or "Special Concern";

- Listed under the NS *ESA as "*Endangered*"*, "Threatened", or "Vulnerable";
- Assessed by COSEWIC as "Endangered", "Threatened", or "Special Concern"; or
- Assessed by NSDNR as "Red" (at risk or may be at risk) or "Yellow" (sensitive).

Priority fish species include:

- Atlantic sturgeon – "Threatened" (COSEWIC), "Red" (NSDNR);
- Atlantic whitefish – "Endangered" (*SARA*), "Endangered" (NS *ESA*), "Red" (NSDNR);
- Atlantic salmon (NS Southern Upland population) – "Special Concern" (COSEWIC), "Red" (NSDNR);
- Atlantic salmon (Inner Bay of Fundy population) – "Endangered" (Government of Canada 2012), "Endangered" (COSEWIC) "Red" (NSDNR); and
- Striped bass – "Threatened" (COSEWIC), "Red" (NSDNR).

Atlantic Salmon (IBoF Population)
Atlantic salmon are native to the North Atlantic Ocean and coastal rivers. These fish are anadromous and as such spend long migration periods in the ocean, returning to freshwater streams to reproduce. The species prefers rivers that are clear, cool and well oxygenated and contain shallow riffles with gravel, rubble, rock or boulder bottoms. The Atlantic salmon (iBoF) population spawns in those rivers of Nova Scotia and New Brunswick that drain into the Minas Basin and Chignecto Bay (COSEWIC 2010a). The on-site watercourses, and associated watersheds flow towards the Atlantic Ocean, therefore Atlantic salmon occurring at the Project site would form part of the NS Southern Upland population, which is discussed below.

Atlantic Salmon (NS Southern Upland Population)
The Sackville River has been known to host Atlantic salmon. However, the historical population has been in decline for decades due to habitat loss and degradation, and is now believed to be extirpated from the Sackville River (COSEWIC 2010a). An initiative managed by the Sackville Rivers Association (SRA) has been stocking Atlantic salmon and speckled trout in the Sackville River since the 1980s (SRA 2012).

The closest major river to the Project site known to support the native NS Southern Uplands population is the Gold River, 45 km to the southwest (Atlantic Salmon Federation 2012; COSEWIC 2010a). This river once had a healthy population of Atlantic salmon and was a fishing destination for anglers from all over Nova Scotia. In recent years, the population of salmon has diminished to the point of the river being completely closed to salmon angling (BCAF 2011a). While the East / Indian River watershed is not known to have hosted Atlantic salmon, it is possible that the tributaries to this watershed once hosted salmon populations as well, but there is limited available data on these minor waterways.

The majority of field identified watercourses on the Project site are seasonal or ephemeral streams characterized by organic sediments and intermittent surface flow, and do not provide suitable spawning or rearing habitat for Atlantic salmon. However, the watercourses may be used during feeding, migration and other life stages, and therefore Atlantic salmon may be present at the Project site.

Potential effects of the Project on this species, as well as proposed species-specific mitigation measures, are discussed in more detail in Section 14.2.1.

Atlantic Sturgeon

Occurring in rivers and estuaries near North Atlantic shore environments, the Atlantic sturgeon has been reported in the Annapolis, Avon, Shubenacadie, St. Croix and LaHave River systems, as well as the Minas Basin (Colligan *et a*l. 1998; COSEWIC 2011). Little is known about the habitat requirements for Atlantic sturgeon at the northern extent of its range, but important freshwater habitats for the species appear to be rivers with access to the sea, preferably with deep channels. Research suggests that the anadromous species spawns in freshwater over hard-bottom substrates at depths of 1-3 m in areas of strong currents, and under waterfalls and in deep pools just above the marine-freshwater demarcation (COSEWIC 2011). In Canada, the species is known to spawn only in two areas, the St. John River and middle St. Lawrence. Small spawning populations are also postulated to exist in the Annapolis, Avon, St. Croix and LaHave systems. Atlantic Sturgeon is not known to migrate up any inland waterways of the Sackville or East Indian River watershed. It is therefore unlikely that the species would be present at the Project site.

Atlantic Whitefish

Atlantic whitefish are a Canadian endemic fish restricted to three lakes in the Petite Riviere watershed (Hebb, Milipsigate and Minamkeak). Though historical populations were anadromous, the remaining population of Atlantic whitefish is considered landlocked and complete their life cycle in the three lakes and connecting streams. Until recently, the lakes have been largely inaccessible to upstream migrants due to a lack of fish passage facilities at Hebbville Dam. Recovery efforts for the species have included a recently installed (2012) fish ladder at the Hebbville dam, which has shown promise in facilitating fish passage and increasing the species' range for the first time in over a century (BCAF 2011b; Withers 2012).

A few records of Atlantic whitefish are known from the Petite Rivière watershed outside of the three lakes including Birch Brook, the lower reaches of the Petite Rivière and estuary (Bradford *et al*. 2010 as cited in COSEWIC 2010b), Fancy Lake and the LaHave River estuary (COSEWIC 2010b). Whether Atlantic Whitefish in these areas are remnants of an anadromous population or strays that have passed downstream over the Hebbville Dam is unknown (COSEWIC 2010b). Habitat requirements for Atlantic Whitefish are not well defined throughout the species' life history, particularly with regards to habitat requirements in the lower reaches of the Petite Rivière (COSEWIC 2010b).

The on-site watercourse are not known to support Atlantic whitefish and are not in close proximity to the Petite Riviere watershed or known whitefish habitat. Therefore, it is unlikely that the species is present at the Project site.

Striped Bass

Striped bass is an anadromous species typically associated with estuaries and coastal waters, which spawns and over-winters in freshwater and occasionally brackish water. In Nova Scotia, the Annapolis River and the Shubenacadie–Stewiacke River system in the Bay of Fundy historically supported spawning populations (Rulifson and Dadswell 1995). Today, the species is known to spawn only in two rivers in eastern Canada; the Miramichi and the Shubenacadie. Catches have been recorded throughout the province, including in the Annapolis River, Shubenacadie and Grand lakes, Mahone Bay and the Minas Basin. The on-site watercourses are not known to support Striped bass and are not hydrologically connected to the Shubenacadie River, therefore it is unlikely that the species is present at the Project site.

General mitigation measures for aquatic fauna are provided in Section 4.0. Where required, species-specific mitigation is provided in Section 14.

8.4 Terrestrial Habitats

Vegetation composition within the Project site is defined as mixed wood forest, made up of intermediate to tall stands of red spruce (*Picea rubens*), eastern hemlock (*Tsuga canadensis*), white pine (*Pinus strobus*), balsam fir (*Abies balsamea*), and red maple (*Acer rubrum*). Extensive areas affected by fire often support black spruce (*Picea mariana*) forests scattered with aspen (*Populus spp.*), red maple, red oak (*Quercus rubra*), white birch (*Betula papyrifera*), and white pine (Webb and Marshall 1999).

Areas characterized by poorly drained soils within the ecodistrict, such as bogs, fens, and swamps, are typically dominated by balsam fir and black spruce species. Exposed hill tops and slopes are often dominated by species such as beech (*Fagus grandifolia*), sugar maple, (*Acer saccharum*) and red oak (Webb and Marshall 1999). Ground vegetation typical of this type of mixed wood forest includes bracken fern, bunchberry (*Cornus canadensis*), sheep-laurel (*Kalmia angustifolia*), and blueberry (*Vaccinium angustifolium*). Stream banks and riparian habitats support communities with higher percentages of herbaceous plants (NSMNH 1989).

The majority of the Project site is forested and softwood stands are the dominant habitat feature (Table 8.4; Drawing 8.5).

Table 8.4 Habitat Types at the Project Site

Habitat Type	Area (ha)	Percent of Site
Softwood	163.61	57%
Mixed woods	53.44	19%
Power line Corridor	20.34	7%
Urban	14.27	5%
Clearcut	8.4	3%
Swamp	6.25	2%
Road Corridor	4.54	2%
Hardwood	3.78	1%
Unclassified Forest	3.16	1%
Dead Stand	4.21	1%
Unclassified Wetland	2.02	1%
Inland Water	1	<1%
Marsh	0.83	<1%
Total	**285.91**	**100%**

Source: NSDNR 2012a

Field surveys at the Project site confirmed that the area encompasses a variety of habitats including secondary conifer forest, mixed forest stands and several conifer wetlands. Infrequent smaller areas of woody shrub habitat were also observed. The forested areas are mostly secondary conifer forest with species such as red spruce, black spruce, and balsam fir dominating, with occasional red maple, yellow birch (*Betula allegheniensis*), and gray birch (*Betula populifolia)*. More mature areas of the Project site permit some undergrowth, but in occasional fir thickets, all lower vegetation is shaded out.

Mixed forest stands are common, and occasionally hardwood stands, are typically dominated by red maple, with occasional trembling aspen (*Populus tremuloides*), big-toothed poplar (*Populus grandidentata*) and yellow birch.

Besides the upland forests, there were several forested wetlands, mostly conifer swamps, dominated by black spruce with a carpet of Sphagnum mosses underfoot. Cinnamon fern (*Osmunda cinnamomea*) is very common in these wooded wetlands, whether dominated by conifers or hardwoods.

Other wetlands include transition zones between open fens and swamps (alongside watercourses), dominated by peat mosses including a variety of sedges and bog plants throughout. Marshes dominated by cattails (*Typha latifolia*) were noted and often appeared to be developing in areas where the competing woody plants were drowned by nearby construction of the watershed facility. The marsh habitat was bordered by wooded wetlands. Wetlands are discussed further in Section 8.4.1.

Occasional small streams often include a narrow riparian zone. Other streamside communities include alder swamps dominated by speckled alder (*Alnus incana*) and cattail ponds, in addition to grasses and sedges. There are small areas of medium-high shrubs, dominated by black huckleberry (*Gaylussacia baccata*) and other such shrubby species. These areas are not homogeneous and it is probable that the shrubs will eventually give way to taller forest species unless subjected to fire.

There are a variety of habitats adjacent to the on-site power line right-of-way including grassy meadows, low shrub barrens, and fens. The low vegetation is artificially maintained to remove the taller woody plants.

Areas throughout the Project site including existing access roads and shoulders, as well as the industrialized area around the water treatment facility provide habitat for weedy exotics such as colt's foot (*Tussilago farfara*) and common crown vetch (*Coronilla varia)*. In contrast, some of the old logging roads in the woods have deep ruts that are now small shaded linear ponds utilized by amphibians.

The Project construction footprint will include five turbines and encompasses a small disturbance area (e.g. access road, turbine pad, and laydown area) of approximately 6.58 ha, which represents 2.3% of the total Project site. Turbines have been located in close proximity to existing Halifax Water (HW) infrastructure to minimize the habitat disturbance associated with creating new access roads.

The permanent Project footprint, meanwhile, will be significantly reduced due to the reclamation of part of the turbine laydown area used during the construction phase. The permanent Project footprint, therefore, will include a total disturbance area of 2.28 ha, representing 0.79% of the Project site. Permanent disturbance occurs primarily within mid-aged to mature softwood (39.69%) and mixed-woods (16.4%), habitat types which are prevalent at the Project site. Other habitats impacted include regenerating cutover (11.4%), with a significant disturbance area (32.51%) occurring in “urban” (in close association with the Halifax Water Treatment facility) or existing road corridor habitat types.

N

Melvin Cove

Pockwock Lake

Hamilton Pond

Alt 01

01

Pockwock Water Treatment Plant

02

Alt 02

Tomahawk Lake

Little Pockwock Lake

Pockwock Road

03

Beaver Lake

04

05

Lizard Lake

Pockwock Rd

Orchard Dr

Anderson Rd

Upper Hammonds Plains

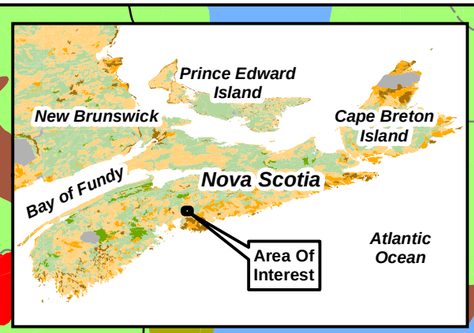
Old Annapolis Rd

Daisywood Dr

Slate Dr

Rockcrest Dr

0 100 200 400 600 800 1,000 Metres



Legend:

- Proposed Turbine
- Alternate Turbine
- Proposed Access Road
- Permanent Disturbance Area
- Project Site Boundary
- Major Roads and Highways
- Public Roads
- Access Roads / Trails
- Water Bodies
- Softwood
- Mixed Wood
- Hardwood
- Unclassified Forest
- Dead Stand
- Alders >75%
- Clear Cut
- Partial Cut-over
- Treed Bog
- Urban
- Other
- Gravel Pit
- Powerline Corridor
- Road Corridor

Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre. Forestry Inventory By Nova Scotia Department Of Natural Resources (NS DNR).
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Habitat Cover Type

Chebucto WindField Community Owned. Naturally.

Community Wind Farms Inc.

juwi

Strum CONSULTING

Date:	Project #:
April 2013	12-4326
Scale: 1:15,000	Drawing #: **8.5**
Drawn By: H. Serhan	
Checked By: M. Smith	

8.4.1 Wetlands

A desktop identification of the location and extent of potential wetlands across the Project site was completed by reviewing the following information sources:

- Satellite and aerial photography;
- Nova Scotia Wet Areas Mapping database (WAM) (NSDNR 2012b);
- Nova Scotia Geomatics Centre; and
- NS Significant Species and Habitats database (NSDNR 2012c).

Topographic mapping and the NSDNR Significant Species and Habitat database indicate that there are multiple areas of swamp habitat scattered throughout the Project site (Drawing 8.3).

The WAM for the Project site is generally consistent with NSDNR mapped wetlands (Drawing 8.3). Potential wet areas are also identified in the northern corner of the Project site, adjacent to Pockwock Lake. These wet areas may represent unmapped watercourses or areas of drainage (NSDNR 2012b).

Fifteen wetlands were observed within the Project site boundaries (Drawings 8.4 A-C) during field surveys completed in June, July and September 2012. Wetland habitat characterizations are provided in Table D1 (Appendix D).

Wetlands habitat is dispersed throughout the Project site (Drawings 8.4 A-C). Wetlands primarily consist of treed and shrub swamps (11), with marsh habitat (3) and one vernal pool accounting for the remainder. In northern portions, general movement of water is to the south toward Little Pockwock Lake, whereas wetlands located elsewhere drain water off-site either to the northeast or to the southwest. The majority of wetlands function as outflow or throughflow wetlands. The outflow wetlands act as a source of water to lower lying waterbodies such as Lizard Lake and Little Pockwock Lake, in addition to larger areas of wetland habitat located northeast of the Project site. The throughflow wetlands intercept water as it seeps down grade toward lower lying receptors located off-site (inflow wetlands). Two small isolated wetlands exist in central portions of the Project site (Drawings 8.4 A-C). The treed and shrub swamps identified are very wet and intermittent standing water was often observed. Typically, the areas of marsh habitat exhibited deeper areas of standing water and a lower diversity of woody vegetative cover. Soil composition within all the swamps and marshes consists of organic soils overlying shallow bedrock, or organic overlying depleted mineral soils.

Based on the current Project construction footprint, no wetland alterations are expected at turbine locations. Two wetlands (Wetlands 11 and 14) will be directly impacted by new road construction to access turbines 4 and 5, respectively. It is estimated that 350.14 m^2 of wetland will be impacted by the construction of the road (based on a total road width of 10 m).

Wetland alterations represent a small area of disturbance. Overall it is expected that the Project will have a minimal effect on wetland habitat and hydrological functions. Provincial wetland alteration permits will be sought for each alteration, as required by the Nova Scotia Wetland Alteration Application process during the permitting stage of the Project. This will include completing a characterization of the functions of all impacted wetlands affected by the development footprint. Detailed mitigation measures and BMPs to reduce adverse effects on the altered wetlands, as well as the adjacent, non-altered wetlands will be outlined as part of this

process. Compensation for direct impacts to wetlands will be provided in accordance with NSE requirements.

General mitigation measures for terrestrial habitats are provided in Section 4.0

8.5 Terrestrial Vegetation

ACCDC Records indicate that 259 vascular flora species, including 179 SOCI, have been identified within 100 km of the Project site. No non-vascular flora species were noted.

This preliminary list was used to develop a short list of plant SOCI that might be present at the Project site. The short list of plant SOCI is provided in Appendix E.

Plant surveys were completed in June, July, and September 2012. The surveys encompassed a variety of habitats including many transition zones giving rise to a mosaic of habitats which provides a niche for many plant species. This is demonstrated by the diverse list of plants identified (Appendix E).
No vascular plant SOCI were observed during the plant surveys.

General mitigation measures for terrestrial habitats are provided in Section 4.0

8.6 Terrestrial Fauna

Information regarding terrestrial fauna for the Project site, including any SOCI, was obtained through a combination of desktop review and field studies.

The desktop component included a review of the NS Significant Species and Habitat Database (NSDNR 2012c) and ACCDC data (ACCDC 2011) for species recorded within a 100 km radius of the Project site. A comparison of habitat mapping data to known habitat requirements for species expected to occur within the area, and for all SOCI, was also completed.

8.6.1 Mammals

The NS Significant Species and Habitats database contains 29 unique records pertaining to terrestrial mammals (excluding bats) within a 100 km radius of the Project site. These records include:

- twenty-two that are classified in the database as “over-wintering habitat” for White-tailed deer (*Odocoileus virginianus*);
- three records are classified as ‘Species of Concern’, for species such as Fisher (*Martes pennanti*) and Long-tailed shrew (*Sorex dispar*);
- two records are classified as ‘Species at Risk’ for species such as American Marten (*Martes Americana*) and Southern flying squirrel (*Glaucomys volans*); and
- two records are classified as ‘Other Habitat’ for species such as American beaver (*Castor canadensis*) and American black bear (*Ursus americanus*).

No records that relate to terrestrial mammal habitat are within 10 km of the Project site.
The ACCDC database (2011) indicates that six species of terrestrial mammals (excluding bats) have been recorded within a 100 km radius of the Project site (Table 8.6).

Table 8.6: Mammal Species Recorded within a 100 km radius of the Project Site

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
American marten	*Martes americana*	Not Listed	Endangered	Not Listed	Red
Canada lynx	*Lynx canadensis*	Not Listed	Endangered	Not at Risk	Red
Fisher	*Martes pennanti*	Not Listed	Not Listed	Not Listed	Yellow
Long-tailed shrew	*Sorex dispar*	Not Listed	Not Listed	Not Listed	Yellow
Mainland moose	*Alces americanus*	Not Listed	Endangered	Not Listed	Red
Southern flying squirrel	*Glaucomys volans*	Not Listed	Not Listed	Not Active	Yellow

Source: ACCDC 2011

[1] Government of Canada 2012; [2] NS ESA 2007; [3] COSEWIC 2012; [4] NSDNR 2010

Of note is that sightings of many of the most common species are unreported to ACCDC, and are therefore under-represented or absent from the database. Consequently, a review of the ACCDC data reveals predominantly rare or noteworthy species despite the fact that these species certainly represent a small fraction of the existing mammal community in an area.

Field surveys (between January 2012 and March 2013) of mammalian fauna at the Project site consisted of direct observation of individuals, as well as the indirect identification of species by sound and/or sign (e.g. scat, tracks, scent, dens, lodges). In addition, snow-tracking surveys were conducted for Mainland moose and other animal sign in January and March 2013. A detailed methodology for snow-tracking surveys is provided in Appendix F.

Table 8.7 lists the mammal species observed/identified at or near the Project site during all field surveys.

Table 8.7: Mammal Species Observed/Identified during Field Surveys

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
American mink	*Mustela vison*	Not Listed	Not Listed	Not Listed	Green
Bobcat	*Lynx rufus*	Not Listed	Not Listed	Not Listed	Green
Eastern coyote	*Canis latrans*	Not Listed	Not Listed	Not Listed	Green
Red squirrel	*Tamiasciurus hudsonicus*	Not Listed	d interactiNot	Not Listed	Green
Short-tailed weasel	*Mustela erminea*	Not Listed	Not Listed	Not Listed	Green
Snowshoe hare	*Lepus americanus*	Not Listed	Not Listed	Not Listed	Green
White-tailed deer	*Odocoileus virginianus*	Not Listed	Not Listed	Not Listed	Green

[1] Government of Canada 2012; [2] NS ESA 2007; [3] COSEWIC 2012; [4] NSDNR 2010

Habitat at the Project site suggests that other terrestrial mammal species, besides those listed in Table 8.7, are likely to occur. Stands dominated by balsam fir typically have a well-developed coarse woody debris/snag component (Neily *et al*. 2010) which adds habitat complexity and provides shelter for a variety of

small mammals. Mixed wood forests provide food and shelter for White-tailed deer (Neily *et al*. 2010), as the conifers limit snow depth and provide thermal refuge in winter, while sapling hardwoods ensure that adequate browse is available.

Priority mammal species include:

- American marten - "Endangered" (NS *ESA*), "Red" (NSDNR);
- Canada lynx - "Endangered" (NS *ESA*), "Red" (NSDNR);
- Fisher – "Yellow" (NSDNR);
- Long-tailed shrew – "Yellow" (NSDNR);
- Mainland moose – "Endangered" (NS *ESA*), "Red" (NSDNR); and
- Southern flying squirrel – "Yellow" (NSDNR).

American marten
In general, American marten prefers mature, coniferous forests, although mixed wood forests are also used when specific structural components such as large denning trees and downed-woody debris are present (Scott 2001; Nova Scotia American Marten Recovery Team 2006). Habitat fragmentation, such as that resulting from forestry operations, results in sub-optimal breeding habitat (Scott 2001).

The current known distribution for American marten in Nova Scotia is limited to Cape Breton and the southwestern part of the province, the latter resulting from a reintroduction into Kejimkujik National Park. ACCDC records indicate that the closest American marten observation to the Project site was 91 ± 10 km away.

No indication of American marten was observed during field studies. While suitable habitat, in the form of mid-aged to mature softwood stands, is abundant (Drawing 8.5), the current range of American marten in Nova Scotia does not coincide with the location of the Project. It is therefore highly unlikely that American marten occur at the Project site.

Canada lynx
Canada lynx typically prefer high elevation softwood stands of varying successional stage, most notably second growth forest following natural or human-induced disturbance, that allow Snowshoe hare (*Lepus americanus*) populations to reach peak densities (Parker *et al*. 1983; Parker 2001). Downed woody debris, such as that associated with older forests, are required for maternal den sites (Nova Scotia Lynx Recovery Team 2006).

The breeding population of Canada lynx in Nova Scotia is limited to the Cape Breton Highlands (Parker 2001; Nova Scotia Lynx Recovery Team 2006). During cyclic lows in Snowshoe hare populations, individual Canada lynx may disperse great distances throughout mainland Nova Scotia. ACCDC data indicate that the closest observation of Canada lynx to the Project site was 69 ± 1 km away.

No indication of Canada lynx was observed during field studies. Mid-aged to mature softwood habitat is present throughout the Project site (Drawing 8.5), which likely supports a moderate Snowshoe hare population while also offering suitable den sites. However, considering the species' known range in Nova

Scotia, it is highly unlikely that Canada lynx occur at the Project site. Any occurrence of this species would represent a transient individual ranging in search of food during periodic lows in the Snowshoe hare cycle.

Fisher
Fisher prefer dense, mature to old-growth forests with continuous overhead cover (Allen 1983). Generally considered a forest-interior species (OMNR 2000), Fisher require large tracts of well-connected habitat (Meyer 2007).

Fisher are distributed throughout mainland Nova Scotia, and trapping data suggests population concentrations in Cumberland, Colchester, and Pictou counties; just 36 Fisher have been harvested from Halifax County since 2000, representing 2% of the provincial total (NSDNR 2012d). ACCDC data indicate that the closest observation of this species to the Project site was 47 ± 10 km away.

No indication of Fisher was observed during field surveys. However, suitable habitat, in the form of mid-aged to mature softwood/mixed wood stands well removed from edge habitat, is present throughout the Project site (Drawing 8.5). The low density population of Fisher in Halifax County means that there is a low likelihood of the species occurring at the Project site. The possibility exists that the Project site forms part of the home range of one or more Fishers.

Potential effects of the Project on this species, as well as proposed mitigation measures, are discussed in more detail in Section 14.2.1.

Long-tailed shrew
Long-tailed shrew are closely associated with steep, talus slopes, usually close to running water, and the presence of rocks is considered a principal habitat component (Kirkland 1981).

Long-tailed shrew in Nova Scotia was thought to be found only in the Cobequid Mountains (Scott 1987; Woolaver *et al*. 1998), but more recent research has identified an additional population 60 km to the southwest, near Wolfville (Shafer and Stewart 2006). ACCDC data indicate that the closest observation of Long-tailed shrew to the Project site was 77 ± 10 km away.

No indication of Long-tailed shrew was observed during field studies. Furthermore, no talus slope habitat is present at the Project site. Considering that the range of this species in Nova Scotia does not coincide with the Project location and that suitable habitat is absent, it is highly unlikely that Long-tailed shrew occur at the Project site.

Mainland moose
Habitat requirements for Mainland moose change throughout the year. Early successional growth, such as that provided by recent cutovers, offers quality foraging habitat for moose, and interspersed wetlands provide suitable summer habitat for cows and calves (Parker 2003; Snaith & Beazley 2004). Mature softwood forest is used as escape cover throughout the year, and also provides thermal relief during the summer months (Broders *et al*. 2012) and relief from deep snows in winter (Telfer 1970).

Five significant concentration areas for Mainland moose have been identified in Nova Scotia (NSDNR 2012e). Part of the Project site falls within such an area centred on the Halifax Peninsula. ACCDC records, meanwhile, indicate that the closest observation of this species to the Project site was 29 ± 10 km away.

No evidence of Mainland moose was observed at the Project site, including during targeted snow-tracking surveys (Appendix F) conducted in January and March 2013. However, shrub successional growth is present in small cut-overs and a transmission corridor that bisects the Project site, and suitable mature forest is present close to these cut-over foraging areas, which could potentially provide thermal cover and escape cover, as well as relief from deep snows in late winter. Given that suitable habitat is present, a known concentration area is present nearby, and that Mainland moose have relatively large home ranges (~45 km^2) (Brannen 2004), it is somewhat likely that Mainland moose occur at the Project site.

Potential effects of the Project on this species, as well as proposed mitigation measures, are discussed in more detail in Section 14.2.1.

Southern flying squirrel
Southern flying squirrel requires mast bearing trees for forage and tree cavities for nesting and in the Atlantic Region, southern flying squirrels select older forest stands (COSEWIC 2006). In Nova Scotia, the species demonstrates a particular affinity to red oak (*Quercus rubra*) which is most commonly found in mixed wood stands as opposed to pure hardwood stands (Lavers 2004).

In Nova Scotia, Southern flying squirrel occur primarily in a region bounded by the South Mountain in the north, Kentville in the east, New Ross in Lunenburg County to the south, and extends to Kejiimkujik National Park in the west (COSEWIC 2006). ACCDC data indicate that the closest observation of this species to the Project site was 58 ± 10 km away.

No indication of Southern flying squirrel was observed during field studies. Furthermore, red oak was not identified at the Project site during intensive botany surveys, a finding which is supported by local habitat mapping. Given that suitable habitat is absent and that the known geographic range of the species in Nova Scotia does not coincide with the Project location, it is highly unlikely that Southern flying squirrel occurs at the Project site.

8.6.2 Herpetofauna

The Nova Scotia Significant Species and Habitats database (NSDNR 2012c) contains 41 unique records relating to reptile/amphibian habitat within a 100 km radius of the Project site. These include:

- Forty records that are classified in the database as ‘Species at Risk’, including Wood turtle (*Clemmys insculpta*), Blanding’s turtle (*Emydoidea blandingii*), Eastern Ribbonsnake (*Thamnophis sauritus*), and Common snapping turtle (*Chelydra serpentine*); and
- One record for ‘Species of Concern’ relating to Painted turtle (*Chrysemys picta*).

None of the records pertaining to reptiles/amphibians occur within 10 km of the Project site.

The ACCDC database identifies records of four terrestrial reptile/amphibian taxa occurring within 100 km of the Project site (Table 8.8).

Table 8.8: Reptile and Amphibian Species Recorded within a 100 km Radius of the Project Site

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
Blanding's turtle	*Emydoidea blandingii*	Endangered	Endangered	Endangered	Red
Eastern ribbonsnake	*Thamnophis sauritus*	Threatened	Threatened	Threatened	Red
Four-toed salamander	*Hemidactylium scutatum*	Not Listed	Not Listed	Not at Risk	Green
Wood turtle	*Glyptemys insculpta*	Threatened	Vulnerable	Threatened	Yellow

Source: ACCDC 2011

[1] Government of Canada 2012; [2] NS ESA 2007; [3] COSEWIC 2012; [4] NSDNR 2010

The same data limitations and interpretations as noted for the mammalian fauna (Section 8.6.1) are also applicable to the reptile and amphibian data.

Field surveys of amphibian and reptile species were conducted in conjunction with other surveys completed between January 2012 and January 2013. Species were either identified directly through visual observation, or indirectly using other evidence or actual presence (e.g. calls, egg masses, tadpoles). Table 8.9 lists the amphibian and reptile species identified at or near the Project site during field surveys.

Table 8.9: Reptile and Amphibian Species Observed During Field Surveys

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
American toad	*Anaxyrus americanus*	Not Listed	Not Listed	Not Listed	Green
Green frog	*Lithobates clamitans*	Not Listed	Not Listed	Not Listed	Green
Northern leopard frog	*Lithobates pipiens*	Not Listed	Not Listed	Not at Risk	Green
Spotted salamander	*Ambystoma maculatum*	Not Listed	Not Listed	Not Listed	Green
Spring peeper	*Pseudacris crucifer*	Not Listed	Not Listed	Not Listed	Green
Wood frog	*Lithobates sylvaticus*	Not Listed	Not Listed	Not Listed	Green

[1] Government of Canada 2012; [2] NS ESA 2007; [3] COSEWIC 2012; [4] NSDNR 2010

Priority herpetofauna species include:

- Blanding's turtle – "Endangered" (*SARA*), "Endangered" (NS *ESA*), "Red" (NSDNR);
- Common snapping turtle – "Special Concern" (*SARA*);
- Eastern ribbonsnake – "Threatened" (*SARA*), "Threatened" (NS *ESA*), "Red" (NSDNR); and
- Wood turtle – "Threatened" (*SARA*), "Vulnerable" (NS *ESA*), "Yellow" (NSDNR).

None of the priority species listed above were observed during field surveys.

Blanding's turtle

Blanding's turtle make use of a variety of wetland habitats including lakes, ponds, brooks, creeks, and marshes (COSEWIC 2005), and are closely associated with areas of extensive beaver activity (The Blanding's Turtle Recovery Team 2012). Research conducted in Kejimkujik Park suggests that nesting occurs predominantly on lakeshore cobble beaches (Standing *et al*. 1999).

The known range of this species in Nova Scotia is restricted to the southwestern interior of the province where there are five disjunct populations within the Medway, Mersey, and Sissiboo River watersheds (The Blanding's Turtle Recovery Team 2012). ACCDC data indicate that the closest observation of this species to the Project site was 76 km away.

No indication of Blanding's turtle was observed during field studies. Several of the preferred macro-habitats for this species are present at the Project site; however, the current extent of this species' range in Nova Scotia does not overlap with the Project location. It is therefore highly unlikely that Blanding's turtle occurs at the Project site.

Common snapping turtle
Common snapping turtle, despite its conservation status, is considered relatively common in mainland Nova Scotia (Davis and Browne 1996). Common snapping turtle habitat is usually associated with slow moving water of moderate depth, with a muddy bottom and dense vegetation. Established populations are typically found in ponds, lakes and river edges (COSEWIC 2008).

The species has a widespread distribution across mainland Nova Scotia, including in the greater Halifax area (COSEWIC 2008), although ACCDC records do not include Common snapping turtle records within 100 km of the Project site.

No indication of Common snapping turtle was observed during field studies. Furthermore, watercourses at the Project site are largely small/ephemeral in nature, and open water is limited except for a small pond adjacent to the northern boundary. Lack of suitable habitat means it is unlikely that Common snapping turtle occurs at the Project site.

Eastern ribbonsnake
Eastern ribbonsnake is a semi-aquatic species associated with a variety of freshwater habitats (COSEWIC 2002). Common habitats in which populations have been identified include slow flowing wetlands with abundant vegetation, which can include fens, meadow streams, lake coves, and shorelines. Eastern ribbonsnake often occurs in association with beaver activity (Parks Canada Agency 2012).

In Nova Scotia, concentrations of Eastern ribbonsnake are thought to be limited to interior portions of the Mersey, Medway, and LaHave River watersheds in the southwestern region of the province (Parks Canada Agency 2012), although recent discoveries have expanded the known range of this species to include the Petite Rivière watershed (Gilhen *et al*. 2012). ACCDC records, meanwhile, indicate that the closest observation of this species to the Project site was 78 ± 0.1 km away.

No indication of Eastern ribbonsnake was observed during field studies. The species' required habitat, including streams, marshes, swamps, and bogs, are present at the Project site (Drawing 8.4A-C). However,

given that the species' known range in Nova Scotia does not overlap with the Project location, it is highly unlikely that Eastern ribbonsnake occurs at the Project site.

Wood turtle
Wood turtle requires three key habitat components: a watercourse, sandy substrate for nesting, and a forested area for thermal relief during the summer months (MacGregor and Elderkin 2003).

The species is found throughout the province but seems to be most abundant in central Nova Scotia, although a small population is present in the Little Sackville River watershed (MacGregor and Elderkin 2003). ACCDC data indicate that the closest observation of this species to the Project site was 17 ± 1 km away.

No indication of Wood turtle was observed during field studies. However, suitable watercourse and associated riparian habitat is present at the Project site to support Wood turtles throughout the annual cycle, particularly in Watercourse 1 which features a sandy substrate (Drawing 8.4A-C). Given that the species is distributed throughout mainland Nova Scotia, and that suitable habitat is present, it is somewhat likely that the individual Wood turtle home ranges include part of the Project site.

Potential effects of the Project on this species, as well as proposed mitigation measures, are discussed in more detail in Section 14.2.1.

8.6.3 Butterflies and Odonates
The NS Significant Species and Habitats database identifies three significant habitat features relating to butterflies and Odonates within a 100 km radius of the Project site. These habitat features include:

- Two records classified as 'Species of Concern', including Jutta arctic (*Oeneis jutta*) and Little bluet (*Enallagma minusculum*); and
- One classified as 'Other Habitat' pertaining to Hoary elfin (*Callophrys polios*).

None of these records were noted within a 10 km radius of the Project site.
The ACCDC database identifies 54 butterfly/Odonate taxa within a 100 km radius of the Project site (Table 8.10).

Table 8.10: Unique Butterfly and Odonate Species Recorded within a 100 km radius of the Project Site

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
Aphrodite fritillary	*Speyeria aphrodite*	Not Listed	Not Listed	Not Listed	Green
Arctic fritillary	*Boloria chariclea*	Not Listed	Not Listed	Not Listed	Yellow
Baltimore checkerspot	*Euphydryas phaeton*	Not Listed	Not Listed	Not Listed	Green
Banded hairstreak	*Satyrium calanus*	Not Listed	Not Listed	Not Listed	Undetermined
Bog elfin	*Callophrys lanoraieensis*	Not Listed	Not Listed	Not Listed	Red
Bronze copper	*Lycaena hyllus*	Not Listed	Not Listed	Not Listed	Green
Brook snaketail	*Ophiogomphus aspersus*	Not Listed	Not Listed	Not Listed	Red

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
Clamp-tipped emerald	*Somatochlora tenebrosa*	Not Listed	Not Listed	Not Listed	Green
Common branded skipper	*Hesperia comma*	Not Listed	Not Listed	Not Listed	Green
Common roadside-skipper	*Amblyscirtes vialis*	Not Listed	Not Listed	Not Listed	Green
Compton tortoiseshell	*Nymphalis vaualbum*	Not Listed	Not Listed	Not Listed	Green
Delicate emerald	*Somatochlora franklini*	Not Listed	Not Listed	Not Listed	Yellow
Eastern comma	*Polygonia comma*	Not Listed	Not Listed	Not Listed	Not Listed
Eastern pine elfin	*Callophrys niphon*	Not Listed	Not Listed	Not Listed	Green
Eastern red damsel	*Amphiagrion saucium*	Not Listed	Not Listed	Not Listed	Green
Elfin Skimmer	*Nannothemis bella*	Not Listed	Not Listed	Not Listed	Green
Forcipate emerald	*Somatochlora forcipata*	Not Listed	Not Listed	Not Listed	Red
Gray comma	*Polygonia progne*	Not Listed	Not Listed	Not Listed	Green
Gray hairstreak	*Strymon melinus*	Not Listed	Not Listed	Not Listed	Green
Green comma	*Polygonia faunus*	Not Listed	Not Listed	Not Listed	Green
Greenish blue	*Plebejus saepiolus*	Not Listed	Not Listed	Not Listed	Not Listed
Harlequin darner	*Gomphaeschna furcillata*	Not Listed	Not Listed	Not Listed	Yellow
Harvester	*Feniseca tarquinius*	Not Listed	Not Listed	Not Listed	Green
Henry's elfin	*Callophrys henrici*	Not Listed	Not Listed	Not Listed	Green
Hoary comma	*Polygonia gracilis*	Not Listed	Not Listed	Not Listed	Yellow
Hoary elfin	*Callophrys polios*	Not Listed	Not Listed	Not Listed	Green
Jutta arctic	*Oeneis jutta*	Not Listed	Not Listed	Not Listed	Red
Juvenal's duskywing	*Erynnis juvenalis*	Not Listed	Not Listed	Not Listed	Green
Kennedy's emerald	*Somatochlora kennedyi*	Not Listed	Not Listed	Not Listed	Red
Lance-tipped darner	*Aeshna constricta*	Not Listed	Not Listed	Not Listed	Green
Laurentian skipper	*Hesperia comma*	Not Listed	Not Listed	Not Listed	Green
Maine snaketail	*Ophiogomphus mainensis*	Not Listed	Not Listed	Not Listed	Red
Milbert's tortoiseshell	*Aglais milberti*	Not Listed	Not Listed	Not Listed	Green
Monarch	*Danaus plexippus*	Special Concern	Not Listed	Special Concern	Yellow
Mottled darner	*Aeshna clepsydra*	Not Listed	Not Listed	Not Listed	Green
Mustard white	*Pieris oleracea*	Not Listed	Not Listed	Not Listed	Yellow
Northern cloudywing	*Thorybes pylades*	Not Listed	Not Listed	Not Listed	Yellow
Northern pearly-eye	*Lethe anthedon*	Not Listed	Not Listed	Not Listed	Green
Northern pygmy clubtail	*Lanthus parvulus*	Not Listed	Not Listed	Not Listed	Green
Ocellated darner	*Boyeria grafiana*	Not Listed	Not Listed	Not Listed	Yellow
Orange bluet	*Enallagma signatum*	Not Listed	Not Listed	Not Listed	Red
Prince baskettail	*Epitheca princeps*	Not Listed	Not Listed	Not Listed	Yellow

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
Quebec emerald	*Somatochlora brevicincta*	Not Listed	Not Listed	Not Listed	Red
Question mark	*Polygonia interrogationis*	Not Listed	Not Listed	Not Listed	Green
Riffle snaketail	*Ophiogomphus carolus*	Not Listed	Not Listed	Not Listed	Green
Rusty snaketail	*Ophiogomphus rupinsulensis*	Not Listed	Not Listed	Not Listed	Red
Salt and pepper skipper	*Amblyscirtes hegon*	Not Listed	Not Listed	Not Listed	Green
Satyr comma	*Polygonia satyrus*	Not Listed	Not Listed	Not Listed	Yellow
Seaside dragonlet	*Erythrodiplax berenice*	Not Listed	Not Listed	Not Listed	Yellow
Skillet clubtail	*Gomphus ventricosus*	Not Listed	Not Listed	Not Listed	Red
Striped hairstreak	*Satyrium liparops*	Not Listed	Not Listed	Not Listed	Undetermined
Taiga bluet	*Coenagrion resolutum*	Not Listed	Not Listed	Not Listed	Red
Vesper bluet	*Enallagma vesperum*	Not Listed	Not Listed	Not Listed	Yellow
Zebra clubtail	*Stylurus scudderi*	Not Listed	Not Listed	Not Listed	Red

Source: ACCDC 2011

[1] Government of Canada 2012; [2] NS ESA 2007; [3] COSEWIC 2012; [4] NSDNR 2010

Incidental observations of butterflies were made during other field studies conducted in summer 2012. Species were identified by direct observation of individuals. Northern spring azure (*Celastrina lucia*) was the only species observed, and is not considered a priority species.

Priority Odonate and butterfly species include:

- Arctic fritillary – “Yellow” (NSDNR);
- Bog elfin – “Red” (NSDNR);
- Brook snaketail – “Red” (NSDNR);
- Delicate emerald – “Yellow” (NSDNR);
- Forcipate emerald – ““Red” (NSDNR);
- Harlequin darner – “Yellow” (NSDNR);
- Hoary comma – “Yellow” (NSDNR);
- Jutta arctic – “Red” (NSDNR);
- Kennedy’s emerald – “Red” (NSDNR);
- Maine snaketail – “Red” (NSDNR);
- Monarch – “Special Concern” (*SARA),* “Special Concern” (COSEWIC), “Yellow” (NSDNR);
- Mustard White – “Yellow” (NSDNR);
- Northern cloudywing – “Yellow” (NSDNR);
- Ocellated darner – “Yellow” (NSDNR);
- Orange bluet – “Red” (NSDNR);
- Prince baskettail – “Yellow” (NSDNR);
- Quebec emerald – “Red” (NSDNR);
- Rusty snaketail – “Red” (NSDNR);

- Satyr comma – "Yellow" (NSDNR);
- Seaside dragonlet – "Yellow" (NSDNR);
- Skillet clubtail – "Red" (NSDNR);
- Taiga bluet – "Red" (NSDNR);
- Vesper bluet – "Yellow" (NSDNR); and
- Zebra clubtail – "Red" (NSDNR).

Monarch
Only the Monarch has been granted a designated conservation status at either the provincial or federal level. This species can be found in open-habitats with abundant wildflower growth. Milkweed (*Asclepias* sp.) is a critical element of breeding habitat, whereas asters (*Asteraciae* sp.) and goldenrods (*Solidago* sp.) provide necessary food resources during migration (Mersey Tobeatic Institute 2008).

Nova Scotia falls within the breeding range of this migratory species (COSEWIC 2010c), and individuals can be found throughout the province from May to October (Maritime Butterfly Atlas 2012).

No indication of Monarch was observed during field surveys. Furthermore, open habitat is limited at the Project site, except in the vicinity of the Halifax Water Commission Treatment Plant and along the associated waterline road (Drawing 8.5). However, considering the widespread distribution of the species in Atlantic Canada, it is possible that Monarch occurs at the Project site, particularly during the migratory period (late summer/early fall). However, it is unlikely that the Project site provides sufficient nectar resources to support a large congregation of migratory Monarchs.

Potential effects of the Project on this species, as well as proposed mitigation measures, are discussed in more detail in Section 14.2.1.

The requirements as set out in *SARA* and *NSESA* will be adhered to for Project activities. Additional general mitigation measures for terrestrial fauna are provided in Section 4.0. Where required, species-specific mitigation is provided in Section 14.

8.7 Avifauna
According to habitat mapping, the Project site is dominated by softwood (57%) and mixed wood forest (19%). Other habitat types including clear cut, dead stand, swamp, and transmission corridor are also present. The diversity of habitat types provides foraging, breeding, and roosting habitat for a variety of resident and migratory bird species.

The closest Important Bird Area (IBA) (IBA Canada 2012) to the Project site is the Southern Bight- Minas Basin IBA located approximately 31.95 km northwest of the Project site. This site is a large tidal embayment composed of intertidal mudflats which provide important staging habitat for an estimated 1 to 2 million shorebirds in late July and early August (IBA Canada 2012). In fact, it is estimated that 50% to 90% of the world's Semipalmated Sandpiper (*Calidris pusilla*) population gathers in this area to feed on the mudflat's invertebrates prior to migrating to South America. Other commonly observed species at this IBA include Red Knot (*Calidris canutus*), Sanderling (*Calidris alba*), Least Sandpiper (*Calidris minutilla*), and Semipalmated Plover (*Charadrius semipalmatus*). There are no other IBAs within a 50 km radius of the Project site.

The Project site is contained within map square 20MQ35, and in the most recent edition of the Maritime Breeding Bird Atlas (MBBA 2012) (covering the years 2006-2010), 97 species were identified as being possible, probable, or confirmed breeders within this area. The following avian SOCI are considered at least possible breeders at the Project site:

- Barn Swallow (*Hirundo rustica*) – "Threatened" (COSEWIC),"Yellow" (NSDNR);
- Bay-breasted Warbler (*Dendroica castanea*) – "Yellow" (NSDNR);
- Black-backed Woodpecker (*Picoides arcticus*) – "Yellow" (NSDNR);
- Bobolink (*Dolichonyx oryzivorus*) – "Threatened" (COSEWIC),"Yellow" (NSDNR);
- Boreal Chickadee (*Poecile hudsonicus*) – "Yellow" (NSDNR);
- Cliff Swallow (*Petrochelidon pyrrhonota*) – "Red" (NSDNR);
- Common Loon – "Red" (NSDNR);
- Common Nighthawk (*Chordeiles minor*) – "Threatened" (*SARA*), "Red" (NSDNR);
- Common Tern (*Sterna hirundo*) – "Yellow" (NSDNR);
- Eastern Wood-Pewee (*Contopus virens*) – "Special Concern" (COSEWIC), "Yellow" (NSDNR);
- Golden-crowned Kinglet (*Regulus satrapa*) – "Yellow" (NSDNR);
- Gray Catbird (*Dumetella carolinensis*) – "Red" (NSDNR);
- Gray Jay (*Perisoreus canadensis*) – "Yellow" (NSDNR);
- Greater Yellowlegs (*Tringa melanoleuca*) – "Yellow" (NSDNR);
- Killdeer (*Charadrius vociferous*) – "Yellow" (NSDNR);
- Olive-sided Flycatcher (*Contopus cooperi*) – "Threatened" (*SARA*),
- "Red" (NSDNR);
- Pine Grosbeak (*Pinicola enucleator*) – "Red" (NSDNR);
- Pine Siskin (*Spinus pinus*) – "Yellow" (NSDNR);
- Ruby-crowned Kinglet (*Regulus calendula*) – "Yellow" (NSDNR);
- Rusty Blackbird (*Euphagus carolinus*) – "Red" (NSDNR), "Special Concern" (COSEWIC), " Special Concern" (Government of Canada 2012);
- Spotted Sandpiper (*Actitis macularius*) – "Yellow" (NSDNR);
- Tree Swallow (*Tachycineta bicolor*) – "Yellow" (NSDNR); and
- Yellow-bellied Flycatcher (*Empidonax flaviventris*) – "Yellow" (NSDNR).

The NS Significant Species and Habitats database (NSDNR 2012c) identifies 385 records relating birds and/or bird habitat within a 100 km radius of the Project site. These include:

- 144 classified in the database as "Other Habitat", of which the majority relate to Bald Eagle (*Haliaeetus leucocephalus*) (94) and Osprey (*Pandion haliaetus*) (41), but also including records of Great Blue Heron (*Ardea herodias*) (4) and Gray Partridge (*Perdix perdix*) (2), among others;
- 102 records classified as "Species of Concern", of which the majority relate to Common Loon (*Gavia immer*) (59), but also including records of unclassified Tern species (14), Common Tern (*Sterna hirundo*) (10), Northern Goshawk (*Accipiter gentilis*) (4), and Great Blue Heron (4), among others;
- 78 records classified as "Migratory Bird", including unclassified shorebirds (17), Double-crested Cormorant (*Phalacrocorax auritus*) (15), Great Blue Heron (14), American Black Duck (*Anas rubripes*) (10), and Common Eider (8), among others; and

- 61 records classified as "Species at Risk", primarily relating to Piping Plover (24), Peregrine Falcon (*Falco peregrinus*) (8), and Common Loon (7) but also including records of Harlequin Duck (*Histrionicus histrionicus*) (5) and Roseate Tern (*Sterna dougallii*) (3), among others.

Multiple significant habitat features related to birds are present within a 25 km radius of the Project site (Table 8.11).

Table 8.11. Significant Habitat Features Related to Birds within a 25 km Radius of the Project Site

Species	Location	Distance to Project Site (km)	Direction
Common Loon	Pockwock Lake	-	N
Bald Eagle	Along Sackville River near McCabe Lake	4.38	NE
Bald Eagle	Hills around Coon Pond and Bull Pond	5.08	SW
Common Loon	Big Indian Lake	5.15	W
Common Loon	Rafter Lake/Sandy Lake	6.08	SW
Common Loon	Drain Lake	6.26	ENE
Common Loon	Mill Lake	7.41	SW
Common Loon	Lewis Lake	7.44	S

Source: NSDNR 2012c

The ACCDC database contains records of 55 bird species within a 100 km radius of the Project site. Table 8.12 lists these species as well as their respective provincial and national conservation status ranks.

Table 8.12 Bird Species Recorded within a 100 km Radius of the Project site

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
American Coot	*Fulica americana*	Not Listed	Not Listed	Not at Risk	Undetermined
American Golden-Plover	*Pluvialis dominica*	Not Listed	Not Listed	Not Listed	Yellow
Arctic Tern	*Sterna paradisaea*	Not Listed	Not Listed	Not Listed	Red
Atlantic Puffin	*Fratercula arctica*	Not Listed	Not Listed	Not Listed	Yellow
Baltimore Oriole	*Icterus galbula*	Not Listed	Not Listed	Not Listed	Red
Bicknell's Thrush	*Catharus bicknelli*	Special Concern	Vulnerable	Threatened	Red
Black Guillemot	*Cepphus grylle*	Not Listed	Not Listed	Not Listed	Green
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Not Listed	Not Listed	Not Listed	Red
Black-legged Kittiwake	*Rissa tridactyla*	Not Listed	Not Listed	Not Listed	Yellow
Bobolink	*Dolichonyx oryzivorus*	Not Listed	Not Listed	Threatened	Yellow
Boreal Owl	*Aegolius funereus*	Not Listed	Not Listed	Not at Risk	Undetermined
Brown Thrasher	*Toxostoma rufum*	Not Listed	Not Listed	Not Listed	Undetermined
Common Goldeneye	*Bucephala clangula*	Not Listed	Not Listed	Not Listed	Green
Common Moorhen	*Gallinula chloropus*	Not Listed	Not Listed	Not Listed	Undetermined
Common Tern	*Sterna hirundo*	Not Listed	Not Listed	Not at Risk	Yellow
Eastern Bluebird	*Sialia sialis*	Not Listed	Not Listed	Not at Risk	Yellow
Eastern Meadowlark	*Sturnella magna*	No Status	Not Listed	Threatened	Yellow

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
Eastern Phoebe	*Sayornis phoebe*	Not Listed	Not Listed	Not Listed	Yellow
Eskimo Curlew	*Numenius borealis*	Endangered	Not Listed	Endangered	Undetermined
Gadwall	*Anas strepera*	Not Listed	Not Listed	Not Listed	Red
Great Crested Flycatcher	*Myiarchus crinitus*	Not Listed	Not Listed	Not Listed	Red
Greater Yellowlegs	*Tringa melanoleuca*	Not Listed	Not Listed	Not Listed	Yellow
Harlequin Duck	*Histrionicus histrionicus*	Special Concern	Endangered	Special Concern	Red
Horned Lark	*Eremophila alpestris*	Not Listed	Not Listed	Not Listed	Green
Hudsonian Godwit	*Limosa haemastica*	Not Listed	Not Listed	Not Listed	Yellow
Indigo Bunting	*Passerina cyanea*	Not Listed	Not Listed	Not Listed	Undetermined
Least Sandpiper	*Calidris minutilla*	Not Listed	Not Listed	Not Listed	Green
Long-eared Owl	*Asio otus*	Not Listed	Not Listed	Not Listed	Red
Northern Cardinal	*Cardinalis cardinalis*	Not Listed	Not Listed	Not Listed	Green
Northern Goshawk	*Accipiter gentilis*	Not Listed	Not Listed	Not at Risk	Green
Northern Mockingbird	*Mimus polyglottos*	Not Listed	Not Listed	Not Listed	Green
Northern Pintail	*Anas acuta*	Not Listed	Not Listed	Not Listed	Red
Northern Shoveler	*Anas clypeata*	Not Listed	Not Listed	Not Listed	Red
Peregrine Falcon	*Falco peregrinus*	Threatened	Vulnerable	Special Concern	Yellow
Philadelphia Vireo	*Vireo philadelphicus*	Not Listed	Not Listed	Not Listed	Undetermined
Purple Martin	*Progne subis*	Not Listed	Not Listed	Not Listed	Red
Purple Sandpiper	*Calidris maritima*	Not Listed	Not Listed	Not Listed	Yellow
Razorbill	*Alca torda*	Not Listed	Not Listed	Not Listed	Yellow
Red Knot	*Calidris canutus*	No Status	Endangered	Endangered	Red
Red Phalarope	*Phalaropus fulicarius*	Not Listed	Not Listed	Not Listed	Yellow
Red-breasted Merganser	*Mergus serrator*	Not Listed	Not Listed	Not Listed	Green
Red-necked Phalarope	*Phalaropus lobatus*	Not Listed	Not Listed	Not Listed	Yellow
Roseate Tern	*Sterna dougallii*	Endangered	Endangered	Endangered	Red
Rusty Blackbird	*Euphagus carolinus*	Special Concern	Not Listed	Special Concern	Red
Scarlet Tanager	*Piranga olivacea*	Not Listed	Not Listed	Not Listed	Undetermined
Semipalmated Plover	*Charadrius semipalmatus*	Not Listed	Not Listed	Not Listed	Green
Short-eared Owl	*Asio flammeus*	Special Concern	Not Listed	Special Concern	Red
Solitary Sandpiper	*Tringa solitaria*	Not Listed	Not Listed	Not Listed	Green
Vesper Sparrow	*Pooecetes gramineus*	Not Listed	Not Listed	Not Listed	Red
Virginia Rail	*Rallus limicola*	Not Listed	Not Listed	Not Listed	Undetermined
Warbling Vireo	*Vireo gilvus*	Not Listed	Not Listed	Not Listed	Undetermined
Whimbrel	*Numenius phaeopus*	Not Listed	Not Listed	Not Listed	Yellow
Whip-Poor-Will	*Caprimulgus*	Threatened	Not Listed	Threatened	Red

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
	vociferus				
Willow Flycatcher	*Empidonax traillii*	Not Listed	Not Listed	Not Listed	Yellow
Wood Thrush	*Hylocichla mustelina*	Not Listed	Not Listed	Not Listed	Undetermined

Source: ACCDC 2011

[1] Government of Canada 2012; [2] NS ESA 2007; [3] COSEWIC 2012; [4] NSDNR 2010

Field surveys were completed to gather data to characterize the year round pre-construction (baseline) bird community at the Project site and were designed to capture changes in the diversity and abundance of bird species at the Project site coinciding with such important events as breeding and migration. All field surveys were designed in consultation with officials from NSDNR and Canadian Wildlife Service (CWS), and conformed to protocols outlined in "Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds" (CWS 2007).

A summary of each survey is provided in the following sections. Detailed bird survey methodology and results are provided in Appendix G.

Winter Bird Survey
Eighteen area searches were conducted at or near the Project site on March 16, 2012 (Drawing 8.6). A total of 18 species were identified, including 210 individual birds (Table G1/2, Appendix G). Common Raven (*Corvus corax*) and American Crow (*Corvus brachyrhynchos*) were the most frequently observed species, although Black-capped Chickadee (*Parus atricapillus*) and White-winged Crossbill (*Loxia leucoptera*) were more abundant than Common Raven.

Spring Migration Surveys
Spring migration surveys were conducted during site visits on April 16, May 22, and June 2, 2012. A total of 35 stopover count surveys were conducted at 17 locations within the Project site boundaries (Drawing 8.6).

A total of 64 species, comprising 1,505 individual birds, were observed during the spring migration surveys (Table G3/4, Appendix G). American Robin (*Turdus migratorius*) was the most frequently observed and most abundant species, while Magnolia Warbler (*Dendroica magnolia*) was the second most frequently observed and abundant species. Common passerine species were abundant during these surveys, with substantial numbers of Black-throated Green Warblers (*Dendroica virens*), Common Yellowthroats (*Geothlypis trichas*), Hermit Thrush (*Catharus guttatus*), and White-throated Sparrows (*Zonotrichia albicollis*) observed.

The majority of bird species observed were passerines, but gull, waterfowl, woodpecker, and upland gamebird species, as well as birds of prey, were also noted.

Breeding Bird Surveys
Eleven point counts locations were surveyed on June 14 and again on July 8, 2012 (8.6). A total of 883 individual birds, representing 53 species, were observed during these point counts (Table G5/6, Appendix G). Of these, 19 species are considered probable breeders based upon the observance of breeding pairs and/or the establishment of permanent territories and four species are confirmed breeders (MBBA 2006).

The most frequently observed species, in terms of the number of point counts at which they were recorded, were American Robin, Black-throated Green Warbler, and Magnolia Warbler. American Robin, Hermit Thrush, and Magnolia Warbler were the most abundant species with 91, 90, and 82 individuals recorded, respectively.

The vast majority of the species identified during the breeding bird surveys were passerines. However, a variety of non-passerine birds were also observed during these surveys, including Common Loon (waterfowl); Black-backed Woodpecker (*Picoides arcticus*), Downy Woodpecker (*Picoides pubescens*), Hairy Woodpecker (*Picoides villosus*), Northern Flicker (*Colaptes auratus*), and Pileated Woodpecker (*Dryocopus pileatus*) (woodpeckers); and Ring-necked Pheasant (*Phasianus colchicus*) and Ruffed Grouse (*Bonasa umbellus*) (upland game birds).

Fall Migration Surveys

A total of 34 stopover count surveys were conducted at 12 locations within the Project site boundaries on October 3, November 2, and November 21, 2012 (Drawing 8.6). A total of 35 species, consisting of 809 individual birds, were recorded during the fall migration surveys (Table G7/8, Appendix G). Yellow-rumped Warbler (*Setophaga coronata*), Black-capped Chickadee, and Golden-crowned Kinglet were the most abundant species, while Blue Jay was the most frequently observed species.

N

Pockwock Lake

PockE3

PockE17

PockE2

Alt 01

01

PockE1

Hamilton Pond

PockECont1

PockE16

02

PockE15

Alt 02

PockE18

PockE4

Bat Detector

Little Pockwock Lake

03

PockE5

PockE14

PockE6

04

PockE13

PockE7

05

PockE8

PockE9

PockE10

PockE 11

PockE12

Lizard Lake

Tomahawk Lake

Beaver Lake

Pockwock Rd

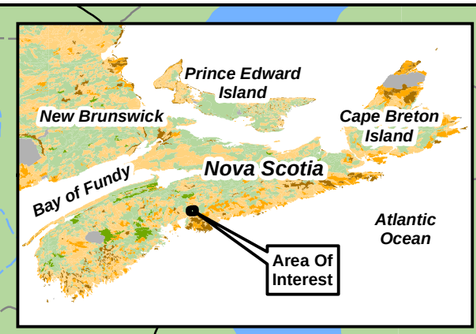
Anderson Rd

Orchard Dr

Daisywood Dr

Slate Dr

Rockcrest Dr



0 100 200 400 600 800 1,000 Metres

Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. GPS Points Taken Are Typically To +/-5m Accuracy.

Legend:

- Proposed Turbine
- Alternate Turbine
- Project Site Boundary
- 2012 Bat Detector
- Proposed Access Road
- Permanent Disturbance Area
- 2012 Bird Survey Locations
- Building
- Roads
- Access Roads / Trails
- Existing Pipeline
- Existing Transmission Lines
- Large Structure
- Mapped Stream
- Indefinite Stream
- Water Bodies
- Mapped Reservoir
- Cleared Area

Bird Survey and Bat Detector Locations

Chebucto WindField
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Strum CONSULTING

Date:	Project #:
April 2013	12-4326
Scale: 1:15,000	Drawing #: **8.6**
Drawn By: H. Serhan	
Checked By: M. Smith	

Bird Survey Summary

At the landscape level, the Project site is situated within a relatively low-lying area interspersed with freshwater lakes, softwood stands, and urban development. The mid-aged to mature, softwood dominated habitat at the Project site provides habitat for a number of migrant, breeding, and resident species throughout the year. The forested nature of the Project site is strongly reflected in its bird community during all seasons.

During the winter months, the Project site offers sufficient shelter habitat for common resident species, including Black-capped Chickadee, Golden-crowned Kinglet, and Dark-eyed Junco (*Junco hyemalis*), while interspersed boreal wetlands provide favourable habitat for swamp/softwood associated species such as Boreal Chickadee (*Poecile hudsonicus*) and Gray Jay (*Perisoreus canadensis*). In addition, the prevalence of mature conifers attracts nomadic finch species, particularly White-winged Crossbill (*Loxia leucoptera*), with smaller numbers of Pine Siskin (*Spinus pinus*), in addition to other conifer seed specialists such as Red-breasted Nuthatch (*Sitta canadensis*). Overall, while winter diversity is rather low, as is expected during the winter months in Nova Scotia, abundance data suggests that the Project site is a preferred over-wintering site for several species.

Spring migrants at the Project site are relatively few in April, but peak both in terms of abundance and diversity in late May. It appears that the diversity of habitat types at the Project site supports a relatively high number of spring migrants, including many of the most common passerine species observed in the province. Spring migrants were distributed throughout the Project site in relatively high numbers, and as such, no particular areas of importance within the Project site were identified.

Overall abundance remained high into the beginning of breeding season, suggesting that the migrant pulse at the Project site extends into early June. It appears, however, that many spring migrants that occur at the Project site use it merely as a stopover site, and do not establish breeding territories. This conclusion might be explained via two ways: firstly, overall abundance at the Project site seemed to have decreased from early June to early July, the peak breeding period for most breeding species in Nova Scotia (MBBA 2006); and secondly, only 52.3% of the species observed during spring migration were also detected during breeding surveys in early July.

Common forest species dominated the breeding bird community at the Project site, in addition to several species typical associated with mature stands including Pileated Woodpecker (*Dryocopus pileatus*) and Black-backed Woodpecker (*Picoides arcticus*). Conifer stands typically support relatively high densities of breeding birds in relation to other habitat types (Davis and Browne 1996), so the low abundances observed in early July were unexpected. Habitat at the Project site, however, appears to be suitable for breeding Canada Warbler (*Wilsonia canadensis*); specifically, dense, low shrub growth associated with wetland habitats found in the southern portion of the Project site.

Fall migrants appear to use the Project site as a stopover, especially in October. Yellow-rumped Warbler, in particular, was observed in relatively high numbers at this time, particularly in young mixed-wood stands. Much of the fall migrant activity, particularly in October, was concentrated towards the southern extent of the Project site, although overall no difference was detected in abundance or diversity between habitat types. Other fall migrants observed in reasonable numbers included Palm Warbler (*Dendroica palmarum*), American Robin, and Magnolia Warbler (*Dendroica magnolia*), although not in numbers that would suggest

that the Project site is of particular importance to these species. Furthermore, over 60% of the birds observed during fall surveys were resident and/or nomadic species, which suggests that the Project site is more important to this group than to true fall migrants. It should be noted, however, that a major pulse of fall migrants through Nova Scotia, particularly the insect eating warblers, occurs in September; fall surveys at the Project site, therefore, may not have completely captured the migrant bird community at the site.

The Project site does not appear to lie within a migratory/local flyway for waterfowl in any season, as no individuals were observed flying over the Project site during any survey. This was somewhat unexpected due to the prevalence of freshwater lakes in the landscape of the general Project area.

Overall, there were 75 different species identified at or near the Project site during surveys conducted throughout the year, including 18 SOCI (Table 8.13, Drawing 8.7 A-D).

Table 8.13 Bird SOCI Identified at the Project site

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]	Survey Observed (Individuals Observed)
Black-backed Woodpecker	*Picoides arcticus*	Not listed	Not listed	Not listed	Yellow	B (1), FM (2)
Blackpoll Warbler	*Dendroica striata*	Not listed	Not listed	Not listed	Yellow	FM (12)
Boreal Chickadee	*Poecile hudsonicus*	Not listed	Not listed	Not listed	Yellow	W (10), SM (6), B (14), FM (26)
Canada Warbler	*Wilsonia canadensis*	Threatened	Not listed	Threatened	Red	SM (3), B (6)
Cape May Warbler	*Dendroica tigrina*	Not listed	Not listed	Not listed	Yellow	SM (1)
Common Loon	Gavia immer	Not listed	Not listed	Not at Risk	Red	B (3), FM (1)
Eastern Wood-pewee	*Contopus virens*	Not listed	Not listed	Not listed	Yellow	SM (1)
Golden-crowned Kinglet	*Regulus satrapa*	Not listed	Not listed	Not listed	Yellow	W (14), SM (14), B (9), FM (84)
Gray Catbird	*Dumetella carolinensis*	Not listed	Not listed	Not listed	Red	SM (1)
Gray Jay	*Perisoreus canadensis*	Not listed	Not listed	Not listed	Yellow	W (4), SM (4), B (7), FM (19)
Pine Grosbeak	*Pinicola enucleator*	Not listed	Not listed	Not listed	Red	FM (2)

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]	Survey Observed (Individuals Observed)
Pine Siskin	*Spinus pinus*	Not listed	Not listed	Not listed	Yellow	W (6), SM (18), B (1), FM (3)
Ruby-crowned Kinglet	*Regulus calendula*	Not listed	Not listed	Not listed	Yellow	SM (23), B (11)
Rusty Blackbird	*Euphagus carolinus*	Special Concern	Not listed	Special Concern	Red	SM (1)
Tennessee Warbler	*Vermivora peregrina*	Not listed	Not listed	Not listed	Yellow	SM (2)
Tree Swallow	*Tachycineta bicolor*	Not listed	Not listed	Not listed	Yellow	SM (1)
Wilson's Warbler	*Wilsonia pusilla*	Not listed	Not listed	Not listed	Yellow	SM (1), B (1)
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Not listed	Not listed	Not listed	Yellow	SM (10), B (14)

[1] Government of Canada 2012; [2] NS ESA 2007; [3] COSEWIC 2012; [4] NSDNR 2010

[5]W - winter; SM - spring migration; B - breeding; FM – fall migration

The requirements as set out in the *MBCA* will be adhered to for Project activities. Additional general mitigation measures for Project-related effects to avifauna are provided in Section 4.0. Where required, species-specific mitigation is provided in Section 14.

N

Golden-crowned Kinglet
Pine Siskin

Pockwock Lake

Golden-crowned Kinglet

Hamilton Pond

Alt 01

01

02

Alt 02

Boreal Chickadee

Little Pockwock Lake

Boreal Chickadee
Golden-crowned Kinglet
Pine Siskin

03

Golden-crowned Kinglet

Boreal Chickadee

04

05

Boreal Chickadee
Pine Siskin

Boreal Chickadee
Golden-crowned Kinglet

Gray Jay

Golden-crowned Kinglet

Gray Jay
Pine Siskin

Lizard Lake

Tomahawk Lake

Beaver Lake

Daisywood Dr

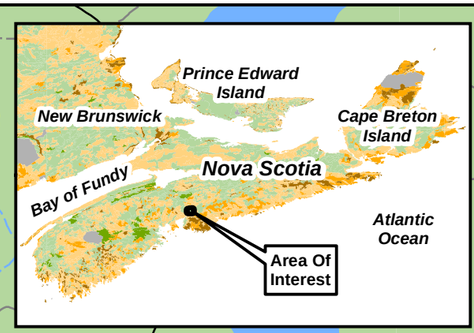
Slate Dr

Rockcrest Dr

Pockwock Rd

Anderson Rd

Orchard Dr



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- Existing Transmission Lines
- Large Structure
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- Indefinite Stream
- Water Bodies
- Mapped Reservoir
- Cleared Area

Winter Bird Species of Conservation Interest Locations

ChebuctoWindField
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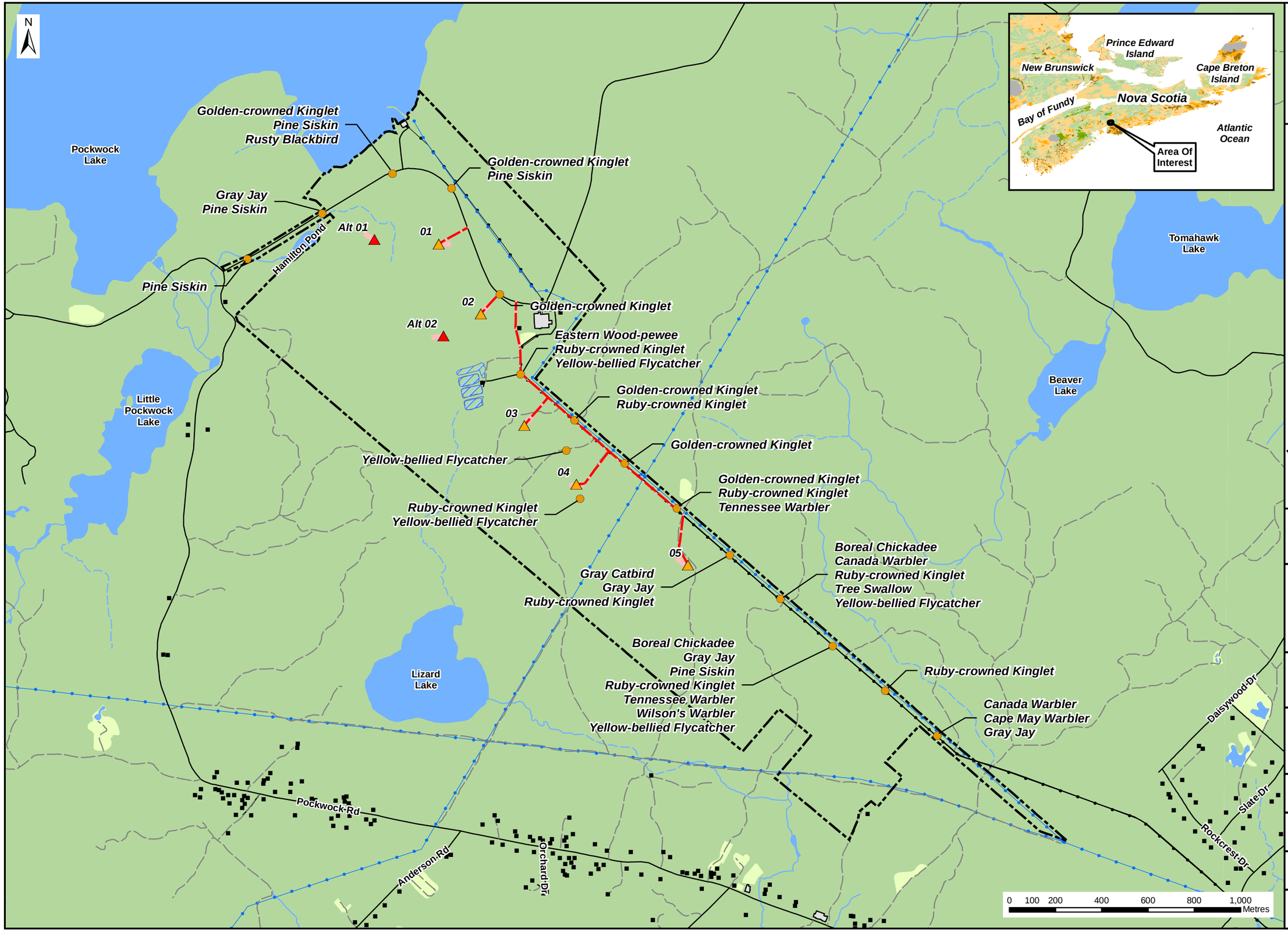
Strum CONSULTING

Date:	Project #:
April 2013	12-4326
Scale: 1:15,000	Drawing #: **8.7A**
Drawn By: H. Serhan	
Checked By: M. Smith	



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Spring Bird Species of Conservation Interest Locations

Chebucto WindField
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Strum CONSULTING

Date:	Project #:
April 2013	12-4326
Scale: 1:15,000	Drawing #: **8.7B**
Drawn By: H. Serhan	
Checked By: M. Smith	