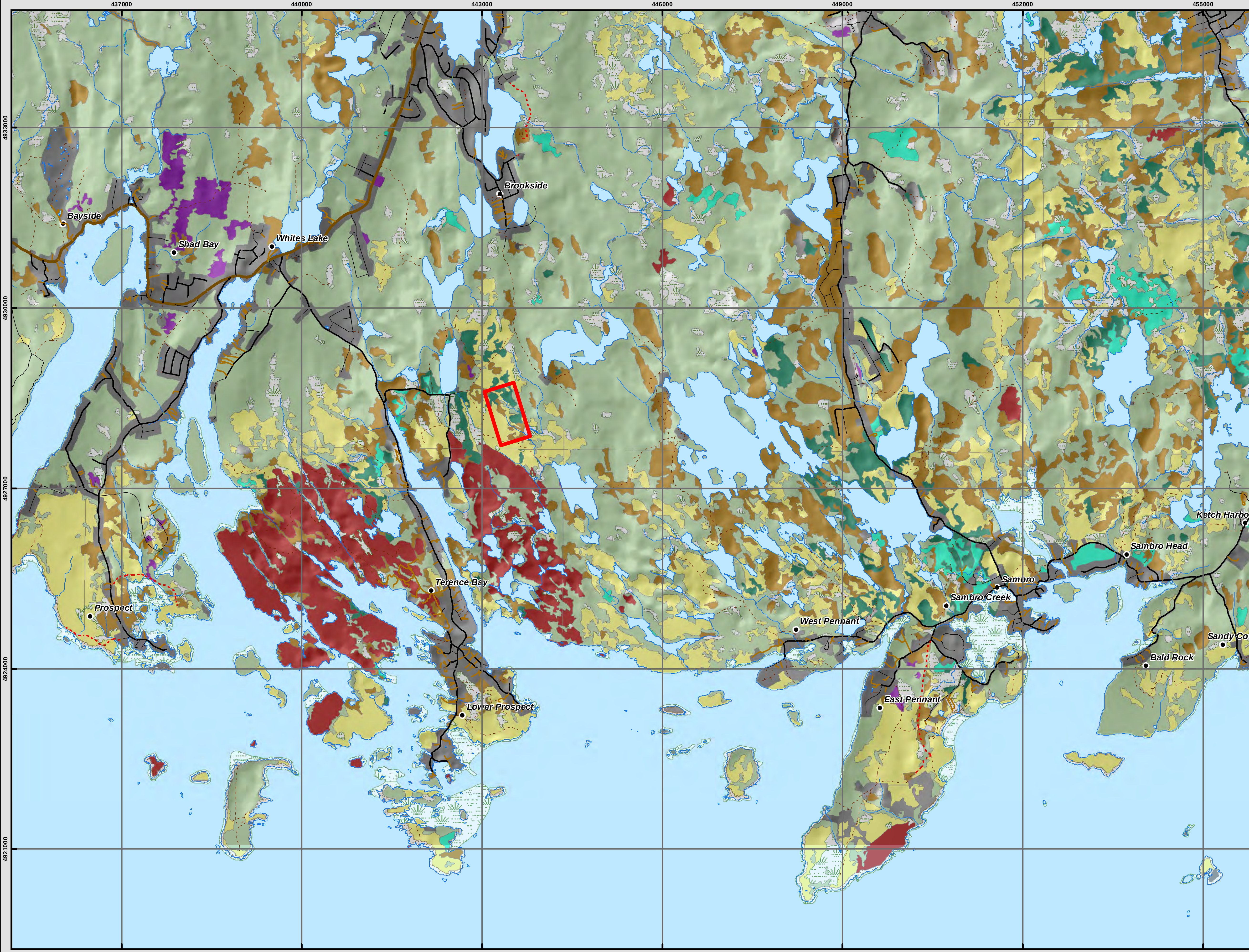
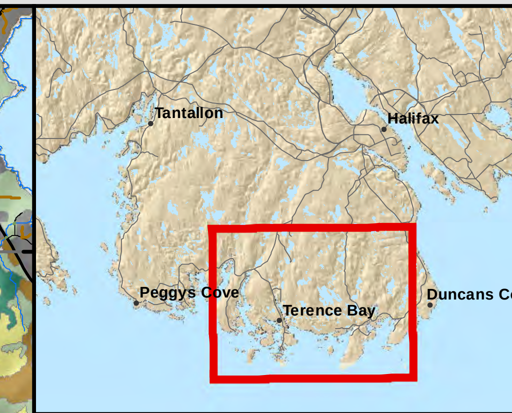




CTB Property Boundary
Open Water
Rivers and Streams

Roads

- Divide Highway
- Arterial
- Collector
- Paved Road
- TCH
- Unpaved Road
- Railroad
- Lanes / Driveways
- ROAD ruin/inactive/abandoned
- Cart Track / Footpath
- Ferry
- Misc

Forest Cover

- Softwood
- Mixedwood
- Hardwood

Non-Forest Land Use

- Brush
- Clear Cut
- Wetland
- Rock Barren
- Barren
- Urban
- Beach

CBCL LIMITED
Consulting Engineers

Chebucto Terence Bay Wind Farm

Figure 4.3

Regional Land Cover

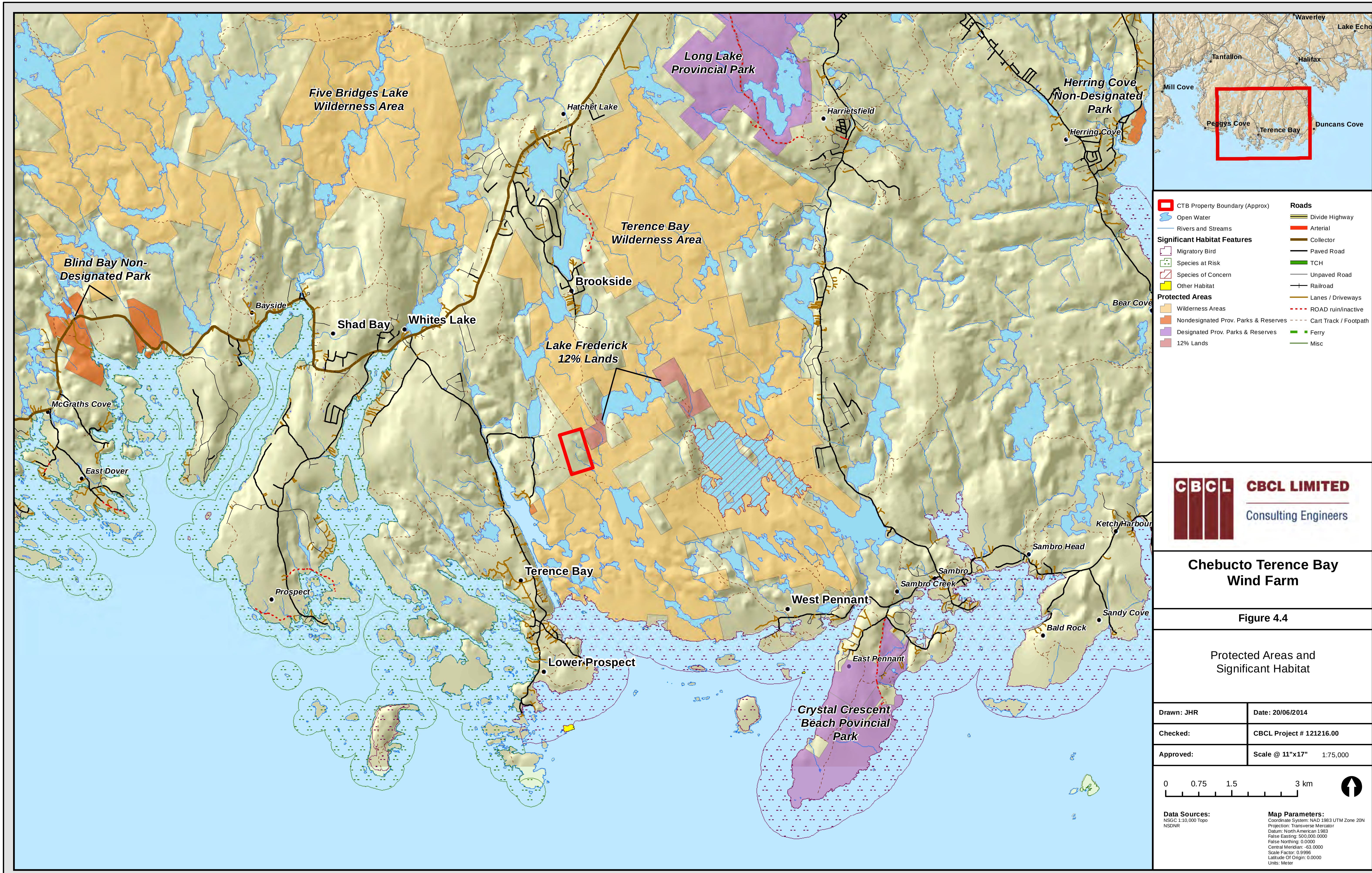
Drawn: JHR	**Date:** 20/06/2014
Checked:	**CBCL Project #** 121216.00
Approved:	**Scale @ 11"x17"** 1:60,000

0 0.5 1 2 km

Data Sources:
NSGC 1:10,000 Topo
NSDNR
NTDB

Map Parameters:
Coordinate System: NAD 1983 UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -63.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

L:\121216.00 RESL Terrence Bay\GIS\LAYOUT\FINAL REPORT FIGURES\121216.00 FIG 4-3 Regional Landcover Types.mxd



L:\121216.00 RESL Terrence Bay\GIS\LAYOUT\FINAL REPORT FIGURES\121216.00 FIG 4-4 Protected Areas in Vicinity of Project Site.mxd

Again, this park is popular with hikers, but has no camping facilities. There are no federally protected areas on the Chebucto peninsula.

The Government of Nova Scotia has committed to protect 12% of the provincial land base by 2015 (*Environmental Goals and Sustainable Prosperity Act,* 2007). As such, the Province has identified areas being considered for protection in order to reach the 12% goal. Two such areas are in close proximity to the Project site. These areas are located on the east and south-west shores of Frederick Lake and together make up approximately 87 ha (NSE, 2011b). It is not yet clear under which designation these lands will be protected.

The coastal region adjacent to the Project site is designated as significant habitat by the NSDNR (NSDNR, 2012b). This designation is given to areas known to be habitat for species at risk/species of concern, special habitats, sites of high biodiversity, or sites of natural history interest. The coastal region directly south and south-east of the Project site (including Lower Prospect, East Pennant and Bald Rock) is designated because of migratory bird use. The designated area begins at the coast and extends 700 m seaward. To the south-east of the Project site, coastal regions and islands are designated as significant habitat based on the presence of species at risk. There is no legislation associated with the significant habitat designation.

4.3 Species of Conservation Concern

A screening of the ACCDC list resulted in a shortlist of 161 species that have been sighted within 25 km of the Project site (Appendix H). This list was reduced to include only species that have been legislated either provincially under the *Endangered Species Act* or federally (*SARA*). The resulting 20 species are listed in Table 4.4. Sections 4.3.1 through 4.3.7 provide additional information on these species.

Table 4.4: Species at risk sighted within 25 km of the Terence Bay wind site

Scientific Name	***Common Name***	***NSDNR General Status***	***SARA***	***NSESA***	***SRANK***	***Nearest Sighting (km)***	***# of Sightings***
BIRDS							
Calidris canutus rufa	Red Knot, rufa subspecies	At risk	E	E	S2S3M	23 ± 0.5	1
Chaetura pelagica	Chimney Swift	At risk	T	E	S2S3B	20 ± 5	3
Charadrius melodus melodus	Piping Plover melodus ssp	At risk	E	E	S1B	18 ± 0.1	4
Chordeiles minor	Common Nighthawk	At risk	T	T	S3B	7 ± 5	10
Contopus cooperi	Olive-sided Flycatcher	At risk	T	T	S3B	7 ± 5	9
Dolichonyx oryzivorus	Bobolink	Sensitive		V	S3S4B	23 ± 5	3
Euphagus carolinus	Rusty Blackbird	May be at risk	SC	E	S2S3B	7 ± 5	9
Hirundo rustica	Barn Swallow	Sensitive		E	S3B	4 ± 5	19

Scientific Name	Common Name	NSDNR General Status	SARA	NSESA	SRANK	Nearest Sighting (km)	# of Sightings
Histrionicus histrionicus pop. 1	Harlequin Duck - Eastern pop.	At risk	SC	E	S2N	9 ± 10	3
Sterna dougallii	Roseate Tern	At risk	E	E	S1B	12 ± 10	3
Wilsonia canadensis	Canada Warbler	At risk	T	E	S3B	4 ± 5	15
REPTILES							
Glyptemys insculpta	Wood Turtle	Sensitive	T	T	S3	16 ± 1	3
INVERTEBRATES							
Danaus plexippus	Monarch	Sensitive	SC		S2B	15 ± 0	3
LICHENS							
Degelia plumbea	Blue felt lichen	Secure		V	S2	2 ± 0.1	4
Erioderma pedicellatum (Atlantic pop.)	Boreal felt lichen - Atlantic pop.	At risk	E	E	S1S2	13 ± 1	1
MAMMALS							
Alces americanus	Moose	At risk		E	S1	7 ± 10	2
Myotis lucifugus	Little brown bat	Sensitive		E	S1	29 ± 10	1
VASCULAR PLANTS							
Clethra alnifolia	Sweet pepperbush	Sensitive	SC	V	S1	19 ± 0.1	1
Fraxinus nigra	Black ash	Sensitive		V	S2S3	29 ±10	1
Helianthemum canadense	Rockrose	May be at risk		E	S1	19 ± 1	1

Under SARA, E=Endangered, T=Threatened and S=Special Concern. Under NS ESA, E=Endangered, T=Threatened and V=Vulnerable.

4.3.1 Birds of Conservation Concern

4.3.1.1 Red Knot (*Calidris canutus rufa*)

The Red Knot *rufa* subspecies is listed as ‘endangered’ both federally and provincially. This bird takes part in large migrations from winter grounds in southern and central USA to breed in the Canadian Arctic. During the non-breeding season, red knots are primarily marine shorebirds and are found along coastal areas with large sand flats or mudflats. They may also visit peat banks, salt marshes, brackish lagoons and mussel beds. Nesting occurs in relatively dry tundra areas in the Arctic. The red knot is usually only present in Nova Scotia as a transient. The closest sighting of a red knot to Terence Bay was 23 km; this species is not likely to be seen in the Project site due to lack of suitable habitat. This species does not breed in Nova Scotia; any presence in the area would be exclusively as a migrant.

4.3.1.2 Chimney Swift (*Chaetura pelagica*)

Chimney Swifts are listed as ‘threatened’ federally and ‘endangered’ provincially. These birds arrive in Nova Scotia in the spring to breed and nest. They roost and nest in chimneys, old cabins or in hollow trees and may be found in both urban and rural areas. They are often found feeding on insects near lakes and wetlands. The closest Chimney Swift sighting in the ACCDC data base occurred 20 km away from the Terence Bay Project site. Due to a lack of suitable habitat, it is unlikely to be found in the Project site.

4.3.1.3 Piping Plover (*Charadrius melodus melodus*)

The Piping Plover is listed as 'endangered' both federally and provincially. Nova Scotia is part of the summer breeding range, although their occurrence is fairly rare. This shorebird nests and rears its young on open sandy beaches, alkali flats and sand flats, laying eggs in depressions in the sand above the highest tide line. Due to the lack of suitable breeding habitat in the Terence Bay Project site, the likelihood of Piping Plover presence is low to negligible.

4.3.1.4 Common Nighthawk (*Chordeiles minor*)

The Common Nighthawk is listed as 'threatened' both federally under *SARA* (schedule 1), and provincially under the *Endangered Species Act*. Its preferred breeding habitat is grassland and open or barren areas within forested land with low vegetation where it lays its eggs directly onto the bare ground. This bird is an aerial insectivore preying on insects on the wing, usually at dusk or dawn, in open areas. From late August to early October, migrating flocks of nighthawks can number in the hundreds en route to wintering grounds in South America. The abundance of bogs, barrens and bare ground at the Project site and in the surrounding area provides good habitat.

4.3.1.5 Olive-sided Flycatcher (*Contopus cooperi*)

The Olive-sided Flycatcher is listed as 'threatened' federally under *SARA* and provincially under the *Endangered Species Art*. These birds summer throughout Nova Scotia and winter in Central and South America. Their preferred habitat includes coniferous forest edges, early post-fire landscapes, and openings such as meadows, rivers, bogs, swamps and ponds. Nests are built on horizontal branches 2 to 15 m off the ground and are most commonly located in spruce trees. These birds feed on flying insects, especially bees, and are often see perched on the tops of tall trees or snags. The Project site provides abundant breeding habitat for the Olive-sided Flycatcher; this species was not detected during surveys.

4.3.1.6 Bobolink (*Dolichonyx oryzivorus*)

The bobolink is listed as 'vulnerable' in Nova Scotia and as 'threatened' by COSEWIC. Bobolink habitat includes hayfields, moist meadows and other areas that are dominated by a mixture of tall grasses. The numbers of this species have sharply declined both in Nova Scotia and throughout its eastern range in part because of more intensive agricultural haying practices. Suitable habitat is likely not present for the Bobolink in the Project site.

4.3.1.7 Rusty Blackbird (*Euphagus carolinus*)

The Rusty Blackbird is listed as 'endangered' provincially under the *Endangered Species Act* and is a *SARA* species of concern. Favourite habitat is among wetlands, such as bogs, fens, meadows and swamps and along watercourses; it particularly favours a boreal forest setting. It is also known to feed extensively on aquatic invertebrates within the riparian zones of shallow, slow moving rivers. These types of wetlands do exist in the Terence Bay area. The Project site provides abundant breeding habitat for the Rusty Blackbird; this species was not detected during surveys.

4.3.1.8 Barn Swallow (*Hirundo rustica*)

Barn Swallows are listed as ‘endangered’ provincially under the *Endangered Species Act* and ‘threatened’ by COSEWIC. These birds often nest in human structures such as barns and cabins that provide sheltered, dry nest sites. In a natural setting, Barn Swallows nest in caves or overhanging cliffs, although these nests are rare where alternative, human structures are available. These birds feed on flying insects. Barn Swallows are not likely to be encountered in the Terence Bay site.

4.3.1.9 Harlequin Duck (*Histrionicus histrionicus*)

The eastern population of Harlequin Ducks are listed as ‘endangered’ provincially under the *Endangered Species Act* and as ‘special concern’ by *SARA*. These birds winter along the coast of NS in marine areas near rocky shorelines or sub-tidal ledges. They are often found near shore in turbulent waters where there are low levels of sea ice. Harlequin Ducks are not known to breed in the Maritime Provinces. Harlequin Ducks are found on the Chebucto Peninsula (MTRI, 2008) and could pass through the Project site. There is, however, no suitable breeding habitat on site.

4.3.1.10 Roseate Tern (*Sterna dougallii*)

The Roseate Tern is listed as ‘endangered’ by both *SARA* and the *Endangered Species Act*. This species arrives in Nova Scotia to breed in the spring, but it is rare. They over-winter along the coast of South America from Columbia to Brazil. Roseate Terns breed in colonies mixed with Common (*Sterna hirundo*) and Arctic Terns (*Sterna paradisaea*) on offshore islands. They prefer areas free of dense woody vegetation and often make nests in dry grass. Roseate Terns are unlikely to be found in the Terence Bay Project site due to a lack of suitable breeding habitat.

4.3.1.11 Canada Warbler (*Wilsonia canadensis*)

Canada Warblers are listed as ‘endangered’ provincially by the *Endangered Species Act* and as threatened by *SARA*. These birds arrive in Nova Scotia in the spring and are fairly common throughout the summer. Canada Warblers are found in mature to mid-aged mixed forests; they build their nests on or near the ground in wet, swampy places in woods of mixed growth. They prefer areas with dense understory, particularly areas where large trees have long since been uprooted and tangled debris remains. The Terence Bay Project site provides suitable habitat. The Canada Warbler was detected in the Project site during the avian migration surveys (see section 4.4.5).

4.3.2 Herpetofauna

4.3.2.1 Wood Turtle (*Glyptemys insculpta*)

The Wood Turtle has been federally and provincially legislated as threatened, due to loss of habitat from increasing land development. Their preferred habitat can be defined as slow moving rivers and streams, intervales and their adjacent riparian zones. Streams with gravel banks with southern exposure are especially important as potential nesting and basking areas. The wood turtle typically congregates in small populations of up to 100 individuals near riparian habitat characterized by high depositional sandy banks that are scoured by winter and spring floods. Suitable habitat does not exist in the Terence Bay site and wood turtles are unlikely to be encountered.

4.3.3 Mammals

The Project site provides habitat for several species of mammals including bear, deer and numerous small mammals. Apart from bats, which are discussed in section 4.3.7, the only provincially or federally listed mammal that may on occasion be present in the area is the mainland moose. References to lynx in the area have not been confirmed.

4.3.3.1 MOOSE (*ALCES AMERICANUS*)

The mainland moose is an 'at risk' listed species under the NSDNR General Status List and is legislated as Endangered provincially under the *Endangered Species Act*. The latter designation was introduced in 2003. Moose live in boreal and mixed-wood forests, where they feed on young deciduous trees and shrubs. They prefer habitat near wetlands in the summer and areas of denser forest cover in the winter. There have been six sightings of moose within 100 km of the Project site and the nearest sighting was only 7 km away. Moose scat was found in the Terence Bay Project site during spring migration avian surveys and an old moose browse was found during the moose presence survey conducted in the winter of 2014 (see Section 4.4.7).

4.3.4 Vascular Plants

4.3.4.1 SWEET PEPPERBUSH (*CLETHRA ALNIFOLIA*)

Sweet pepperbush is a woody shrub that is listed as a species of special concern federally and vulnerable provincially. This shrub occurs high on lakeshores in the shrub zone, to a lesser degree near streams and often grows in areas where granite boulders are present. Only one sighting, 19 km distant from the Project site, was recorded in the ACCDC database. There are no lakes in the Project site, which makes the possibility of encountering sweet pepperbush quite low; this species was not encountered during the plant surveys (see section 4.4.2).

4.3.4.2 BLACK ASH (*FRAXINUS NIGRA)*

Black ash was listed provincially as threatened in 2013 under the *Endangered Species Act*. This deciduous tree is generally small, but can reach heights of 18 to 21 m. It is a slow-growing, wind pollinated tree that generally lives for 130 to 150 years. Leaves are lance-shaped to oblong and compound. Black ash is shade intolerant and prefers moist sites, such as low areas, damp woods or swamps (Ratzlaff and Barth, 2006). In Nova Scotia, only about 1,000 trees exist, and these are found scattered throughout the northern parts of the province. According to the ACCDC data, there was only one sighting of black ash that was located 29 ±10 km from the Project site. It was not encountered during the vegetation surveys.

4.3.4.3 ROCKROSE (*HELIANTHEMUM CANADENSE*)

Rockrose is a perennial herb with a yellow flower that is listed as endangered in Nova Scotia. It is found in areas that have been lightly disturbed as well as in dry sand plains, heath barrens, borders of mixed woods and ditches. Rockrose likes exposure to the sun. The nearest sighting to Terence Bay was 19 km away. In Nova Scotia, it is primarily found in Kings County and to a lesser degree in Queens County. Suitable habitat exists on site, but the species was not detected during the plant surveys.

4.3.5 Lichens

4.3.5.1 Blue Felt Lichen (*Degelia plumbea)*

Blue felt lichen was listed as vulnerable provincially by the *Endangered Species Act* in 2013, and as a COSEWIC species of special concern in 2010. Within Canada, it is only found in the Atlantic region, most commonly in Nova Scotia. Blue felt lichen grows predominately on hardwoods in woodlands. This species is at risk due to forest harvesting and other disturbances that reduce humidity, as well as from acid rain. This lichen has been sighted 2 km away and was found growing on red maple during surveys of the Terence Bay Wilderness Area (Cameron and Richardson, 2006). It was not found during field surveys on site (see Section 4.4.4).

4.3.5.2 Boreal Felt Lichen (*Erioderma pedicellatum*)

Boreal felt lichen is listed as an endangered cyanolichen, both federally and provincially. This leaf-like lichen is found in forested balsam fir (*Abies balsamea*) stands within 30 km of the coast in Nova Scotia; it has been found in Cape Breton and in Guysborough, Halifax, Lunenburg, Queens and Shelburne counties. It generally grows on the north-facing side of mature tree trunks that are located in cool, moist habitats often associated with a sphagnum/cinnamon fern (*Osmunda cinnamomea*). The combination of these habitat characteristics maintains the cool humid micro-climate that the boreal felt lichen requires to thrive. The nearest ACCDC reported sighting of the Boreal Felt Lichen was 13 km from the Project site. It was not found during field surveys on site.

4.3.6 Invertebrates

4.3.6.1 Monarch Butterfly (*Danaus plexippus*)

The monarch butterfly can be found almost anywhere during its spring (northward) migration. During the breeding season, monarchs can be expected to be found near the larval-stage food plants, namely common milkweed (*Asclepias syriacal*) and swamp milkweed (*A. incarnata*). In the fall they are found, often in large numbers, near the coast before they head south. Although the monarch butterfly is found in the larger regional area, it is unlikely that the Project site is prime habitat, due to the lack of a suitable food supply.

4.3.7 Bats

4.3.7.1 Bat Species

According to ACCDC records, four species of bats have been recorded near the Terence Bay area (within 55 km): the little brown bat (*Myotis lucifugus*), the northern long-eared bat (*Myotis septentrionalis*), the tricoloured bat (*Perimyotis subflavus*) and the hoary bay (*Lasiurus cinereus*). The first three of these species were listed in 2013 as “endangered” provincially under the *Endangered Species Act*. The little brown bat, the northern long-eared bay, and the tricoloured bat are regular and year-round inhabitants of Nova Scotia, while the hoary bat is much less common. Hoary bats are migratory and may travel >100 km to spend their winters further south in the United States. There are occasional records of this species in Nova Scotia, as well as two other migratory species: the red bat (*Lasiurus borealis*) and the silver haired bat (*Lasionycteris noctivagans*). The rareness of these three species in this region suggests that Nova Scotia is likely at the northern fringe, or is possibly beyond the normal range, of these bats (Broders et al., 2003).

Of the three non-migratory species found in Nova Scotia, the tricoloured bat is the least abundant. Nova Scotia may be near the northern boundary of their range, resulting in the small population. Their relative abundance in the Terence Bay area is unknown. The little brown bat and the northern long-eared bat are found ubiquitously throughout the province.

4.3.7.2 Habitat in Terence Bay

The three species found in Nova Scotia, the little brown bat, the northern long-eared bat and the tricoloured bat, are all hibernators and spend their winters in caves or abandoned mines. These sites are ecologically important not only for over-wintering, but also because they serve as swarming sites where bats congregate and mate in the autumn. As such, levels of bat activity can be high in the area surrounding an underground site in the autumn. Individual bats can travel long distances (>100 km) in the late summer and early fall to reach their hibernation sites (Davis and Hitchcock, 1965).

In the Terence Bay area, there are no known hibernacula. The rock of Terence Bay is primarily made up of granite, which makes it very unlikely that there are any natural caves. To assess the possibility that suitable abandoned mines may exist in the area, the NSDNR Abandoned Mines Opening database was consulted. The database contains no records of abandoned mines in or near Terence Bay with a large enough depth to support a hibernating population.


Potential bat roost trees in the Terence Bay Project site

During the spring, summer and fall, bats in Nova Scotia roost primarily in trees, or in the case of the little brown bat, in human structures. Roost selection varies by species, sex and reproductive status. The roosting habits of the tricoloured bat are somewhat different; while this species also uses tree roosts, females in maternity colonies use bony beard lichen (*Usnea trichodea*) lichen as roosts (Poissant et al., 2010). The little brown bat and the northern long-eared bat use both coniferous and deciduous trees as roosts (Broders and Forbes, 2004). Trees in mid-decay stages and old snags also represent an important habitat component. In the Project site, there are stands of deciduous, coniferous and mixed wood forest, which could provide suitable roost trees. Several sections of these stands contain old snags and trees in various stages of decay that could serve as roost trees for bats.

The barrens in the Terence Bay area do not provide suitable roosting habitat, nor do areas with low, scrubby vegetation. Foraging habits differ between the two *Myotis* species, the little brown bat and the northern long-eared bat. The northern long-eared bat tends to forage mainly in forested areas, whereas the little brown bat is much more likely to venture into open areas and often forage over water. Terence Bay likely has suitable foraging habitat for both species. The stream in the south-east corner of the wind farm could be used for foraging by the little brown bat.

No monitoring for bats has been conducted in the Project Site. Despite this, it is possible to gain a fairly good understanding of bat presence by examining the landscape. The site likely does not provide ideal bat habitat due to its open, exposed nature and the abundance of barrens. There is, however, enough suitable habitat that it is probable that at least two species of bats (the little brown bat and the northern long-eared bat) would be found in this region in the spring, summer and fall. There are, however, no suitable hibernacula in the area.

4.4 Results of Ecological Field Programs

4.4.1 Major Vegetation Communities

Overall, the Project site is very much intact and undisturbed. A minor amount of ATV traffic was observed along both the northern boundary, originating from the access road from the north; and along the southern boundary, originating from a network of ATV trails through the barrens located to the south and west of the Project property. A number of hunting blinds located within the site, suggested usage of the site by hunters. There is little or no sign of past forest harvesting on the site, as evidenced by the lack of stumps, machine tracks, etc., but the overall vegetation of the site suggests that fire has played a key role in the establishment of the current vegetation communities.

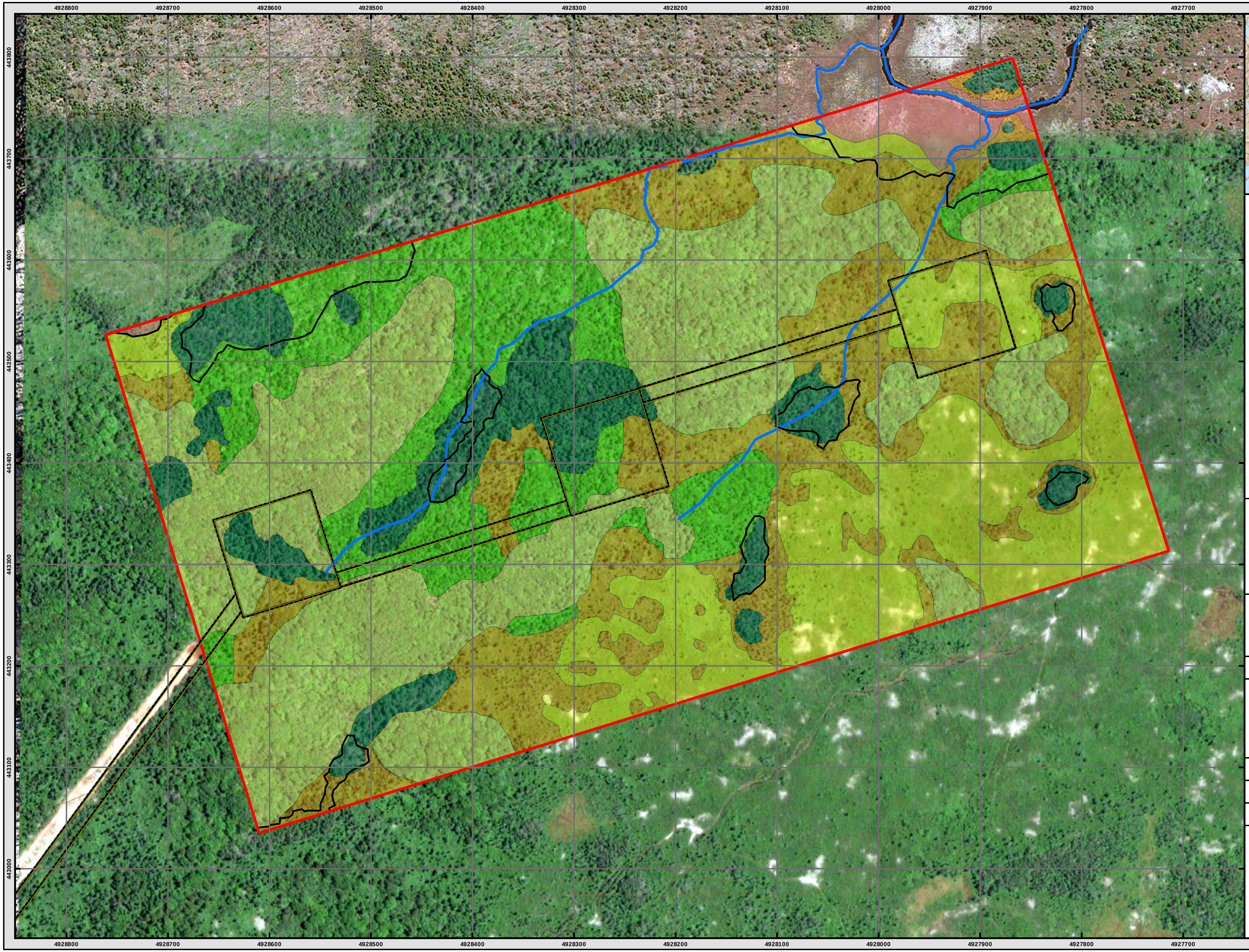
The vegetation communities identified on site (Figure 4.5) are identified in the sections that follow. These communities are prominently affected by the site's proximity to and the influence of the Atlantic Ocean.

4.4.1.1 Intolerant Hardwood Forest

A large portion of the northern portion of the site consists of hardwood forest comprising shade intolerant tree species, with the most commonly encountered VT being NSDNR CO6.

Typical coastal forest CO6 found on the Project site dominated by white birch, red maple, bracken fern and lambkill.

NSDNR CO6 (Red Maple – Birch / Bunchberry – Sarsaparilla): This is a later successional coastal forest type, often arising from CO5 (see section 4.4.1.2). This VT is typically located in sheltered inland areas, protected from the harsh coastal environment by the more seaward coniferous stands (NSDNR, 2010). On this site, this VT is characterized by an overstorey dominated by white birch (*Betula papyrifera*) and red maple (*Acer rubrum*) and an understorey dominated by sarsaparilla (*Aralia nudicaulis*), bunchberry *(Cornus canadensis*) and bracken fern (*Pteridium*



Road and Pad Layout
Contour Line (5m Interval)
CBCL Delineated Wetlands
CBCL Delineated Watercourses
RESL Propoerty Boundary (Approx)

Cover Type

Bog
Coniferous
Mixed Wood
Deciduous
High Shrub
Low Shrub
Water

CBCL LIMITED
Consulting Engineers

Chebucto Terence Bay Wind Farm

Figure 4.5

Vegetation Communities

Drawn: IB	**Date:** 18/06/2014
Checked:	**CBCL Project #** 121216.00
Approved:	**Scale @ 11"x17"** 1:3,500

0 35 70 140 m

Data Sources:
NSGC 1:10,000 Topo
Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

Map Parameters:
Coordinate System: NAD 1983 UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -63.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

L:\121216.00 RESL Terrence Bay\GIS\LAYOUT\FINAL REPORT FIGURES\121216.00 FIG 4-5 Vegetation Communities.

aquilinum). Minor amounts of trembling aspen (*Populus tremuloides*) and coniferous trees such as black spruce (*Picea mariana*) and balsam fir (*Abies balsamea*) are common within this VT and are found on this site. Also common in the understorey on this site are shrubs such as wild raisin (*Viburnum nudum*), lambkill (*Kalmia angustifolia*) and lowbush blueberry (*Vaccinium angustifolium*), as well as ground vegetation comprising goldthread (*Coptis trifolia*), wild lily-of-the-valley (*Maianthemum canadense*), wood sorrel (*Oxalis montana*) and woodferns (*Dryopteris spp.*).

4.4.1.2 Mixed-wood forest

The mixed-wood forests on the Project site are intermediate in character between the coniferous and deciduous forests, and are generally members of NSDNR CO5 (White Birch – Balsam Fir / Foxberry – Wood Aster).

Typical coastal forest CO5 found on the Project site dominated by balsam fir, red maple, lambkill, and wild raisin.

4.4.1.3 Coniferous Forest

The type of coniferous forest encountered on site varies depending on the soil and nutrient conditions, both of which are potentially limiting to tree growth.

Fresh to moist nutrient poor portions of the site are occupied by NSDNR CO1, a conifer-dominated coastal forest type. This VT is dominated by black spruce and balsam fir in the overstorey, and various mosses in the understorey, of which Schrebers' moss (*Pleurozium schreberii*) and plume moss (*Ptilium crista-castrensis*) are dominant on this site. Sarsaparilla, goldthread and twinflower (*Linnaea borealis*) are common understorey herbs.

Imperfectly to poorly drained portions of the site include portions of the wetlands, i.e., WC1, WC2, WC6 and WC7. These VTs are described in Section 4.4.3. On the wettest sites, such as the edges of bogs, tree growth is typically stunted.

Typical wet coniferous forest WC2 found on the Project site dominated by black spruce, lambkill, Labrador tea and sphagnum moss.

4.4.1.4 Barrens

Being non-forested communities in the technical sense, NSDNR's FEC guides are not applicable to this habitat type. The barrens encountered on site are broadly classified into two communities, low shrub and high shrub.

Low Shrub Barrens (heathland): The low shrub barrens are dominated by ericaceous shrubs of low stature (<1 m tall) such as huckleberry (*Gaylussacia baccata*), lambkill, lowbush blueberry, and black crowberry (*Empetrum nigrum*). Common juniper (*Juniperus communus*), bracken fern, bunchberry and reindeer lichen (*Cladina spp.*) are interspersed throughout this shrub mosaic. In areas with exposed rock, reindeer lichen tends to dominate. Other occasional species include deergrass (*Trichophorum caespitosum)*, three-toothed cinquefoil (*Sibbaldiopsis tridentata*), bog goldenrod (*Solidago uliginosa*) and tall rattlesnake root (*Prenanthes altissima*).

Typical low shrub barrens on the Project site, dominated by ericaeous shrubs such as lambkill, huckleberry and lowbush blueberry.

High Shrub Barrens: This community is typically dominated by shrubs in excess of 1 m, including false holly (*Nemopanthus mucronata*), rhodora (*Rhododendron canadense*), speckled alder (*Alnus incana)*, green alder (*Alnus viridis*) and Canada holly (*Ilex verticillata*). Occasional trees are scattered throughout the shrub matrix, including black spruce, white birch, aspen (*Populus grandidentata* and *P. tremuloides*) red maple and balsam fir. Herbaceous vegetation is often sparse due to the density of shrubbery, but includes sarsaparilla, cinnamon fern and bracken fern.

Typical high shrub barrens on the Project site dominated by speckled alder and false holly, with white birch and red maple.

4.4.1.5 Bog

A bog is a type of peatland which is characterized by its distinct hydrology, which is sourced primarily from precipitation, i.e., snow, rain and fog. Bogs are virtually unaffected by surface runoff and groundwater, and surface waters are consequently low in dissolved minerals and quite acidic (National Wetland Working Group, 1997; Rydin and Jeglum, 2006). Acidity in bogs is further enhanced by the release of organic acids during the decomposition of *Sphagnum* moss, which is the dominant substrate of these peatlands (National Wetland Working Group, 1997). The various species of *Sphagnum* mosses that compose the wetlands have a unique capacity to store water in both living and dead plant tissues. As a result of this increased moisture retention, anaerobic conditions form, inhibiting the decomposition of the *Sphagnum* which results in an ever increasing peat layer. This process of bog formation, known as ombrotrophication, increasingly isolates the bog flora from groundwater influence (Rydin and Jeglum, 2006). The peat formations are generally quite deep, on average 3-5 m in most of Canada, and occasionally up to 10 m in exceptional cases (National Wetland Working Group, 1997).

Within the Project site, the bog community is mostly treeless, although scattered and often stunted black spruce and tamarack (*Larix laricina)* are found. The community contains a profuse growth of ericaceous dwarf shrubs including lambkill, bog laurel (*Kalmia polifolia*), leatherleaf (*Chaemadaphne calyculata*), Labrador tea (*Ledum groenlandicum*), dwarf huckleberry (*Gaylussacia dumosa*) and bog rosemary (*Andromeda polifolia*). Herbaceous vegetation is dominated by *Sphagnum* mosses, which form the peat substrate of this community. Lesser amounts of graminoid species are also characteristic of bogs, with species such as Atlantic sedge (*Carex atlantica*), little prickly sedge (*C. echinata*), few-seeded sedge (*C. pauciflora*), long sedge (*Carex folliculata*), cottongrass (*Eriophorum spp.*), white beakrush (*Rhynchospora alba*) and deergrass forming 'lawns' in the wetter hollows and flats. Herbaceous species such as the pitcher plant (*Sarracenia purpurea*) are encountered throughout the community. Reindeer lichen is often interspersed with the *Sphagnum* and ericaceous shrubs in the dryer portions of the community and on the bog hummocks.

Typical bog found on the Project site dominated by leatherleaf, bog laurel and lambkill with black spruce, tamarack, sphagnum and reindeer lichen.

4.4.1.6 Fen

Fens are peatlands that have a fluctuating water table that is either at or slightly below the wetland surface (Rydin and Jeglum, 2006) and are rich in dissolved minerals derived from the influence of surrounding mineral soils (National Wetland Working Group, 1997). In general, vegetation in fens varies depending on the water table position and the degree of mineral enrichment in the wetland. The fen within the Project site is a nutrient poor riparian fen. Riparian fens develop adjacent to waterbodies such as lakes, ponds and streams and may be subject to occasional inundation by floodwaters (National Wetland Working Group, 1997). A defined vegetation gradient is typical in these wetlands, with graminoids and bryoids proximal to the waters' edge, grading to shrubs and trees with increasing lateral and vertical distance from the water. In most cases, peat forms the interface between the wetland and its associated waterbody, and the water table within the wetland is directly affected by the water level of its associated waterbody, whether normal or flooded.

Typical fen found on the Project site dominated by graminoids such as *Carex* sp. and *Scirpus* sp.

4.4.2 Rare Flora and Biodiversity

During the fieldwork conducted, a total of 132 species representing 38 families of vascular flora were encountered. There is a relative paucity of species, given the small size of the site and the fact that the nutrient regime appears to be rather poor; even the most promising sites, i.e., major wetlands and wet forests, are species poor. Site-wide, the dominance of ericaceae (heath) plants is reflective of the poor nutrient regime, as these species are well adapted to thrive under even the poorest of conditions. Notably lacking from the on-site flora are the exotics and disturbance loving species, many of which are both common and abundant in nearby areas, e.g., roadsides and other anthropogenic environments.

No rare plant sightings (i.e., ranked S3 or greater) were documented over the course of the fieldwork, and no Federal or Provincially legislated species of flora were encountered.

While the site vegetation is not considered to be extraordinary in composition, it is noteworthy that such a small portion of the overall flora is composed of exotics (five species, <4% of sites flora). This speaks to the integrity of the site's vegetation and to the lack of human disturbance on the site.

A complete listing of vascular flora encountered is presented in Appendix N.

4.4.3 Wetlands

A total of eight wetlands were encountered and delineated on the site (Figure 4.2). These are detailed in the following sections.

4.4.3.1 Wetland #1 – Bog / Treed Swamp Complex

The majority of the onsite portion (10,670 m^2) of this wetland complex is a treed swamp, consistent with NSDNR VT WC6. Black spruce, cinnamon fern, *Sphagnum spp.*, three-seed sedge (*Carex trisperma*), three-leaved solomons seal (*Smilacina trifolia*), creeping snowberry (*Gaultheria hispidula*) and bunchberry are the dominant species.

The northeastern portion of the wetland (most of which is offsite) is a basin bog, characterized by a substrate of *Sphagnum* moss, dwarf coniferous trees and ericaceous shrubs. Dwarf conifers consist primarily of black spruce (*Picea mariana*), larch (*Larix laricina*) and scattered common juniper (*Juniperus communus*). The ubiquitous ericaceous species throughout the wetland include lambkill (*Kalmia angustifolia*), Labrador tea (*Ledum groenlandicum*), leatherleaf (*Chaemadaphne calyculata*), bog rosemary (*Andromeda polifolia*) and bog laurel (*K. polifolia*).

Ground vegetation includes bakeapple (*Rubus chamaemorus*), bog goldenrod (Solidago uliginosa), bunchberry (*Cornus canadensis*), pitcher plant (*Sarracenia purpurea*) and bog aster (*Oclomena nemoralis*).

Dryer hummocks are common throughout the bog and are often colonized by black crowberry (*Empetrum nigrum*) and reindeer lichens (*Cladonia spp.*), as well as the various ericaceous species mentioned above. The wet hollows between the hummocks, as well as occasional flats and swales throughout the bog are dominated by *Sphagnum*, often with graminoid species such as deergrass (*Tricophorum cespitosum*), Pickering's reed bent-grass (*Calamagrostis pickeringii*), few-flowered sedge (*Carex pauciflora*), prickly bog sedge (*C. atlantica*), bladder sedge (*C. intumescens*), and three-seeded sedge (*C. trisperma*).

4.4.3.2 Wetland #2 – Shrub Fen / Swamp Complex

This is a relatively large wetland (19,163 m^2 onsite) compared to most others on the Project site. The wetland contains a deep peat layer throughout, almost always exceeding 4 ft in the centre, and gradually decreasing toward the wetland edge. At the wetland edge, boulders become visible protruding from the surface of the wetland, with peat deposits formed in the interstitial spaces between them. The onsite (delineated) portion of the boundary gives rise rapidly to the surrounding upland, which is a combination of shrubby barrens and a modest amount of mixed wood forest.

A watercourse approximately 6 m wide and 1.5 m deep flows from southwest to northeast through this wetland; this would indicate the wetland's classification as a fen. The influence of the more nutrient rich water from the watercourse, however, is restricted to approximately 20 m from the water's edge; within this area there is a high incidence of graminoid species, including the sedges *Carex stricta, C. nigra* and *C. trisperma*. Beyond this distance, there appears to be a more oligotrophic environment, as evidenced by the predominance of bog-like vegetation over that of graminoids; this bog-like flora includes a substrate of *Sphagnum* moss and a dense cover of low shrubs dominated by rhodora (*Rhododenron canadense*), sweet gale *(Myrica gale*), lowbush blueberry (*Vaccinium angustifolia*) and leatherleaf with lesser amounts of false holly (*Nemopanthus mucronata*), wild raisin (*Viburnum nudum*), black huckleberry (*Gaylussacia baccata*), bog rosemary, lambkill and bog laurel.

The southeastern portion of the wetland complex is a treed swamp, consistent with NSDNR VT WC6, described in wetland #1.

4.4.3.3 Wetlands #3 to #8 – Treed Swamps

The remaining wetlands on site are similar in character and are classified as treed swamps. The dominant vegetation of these swamps is referenced to NSDNR's VTs in Table 4.5, all of which are variants of the 'Wet Coniferous' (WC) forest group.

In all cases, the soils encountered throughout these wetlands are histosols, grading toward histic epipedon at the wetland-upland boundary. At all formal sample locations with the exception of wetland #7, 16-20" of moderately decomposed peat were encountered, overlaying rock. In wetland #7, a shallower (11" deep) organic horizon was measured, overlaying a dark reddish- brown (Munsell 5YR 2.5/2) loamy-sand, meeting the definition of a histic epipedon.

Table 4.5: Area and NSDNR vegetation classification for wetlands #3 to #8

Wetland	*NSDNR Vegetation Type (VT)*	*Area (m^2)*
#3	WC2 – Black Spruce / Lambkill – Labrador Tea / Sphagnum	863 m^2
#4	WC1 – Black Spruce / Cinnamon Fern / Sphagnum	1,075 m^2
#5	WC1 – Black Spruce / Cinnamon Fern / Sphagnum	3,135 m^2
#6	WC7 – Tamarack – Black Spruce / Lambkill / Sphagnum	1,705 m^2
#7	WC1 – Black Spruce / Cinnamon Fern / Sphagnum	2,795 m^2
#8	WC6 – Balsam Fir / Cinnamon fern – Three-seeded Sedge / Sphagnum	1,713 m^2 (Onsite Portion)

Wetland #3 (NSDNR VT WC2): This is a black spruce dominated forest type. The shrub layer is defined by the presence of false holly, with lesser amounts of black spruce, balsam fir, lambkill and Labrador tea. The ground vegetation is dominated by Sphagnum moss, three-seeded sedge and bunchberry.

Wetlands #4, #5, and #7 (NSDNR VT WC1): These wetlands are dominated by black spruce, with lesser amounts of balsam fir, red maple and white birch in the tree stratum. The shrub layer is generally sparse, with lambkill and wild raisin being well represented; Labrador tea, and regenerated black spruce, red maple and balsam fir are scattered throughout this shrub layer. The ground vegetation is characterized by Sphagnum moss, three-seeded sedge and cinnamon fern, with scattered goldthread and wild lily-of-the-valley.

Wetland #6 is (NSDNR VT WC7): This wetland is dominated by black spruce and tamarack, with lesser amounts of red maple in the tree stratum. The shrub layer is dominated by lambkill and wild raisin with lesser amounts of black spruce, balsam fir and false holly. The ground vegetation is predominantly Sphagnum moss and three-seeded sedge, with lesser amounts of starflower, pitcher plant and goldthread.

Wetland #8 (NSDNR VT WC6): This wetland is characterized by a dominance of balsam fir and lesser amounts of black spruce in the tree stratum. The shrub stratum is dominated by balsam fir, black spruce and wild raisin, with lesser amounts of lambkill, white birch and red maple. The ground vegetation is dominated by sphagnum moss, Schrebers' moss, bazzania (*Bazzania trilobata*), creeping snowberry, cinnamon fern, three-seeded sedge and broom moss (*Dicranum scoparium*). The ground vegetation comprises lesser amounts of mountain cranberry (*Vaccinium vitus-idaea*), indian pipe (*Monotropa uniflora*), starflower, goldthread and wild lily-of-the-valley.

4.4.4 Lichen Survey

To determine the presence or absence of the Boreal Felt Lichen, a foot survey of the Project site was conducted in September, 2013. Each of the eight wetlands identified and referenced above was visited. Balsam fir was dominant in one wetland, i.e., wetland #8. The remaining wetlands had only scattered balsam fir, black spruce (*Picea mariana*), larch (*Larix laricina*), red maple (*Acer Rubrum*) and paper birch (*Betula papyrifera*). No indicator species for boreal felt lichen, e.g., *Coccocarpia palmicola, Moeleropsis nebulosa* and *Lobaria scrobiculata* (when found on Balsam Fir) were observed in any of the wetlands. The cyanolichens present were limited to *Lobaria pulmonaria, L. quercizans, L. scrobiculata, Leptogium cyanescens, Pseudocyphellaria, Peltiqera apthosa* and *Peltigera sp*.

4.4.5 Results of Avifauna Assessment

4.4.5.1 Spring Migration

i) Stop-over Surveys

Spring migration on the Chebucto Peninsula begins in March for the earliest migrants. During April the pace of migration and the number of returning species increases. During May a wide diversity of birds pass through the area, or arrive on their breeding territories. Some migration continues through the first seven to 10 days of June for the last arrivals.

In total, 418 individual birds of 43 species were recorded during the spring migration stop-over surveys undertaken in 2013. These data were used to examine the effects of seasonality on birds migrating through the study area. Figure 4.6 represents the overall abundance of the spring migration by displaying the total number of birds seen per transects at all distance bands (abundance). This figure can be interpreted as the aggregate of all bird activity on the Project site, i.e., early breeding and migration. Figure 4.7 presents the overall diversity of species detected per transect in the Project site during the same time period (diversity); as expected, the overall diversity of bird species increases over time during the migratory period.

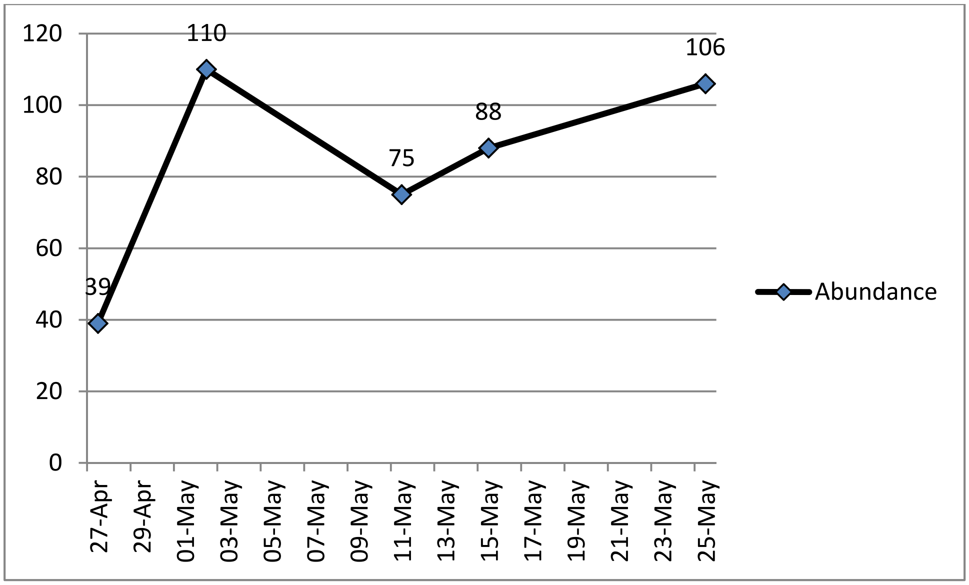


Figure 4.6: Overall abundance of birds in the Project site during spring migration

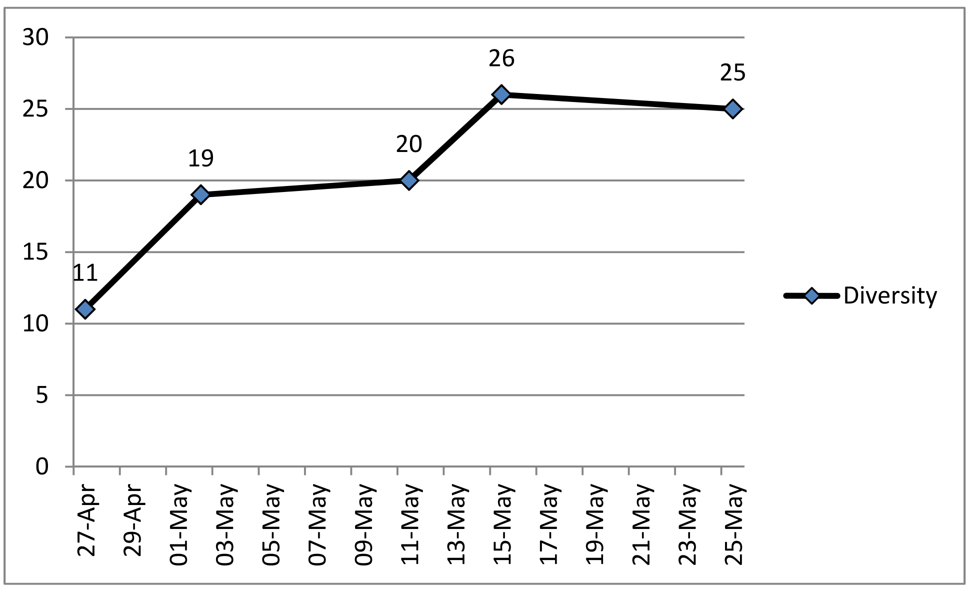


Figure 4.7: Overall diversity of birds in the Project site during the spring migration

As the season progresses, a growing number of birds are no longer migrating, but are in fact on their breeding territories. To account for this, representations were made of the total abundance (Figure 4.8) and diversity (Figure 4.9) of the birds on migration stop-over by progressively eliminating from the data any species that had started breeding activities, i.e., the establishment of territories, courtship, nest building, etc. This method allows for a clearer picture of migration by removing early breeding species from the counts. The breeding calendar of the Maritimes Breeding Bird Atlas (http://www.mba-aom.ca/) was used as a reference in establishing these cut-off dates.

Figure 4.8 suggests that peak abundance for migrating birds occurs in early-May; Figure 4.9 suggests that the peak diversity of migrating birds on the Project site also occurs in early May, before declining through the remainder of the month.

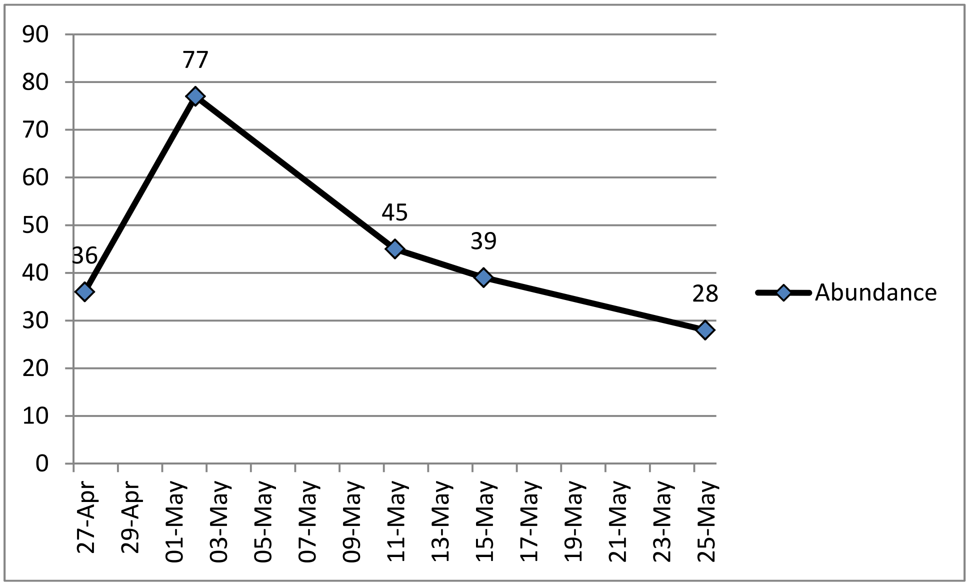


Figure 4.8: Overall abundance of birds at the Project site during spring migration (early breeders removed.)

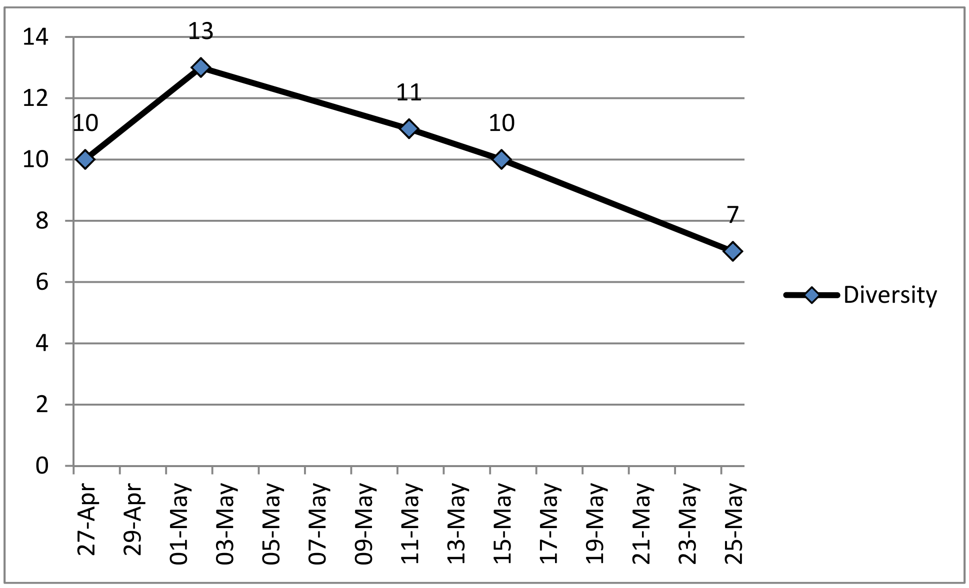


Figure 4.9: Overall diversity of birds at the Project site during spring migration (early breeders removed.)

ii) Diurnal Fly-Over Surveys

During the diurnal fly-over surveys, a total of 14 identifiable species were observed; these included four species of raptor, one water bird, one woodpecker, three corvids, four passerines and one kingfisher. Due to the difficulty in reliably identifying migrating warbler and sparrow species, all warblers and sparrows observed were grouped into their own categories, i.e., 'Warbler spp.' and 'Sparrow spp.'. The results are summarized in Table 4.6. The most commonly observed bird was the American Robin, which was detected during 67% of time blocks. The American Crow (observed in 50% of time blocks) and the Common Raven (observed in 33% of time blocks) were seen frequently during the spring fly-over surveys. Warbler species were seen frequently, with at least one observation in 58% of time blocks.

In addition to the ravens and crows, several raptor species were observed from the observation point suggesting that the study area is used frequently by local populations of both raptors and corvids. In order to gain altitude, these species are known to use thermals and air currents that are generated off the forest canopy (albedo effect), as well as topographic features such as steep hills and ridges.

Table 4.6: Results of the spring diurnal fly-over survey

Species	***# of Individuals***	***# of Observations***	***Mean # per Observation***	***% of Time Blocks Observed***
Diurnal Raptors				
Bald Eagle	3	2	1.5	17%
Red-tailed Hawk	2	2	1.0	17%
Osprey	1	1	1.0	8%
Sharp-shinned Hawk	1	1	1.0	8%
Corvids				
American Crow	13	7	1.9	50%
Common Raven	5	4	1.25	33%
Blue Jay	3	3	1.0	17%
Water Birds				
Black Duck	2	1	2.0	8%
Woodpeckers and Passerines				
Warbler spp.	22	8	2.75	58%
American Robin	17	11	1.5	67%
American Goldfinch	11	4	2.75	25%
Common Grackle	6	2	3.0	17%
Black-capped Chickadee	5	2	2.5	17%
Sparrow spp.	5	3	1.7	17%
Northern Flicker	2	2	1.0	17%
Belted Kingfisher	1	1	1.0	8%

4.4.5.2 Breeding Season

i) Early Breeding

Table 4.7 summarizes the results of the point count analysis for early breeders. The most abundant early breeder was the Black-capped Chickadee with a mean of 4.5 individuals per point count station. It was followed by the American Robin with a mean of 2.8. Other species averaging 1.5 or more individuals per station were in rank order: Hermit Thrush, White-throated sparrow, Yellow-rumped Warbler, Blue Jay, Dark-eyed Junco and American Redstart.

Table 4.7: Summary of Early Breeders Detected During the Spring Migration Stop-Over Survey

Species	***Breeding Start Week***	***Mean***	***Sum***	***Rank***
Black-capped Chickadee	1-May	4.50	27	1
American Robin	1-May	2.83	17	2
Hermit Thrush	15-May	2.50	15	3
White-throated Sparrow	15-May	2.50	15	4
Yellow-rumped Warbler	8-May	2.50	15	5
Blue Jay	1-May	2.50	15	6
Dark-eyed Junco	1-May	1.83	11	7
American Redstart	22-May	1.83	11	8
American Crow	8-April	1.33	8	9
Common Raven	1-March	1.17	7	10
Ring-necked Pheasant	1-May	1.17	7	11
Common Yellowthroat	22-May	1.17	7	12
Magnolia Warbler	22-May	1.17	7	13
Golden-crowned Kinglet	8-May	1.0	6	14
Northern Flicker	1-May	0.83	5	15
Ruffed Grouse	22-April	0.67	4	16
Ruby-crowned Kinglet	22-May	0.50	3	17
Palm Warbler	15-May	0.50	3	18
Canada Goose	1-May	0.33	2	19
Hairy Woodpecker	1-May	0.33	2	20
Bald Eagle	22-March	0.33	2	21
Yellow Warbler	22-May	0.33	2	22
House Finch	22-March	0.17	1	23
Common Grackle	22-April	0.17	1	24
Red-tailed Hawk	15-April	0.17	1	25
Wilson's Snipe	1-May	0.17	1	26
Mourning Dove	15-May	0.17	1	27

ii) Peak Breeding

Table 4.8 presents a summary of the results of the peak breeding bird survey. In total, 155 individual birds of 37 species were recorded during the peak breeding surveys. In total, 134 individual birds of 32 species were recorded at the control locations within the Project site. These data are compared to the point counts conducted at the Project site and may be used as controls for use in the event of any post-construction monitoring. The White-throated Sparrow was the most common bird encountered during the peak breeding season survey and was detected on 69% of all point counts. It was closely followed by the Magnolia Warbler and the Common Yellowthroat, both of which were detected on 63% of all point counts. The Alder Flycatcher and Golden-crowned Kinglet round out the top five breeding species in the study area, having been detected on 56% and 44% of point counts, respectively.

Table 4.8: Summary of Birds Detected During the Peak Breeding Survey Within The Study Area

Species	***Breeding Start Week***	***Sum***	***Mean***	***Frequency***	***Rank***
White-throated Sparrow	15-May	17	1.06	69%	1
Magnolia Warbler	22-May	14	0.88	63%	2
Alder Flycatcher	8-June	14	0.88	56%	3
Common Yellowthroat	22-May	12	0.75	63%	4
Golden-crowned Kinglet	8-May	11	0.69	44%	5
Hermit Thrush	15-May	8	0.50	38%	6
Black-capped Chickadee	1-May	7	0.44	25%	7
Chipping Sparrow	15-May	7	0.44	38%	8
Chestnut-sided Warbler	1-June	6	0.38	25%	9
American Redstart	22-May	5	0.31	31%	10
Dark-eyed Junco	1-May	5	0.31	31%	11
Palm Warbler	15-May	5	0.31	25%	12
Gray Jay	1-April	4	0.25	6%	13
Lincoln’s Sparrow	8-June	4	0.25	19%	14
Black-throated Green Warbler	1-June	3	0.19	13%	15
Yellow-rumped Warbler	8-May	3	0.19	19%	16
Black-and-white Warbler	1-June	3	0.19	19%	17
Nashville Warbler	22-May	2	0.13	13%	18
Common Loon	8-May	2	0.13	13%	19
Boreal Chickadee	22-May	2	0.13	13%	20
Cedar Waxwing	8-June	2	0.13	6%	21
Bald Eagle	22-March	2	0.13	6%	22
Savannah Sparrow	22-May	2	0.13	13%	23
American Crow	8-April	2	0.13	13%	24
American Robin	1-May	1	0.06	6%	25
Wilson’s Warbler	15-June	1	0.06	6%	26
Blue Jay	1-May	1	0.06	6%	27
Winter Wren	22-May	1	0.06	6%	28
Blue-headed Vireo	22-May	1	0.06	6%	29
Purple Finch	22-May	1	0.06	6%	30
Eastern Wood-Pewee	8-June	1	0.06	6%	31
Yellow Warbler	22-May	1	0.06	6%	32
Yellow-bellied Flycatcher	15-June	1	0.06	6%	33
Mourning Warbler	15-June	1	0.06	6%	34
Canada Goose	1-May	1	0.06	6%	35
Mourning Dove	15-May	1	0.06	6%	36
Red-eyed Vireo	8-June	1	0.06	6%	37

At the control points, 134 individual birds of 32 species were recorded (Table 4.9). These data are compared to the point counts conducted at the Project site and may be used as controls for use in the event of any post-construction monitoring. Although the control count locations were closer to a road, the most abundantly detected birds at the Project site were very similar to the most abundantly detected birds at the control locations. Five of the top six species detected at the Project site were also in the top six bird species detected during control point counts; they included the White-throated Sparrow, Magnolia Warbler, Alder Flycatcher, Common Yellowthroat and Hermit Thrush.

Table 4.9: Summary of Birds Detected at Control Locations During the Peak Breeding Survey

Species	*Breeding Start Week*	*Sum*	*Mean*	*Frequency*	*Rank*
American Goldfinch	22-June	16	1.33	58%	1
Common Yellowthroat	22-May	14	1.16	92%	2
White-throated Sparrow	15-May	10	0.83	67%	3
Alder Flycatcher	8-June	9	0.75	58%	4
Magnolia Warbler	22-May	9	0.75	58%	5
Hermit Thrush	15-May	7	0.58	42%	6
Mourning Dove	15-May	7	0.58	42%	7
American Redstart	22-May	6	0.50	33%	8
European Starling	22-April	6	0.50	25%	9
American Crow	8-April	5	0.42	33%	10
Ruby-crowned Kinglet	22-May	4	0.33	25%	11
American Robin	1-May	4	0.33	33%	12
Black-throated Green Warbler	1-June	4	0.33	25%	13
Black-capped Chickadee	1-May	4	0.33	17%	14
Chestnut-sided Warbler	1-June	3	0.25	17%	15
Red-eyed Vireo	8-June	3	0.25	25%	16
Common Raven	1-March	2	0.13	17%	17
Ring-necked Pheasant	1-May	2	0.13	17%	18
Northern Flicker	1-May	2	0.13	17%	19
Dark-eyed Junco	1-May	2	0.13	17%	20
Black-and-white Warbler	1-June	2	0.13	17%	21
Blue Jay	1-May	2	0.13	17%	22
Chipping Sparrow	15-May	2	0.13	17%	23
Yellow Warbler	22-May	1	0.08	8%	24
Winter Wren	22-May	1	0.08	8%	25
American Kestrel	22-April	1	0.08	8%	26
Purple Finch	22-May	1	0.08	8%	27
Herring Gull	15-April	1	0.08	8%	28
Cedar Waxwing	8-June	1	0.08	8%	29
Least Flycatcher	1-June	1	0.08	8%	30
Savannah Sparrow	22-May	1	0.08	8%	31

Species	Breeding Start Week	Sum	Mean	Frequency	Rank
Sharp-shinned Hawk	15-May	1	0.08	8%	32

iii) Crepuscular and Nocturnal Breeding Birds

No nocturnal or crepuscular birds were detected during this survey.

4.4.5.3 Fall Migration

i) Fall Migration Stop-over Surveys

The autumn migration of birds on the Chebucto Peninsula can be first detected in early to mid-July with the passage of sandpipers. Many other species, including local nesting birds, begin their southward journey in August with the peak fall migration occurring in the last week of August to early October. By mid-October and early November, many of the birds seen at the Project site have arrived from other areas to spend the winter there, or to move from the site to more southerly or coastal areas should food supplies become scarce.

In total 424 individual birds of 40 species were recorded during the fall migration stop-over surveys. These data were used to examine the effects of seasonality on birds migrating through the study area. Figure 4.10 represents the overall magnitude of the fall migration at the Project site by displaying the total number of birds seen per transects at all distance bands (abundance). This figure suggests that peak fall migration in the study area occurs in mid-September.

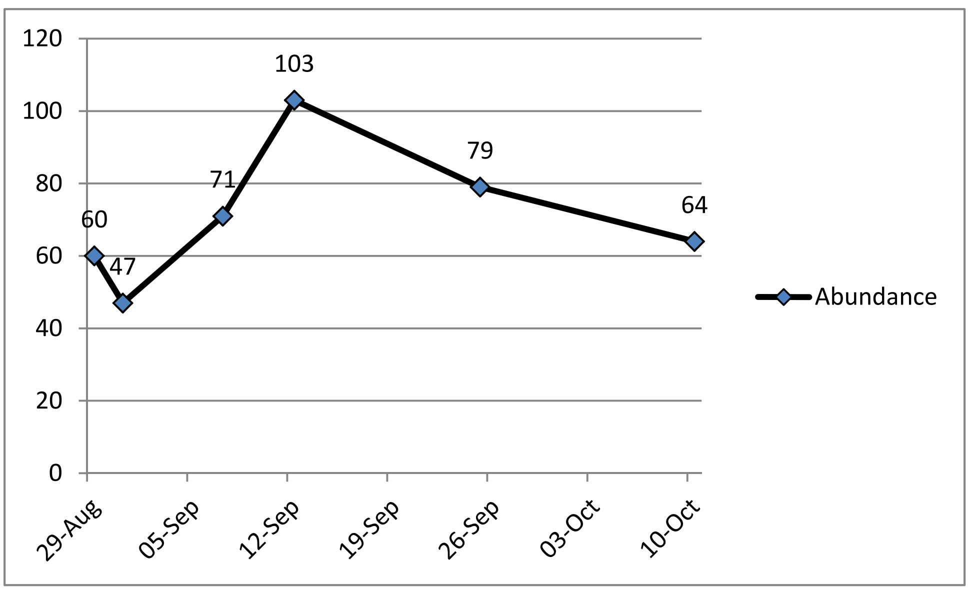


Figure 4.10: Overall abundance of birds at the Project site during fall migration

Figure 4.11 presents the overall number of species detected per transect at the Project site during the same time period (diversity). This figure shows that, as expected, the overall diversity of bird species is highest during peak migration (mid-September) and decreases over the remainder of the fall migratory period.

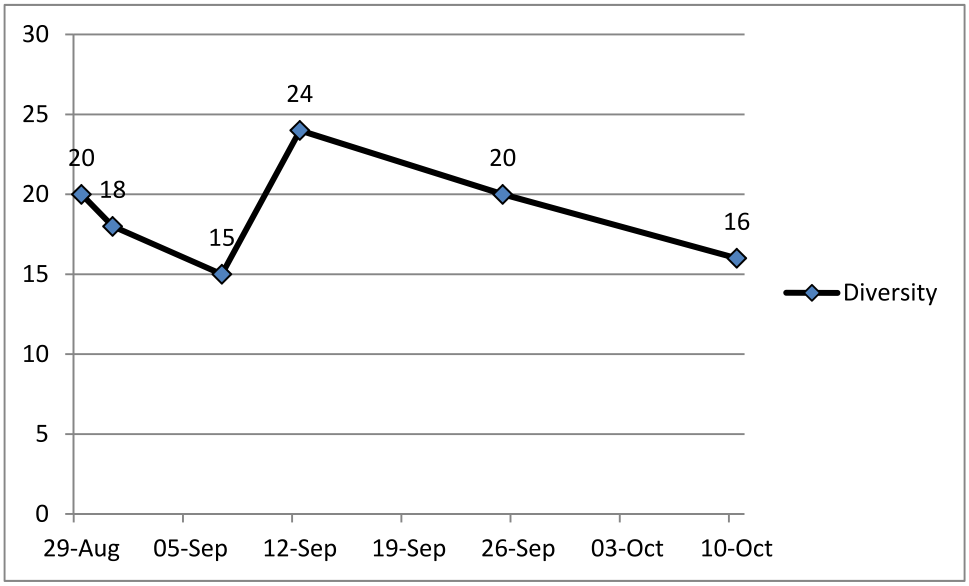


Figure 4.11: Overall diversity of birds at the Project site during fall migration

ii) Diurnal Fly-Over Surveys

In total, 23 identifiable species were observed during the fly-over surveys; these include five species of raptor, four water bird species, three woodpecker species, four corvid species and seven passerine species. Due to the difficulty in reliably identifying migrating warbler and sparrow species, all warblers and sparrows observed were grouped into their own categories, i.e., 'Warbler spp.' and 'Sparrow spp.'. These results are summarized in Table 4.10. By far the most abundantly observed bird was the Double-crested Cormorant, which was seen migrating in large flocks throughout the month of October. The most commonly observed birds included the Blue Jay (observed in 68% of time blocks), the American Robin (observed in 61% of time blocks) and the American Crow (observed in 46% of time blocks). Warbler species were also seen very frequently, with at least one observation in 93% of time blocks.

Ravens and several raptor species occurred regularly at the observation point suggesting the Project site is used frequently by local populations of raptors and corvids. In order to gain altitude, these species are known to use thermals and air currents that are generated off the forest canopy (albedo effect), as well as topographic features such as steep hills and ridges.

Table 4.10: Results of the Fall Diurnal Fly-Over Survey

Species	***# of Individuals***	***# of Observations***	***Mean # per Observation***	***% of Time Blocks Observed***
DIURNAL RAPTORS				
Red-tailed Hawk	5	4	1.3	14%
Northern Harrier	4	4	1.0	11%
Bald Eagle	2	2	1.0	7%
Osprey	2	2	1.0	7%
Sharp-shinned Hawk	3	2	1.5	7%
CORVIDS				
Blue Jay	58	25	2.3	68%

Species	# of Individuals	# of Observations	Mean # per Observation	% of Time Blocks Observed
American Crow	47	15	3.1	46%
Common Raven	12	9	1.3	29%
Gray Jay	1	1	1.0	4%
WATER BIRDS				
Double-crested Cormorant	1192	16	74.5	32%
Herring Gull	3	3	1.0	11%
Mallard	2	1	2.0	4%
Short-billed Dowitcher	3	1	3.0	4%
WOODPECKERS & PASSERINES				
American Robin	265	31	11.8	61%
*Warbler spp.	190	56	3.4	93%
Cedar Waxwing	89	15	5.9	39%
White-winged Crossbill	33	5	6.6	11%
**Sparrow spp.	16	9	1.8	25%
American Goldfinch	14	7	2.0	25%
Northern Flicker	8	7	1.1	25%
Hermit Thrush	2	1	2.0	4%
Hairy Woodpecker	1	1	1.0	4%
Downy Woodpecker	1	1	1.0	4%
Red-winged Blackbird	1	1	1.0	4%
Ruby-throated Hummingbird	1	1	1.0	4%

**Birds that were unidentified to the species level

4.4.5.4 Overwinter Study

The locations of the winter survey transect and point counts remained the same as the one used for the migration stop-over surveys (Figure 3.3). Overall, very few birds wintered within the boundaries of the Project site, only 66 individual birds of 13 species were detected. The results are summarized in Table 4.11.

Table 4.11: Summary of Birds Detected Duringthe Overwinter Survey within the Study Area

Species	# of Individuals Detected	Rank
Black-capped Chickadee	15	1
Pine Siskin	11	2
American Crow	10	3
Common Raven	9	4
White-winged Crossbill	7	5
Golden-crowned Kinglet	6	6
Gray Jay	2	7
Downy Woodpecker	1	8
Hairy Woodpecker	1	9

Species	*# of Individuals Detected*	*Rank*
Northern Flicker	1	10
Pine Grosbeak	1	11
Evening Grosbeak	1	12
Purple Finch	1	13

4.4.5.5 Species of Concern

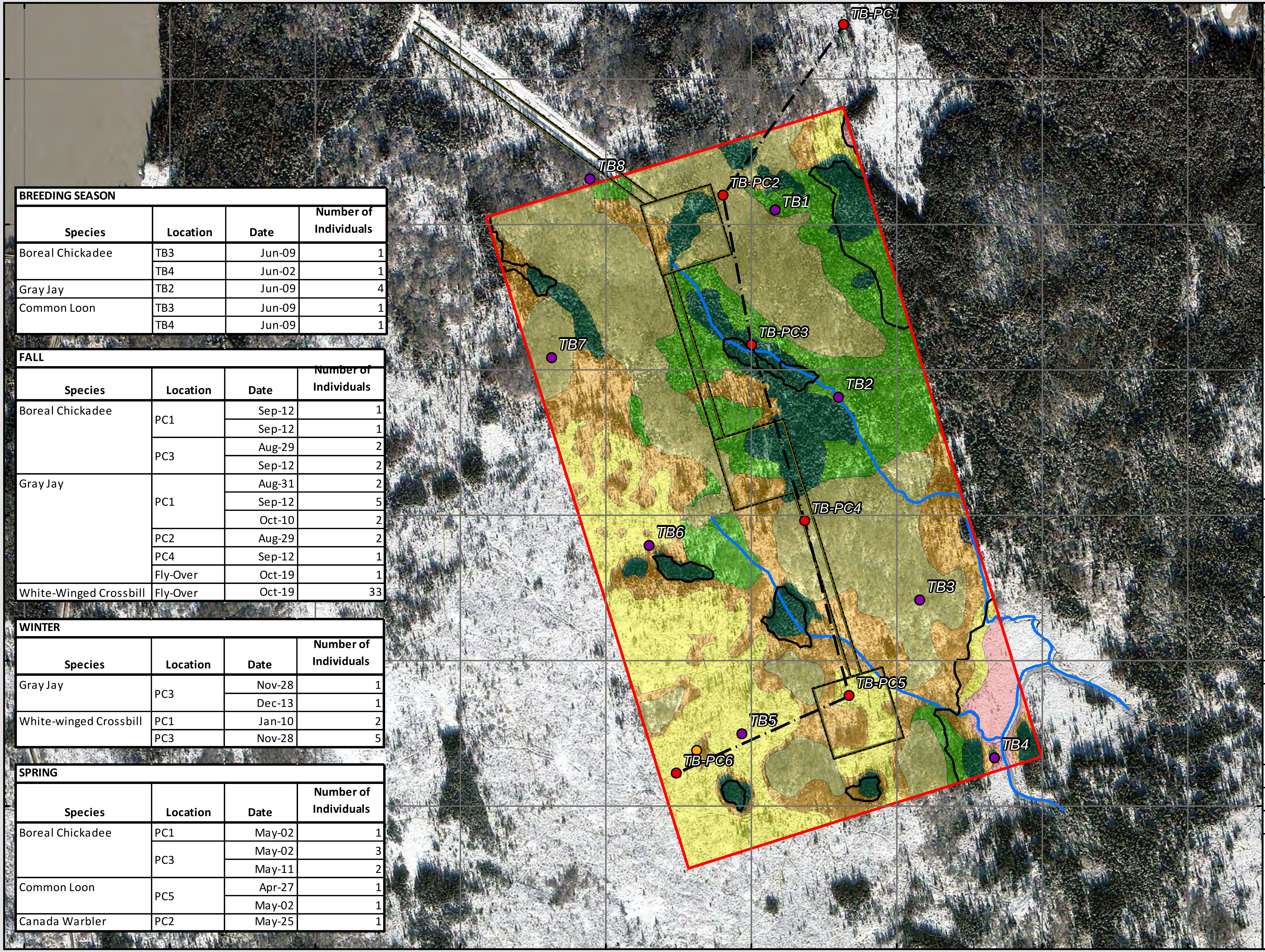
Table 4.12 lists bird species of concern, i.e., bird populations in Nova Scotia that are considered by various conservation agencies to be at a higher degree of risk for serious decline or extirpation. The number of observations of these birds at the Project site and the control locations is referenced in the final column. Figure 4.12 indicates the location(s) each species was detected at.

Table 4.12: Species of concern and their status at the Project site and the control locations

Species	*NSESA*	*Nova Scotia General Status*	*COSEWIC*	*SARA*	*Status in Study Area*
Boreal Chickadee		Sensitive			Detected on 11 occasions throughout the Study Area.
Gray Jay		Sensitive			Detected on nine occasions throughout the Study Area.
Canada Warbler	Endangered	At Risk	Threatened	Threatened	Detected on one occasion during the spring migration on May 25th, 2012.
Common Loon		May Be At Risk	Not at Risk		Detected on four occasions in the South-Eastern corner of the Study Area.

The only species with a formal listing is the Canada Warbler, which is listed as ‘endangered’ provincially in the *Endangered Species Act* and as ‘threatened’ by *SARA*. It was detected once during its spring migration period in the northern end of the Project site (Figure 4.12).

The breeding habitat of the Canada Warbler is moist, mixed coniferous-deciduous forest, with a well-developed understory, often near open water (Conway, 1999). Its decline is believed to be related to the loss or degradation of nesting habitat (Conway, 1999); the forestry practices aimed at reducing the deciduous component of Maritime forests have likely had a negative impact (Erskine, 1992). Studies in New England and the Middle Atlantic States reported the Canada Warbler was one of the top five species most sensitive to forest fragmentation. At a more site-specific level, studies have shown that the clearing of brush and understory in forests, as well as grazing by ungulates, negatively affects their populations (Conway, 1999).



BREEDING SEASON

Species	Location	Date	Number of Individuals
Boreal Chickadee	TB3	Jun-09	1
	TB4	Jun-02	1
Gray Jay	TB2	Jun-09	4
Common Loon	TB3	Jun-09	1
	TB4	Jun-09	1

FALL

Species	Location	Date	Number of Individuals
Boreal Chickadee	PC1	Sep-12	1
		Sep-12	1
	PC3	Aug-29	2
		Sep-12	2
Gray Jay	PC1	Aug-31	2
		Sep-12	5
		Oct-10	2
	PC2	Aug-29	2
	PC4	Sep-12	1
	Fly-Over	Oct-19	1
White-Winged Crossbill	Fly-Over	Oct-19	33

WINTER

Species	Location	Date	Number of Individuals
Gray Jay	PC3	Nov-28	1
		Dec-13	1
White-winged Crossbill	PC1	Jan-10	2
	PC3	Nov-28	5

SPRING

Species	Location	Date	Number of Individuals
Boreal Chickadee	PC1	May-02	1
	PC3	May-02	3
		May-11	2
Common Loon	PC5	Apr-27	1
		May-02	1
Canada Warbler	PC2	May-25	1

Breeding Season Point Count Locations
Fly-Over Observation Point
Transect Points
Transect
Road and Pad Layout
CTB Property Boundary (Approx)
CBCL Delineated Wetlands
CBCL Delineated Watercourses
Contour Line (5m Interval)

Cover Type

Bog
Coniferous
Mixed Wood
Deciduous
High Shrub
Low Shrub
Water

CBCL LIMITED
Consulting Engineers

Chebucto Terence Bay Wind Farm

Figure 4.12

Avian Species of Concern

Drawn: MD	Date: 20/06/2014
Checked:	CBCL Project # 121216.00
Approved:	Scale @ 11"x17" 1:5,000

0 50 100 200 m

Data Sources:
NSGC 1:10,000 Topo
Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

Map Parameters:
Coordinate System: NAD 1983 UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -63.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

L:\121216.00 RESL Terrence Bay\GIS\LAYOUT\FINAL REPORT FIGURES\121216.00 FIG 4-12 Locations of Avian Species of Concern.mxd

4.4.6 Aquatic Environment

Fish and fish habitat assessments were conducted along three watercourses in proximity to the Project footprint (Figure 3.2). All the watercourses on the site drain south into Brophys Run which in turns flows into Brophys Front Lake and eventually into the Terence Basin and Terence Bay.

4.4.6.1 WATERCOURSE 1: PRIMARY TRIBUTARY TO BROPHYS RUN

At this location, the watercourse is ephemeral and is considered to be a primary tributary to Brophys Run (WC 1a). The watercourse was at a high water stage with standing water at the time of assessment. The amount of water observed was likely due to a recent heavy rainfall event. Underground sections were observed. The channel was not defined and no bed or banks were observed. The riparian vegetation consisted of deciduous forest with ferns, shrubs and mosses. Crown Closure was approximately 26-50%. No fish habitat was present at the time of assessment.

Watercourse 1a: Tributary to Brophys Run - Upstream View

Watercourse 1a: Tributary to Brophys Run - Downstream View

At the time of assessment, this section of the tributary to Brophys Run was an ephemeral watercourse (WC 1b). Downstream, this watercourse is suspected to connect with Brophys Run (WC 3) (see Section 4.4.6.3). It was at a high water stage at the time of assessment, likely due to a recent heavy rainfall event. The channel was not defined and no bed or banks were observed. Riparian vegetation consisted of a high shrub barren small black spruce and shrubs. Crown Closure was approximately 1-25%. No fish habitat was present at the time of assessment.

Watercourse 1b: Tributary to Brophys run - Upstream View

Watercourse 1b: Tributary to Brophys Run - Downstream View

4.4.6.2 Watercourse 2: Primary Tributary to Brophys Run

Watercourse 2a is a primary tributary to Brophys Run and is an ephemeral watercourse with intermittent characteristics (WC 2a). This section of the watercourse was at a high water stage with flowing water at the time of assessment. The majority of the channel was either not defined or poorly defined; the morphology of the watercourse at this location consisted primarily of runs and riffles. The substrate was composed of fines and organics (100%). Banks, where present, were composed of fines and were sloped to vertical in shape. Cover was composed of moderate instream mosses and trace amounts of small woody debris and overhanging vegetation. Channel width was 0.40 m, wetted width was 0.32 m and water depth was 0.09m. Immediately after the intermittent section, the watercourse was observed dissipating into an ephemeral watercourse. Underground sections were observed and the watercourse appeared to originate from groundwater. Riparian vegetation consisted of a young deciduous forest, with red maple, ferns, shrubs and mosses. Crown Closure was approximately 1-25%. Dissolved oxygen was 6.16 mg/l (59.4% saturation), temperature was 13.7^{o}C and pH was 4.2. No fish habitat was present at the time of assessment due to the observed ephemeral characteristics observed both upstream and downstream.

Watercourse 2a: Tributary to Brophys Run - Upstream View

Watercourse 2a: Tributary to Brophys Run - Downstream View

At the time of the assessment, this section of the tributary to Brophys Run was a small permanent watercourse (WC 2b). This watercourse connects immediately downstream to Brophys Run. This section of the watercourse was at a high water stage and flowed in a sinuous pattern. The morphology consisted primarily of runs and flats. Substrate was composed of fines (100%). Banks consisted of fines and were sloped in shape. Cover was composed of moderate amounts of small woody debris. Overhanging vegetation was abundant upstream, but only trace amounts were observed downstream. Channel and wetted widths were approximately 2.2 m. Water depth was 0.75 m. Velocity was very slow since the section assessed consisted primarily of a flat/slow run. The watercourse is located within a shrub fen/swamp complex. Vegetation consisted primarily of sedges (*Carex stricta, C. nigra* and *C. trisperma*) Sphagnum sp., rhodora, sweet gale, lowbush blueberry and leatherleaf. Crown Closure was 0%. Dissolved oxygen was 7.49 mg/l, temperature was 14.6^{o}C and pH was 4.3. These parameters are within the tolerance range for brook trout (Raleigh, 1982).

Salmonid spawning habitat quality, however, was poor due to no sections of adequate substrate and slow flow. Rearing habitat was poor to moderate due to low flow and in adequate depth, small woody debris and overhanging vegetation for cover. Overwintering habitat was poor to moderate owing to deep sections >1.5 m, but water flow was slow. The potential for salmonids was considered low year round due to slow flow and the fact that the pH was within the lower tolerance limit for brook trout. The tolerance and optimum range for brook trout is 4.0 to 9.5 and 6.5 to 8.0, respectively (Raleigh, 1982). The potential for non-salmonid species was considered moderate since some species are more tolerant of extremities in water quality (see Section 4.4.6.4). A belted kingfisher was observed near the watercourse during the assessment which might suggest that the watercourse contains fish, such as sticklebacks and trout. Their diets also include insects, crustaceans, mollusks, amphibians, reptiles, small birds, small mammals and berries (Cornell Lab of Ornithology, 2013).

Watercourse 2b: Tributary to Brophys Run - Upstream View

Watercourse 2b: Tributary to Brophys Run - Upstream View

4.4.6.3 Watercourse 3: Brophys Run

Brophys Run is a permanent watercourse (WC 3). This watercourse was at a high water stage and flowed in an irregular meandering pattern. The morphology of the watercourse consisted primarily of runs and flats. The substrate was composed of fines (100%), and the banks consisted of fines and were sloped in shape. Cover was composed of moderate amounts of instream vegetation and trace overhanging vegetation. Small woody debris is likely present at the bottom of the channel. Channel and wetted width was estimated to be approximately 6.5 to 7 m. The water depth was 0.90 m at the side of the watercourse and is likely > 1.5 m in the center. The velocity was very slow since the section assessed consisted primarily of a flat/slow run. The watercourse is located within a shrub fen/swamp complex. The vegetation consisted primarily of sedges (*Carex stricta, C. nigra* and *C. trisperma*) Sphagnum sp., rhodora, sweet gale, lowbush blueberry and leatherleaf. Crown Closure was 0%. Dissolved oxygen was 6.2 mg/l (46.3% saturation), temperature was 14.3^{o}C and pH was 4.4. These parameters are within the tolerance range for brook trout, but the pH and dissolved oxygen are outside the optimum range for brook trout. Dissolved oxygen is considered to be low for egg development (Raleigh, 1982).

Salmonid spawning habitat quality was poor due to no sections of adequate substrate, slow flow and low dissolved oxygen. Rearing habitat was considered poor to moderate due to the low flow and adequate depth for cover. Overwintering habitat was poor to moderate owing to deep sections >1.5 m, slow flow and low dissolved oxygen. The potential for salmonids was considered low year round due to the slow flow and the fact that the pH and dissolved oxygen was outside the optimum range for brook trout. For pH, the tolerance and optimum range for brook trout is 4.0 to 9.5 and 6.5 to 8.0, respectively. For dissolved oxygen, optimum levels are ≥7.00mg/L, whereas the tolerance limit is ≥5.00 mg/L (Raleigh, 1982). The potential for non salmonid species was considered moderate since some species are more tolerant of extremities in water quality. A belted kingfisher was observed during the assessment which might suggest that the watercourse contains fish, such as sticklebacks and trout.

Watercourse 3: Brophys Run - Upstream View

Watercourse 3: Brophys Run - Downstream View

4.4.6.4 SUMMARY OF FISH AND FISH HABITAT ASSESSMENTS

In total, three watercourses were identified in the Project area. Fish habitat and potential for fish presence was identified at two watercourses: WC 2b and WC 3. Fish habitat was not observed at WC 1, WC 2 and WC 3. A summary of fish and fish habitat quality and the potential for fish presence is provided in Table 4.13.

Table 4.13: Summary Fish Habitat Quality and Potential for Fish Presence

Watercourse Name	***Watercourse Classification***	***Spawning Habitat (Salmonid)***	***Rearing Habitat***	***Overwintering Habitat***	***Potential for Fish Presence***
WC 1a: Primary Tributary to Brophys Run	Ephemeral	None	None	None	None
WC 1b: Secondary Tributary to Brophys Run	Ephemeral	None	None	None	None
WC 2a: Primary Tributary to Brophys Run	Ephemeral with Intermittent Characteristics	None	None	None	None
WC 2b: Primary Tributary to Brophys Run	Small Permanent	Poor	Poor to Moderate	Poor to Moderate	Salmonids: Low Non Salmonids*: Moderate
WC 3: Brophys Run	Large Permanent	Poor	Poor to Moderate	Poor to Moderate	Salmonids: Low Non Salmonids*: Moderate

*Non-Salmonids which could occur in these watercourses include: Banded killifish, threespine stickleback, ninespine stickleback, American eel, brown bullhead and yellow perch.

4.4.6.5 Summary of Water Quality

Water sampling was conducted for pH, dissolved oxygen and temperature. Water quality parameters for watercourses with the potential for fish, i.e., WC 2b and WC 3, are within the tolerance range for brook trout. However, the pH was outside the optimum range at both WC 2b and WC 3. Dissolved oxygen was outside the optimum range for brook trout at WC 3 (Raleigh, 1982). At both WC 2b and WC 3, the pH was outside the Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME, no date). Detailed descriptions on the potential for fish presence in WC 2b and WC 3 are provided in Sections 4.4.6.2 and 4.4.6.3. A summary of measured water quality parameters and corresponding brook trout tolerance/optimum ranges and CCME Guideline is provided in Table 4.14.

Table 4.14: Summary of Water Quality Parameters and Corresponding Brook Trout Tolerance/Optimum Ranges and CCME Guidelines

Parameter	*WC 1a*	*WC 1b*	*WC 2a*	*WC 2b*	*WC 3*	*Brook Trout Tolerance and Optimum Ranges*	*CCME Guidelines*
pH	-	-	4.2	4.3	4.4	Tolerance: 4.0 to 9.5 Optimum: 6.5 to 8.0	6.5-9.5
Dissolved Oxygen (mg/L)	-	-	6.16	7.49	6.2	Tolerance: ≥5.00 Optimum: ≥7.00	≤ 5.50 to 9.50
Temperature (^{o}C)	-	-	13.7	14.6	14.3	Tolerance: 0 to 24.0 Optimum: 11.0 to 16.0	n/a

4.4.6.6 Freshwater Fauna

Brophys Run and its associated tributaries could contain fish species that can tolerate low pH and low dissolved oxygen levels. These species could include brook trout (*Salvelinus fontinalis*), banded killifish (*Fundulus diaphanus*), threespine stickleback (*Gasterosteus aculeatus*), ninespine stickleback (*Pungitius pungitius*), brown bullhead (*Ameiurus nebulosus*), American eel (Anguilla rostrata) and yellow perch (*Perca flavescens*). A life history description for each of these species is provided in the sections below.

American Eel (*Anguilla rostrata*)

The American eel is listed as 'May be at Risk' by the Nova Scotia Department of Natural Resources (NSDNR) General Status Rank of Wild Species in Nova Scotia, but listed as a Species of Special Concern by COSEWIC (*SARA*, 2013; NSDNR, 2013). American eels spawn in the Sargasso Sea which is located within the Atlantic Ocean. Nursery areas can be located in salt or freshwater and they typically overwinter in muddy bottoms in bays and estuary habitats, but their winter habitat is poorly known. For cover, they prefer shallow, protected waters, as well as, rock, sand, mud, woody debris and aquatic vegetation for cover. Eelgrass and interstitial spaces are also important for cover. They forage on fish, molluscs, crustaceans, insect larvae, surface-dwelling insects, worms, and plants (COSEWIC, 2012). American eel have been known to tolerate dissolved oxygen levels as low as 4 mg/l (Rulifson et al., 2004) and pH levels as low as 4.0 (Reynolds, 2011).

Banded Killifish (*Fundulus diaphanus*)
The banded killifish is listed as 'Secure' by the NSDNR General Status Rank of Wild Species in Nova Scotia (NSDNR, 2013). Banded killifish generally inhabit shallower areas of clear lakes, ponds, rivers and estuaries showing a preference for sandy, gravel or muddy substrates with abundant aquatic vegetation. Spawning occurs in shallow waters within dense vegetation, between June and August, where eggs are attached to plant material via adhesive strings. Fries emerge 10 to 12 days later approximately 6 to 7 mm in length and reach maturity, growing to about 6 to 7 cm, after one year. Banded killifish feed on a wide array of food items such as terrestrial insects, nymphs, mollusks and turbellarians. In Nova Scotia, banded killifish have been observed living in water with a pH as low as 4.12 (CBCL, 2012).

Brook Trout (*Salvelinus fontinalis*)
The brook trout in Nova Scotia is listed as 'Sensitive' by NSDNR pursuant to the General Status Rank of Wild Species in Nova Scotia (NSDNR, 2013). This species, also known as speckled trout, is native to many areas of eastern North America. It can be found in a variety of different waters including tiny ponds, large rivers, lakes and saltwater estuaries, but, they usually live in spring-fed streams with many pools and riffles. Speckled trout prefer cool, clear waters with plenty of cover and make use of nearly anything that will provide them with hiding places. Sea-run brook trout in Nova Scotia spawn during October and November in shallow, gravelly areas of streams with clean bottoms and good water flow (NS Fisheries and Aquaculture, 2007). Brook trout can tolerate pH levels from 4.0 to 9.5 and dissolved oxygen levels ≥5.00 mg/L (Raleigh, 1982).

Brown Bullhead (*Ameiurus nebulosus*)
The brown bullhead is listed as 'Secure' by NSDNR and 'S5' by ACCDC. The brown bullhead is a member of the catfish family and typically average 20-35 cm in length. This species can be identified by its large, rounded head bearing four pairs of 'whiskers', or barbels, surrounding its mouth. The brown bullhead favours warmer waters and is commonly found near the bottom of ponds, lakes and larger slow-moving rivers that have a mucky to sandy bottom substrate. Like many catfish species, the brown bullhead does most of its foraging at night searching for food using their barbels. They are omnivorous and their food is composed of offal, waste, molluscs, immature insects, terrestrial insects, leeches, crustaceans, worms, algae, plant material, fishes and fish eggs (Page and Burr, 1991). Brown bullheads have been known to tolerate pH levels as low as 3.4. The lethal summer dissolved oxygen concentration for the black bullhead is 3 mg/L (Stuber, 1982).

Ninespine Stickleback (*Pungitius pungitius*)
The ninespine stickleback is listed as 'Secure' by NSDNR and 'S5' by ACCDC. The ninespine stickleback is a small minnow averaging 4 to 7 cm in length and can be distinguished from other stickleback species by the presence of seven to 12 free spines in front of the dorsal fin and a long caudal keel that usually reaches beneath the dorsal fin. These minnows are usually found in shallow vegetated areas of lakes, ponds, pools of slow-moving streams and sometimes in open water over sandy substrates. They feed on small invertebrates, aquatic insects and their eggs and larvae (Page and Burr, 1991). Unarmored threespine stickleback can tolerate dissolved oxygen levels as low as 2 mg/L (Feldmeth and Baskin, 1976).

Threespine Stickleback (*Gasterosteus aculeatus*)
The three-spine stickleback is listed as 'Secure' by the NSDNR General Status Rank of Wild Species in Nova Scotia (NSDNR, 2013). This species has both marine and purely freshwater populations that show distinct habitat-specific morphological adaptations. Marine populations of this species are fully-plated and anadromous, while upland freshwater forms are plateless. These fish typically spawn in June and July with the male providing very active care of the offspring. The male builds a nest from twigs, vegetation and substrate held together by an adhesive secretion of the liver and fans the eggs to provide sufficient oxygen for the development of fry. Threespine sticklebacks will usually reach approximately 5 to 10 cm in length and live for two to three years, spawning one to two times in that period. Unarmored threespine stickleback can tolerate dissolved oxygen levels as low as 2 mg/L (Feldmeth and Baskin, 1976). Although threespine sticklesbacks can tolerate low dissolved oxygen levels, they avoid waters with a pH below 5.5 (Peterson et al., 1989).

Yellow Perch (*Perca flavescens*)
The yellow perch is listed as 'Secure' by NSDNR and 'S5' by ACCDC. Yellow perch are a small, freshwater fish common across North America. This species can be identified by its olive to golden brown coloured head with this colour extending down its body to form six to eight vertical bars over its yellow to yellow-green sides. Yellow perch will persist in almost any waterbody, but they thrive in clear-watered lakes with bottom substrates of much, sand and gravel. Spawning occurs in the spring, usually from mid-April to May when adults migrate to the shallow waters of lakes or into tributary rivers to spawn. The diet of this species changes with size and season, but it is mainly composed of immature insects, larger invertebrates, and the eggs and young of a wide variety of other fishes (Page and Burr, 1991). Yellow perch have been known to tolerate pH levels as low as 3.9 (see Krieger et al., 1983). For dissolved oxygen, the lower optimum limit is considered to be 5 mg/L (Krieger et al., 1983).

4.4.7 Ungulate Survey
During the 'Presence/Absence Ungulate Survey', 25 incidences of ungulate browse were observed and documented. While most of the browsing damage was at a height typical of white-tailed deer, one incidence was at a height of 2.2 m from the ground, indicating that it was likely caused by an eastern moose. This potential moose browse was located near the proposed location of Turbine #3; it was likely old browse damage, as the branches displaying the damage were dead. 62 incidences of deer tracks were noted, but no eastern moose tracks, lending further support to the conclusion that the possible moose browse was old, and that the site is by moose not regularly frequented.

4.5 Socio-Economic Environment

4.5.1 Key Settlements and Local Population Trends
Key settlements surrounding the proposed Terence Bay Wind Farm are Terence Bay, Prospect (including Lower Prospect), White's Lake and Shad Bay. Terence Bay was settled in the mid-1700s by German Protestants and was mainly populated by German and Irish immigrants. The community is part of HRM; the latter has a population of 413,710 and encompasses an area of 5,490.18 km^2.

Most people in Terence Bay and from the surrounding areas travel the 25 km+ into Halifax on a regular basis to shop, to work and to access medical and other services.

The community of Terence Bay has a population of approximately 760; since the 2006 census, the community has experienced an 8.1% decrease in size. Early records go back to 1823 based on the parish register of Our Lady of Mount Carmel in Prospect. Although fishing was the traditional industry for most in the area, it now employs very few (1.6%). Most are employed in the trades, transportation, education, social work and service industries. All people travel by private vehicle to work; the median commute is approximately 30 minutes.

Prospect is the nearest large community to Terence Bay. Located on Route 333, Prospect has a population of 3,246; it has experienced an increase of 1.1% since the 2006 census. The permanent settlement was established in 1754 by Irish and English fishermen, but the larger area was inhabited by the Mi'kmaq, at least on a seasonal basis for centuries. The primary sources of employment include the retail trade, health care and public administration. Almost all people travel by private vehicle to work.

4.5.2 Existing Land Use and Economic Activity
The Chebucto peninsula is rocky, windy and exposed to the ocean, and is not conducive to either forestry or agriculture. Fishing was, at one time, the dominant industry, but today employs very few. Aside from single family dwellings, the land is largely unused. Hiking, sea kayaking, diving and boating are popular recreational activities along the coast and through parts of the inland lake system. The numerous small islands that dot Prospect Bay provide locales for day trips from the mainland.

The Project site has evidence of ATV usage and hunting activities. Deer blinds were observed in several locations, as well as numerous spent cartridges and shooting targets.

The Terence Bay Wilderness Area comprises 4,450 ha of protected coastal and near coastal habitat. Together with the adjacent Long Lake Provincial Park, it forms a nearly 20 km natural corridor between Spryfield and the Atlantic Ocean. The Terence Bay Wilderness Area is a popular location for hikers and nature enthusiasts providing an unaltered natural coastal ecosystem close to Halifax.

4.5.3 Communication and Radar Systems
The document entitled "Technical Information and Guidelines on the Assessment of the Potential Impact of Wind Turbines on Radio Communication, Radio Communication, Radar and Seismoacoustic Systems" produced by the Radio Advisory Board of Canada (RABC) in conjunction with the Canada Wind Energy Association (CANWEA) provides guidelines wherever there is a possibility that a wind farm may impact such systems. The crux of these guidelines is a "series of analytical methodologies and thresholds that help to indicate where a potential interference may

occur, thereby acting as a voluntary (but highly recommended) trigger for the proponents to notify the applicable authority”.[1]

The referenced document provides basic information on the manner in which interference may arise and its effects on systems. Radio communication systems include two main types: broadcast-type systems, including cellular type networks, and point-to-point (one-way or two-way) or point-to-multipoint systems. Radar systems are used for several purposes including:

- Predicting the weather;
- The Canadian Air Defence System; and
- Air traffic control systems.

Wind farms may also affect the functioning of the 52 Seismological Monitoring Stations located in Canada to detect and record ground motion signals related to distant earthquakes, etc.

To address these concerns a number of parties were consulted in regard to the proposed wind farm at Terence Bay. The results of these communications are summarized in the following paragraph.

The Canadian Coast Guard responded on October 4, 2013 that no interference issues were anticipated to their services from the proposed wind turbines. The Meteorological Service of Canada, a branch of Environment Canada, indicated on October 8, 2013 that they had no strong objections to the proposed development. On December 13, 2013, Industry Canada indicated that they had no non-disclosed assignments within 15 km of the wind farm site. DND responded on January 10, 2014, that they had no objections to the project as submitted. NavCanada responded in a letter (Appendix A) dated March 2, 2014 that they had no objection to the project as submitted. No response has been received from the RCMP.

4.5.4 Transportation Routes and Traffic Patterns

The Project site is accessed by River Road, off Terence Bay Road and Route 333. River Road connects with the Terence Bay Road 3.2 km after the Terence Bay Road leaves Route 333. Route 333, also called Prospect Road, circuits the western portion of the Chebucto Peninsula. It leaves Highway 3 to the west of Halifax and travels south towards the coast, following the coastline until it intersects Highway 103 at Upper Tantallon.

The village of Prospect is accessed by the Prospect Bay Road, which leave Route 333 1.2 km past Terence Bay Road. Both the Prospect Bay Road and the Terence Bay Road terminate at the coast. Roads throughout the communities consist of dirt, gravel and paved sections serving the residential area. Route 333, Prospect Bay Road and Terence Bay Road are paved two-lane, winding roads with narrow soft shoulders.

[1] Radio Advisory Board of Canada and Canada Wind Energy Association, “Technical Information on the Assessment of the Potential Impact of Wind Turbines on Radio Communication, Radar and Seismoacoustic Systems”, April 2007, p4.

There is no public transit route that serves the study area. There is a "park and ride" located at Exhibition Park on the Route 333, 18 km from the Project site. As a result, most who work in the city drive a vehicle into town, leaving for work between 7:00 and 9:00 am.

4.5.5 Archaeological Findings

An archaeological resource impact assessment was conducted to determine the potential for archaeological resources within the study site and to provide recommendations for mitigation if necessary. Conducted by Davis MacIntyre & Associates Limited in August 2012, the work included a historic background study, a search of the Maritime Archaeological Resource Inventory and field reconnaissance.

Archaeological evidence shows that the ancestors of the Mi'kmaq settled along the waterways of Prospect and Shad Bays and may have also settled along Terence Bay and the inward reaches of the Terence Bay River. To date, however, no archaeological evidence has been recorded to confirm First Nations land use along this river. The proposed wind farm is located on rugged terrain more than 1.5 km inland from the river and 700 m from the nearest lake on this system (Fourth Lake).

The earliest settlers in Terence Bay were German Protestants who arrived in 1753. In the 19th century, they were followed by Irish settlers. The wind farm site was granted to one David Kirk sometime in the first half of the century, but it is not known if he actually settled the land. It is more likely, given the terrain, that the land was used for logging as agricultural pursuits in this area would have been fruitless. Maps from the latter half of the 19th century and the early part of the 20th century do not indicate any settlement, or land use, on the Project site.

The assessment concluded that that there was no historic record of land use in the general area and that there is little in the area to have attracted First Nations peoples. The reconnaissance did not reveal any evidence of past cultural activity and the study area was determined to be of low archaeological potential. The location of the access road was not known at the time of the first reconnaissance, but was reviewed in early 2014. The full archaeological resource impact assessment is provided in Appendix J.

4.5.6 Mi'kmaq Ecological Knowledge Study

The MEK study was undertaken in the latter part of 2013 by Membertou Geomatics. Various archival documents, maps, oral histories and published works were reviewed to obtain accurate information regarding the past or present Mi'kmaq use or occupation of the Project site and study area. The results indicated that spear points and hollow stone tube artefacts associated with burial were found in White's Lake, 5 km NW of the Project Site. Laboratory analysis of retrieved charcoal dated the site between 2260 and 2440 years before present. The former Sambro Reserve is 10 km to the east of the Project site and the Sambro Mi'kmaq would have utilized the area's natural resources. Frank Speck's 1922 map of Nova Scotia Mi'kmaq traditional hunting territories and villages, however, show no traditional hunting territories within the study area.

During interviews, no Mi'kmaq traditional fishing, hunting or gathering areas were identified on the Project site. Several important fishing areas, both for historic and present use, were identified in the larger study area; these involved the harvesting of salmon, trout and mackerel and other fish species. Deer hunting was the only hunting activity that took place in the study area; three sites involving historic and present usage were identified. Two gathering sites used in the historic past were identified: a blueberry gathering area around Shad Bay and a white ash gathering location between Terence Bay River and the Project site.

The Terence Bay MEKS did not identify Mi'kmaq Traditional Use Activities occurring on the Project Site, but did identify use, including fishing, in various locations throughout the greater study area. The full MEKS report is available in Appendix K.

4.5.7 Results of Visibility Analysis

As referenced in section 3.2.3.3 a visibility analysis was conducted from six viewing positions. The results are expressed below and illustrated on the accompanying figures.

Visual Simulation 1 – Figures 4.13a and b

Viewing Position 1 is located on River Road, a residential area to the west of the proposed wind farm. The closest turbine at this location is Turbine 3 at the right hand side of Figure 4.13b, which is approximately 1.2 km away from the viewing position. Apart from screening objects such as trees in the foreground, all turbines are fully visible from this viewing position.

Visual Simulation 2 – Figures 4.14a and b

Viewing Position 2 is located in an undeveloped area along River Road to the west of the proposed wind farm. The closest turbine at this location is Turbine 1 at the left hand side of Figure 4.14b, which is approximately 1 km away from the viewing position. Turbine 1 is fully visible, while tree stands in the foreground along the southern side of River Road partially screen the remaining two turbines.

Visual Simulation 3 – Figures 4.15a and b

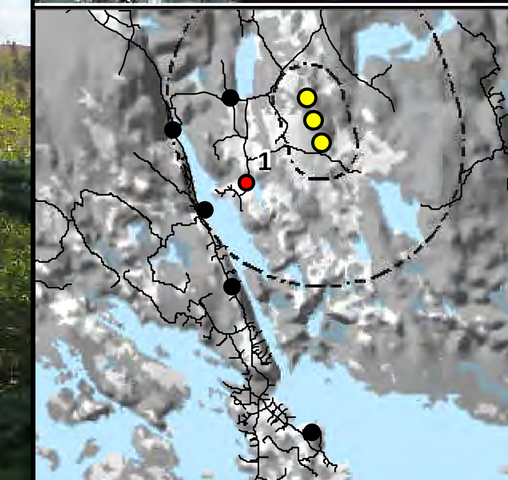
Viewing Position 3 is located in a residential area along Terence Bay Road to the west of the proposed wind farm. The closest turbine at this location is Turbine 1 at the left hand side of Figure 4.15b, which is approximately 1.9 km away from the viewing position. Existing tree stands in the mid-ground screen all three turbines shafts up to the hub. The rotor blades of the turbines can be viewed intermittently.

Visual Simulation 4 – Figures 4.16a and b

Viewing Position 4 is located at Terence Bay Road Park and Terence Bay Boat Launch to the southwest of the proposed wind farm. The closest turbine in this location is Turbine 3 at the right hand side of Figure 4.16b, which is approximately 1.9 km away from the viewing position. All turbines are fully visible from Viewing Position 4.

Visual Simulation 5 – Figures 4.17a and b

Viewing Position 5 is located in a residential area along Terence Bay Road to the southwest of the proposed wind farm. The closest turbine in this location is Turbine 3 at the right hand side of Figure



Chebucto Terence Bay Wind Farm

Figure 4.13 a) & b)

Viewshed Analysis:
Existing and Simulated Views

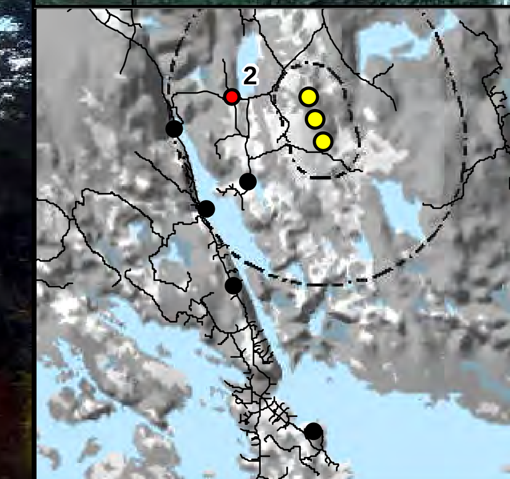
VIEW 1

Drawn: SK	**Date:** 13/06/2014
Checked:	**CBCL Project #** 121216.00
Approved:	**Scale @ 11"x17"** 1:8,000

Data Sources:
NSGC 1:10,000 Topo
NSDNR
NTDB

Map Parameters:
Coordinate System: NAD 1983 UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -63.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

L:\121216.00 RESL Terrence Bay\GIS\LAYOUT\FINAL REPORT FIGURES\121216.00 FIG 4.15 Upland Viewshed Analysis View 1.mxd



Chebucto Terence Bay Wind Farm

Figure 4.14 a) & b)

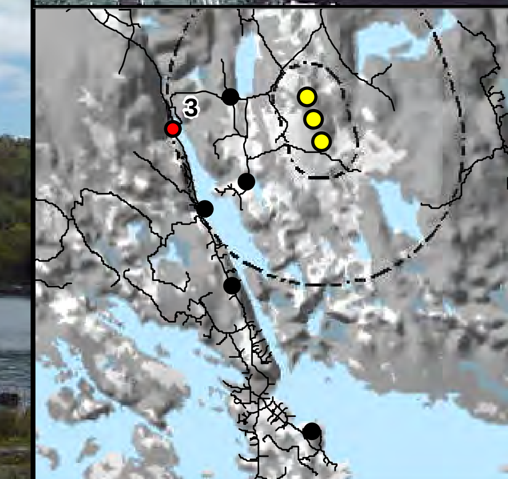
Viewshed Analysis:
Existing and Simulated Views

VIEW 2

Drawn: SK	**Date:** 13/06/2014
Checked:	**CBCL Project # 121216.00**
Approved:	**Scale @ 11"x17"** 1:8,500

Data Sources:
NSGC 1:10,000 Topo
NSDNR
NTDB

Map Parameters:
Coordinate System: NAD 1983 UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -63.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter



Chebucto Terence Bay Wind Farm

Figure 4.15 a) & b)

Viewshed Analysis:
Existing and Simulated Views

VIEW 3

Drawn: SK	**Date:** 13/06/2014
Checked:	**CBCL Project #** 121216.00
Approved:	**Scale @ 11"x17"** 1:8,500

Data Sources:
NSGC 1:10,000 Topo
NSDNR
NTDB

Map Parameters:
Coordinate System: NAD 1983 UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -63.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

Chebucto Terence Bay Wind Farm

Figure 4.16 a) & b)

Viewshed Analysis:
Existing and Simulated Views

VIEW 4

Drawn: SK	**Date:** 13/06/2014
Checked:	**CBCL Project #** 121216.00
Approved:	**Scale @ 11"x17"** 1:8,500

Data Sources:
NSGC 1:10,000 Topo
NSDNR
NTDB

Map Parameters:
Coordinate System: NAD 1983 UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -63.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

Chebucto Terence Bay Wind Farm

Figure 4.17 a) & b)

Viewshed Analysis:
Existing and Simulated Views

VIEW 5

Drawn: SK	**Date:** 13/06/2014
Checked:	**CBCL Project # 121216.00**
Approved:	**Scale @ 11"x17"** 1:7,022

Data Sources:
NSGC 1:10,000 Topo
NSDNR
NTDB

Map Parameters:
Coordinate System: NAD 1983 UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -63.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

L:\121216.00 RESL Terrence Bay\GIS\LAYOUT\FINAL REPORT FIGURES\121216.00 FIG 4.19 Upland Viewshed Analysis View 5.mxd

4.17b, which is approximately 2.4 km away from the viewing position. All turbines are fully visible from Viewing Position 5.

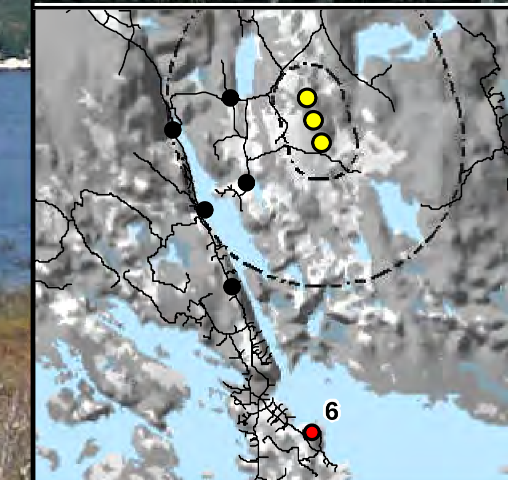
Visual Simulation 6 – Figures 4.18a and b
Viewing Position 6 is located at a walking trail that is part of the SS Atlantic Heritage Interpretation Park and Interpretation Centre on Sandy Cove Road to the south of the proposed wind farm. The closest turbine in this location is Turbine 3 at the right hand side of figure 4.18b, which is approximately 4.1 km away from the viewing position. All turbines are fully visible from Viewing Position 6.

4.5.8 Results of Noise Analysis
As indicated in section 2.5.3.1, the Enercon E92 is a gearless turbine with a direct drive variable speed generator which is substantially quieter than a gearbox machine. An independent sound analysis was undertaken to determine the generation and distribution of noise from the proposed WTGs. A total of 94 receptors were included in the analysis; the results are provided in Appendix L. The current sound guideline for wind farms in Nova Scotia is based on a threshold level of 40 dBA, i.e., modeled sound pressure levels should not exceed 40 dBA at residential receptors including camps, cottages, schools and hospitals. Figure 4.19 presents the dBA contours greater than 40 dBA, and it is clear that no residential property is located within the impacted area. All of the identified receptors within 2 km of the proposed WTGs had predicted sound levels below the 40 dBA threshold.

4.5.9 Results of Flicker Analysis
In most jurisdictions, a maximum of 30 hours of shadow flicker per year with a maximum of 30 minutes per day are the threshold parameters used to define the acceptable level of flicker from wind projects. As identified in section 3.3.2, a model was run to determine which receptors were susceptible to flicker. Figures 4.20a and 4.20b were prepared to show the impacted areas for the maximum minutes per day and the total hours per day. In the worst case scenario there are two buildings that are expected to receive more than 30 hours per year and one that will receive 30 minutes per day; these properties are identified on the figures.

As these results are based on very conservative model inputs, the actual level of impact will be much less as sunshine, wind conditions and turbine availability will all reduce the impacts when compared to the worst case scenario. The 20 year Canadian Climate Normals at Halifax Stanfield International Airport (40 km from the site) show that clouds cover between 8 and 10 tenths of the sky for 5,090 hours per year, or for 55% of the time. The high incidence of cloud cover in the region will significantly reduce the actual levels of shadow flicker that is experienced at the various receptors when compared to the worst case scenario that has been modelled.

4.6 Environmental Factors Susceptible to Impact
Based on the expertise and experience of the Project team and the work undertaken to compile this environmental baseline, the following physical, ecological and socio-economic factors have been identified as VECs or socio-economic issues of concern:



Chebucto Terence Bay Wind Farm

Figure 4.18 a) & b)

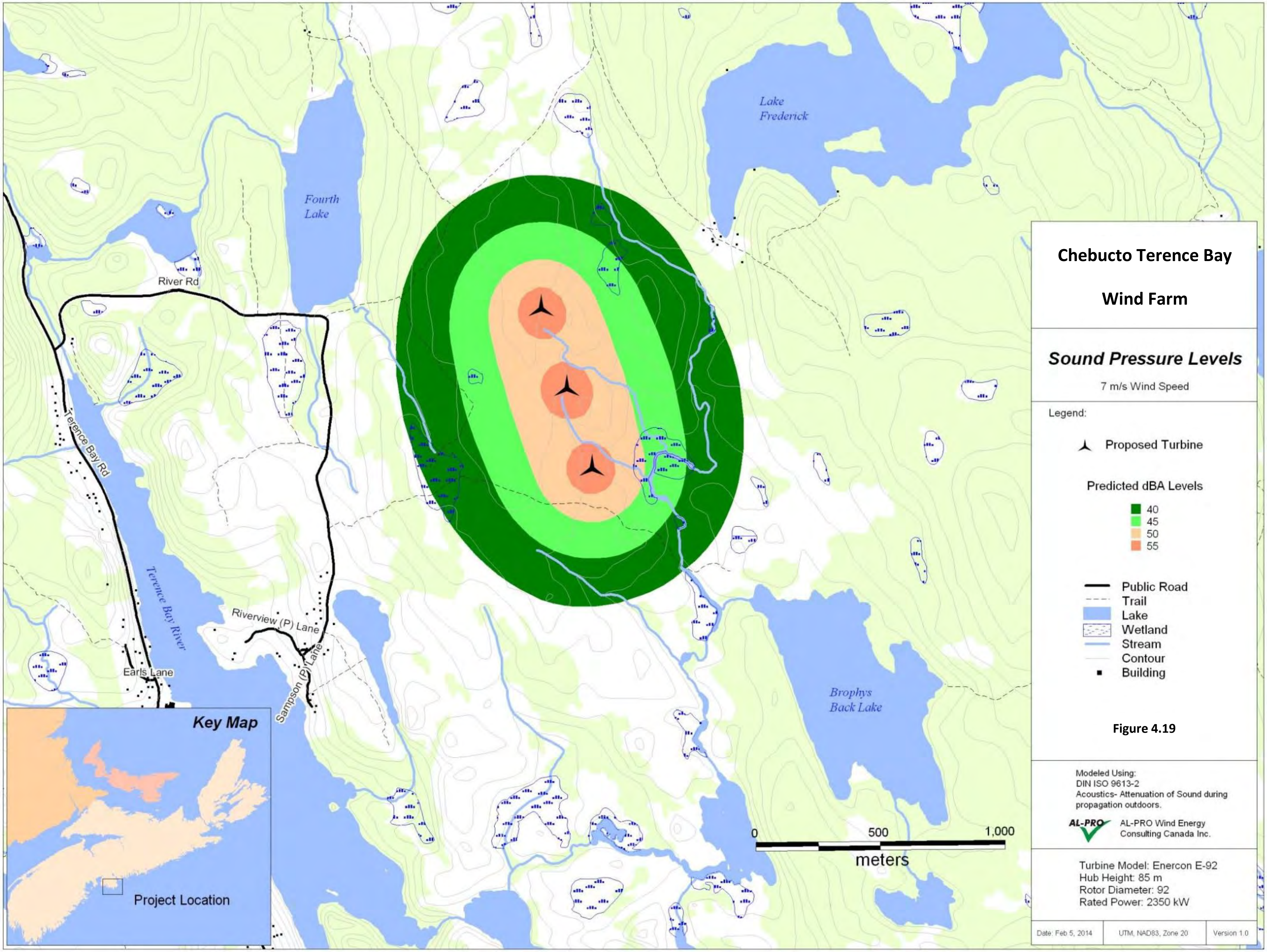
Viewshed Analysis:
Existing and Simulated Views

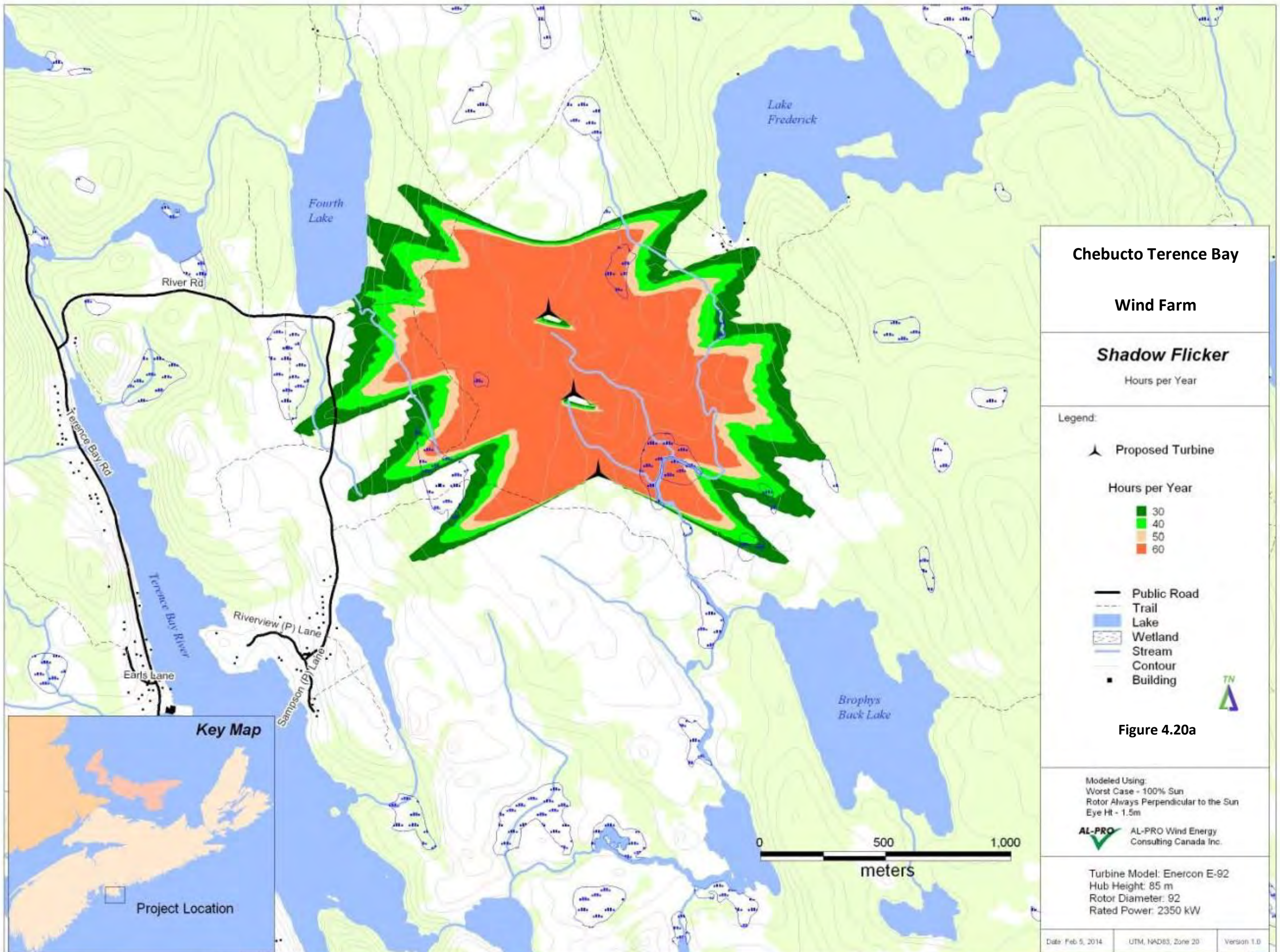
VIEW 6

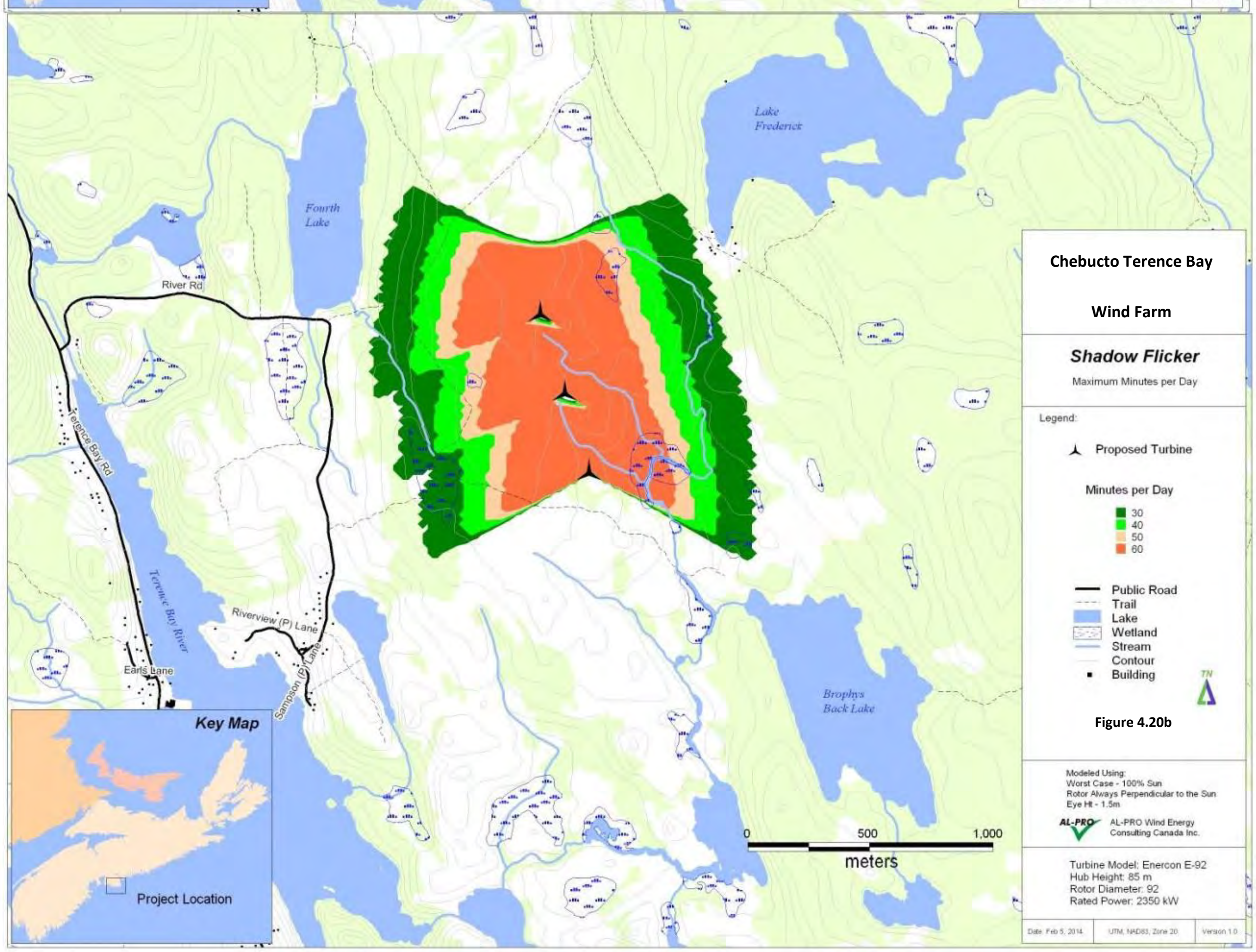
Drawn: SK	**Date:** 13/06/2014
Checked:	**CBCL Project #** 121216.00
Approved:	**Scale @ 11"x17"** 1:4,060

Data Sources:
NSGC 1:10,000 Topo
NSDNR
NTDB

Map Parameters:
Coordinate System: NAD 1983 UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -63.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter


Chebucto Terence Bay
Wind Farm
Sound Pressure Levels
7 m/s Wind Speed
Legend:
Proposed Turbine
Predicted dBA Levels
40
45
50
55
Public Road
Trail
Lake
Wetland
Stream
Contour
Building
Figure 4.19
Modeled Using:
DIN ISO 9613-2
Acoustics- Attenuation of Sound during propagation outdoors.
AL-PRO Wind Energy Consulting Canada Inc.
Turbine Model: Enercon E-92
Hub Height: 85 m
Rotor Diameter: 92
Rated Power: 2350 kW
Date: Feb 5, 2014
UTM, NAD83, Zone 20
Version 1.0
Lake Frederick
Fourth Lake
River Rd
Terence Bay Rd
Terence Bay River
Riverview (P) Lane
Sampson (P) Lane
Earls Lane
Brophys Back Lake
0
500
1,000
meters
Key Map
Project Location


Chebucto Terence Bay
Wind Farm
Shadow Flicker
Hours per Year
Legend:
Proposed Turbine
Hours per Year
30
40
50
60
Public Road
Trail
Lake
Wetland
Stream
Contour
Building
Figure 4.20a
Modeled Using:
Worst Case - 100% Sun
Rotor Always Perpendicular to the Sun
Eye Ht - 1.5m
AL-PRO Wind Energy Consulting Canada Inc.
Turbine Model: Enercon E-92
Hub Height: 85 m
Rotor Diameter: 92
Rated Power: 2350 kW
Date: Feb 5, 2014
UTM, NAD83, Zone 20
Version 1.0
Lake Frederick
Fourth Lake
River Rd
Terence Bay Rd
Terence Bay River
Riverview (P) Lane
Sampson (P) Lane
Earls Lane
Brophys Back Lake
0
500
1,000
meters
Key Map
Project Location


Chebucto Terence Bay
Wind Farm
Shadow Flicker
Maximum Minutes per Day
Legend:
Proposed Turbine
Minutes per Day
30
40
50
60
Public Road
Trail
Lake
Wetland
Stream
Contour
Building
Figure 4.20b
Modeled Using:
Worst Case - 100% Sun
Rotor Always Perpendicular to the Sun
Eye Ht - 1.5m
AL-PRO Wind Energy Consulting Canada Inc.
Turbine Model: Enercon E-92
Hub Height: 85 m
Rotor Diameter: 92
Rated Power: 2350 kW
Date: Feb 5, 2014
UTM, NAD83, Zone 20
Version 1.0
Lake Frederick
Fourth Lake
River Rd
Terence Bay Rd
Terence Bay River
Riverview (P) Lane
Sampson (P) Lane
Earls Lane
Brophys Back Lake
0
500
1,000
meters
Key Map
Project Location

- Surface Water Quality: because the Project area is located in proximity to surface waters, care must be taken throughout construction to prevent erosion and the transportation of silt to these areas;
- Species of Concern: a legislative requirement;
- Forest cover: although this is a small installation, some forest cover will be removed to facilitate the siting of the turbines;
- Migratory and Breeding Birds: given the nature of the Project, birds are susceptible to collision with the rotating blades of the turbines;
- Bats: given the nature of the Project, bats are susceptible to collision with the rotating blades of the turbines; and
- Flicker: two properties may be intermittently impacted by flicker.

CHAPTER 5 CONSULTATION

5.1 Community Engagement

Open, transparent and comprehensive community engagement is crucial to the success of any development. It is an important part of the environmental assessment process and it is necessary to convey accurate, relevant and complete information to the local community and other interested parties. Community engagement forms an integral part of the proposed development. It consists of various engagement activities that CTB has and will undertake throughout the development, construction and operation of the Chebucto Terence Bay Community Wind Farm. CTB is committed to addressing, to the best of its abilities, all concerns pertaining to the proposed development that are raised by local residents.

Management of CTB and the study team have had meetings with property owners and others in the area that may in one way or another have an interest in the construction and operation of the Project. They have also met with and kept elected officials fully informed about the Project and the various studies that have been undertaken. Representatives of federal and provincial government departments have been provided with information as have the Kwilmu'kw Maw-klusuaqn Negotiation Office (KMK) and the Native Council of Nova Scotia. In addition to the informal meetings and communications that have taken place, one public meeting was held in Terence Bay and a second public meeting will be scheduled upon registration of this document. Further details on these events and other facets of the engagement program, including the responses to questionnaires that were completed at the public meeting, are provided below.

The numerous engagement activities described in the following sections will provide an opportunity to facilitate meaningful dialogue between various stakeholders and CTB; as well as provide true and accurate information about the Project in an open and transparent fashion.

5.2 Community Consultation

5.2.1 First Public Open House

The first Open House was held at the Terence Bay Fire Hall from 7:00 to 9:00 pm on Tuesday July 17, 2012. Representatives of CTB and CBCL Limited, the environmental consultants, were on hand to explain the detail provided on the display materials. The intent of this initial Open House was to introduce the Project to the community, to seek input, including initial concerns, and to indicate that initial studies for the environmental assessment process had been initiated.

Approximately 75 people signed the attendance sheet, but the total in attendance was probably closer to 90. The majority of the people who responded to the Questionnaire and attended the open house lived within 2 km of the proposed wind farm (21 respondents live < 2 km away, 14 respondents live from 2 – 5 km, 10 respondents lived > 5 km away).

A group called the Friends of River Road (FORR) was subsequently established with the stated purpose of opposing the development of the three proposed turbines. The group represents approximately 30 households in the Terence Bay area, many residents of the River Road. In July 2013, FORR appealed the decision made by the Department of Energy to approve the COMFIT status of the Project to the Nova Scotia Utility and Review Board (NSUARB) on the grounds that the Project did not meet the requirements for local support. The appeal was dismissed by the NSUARB in November 2013.

5.2.2 Responses to Questionnaire

Forty-five people filled out the questionnaire at the Open House held on July 17th, 2012. The information provided by the questionnaires reflected a variety of opinions on the proposed wind farm, including the following:

- "Wind farms provide 'clean' energy. They are the way of the future";
- "I would like to see a holdback until the Federal government completes its Health study";
- "Devaluation of property";
- "Adjacent to a wilderness protected area";
- "Don't look forward to the change in view from the bedroom window";
- "Cancel it; it doesn't belong there. Are there any other planned sites for wind turbines on the Terence Bay Road"?; and
- "It is a viable alternative to the current fuel sources of power".

The majority of the questionnaire respondents were not in favour of the proposed wind farm. Twenty-one of the respondents expressed opposition to the wind farm, while 11 were in favour and 10 undecided. Twenty-one people said they would be interested in participating on a community liaison committee, while another 10 people responded that they might be interested.

Some common themes, however, did emerge through the responses to the questionnaires. Many expressed concern that the wind farm is being proposed too close to a designated wilderness area and consider the development of the WTGs to be an inappropriate use of the identified land. Other residents felt that the turbines would be too close to their residences and worried about associated health impacts, as well as consequences to their property values. Many indicated that they would like additional information on potential health and environmental impacts. The following section provides additional information on the topics raised in the questionnaires.

5.2.3 Summary of Issues Raised in the Responses to the Questionnaires

The following identifies the issues raised by those who submitted completed questionnaires:

- Wildlife
  - Deer;
  - Bats;
  - A lynx spotted about four years ago in the River Road area;
  - Birds, e.g., ducks, loons, geese, and the importance of avian migratory patterns;
  - Desecration of the plant life to build the roads and turbine bases;
  - Three cyanolichens found in the Terence Bay Wilderness Area, should be protected, if located on site:
    - *Degelia plumbea* (rare, found in red maple);
    - *Nephroma bellum* (uncommon);
    - *Stricta fuliginosa* (very rare);
- Drinking water
  - Drinking water drains from the marsh at the end of property, i.e., PID 00384966, to the Little Lake and wells. How will construction affect water going into that marsh and ultimately into local wells?;
  - Concerned about excavation/blasting and the possible effects of this on drinking water. Residents on River Road are on wells that are downhill from this area;
- Potential pollution of numerous lakes in the area by oil coming off blades connected to the gear box; reference was made to the Goodwood wind turbine on the Prospect Road which appears to have been leaking oil from a gear box seal;
- Impacts on the brook from the proposed wind farm site;
- Concern that the project is not energy efficient;
- Land Use Concerns
  - The wind farm is surrounded by conservation and wilderness areas and the right of way for access is located in a conservation area ;
  - Located within 400 m of residential zoned property;
  - Too close to residential homes;
  - Too close to privately owned undeveloped land; and
  - The site will become a dump site and junk yard if the old roads are fixed up.
- Social Concerns
  - Health concerns, e.g., as a result of low frequency vibrations;
  - Health Canada is presently completing a heath study as to adverse effects – would like to see results before a decision is made;
  - Noise;
  - Property devaluation;
  - Concerned about brightness and direction of lighting;
  - View of turbines/impact on beauty of the lake and surrounding wilderness;
  - Residents were not aware of project until the last minute - there should have been community involvement from the beginning;
  - How could residents benefit from new development? Economic value of project for community;
  - Could property taxes increase to accommodate upgrades to River Road; and
  - Good hunting area.
- Other Concerns
  - Ice thrown from the blades in winter may cause serious concern to hikers, hunters and animals;
  - Is the power to be used in NS, or sold to the US;

- Could turbines cause electrical interference;
- Concerned that this development will drive more dangerous animals into our backyards, e.g., bears and coyotes;
- Are there any other planned sites nearby, e.g., on Terence Bay Road;
- Worried about the huge size of turbines; and
- Want more information – there are lots of unknowns related to health effects and environmental impact.

The information from the Open House has been documented and, as necessary, acted upon; Table 5.1 provides a concordance table that summarizes the actions taken and cross references as pertinent to sections in this EA document.

Table 5.1: Concordance: Key Issues and EA Reference

Issues Raised	***EA Reference***	***Observations***
Physical Matters		
Maintenance of drinking water	4.1.4 & 7.2.1	
Pollution of lakes from turbines	2.2.1, 2.3.2, 2.5.1, 2.5.2, 2.6 & 7.2.1	
Ice throw	2.2.6, 7.4.5 & Appendix E	
Electrical interference		Electrical interference is not anticipated
Wind farms sites in the vicinity		No awareness of other proposed turbines in the vicinity
Size of turbines	2.2.1	
Where the power is sold		Power is sold into the provincial grid
Project is not energy efficient		Wind farms provide clean energy and a viable alternative to current fuel sources
Location & Land Use Matters		
Proximity to wilderness and conservation areas	4.2.2 & 7.3	
Within 400 m of residentially zoned land	1.5.3	
Site conditions will deteriorate with improved access		The access will be gated which will inhibit motorized access to the site
Ecological Concerns		
Mammals; deer, lynx and bears	4.3.3 & 7.3.6	
Bats	4.3.7 & 7.3.5	
Birds & the importance of the migratory patterns	4.3.1, 4.4.5 & 7.3.4	
Plant destruction	4.4.1, 4.4.2 & 7.3.2	
Presence of cyanolichens	4.3.5 & 7.3.2	
Socio-economic Matters		
Health concerns	4.5.6, 4.5.7 & 7.4.6	
Noise	4.5.6 & 7.2.3	
Property devaluation	7.4.3	

Issues Raised	*EA Reference*	*Observations*
Lighting	2.2.5	
View of turbines	4.5.7 & 7.4.4	
Knowledge of project	Chapter 5	Proponent took information on the project to the community early in the regulatory process, i.e., July 2012
Economic benefits to community	7.4.2	
Impact on property taxes	7.4.3	

5.2.4 Other Consultations

CTB has held discussions with a number of individuals who have called or written about their concerns. Wherever possible these concerns have been addressed by providing additional information or undertaking studies. CTB will continue to work with community members to resolve any issues that may arise as a result of developing the Project.

5.2.5 Website

CTB has set up website that is dedicated to the Project. It can be accessed at:
http://www.chebuctoterencebay.com/
This website will be updated periodically and used to inform the general public and all stakeholders about all aspects of the proposed development. Website content and updates will include some or all of the following items:

- Notices for public information sessions;
- Photos of the Project location and turbine types;
- Environmental Assessment;
- Project schedule;
- Construction activity notifications;
- Online questionnaire and comment form; and
- Media and public relations material.

5.2.6 Community Liaison Committee

CTB is in the process of establishing a Community Liaison Committee (CLC) that will be comprised of volunteers from the local community. CTB will provide the CLC with timely and accurate information about project plans and activities. CLC members will serve as a sounding board for the Project, providing a representative cross-section of community views, concerns, and ideas on Project plans and activities. CTB will provide a page on the Project website for CLC communication and announcements. CTB will facilitate meeting space and undertake to act on advice from the CLC regarding communication with the community.

A number of people who live within a 5 km radius of the Project have expressed an interest in participating on this committee. The first meeting of the CLC is expected to be convened before the end of June 2014.

5.3 Regulatory Consultation

An integral and important part of the environmental assessment is to meet and/or communicate with the many regulatory departments that have expertise and guidance to contribute to the successful execution of the various field programs and studies. This has been done in various ways, i.e., through electronic communications, by accessing data bases, by phone and in person. The following sections reference the key communications.

5.3.1 Provincial and Federal Involvement

As detailed in section 4.5.1, the study team reached out and received feedback from the Canadian Coast Guard, the Meteorological Service of Canada, Industry Canada, DND and NavCanada with respect to the potential interference on communication and radar systems by the proposed WTGs. No interference is anticipated. Table 5.2 identifies other government departments and agencies that have contributed in one way or another to the environmental assessment process. In some instances the study team has accessed pertinent data bases and in others has met with representatives of the department involved.

Table 5.2: Involved Provincial and Federal Departments

Agency/Organization	*Role*	*Observations*
Nova Scotia Environment	Primary regulator pursuant to *Environment Act*	• Reviewed regulatory requirements • Met with departmental representatives on May 14, 2014
Nova Scotia Department of Natural Resources	Important advisory department	• Accessed departmental data bases • Communication on specific topics • Met with departmental representatives on September 9th, 2013
Health Canada	Advisory	• human health concerns related to noise • exposure to electric and magnetic fields (EMFs)
DFO		• clarification of impact on stream crossings and fish habitat
Environment Canada	Expert Authority with mandates under several federal statutes and source of pertinent data sets	• accessed and reviewed pertinent data bases and regulatory requirements • recommended lighting with short flash durations and the ability to emit no light during the “off phase” of the flash, e.g., strobes and modern LED lights

5.3.2 Municipal Government Involved

Halifax Regional Municipality (HRM) has had an involvement with the Project for a number of years. In fact the site was highlighted by HRM as an ideal location for a wind farm when community consultations were held with HRM residents in 2010-2011regarding the establishment of regulations for wind farms throughout HRM. Upon enactment of those regulations, the Project site was zoned by HRM for use as a wind farm.

The Project has received strong support from HRM Councillors who represent the region. In 2012-2013 HRM held two public hearings in the local community regarding the Project. At a public hearing on January 7, 2013 Halifax and West Community Council presented a motion to re-zone the driveway leading to the Project site to permit its use to transport turbines and heavy equipment. Although the motion was opposed by the local community group FORR, it was approved unanimously by the six Councillors. Subsequently HRM issued a development permit for the Project.

5.4 First Nations Engagement

As indicated in sections 3.2.3.2, Membertou Geomatics were commissioned to undertake a MEKS. The results of this initiative are discussed in sections 4.5.6 and 7.4.6; a full copy of the MEKS is provided in Appendix K. To further ensure not only that First Nations interests were understood, but that those with the responsibility of considering First Nations interests were fully informed of the nature and location of the Terence Bay Wind Farm, a meeting took place with a representative of KMK on February 10, 2014 at which time they were provided with copies of both the MEKS and the archaeological work that had at that date been undertaken. A subsequent update of the archaeological work was hand delivered to the KMK office in Truro on June 3, 2014.

On June 4, 2014 the study team also met with the director of the Maritime Aboriginal Aquatic Resources Secretariat and the Executive Director of Ikanawtiket. The project was outlined and a brief discussion of the field programs provided. Copies of the MEKS Study and the archeological work had been submitted ahead of the meeting and provided input to the discussion. No matters of concern were raised.

Letter indicating the intent to develop the Chebucto Terence Bay Wind Farm, together with copy of both of the Archaeological Resource Impact Assessment and the MEKS have been sent to the Union of Nova Scotia Indians and the Confederacy of Mainland Mi’kmaq.

CHAPTER 6 SCOPE OF THE ASSESSMENT

6.1 Approach

The overall approach to this assessment and the fieldwork is detailed in Chapter 3. Figure 3.1 depicts the steps in the environmental assessment process. The following sections provide a further explanation of how the environmental evaluation was undertaken.

6.2 Scoping: VECs and Socio-Economic Issues

It is impractical, if not impossible, for an assessment to address all of the potential environmental effects that might be directly or indirectly associated with a proposed undertaking. An important part of the assessment process, therefore, is to identify those matters upon which the assessment may be focused to ensure a meaningful and effective evaluation. This process is often referred to as scoping, i.e., an activity designed to identify those components of the biophysical and socio-economic environment which may be impacted by the Project and for which there is public and professional concern (Sadar, 1994). This section references the steps that were taken to focus this assessment and to identify the VECs and socio-economic issues.

As detailed in Chapters 3 and 4, there was both extensive documentary research and the execution of a range of field programs. The resultant database, in conjunction with the consultation undertaken, including consultation with pertinent provincial and federal departments, consideration of the objectives of the COMFIT program under which this program is being developed, and the study team's professional expertise and experience, has enabled the definition of the VECs and socio-economic issues. This process has involved internal team discussions to ensure that the requisite interdisciplinary rigor brought focus to the assessment. These discussions have included the participation of the specialists contracted to execute specific field programs and the engineers involved in the prefeasibility studies associated with the siting of the turbines and the access roads. The inputs of stakeholders, including but not limited to the community, neighbours and representatives of pertinent provincial and federal departments, were also considered in the scoping process. The informed professional judgement of this team, particularly those who have executed the various field programs, and the local knowledge that the proponent team brought to the process, were important inputs to the determination of the VECs and socio-economic issues identified in Section 6.3. It is these factors that are subject to evaluation in Chapter 7.

6.3 Potential Pathway and the Definition of VECs and Socio-Economic

Once the scope of the Project were determined and the phases of the Project defined, it is possible to identify those facets that may cause consequences for the receiving environment. This is accomplished by identifying the linkages, or pathways, between the Project and the receiving environment. That is, those components and activities that will be carried out on the site during Project construction, operation and eventual decommissioning that may have the potential to interact with the physical, ecological and/or socio-economic environment. Such pathways will include, but will not be limited to, the generation of sedimentation and emissions, including noise.

The study team has determined the VECs and socio-economic issues that will be subject to assessment based upon its collective knowledge and experience; input received from the Proponent; review of the regulatory requirements and feedback from the regulatory authorities and others as part of the consultation program and selected field programs. The VECs and socio-economic issues that will be evaluated are identified in Table 6.1.

Table 6.1: Potential VECs and Socio-economic Issues

Physical Components	***Ecological Components***	***Socio-economic Issues***
• Ground and surface water quality • Watercourses • Noise • Flicker	• Wetlands • Vegetation and forest cover • Species of Concern • Migratory and breeding birds • Bats • Adjacent wilderness areas • Mammals	• Land use • Employment and the economy • Residential factors: proximity, value and taxes • Visual impacts • Traffic • Health and Safety • Aboriginal use of land • Archaeological resources

6.4 Analysis and Evaluation Criteria

The definition of "environment" in the *NS Environment Act* is as follows:

"Environment" means the components of the earth and includes

(i) air, land and water;

(ii) the layers of the atmosphere;

(iii) organic and inorganic matter and living organisms;

(iv) the interacting systems that include components referred to in sub clauses (i) to (iii); and

(v) for the purpose of Part IV, the socio-economic, environmental health, cultural and other items referred to in the definition of environmental effect."

In the provincial legislation *"environmental effect"* means in respect of an undertaking

a) any change, whether positive or negative, that the undertaking may cause in the environment, including any effect on socio-economic conditions, environmental health, physical and cultural heritage or on any structure, site or thing including *those of historical, archaeological, paleontological or architectural significance, and*

b) *any change to the undertaking that may be caused by the environment, whether that change occurs inside or outside the Province.*

This assessment focuses on the evaluation of potential interactions between the VECs and socio-economic issues and the various Project activities outlined in the Project description, i.e., in Chapter 2. A standard evaluation system has been developed to ensure that potential effects are clearly and completely evaluated. Residual environmental effects are those that remain after mitigation and control measures are applied. The prediction of residual environmental effects follows three general steps:

- determining whether an environmental effect is adverse;
- determining whether an adverse environmental effect is significant; and
- determining whether a significant adverse environmental effect is likely to occur.

Many, if not all potential adverse effects, can be avoided through the application of good engineering and construction practices, the careful timing of activities, and the adherence to appropriate environmental management techniques.

The effects evaluation for each VEC and socio-economic issue is conducted by Project phase, i.e., construction, operation, and decommissioning, as well as malfunctions and accidents. For each phase, the study team identifies those Project activities that may result in a positive or negative effect on the VEC or socio-economic issue. To determine if there are adverse effects, the study team took the following factors into account:

- negative effects on the health of the biota;
- loss of rare and endangered species;
- loss of critical and/or productive habitat;
- fragmentation of habitat;
- transformation of natural landscapes;
- discharge of persistent and/or toxic chemicals;
- reductions in the capacity of resources to meet the needs of present and future generations, including those lands and resources used by aboriginal peoples; and
- interference with the use and enjoyment of property.

The analysis evaluates the interactions between Project activities and the VEC or socio-economic issue and determines the significance of any residual adverse environmental effects, i.e., effects that may persist after all mitigation strategies have been implemented. To determine and appreciate the relevance of residual effects following mitigation, the following definitions of impact have been adhered to:

- *Significant*: Potential impact could threaten sustainability of the resource in the study area and should be considered a management concern - research, monitoring and/or recovery initiatives should be considered; and

- *Negligible*: Potential impact may result in a slight decline of the resource in the study area during the life of the project - research, monitoring and/or recovery initiatives would not normally be required.

As not all consequences of Project development and operation on the identified VECs and socio-economic issues are adverse, the above table has been supplemented by the following two definitions:

- no impact, i.e., where the consequences of the Project have no effects on the specific VEC or socio-economic issue; and
- beneficial impact, i.e., where the consequences of that phase of the Project enhance the specific VEC or socio-economic issue.

6.5 Cumulative Effects

A consideration in any environmental assessment process is how the proposed Project may interact with past, present or likely, i.e., approved, future projects or activities within the defined spatial and temporal timeframes identified. It is, in fact, a way of setting the Project into its broader ecological and regional development context, and it is the Project's interface with this context that is discussed further in the evaluation.

6.6 Effects of the Environment on the Project

Several naturally occurring environmental factors, including fire, extreme weather events and climate change, could to varying degrees have consequences for the development and operation of the Project. These are referenced as appropriate in the evaluation of specific VECs and socio-economic issues in Section 7.5.

CHAPTER 7 ANALYSIS

7.1 VECs and Socio-Economic Issues

The VECS and socio-economic issues that form the basis for this environmental analysis were identified in Table 6.1. For an impact to occur, however, there has to be a link between the Project and the VEC or socio-economic issue, i.e., a pathway. Table 7.1 depicts where there is a potential pathway or linkage between the identified VEC or socio-economic issue through site preparation and construction, the operation and maintenance of the turbines and their decommissioning. This table graphically depicts potential interactions where there is a possibility for impact. Where there is no pathway, or linkage, there can be no impact on that VEC or socio-economic issue; a justification of this outcome is provided in the text.

Table 7.1: Potential Interactions between Project Activities and VECs/Socio-Economic Issues

Valued Ecosystem Component	***Site Preparation and Construction***					***Operation and Maintenance***				***Reclamation & Decommissioning***		
	Site preparation	Transportation of wind turbines	Assembly of wind turbines	Release of hazardous materials	Accidents and malfunctions	Movement of wind turbine blades	Release of hazardous materials	Presence of wind turbines	Accidents and malfunctions	Dismantling of wind turbines	Transportation of wind turbines	Accidents and malfunctions
Physical Components												
Ground and surface water quality	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓
Watercourse	✓	✓	✓	✓			✓		✓	✓		✓
Noise	✓	✓	✓	✓		✓				✓	✓	
Flicker						✓						
Biophysical												

Valued Ecosystem Component	***Site Preparation and Construction***					***Operation and Maintenance***				***Reclamation & Decommissioning***		
	Site preparation	Transportation of wind turbines	Assembly of wind turbines	Release of hazardous materials	Accidents and malfunctions	Movement of wind turbine blades	Release of hazardous materials	Presence of wind turbines	Accidents and malfunctions	Dismantling of wind turbines	Transportation of wind turbines	Accidents and malfunctions
Wetlands	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓
Vegetation and forest cover	✓				✓				✓	✓		✓
Species of Concern*												
Migratory and breeding birds	✓		✓	✓	✓	✓	✓	✓	✓			✓
Bats	✓					✓						
Mammals	✓		✓			✓				✓		
Adjacent wilderness areas												
Socio-economic												
Land use	✓						✓	✓		✓		
Employment and the economy	✓	✓	✓					✓		✓	✓	
Residential factors: proximity, value and taxes	✓		✓					✓		✓		
Visual impacts	✓							✓				
Traffic	✓	✓									✓	
Health and safety	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Aboriginal use of lands												
Archaeological resources												

***** With the exception of certain bird species, the Project area does not provide habitat for Species of Concern. The birds of concern are addressed within the VEC – migratory and breeding birds.

The following sections present the environmental evaluation and identify the residual effects of the proposed Project on the above identified physical and biophysical VECs and socio-economic issues. Recommendations for mitigation are identified where applicable. The analysis also takes into account the consequence of the proposed Project interacting cumulatively with other activities taking place in the area.

7.2 Physical VECs

Examination of Table 7.1 indicates that various activities associated with the Project's development, operation and subsequent decommissioning may impact ground and surface water quality, watercourses and may generate noise and/or flicker. These factors and potential interactions are explored further in the sections that follow.

7.2.1 Ground and Surface Water Quality

The maintenance of the quality of the ground and surface waters on site and in adjacent areas is important both to the maintenance of habitat quality, particularly that associated with the wetlands that have been identified, and also to the ground water that is sourced through wells for residential use. Ground and surface water quality has therefore been identified as a VEC.

A significant environmental effect on ground and surface water quality would result if a substantive change attributable to the Project was be identified in ground and surface water quality in the immediate area of the Project site.

7.2.1.1 BOUNDARIES

The physical boundaries encompass the lands that will be subject to the construction or upgrading of the access roads, laydown areas and wind turbine foundations. Construction will involve the use of heavy equipment and may involve some excavation of bedrock. During Project operation, the focus will be upon maintenance activities while the eventual decommissioning of the wind turbines will again involve the use of heavy equipment. The temporal boundaries are primarily those associated with site preparation and Project construction. In the broader sense the temporal boundaries relate to the anticipated life of the Project, i.e., perhaps 20 years or more. However, if mitigative measures are not applied, the effects could be more reaching both spatially and over time.

7.2.1.2 PATHWAY ANALYSIS

The pathways that may adversely affect ground and surface water quality include:

- The disturbance of sediments and the generation of dust during the construction of the wind turbines and associated access roads;
- The disturbance of sediments and the generation of dust during the decommissioning of the wind turbines; and
- The accidental release of hazardous materials such as fuels, oils and lubricants.

7.2.1.3 MITIGATIVE MEASURES

Construction activity will involve clearing, grubbing and excavation which have the potential to cause erosion and the transportation of sediment to adjacent areas, including existing ditches, wetlands and streams. The severity of erosion and sediment transport depends on several factors such as precipitation, soil type, slope, vegetation cover and distance. Some portions of the area may be composed of unconsolidated till material that is susceptible to erosion. Nevertheless, the greater part of the site and the vegetation surrounding the wind pad locations will remain largely untouched. In most areas, erosion and associated sedimentation is not anticipated. This will be reinforced through the use of proven methods to control run-off, erosion and dust including:

- Defined procedures for the storage and handling of excavated materials;
- Timely re-vegetation, if necessary, of disturbed areas after construction;
- The installation of temporary erosion control measures, e.g., drainage barriers, sediment fences, plastic sheeting, straw or mulches, etc.: and
- Watering of exposed areas in dry conditions to control dust.

As referenced in section 4.1.4, the more ephemeral water movement on the site tends to flow from north to south across the landscape towards the sea. In the preparation of the access roads, culverts will be installed as necessary to protect drainage patterns, and the necessary protective measures will be installed to ensure that there is no impact from the disturbance of soils, etc. At a minimum, culverts will be required at two locations along the access road between the turbines: details of these and other measures will be prepared in subsequent phases of engineering design. Reference should also be made to Appendix D which provides detail with respect the Access Roads and Crane Platforms. More specifically the following mitigative measures are proposed for the construction, operation and decommissioning phases of the Project.

Site Preparation and Construction

- Compliance with engineering best practices and all applicable codes;
- Installation of erosion and sedimentation control measures and surface water control features, e.g., silt fencing, where appropriate, before land clearing and earth handling;
- Excavation for turbine footings and the storage, handling and disposal of excess materials in an environmentally appropriate manner;
- Installation of required culvert sections to specified grades and inspections to ensure tight joints; and
- Placement of road gravels; and covering exposed surfaces where applicable with straw mulch.

Operation and Maintenance

During the operation and maintenance of the site, storm drainage structures will be monitored and maintained to the extent applicable to prevent sediment migration from any runoff from the turbine pads.

Reclamation and Decommissioning

The mitigative actions during reclamation and decommissioning will be comparable to those executed during the construction phase, including the installation of site specific erosion and sedimentation control measures and the management of storm drainage from disturbed areas.

Accidental releases of hazardous materials could occur during any phase of the Project and might include petroleum products, solvents and paints. Accidental releases of other chemicals could occur from storage facilities or vehicles. The severity of an accidental event would depend on the chemical characteristics and volume of the release. Relatively small amounts of fuel and hydraulic fluid spilled during the operation of the construction equipment, or the servicing of the turbines, are the most likely types of accidental releases. Standard practices for the handling, storage and use of potentially hazardous materials will be enforced through all phases of the Project. The following mitigative measures will also be applied:

- All hazardous materials used at the site will be labeled according to WHMIS regulations;
- Vehicle maintenance and refuelling will be prohibited on site;
- Frequent inspection and maintenance of all equipment used on site will be undertaken to identify and repair fuel leaks;
- Used oil, filters and other products associated with equipment shall be collected and disposed of in accordance with regulatory requirements; and
- All spills shall be immediately reported to the environmental Emergency # 1-800-565-5733.

Given the use of proven sedimentation control measures, including those advocated in the "Erosion and Sedimentation Control Handbook for Construction sites", the distances from the wind turbine pads to streams and lakes, and the further development of standard practices for the handling, storage and use of potentially hazardous materials as part of a comprehensive EMP program, it is highly unlikely that sedimentation will pose a hazard to ground and surface waters. Since the nearest residential well is over 1,000 m from the WTGs, there will be no impact on groundwater recharging. In summary, through the use of standard and accepted industry procedures and mitigative measures, adherence to applicable regulations and guidelines, and waste management planning, the construction of the proposed Project will be undertaken in an environmentally responsible manner and is unlikely to result in a significant adverse effect on surface and ground water quality.

Project interactions with surface and ground water during Project operation are anticipated to be minimal. The most likely interface is an accidental release of a hazardous material during turbine maintenance or when machinery is necessary to facilitate repairs. However, by adhering to applicable regulations and guidelines, implementing mitigation measures and applying good management practices as referenced above, the operation of the proposed Project is unlikely to result in a significant adverse effect on surface and ground water quality.

The decommissioning of the Project will involve the dismantling and removal of the wind turbines and the reasonable rehabilitation of the Project site. There will be no excavation of bedrock involved. And the concrete pads at the site would likely remain in place. Therefore the reclamation and decommissioning of the site is unlikely to result in a significant adverse impact on surface and groundwater quality.

Beyond the accidental release of hazardous material, malfunctions could perhaps involve a need to replace component of one of the turbines, or other infrastructure associated with the Windfarm. The measures adopted to minimise erosion or sedimentation during construction would be likewise adopted to address the consequences of any earthworks required to resolve malfunctions in equipment.

7.2.1.4 Cumulative Effects

There are no known development activities taking place in or in the vicinity of the site that might act cumulatively with the proposed Project to cause a significant adverse effect on surface or ground water quality; no cumulative effects are anticipated.

7.2.1.5 Residual Effects

The Project is not anticipated to have a significant residual environmental effect on surface and ground waters; the impact is predicted to be negligible.

7.2.2 Watercourses

As detailed in section 4.4.6, all the watercourses in proximity to the Project footprint (Figure 3.2) drain southwards into Brophys Run which in turn flows into Brophys Front Lake and eventually into the Terence Basin and Terence Bay. Brophys Run in the southwest corner of the Project site is a permanent watercourse; there are a number of other more ephemeral streams on site.

A significant environmental effect on a watercourse would result if a substantive change in flow could be attributed to the Project in the immediate area of the project site.

7.2.1.6 Boundaries

The physical boundaries encompass the lands of the Project site and the waters immediately adjacent to them. The temporal boundaries are primarily those associated with site preparation and Project Construction. In the broader sense the temporal boundaries relate to the anticipated life of the Project, i.e., perhaps 20 years or more. If mitigative measures are not applied, however, the effects could be more far reaching both spatially and over time.

7.2.1.7 Pathway Analysis

The pathways that may adversely affect the watercourses include:

- The disturbance of sediments and the generation of dust during the construction of the wind turbines and associated access roads;
- The disturbance of sediments and the generation of dust during the decommissioning of the wind turbines; and
- The accidental release of hazardous materials such as fuels, oils and lubricants.

7.2.1.8 Mitigative Measures

As referenced above, construction activity will involve clearing, grubbing and excavation which have the potential to cause erosion and the transportation of sediment to adjacent areas, including watercourses. The severity of erosion and sediment transport depends on several factors such as precipitation, soil type, slope, vegetation cover and distance. Some portions of the area may be composed of unconsolidated till material which is susceptible to erosion. Nevertheless the greater part of the site and the vegetation surrounding the wind turbine pad locations will remain largely untouched. In most areas, erosion and associated sedimentation is not anticipated. This will be reinforced through the use of proven methods to control run-off, erosion and dust including:

- Defined procedures for the storage and handling of excavated materials;
- Timely re-vegetation, if necessary, of disturbed areas after construction;
- Maintenance of a 20 m watercourse buffer should be adhered to as best practice;
- The installation of temporary erosion control measures, e.g., drainage barriers, sediment fences, plastic sheeting, straw or mulches, etc.; and
- Watering of exposed areas in dry conditions to control dust.

As referenced in Section 4.1.4, the more ephemeral water movement on the site tends to flow from north to south across the landscape towards the sea, some of it into Brophys Run. The mitigative measures identified in section 7.2.1.3 to protect ground and surface water quality through all phases of the Project will also serve to protect Brophys Run.

7.2.1.9 Cumulative Effects

There are no known development activities taking place in or in the vicinity of the site that might act cumulatively with the proposed Project to cause a significant adverse effect on surface or ground water quality; no cumulative effects are anticipated.

7.2.1.10 Residual Effects

The Project is not anticipated to have a significant residual environmental effect on watercourses; the impact is predicted to be negligible.

7.2.3 Noise

Noise produced by WTGs is a recognised concern often identified by people when they first learn of the possible development of a wind farm in or near their community. It is a concern that has been raised by many who live in the vicinity of the proposed Project. Noise from a WTG is caused by the conversion of wind energy into sound when interacting with the blades and by other mechanical sources. Sound is measured in decibels (dBs) and the audible range for humans is from 0 dB, the threshold of hearing, to 140 dB, the threshold of pain.

The impact of noise depends on a range of factors that influence sound propagation including, but not limited to, the following:

- Distance from the source, e.g., the bulldozer or wind turbine;
- Height of the source;
- Atmospheric conditions, including humidity;
- Intervening topography or structures;
- Vegetation; and
- Background wind noise levels.

The effect of wind turbine noise on human health is debated, with many individuals claiming various health issues despite the lack of research exhibiting a relationship. The negative impacts of prolonged noise exposure on human health has been documented and can include cardiovascular disease, hypertension, stroke, diabetes, sleep disturbance, endocrine effects, minor psychiatric disorders, and impaired cognitive development. The World Health Organization has concluded that noise-induced annoyance can be considered an adverse effect on health. It has been reported that sleep interference increases and health-related quality of life decreases in residents nearer to wind turbines (Shepherd et al., 2011; Nissenbaum et al., 2012). Wind turbine noise often appears to have opposing effects depending on individuals, no effect at all or powerful adverse effects, suggesting that it may be the type of noise produced that causes issues (Seltenrich, 2014). Wind turbines generate lower frequency sound (<20 Hz) than traffic noise; lower frequency noises tend to be judged as more annoying and are more likely to travel through walls and windows. As well, it is thought that perhaps airborne infrasound may be impacting the inner ear, resulting in many of the reported adverse health effects, although the mechanisms are not understood (Massachusetts Department of Environmental Protection, 2012). Although the exact distance is debated, noise disturbance complaints are higher amongst those living closer (<400 m) to wind turbines (Nissenbaum et al., 2012).

Concerns surrounding the health effects of wind turbines are great enough that in 2012 Health Canada in collaboration with Statistics Canada commissioned an epidemiological study to determine the effect of wind turbine noise on public health and safety. This study has not yet been completed and is expected to be released in early 2015.

As referenced in sections 3.2.3.3 and 4.5.7, noise modeling was undertaken to determine potential noise levels from the three turbines at all buildings located within 2 km of the proposed wind turbines. A total of 94 receptors were included in the analysis; the full results of that analysis are provided in Appendix L.

A significant environmental effect would arise if noise attributed to the Project was demonstrated to exceed acceptable levels at one or more of the receptors.

7.2.1.11 Boundaries

The geographical area of interest is the area with respect to the noise that will be generated has been defined as 2 km of the proposed turbines. The temporal boundary encompasses the anticipated life of the Project, i.e., 20 years or more.

7.2.1.12 Pathway Analysis

All phases of the proposed Project, i.e., construction, operation and decommissioning, will generate noise. During the construction and decommissioning phases, the anticipated noise will be generated by typical construction activities including the transportation of materials and site works, the building of the access roads, turbine pads, etc. Noise will be generated by the operation of heavy equipment such as back hoes, bulldozers, flatbeds trailers, cranes, dump trucks, ready mix trucks and the smaller vehicles used to transport workers to and from the site.

The nearest occupied residence is over 1 km distant. Typical dBA levels in a rural environment, such as Terence Bay, are 38-46 dBA. It is very unlikely that construction activity would be heard at 1 km distance, but if it is, it will be intermittent and unlikely to be an ongoing nuisance. Such noise, however, may temporarily disrupt the activities of fauna and birds at, or in the vicinity of, the Project site.

AL-PRO Wind Energy Consulting Canada Inc. has modelled the predicted noise from the turbines and demonstrated that the Project will comply with all applicable guidelines. The current sound guideline for wind farms in Nova Scotia is based on a threshold level of 40 dBA. Modeled sound pressure levels should not exceed 40 dBA at residential receptors which include homes, camps, cottages schools and hospitals. Sound levels at all 94 receptors were below this point, i.e., the noise from the WTGs will likely be lower than the ambient rural noise most of the time. Indeed, background noise from natural and anthropogenic sources would likely drown out the sounds associated with the wind turbines.

7.2.1.13 Mitigative Measures

To mitigate the impact of noise from construction activities, construction and decommissioning should be limited to day time working hours whenever reasonably possible and all machinery should be fully serviced.

The distance to the nearest residence is over 1,000 m, meeting the setbacks established by HRM. These distances will absorb the incremental noise generated to the level of a typical rural environment. No further mitigation is required.

7.2.1.14 Cumulative Effects

There are no known development activities that will take place in, or within the vicinity of, the Project site that might act cumulatively with the proposed Project to increase noise levels thereby causing a significant adverse effect; no cumulative effects are anticipated.

7.2.1.15 Residual Effects

The noise that will be generated by the Project is not predicted to have a significant residual effect on the wildlife, or on the occupants of the nearest residences; the impact is predicted to be negligible.

7.2.2 Shadow Flicker

Shadow flicker is the visual impact that results when the blade of a wind turbine passes between the sun and a particular point of observation, i.e., the receptor, and interrupts the sun's rays causing a flicker effect. Whether such flicker occurs at all and to what extent is dependent on many factors including weather conditions, i.e., whether the sun is shining or not, geographical position, topography and time of day. The duration and severity of shadow flicker effects also varies depending on the time of the year and wind conditions. Finally the distance of the wind turbine from a receptor will also influence the impact, since light perception diminishes with distance.

The primary impact of shadow flicker is annoyance. As detailed in Model Wind Turbines By-Laws and Best Practices, "shadow flicker from wind turbines usually has a frequency range of between 0.5 Hz to 1.25 Hz which is well below the level of concern for this health issue" (Noble Environmental Power, Department of Business Enterprise and Regulatory Reform, UK). The same British government ministry has indicated that at a distance of 10 rotor diameters, i.e., ~ 920 m, a person should not experience shadow flicker.

7.2.2.1 Boundaries

The geographical area of interest is the area with respect to the flicker that may be generated has been defined as 2 km from the proposed turbines. The temporal boundary encompasses the anticipated life of the Project, i.e., 20 years or more.

7.2.2.2 Pathway Analysis

A worst case scenario shadow flicker analysis was done for the proposed wind turbines at Terence Bay (see sections 3.3.2, 4.5.8 and Appendix M). This scenario assumed that:

- The sun shines 100% of the time when it is above the horizon;
- The turbine rotor is always perpendicular to the sun;
- Shadow flicker starts as the sun moves above 3 degrees of the horizon;
- The shadows dissipate at a maximum distance from the blade as a result of atmospheric conditions and light diffusion; and
- The rotor blades are always spinning.

The total length of the shadow influence in the atmosphere is calculated from the physical dimensions of the turbine blade. In this analysis, the maximum shadow distance for the E-92 was calculated to be 1,517 m. A maximum of 30 hours of shadow flicker per year and a maximum of 30 minutes per day are the threshold parameters used to define the acceptable level of flicker from wind Projects. The study found that two buildings might receive more than 30 hours per year and that one could receive more than 30 minutes per day in the worst case scenario. However, the actual level of impact will be much less as sunshine, wind conditions and turbine availability will all reduce impacts when compared to the worst case scenario. The high case of cloud cover in the region will also significantly reduce the actual levels of shadow flicker experienced at the various receptors when compared to the worst case scenario. Finally as referenced above, no one should experience shadow flicker at any distance beyond 920 m; all residences are more than 1000 m distant.

7.2.2.3 Mitigative Measures

No mitigative measures are necessary.

7.2.2.4 Cumulative Effects

There are no known development activities that will take place in, or within the vicinity of, the Project site that might act cumulatively with the proposed Project to increase shadow flicker levels levels thereby causing a significant adverse effect; no cumulative effects are anticipated.

7.2.2.5 Residual Effects

The flicker that may be generated by the turbines are not predicted to have a significant residual effect on wildlife, or on the occupants of the nearest residences; the impact is predicted to be negligible.

7.3 Ecological VECs

Examination of Table 7.1 indicates that the various activities associated with the Project's development, operation and subsequent decommissioning may impact the wetlands, vegetation and forest cover, migratory and breeding birds, mammals and bats; consideration has also been given to Species of Concern, a legislative requirement. Concern was expressed that the construction and operation of the wind turbines would adversely impact adjoining wilderness areas. No aspect of the wind farm's development, operation or decommissioning will impact the adjoining lands. There is no linkage, therefore there is no impact.

At the Open House, concern was also expressed that the Project would adversely impact the adjoining wilderness areas to the north, south and west (see section 4.2.2 and Figure 4.4). Consideration of the nature of the project indicates that there is no pathway, or linkage, by which the development and operation of the Project could adversely impact these lands.

7.3.1 Wetlands

Wetlands provide distinctive habitat and serve as an important link between freshwater and terrestrial ecosystems. The intent of the Provincial Wetland Conservation Policy (November, 2011) is the "no-net-loss" of wetland functions. This policy is achieved through three main avenues: avoidance, mitigative design and compensation for the loss of habitat. NSDNR Wet Area Mapping was used to focus field investigations with the proponent making every effort through the configuration, site verification and iterative reconfiguration of the turbines, the laydown areas and the access road to avoid the eight wetlands delineated on the Project site (Figure 4.2). Sections 3.2.2.2 and 4.4.3 detail the extent of the wetland fieldwork that has been undertaken to date and provide the extent of the wetlands on site.

As depicted on the Figure 4.2, the access road between two of the turbines will cross Wetland #7. The delineation of this wetland will be confirmed as per NSE approved procedures as part of compiling the Wetland Alternation Approval Application. The intent of the proposed layout is to ensure the retention of as much of the existing wetland habitat as possible, while meeting other Project requirements. It is understood that compensation will be part of the approval to alter any wetland in accordance with NSE's policies.

A significant environmental effect on wetlands would result if there was a substantive change to the wetlands in the area that could be attributed to the Project.

7.3.1.1 Boundaries

The spatial boundaries are limited to the physical extent of the wetlands themselves and the physical relationships between these areas and the wind turbines and access roads. The temporal boundaries are those associated with Project construction.

7.3.1.2 Pathway Analysis

Activities during construction that could have an adverse impact on the wetlands include the grubbing and clearing of land for the wind turbines and the access roads, the construction process itself and the associated disturbance of sediment and dust that may be associated with such activities. The accidental spilling of fuels, lubricants, or hydraulic fluids and pedestrian and vehicular access into the wetlands may also negatively impact these habitats.

Construction activities can affect a wetland in several ways. The movement of heavy machinery, for example, can result in the physical disturbance of plant communities and substrates. Other activities such as clearing and grubbing, trenching and backfilling, if inappropriately undertaken, can result in the sedimentation of inundated portions of a wetland. Trenching can alter the hydrologic regime by changing groundwater flows. In dry weather, excessive dust could be blown into wetland areas. In turn, this may result in increased or decreased water levels depending on whether groundwater is directed into the wetland or drained from it. Wetland flora and wildlife species can also be affected by accidental spills of fuels, lubricants or hydraulic fluids.

7.3.1.3 Mitigative Measures

As referenced above, effective planning for the proposed wind farm has enabled the siting of both the wind turbines and the access roads to be undertaken in a manner that will minimize the amount of direct impact on any wetland. Indirect impacts in the absence of effective mitigation could be associated with the consequences of construction on ground or surface waters. The latter are addressed in Sections 7.3.1 and 7.3.2 above. As detailed in section 4.4.3.3, wetland #7 (2,795 m^2) has been delineated as part of the field work undertaken. Once the necessary engineering has been undertaken for the access road, the actual amount of wetland to be disturbed will be determined and a formal application will be made to NSE for a Wetland Alteration Permit with respect to the proposed works.

It is not anticipated that the operation and maintenance of the proposed facilities will have a significant effect on wetlands. The most likely pathway for impact would be through an accidental release of a hazardous material during turbine maintenance, or when machinery is necessary on site to facilitate repairs. Through the application of good management practices, the operation of the proposed Project is unlikely to result in a significant adverse effect on the wetlands identified.

The decommissioning of the Project will involve the dismantling and removal of the wind turbines and the reasonable rehabilitation of the Project site. There will be no excavation involved and the foundations of the wind turbines would likely be left in situ. In summary, the decommissioning of the site, though involving the transportation of heavy equipment and large structural components, will be less invasive than the construction program and will be conducted in accordance with all applicable regulatory requirements in an environmentally responsible manner.

Beyond the accidental release of a hazardous material, malfunctions could involve the need to replace components on one or more wind turbines, or other components of the wind farm. The measures advocated to address spills and minimize sedimentation would be applied as appropriate. Malfunctions and accidents are not predicted to have a significant adverse effect on the wetlands.

7.3.1.4 Cumulative Effects

There are no known works that are proposed in the vicinity of the proposed wind farm that would interact cumulatively with the construction and operation of the wind farm to have an adverse impact on wetlands in the area. Intermittent logging, the use of ATVs and hunting will continue in the area. Some of this activity would likely use the proposed access roads so there may be less impact on wetlands, e.g., rutting, in some areas than in the past. Once the WTGs and the access road have been constructed and are in operation, and the mitigation measures referenced above deployed, the proposed Project will not act cumulatively with other activities to cause a significant adverse impact on the wetlands; no cumulative impacts are anticipated.

7.3.1.5 Residual Effects

The Project is not anticipated to have a significant residual environmental effect on the wetland habitat, i.e., the impact will be negligible.

7.3.2 Vegetation and Forest Cover

As detailed in Section 4.4.1, the landscape is characterized by a matrix of coniferous and deciduous forest. Such forest cover provides habitat for a range of wildlife, including birds, and has therefore been recognized as a VEC.

Field work undertaken has identified the following forest habitats:

- Intolerant hardwood forest;
- Intermediate mixed-wood forest;
- Coniferous dominated coastal forest;
- Low-shrub barrens; and
- High shrub barrens.

A large portion of the northern part of the site consists of hardwood forest comprising shade intolerant tree species. This is a late successional coastal forest type arising from the mixed-wood forest found elsewhere on the site. The coniferous forest types encountered on site vary depending on soil and nutrient conditions, both of which are potentially limiting to tree growth. The low shrub barrens are dominated by ericaceous shrubs less than 1 m tall with lichen covered rocks interspersed throughout. The high shrub barrens are dominated by shrubs in excess of 1 m tall with the occasional tree scattered throughout and sparse vegetation.

A total of 132 species representing 38 families of vascular flora were identified on site. Site wide, the dominance of *ericaceae* (heath) plants is reflective of the poor nutrient regime. No rare plant sightings, i.e., ranked S3 or greater, were documented, and no Federal or Provincially legislated species of flora noted. Because of concern expressed about rare lichens, a specific search was undertaken (section 4.4.4); no valued lichens were found on site.

While the identified habitats are not particularly outstanding, their ecological role is nonetheless important. A significant environmental effect could result if there was a substantive loss of the existing cover that was attributable to the Project.

7.3.2.1 Boundaries

The areas of concern with respect to forest cover include:

- The areas that will have to be cleared to accommodate the wind turbines not sited in existing open areas; and
- The areas that will have to be cleared to accommodate the new access roads.

The temporal boundary encompasses the period associated with the construction of the Project, when there will be site clearing to enable work to proceed. In the longer term, the forest cover in some areas will regenerate, but the cover will continue to be modified through ongoing practices.

7.3.2.2 Pathway Analysis

To enable the development of the Project, trees and associated vegetation in defined areas, i.e., the turbine sites, laydown areas and access road, will be cleared; this work will contribute to the fragmentation of the forest cover. The main effect of this clearing is an increase in the amount of edge condition within the landscape.

7.3.2.3 Mitigative Measures

During construction, fragmentation will be minimized by clearing only the area required for the construction of the required access roads, the turbine pads and the laydown areas. As indicated in section 2.4, the plan is to undertake clearing in the fall of 2014. This ensures that the cover and vegetation that needs to be cleared will be removed before the start of the 2015 bird breeding season.

Staff will be trained to respond appropriately to accidental events, including the occurrence of fire, that may pose a hazard to the vegetation and forest cover. The Contingency and Safety Plan will detail appropriate response measures.

7.3.2.4 Cumulative Effects

There are no known works in the vicinity of the Project site and surrounding communities that would act cumulatively with the Project to negatively impact vegetation and forest cover; no cumulative impacts are anticipated.

7.3.2.5 Residual Effects

Over time, there will likely be some natural regeneration of some of the areas cleared for the construction of the Project. The Project is not anticipated to have a significant residual environmental effect on forest cover in the area; the impact will be negligible.

7.3.3 Species of Concern

As detailed in section 4.3, a screening of the ACCDC list resulted in a shortlist of 161 species that had been sighted with 25 km of the Project site. This list was reduced to include only those species that have been legislated either provincially or federally. This resulted in 20 species as presented in Table 4.4. Neither plant species of concern (section 4.4.2), nor lichen species of concern (section 4.4.4), were identified during the dedicated field programs. Secondary research determined that the Project site did not provide suitable habitat for the wood turtle (section 4.3.2.1), for the monarch butterfly (section 4.3.6.1), or for bats (section 4.3.7.1). Moose scat was found in the Project site during the spring avian survey (section 4.3.3.1) and an old moose browse was found during the moose presence study conducted in the winter of 2014 (section 4.4.7); these findings suggest that moose are perhaps an intermittent visitor to the site, but are more likely to be found in the adjoining wilderness areas.

Certain birds of concern were identified during the avian field program; these are taken into account in section 7.3.4 in the context of migratory and breeding birds.

7.3.4 *Migratory and Breeding Birds*

The study area is a migration stop-over and breeding area for a variety of woodland bird species. Migratory and breeding birds have therefore been identified as a VEC. As detailed in section 4.4.5, work undertaken in the field included stop-over surveys and diurnal fly-over surveys in the spring, point counts for breeders and stop over and fly over surveys to catch the fall migration. In addition, work was undertaken through the winter to determine species over-wintering. 70 species of birds were identified, including four species of concern in Nova Scotia, i.e., the Boreal Chickadee, the Gray Jay, the Canadian Warbler and the Common Loon; the Canadian Warbler is the only one of the four that is protected by legislation.

A significant environmental effect on migratory and breeding birds would result if a substantive change in their numbers and habits could be attributed to the Project.

7.3.4.1 Boundaries

The spatial boundary associated with the determination of effects for breeding and migratory birds encompasses the entirety of the Project site and the immediately adjacent lands. The pertinent temporal boundary for the assessment of Project impacts on avian species is the duration of the Project, i.e., 20 years or more.

7.3.4.2 Pathway Analysis

The two primary pathways that may cause detrimental impacts to birds are:

- The destruction of habitat during Project construction; and
- The operation of the wind turbines throughout the operating life of the Project.

Habitat Destruction

The footprint where the wind turbines and access roads are located will result in some habitat loss to locally breeding species. There were 47 species found breeding on the Project site. However, due to the small footprint size and the fact that much of site is barrens, the effects on breeding bird nesting sites should be minimal if clearing is done outside of the bird breeding season (May 1st to August 31st for most migratory birds). Beyond the access roads, the sites of the WTGs and laydown areas, the balance of the Project site, i.e., the greater portion of the area, will not be disturbed. Given the timing of the proposed clearing and associated construction, there will be no disturbance of active nests; birds will likely return and breed in the area undisturbed through the spring and summer of 2015. In the circumstances, project construction is unlikely to severely impact the numbers or diversity of bird species breeding in the Project area.

The only formally listed bird recorded on site, the Canada Warbler was seen once during the spring migration; this species is not likely to be impacted by site clearing for turbine construction since the turbines will be built on higher ground, away from the moist woodlands and forested wetlands. The construction or improvement of roads and the construction of ancillary structures should avoid removing forest understory in wet areas as much as possible as these habitat features are known to be important to the life history of the Canada Warbler. The wetlands that are interspersed throughout the study area offer the most promising habitat for the Canada Warbler (Figure 4.5).

Risk of Collisions with Wind turbines

It has been noted that the majority of migrating birds fly between 150 m and 450 m above ground level (Bellrose, 1971). Radar studies have largely confirmed these visual observations with the majority of nocturnal bird migration appearing to occur between 500 m to 700 m above the ground (Able, 1970; Alerstam, 1990; Gauthreaux, 1991 and Cooper and Ritchie, 1995). The wind turbines are in the range of 130 m in height, from the base to the tip of the extended blade, and are therefore of a height less likely to interfere with bird passage.

Several birds detected during the avian survey, including the Bald Eagle, Red-tailed Hawk, Osprey, Northern Harrier, Common Raven and American Crow use thermals and updrafts to gain altitude. This behaviour can lead to an increased risk of collision if turbines are sited in areas conducive for this purpose. These species were detected during both the spring and fall fly-over surveys and are known to use thermals and updrafts. Although no American Woodcock were detected within the study area during the avian field program, a deceased American Woodcock was detected outside the study area having struck a utility pole or line. Male American Woodcocks will perform elaborate flight songs, using any open, relatively flat area with bare ground, short grass, or even patches of snow as a display ground, sometimes far from their preferred diurnal habitat (Keppie and Whiting Jr., 1994). Their flight songs involve a wide, upward spiral to a height of 70-100 m, before diving in a steep, zigzag fashion (Cornell Laboratory of Ornithology, 2013). The cleared areas around newly erected turbines might attract woodcocks as a platform for their flight songs.

Despite the large number of migrating Double-crested Cormorants observed during the Fall Fly-Over Surveys, wind turbines would pose little risk for this species. During migration, these birds were always observed flying well above the proposed turbine height (>140 m) in linear formations.

7.3.4.3 Mitigative Measures

Under the *Migratory Bird Convention Act*, it is prohibited to destroy a nest of a bird listed under the Act. To mitigate the effect on habitat and breeding birds, clearing activities should occur outside the main breeding bird season (May 1st to August 31st). Breeding bird seasons vary depending on species and there is a possibility for birds to breed during the early breeding season which can include April and March.

Initial siting and wind turbine choice could be viewed as the primary mitigative measures. The selected wind turbine towers are a modern, solid, tubular design. This is preferable to latticed designs used elsewhere that act as attractive perches for many species of raptor and songbird.

Although it is known that wind turbines will from time to time kill birds, it is also important to put such kills into perspective. The following paragraph addresses this issue:

> "One American study estimated that an average of 2.19 birds is killed annually at each wind turbine in the United States. Outside of California, the estimated fatality rate drops to 1.83 (there is no published study of the impacts of wind turbines on birds in Canada). Therefore, based on 15,000 American wind turbines in operation, approximately 33,000 birds are killed each year by wind turbines in the US including 26,000 in California alone. Although 33,000 is

a lot of dead birds, the overall impact is small when compared to the millions of birds that travel over wind farms each year; not to mention the millions to hundreds of millions of birds that die due to collisions with transmission lines, vehicles, buildings and communication towers each year. Even if there were a million turbines in North America, they would likely not contribute to more than a few per cent of all bird collision deaths attributed to human structures" (Whittam and Kingsley, 2003).

7.3.4.4 Cumulative Effects

There are no known works in the vicinity of the Project site and surrounding communities that would act cumulatively with the Project to negatively impact migratory and breeding birds; no cumulative effects are anticipated.

7.3.4.5 Residual Effects

In summary, although there may be some minimal impact on birds, the construction, operation and decommissioning of the wind farm is unlikely to result in a significant adverse effect on migratory and breeding birds; the impact will be negligible.

7.3.5 Bats

As stated in section 4.3.7.2, there are no hibernacula in the area; further the Project site does not provide ideal bat habitat due to its open, exposed nature. It is probable, however, that at least two species of bats, the little brown bat and the northern long-eared bat, could be found in the area in the spring, summer and fall.

A significant environment effect on bats would result if a substantive change in the numbers of bats could be attributed to the development and operation of the Project.

7.3.5.1 Boundaries

The spatial boundaries associated with the determination of effects on bats is restricted to the Project footprint. The pertinent temporal boundary is the duration of the Project, i.e., 20 years or more.

7.3.5.2 Pathway Analysis

The two primary pathways that may cause detrimental impacts to bats are:

- the destruction of their habitat during Project construction; and
- the operation of the wind turbines throughout the operating life of the Project.

There will be some habitat loss, but the footprint is small relative to the balance of the Project. Although the turbines pose some danger to bats, two factors are important: the area provides generally poor habitat for bats and there are only three turbines.

7.3.5.3 Mitigative Measures

No mitigative measures are proposed.

7.3.5.4 Cumulative Effects
There are no known works in the vicinity of the Project site that would act cumulatively with the Project to negatively impact bats; no cumulative effects are anticipated.

7.3.5.5 Residual Effects
Although there may be some minimal impacts on bats, the construction, operation and decommissioning of the wind farm is unlikely to result in a significant adverse effect on bats; the impact will be negligible.

7.3.6 Mammals
As indicated in Table 5.1, attendees at the Open House articulated concern that mammals, particularly deer, lynx and bears would be adversely affected by the construction and operation of the three WTGs. The field teams saw evidence of both bear and deer presence on site; they noted moose scat and an old browse and evidence of the presence of smaller mammals. No evidence of lynx was seen.

A significant environmental effect on mammals would result if a substantive change in the numbers and habits of any species could be attributed to the development and operation of the Project.

7.3.6.1 Boundaries
The spatial boundary associated with the determination of effects on mammals encompasses the entirety of the Project site and the immediately adjacent lands. The pertinent temporal boundary for the assessment of Project impacts on mammals is the duration of the Project, i.e., 20 years or more.

7.3.6.2 Pathway Analysis
The two primary pathways that may cause detrimental impacts to mammals are:
- the destruction of habitat during the Project Construction; and
- the operation of the wind turbines throughout the operating life of the Project.

The clearing of vegetation to enable the construction of the access roads and the turbine pads will result in habitat loss to some mammal species, particularly the small species. The larger mammals, particularly bear, deer and moose likely spend the greater part of their time in the deeper woods on site or in the abutting wilderness areas.

The presence and operation of the turbines may cause disturbance to certain mammals, particularly the larger mammals until they become accustomed to their presence.

7.3.6.3 Mitigative Measures
Apart from minimizing clearing to the extent practical, no other mitigative measures are proposed.

7.3.6.4 Cumulative Effects
There are no known works in the vicinity of the Project site that would act cumulatively with the Project to negatively impact mammals; no cumulative impacts are anticipated.

7.3.6.5 Residual Effects

The Project is not anticipated to have a significant residual environmental effect on mammals; the impact will be negligible.

7.4 Socio-Economic Issues

Examination of Table 7.1 indicates that the various activities associated with the Project's construction, operation and subsequent decommissioning may impact land use, employment and the economy, residential factors, visual impact, traffic patterns and health and safety. As detailed in 4.5, no visible signs of archaeological resources were found during the field work undertaken and the study area, including the access road, was determined to be of low archaeological potential. No further evaluation is undertaken of this socio-economic issue. Similarly the MEKS revealed no First Nations interests within, or in the immediate vicinity of, the Project site. No further evaluation is undertaken of this socio-economic consideration.

7.4.1 Land Use

As indicated in section 1.5.3, the Project site is zoned RE (Resource); it is directly surrounded by lands zoned as Protected Area (PA) or Conservation (P-3). The Project site is private property, but is used for hunting, by ATVs, and is occasionally visited by naturalists. ATV trails were observed in the south-west portion of the site. Deer blinds and bear baiting stations were observed throughout. At the present time there are no barriers to inhibit public access to the site.

A significant effect on land use would result if a significant change occurred in existing land use practices that could be attributed to the Project.

7.4.1.1 Boundaries

The spatial area of greatest relevance includes those lands within 1,000 m of the wind turbines; the temporal boundary extends over the life of the Project, i.e., 20 years or more.

7.4.1.2 Pathway Analysis

There is little if any commercial use of the lands within 1,000 m of the Project site and no occupied residential units. As indicated above, the Project lands are used intermittently for recreational purposes, e.g., hunting, hiking, etc., and people currently have free access to the Project site and through the Project site to adjoining lands. This will not change because three turbines have been constructed and are in operation.

Although there will always be some demand for new development, including new housing, Terence Bay has experienced an 8.1% decline in population since 2006 census. It is not an area experiencing rapid growth. The proposed development will bring some enhanced value to what is presently an unused, or at best under used lot, and will in no way inhibit the current and future use of adjoining lands.

In the interests of safety, access to those areas of the Project site that will accommodate the development will be restricted during both construction and decommissioning.

7.4.1.3 Mitigative Measures

Apart from minimizing the footprint of the proposed works, no specific mitigative measures are proposed to protect existing land use in the area. To ensure the safety of individuals who may use the area for recreational purposes, 'no trespassing' signs, or signs highlighting the safety risks associated with the wind turbines, e.g., ice throws, will be posted around the perimeter of the property.

7.4.1.4 Cumulative effects

There are no other known works that would act cumulatively with the proposed Project to adversely impact land use in the area; no cumulative effects are anticipated.

7.4.1.5 Residual Effects

Based on the above analysis, the Project is not anticipated to have a significant residual effect on land use; the impact is expected to be negligible.

7.4.2 Employment and the Economy

The development of the three WTGs will generate taxes for HRM and its construction will generate some local employment for a limited period. Employment and the economy have therefore been identified as a socio-economic factor to be evaluated.

A significant effect on employment and the economy would result if a substantive change in either employment or the economy could be attributed to the Project.

7.4.2.1 Boundaries

The spatial area of interest is the acceptable commuting distance to the Project site and the municipality to which taxes will be paid, i.e., HRM. The temporal boundary is the life of the Project, i.e., 20 years or more.

7.4.2.2 Pathway Analysis

Both the development and decommissioning of the proposed Project will generate some employment for defined periods of time. Labour will be required, for example, to clear certain portions of the site, to develop the access road, the wind turbine sites and laydown areas and to build the wind turbines. Although contractors have not yet been selected, construction will provide temporary employment; some of this labour will be drawn from the regional area. Throughout construction, those working on the Project will seek services and supplies such as gas, accommodation and food to more sophisticated equipment and services both in the immediate and regional areas. These expenditures, large and small, will bring benefit to a range of suppliers.

After the wind turbines are up and operational, there will be a need for one or two skilled persons with applicable training to maintain the wind turbines and to assist with the management of the site.

A tax benefit will also accrue to HRM and to the province of Nova Scotia. Legislation has been enacted as to how this amount is determined.

7.4.2.3 Mitigative Measures
No mitigative measures are recommended.

7.4.2.4 Cumulative Effects
There are no known works in the vicinity of the Project site and surrounding communities that would act cumulatively with the Project to impact employment and the economy; no cumulative effects are anticipated.

7.4.2.5 Residual Effects
Based on the evaluation undertaken, the Project will result in temporary employment opportunities during construction and decommissioning, long term employment for maintenance and site management, and will create a tax base for the Municipality. The impact will be beneficial.

7.4.3 Residential Factors – Proximity, Value and Taxes
Among the matters raised at the Open House, there were several that articulated concern about the impact of the proposed development on residential property. Taken together these related to the proximity of the residential property to the turbines, the impact of the development on property value and whether the proposed development would trigger an increase in the residential tax rate.

Whenever a new use, particularly an industrial or commercial use, is introduced into an area, there is often concern that such a use will cause a decrease in property values. It is a difficult subject, because there are many variables that affect property value. Thus empirically isolating the impacts of one variable, in this instance a small wind farm, is difficult if not impossible. It is possible to theorize about variables such as landscape aesthetics in a scenic area, and whether or not a change in such a landscape would lower property value, but it would remain only one of the variables involved. Property values have been identified as a socio-economic issue to be considered in the evaluation.

The proposed Project is located amidst forested land approximately 4.5 km west of the community of Terence Bay and over 8 km from the coast. As detailed in sections 2.1, the nearest dwelling to a proposed turbine is 1,112 m distant from the nearest turbine.

Property values fluctuate for a variety of reasons including, but not limited to the demand for property in an area, and the nature and age of the property involved. Values can both increase and decrease over time. Whether or not the development and operation of a wind farm might influence such trends is difficult to determine and there are only a few studies that explore this issue. The findings of a study undertaken by Sterzinger et al., in 2003 in the US suggested that the development of a wind farm had no adverse impacts on property values within a radius of 5 km of such a development. For their study, Sterzinger et al., compiled data on US wind farms commissioned between 1998 and 2001 that had a capacity of 10 MW or greater. Property sales records for an area within 8 km of the wind farm site were compiled for three years prior to commissioning and for three years subsequent to commissioning to determine change. For comparison, sales records were also compiled for the same period from communities comparable to that for each wind farm. A total of 10 wind farms were examined. Overall, property values increased at the same rate in the wind farm communities as they did in those communities without wind farms. Nine of the 10 projects showed a greater increase in property values after commissioning compared to the period prior to commissioning. Indeed, communities near a wind farm actually experienced greater increases to property values than those without a nearby wind farm. These findings suggest that there is no support for the notion that the development of wind farms decreases property values.

The British Wind Energy Association posted a news article in March 2007 that concluded that the effect of wind farms on property values is neutral or positive. This conclusion was based on an independent study conducted by the Royal Institute of Chartered Surveyors and Oxford Brookes University which found that there was no clear relationship between the location of a wind farm and property values in the surrounding area. Two more recent studies, one conducted in Ontario (CANWEA, 2010) and one in Central Illinois (Hinman, 2010) confirm the above conclusions. In the Executive Summary to the latter study, the following was stated:

> "The examination results provided evidence that a "locational effect" exists such that before the wind farm was even approved, properties located near the eventual wind farm area were devalued in comparison to other areas. Additionally, the results show that property value impacts vary based on different stages of wind farm development. These stages of wind farm development roughly correspond to the different levels of risk as perceived by local residents and potential homebuyers. Some of the estimation results support the existence of 'wind farm anticipation stigma theory' meaning that property values may have diminished in 'anticipation' of the wind farm. Wind farm anticipation stigmas likely due to the impact associated with a fear of the unknown, a general uncertainty surrounding the proposed wind farm project regarding the aesthetic impacts on the landscape, the actual noise impacts from the wind turbines, and just how disruptive the wind farm will be. However, during the operational stage of the wind farm project, as surrounding property owners living close to the wind turbines acquired additional information on the aesthetic impacts on the landscape and actual noise impacts of the wind turbines to see if any of their concerns materialized, property values rebounded and soared higher in real terms than they were prior to wind farm approval. Thus, this study presents evidence that demonstrates close proximity to an operating wind farm does not necessarily negatively influence property values or property value appreciation rate."

A significant impact on property values would result if a substantive decline in property values, greater than any comparable shift in property value in the area, could be attributed to the development and operation of the proposed wind farm.

7.4.3.1 BOUNDARIES

The spatial boundaries with respect to these residential factors are difficult to define, but may be assumed to include properties within the viewshed of the wind farm, i.e., perhaps the areas identified within the 10 km boundary depicted in Figure 3.6. Property beyond that boundary would be unlikely to be affected by the presence of the Project. Sterzinger et al., for example, adopted the premise that wind developments could have a visual impact within 8 km of the turbines; they suggested that although WTGs might be visible beyond that distance, they do not tend to be highly noticeable, and at that distance they have relatively little influence on the area's overall character. The temporal boundary is the life of the Project, i.e., 20 or more years.

7.4.3.2 Pathway Analysis

Proximity

There is no occupied residential property within 1,000 m of the proposed development, and all requirements for adequate buffering distances have been met. Further, as detailed in sections 7.2.3 and 7.2.4, the distances that have been achieved between the nearest residential properties and the WTGs will ensure that these homes will not be disturbed by either noise or shadow flicker. Proximity therefore is not an issue.

Property Value

All people in the local area are more than 1,000 m distant from the proposed Project with many more than 2,000 m distant. Although there may be some disturbance or nuisance caused to the residents in these areas through the period of construction, it is the longer timeframe associated with the operation of the wind farm that would have an effect, if any, on property value. As stated above, it is difficult to determine whether the development and operation of three WTGs within a certain distance of a property would be the key variable influencing a change in the value of that property. If, as is the case in this instance, there are only three WTGs set a minimum of 1,000 m or more distant from all residential properties, it would appear unlikely that the development would have a detrimental impact on property value.

Residential Property Tax

The development and operation of the proposed wind farm will generate taxes to the Municipality and to the Province, and the proponent will be responsible for any upgrades necessary to the access roads to enable the transportation of the turbine components to the site. In this context the development and operation of the wind farm will augment the taxes collected as opposed to imposing a burden that might be passed on to the residential tax base.

7.4.3.3 Mitigative measures

No mitigative measures are necessary.

7.4.3.4 Cumulative Effects

There are no other known works proposed in the area that would act cumulatively with the Project to impact the residential factors referenced above; no cumulative effects are anticipated.

7.4.3.5 Residual Effects

Based on the above analysis and the negligible residual effects predicted for either the biophysical VECs or other social and economic issues, the Project is not anticipated to have an adverse effect on the residential factors considered; no impact is predicted.

7.4.4 Visual Impact

Wind turbines are highly visible in most landscapes due to their size and can be intrusive. As such, visual impact has been identified as a socio-economic factor to be evaluated. There are views in Nova Scotia and elsewhere that are highly valued as reflective of the locality and that attract visitors to an area, i.e., views can have an intrinsic economic value. The Chebucto Peninsula is known for its stark, coastal beauty. Small islands dot the coastline and the coastal and near-coastal ecosystem remains, largely, unaltered with little industrial activity. Its close proximity to Halifax heightens its appeal: route 333 is popular in the summer time as tourists travel to and from Peggy's Cove lighthouse and boating is popular along the coastline. Adverse visual impacts can be defined as 'unwelcome visual intrusion, or the creation of visual contrasts, that affect the quality of the landscape' (BLM, 2004).

A significant visual impact would involve substantive intrusion into a view of provincial or national significance and having a recognized economic value in the local economy.

7.4.4.1 BOUNDARIES

The visual impact of the proposed Project extends some distance from the site itself. Two factors come into play:

- Distance and topography; and
- Vegetation and manmade structures that may block the line of sight to one or more of the turbines.

As detailed in section 3.2.3.3, a viewshed analysis was conducted for an area of several kilometres around the proposed wind farm. The further away from the proposed turbines, the smaller they will appear and the less intrusive they will be on the line of sight, i.e., spatial boundaries encompass the area from which the turbines are visible. The temporal boundary is the operating life of the proposed Project, i.e., the time period that the turbines will be in place, 20 years or more.

7.4.4.2 PATHWAY ANALYSIS

As detailed in sections 3.2.3.3 and 4.5.8, a visibility analysis was conducted and visual simulations prepared for six locations (Figure 3.7). The results of this analysis are depicted in Figures 4.13 through 4.19. The depictions illustrate different perspectives and show how vegetation and distance alter the impact.

7.4.4.3 MITIGATIVE MEASURES

The visual impact of the Project cannot be totally avoided. A number of mitigative measures, however, have been considered by the turbine manufacturers in the design of their products and by the proponent in the consideration of the layout of the wind farm. These include:

- Tubular towers presenting an aesthetic design balance;
- Off white, or essentially very light grey in colour, and non-reflective, i.e., not shiny;
- All wind turbines will be ENERCON E-92s, i.e., the same model;
- Minimizing the lighting on the turbines to what is required for air safety;
- Minimizing the Project footprint;
- Limit tree-falling and brush clearing during construction;

- Maintaining the turbines on a regular basis; and
- Removing all construction debris and associated litter, thereby maintaining a tidy and clean site.

7.4.4.4 Cumulative Effects

There are no known works in the vicinity of the Project site that would act cumulatively with the Project to impact the visual frame of reference; no cumulative effects are anticipated.

7.4.4.5 Residual Effects

Based on the analysis undertaken, the implementation of the recommended mitigative measures, including the maintenance of a tidy and clean site, the proposed Project is not anticipated to have adverse effects on visual aesthetics. Indeed, given the subjective nature of the topic, there may be many in the community that perceive the sight of the proposed turbines in the distance as attractive and as contributing positively to the environment and to the local and provincial economy. The impact is expected to be negligible.

7.4.5 Traffic

As indicated in Section 4.5.4, the Project site is accessed from River Road. River Road and Terence Bay Road are rural residential roads that service residential traffic. Route 333 is a secondary highway servicing residential traffic and summer tourist traffic. All roads that will be used to accommodate the transportation of the turbine components to the site will be evaluated as to their capacity and some select upgrading may be necessary to facilitate the movement of the large loads that will be involved.

A significant effect would be if there was substantial damage incurred to the road system or substantive inconvenience to the movement of local traffic on Terence Bay Road, Route 333 or elsewhere in the vicinity of the Project site.

7.4.5.1 Boundaries

The spatial boundary is the roads that will be used through the construction and decommissioning phases of the Project. The temporal boundaries are primarily those associated with the construction and decommissioning phases of the Project.

7.4.5.2 Pathway Analysis

During both construction and decommissioning, the roads referenced above will be accommodating increased and heavier traffic on a daily basis. The transportation of the major wind turbine components will involve the use of a number of large flatbed trucks. Their movement on local roads may be slow and may cause inconvenience to the local traffic for a limited duration of time.

7.4.5.3 Mitigative Measures

The proponent will work closely with all parties involved, including NSTIR, to evaluate what works, if any, need to be done to the roads to ensure the integrity of road structures, the safety of the travelling public and to minimize the inconvenience to road users. On the recommendations of the authorities, including the RCMP, the roads will be posted and flagged during key transportation events and the proponent will ensure that every effort will be made to ensure that oversized loads are delivered during times of lowest traffic.

7.4.5.4 Cumulative Effects

There are no other known works proposed in the Terence Bay area that would act cumulatively with the Project to acerbate construction traffic; no cumulative effects are anticipated.

7.4.5.5 Residual Effects

The construction traffic necessary to facilitate the development of three WTGs will cause a modicum of inconvenience to other road users for a limited period of time. There will be no impact on traffic patterns during the day to day operations of the Project. The impact is expected to be negligible.

7.4.6 Health and Safety

Regard for public health and safety and the occupational safety of workers is very important to the Proponent and to all associated with the development and operation of the proposed Project. Considerations discussed in this section include ice throw, EMFs and occupational and site safety. Health and safety has been identified as a socio-economic issue to be addressed because it was raised at the open house and it is a factor of interest to Health Canada.

A significant effect on health and safety would result if the health or safety of those involved in the construction and operation of the wind farm, those who access the lands at the Project site, or those who live in the surrounding area were adversely impacted.

7.4.6.1 Boundaries

The spatial area associated with the above safety issues is primarily the Project site; the exception is the larger area that should be taken into account when dealing with noise and shadow flicker, i.e., an area up to 1,517 m from a wind turbine. The temporal boundary involves the construction, operation and decommissioning phases of the proposed Project.

7.4.6.2 Pathway Analysis

Ice Fall or Throw

Under certain atmospheric conditions, it is possible for ice to form on the wind turbine blades. Generally, icing occurs at temperatures below 0°C when there is humidity in the air. The type, amount and density of ice depend on both meteorological conditions and the dimensions and type of structure (moving/static). To the extent such icing may occur, it can break free in a warming of temperatures or by movement of the blades and fall or be thrown to the ground. As detailed in section 2.2.6 and Appendix E, the WTGs for this Project will be installed with ice detection and blade de-icing systems.

Given the meteorological conditions in the area 15 to 25 freezing rain events may not be uncommon in an average year. However, for the reasons noted above, it is not necessarily the case that ice accumulation on wind turbine blades will occur with this frequency. If ice does form on the blades on occasion or occasions through the winter period, the risks of any safety concern are then a function of proximity of the wind turbine to residences and persons in the area and any mitigation measures undertaken by the proponent. It is noteworthy to consider the work done by Garrad Hassan as described in the report entitled *Recommendations for Risk Assessment of Ice Throw and Blade Failure in Ontario*. In this work, it was found (in the Ontario context) that the risk of a fixed dwelling situated 250 m from a turbine being struck by ice fragments is equivalent to 1 in 300 years and the risk to an individual being struck in the vicinity of the dwelling is equivalent to 1 in 500,000 years. There are no residential dwellings within 1,000 m of a proposed WTG. The risk is to people who are for whatever reason in substantially closer proximity to a WTG.

Ice may accumulate on wind turbine blades under conditions of freezing rain or melting snow, however the in-situ designs outline will greatly minimize the risk of ice throws. Safety issues, however, can arise if anyone is within 140 m of a turbine when ice does slide, or is thrown off the blades.

Electric and Magnetic Fields

Power frequency electric and magnetic fields (EMFs) are present everywhere electricity flows. All electric wires and the lighting, appliances and other electrical devices they supply are sources of electric and magnetic fields. Although they are often referenced together as EMFs, electric fields and magnetic fields are actually distinct components of electricity. Most of the public interest regarding possible health effects is related to magnetic fields. So usually, when the term EMF level is used, it is the magnetic field strength that is being referred to. Both electric and magnetic fields, whether it is a power line or an appliance such as a hair dryer, dishwasher or microwave oven, are strongest at their sources; these fields, including those associated with the wind turbines, decrease rapidly as you move away from the sources and become indistinguishable from background levels.

Both electric and magnetic fields decrease rapidly as you move away from the source and become indistinguishable from background levels. The term “extremely low frequency” is used to describe any frequency below 300 Hz, and power frequency EMF (such as that from components of the proposed Project) has a frequency of 60 Hz, placing it in the extremely low frequency category. It is at the lower end of the spectrum near DC electricity and well below the microwave, or RF (radio frequency) radiation emitted by cellular phones and radio broadcast transmitters. Epidemiological studies have failed to establish a cause and effect relationship between electromagnetic energy and health concerns. As a consequence, there are no Canadian government guidelines for exposure to EMFs at extremely low frequencies. Health Canada does not consider guidelines necessary because the scientific evidence is not strong enough to conclude that typical exposures cause health problems. Based on the evidence there is no obvious pathway between the proposed Project and the articulated public concern with respect to EMFs.

Occupational and Site Safety

The assembly and maintenance of wind turbines pose the range of occupational health and safety issues associated with any major construction project that involves the use of heavy equipment and the assembly of large structures. Ensuring the safety of all parties on site is a priority of the proponent and all associated with the proposed Project and, as will be referenced below, the Proponent will take steps to ensure site safety for all concerned.

7.4.6.3 Mitigative Measures

The siting of the proposed wind turbines relative to the nearest residential property could be viewed as a preliminary mitigative measure. Further proposed mitigative measures for the different phases of the Project in conjunction with the preparation of a comprehensive EMP will ensure that the health and safety of the workforce, those accessing the lands at the Project site and those working in proximity to the site are protected. More specifically the following mitigative measures are proposed:

- Training including training on the hazards associated with ice forming on tall structures;
- A flag placement protocol which will necessitate the posting of a falling ice warning if, and when, ice is identified as an issue. This necessitates that operational staff are trained to be aware of the conditions likely to lead to ice accumulation on the wind turbines and the risk of ice falling;
- Signs highlighting potential hazards associated with the site, i.e., ice throw, will be posted around the property;
- Establishment of a comprehensive EMP which will include a Contingency and Safety Plan; the latter will detail the training and the protective equipment required for all who access the site;
- Access to the site will be restricted to authorized personnel throughout the construction period;
- During construction and decommissioning, activities will be restricted to daytime hours to minimize noise disturbance.

7.4.6.4 Cumulative Effects

There are no other known works that will take place within the vicinity of the Project site that would act cumulatively with the proposed Project to impact upon health and safety; no cumulative effects are anticipated.

7.4.6.5 Residual Effects

Based on the analysis undertaken and the implementation of the recommended mitigative measures, the Project is unlikely to have a significant adverse effect on health and safety; the impact is expected to be negligible.

7.5 Effects of the Environment on the Project

Several environmental factors, e.g., fire, extreme weather, and climate change, could have an adverse effect on the Project. These factors have all influenced the design criteria for the turbines and the layout of the proposed wind farm.

7.5.1 Boundaries

The spatial boundaries for these effects are restricted to the Project site. Temporal boundaries include all Project phases: construction, operation and decommissioning. Fire and extreme weather events could adversely impact the Project schedule, but such events are likely to be of short duration. Fire in the area could be instigated by both natural events, e.g., a lightning strike, or by humans. Extreme weather events, including such events as might be aggravated by global warming, including ice formation, high winds, hail or lightning strikes, could damage the turbines.

7.5.2 *Pathway Analysis*

Fire and extreme weather could conceivably damage the installed facilities, reduce productivity and/or cause the turbines to be shut down.

7.5.3 *Mitigative Measures*

The design and operation of the wind turbines, however, include measures to address the consequences of extreme weather events. For example, the turbines and transformers are equipped with temperature related alarms. In addition, there are fire watches maintained during the most sensitive dry summer months in the region. It is therefore likely that any fire would be quickly detected and a prompt emergency response instigated. The turbine towers are also sufficiently high that damage to the nacelle in the event of a fire is unlikely. Any damage to power transmission in such circumstances would be quickly repaired.

During high wind events, or ice formation, the design of the wind turbines is such that the wind turbines will cut out. These factors have been taken into consideration in the operational and commercial planning of the Project. As referenced in Section 2.2.5, the turbine towers will be equipped with lightening protection and damage to wind turbines from such an event is considered very rare.

In conclusion, extreme weather events are unlikely to pose a significant adverse effect on project construction, operation or decommissioning.

7.5.4 *Cumulative Effects*

There are no other known works taking place in the vicinity that might act cumulatively with severe weather events to increase the likelihood of an adverse environmental effect on the Project; no cumulative effects are anticipated.

7.5.5 *Residual Effects*

Extreme environmental events are not anticipated to have a significant residual environmental effect on the Project, i.e., the impact is predicted to be negligible.

7.6 Summary of Potential Environmental Impacts

Residual environmental effects are those predicted to remain after the proposed mitigative measures have been implemented. Table 7.2 summarizes those effects for the proposed Project for each VEC or socio-economic issue. The effect is presented in terms of nature of effect, magnitude, reversibility, duration, timing and aerial extent. These are defined as:

- Nature of effect, i.e., positive (+) or negative (-);
- Magnitude of effect on background levels, i.e., small, moderate or large;
- Reversibility of the effect, i.e., reversible or irreversible;
- Timing of the effect during construction or operation, i.e., long or short term; and
- Aerial extent of the effect, e.g., immediate area of construction is considered local.

Table 7.2: Residual Effects Assessment

VEC or Issue	*Nature*	*Magnitude*	*Reversibility*	*Timing*	*Extent*
Ground and Surface Water Quality	-	Small	Reversible	Short	Local
Watercourses	-	Small	Reversible	Short	Local
Noise	-	Small	N/A	Long	Local
Flicker	-	Moderate	N/A	Long	Local
Wetlands	-	Small	Reversible	Short	Local
Vegetation and Forest Cover	-	Small	Irreversible	Long	Local
Species of Concern	NI	N/A	N/A	N/A	N/A
Migratory and Breeding Birds	-	Small	Reversible	Long	Local
Bats	-	Small	Reversible	Long	Local
Mammals	-	Small	Irreversible	Long	Local
Adjacent wilderness areas	N/A	N/A	N/A	N/A	N/A
Land Use	-/+	Small	Reversible	Short/Long	Local
Employment and the Economy	+	Moderate/Small	N/A	Short/Long	Regional
Residential factors: proximity, value and taxes	NI	N/A	N/A	N/A	N/A
Visual Impacts	-	Small	Reversible	Long	Local
Traffic	-	Small	Reversible	Short	Local
Health and Safety	-	Small	Reversible	Long	Local
Aboriginal Use of Lands	NI	N/A	N/A	N/A	N/A
Archaeological Resources	NI	N/A	N/A	N/A	N/A

NI = No Impact
N/A = Not Applicable

This is an important Project. Given the nature of such an investment, numerous studies have been executed and detailed engineering and associate work is ongoing to ensure that all necessary issues are addressed and that both corporate and regulatory decision makers have the information that they require to make decisions in a timely manner. It is a progressive and iterative process. Environmental work continues to be executed and will be an integral work stream throughout detailed engineering and construction.

Because the adverse residual effects are primarily small to moderate, reversible and local, it is concluded that the undertaking can be executed with negligible residual effects on VECs and socio-economic issues with the application of standard and accepted industry practices and procedures, adherence to applicable regulations and guidelines, and proactive environmental protection planning, including implementation of the mitigative measures as identified.

7.7 Environmental Management and Monitoring

While it is anticipated that the residual environmental effects of the proposed works will be negligible based on the work that has been conducted, the Proponent will prepare an EMP to address potential issues and concerns and to ensure that the necessary work through Project construction and decommissioning is undertaken with due regard to environmental considerations and safety. The proponent also undertakes to honour all commitments made in this environmental assessment and to comply with all applicable laws and regulations. As indicted in Table 7.2, most, if not all, potential adverse effects, can be avoided through the application of good engineering and construction practices, the careful timing of activities and the adherence to appropriate environmental management techniques. All work in and around the site will be undertaken in accordance with the standards and protocols set out in the *Erosion and Sedimentation Handbook for Construction Sites.*

The EPP is a key component of the EMP and will be developed for both the construction and operation phases of the Project. The underlying objective of the construction EPP is to reduce environmental impacts during this period and consists of routine activities including:

- Contingency procedures in the event of an erosion control failure;
- Procedures to address fuel and hazardous material spills;
- Procedures to address fire; and
- Procedures to address any archaeological finds.

The EPP for construction will detail inspection and reporting requirements, include detail of the applicable permits, approvals and authorizations, and incorporate a key contact list. The EPP for the operation of the wind farm will articulate guidelines for equipment maintenance activities, the storage, handling and disposal of petroleum, oils and lubricants, and the safe storage and handling of hazardous materials.

A second component of the EMP is the Contingency and Safety Plan. This provides detail of the response system that will be implemented to respond to an accidental event including the release of petroleum, oils lubricants or any other hazardous material. It will reference the need for personnel training, preventative measures, the response plan and a spill clean-up recourse list. The Contingency and Safety Plan will also detail necessary responses to address fire.

Finally, to ensure that work is carried out with minimal consequences for the environment and as a check on the evaluation that has been undertaken, a number of specific environmental effects monitoring programs will be designed and undertaken. Such programs can include either the direct monitoring of specific VECs or the monitoring of the environmental parameters known to be important to the VECs. Such studies are normally undertaken to address the following objectives:

- To verify predictions and evaluate the effectiveness of mitigation measures;
- To detect undesirable changes in the environment; and
- To improve the understanding of environmental cause and effect relationships.

Specific programs will be detailed subsequent to release from the environmental assessment process.

CHAPTER 8 CONCLUSIONS

This environmental assessment was conducted to determine the potential environmental effects of the construction, operation and decommissioning of a proposed wind farm on the Chebucto peninsula in Terence Bay, Nova Scotia, to satisfy the requirements of the *Nova Scotia Environment Act*. Potential environmental effects from Project related malfunctions and accidents were also considered. The proponent conducted an Open House in the Project area and consulted extensively both with and through the auspices of the local municipality and with local individuals. The proponent also met, or communicated, with representatives of a number of federal and provincial departments to discuss the Project and review the environmental work that was being undertaken. The proponent has committed to keep all interested parties informed of Project progress and to respond to all reasonable questions posed.

The proposed project is located on approximately 50 ha of land in the River Road area near Terence Bay to the southwest of downtown Halifax. The proponent plants to construct three 2.35 MW turbines to generate up to 7.05 MW of wind energy under the COMFIT Program for sale to NSPI. To facilitate development, the proponent has entered into lease agreements with the owner of the land parcel involved. The land is owned by Deal Excavating Services Limited and is zoned as resource (RE) and rural wind energy zone (RW-2).

Fieldwork has demonstrated that there will be negligible impacts on the identified physical and biophysical VECS and on the identified socio-economic factors evaluated. The nearest occupied residence that is occupied year round is 1,112 m distant from the closest wind turbine. There will be negligible impacts attributable to noise, flicker or visibility on the surrounding communities. The site`s attributes include its elevation, the wind regime and, as stated, its separation from the nearest occupied dwellings. From the technical and environmental evaluations that have been undertaken, it is an excellent location in which to develop a small wind farm.

The environmental assessment considered biophysical and socio-economic factors. In addition to an extensive search of the literature and pertinent data bases, the study team consulted with regulatory agencies and acknowledged experts in pertinent disciplines. A number of specific field programs were executed: these included field work with respect to birds, vegetation, wetlands and streams, wildlife and archaeology; Membertou Geomatics Solutions conducted a Mi`kmaq Ecological Knowledge Study which is included in its entirety as Appendix K. Eighteen VECs or socio-economic issues were subject to analysis. The significance of the residual effects, i.e., after mitigation has been applied, is predicted for each of the identified VECs and socio-economic issues; the potential for the Project to interact cumulatively with other projects and activities taking place in the area was also factored into the evaluation.

Subject to adherence to all pertinent regulations and the application of appropriate mitigative measures, the conclusion of this environmental assessment is that no significant adverse residual environmental effects are likely as a result of the Project. The generation of electricity from a renewable energy source in this fashion is in accordance with Provincial government articulated strategies and would contribute to a reduction of greenhouse gases as required by the *Environmental Goals and Sustainable Prosperity Act*.

References

Able, K.P. 1970. Radar study of altitude of nocturnal passerine migration. Bird-Banding. 41: 282-290.

Alerstam, T. 1990. Bird Migration. Cambridge University Press, Cambridge, New York, Melbourne. 420 pp.

Baerwald, E. F., d'Amours, G.H., Klug B.J., and Barclay, R.M.R. 2008. Barotrauma is a significant cause of bat fatalities at wind turbines. Current Biology 18:R695–696.

Barclay, R.M.R., Baerwald, E.F., and Gruver, J.C. 2007. Variation in bat and bird fatalities at wind energy facilities: assessing the effects of rotor size and tower height. Canadian Journal of Zoology 85: 381-387.

Barker, R.J., and Sauer, J.R. 1995. Statistical Aspects of Point Count Sampling. Pp 125-130 in *Monitoring Bird Populations by Point Counts*, edited by C. J. Ralph, J. R. Sauer and S. Droege. Albany, CA: Southwest Research Station, Forest Service, U.S. Department of Agriculture.

Bellrose, F.C. 1971. The distribution of nocturnal migrants in the airspace. Auk. 88: 387-424.

BCMOF/CFS (British Colombia Ministry of Forests and Range and the Canadian Forestry Service). 2001. Field Guide to Forest Damage in British Columbia. Second Edition. Edited by J. Henigman, T. Ebata, E. Allen, J. Westfall, and A. Pollard. Joint Publication Number 17.

Broders H.G., Quinn, G.M., Forbes, G.J. 2003. Species status, and the spatial and temporal patterns of activity of bats in southwest Nova Scotia, Canada. Northeastern Naturalist 10:383-398.

Broders H.G., and Forbes, G.J. 2004. Interspecific and intersexual variation in roost site selection of *Myotis septentrionalis* and *M. lucifugus*. Journal of Wildlife Management. 68:602-610.

Buskirk, W.H., and McDonald, J.L. 1995. Comparison of Point Count Sampling Regimes for Monitoring Forest Birds. Pgs 25-34 in *Monitoring Bird Populations by Point Counts*, edited by C. J. Ralph, J. R. Sauer and S. Droege. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.

Canadian Wind Energy Association (CANWEA). 2010. Wind Energy Study – Effect on Real Estate Values in the Municipality of Chatham-Kent, Ontario.

Cameron, R.P. and Richardson, D.H.S. 2006. Occurrence and abundance of epiphytic cyanolichens in Nova Scotia protected areas. Opuscula Philolichenum 3:5-14.

CBCL Limited (CBCL). 2012. Mill Cove Update of Natural Resource Management Plan.

CCME. No date. Canadian Water Quality Guidelines for the Protection of Aquatic Life.

Chapman, S. 2012. The sickening truth about wind farm syndrome. New Scientist. 216: 26-27.

Chrichton, F. Dodd, G., Schmid, G., Gamble, G., and Petrie, K.J. 2013. Can Expectations Produce Symptoms From Infrasound Associated with Wind Turbines? Health Psychol. 33: 360-4.

Conway, Courtney J. 1999. Canada Warbler (Wilsonia canadensis). *The Birds of North America Online (A. Poole, Ed.)*, http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/421/articles/introduction.

Cooper, B.A., and Ritchie, R.J. 1995. The altitude of bird migration in east-central Alaska: a radar and visual study. Journal of Field Ornithology 66: 590-608.

Cornell Laboratory of Ornithology. 2013. *All About Birds*. Available from http://www.birds.cornell.edu/AllAboutBirds/.

COSEWIC. 2012. COSEWIC assessment and status report on the American Eel (*Anguilla rostrata*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.

Cryan, P.M., and Brown, A.C. 2007. Migration of bats past a remote island offers clues toward the problem of bat fatalities at wind turbines. Biological Conservation 139: 1-11.

Cryan, P. M., and Barclay, R. M. R. 2009. Causes of bat fatalities at wind turbines: hypotheses and predictions. Journal of Mammalogy, 90(6): 1330-1340.

Cyr, A., Lepage, D., and Freemark, K. 1995. Evaluating Point Count Efficiency Relative to Territory Mapping in Cropland Birds. Pgs 63-67 in *Monitoring Bird Populations by Point Counts*, edited by C. J. Ralph, J. R. Sauer and S. Droege. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.

Davis, W. H., and H. B. Hitchcock. 1965. Biology and migration of the bat, *Myotis lucifugus*, in New England. Journal of Mammalogy, 46: 296-313.

Davis, D., and S. Brown. 1996. The Natural History of Nova Scotia. Volumes I & II. Published by the Province of Nova Scotia and the Nova Scotia Museum.

Dawson, D.K., Smith, D.R., and Robbins, C.S. 1995. Point Count Length and Detection of Forest Neotropical Migrant Birds. Pgs 35-43 in *Monitoring Bird Populations by Point Counts*, edited by C. J. Ralph, J. R. Sauer and S. Droege. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.

Drewitt, A.L., and Langston, R.H.W. 2006. Assessing the Impacts of Wind Farms on Birds. *Ibis* 148:29-42.

Environment Canada. 2007a. Wind Turbines and Birds: A Guidance Document for Environmental Assessment. http://www.ec.gc.ca/Publications/default.asp?lang=En&xml=9B1BDC4A-E66F-4EAD-B5A9-20475F7DB29B

Environment Canada. 2007b. Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds. http://www.ec.gc.ca/Publications/default.asp?lang=En&xml=C8CE090E-9F69-4080-8D47-0622E115A4FF

Environment Canada Climate Normals: 1971-2000. Available from http://www.climate.weatheroffice.gc.ca/climate_normals/index_e.html

Environmental Goals and Sustainable Prosperity Act. 2001. Bill No. 146. The Nova Scotia Legislature. Available from http://nslegislature.ca/legc/bills/60th_1st/3rd_read/b146.htm

Environmental Laboratory. 1987. US Army Corps of Engineers Wetland Delineation Manual.

Erickson, W., Kronner, K., and Gritski, B. 2003. Nine Canyon Wind Power Project avian and bat monitoring report: September 2002-August 2003. Prepared for Nine Canyon Technical Advisory Committee and Energy Northwest.

Erskine, Anthony J. 1992. *Atlas of Breeding Birds of the Maritime Provinces*. Halifax: Nova Scotia Museum.

Feldmeth R.C., and Baskin J.N. 1976. Thermal and respiratory studies with reference to temperature and oxygen tolerance for the unarmoured stickleback Gasterosteusaculeatus williamsoni hubbs. Bull South Calif Acad Sci. 15:127-131

Garrad, Hassan. 2007. Recommendations for Risk Assessments of Ice Throw and Blade Failure in Ontario.

Gauthreaux, S.A. 1991. The flight behavior of migrating birds in changing wind fields: radar and visual analyses. Amer Zool. 13: 187-204.

Hinman, G.L. 2010. Wind Farm Proximity and Property Values: A Pooled Hedonic Regression Analysis of Property Values in Central Illinois. Illinois State University.

Holland, R.A. 2007. Orientation and navigation in bats: known unknowns or unknown unknowns? Behavioural Ecology and Sociobiology. 61: 653-660.

Johnson, G.D., Erickson, W.P., Strickland, M.D., Shepherd, M.F., Sherpherd, D.A. and Sarappo, S.A. 2003. Mortality of bats at a large-scale wind power development at Buffalo Ridge, Minnesota. American Midland Naturalist 150: 332-342.

Keppie, D.M., and Whiting Jr, M.J. 1994. American Woodcock (Scolopax minor). *The Birds of North America Online (A. Poole, Ed.),* http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/100/articles/introduction.

Kerns, J., Erickson, W.P., and Arnett, E.B. 2005. Bat and bird fatality at wind energy facilities in Pennsylvania and West Virginia. Pp. 24-95 *in* E.B. Arnett, technical editor. Relationships between bats and wind turbines in Pennsylvania and West Virginia: an assessment of bat fatality search protocols, patterns of fatality, and behavioral interactions with wind turbines. A final report prepared for the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas. 187 pp.

Knopper, L.D., and Ollson, C.A. 2011. Health effects and wind turbines: a review of the literature. Environ Health. 10: 78.

Krieger, D.A., Terrell, J.W., and Nelson, P.C. 1983. Habitat suitability information: Yellow Perch. U.S. Fish Wildl Serv. FWS/OBS-83/10.55. 37 pp.

Lynch, J.F. 1995. Effect of Point Count Duration. Time-of-Day, and Aural Stimuli on Detectability of Migratory and Resident Bird Species in Quintana Roo, Mexico. Pgs 1-6 in *Monitoring Bird Populations by Point Counts,* edited by C.J. Ralph, J.R. Sauer and S. Droege. Albany, CA: Southwest Research Station, Forest Service, U.S. Department of Agriculture.

Massachusetts Department of Environmental Protection. 2012. Massachusetts Wind Turbine Health Impact Study.

MTRI (Mersey Tobeatic Research Institute). 2008. Species at Risk in Nova Scotia: Identification and Information Guide. www.speciesatrisk.ca

NRC (National Research Council). 1996. Possible health effects of exposure to residential electric and magnetic fields. National Academy Press, Washington, DC.

Neily, P., Basquill, S., Quigley, E., Stewart, B., and Keys, K. 2011. Forest Ecosystem Classification for Nova Scotia Part I: Vegetation Types. Nova Scotia Department of Natural Resources. Renewable Resources Branch Report for 2011-1.

Neily, P.D., Quigley, E., Benjamin, L., Stewart, B., and T.Duke. April, 2003. Ecological Land Classification for Nova Scotia: *Volume 1 - Mapping Nova Scotia's Terrestrial Ecosystems.*

Nissenbaum, M.A., Aramini, J.J., and Hanning, C.D. 2012. Effects of industrial wind turbine noise on sleep and health. Noise Health. 12:237-243.

NSDNR (Nova Scotia Department of Natural Resources). 2001. Wetlands Database. Available from http://novascotia.ca/natr/wildlife/habitats/wetlands.asp

NSDNR (Nova Scotia Department of Natural Resources). 2003. Renewable Resources Branch. Report DNR 2003 -2. Available from http://www.gov.ns.ca/natr/forestry/ecological/pdf/ELCrevised2.pdf

NSDNR (Nova Scotia Department of Natural Resources). 2010. Forest Ecosystem Classification for Nova Scotia. Prepared by NSDNR Renewable Resources Branch. Report for 2013-1.

NSDNR (Nova Scotia Department of Natural Resources). 2012a. Wet Areas Mapping and Flow Accumulation Channels. Available from http://novascotia.ca/natr/forestry/gis/wamdownload.asp

NSDNR (Nova Scotia Department of Natural Resources). 2012b. Significant Species and Habitat Database. Available from http://www.gov.ns.ca/natr/wildlife/habitats/hab-data/

NSDNR (Nova Scotia Department of Natural Resources). 2013. General Status Ranks of Wild Species in Nova Scotia. Available from http://novascotia.ca/natr/wildlife/genstatus/

NSE (Nova Scotia Environment). 1988. Erosion and Sedimentation Control Handbook.

NSE (Nova Scotia Environment). 2011a. More valuable land protected. Available from http://novascotia.ca/news/release/?id=20111025005

NSE (Nova Scotia Environment). 2011b. Maps and descriptions of 12 percent lands for review. Available from http://www.gov.ns.ca/nse/12percent/maps.asp

NSE (Nova Scotia Environment). 2012. The impacts of climate change on Nova Scotia. Available from http://www.climatechange.gov.ns.ca/content/adapt

NSE (Nova Scotia Environment). 2012. Proponent's Guide to Wind Power Projects: Guide to Preparing an Environmental Assessment Registration Document.

NSE (Nova Scotia Environment). 2013. Climate Change Nova Scotia. Available from http://www.climatechange.gov.ns.ca/content/impacts

NS Fisheries and Aquaculture. 2007. Species fact sheets: Speckled trout. Available from http://www.novascotia.ca/fish/sportfishing/species/spec.shtml

Massachusetts Department of Environmental Protection. 2012. Wind Turbine Health Impact Study: Report of Independent Expert Panel. Available from http://www.mass.gov/eea/docs/dep/energy/wind/turbine-impact-study.pdf

Page, L.M., and B.M. Burr, 1991. A field guide to freshwater fishes of North America north of Mexico. Houghton Mifflin Company, Boston. 432 p.

Pendleton, G.W. 1995. Effects of Sampling Strategy, Detection Probability, and Independence of Counts on the Use of Point Counts. Pgs 131-133 in *Monitoring Bird Populations by Point Counts*, edited by C. J. Ralph, J. R. Sauer and S. Droege. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.

Peterson, R.T. 1980. Field Guides to Eastern Birds.

Peterson, R.H., Coombs, K., Power, J., and Paim, U. 1989. Responses of several fish species to pH gradients. Can J Zool. 67: 1566-1572.

Petit, D.R., Petit, L.J., Saab, V.A., and Martin, T.E. 1995. Fixed-Radius Point Counts in Forests: Factors Influencing Effectiveness and Efficiency. Pgs 49-56 in *Monitoring Bird Populations by Point Counts*, edited by C. J. Ralph, J. R. Sauer and S. Droege. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.

Poissant J.A., Broders H.G., Quinn G.M. 2010. Use of lichen as a roosting substrate by Perimyotis subflavus, the tricolored bat, in Nova Scotia. Ecoscience 14: 372-378.

Provincial Parks Act. R.S., c. 367, S. 1. 1987. The Nova Scotia Legislature. Available from http://nslegislature.ca/legc/statutes/provpark.htm

Raleigh, R. F. 1982. Habitat suitability index models: Brook trout. U.S. Dept. Int., Fish Wildl. Servo FWS/OBS-82/10.24. 42 pp.

Ralph, C. J., Droege, S., and Sauer, J.R. 1995. Managing and Monitoring Birds Using Point Counts: Standards and Applications. Pgs 161-169 in *Monitoring Bird Populations by Point Counts*, edited by C. J. Ralph, J. R. Sauer and S. Droege. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.

Ratzlaff, N.S., and Barth, R.E. 2007. Field Guide to Trees, Shrubs, Woody Vines, Grasses, Sedges and Rushes: Fontenelle Forest and Neale Woods Nature Centers. Fontenelle Nature Association. 218 pp.

RIC (Resource Inventory Committee). 2001. Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Standards and Procedures. BC Fisheries Information Services Branch.

Reynolds, C. 2011. The Effect of Acidification on the Survival of American Eel. M.Sc. Thesis. Department of Biology, Dalhousie University, Halifax, N.S. vi + 67 p.

Rosenberg, K. V., and Hodgman, T.P. 2000. Partners in Flight Bird Conservation Plan for Eastern Spruce-Hardwood Forest (Physiographic Area 28).

Rydin, H., and Jeglum, J.K. 2006. The Biology of Peatlands. Oxford University Press. 343 p.

Sadar, M.H. 1994. Environmental impact assessment. Carleton University Press for the Impact Assessment Centre, Carleton University, Ottawa. 125 pp.

Seltenrich, N. 2014. Wind Turbines: A New Breed of Noise. Environ Health Perspect. 122: A21-25.

Shepherd, D., McBride, D., Welch, D., Dirks, K.N., and Hill, E.M. 2011. Evaluating the impact of wind turbine noise on health-related quality of life. Noise Health. 13: 333-9.

Special Places Protection Act. R.S., c. 438, s. 1. 1989. Nova Scotia Legislature. Available from http://nslegislature.ca/legc/statutes/specplac.htm

Species at Risk Public Registry. 2013. http://www.sararegistry.gc.ca

Sterzinger, G., Beck, F. and Kostiuk, D. 2003. The Effect of Wind Development on Local Property Values. Renewable Energy Policy Report.

Stewart, G.B.,Pullin, A.S., and Coles, C.F.. 2004. Effects of Wind Turbines on Birds: Summary Report. Birmingham C. f. E.-B. Conservation

Stuber, R.J. 1982. Habitat Suitability Index Models: Black Bullhead. Federal Government Series: FWS/OBS-82/10.14

Takats, D. L., Francis, C. M., Holroyd, G. L., Duncan, J. R., Mazur, K. M., Cannings, R. J., Harris, W., and Holt, D. 2001. Guidelines for Nocturnal Owl Monitoring in North America. Beaverhill Bird Observatory and Bird Studies Canada, Edmonton, Alberta. 32 pp.

Tilghman, N.G., and Rusch, D.H. 1981. Comparison of Line-Transect Methods for Estimating Breeding Bird Densities in Deciduous Woodlots. *Studies in Avian Biology* 6:202-208.

US Department of Agriculture. "Field Indicators of Hydric Soils in the United States".

US Fish and Wildlife Service. 2012. News release: North American bat death toll exceeds 5.5 million from white-nose syndrome. http://www.whitenosesyndrome.org/sites/default/files/files/wns_mortality_2012_nr_final_0.pdf

US Fish and Wildlife Service. 2014. White-nose syndrome map. Posted March 14, 2014. http://www.whitenosesyndrome.org/resources/map

Whittam, B., and Kingsley, A. 2003. Shades of Green: A Bird's Eye View of Wind Energy. Bird Watch Canada, Spring 203 No. 23.

Wilderness Areas Protection Act. 1998, c. 27, s.1. The Nova Scotia Legislature. Available from http://nslegislature.ca/legc/statutes/wildarea.htm

Wilson, R.R., Twedt, D.J., and Elliott, A.B. 2000. Comparison of Line Transects and Point Counts for Monitoring Spring Migration in Forested Wetlands. *Journal of Field Ornithology* 71 (2):345-355.

Yong, W, and Finch, D.M. 2002. Consistency of Mist Netting and Point Counts in Assessing Landbird Species Richness and Relative Abundance During Migration. *The Condor* 104 (1):59-72.