stands, with mature forest present at the southern and northern extents. The landscape position and habitat character of the Project site influence the bird community during all seasons.

Small numbers of migrants begin to arrive at the Project site in late April, but a significant influx does not occur until early May. At this time, significant numbers of American Robins, Hermit Thrush, and White-throated Sparrows descend on the site; a second migrant wave occurs in late May, when wood-warblers such as Magnolia Warbler, Black-throated Green Warbler, and Black-and-white Warbler (*Mniotilta varia*) appear in relative abundance. Abundance and diversity were relatively consistent throughout the Project site, particularly in May.

Seventy-nine percent (79%) of the species observed during spring surveys were also recorded during the breeding season. Furthermore, there was no significant difference in the number of birds observed per survey location in May (spring surveys) and June (breeding season surveys) ($F= 2.45$, $p= 0.125$). These results suggest that most birds arriving at the Project site during spring migration remain to establish breeding territories. Forest dwelling birds breed at the Project site at reasonable densities, and are abundant throughout the Project site during the breeding season. Dominant species, particularly thrushes and warblers, are a reflection of the fir/spruce forest type that is prevalent in the interior of the Project site. High breeding densities throughout the Project site are likely due to habitat heterogeneity typical of mixed-age, mixed wood stands and the presence of edge habitat associated with cutovers. Key indicator species, including Pileated Woodpecker, are indicative of relatively large patches of mature forest habitat in the southern and northern extents of the Project site. Pileated Woodpecker and Northern Flicker, both primary cavity nesters, were confirmed breeders at the Project site. The presence of these species can create nesting habitat for a variety of secondary cavity nesters, including birds of prey such as American Kestrel (*Falco sparverius*) Northern Saw-Whet Owl (*Aegolius acadicus*), as well as a variety of passerines including Winter Wren (*Troglodytes troglodytes*) and Eastern Bluebird (*Sialia sialis).* Indeed, the mature forest at the Project site appears to feature snags in numbers high enough to support a diverse, yet not particularly abundant, cavity nesting community.

The fall bird community at the Project site was dominated by resident species, including Black-capped Chickadee, American Crow, Blue Jay, and Golden-crowned Kinglet. Overall, resident species accounted for 43.6% of the birds observed during the fall months. In some cases, it can be difficult to separate migrants from resident birds. Yellow-rumped Warbler and Dark-eyed Junco (*Junco hyemalis*), for example, are typically considered migrants, but some individuals over-winter in Nova Scotia when food resources are available. It is likely that the individuals observed in September and October at the Project site were migrants, however, since both species were present in low numbers or absent in November. Although species diversity was relatively high, migrant warblers, sparrows, and thrushes were generally observed in low numbers throughout the migration period. Exceptions included reasonable numbers of American Robin and White-throated Sparrow. The only observations of diurnal migrant flocks consisted of a single flock of 135 Common Grackles and two, smaller flocks of Red-winged Blackbirds moving through Project the site in October. Migrants were largely absent from the Project site in November, at which time small flocks of nomadic Pine Grosbeaks (*Pinicola enucleator*) and White-winged Crossbills (*Loxia leucoptera*) occurred, presumably to access seed-resources in intact conifer stands.

Winter data were collected at the Project sites in two consecutive years; conclusions should therefore be interpreted with caution as between-year variation may introduce a bias. Overall abundance and diversity, for example, were significantly higher in 2012 than in 2013 (F= 6.02, p= 0.02 and F= 8.67, p= <0.01, respectively). The results in both years, however, demonstrate that the Project site supports a limited winter bird community consisting of both resident and nomadic species, with only a minor winter visitor component, as is typical of most of Nova Scotia during the winter months (Davis and Browne 1996). In some cases, species were less abundant than habitat/observations during other times of year might suggest. This is particularly true of Golden-crowned Kinglet, which were largely absent during winter surveys in both years despite the presence of apparently suitable softwood habitat. Low numbers of Golden-crowned Kinglets have been reported throughout Nova Scotia this winter, which may reflect a die-off resulting from severe winter conditions (Swanson *et al*. 2012). Barred Owl (*Strix varia*), and to a lesser extent Hairy Woodpecker are indicative of mature-forest habitat.

Overall, there were 77 different species identified at or near the Project sites during surveys conducted throughout the year, including 14 SOCI (Table 8.13, Drawing 8.7).

Table 8.13: Bird SOCI identified at the Project Site

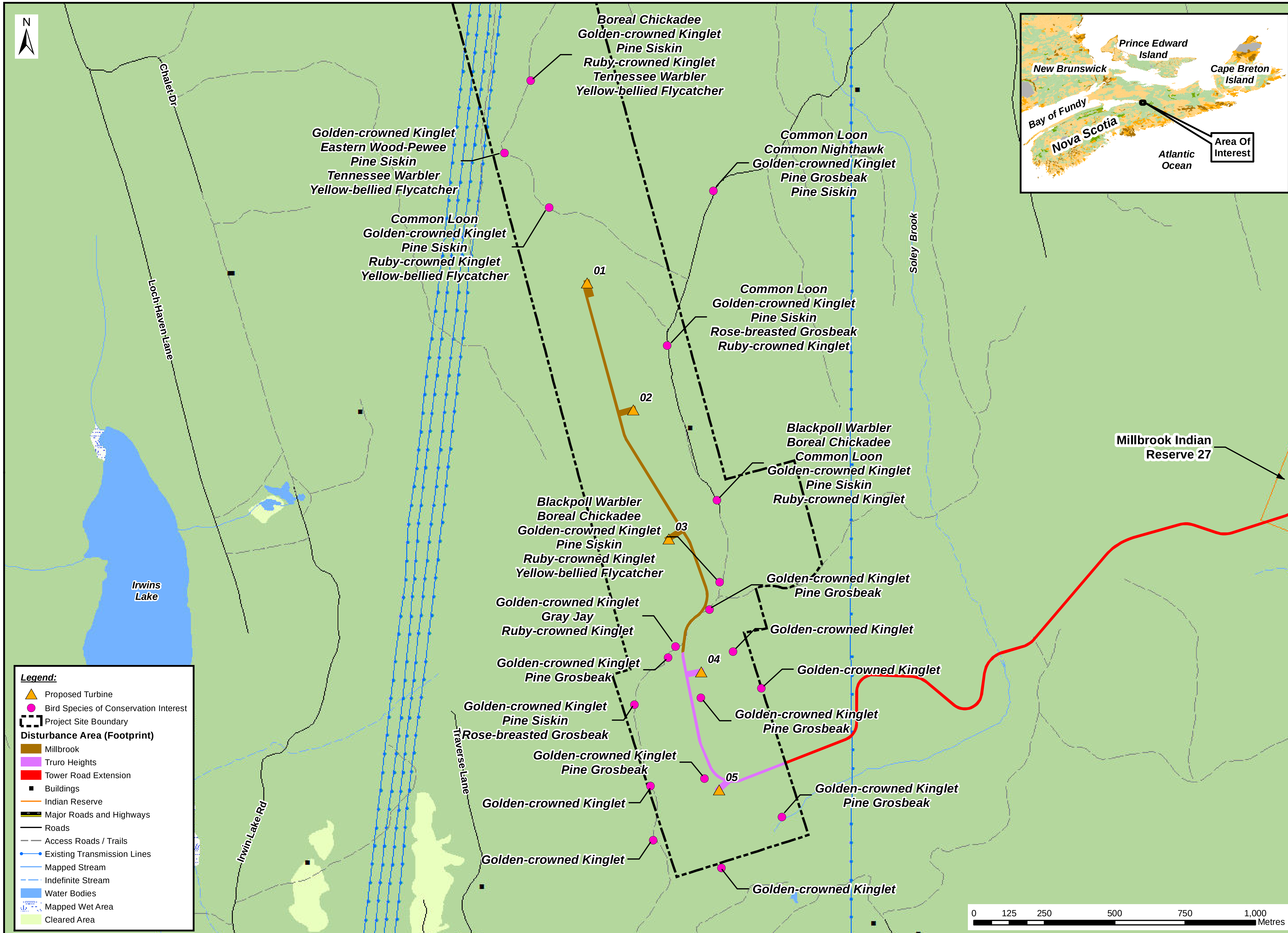
Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status [2]	COSEWIC Status[3]	NSDNR Status[4]	Survey(s) Observed
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Not listed	Not listed	Not listed	Red	SM (1), FM (1)
Blackpoll Warbler	*Dendroica striata*	Not listed	Not listed	Not listed	Yellow	FM (7)
Boreal Chickadee	*Poecile hudsonicus*	Not listed	Not listed	Not listed	Yellow	FM (3), W (4)
Common Loon	*Gavia immer*	Not listed	Not listed	Not at Risk	Red	B (4), FM (1)
Common Nighthawk	*Chordeiles minor*	Threatened	Threatened	Threatened	Red	B (1)
Eastern Wood-pewee	*Contopus virens*	Not listed	Not listed	Special Concern	Yellow	SM (2), B (2)
Golden-crowned Kinglet	*Regulus satrapa*	Not listed	Not listed	Not listed	Yellow	W (4), SM (2), B (1), FM (84)
Gray Jay	*Perisoreus canadensis*	Not listed	Not listed	Not listed	Yellow	FM (2), W (3)
Pine Grosbeak	*Pinicola enucleator*	Not listed	Not listed	Not listed	Red	FM (21)
Pine Siskin	*Spinus pinus*	Not listed	Not listed	Not listed	Yellow	W (15), SM (14), FM (3)
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Not listed	Not listed	Not listed	Yellow	B (4), FM (3)

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status [2]	COSEWIC Status[3]	NSDNR Status[4]	Survey(s) Observed
Ruby-crowned Kinglet	*Regulus calendula*	Not listed	Not listed	Not listed	Yellow	SM (12), B (1), FM (4)
Tennessee Warbler	*Oreothlypis peregrina*	Not listed	Not listed	Not listed	Yellow	B (2)
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Not listed	Not listed	Not listed	Yellow	SM (2), B (8)

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

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

The requirements as set out in the *MBCA* will be adhered to for Project activities. Additional mitigation measures for avifauna are provided in Section 4 and 14.



Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Bird Species of Conservation Interest Locations

Eskasoni Corporate Division

Millbrook First Nation

Community Wind Farms Inc.

juwi

Strum Consulting

Date: April 2013	Project #: 12-4328/12-4544
Scale: 1:12,500	Drawing #: 8.7
Drawn By: G. Gregory	
Checked By: M. Smith	

8.8 Bats

The NS Significant Species and Habitats database (NSDNR 2012c) indicates 20 features related to bats and/or bat habitats within a 100 km radius of the Project site. Most of which pertain to observations of Little brown bats. Other bat species observed within this radius include Tri-colored bat and Northern long-eared bat.

Moseley (2007) provided an overview of the known bat hibernacula in the caves and mines of Nova Scotia. This research indicates 16 known hibernacula within a 100 km radius of the Project site (Table 8.14).

Table 8.14: Known Bat Hibernacula within 100km of the Project Site

Hibernacula	Distance from Project Site (km)	Direction
Hayes Cave	18.8	SW
Lear Shaft	25.4	NW
Black Brook	29.5	S
Gayes River Gold Mine	34.0	S
Minasville Ice Cave	36.8	W
Cave of the Bats	39.0	SSW
Centre Rawdon Gold Mine	42.6	SW
Peddlar's Tunnel	43.9	W
New Laing Adit	45.9	ENE
Walton Barite Mine	51.7	WSW
Woodville Ice Cave	56.3	SW
McLellan's Brook Cave	63.9	ENE
Lake Charlotte Gold Mine	66.1	SSE
Miller's Creek Cave	67.3	SW
Cheverie Cave	67.9	WSW
Frenchman's Cave	69.6	SW

Source: Moseley 2007

Hayes Cave, the largest known bat hibernaculum in Nova Scotia, is located approximately 18.8 km to the southwest of the Project site (Moseley 2007). The Little brown myotis is the most common species at this gypsum cave (Poissant and Broders 2008; Randall 2011), although the Northern-long eared myotis, and the Tri-colored bat also occur between September and June (Davis and Browne 1996; Moseley 2007). Up to 6,000 bats have been recorded at Hayes Cave during winter hibernation (Davis and Browne 1996), although preliminary data from 2012 suggest that White-nose syndrome has reduced this hibernating population to approximately 250 (M. Elderkin, personal communication).

Table 8.15 presents bat species recorded within a 100 km radius of the Project site, according to ACCDC.

Table 8.15: Bat Species Recorded within a 100 km Radius of the Project Site

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
Hoary bat	*Lasiurus cinereus*	Not Listed	Not Listed	Not Listed	Undetermined
Northern long-eared myotis	*Myotis septentrionalis*	Not Listed	Not Listed	Endangered	Yellow
Tri-colored bat	*Perimyotis subflavus*	Not Listed	Not Listed	Endangered	Yellow

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

Field surveys of bat migration/habitat use were carried out from September 8th to September 25th, 2012 using an AnaBat SD2 Detector (Titley Electronics, Columbia, Missouri) deployed near the Project site. Field survey methodology and timing was designed in consultation with NSDNR (M. Elderkin, personal comm.). The detector was deployed in a clearing associated with a meteorological tower installed to collect site-specific weather data. The detector was located 667 m north of Turbine 4 and 1,071 m north of Turbine 5 (Drawing 8.6).

Due to their similarity, calls of Nova Scotia's two resident *Myotis* species (Little brown myotis and Northern long-eared myotis) can be difficult to reliably distinguish from one another (O'Farrell *et al.* 1999; Broders 2011), so these calls were not identified to species.

In total, 500 files were recorded, of which only 168 files were determined to be bat generated ultrasound. Most echolocation calls were recorded between September 10th and 14th, and were associated with *Myotis* species bats (e.g., Little brown myotis and Northern long-eared myotis) (Table 8.16). Thirteen of the 168 calls identified were categorized as unknown species. These calls were clearly bat generated ultrasound; however, the quality of the files was not sufficient to render a positive identification. However, most of the unknown calls were likely Myotis spp. due to the frequency and slope of the calls.

One Silver-haired bat (*Lasionycteris noctivagans*) call was detected on the night of September 9th (Table 8.16). This seems to be an isolated occurrence as no other calls were detected over the course of the survey. Because Silver-haired bats are migratory this bat could have been passing through the area, as early to mid-September coincides with the peak migration period. One of the unknown calls detected on the night of September 12th had characteristics consistent with Tri-colored bat (*Perimyotis subflavus*), however, some segments of the call were clearly Myotis spp. This was an isolated occurrence and all prior and subsequent calls were identified as Myotis spp.

Table 8.16: Number of Echolocation Calls Recorded near the Project Site (Sept 8th – 25th)

Date	Echolocation Calls			
	Myotis	***Lasionycteris noctivagans***	**Unknown spp.**	**Total**
9/8/2012	0	0	0	0
9/9/2012	2	1	0	3
9/10/2012	12	0	0	12
9/11/2012	0	0	0	0
9/12/2012	78	0	5	83

Date	Echolocation Calls			
	Myotis	***Lasionycteris noctivagans***	**Unknown spp.**	**Total**
9/13/2012	36	0	7	43
9/14/2012	10	0	1	11
9/15/2012	1	0	0	1
9/16/2012	5	0	0	5
9/17/2012	9	0	0	9
9/18/2012	0	0	0	0
9/19/2012	0	0	1	1
9/20/2012	0	0	0	0
9/21/2012	0	0	0	0
9/22/2012	0	0	0	0
Total	**153**	**1**	**13**	**168**

An average of 12 echolocation calls per night were detected during the monitoring period. The highest recorded activity occurred on the night of September 12th during which 83 of 168 (49.4%) of echolocation calls were detected. Increased activity on this night may have been due to the presence of just one or a few bats, likely *Myotis* spp., continuously foraging in close proximity to the detector over the course of the evening. It is not necessarily an indication of bat abundance but may indicate that there was an abundance of insects in the area surrounding the detector on that particular night.

As expected, average nightly bat activity peaked between 20:00 and 23:00 coinciding with sunset and resultant bat emergence due to insect availability.

Bat species that were identified during field surveys or that have been recorded within a 100 km radius of the Project site were screened against the criteria outlined in the document "Guide to Addressing Wildlife Species and Habitat in an EA Registration Document" (NSE 2009b) to develop a list of priority species. These priority bat species include:

- Little brown myotis – "Endangered" (COSEWIC), "Yellow" (NSDNR);
- Northern long-eared myotis– "Endangered" (COSEWIC), "Yellow" (NSDNR); and
- Tri-colored bat – "Endangered" (COSEWIC), "Yellow" (NSDNR).

Little brown myotis
During the spring and summer, Little brown myotis can be found feeding on small aerial insects over water bodies and at the edges of forest clearings during the evening and night (Barclay 1991). During the day, the Little brown myotis will roost in buildings, trees, under rocks, in wood piles, and in caves, congregating in tight spaces to roost at night (Fenton and Barclay 1980). As a non-migratory species, Little brown myotis are known to congregate in large hibernation groups, known as hibernacula, from September to early or mid-May in abandoned mines or caves (Fenton and Barclay 1980; Moseley 2007).

Little brown myotis is the most common species in Nova Scotia, and is probably ubiquitous in the province (Broders *et al*. 2003). According to the ACCDC database, no observations of Little brown myotis were recorded within 100km of the Project site. Until recently however, no bat species were considered to be of conservation concern in Nova Scotia, so these observations of Little brown myotos may have gone un-reported to the ACCDC. Multiple known hibernacula are known to occur within a 100 km radius of the Project site, including Hayes Caves, the largest known hibernacula in the province.

A number of echolocation calls emitted by *Myotis sp.* were detected at the Project site, most of which were likely generated by Little brown myotis. In addition, suitable habitat is present at the Project site, including forest stands of varying age composition (Drawing 8.4). It is therefore highly likely that this species occurs at the Project site, either during the early summer breeding season or during late-summer movements to hibernacula.

Northern-long eared myotis

The Northern-long eared myotis often feeds shortly after sunset near water bodies and open areas near forest edges (Gill 2006). During the day, Northern long-eared myotis show a preference for roosting in trees, the characteristics of which have been shown to vary according to the reproductive status of bred females (Garroway and Broders 2008). Females appear to prefer shade tolerant deciduous trees over coniferous trees, whereas males roost solitarily in coniferous or mixed-stands in mid-decay stages (Broders and Forbes 2004). Northern long-eared myotis are also non-migratory and are typically associated with the Little brown myotis during hibernation, in caves or abandoned mines (Moseley 2007). Hibernation in this species is thought to begin as early as September and can last until May (as cited in Caceres and Barclay 2000).This species is widely distributed in the eastern United States and Canada, and is commonly encountered during swarming and hibernation (Caceres and Barclay 2000).

Although once considered uncommon throughout Nova Scotia (Moseley 2007), Northern long-eared myotis is likely ubiquitous in the forested regions of the province (Broders *et al*. 2003). ACCDC data indicates that the closest Northern long-eared myotis sighting to the Project site was 23±10 km away; in addition, this species has been identified at several known hibernacula within a 100 km radius of the Project site.

A number of echolocation calls emitted by *Myotis sp.* were detected at the Project site, of which a proportion was likely from Northern long-eared myotis. In addition, suitable forest habitat is present throughout the Project site (Drawing 8.4). It is therefore highly likely that this species occurs at the Project site, either during the breeding season/summer or during late-summer movements to hibernacula.

Tri-colored bay (Eastern pipistrelle)

Tri-colored bats, formerly known as the Eastern pipistrelle, forage over water bodies, tree canopies and in open areas (Quinn and Broders 2007; Poissant and Broders 2009). This species requires clumps of *Usnea* lichen for roosting; a habitat feature typically associated with mature spruce and balsam fir trees (Farrow 2007), which are present at the Project site. This species is non-migratory, and generally hibernates alone, or in small numbers, in caves or abandoned mines where it appears to show a preference for small side passages, rather than main passages (Fujita and Kunz 1984;

Moseley 2007). Individuals show strong fidelity to specific hibernacula, although in Nova Scotia only 10 hibernating individuals have ever been recorded (Quinn and Broders 2007).

The species occurs throughout most of eastern North America, with Nova Scotia representing the northeastern extent of its range (Fujita and Kunz 1984). Within Nova Scotia the species has a restricted breeding distribution focused in the interior of the southwest region of the province (Farrow and Broders 2011). Research conducted at Kejimkujik National Park found the Tri-colored bat to be locally abundant, and results indicate that this population may represent the only breeding population of the species in Canada (Broders *et al*. 2003). In the summer months, the Tri-colored bat is concentrated in a geographic area bounded by Wolfville to the west, Halifax to the northeast, and Shelburne to the southeast (Quinn and Broders 2007). ACCDC data indicates that the closest observation of this species to the Project site was 16±5 km away, and Tri-colored bat has been recorded in Hayes Cave less than 20 km away.

One echolocation signal recorded during field studies had characteristics of Tri-colored bat, although a conclusive species determination was not possible in this instance. Nonetheless, suitable softwood dominated roosting habitat is present at the Project site, and in consideration of the site's proximity to Hayes Cave, it is highly likely that Tri-colored bat occurs at the Project site, probably during late summer movements to hibernacula.

Mitigation measures for bats are provided in Section 4 and 14.

9.0 SOCIO-ECONOMIC ENVIRONMENT

9.1 Local Demographics and Industry

The Project site is located on land within the Municipality of the County of Colchester. The Municipality is home to many long established communities including Bible Hill, Old Barns, Brookfield, Upper Stewiacke, Salmon River, Tatamagouche, North River, Debert, Great Village and the Millbrook First Nation community. The population centres in Colchester County are Truro (population 23,261) and Stewiacke (population 1,438) (Statistics Canada 2011). The nearest communities to the Project are Hilden (3.9 km), Truro Heights (4.0 km), Millbrook (4.5 km) and Lower Truro (5.0 km).

9.1.1 Demography

Population statistics for Colchester County and the Town of Truro from the 2011 census are summarized in Table 9.1.

Table 9.1: Population in Colchester County and the Town of Truro

Population Statistics	Colchester County	Truro
Population in 2011	50,968	23,261
Population in 2006	50,023	22,376
Population change from 2006-2011 (%)	1.9	4.0
Total private dwellings in 2011	24,478	11,046
Land area (km^2)	3,627.94	44.72
Population density per km^2	14.0	520.1

Source: Statistics Canada 2011

The age distribution in Colchester County and the Town of Truro reveals slightly older populations with a median age of 42.5 years and 44.7 years, respectively compared to the median age of the province (41.8), and HRM (39.0) (Statistics Canada 2006). A breakdown of age distribution in Colchester County and the Town of Truro is outlined in Table 9.2 below.

Table 9.2: Age in Colchester County and the Town of Truro

Age Statistics	Colchester County	Truro
0 - 14 years	8,375 (16.7%)	1,565 (13.3 %)
15 - 64 years	33,505 (67.0%)	7,575 (64.4 %)
65+ years	8,145 (16.3%)	2,630 (22.3 %)
Total Population	**50,025 (100%)**	**11,770 (100%)**

Source: Statistics Canada 2006

Colchester County's average housing cost is $129,116, slightly less than Truro at $132,142; however both are lower than the provincial average of $158,000 (Statistics Canada 2006). As for median earnings for full-time, full year earners, Colchester County and Truro fall below the provincial median earnings of $36,917 for full-time, full year earners (Statistics Canada 2006) (Table 9.3).

Table 9.3: Household Costs and Median Earnings for Full-Time, Full Year Earners

Jurisdictions	Average Housing Cost	Median Earnings
Colchester County	$129,116	$33,030
Town of Truro	$132,142	$30,898
Province of Nova Scotia	**$158,000**	**$36,917**

Source: Statistics Canada 2006

9.1.2 Health Care and Emergency Services

The Town of Truro has a fire department consisting of highly dedicated career and volunteer fire personal. At the present time, the County of Colchester, Town of Stewiacke and the Town of Truro have signed an agreement to develop one Emergency Plan for the region. This plan will be developed by the Regional Emergency Management Organization (REMO). The REMO is made up of the Regional Emergency Management Advisory Committee, the Regional Protective Services Coordinator and the Regional Emergency Planning Committee. The Advisory Committee is comprised of the mayor of each municipality and one other elected official. The Planning Committee is comprised of representatives from community services, law enforcement, fire, health services, engineering, transportation and communications (REMO 2011).

Health services in the region include Colchester Regional Hospital located in the Town of Truro.

9.1.3 Industry and Employment

Employment and unemployment rates for January 2013 in the North Shore Economic Region (includes Colchester County) indicates that the unemployment rate was 12.2%, which is higher than the provincial average of 9.4% (Statistics Canada 2013). The North Shore employment rate of 53.1% is lower than the provincial rate of 57.1% (Statistics Canada 2013).

A breakdown of the labour force within Colchester County and Truro is provided in Table 9.4. The highest proportion of workers in both Colchester County and Truro fall into the "other services" category (19.0% and 18.8%, respectively). While Statistics Canada does not specifically list tourism as an industry, it likely falls under the "other services" heading. The high proportion of workers listed as working within "other services" and "retail trade" is reflective of the tourism industry. Other significant industries include business services, manufacturing, and health care (Statistics Canada 2006).

Table 9.4: Labour Force by Industry in Colchester County and the Town of Truro

Industry	Total Colchester County	Industry	Total Truro
Total experienced labour force 15 years +	25,150	**Total experienced labour force 15 years +**	5,695
Other services	4,790	**Other services**	1,070
Business services	3,905	**Business services**	1,055
Manufacturing	3,575	**Retail trade**	750
Retail trade	3,285	**Health care and social services**	725
Health care and social services	2,365	**Manufacturing**	720
Educational services	1,875	**Educational services**	505
Construction	1,685	**Wholesale trade**	340
Wholesale trade	1,470	**Construction**	245
Agriculture and other resource-based industries	1,460	**Finance and real estate**	170
Finance and real estate	740	**Agriculture and other resource-based industries**	115

Source: Statistics Canada 2006

A review of businesses located within 5 km of the Project site is outlined in Table 9.5.

Table 9.5: Local Businesses and Proximity to Project Site

Business	Proximity to Project Site*
Irwin Lake Chalets	1.5 km west of the Project site, on Loch Haven Lane
Super 8 Truro	3.1 km east of the Project site, on Treaty Trail
Truro Visitor Information Center	3.25 km east of the Project site, on Treaty Trail
Empire Theatres Studio 7 Truro	3.1 km east of the Project site, on Treaty Trail
Subway	3.1 km east of the Project site, on Treaty Trail
Leon's Furniture	3.1 km east of the Project site, on Treaty Trail
Saltscapes Restaurant and General Store	3.2 km east of the Project site, on Treaty Trail
Leisure Days RV Center	3.2 km east of the Project site, on Treaty Trail

Business	Proximity to Project Site*
Tim Horton's and Stone Cold Creamery	3.2 km east of the Project site, on Treaty Trail
A&W Restaurant and Ultramar	3.2 km east of the Project site, on Treaty Trail
Treaty Entertainment	3.2 km east of the Project site, on Treaty Trail

*All distances measured from center of the Project Site, using the most direct route.

Economic effects as a result of the Project will include job creation, increased revenue for the Eskasoni First Nation, tax revenue for the Municipality of the District of Colchester, and investment in the local community through a Community Sustainability Fund.

It is estimated that the Project will result in approximately $10-$12 million in investments into the province of Nova Scotia. It is estimated that the Project will result in millions of dollars in contracts with Nova Scotian companies for the delivery of equipment and construction materials, as well as professional development, construction and operational services. A significant portion of the total investment will come from sources outside Nova Scotia, resulting in a significant capital investment into the Nova Scotia economy.

Job Creation

Elements of job creation throughout the lifespan of the Project include:

- Project Development- During the development phase of the Project, Nova Scotian professionals will deliver a host of services to the Project, including: civil and electrical engineering, legal, financial, environmental, and archaeological services, land and community relations services, website development, and many others. As this project is one of many COMFIT projects being developed in the Province, it is difficult to precisely estimate the number of full-time-equivalent jobs that are created through the development of this Project alone. It is known, however, that dozens of professionals within Nova Scotia will render their services as part of the development of the Project.
- Construction - Though the construction phase of the Project is relatively short, it will require significant manpower for realization. Much of the construction employment will come through contracting and subcontracting of Nova Scotian construction firms. This will likely include significant elements of civil and electrical construction. During the construction phase, it is estimated that 50 people will be temporarily employed by the Project. Many of these people will be employed through Nova Scotia construction firms which are part of the project.
- Operations and Maintenance - Operational wind projects require long-term operations and maintenance professionals to be located either on-site or within short driving distance of the project. Technical maintenance of the turbines requires three technicians at all times for safety purposes. In addition to the three technicians, there will be a team of two individuals representing the owner as site managers and facilitating the maintenance of all balance of plant equipment. It is generally anticipated that a team of two operations and maintenance technicians can maintain regular operations and maintenance service on approximately a dozen turbines. Once constructed, it is anticipated that the Project will be one of several projects which share long-term operations and maintenance teams to ensure project

performance. The jobs associated with operations and maintenance are long-term, steady, stable, and high-paying jobs.

The involvement of Eskasoni First Nation as a Project partner will maximize the local economic benefit to the community through job creation and utilization of local contractors. As Eskasoni First Nation is to be a majority owner of the Project, significant efforts have been made and will continue to be made to involve Mi'kmaq owned and affiliated businesses and laborers in the development, construction and operation of the Project. In addition, the proponents are working to develop an Industrial Benefit Agreement for the Project, which aims to create opportunities for Mi'kmaq contractors and labor to participate in the Project.

In addition to the direct investments that the Project would bring to Nova Scotia's economy, a suit of auxiliary economic benefits can also be expected. It has previously been demonstrated that investments in wind power developments can result in significant indirect ancillary benefits to local communities. Workers that are directly involved with the development would contribute to local economies by redistributing wealth to a variety of goods and services such as hotels, restaurants, and grocery stores (USDE 2008).

Tax Revenue
As outlined in the *Wind Turbine Facilities Municipal Taxation Act (2006),* the Municipality of the District of Colchester will receive tax revenues per MW on an annual basis and as such, the royalty will annually increase as the Consumer Price Index (CPI) rises. Property taxes to be paid to the municipality over the lifespan of the Project are estimated at $800,000.

Investment in the Local Community
Through investments into a Community Sustainability Fund, the proponent is committed to sharing the economic benefits of the Project with the surrounding community. The fund will contribute 1% of the annual revenues to the local community development association to be used for the betterment of the community. It is estimated that over the lifetime of the Project, the Community Sustainability Fund will invest more than $400,000 in the community surrounding the Project.

9.2 Land Use and Value
Presently, the area surrounding the Project site property is primarily zoned as "Resource Forest". The property on which the wind farm is proposed to be built is privately owned, and small scale forestry is the only current economic activity occurring on the Project site.

Potential effects on property values is often a primary concern of neighboring residents due largely to anecdotal reports from appraisers of drastic declines in property values following the nearby installation of a wind energy facility (as reviewed in Gulden 2011). Despite these concerns, a number of rigorous and statistically defensible studies have concluded that wind energy developments have had no significant effect on surrounding property values.

The most comprehensive study to date on the impact of wind farms on property values was completed by Hoen *et al*. (2009). This research analyzed data on nearly 7,500 sales of single family homes situated within 10 miles of 24 existing wind farms in the United States. Eight different hedonic pricing models failed to generate statistically significant evidence that property values for houses located within 10 miles of wind farms are influenced by the developments. Subsequent research by the same laboratory but employing further analyses confirmed these results (Hoen *et al.* 2010).

Carter (2011) analyzed home transactions in a rural landscape surrounding small (1-4 turbines) wind energy developments, while employing a hedonic model to statistically control for variables affecting all real estate transactions such as square footage, age of home, and school zone. This study concluded that proximity to the wind farms did not impact average selling price of homes; in fact, in one case, homes closer to a wind farm sold for significantly higher than those elsewhere.

A study by Hinman (2010) tracked property transactions in communities located close to a 240-turbine wind farm for an eight year period that spanned pre-development and operation stages. Hinman (2010) found that before project approval, property values in the area decreased. This was attributed to a fear of the unknown effects that the development would have; an effect known as *anticipation stigma*. However, once the development became operational, property values recovered. This recovery was attributed to a greater understanding of the operational effects of the development. Anticipation stigma, however, was not detected in a similar study in Colorado (Laposa and Mueller 2010), in which it was concluded that the announcement of a large wind energy development did not significantly reduce the selling prices of homes surrounding the proposed development.

Although there is some evidence of a “valley” in property values in the interim between wind farm announcement and operation (Hoen 2011), research has consistently demonstrated that, in a variety of spatial settings and across a wide temporal scale, sale prices for homes surrounding wind energy facilities are not significantly different from those attained for homes sited away from wind energy facilities.

9.3 Recreation and Tourism

Existing outdoor recreation in the area includes hunting, fishing, ATVing, and hiking. There are wildlife associations serving the area, notably the Cobequid Wildlife Rehabilitation Centre in Brookfield, the Cobequid Salmon Association in Truro, the Vahalla Gun Club in Truro, and the Nova Scotia Wildlife Carvers and Artists Association in Truro. For hiking, the Cobequid Trail Network lies north of the Project site in Old Barns, extending 11 km east towards the Town of Truro. The area is also home to the South Colchester ATV Club in Brookfield and the North Shore ATV Club in Truro (ATV Association of NS 2012).

The 2011 Nova Scotia Visitor Exit Survey Community Report outlines the total trips (stopped or stayed) to communities in Nova Scotia, to particular tourist regions, as well as capture rates of communities within tourist regions (Nova Scotia Department of Economic and Rural Development and Tourism 2011). The communities of Truro, Brookfield and Stewiacke in the Fundy Shore Annapolis Valley Region were examined. Table 9.6 shows the total trips (people who stopped for at least 30 minutes or stayed overnight) that were made to these communities, as well as their capture rate (the percentage of parties that stopped in a specific community compared to other communities within the region) out of the total number of parties who visited the tourism region.

Table 9.6: Communities Visited in Nova Scotia

Region/Community	Total Trips (% who stopped or stayed)	Capture Rate (%)
Fundy Shore and Annapolis Valley	**37%**	
Truro	21%	56%
Brookfield	2%	4%
Stewiacke	3%	8%

Source: NSDERDT 2011

The data shows tourism in Brookfield and Stewiacke is not a major economic driver. Comparatively, Truro is a more popular destination solidifying the town's reputation as a transportation hub for the Maritimes with all major highways intersecting through the town. Being located at the tip of the Bay of Fundy, Truro offers the tidal bore experience in additional to an array of activities including golf courses, multiple museums, Victoria Park and several accommodations and dining options for tourists.
The Project site is privately owned, though evidence of various forms of recreational activity have been observed on the site, including hunting and ATV/snowmobile use.

It is difficult to determine with certainty how tourists will react to a wind development. Wind farms are objects of fascination for many and thus can generate tourism for the local community. Some wind farms get upwards of 60,000 visits a year and the benefits of even drawing a fraction of that amount of visitors to a community can be felt by many businesses including shops, restaurants and hotels (CanWEA 2006). Pincher Creek, Alberta developed a 19 MW wind farm in 1993, since that time tourism revenue from visitors from as far away as Russia has generated $5,000 in annual sales of clothing and souvenirs branded with the "Naturally Powerful Pincher Creek" logo (CanWEA 2006).

A 2002 study from MORI (Market & Opinion Research International) interviewed tourists visiting Argyll and Bute, Scotland and asked them about their attitudes towards the presence of wind farms in the area. Of those who knew about the surrounding wind farms (40% of those interviewed), 43% felt that wind farms had a positive effect on the area, 43% felt it made no difference, and 8% felt it had a negative effect (MORI 2002).

10.0 CULTURAL AND HERITAGE RESOURCES

10.1 Archeological Resource Impact Assessment

Davis MacIntyre & Associates Limited conducted an ARIA for the Project. The purpose of the assessment was to determine the potential for historic and pre-contact period archeological resources within the Millbrook Community Wind Project site and the Truro Heights Community Wind Project site. Background research indicated that Mi'kmaq settled along Salmon River and the banks of Cobequid Bay however historic maps indicate that there were no roads into the study area until after 1902 suggesting that people were not likely settled here in historic times (Davis MacIntyre & Associates Ltd. 2012). The only cultural activity near the study area in the early 20th century was located to the north along Soley and McNutt's Brooks where saw mills and related camps were established and to the south where a single building, possibly a camp related to gypsum extraction, were located (Davis MacIntyre & Associates Ltd. 2012).

A field survey completed in (October and December) 2012 concluded that there is a low potential for both Mi'kmaq and Euro-Canadian resources. The field assessment revealed that much of the study area was logged throughout the latter quarter of the 20th century at which point the road may have been pushed through beyond Kent Road (Davis MacIntyre & Associates Ltd. 2012). The ARIA was forwarded to the NS Department of Communities, Culture and Heritage. The response letter is provided in Appendix H, confirming that no significant archaeological material will be disturbed by the Project.

Procedures related to potential discovery of archaeological items or sites during construction/decommissioning will be described in the EPP.

11.0 MI'KMAQ RESOURCES

A MEKS is being completed by NEXUS Coastal Resource Management and is currently in progress. The purpose of the study is to document the collective ecological knowledge held by the Mi'kmaq and identify any concerns regarding the Project's impact on the Mi'kmaq's use of land, resources and special places within the study area. The study area defined for the MEKS includes the Project site and the immediate surrounding area. Although the Millbrook and Truro Heights Community Wind Projects are being developed collaboratively, the MEKS report provided in Appendix I is related specifically to the Truro Heights Project.

The methodology for the MEKS was developed in accordance with the protocol adopted by the Assembly of Nova Scotia Mi'kmaq Chiefs. A desktop review was conducted to gather all relevant information pertaining to the project study areas, historical Mi'kmaq knowledge and Mi'kmaq resource use. Workshops with local Mi'kmaq knowledge holders enabled the collection of local site-specific knowledge of historical and current Mi'kmaq use of natural resources. A field survey will be conducted in June 2013 to identify and locate general habitats, plant species and other related resources that may be of importance to the Mi'kmaq community. The final report will provide complete analysis and presentation of field data from the June field surveys.

The results of the consultation process show that there has been a long-standing relationship and interest with the regions in and around the Project site. The meeting held with Mi'kmaq participants from the Millbrook First Nation highlights the vested interest the Mi'kmaq have with their traditional territory. Mi'kmaq ecological and traditional resources associated with the area are still accessible by the surrounding communities and are being utilized by a wide range of community sectors, from youth to elders. While some activities and areas are more commonly cited than others, the level of community interest in the lands and resources remains active and relevant. It should be noted that the Eskasoni First Nation is a partner in the development of the Project, and Millbrook First Nation is a partner in the development of the co-located Millbrook Community Wind Project. This Project is widely known within the community and has substantial community support. There is also large support within the Mi'kmaq community for similar renewable energy developments.

Based on the preliminary results, future planning and collaboration between the proponent and local Mi'kmaq communities will be maintained throughout the development of the Project through the application of Mi'kmaq Ecological Knowledge, in keeping with the principles and statements of the United Nations Declaration of the Rights of Indigenous Peoples.

The MEKS is provided in Appendix I.

12.0 OTHER CONSIDERATIONS

12.1 Shadow Flicker

Shadow flicker can occur when rotating blades cast flickering shadows during times of direct sunlight. The magnitude of shadow flicker is determined by the position and height of the sun, wind speed and direction, geographical location, time of year, cloud cover, turbine hub height and rotor diameter, and proximity to the turbine (CanWEA 2011).

For shadow flicker to occur, the following criteria must be met:

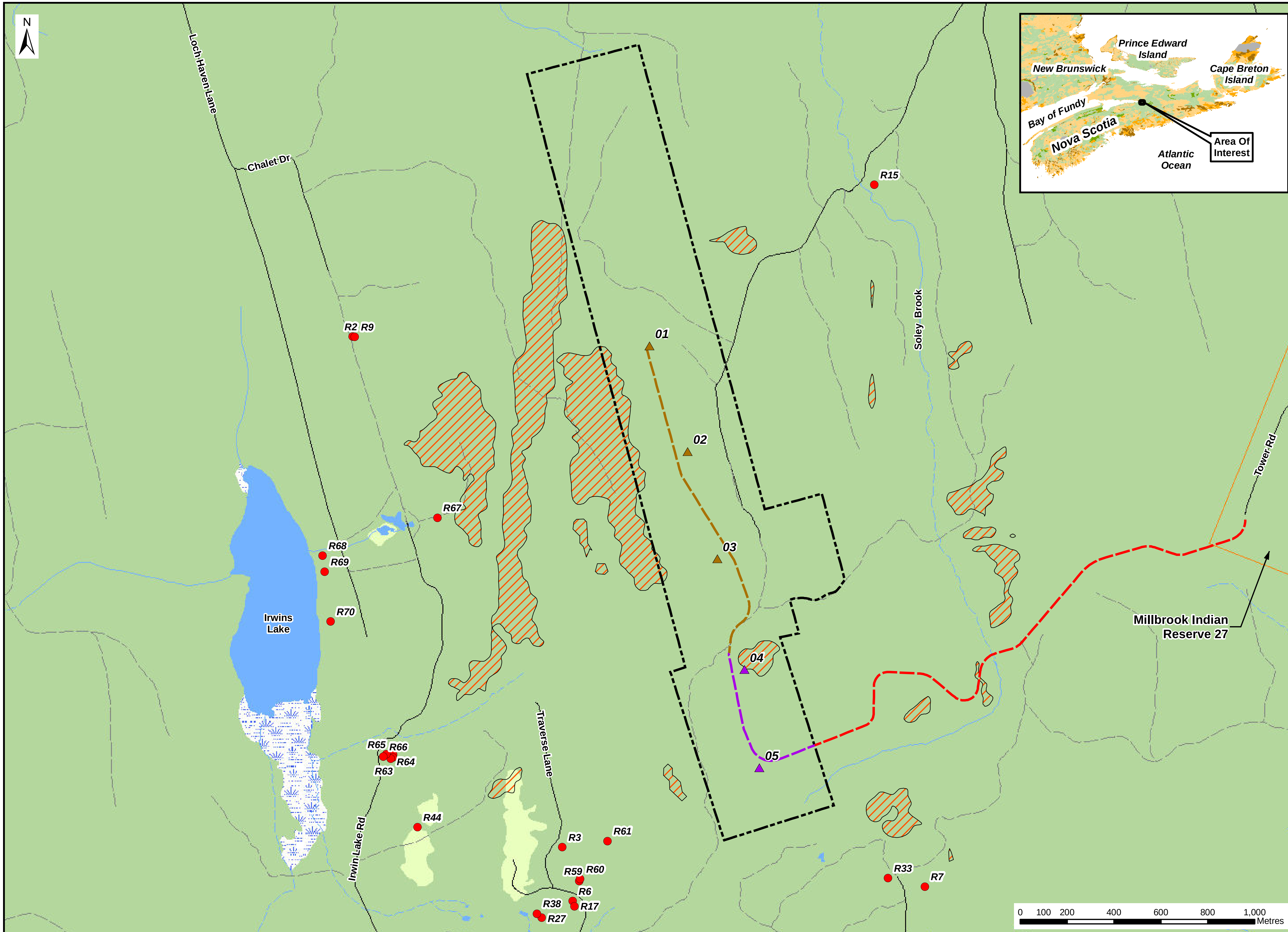
1. The sun must be shining and not be obscured by clouds/fog.
2. The source turbine must be operating.
3. The wind turbine must be situated between the sun and the shadow receptor.
4. The wind turbine must be facing directly towards, or away from, the sun such that the rotational plane of the blades (rotor plane) is perpendicular to the azimuth of incident sun rays. For this to occur, the wind direction would have to be parallel to the azimuth of the incident sun rays throughout the day.
5. The line of sight between the turbine and the shadow receptor must be clear. Light-impermeable obstacles, such as vegetation, tall structures, etc., will prevent shadow flicker from occurring at the receptor.
6. The shadow receptor has to be close enough to the turbine to be in the shadow.

A shadow flicker assessment was completed for the proposed Project to assess the potential impact on surrounding shadow receptors. The assessment included consideration of the Millbrook Community Wind Project. The analysis was conducted using the WindPRO version 2.8 software package using worst case scenario conditions, including constant sunshine and receptor windows oriented perpendicular to the rotational axis of the turbines. There are no municipal, provincial, or federal guidelines related to shadow flicker, but many jurisdictions have adopted the industry standard of no more than 30 hours of shadow flicker per year, or no more than 30 minutes of shadow flicker on the worst day of the year. These guidelines were used in the shadow flicker assessment for the Project.

As a final agreement has not been reached with a turbine supplier, all turbine models under consideration were modeled separately. This conservative measure was taken to ensure that all potential shadow-related issues are addressed, regardless of the turbine model ultimately used for the Project.

A list of 70 non-participating structures (i.e. not located on Project lands) within a 2 km radius of the proposed turbine locations was developed using GIS data from the Nova Scotia Geomatics Centre and aerial imagery. For modeling purposes, the receptor list is considered to be conservative as no distinction has been made between habitable dwellings and barns, sheds, or outbuildings. In cases where topographic mapping indicated a structure that was not visible on aerial imagery, field truthing was carried out to verify that no structure was present; if verified, the receptor was removed from the model. Vegetation effects were incorporated into the model using data from the Nova Scotia Forest Inventory (NSDNR 2012a). Specifically, forest stand height was included to determine if any part of the turbine will be visible from the receptor location. If vegetation obscures the visibility of turbines from a receptor, shadow flicker will not occur at that location.

Modeling results (Appendix J) indicated that all receptors are predicted comply with the 30 hours of shadow flicker per year/30 minutes of shadow flicker per day guideline (Drawing 12.1).



Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Legend:

- Project Site Boundary
- Millbrook Proposed Road
- Truro Heights Proposed Road
- Tower Road Extension
- Truro Heights Turbine
- Millbrook Turbine
- Existing Receptors
- 30+ Shadow Flicker Hours Per Year
- Major Roads and Highways
- Roads
- Access Roads / Trails
- Mapped Stream
- Indefinite Stream
- Water Bodies
- Mapped Wet Area
- Cleared Area

Shadow Flicker Modeling Results

ESKASONI Corporate Division

MILLBROOK FIRST NATION

Community Wind Farms Inc.

juwi

Strum CONSULTING

Date: April 2013	Project #: 12-4328/12-4544
Scale: 1:15,000	Drawing #: 12.1
Drawn By: G. Gregory	
Checked By: M. Smith	

12.2 Electromagnetic Interference (EMI)

The rotating blades and support structures of wind turbines can interfere with various types of electromagnetic signals emitted from telecommunication and radar systems (RABC and CanWEA, 2012). In response to this phenomenon, the Radio Advisory Board of Canada (RABC) and CanWEA developed guidelines for assessing the EMI potential from a wind turbine development. These guidelines outline a consultation based assessment protocol that establishes areas, called "consultation zones", around transmission systems, based on the system's type and function.
The EMI study for this Project was completed in accordance with the RABC/CanWEA published guidelines. Location information and frequency details were obtained from the Technical and Administrative Frequency Lists (TAFL) database, which is administered by Industry Canada, and from email communications with the Royal Canadian Mounted Police (RCMP), Department of National Defense (DND), Canadian Coast Guard, Environment Canada, NAV CANADA, Natural Resources Canada, and Industry Canada. Results are provided in Table 12.1.

Table 12.1: Radar Transmission Array Interference Consultation Results

Signal Source	Operator	Required/ Suggested Consultation Zone Radius	Consultation Results
Television - Broadcast and Reception			
Analog Television Broadcast (Private)	n/a	2 km	Three analog transmitters within the consultation zone. The closest is located 0.7 km away.
Analog TV Broadcast (Public)	CBC	89 km	One television transmitter within the consultation zone, located 79 km away.
Analog Television Receivers	n/a	6.96 km	Consultation may be required to evaluate the effects of the Project on analog TV reception within 14 km radius. However, analog signal transmission has been predominantly replaced. The majority of TV broadcast operators have converted their analog NTSC TV stations to the ATSC North American digital standard, as required by a decision of the CRTC (Public Notice CRTC 2007-53).
Radio – Broadcast and Reception			
AM Radio (Private)	n/a	5 km (omnidirectional antenna) 15 km (directional antenna)	One AM tower within consultation zone. 2 km from proposed wind farm. Call Sign 540Halifax @ 0.76 MHz
AM Radio (Public)	CBC	5 km	None required – interference unlikely.
FM Radio (Private)	n/a	2 km	None required – interference unlikely.
FM Radio (CBC)	CBC	5 km	No receivers located within consultation zone.
Regulatory Agencies			
Air defense and air control radar systems	DND	100 km	No objections or concerns.

Signal Source	Operator	Required/ Suggested Consultation Zone Radius	Consultation Results
DND Radio Communications	DND	n/a	No objections or concerns.
Maritime vessel traffic system radars	Canadian Coast Guard	60 km	No objections or concerns.
Radar communication systems	RCMP	N/A	No response received
VHF omnidirectional range	Nav Canada	15 km	No objections or concerns.
Primary air traffic control surveillance radar		80 km (primary surveillance) 10 (secondary surveillance)	
Weather radar	Environment Canada	50 km	No objections or concerns.
Seismic monitoring stations	Natural Resources Canada (NRCan)	N/A	No response received

Relevant correspondence from operators and reporting is provided in Appendix K.

No objections were received from operators. Once the finalized layout is confirmed, the above agencies will be provided with the updated information, as appropriate.

Point to Point Systems
The CanWEA/RABC Guidelines recommend a consultation zone within a 1 km radius around the transmit and receive sites for point to point type radio systems, and a cylinder around the transmission path, with a diameter determined as a function of the Fresnel zone.

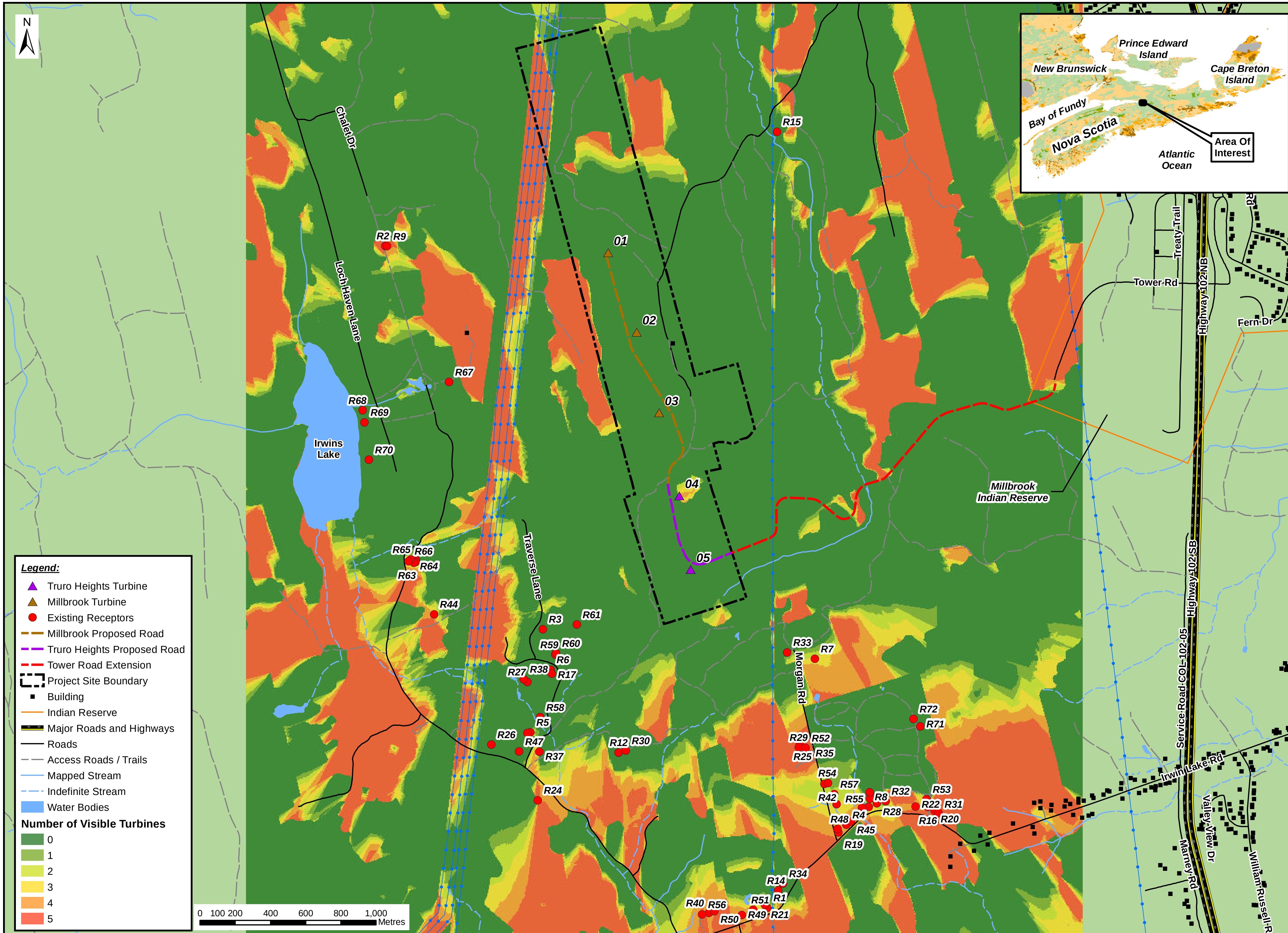
A total of 348 search results were identified as point to point radio systems. These results were paired using the call sign field, where call signs were not available pairing was completed based on Owner and TX/RX frequency pairing. One tower was identified to be within the 1 km consultation zone. This tower has a call sign of VFW529 and is owned by the local Fire Department.

12.3 Visual Landscape

Zone of Visual Influence (ZVI)
The visibility of wind turbines from a given location is influenced by local topography as well as obstacles which could obscure sightlines. Turbine visibility was modeled using the WindPRO version 2.8 software package. Model inputs included the proposed turbine locations from the Truro Heights and Millbrook Projects, local elevation data, as well as forest stand height from the Nova Scotia Forest Inventory (NSDNR 2012a). Turbine visibility was calculated based upon a 5 m grid resolution to achieve the highest precision possible. For the purposes of the model, a turbine was deemed visible if any part could be seen from given location, including any part of the rotating blade above the tower and hub assembly. An assessment area of 2,848 hectares was defined to encompass a 2 km buffer around the proposed turbine locations.

As a final agreement has not been reached with a turbine supplier, modeling was conducted using the tallest (hub height + ½ rotor diameter) turbine model under consideration, as this model extends farthest into the air and is therefore more likely to be visible.

Model results indicate that no turbines will be visible from 68.2% (1,942 ha) of the assessment area, while five turbines will be visible from 17% (484 ha) of the area (Drawing 12.2).



Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

ZVI Analysis Results

ESKASONI Corporate Division

MILLBROOK FIRST NATION

Community Wind Farms Inc.

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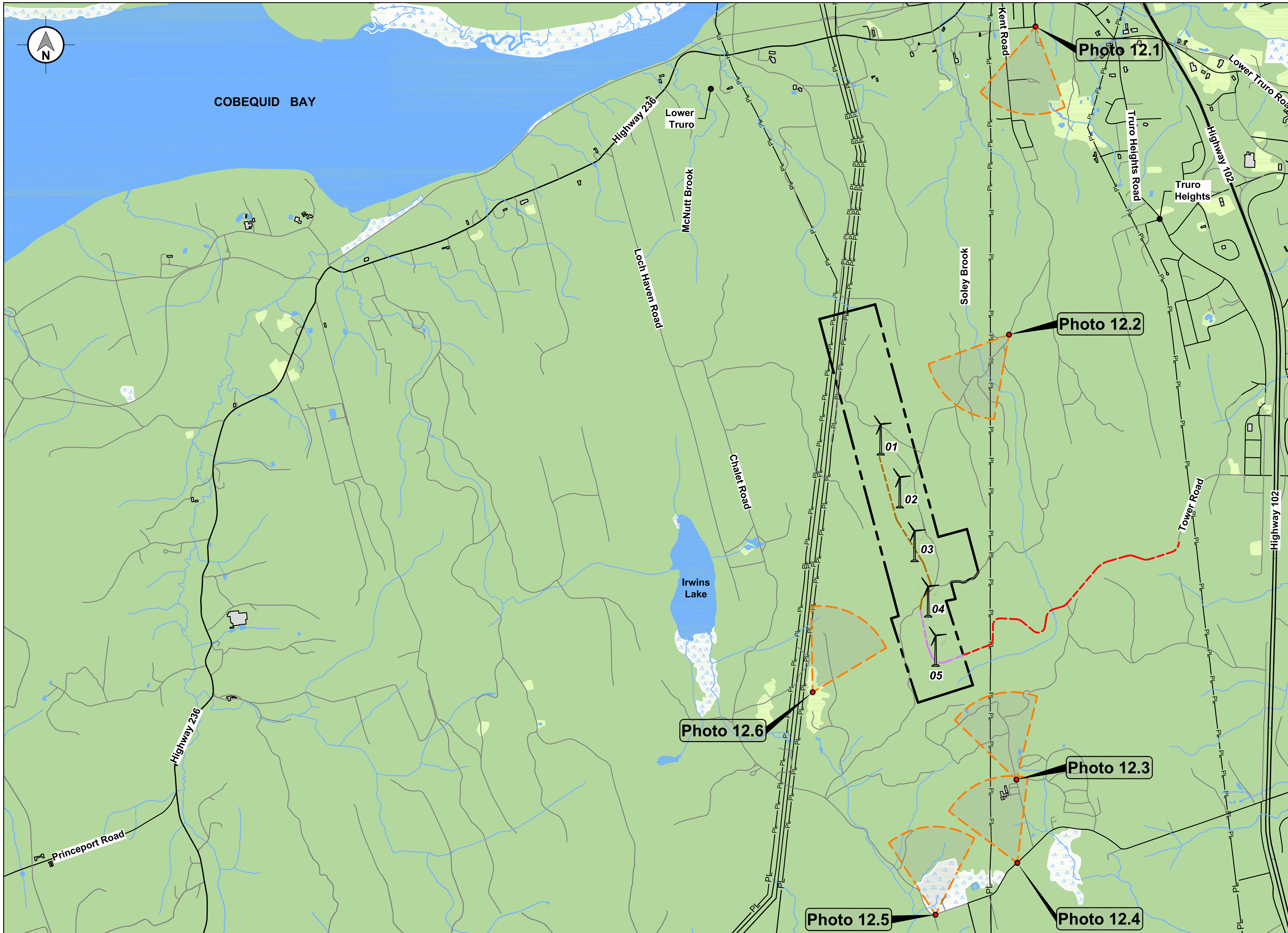
Date: April 2013	Project #: 12-4328/12-4544
Scale: 1:20,000	Drawing #: 12.2
Drawn By: G. Gregory	
Checked By: M. Smith	

Predicted View Plane
Representative photos were taken from vantage points within the community to represent the existing and future visual landscape.

Photographs were collected with magnetic bearings and a GPS waypoint recorded at each photo location. Geographical Information System (GIS) software was used to plot the photo locations and construct bearing lines to assist in the construction of a 3D view, generated using the GIS. A 3D surface was then constructed using the provincial Digital Elevation Model (DEM) points from the Nova Scotia Topographic Database, which supports 5 m contour intervals. The proposed turbine location and specifics regarding the height of the turbine were used to develop the view plane. Each selected viewing site was created using the viewer location (photo GPS point, elevation, and bearing line) resulting in an accurate 3D view. The resulting computer generated view was then merged with the digital photographs using a scaled image of the proposed turbine.

Photos were taken from six locations as shown in Drawing 12.3. Simulated results, including turbines from both the Truro Heights and Millbrook Projects, are provided in Figures 12.1-12.6.



Notes:

1. Reference: Digital topographic Mapping by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Legend:

- Proposed Turbine Location
- Viewpoint Location
- Direction of View
- Project Site Boundary
- Millbrook Proposed Road
- Truro Heights Proposed Road
- Tower Road Extension
- Existing Paved Road
- Existing Trail / Access Road
- Mapped Stream
- Indefinite Stream
- Mapped Water Bodies
- Mapped Wet Area
- Cleared Area

Visual Assessment Locations

ESKASONI Corporate Division

MILLBROOK FIRST NATION

Community Wind Farms Inc.

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Strum CONSULTING

DATE: April 2013	PROJECT #: 12-4328/12-4544
SCALE: 1:25,000	DRAWING #: 12.3
DRAWN BY: H. Serhan	
CHECKED BY: M. Smith	

Predicted View:

Actual View:

Figure 12.1. Tideview Drive: View to the southwest, towards the Project site.

Predicted View:

Actual View:

Figure 12.2. Kent Road: View to the southwest, towards the Project site.

Predicted View:

Actual View:

Figure 12.3. Morgan Road: View to the northwest, towards the Project site.

Predicted View:

Actual View:

Figure 12.4. Irwin Lake Road: View to the northwest, towards the Project site.

Predicted View:

Actual View:

Figure 12.5. Irwin Lake Road: View to the north, towards the Project site.

Predicted View:

Actual View:

Figure 12.6. Little Brook Road: View to the northeast, towards the Project site.

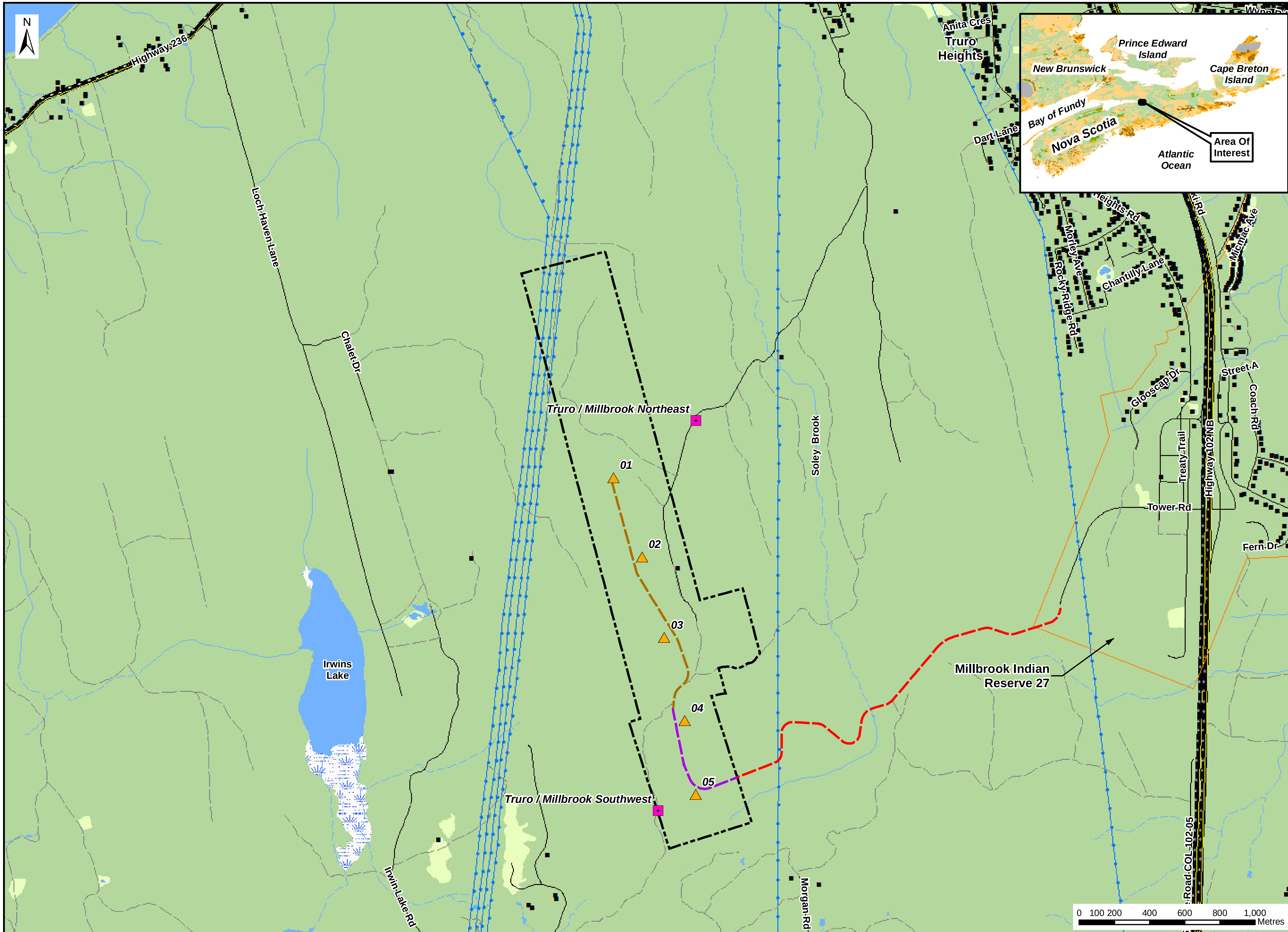
12.4 Sound

Sound from wind turbines comes from two general sources: the mechanical equipment, and the interaction of the air with the turbine parts, primarily the blades (NSDE 2008). In modern turbine designs, much of the mechanical noise is mitigated through the use of noise insulating materials. Aerodynamic noise, however, is a product of the turning of turbine blades and is thus an unavoidable aspect of wind power operations. Turbines can emit noises of different frequencies, and an individual's perception of the noise can depend on hearing acuity and tolerance for particular noise types (National Research Council 2007). Furthermore, the propagation of sound from the turbine source to a receptor, such as a residential dwelling, is influenced not only by the sound power level emitted from the turbine, but also by local factors such as distance to the receptor, topography, and weather conditions (Hau 2006). For example, increases in wind speed result in increases in ambient, natural noise (from vegetation movement) that can mask the sounds emitted from the turbine(s) (National Research Council 2007).

Ambient Sound Assessment

Ambient sound monitoring was completed to establish pre-construction sound levels at a two locations at the Project site. Locations were selected to be in close proximity to potential receptors (Drawing 12.4). Average sound levels over the duration of the sampling period were measured to be 49.3 and 50.2 dBA. Sound levels are likely influenced by existing sound generated by traffic on the nearby 102 highway.

Details of the assessment including methodology, full results and discussion are provided in Appendix L.



Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Legend:

- Proposed Turbine
- Sound Monitor
- Millbrook Proposed Road
- Truro Heights Proposed Road
- Tower Road Extension
- Project Site Boundary
- Building
- Major Roads and Highways
- Roads
- Access Roads / Trails
- Existing Transmission Lines
- Mapped Stream
- Indefinite Stream
- Water Bodies
- Mapped Wet Area
- Cleared Area

Sound Monitoring Locations

Eskasoni Corporate Division

Millbrook First Nation

Community Wind Farms Inc.

juwi

Strum Consulting

Date: April 2013	Project #: 12-4328/12-4544
Scale: 1:20,000	Drawing #: 12.4
Drawn By: H. Serhan	
Checked By: M. Smith	

Acoustic Assessment

An acoustic assessment was conducted for the Project to predict sound pressure levels at identified receptors within a 2 km radius of the proposed turbine locations. The assessment was completed using the WindPro v. 2.8 software package. For the purposes of this model, receptors included all structures identified in the provincial topographic mapping, as well as any additional identifiable structures based on aerial imagery. In cases where topographic mapping indicated a structure that was not visible on aerial imagery, field truthing was carried out to verify that the no structure was present; if verified, the receptor was removed from the model. The assessment included consideration of the Millbrook Community Wind Project. The model followed ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method and calculations, and was based on the following input information:

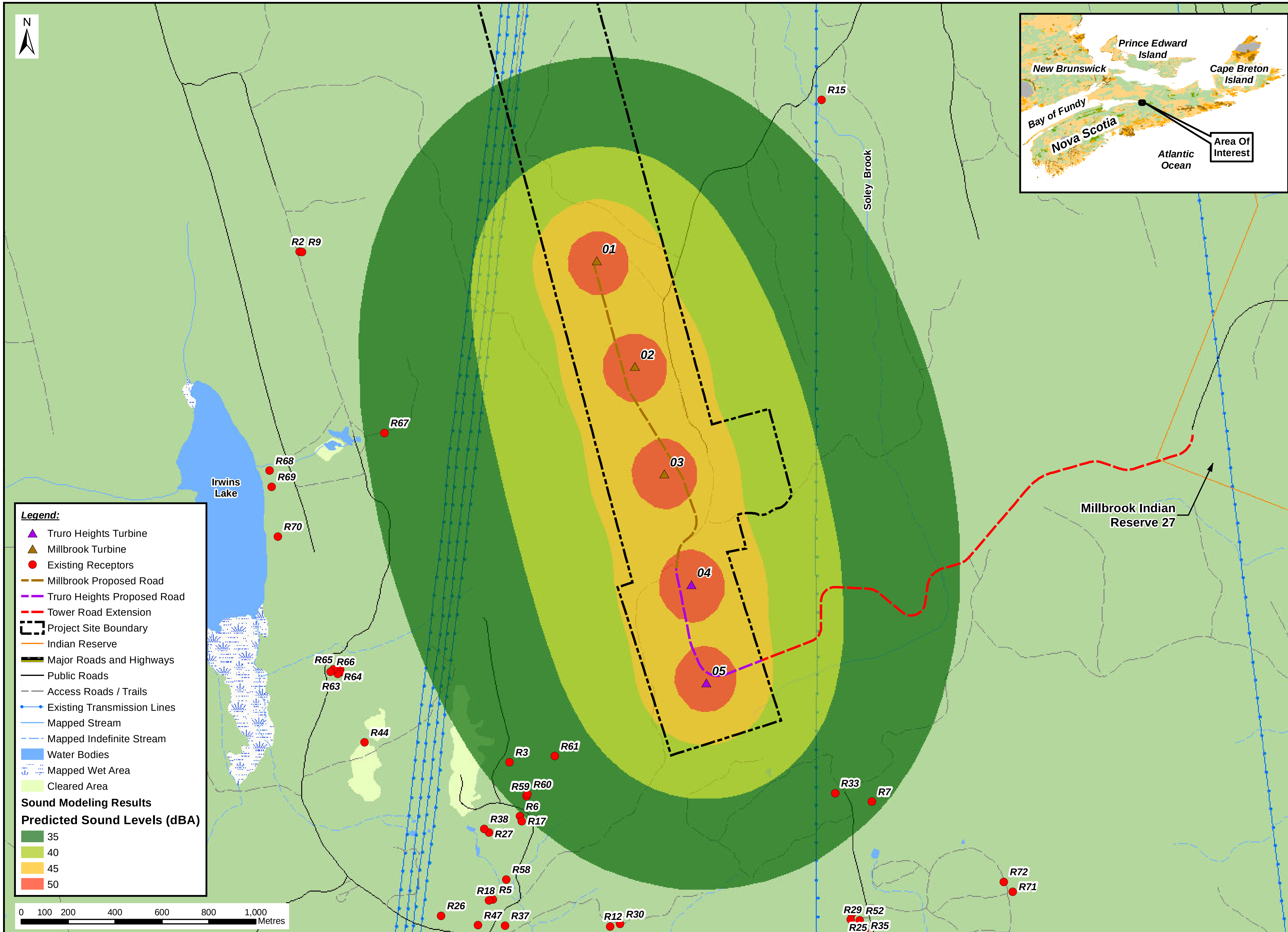
- UTM coordinates for the wind turbines;
- Generic 1/1 Octave band sound power level data for the wind turbines, as calculated by WindPro;
- UTM coordinates for receptors;
- A wind speed of 8 m/s, the speed at which the highest sound power level output is achieved (based on test data from the manufacturer); and
- Topographic data for the surrounding area.

As a final agreement has not been reached with a turbine supplier, all turbine models under consideration were modeled separately. This conservative measure was taken to ensure that all potential noise-related issues are addressed, regardless of the turbine model ultimately used for the Project. The most conservative results (e.g., the turbine model producing the loudest overall sound pressure level at receptors) are presented.

Nova Scotia has no specific sound guidelines for wind farms; however, through the EA process, NSE requires that predicted noise levels at identified residential receptors (as well as daycares, hospitals and schools) not exceed 40 dBA. As this guideline is intended to be protective of human sleep disturbance, 40 dBA does not apply to commercial receptors. Mapping illustrating the predicted sound levels relative to receptors is provided in Drawing 12.5

A total of 70 existing non-participating structures (i.e. not located on Project lands) were identified within a 2 km radius of the proposed turbine locations. Modeling results indicated that all receptors are predicted to comply with the NSE standard of 40 dBA. Excessive noise resulting from turbine operation is therefore not expected to be an issue at any existing dwellings/residences. Detailed results are provided in Appendix L.

A literature review related to infrasound is provided in Appendix C.



Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Sound Modeling Results

Community Wind Farms Inc.

Date: April 2013	Project #: 12-4328/12-4544
Scale: 1:15,000	Drawing #: 12.5
Drawn By: G. Gregory	
Checked By: M. Smith	

13.0 CONSULTATION AND ENGAGEMENT

13.1 Public Consultation

As Communications Coordinator, Mr. Keith Towse (CWFI), coordinates meetings, addresses community concerns, and acts as a liaison between the community and the Project team.

The Project team has met several times with Municipality of Colchester staff, Millbrook First Nation Band members, and local residents. A summary of the consultation for this Project is provided in Table 13.1. Detailed information on community events and website is provided below.

Table 13.1: Consultation Meetings and Events

Date	Stakeholder	Activity
September 15, 2011	NSE EA Branch	Early environmental discussions to better understand critical issues and permitting regime
January 16, 2012	NSE EA Branch	Meeting with NSE staff to introduce the Project.
March 12, 2012	CWS NSDNR	Bird monitoring protocol provided to CWS and NSDNR.
April 24, 2012	CWS	Received written feedback from CWS regarding the bird monitoring program.
May 30, 2012	Community Millbrook First Nation	Open House event held at Glooscap Heritage Centre – attended by approximately 30 members of the public, Millbrook First Nation Chief Gloade and members of Band Council.
June 13, 2012	NSDNR	Phone conversation with DNR staff to discuss bat monitoring and timing.
June 27, 2012	NSE EA Branch	Meeting with NSE Staff and Eric Christmas to discuss issues relating to noise and shadow flicker
September 23, 2012	Province	Meeting with Gary Burill (MLA) to provide Project update.
September, 26, 2012	NSDE	Meeting with Barry Francis to discuss development of Mi'kmaq Supply Chain
September, 28, 2012	NSDE	Meeting to discuss general update of project and partnership developments
October 2, 2012	Municipality	Meeting with Garry Buott (Municipal Councillor) to provide Project update
October 15, 2012	NSDNR	Email update to NSDNR regarding bird and bat monitoring.
November 12, 2012	Municipality Millbrook First Nation	Meeting with Colchester Mayor Bob Taylor and Chief Gloade to provide Project update.

Date	Stakeholder	Activity
November 15, 2012	NSDNR	Email regarding species status.
November 2012 – January 2013	Municipality	Telephone meetings with Geoff Stewart (Municipal Councillor) – provided information to be passed to Hilden Community Association.
October 2012- February 2013	Community	Individual meetings with all residents within 2 km of Project site to deliver Project update.
December 5-7, 2012	NSDNR	Provided moose monitoring protocol to NSDNR staff and incorporated feedback into protocol.
February 2013	Municipality	Meeting with Municipality of Colchester staff (Colin Forsyth) to provide Project update.
February 14, 2013	NSE EA Branch	Met with NSE staff to discuss the Project.
February 18, 2013	NSDNR	Received feedback on moose protocol update.
March 4, 2013	Hilden Community Association	Met with members of Hilden Community Association, members of Municipality of Colchester Council and staff to provide Project update
April 4, 2013	NSE EA Branch NSDNR	Met with NSE and NSDNR staff to discuss the Project.
April 25, 2013	Community	Wind 101 information session (see below).
May 1-2, 2013	Community	Distributed summary of EA report to all residences within 2 km of Project site.
May 11, 2013	Community	Wind farm tour (see below).
May 14, 2013	Community	2^{nd} Open house (see below).

Community Events

One community open house event was held at Glooscap Heritage Centre on May 30, 2012 from 7-9 pm to inform the public about the Project and to hear local comments and concerns. The open house featured posters that provided information about the Project and associated studies that were underway. Copies of the posters and newsletter from the open house are provided in Appendix M. Attendees had the opportunity to speak one-on-one with Project team members and submit written comments and/or questions.

The proponent hosted a Wind 101 information session that was presented by Dr. Lukas Swan (Dalhousie University) on April 25, 2013 at the Hilden Fire Hall, which was attended by approximately 50 people. The purpose of the session was to provide the community with general information about local energy/electricity use and production, wind energy, and wind project development. A sign-up sheet was available at the presentation for those wishing to take a wind farm tour on May 11, 2013.

The Project Team will continue to help address any concerns raised by local citizens over the duration of the Project's development and has planned another open house event for May 14th at 6:00 – 9:00 pm, located at the Hilden Fire Hall.

Website
A website for the Project has been developed and can be accessed at: www.truroheightswindfarm.ca. The website provides an overview of the Project, provides access to the featured posters, shares information on upcoming meetings, and Project news, as well as allows interested public to pose questions to the Project team. The website contains a link for Aboriginal speakers, which presents the Project details in the Mi'kmaq language.

Aboriginal Engagement
Preliminary Project details were submitted to the Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO), the Confederacy of Mainland Mi'kmaq, the Native Council of Nova Scotia, the Union of Nova Scotia Indians, and the Unama'ki Institute of Natural Resources.

Eskasoni First Nation is the COMFIT eligible community partner for the Project, and therefore has been highly involved in Project activities to date. As such, Eskasoni First Nation has been invaluable in ensuring the project is developed in a manner that is harmonious with the surrounding community and culture. The involvement of Eskasoni First Nation will also maximize the local economic benefit to the community through job creation and utilization of local contractors. In addition, the proponents are working to develop an Industrial Benefit Agreement for the Project, which aims to create opportunities for Mi'kmaq contractors and labor to participate in the Project.

14.0 EFFECTS ASSESSMENT

Based on the discussion in Section 7, the following VECs have been identified for additional assessment:

- SOCI;
- Avifauna; and
- Bats.

To ensure all relevant issues and concerns related to the proposed Project are identified, an interaction matrix was used to evaluate the interactions between the Project phases and the VECs (Table 14.1). The potential for accidents and malfunctions is also considered for each Project phase.

Table 14.1: Interaction Matrix

Project Phases/Activities	SOCI	Avifauna	Bats
Site Preparation and Construction			
Land Surveys for Placement of Roads, Turbines and Associated Works			
Geotechnical Investigations	X	X	
Placement of Sedimentation and Erosion Control Measures			
Clearing of Trees and Grubbing Areas for Construction	X	X	X
Access Road Upgrading and Construction	X	X	X
Laydown Area and Turbine Pad Construction	X	X	X
Transportation of Turbine Components			
Turbine Assembly	X	X	X
Grid Connection			
Removal of Temporary Works and Site Restoration	X		
Commissioning			
Operation & Maintenance			
General Operation and Maintenance	X	X	X
Vegetation Management		X	
Decommissioning			
Dismantling and Removal of Turbines from Project Site	X	X	X
Removal of Turbine Foundations to Below Grade and Reinstatement of Topsoil	X	X	X
Removal of On-site Roads and Reinstatement of Lands	X	X	X
Removal and Disposal of Collection System, Conductor and Poles	X	X	X
Removal of All Other Equipment and Stabilization of Lands	X	X	X

14.1 Environmental Effects Analysis Methodology

The completion of the environmental effects analysis involves consideration of the following elements:

- Description of potential negative environmental effects;
- Mitigation measures;
- Residual effects;
- Significance of residual environmental effects; and
- Monitoring or follow up programs.

This EA is structured to include proposed mitigation to reduce or eliminate potential adverse environmental effects. The determination of significance of adverse environmental effects is based on post-mitigation (residual) effects, rather than unmitigated potential effects. The significance of residual effects of the Project will be determined using the criteria, based on federal and provincial EA guidance (Table 14.2).

The expectation for, and significance of, residual effects determines the need for a monitoring and/or follow-up program.

Table 14.2: Criteria for Identification and Definition of Environmental Impacts

Attribute	Options	Definition
Scope (Geographic Extent)	Local	Effect restricted to area within 1 km of the Project site
	Regional	Effect extends up to several km from the Project site
	Provincial	Effect extends throughout Nova Scotia
Duration	Short-term	Effects last for less than 1 year
	Medium-term	Effects last for 1 to 10 years
	Long-term	Effects last for greater than 10 years
Frequency	Once	Occurs only once
	Intermittent	Occurs occasionally at irregular intervals
	Continuous	Occurs on a regular basis and regular intervals
Magnitude	Negligible	No measurable change from background in the population or resource; or in the case of air, soil, or water quality, if the parameter remains less than the standard, guideline, or objective
	Low	Effect causes <1% change in the population or resource (where possible the population or resource base is defined in quantitative terms)
	Moderate	Effect causes 1 to 10% change in the population or resource
	High	Effect causes >10% change in population in resource

The potential level of impact after mitigation measures are applied (e.g., residual effects) was identified based on the criteria and definitions provided in the NRCan document, "Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the Canadian Environmental Assessment Act" (NRCan 2003), as shown in Table 14.3.

Table 14.3: Definition of Significant Residual Environmental Impact

Significance Level	Definition
High	Potential effect could threaten sustainability of the resource and should be considered a management concern. Research, monitoring, and/or recovery initiatives should be considered.
Medium	Potential effect could result in a decline in resource to lower-than-baseline but stable levels in the study area after project closure and into the foreseeable future. Regional management actions such as research, monitoring, and/or recovery initiatives may be required.
Low	Potential effect may result in slight decline in resource in study area during life of the project. Research, monitoring, and/or recovery initiatives would not normally be required.
Minimal/None	Potential effect may result in slight decline in resource in study area during construction phase, but should return to baseline levels.

14.2 Effects Assessment

Effects and mitigation measures related to each VEC are described below. Potential effects of the Project on the identified VECs are further analyzed in Tables 14.4 to 14.6 to identify and evaluate the significance of residual effects, based on the criteria listed above. Mitigation measures are also summarized.

14.2.1 Species of Conservation Interest

It is widely acknowledged that wind energy development can have a suite of potential direct and indirect impacts on terrestrial fauna (Arnett *et al.* 2007; Kuvlesky, Jr. *et al.* 2007). General construction activities within and adjacent to watercourses and water bodies, can affect aquatic fauna and habitat. The extent and magnitude of these effects can vary with the stage of the Project but are present for all phases.

During the site preparation and construction phases of wind energy projects, potential impacts to SOCI will be related to:

- sensory disturbance;
- habitat loss/alteration and/or fragmentation;
- effects to fish passage/migration and
- collision mortality.

Sensory Disturbance

Sensory disturbance to terrestrial fauna SOCI may occur from a variety of anthropogenic sources. For wind energy projects, disturbance effects are typically most significant during the construction phase, which involves increased presence of on-site personnel, vehicles, and heavy equipment (Helldin *et al.* 2012). Avoidance effects related to the construction phase have been reported for large mammals in two cases [e.g., Rocky Mountain Elk (*Cervus elaphus*) (Walter *et al.* 2006) and wolves (Álvaras *et al.* 2011)], but in both cases the effects were temporary and subsided once construction was completed. It is expected that avoidance or displacement effects related to the site preparation and construction phases of the Project will not persist in the long-term.

It is also important to distinguish wind energy facility roads from high-use motorways in regards to sensory disturbance. Many of the documented effects of roads are related to avoidance due to traffic noise (Forman and Alexander 1998). The magnitude of such effects will be greatly reduced in the context of this wind energy development, as road traffic will be minimal (maintenance vehicles during operations) and limited.

Sensory disturbance during the operations and maintenance phase of the Project will be limited to the presence of on-site personnel conducting maintenance on Project infrastructure. Although literature on the topic is sparse, most evidence suggests that in general, terrestrial wildlife are not adversely effected by operating wind turbines. It was determined that a population of elk in Oklahoma, for example, did not change their home range or experience reduced dietary quality within an operating wind power development (Walter *et al.* 2006). It is therefore unlikely that ungulates in the Project site, including White-tailed deer and potentially Mainland moose, will be affected. Likewise, small mammal communities at wind energy developments do not appear to be affected by turbine operations (de Lucas *et al.* 2005).

Effects to fauna SOCI during the decommissioning phase of the Project will be similar to those experienced during the site preparation/construction phase (Helldin *et al.* 2012). Namely, sensory disturbance due to the increased presence of on-site personnel and the operation of heavy equipment may elicit temporary displacement/avoidance behaviours in mobile wildlife species.

Sensory disturbance impacts related to aquatic SOCI are not expected.

Habitat Loss/Alteration
Although the permanent footprint of a wind energy facility is generally estimated to be just 5 to 10% of the Project site (Arnett *et al.* 2007), there is the potential that significant habitat elements for certain terrestrial fauna SOCI may altered/removed during site preparation activities, such as clearing, for turbine pads and access roads. The effects may be negligible if the habitat is in adequate supply in the general area surrounding the Project site (Arnett *et al.* 2007). Since the permanent disturbance area of both the Truro Heights and Millbrook Project footprints represent 1.6% of the total Project site, and forest stands of similar age and composition are prominent in nearby areas, the effects of habitat loss/alteration on terrestrial fauna SOCI will be minimized.

The construction of roads has a variety of well-documented, adverse effects including fragmentation of otherwise continuous segments of suitable habitat and restriction of movement of individuals between habitat patches (Trombulak and Frissell 2000, Eigenbrod *et al.* 2008), avoidance of adjacent habitat, increased access for hunters/poachers (Brody and Pelton 1989; Helldin *et al.* 2012), which can potentially result in increased mortality of certain wildlife species while also facilitating the expansion of interspecific competitors (Beazley *et al.* 2004) and exotic species (Trombulak and Frissell 2000). The road network for this Project will have a small footprint due to the overall size of the Project, which will significantly reduce the magnitude of any potential effects.

Effects to Atlantic salmon and its habitat during the site preparation and construction phases the Project are primarily related to the construction and upgrading of access roads and the installation of crossing structures where roads intercept watercourses. Vegetation clearing along banks and land adjacent to watercourses could result in significant habitat degradation for fish and other aquatic biota if appropriate mitigation techniques are not employed. The alteration or removal of riparian vegetation may result in bank instability and erosion, leading to sedimentation of the water body and degradation of water quality.

Removal of overhanging vegetation from stream banks decreases shade/cover for fish resulting in increased vulnerability to predators and potentially in increased localized water temperatures. Likewise, the removal of instream cover, such as coarse woody material or edge habitat (e.g, undercut banks) may have a similar effect on fish habitat. Coarse woody material also provides habitat for aquatic invertebrates. Alterations to channel morphology and interference with sediment transport may also lead to Atlantic salmon habitat modification/degradation (MTO 2009). Many effects to Atlantic salmon habitat can be mitigated through thoughtful planning and the incorporation of standard mitigation and BMPs (refer to Section 4.0).

The potential effects of the Project on fauna SOCI habitat during the operational phase are likely to be minimal. Aside from surface disturbance and the possible removal of regenerated vegetation, decommissioning will not include additional habitat loss/alteration. Therefore, the effects to fauna SOCI during this phase of the Project are not expected to be significant in magnitude nor long-term in duration.

Effects to Passage/Migration
Lack of consideration for fish migration/passage during the design of crossing structures and/or appropriate installation techniques may also lead to a number of effects to Atlantic salmon. These effects typically manifest as modifications or barriers to fish movement through the affected watercourse. Barriers to fish passage include velocity barriers, alteration of the stream gradient and insufficient flow/depth (MTO 2009).

Many effects to Atlantic salmon passage can be mitigated through thoughtful planning and the incorporation of standard mitigation and BMPs (refer to Section 4.0).

Mortality
Increased vehicle and heavy equipment traffic during all phases of the Project may result in collisions with terrestrial wildlife. It is expected that these collision events will be minimized by the implementation of safe work practices (e.g., strict adherence to speed limits, obeying all warning signs). Collisions, should they occur, will be infrequent and will not have a significant effect on population levels.

General Mitigation Measures
The following specific mitigative measures will be implemented to avoid and mitigate any potential effects on terrestrial and aquatic fauna SOCI:

- Minimization of the footprint of physical disturbance by:
    - Designing and constructing access roads to avoid environmentally sensitive habitats, where possible, and ensuring the most efficient means to access turbines is achieved.
    - Maintenance of a buffer around sensitive habitats such as watercourses and wetlands, where possible.
    - Minimizing routine vegetation clearing:
        - clearing of land only if required for construction area footprint;
        - restoration of areas of disturbance where possible, post construction; and
        - siting construction compounds in/on non-sensitive areas.
    - Completion of a comprehensive schedule and determination of timelines to efficiently complete Project activities within the shortest time frames possible.

Species-Specific Mitigation
Desktop and field analyses for terrestrial and aquatic fauna SOCI revealed several species that have the potential to occur at the Project site. Addressing the potential impacts of the Project on these species will require species-specific mitigation techniques, as described below:

Mainland moose:

- Pre-construction snow-tracking surveys revealed no evidence of Mainland moose at the Project site. The EPP for the Project will require Project personnel to report any Mainland moose sightings to NSDNR.

Monarch:

- Should large congregations of Monarchs be found at the Project site, Project activities in the area should cease until the migrating group has left the Project site. This is most likely to occur in late summer, prior to the fall migration.

Wood turtle:

- Based on recommendations outlined in the document 'Protecting and Conserving Wood Turtles: A Stewardship Plan for Nova Scotia' (MacGregor and Elderkin 2003), and the NS Transportation and Public Works Generic Environmental Protection Plan for the Construction of 100 Series Highways (2007), the following general procedures will be implemented to ensure the protection of Wood turtles:
  - Any turtles found (identification booklet to be provided to site personnel) will be relocated outside of the construction zone, along the same habitat corridor in the direction of travel the turtle was originally oriented and preferably upstream within the same riparian habitat corridor (< 400 m).
  - Any sightings of wood turtle will be reported to the NS Wood Turtle Recovery Team at 1-866-727-3447
  - Adequate, permanent buffers of vegetation will be left around important Wood turtle habitat. If necessary (e.g., in the event that Wood turtles are confirmed at the site), an appropriate mixture of shrubs and trees shall be planted to create a buffer.

Atlantic salmon:

- The siting, design, installation and decommissioning of all crossing structures will incorporate ongoing consultation with DFO, and NSE, and will avoid areas of sensitive habitat and ensure that fish passage is maintained.
- Additional mitigation for the protection of fish habitat will be ensured through the NS watercourse alteration permitting process.

14.2.2 Avifauna

The effects of a wind farm on birds are variable and depend on factors such as the development design, topography of the area, habitats affected, and the bird community in the wind farm area (Drewitt and Langston 2006). Although some effects are related to construction (e.g., habitat alteration), most potential effects on avifauna are mainly related to operation and may include:

- habitat loss/alteration;
- mortality resulting from direct collision; and
- sensory disturbance.

Habitat Loss/Alteration

Habitat alterations resulting from the site preparation and construction phases of wind energy developments have the potential to impact bird populations either directly or indirectly (Arnett *et al.*

2007). However, impacts are considered less severe than those from other energy extraction developments such as oil and gas exploration because the disturbance is limited to the construction footprint (turbine pads, roads, associated buildings, etc.) (Kuvlesky *et al.* 2007). The magnitude of these effects, however, may be magnified if the disturbed area contains sensitive plant communities that provide important habitat to local bird populations (Kuvlesky *et al.* 2007). Altered landscapes can potentially lead to displacement of species with sensitive habitat requirements (Arnett *et al.* 2007). Site clearing and preparation may involve the removal of key habitat features, such as standing deadwood, mature trees, or shrub cover required as foraging and/or breeding habitat for certain bird species.

Mature forest, for example, is present in the southern and northern extents of the Project site; however, Project infrastructure does not coincide with this habitat type. Surface disturbance is greater in the construction phase than in the operational phase because large right of ways need to be created to accommodate large construction equipment and transport vehicles (Arnett *et al.* 2007). It can therefore be assumed that impacts associated from direct habitat alteration are greatest in the short-term, except when key habitat features are permanently removed. Depending on the availability of nearby alternative habitat, habitat alterations associated with wind energy infrastructure may have detrimental effects on local bird populations. The landscape of the Project site and immediately surrounding area features forest stands that would appear to provide suitable alternative habitat to bird species displaced due to habitat alteration at the Project site.

Collision Mortality

The most overt potential effect of the Project on birds is direct mortality resulting from collision with Project infrastructure, namely turbine blades, during the operational phase. Most evidence suggests that mortality levels resulting from turbine collisions are low (EC *et al.* 2012) although many studies do not adequately incorporate carcass removal by scavengers into mortality estimates. In a review of night migrant fatalities at wind farm sites in North America, Kerlinger *et al.* (2010) found fatality rates of less than one bird/turbine/year to approximately seven birds/turbine/year, even with corrections made for scavenger removal and searcher efficiency. Furthermore, multi-bird fatality events, in which more than three birds were killed at a turbine site in a single night, were found to be rare and may have been related to lighting and/or inclement weather (Kerlinger *et al.* 2010).

Collision risk is greater on or near areas used by large numbers of foraging or roosting birds or in important migratory flyways (Drewitt and Langston 2006). In Canada, passerines account for 70% of all fatalities, with most occurring during the fall migration season (EC *et al.* 2012). The probability of raptor collision with wind turbines depends on the species, turbine height, and local topography (de Lucas *et al.* 2008). Collision risk can therefore be greatly reduced by incorporating knowledge of the avifauna into the design and placement of wind power infrastructure.

Evidence cited by Erickson *et al.* (2001), NAS (2007) and Manville (2009) in NWCC (2010), demonstrates that although only general estimates are available, the number of birds killed at wind energy developments is substantially lower than then estimated annual bird casualty rates from a variety of other anthropogenic factors including vehicles, buildings, and windows, power transmission lines, communication towers, toxic chemicals (including pesticides), and feral and domestic cats (NWCC 2010). In summary, available research suggests that the probability of large-scale fatality events occurring at wind farms is extremely low (Kerlinger *et al.* 2010).

Sensory Disturbance

Sensory disturbance to birds can occur during the construction, operational, and decommissioning phases of wind power projects, and can be caused by the increased presence of personnel, vehicle movement, operation of heavy equipment, and the operation of the turbines themselves (Drewitt and Langston 2006). It is thought that disturbance to birds may have a greater population impact than collisions, although research is lacking in this area (Kingsley and Whittam 2005). Primary concerns with regards to sensory disturbance are related to displacement and potential effects on key physiological processes such as breeding.

Some studies have shown that birds will exhibit avoidance behaviours post-construction, leading to a variable degree of displacement from previously used habitat (reviewed in Drewitt and Langston 2006) which essentially amounts to habitat loss. In most cases, such displacement is on the scale of tens to hundreds of metres, which can lead to localized changes in bird densities (Leddy *et al.*1999; Pearce-Higgins *et al.* 2009). However, while birds may avoid specific sites, the evidence does not suggest that birds abandon the general area as a whole. Other research indicates that the presence of wind turbines has no effect on the distribution of the bird community (Devereux *et al.* 2008) and birds may habituate to the presence of operating wind turbines (Madsen and Boertmann 2008). The tolerance to Project related disturbance may be species specific but may also be related to the availability of alternative habitat (Kingsley and Whittam 2005). Thus, careful site selection of turbines to avoid any unique habitat types will alleviate some disturbance and/or displacement effects, especially during the operational phase of the Project.

General Mitigation Measures

The following mitigative measures will be implemented to avoid and mitigate any potential effects on avifauna:

- Where possible, clearing of site vegetation will be conducted outside of the breeding and nesting season for birds (April to August). If this is not possible, a mitigation plan will be developed in consultation with NSDNR and CWS prior to clearing activities.
- Use of lighting during construction will be limited to minimum levels.
- Use of lighting on turbine hubs and blades will be limited to minimum levels while still meeting requirements of Transport Canada.
- There will be no general lighting at the Project site. Lighting will only be used when technicians are working on-site.
- Where possible, placement of Project infrastructure in habitats significant to bird species (as identified during avian surveys) will be avoided. These include wetlands, mature forests, and areas with large, hollow trees.
- Post-construction monitoring will be implemented under direction from NSE and in consultation with CWS and NSDNR to monitor for significant mortality trends.

14.2.3 Bats

The installation of wind turbines has the potential to affect bats both directly and indirectly (Arnett *et al.* 2007). Although some effects are related to construction (e.g., habitat alteration), most potential effects on bats are mainly related to operation and may include:

- habitat loss/alteration;
- mortality resulting from direct collision and/or barotrauma; and
- sensory disturbance.

The significance of these impacts at the population level depends on a number of biotic and abiotic variables, including the number of individuals affected and the stability of the population, season, physiologic condition of the individuals affected, and weather factors.

Habitat Loss/Alteration

Habitat alterations, including vegetation clearing and soil disruption (NRC 2007) resulting from the site preparation and construction phases, may impact bats (Arnett *et al.* 2007). The removal of trees during the site clearing and preparation phases can be especially detrimental, particularly to those bat species which use trees as roosting habitat (Arnett *et al.* 2007).

Some studies, however, suggest that habitat changes related to wind power developments may in fact create benefits to bats by increasing cleared areas and creating access roads, both of which can be used by bats as foraging habitat (as cited in Arnett *et al.* 2007; Kunz *et al.* 2007a). In relation to this, small-scale disturbances, including creating small cutblocks or small scale access roads through forested habitat, have been shown to stimulate an increase in bat activity relative to previous years (Grindal and Brigham 1998). It is important to note, however, that increased edge habitat due to forest clearing may subsequently increase the risk of mortality by virtue of attracting bats to the area of the operating turbine (Kunz *et al.* 2007b).

Mortality

Mortality of bats is a potential effect during the operational phase of wind energy projects, Necropsy of recovered carcasses found that the cause of death for baths killed at wind-energy facilities is an indiscernible combination of direct collision with the turbine blades and barotrauma (Grodsky *et al.* 2011), although more recent pathological research has found that traumatic injury is the major cause of bat mortality at wind farms and that post-mortem artifacts may manifest themselves as pulmonary barotrauma lesions (Rollins *et al.* 2012). Barotrauma is characterized by a drop in atmospheric pressure along the top of a rotating turbine blade, which causes thoracic, abdominal, and pulmonary injury to bats when passing through the low pressure area (Baerwald *et al.* 2008).

Much of the established literature has not attempted to elucidate the causes of bat mortality but has instead reported on the magnitude of mortalities. In Canada, EC reports that bat fatalities outnumber bird fatalities (EC *et al.* 2012). This causes concern as bats are long-lived and have low reproductive rates (Arnett *et al.* 2007).

Research suggests that migratory tree-roosting species suffer the highest fatalities at wind farms (Kunz *et al.* 2007a; Kuvlesky *et al.* 2007; Cryan and Barclay 2009), although deaths of Tri-colored bats constituted 25.4% of total bat fatalities at wind facilities in the eastern United States (as cited in

Arnett *et al.* 2007). Migratory species, including Hoary bat, Eastern red bat, and Silver-haired bat, accounted for 71% of 2,270 bat fatalities recorded at wind energy facilities across Canada between 2006 and 2010 (EC *et al.* 2012). Although an individual Silver-haired bat was identified at the Project site during field studies, results of pre-construction bat monitoring do not suggest that the species occurs at high densities in the area. Most bat fatalities are reported in the late summer months (Johnson 2005) coinciding with the start of swarming and autumn migration (Arnett *et al.* 2007: EC *et al.* 2012). Periods of high mortality may therefore be linked with the timing of large-scale insect migrations when bats feed at altitudes consistent with wind turbine heights (Rydell *et al.* 2010). It has been found that bat fatalities increase exponentially with wind tower height, with turbine towers 65 m or taller having the highest fatality rates (Barclay *et al.* 2007). This hypothesis is also supported by the findings of Horn *et al.* (2008), who reported that bats were not being struck by turbine blades when flying in a straight line en route to another destination, but were struck while foraging in and around the rotor-swept zone of the turbine.

Temporal variation in bat activity and subsequent fatality rates can be influenced by weather variables, as well as the characteristics of the facility (Baerwald and Barclay 2011). Although bats exhibit species-specific responses to environmental variables (Baerwald and Barclay 2011), in general they appear to be more active when wind speeds are low, which increases the risk of collisions with rotating turbine blades (Arnett *et al.* 2007) and mortality resulting from barotrauma.

Sensory Disturbance

Increased human presence may also disturb roosting bats (Arnett *et al.* 2007), but it is unknown if this disturbance is sufficient to disrupt normal behaviour or physiology. Sensory disturbance to bats is most likely during the site preparation/construction and decommissioning phase of the Project, during which the presence of on-site personnel and equipment will be the highest. During hibernation, bats are sensitive to human presence, and human intrusion into hibernacula can lead to increased arousals leading to a premature depletion of fat reserves (Thomas 1995). Siting wind-energy facilities away from hibernacula is therefore recommended in the design phases of these projects.

It is unknown if noise associated with the operational phase of wind energy projects has any measureable effect on bats, although it is thought that bats may become acoustically disoriented by the low-frequency noise emitted from rotating turbines (Kunz *et al.* 2007a). Bats have been shown, experimentally, to avoid foraging in areas with intense, broadband noise (Schaub *et al.* 2008), however this research was not conducted in the context of wind-energy development and other studies indicate that bats have been shown to forage in close proximity to operational turbines (Horn *et al.* 2008).

General Mitigation Measures

The following specific mitigative measures will be implemented to avoid and mitigate any potential effects on bats:

- Use of lighting during construction and on turbine hubs and blades will be limited to minimum levels while still meeting requirements of Transport Canada.

- Where possible, placement of Project infrastructure in or directly adjacent to habitats significant to bat species will be avoided. These include hibernacula, wetlands, and lands directly adjacent to open bodies of water.
- Post-construction monitoring will be implemented under direction from NSE and in consultation with CWS and NSDNR to monitor for significant mortality trends.

14.3 Environmental Effects Analysis

The following tables (Tables 14.4 to 14.6) identify and evaluate the significance of residual effects for each phase of the Project on each VEC. Accidents and malfunctions are also analyzed. As most of the mitigation is the same for avifauna and bats, these VECs are considered together in order to decrease repetition.

Table 14.4: Environmental Effects Analysis – Construction Phase

Environmental Component (VEC)	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
SOCI	• Sensory disturbance • Habitat loss/alteration and/or fragmentation. • Effects to fish passage/migration. • Mortality.	*General Mitigation Measures* • Implementation of the EPP. • Minimize of the footprint of physical disturbance • Avoid sensitive habitats during Project siting. • Implementation of Safe Work Practices and strict adherence to speed limits and warning signs to avoid traffic collisions. • Maintain of a buffer around sensitive habitats such as watercourses and wetlands, wherever possible. • Minimize vegetation clearing, wherever possible. • Prompt restoration of cleared areas post-construction. • Maintain efficient timelines to complete Project activities within the shortest amount of time possible. • Herbicides will not be utilized in the removal of vegetation during construction activities. *Species-specific Mitigation* • The EPP for the Project will require Project personnel to report any Mainland moose sightings to NSDNR. • Should large congregations of Monarchs be found at the Project site, Project activities in the area should cease until the migrating group has	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible-Low	No residual effect anticipated	Not applicable

Environmental Component (VEC)	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
		left the Project site. • Leave adequate, permanent buffers of vegetation around important Wood turtle habitat. • Report any Wood turtle sightings to the Wood Turtle Recovery Team. • In the event that Wood turtles are confirmed at the site, an appropriate mixture of shrubs and trees will be planted to create a buffer. • Relocate any wood turtles outside of the construction zone (as per guidelines outlined in MacGregor and Elderkin 2003, and NSTPW 2007). • All watercourses on the Project site will be treated as salmonid bearing during all phases of the Project. • All in-stream work will be conducted "in-the-dry" and adhere to timing windows (Atlantic salmon). • Crossing structures will be designed and installed in consultation with DFO and NSE to ensure fish passage is facilitated (Atlantic salmon).			
Avifauna and Bats	• Habitat loss/Alteration • Mortality • Sensory disturbance.	• Implementation of the EPP. • Conduct vegetation clearing outside of the breeding and nesting season for birds (April to August). • If this is not possible, a mitigation plan will be developed in consultation with NSDNR and CWS prior to clearing activities.	Scope: Local Duration: Short-term Frequency: Once Magnitude: Low	No residual effect anticipated	Not applicable

Environmental Component (VEC)	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
		• Limit the use of lighting during construction to minimum acceptable levels. • Avoid placement of Project infrastructure in habitats significant to bird and bat species. These include wetlands, hibernacula, mature forests, land directly adjacent to open water and areas with large, hollow trees.			
Accidents and Malfunctions	• Accidental spill/release. • Failure of erosion and sediment /control measures.	• Implementation of the EPP, including the spill prevention plan and contingency plans (as necessary).	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible-Low	No residual effect anticipated	Not applicable

Table 14.5: Environmental Effects Analysis – Operation/Maintenance Phase

Environmental Component (VEC)	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
SOCI	• Sensory Disturbance • Collision Mortality	• Implementation of the EPP. • Implementation of Safe Work Practices and strict adherence to speed limits and warning signs to avoid traffic collisions. • Minimize road traffic to the extent possible. • Implement efficient timelines to complete Project activities within the shortest possible time frame. • To the extent possible, plan operation and maintenance activities to avoid sensitive habitats and minimize time on-site. • Herbicides will not be utilized in the removal of vegetation during maintenance activities. *Species-specific Mitigation* • In-stream maintenance activities will be conducted "in-the-dry", and adhere to timing windows (Atlantic salmon).	Scope: Local Duration: Long-term Frequency: Intermittent Magnitude: Negligible	No residual effect anticipated	Not applicable
Avifauna and Bats	• Mortality from collision (avifauna and bats) or barotrauma (bats). • Sensory disturbance.	• Implementation of the EPP. • To the extent possible, plan operation and maintenance activities to minimize time on-site. • Avoid routine vegetation clearing during breeding and nesting season. • Avoid all unnecessary lighting at the Project site. Lighting will only be used when technicians are working on-site.	Scope: Local Duration: Long-term Frequency: Continuous Magnitude: Low	It is expected that birds and bats will avoid the immediate area of the turbines (but not the Project site and surrounding area), which will reduce the number of bird collisions. Bird and bat fatalities due to	Low-Medium

Environmental Component (VEC)	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
		• Limit lighting on turbine hubs and blades to minimum levels while still meeting requirements of Transport Canada. • Implement post-construction monitoring under direction of NSE and in consultation with CWS and NSDNR to monitor for significant mortality trends.		turbine collisions are not expected to be significant.	
Accidents and Malfunctions	• Accidental release. • Failure of erosion and sediment control measures.	• Implementation of the EPP, including the spill prevention plan and contingency plans (as necessary).	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible-Low	No residual effect anticipated	Not applicable

Table 14.6: Environmental Effects Analysis – Decommissioning Phase

Environmental Component (VEC)	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
SOCI	• Sensory Disturbance. • Habitat alteration and/or degradation. • Mortality.	• Implementation of the EPP. • Minimize of the footprint of physical disturbance to the extent possible. • Avoid disturbing sensitive during decommissioning. • Prompt restoration of cleared areas post-construction. • Maintain efficient timelines to complete Project activities within the shortest amount of time possible. • Limit access to existing roads only. • Avoidance of known significant habitat, where possible. • Herbicides will not be utilized in the removal of vegetation during decommissioning activities. *Species-specific Mitigation* • In-stream decommissioning work will be conducted "in-the-dry" and adhere to timing windows (Atlantic salmon). • Stream banks will be promptly re-stabilized and re-vegetated post-decommissioning (Atlantic salmon).	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible	No residual effect anticipated	Not applicable
Avifauna and Bats	• Sensory disturbance.	• Implementation of the EPP • Limit access to existing roads only. • Limit time on site. • Avoid decommissioning activities during breeding/nesting season, to the extent possible.	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible	No residual effect anticipated	Not applicable

Environmental Component (VEC)	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
		• Restore vegetation promptly following decommissioning. • Limit the use of lighting during decommissioning to minimum acceptable levels			
Accidents and Malfunctions	• Accidental release. • Failure of erosion and sediment control measures.	• Implementation of the EPP, including the spill prevention plan and contingency plans (as necessary).	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible-Low	No residual effect anticipated	Not applicable

14.4 Follow-up Measures

A potential residual effect for avifauna and bats was noted in Table 14.5. The potential effect of collisions and/or fatalities to avifauna and bats will be addressed in post-construction monitoring programs that will be implemented to assess the effects of the operation of the proposed wind farm.

Monitoring programs are scheduled to begin in 2015.

15.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Environmental factors that have the potential to have damaging effects on wind turbines include:

- Extreme wind (typically associated with hurricanes);
- Hail;
- Ice storms/ ice formation;
- Heavy snow;
- Lightning; and
- Fire.

The primary mitigative measure employed during the construction and operation of the Project will be to educate and train site personnel. Environmental and safety orientations will be conducted prior to the start of construction and all staff will be informed of the potential effects of the environment on the Project. Staff responsible for the operation and maintenance of the Project will be trained on the design and operation of the turbine, including applicable operating procedures, safety protocols and evacuation plans.

Modern wind turbines are equipped with a number of mechanisms to reduce damage caused by extreme weather and are designed to shut down when certain thresholds are detected (CanWEA 2011). Further, best practices and industry standards will be applied to the operation of the Project to manage risks of damage from extreme events. Table 15.1 demonstrates potential effects resulting from environmental events and the mitigation associated with each.

Table 15.1 Effects of Environmental Events and Associated Mitigation

Environmental Event	Effect	Mitigation
Hurricane/ Extreme winds	Damage to blades.	• Turbine design equipped to shut down.
Hail	Damage to blades.	• Turbine maintenance according to best practices and industry standards.
Ice storms	Ice formation. Potential ice throw.	• Turbine design equipped to shut down • Appropriate safety protocol • Restrict use of Project site signage to indicate potential falling ice
Heavy snow	Damage to turbines.	• Turbine design equipped to shut down
Lightning strike	Potential fire during operation. Damage to electrical systems.	• Turbine design equipped with built-in grounding system • Appropriate safety protocol.
Fire	Fire during construction due to materials and machinery	• Appropriate safety protocol • Fire prevention plan • Evacuation plan • Local training of first responders

16.0 CUMULATIVE EFFECTS ASSESSMENT

Concerns are often raised about the long-term changes that may occur not only as a result of a single action but of the combined effects of each successive action on the environment (Hegmann *et al.*1999).

The cumulative effects assessment focuses only on adverse effects of the Project remaining after the application of mitigation measures (e.g., only residual effects). For this Project, the only VECs identified to have a potential residual effect are avifauna and bats (i.e., collision mortality). Therefore, known or anticipated activities within a 20 km radius of the Project site were reviewed to identify the potential for cumulative effects on collision mortality for avifauna and bats.

A search for existing or proposed wind farm developments was completed within the 20 km radius of the Project site. No future expansion is planned for the Millbrook or Truro Heights Community Wind Projects. One 4.8 MW wind farm project was identified in the Truro area (within 10 km of the Project site), which has the potential to act cumulatively with this Project. Both Projects are of relatively small size, and consist of eight turbines in total; therefore the potential for cumulative effects related to avifauna and bat mortality as a result of both Projects is considered not significant.

17.0 OTHER APPROVALS

In addition to the EA Approval, several other permits and/or approvals may be required prior to the start of construction (Table 17.1).

Table 17.1: Potential Future Approvals

Approval/Notification/Permit Required	Government Agency
Municipal	
Wind Energy Facility Development Permit	Municipality of Colchester
Building Permit	Municipality of Colchester
Provincial	
EPP/Sediment and Erosion Control Plan	NSE
Watercourse Alteration Approval	NSE
Wetland Alteration Approval	NSE
Notification of Blasting (if required)	NSE
Work within Highway Right-of-Way (if required)	NSTIR
Access Permit	NSTIR
Use of Right-of-Way for Pole Lines	NSTIR
Electricity Standard Approval	NSDE
Elevator/Lift License	Nova Scotia Department of Labour and Advanced Education
Overweight/ Special Move Permit	Service Nova Scotia
Federal	
Blasting Near Watercourses Approval (if required)	DFO
Notification of Project (awaiting response)	RCMP
Aeronautical Obstruction Clearance	Transport Canada

18.0 CONCLUSIONS

In accordance with "A Proponent's Guide to Wind Power Projects: Guide for Preparing an Environmental Assessment" (NSE 2012a), the studies, regulatory assessments, and VEC evaluations described within this document have been considered both singularly and cumulatively.

The results indicate that there are no significant environmental concerns or effects that may result from the Project that cannot be effectively mitigated or monitored.

Best practices and standard mitigation methods will be implemented during all phases of the Project, to ensure methods and practices are comprehensive and are adhered to. Furthermore, an EPP will be developed and communicated to all employees working on the Project.

Combined with the Millbrook Community Wind Project, the proposed capacity of the five turbines (10 MW) will produce enough energy to power 3,300 households with local, clean renewable energy and will contribute to reaching Nova Scotia's renewable energy commitments.

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