

#### **5.4.1.1 Desktop Studies**

An important source of bird information is the Maritimes Breeding Bird Atlas (MBBA) database (Naturecounts 2011), which contains a summary of bird distribution and abundance across the Maritime Provinces of Canada. The MBBA data was used to provide a general inventory of breeding birds in the vicinity of the Project Study Area. The MBBA also provides a list of bird Species of Conservation Concern which may be present in the Project Study Area, and also the locations of recent (2006-2010) records of species. The Project Study Area includes parts of three MBBA map squares: 20MR94, 20MR95 and 20NR04. In the most recent breeding bird atlas (2006-2010), there was good coverage/effort of atlassing in each of the squares, with 50.68 hrs, 21.25 hrs, and 45.75 hrs effort, respectively (Nature Counts 2011).

In the second atlas there were 111 bird species possibly, probably, or confirmed breeding in one or more of the three squares, with 12 possible breeders, 34 probable breeders, and 65 confirmed breeders.

Species observed or heard singing in suitable nesting habitat are classified as possible breeders. Species exhibiting the following behaviours are classed as probable breeders:

- courtship behaviour between a male and female;
- birds visiting a probable nest site;
- birds displaying agitated behaviour; and
- male and female observed together in suitable nesting habitat.

Species are confirmed as breeding if any of the following items or activities were observed:

- nest building or adults carrying nesting material;
- distraction display or injury feigning;
- recently fledged young;
- occupied nest located; and
- adult observed carrying food or fecal sac for young.

A review of the bird data collected during the second MBBA identifies 34 bird species (31%) listed as federally threatened, provincially rare or sensitive recorded within the three relevant atlas squares. Of those species with available location information from the MBBA rare and colonial species data, none are located within the Study Area.

Also included in the available MBBA data are 5 minute point count survey results for one square (20MR94; White Brook) which encompasses most of the Project Study Area. A total of 16 (unique) point counts were surveyed, 12 on June 25, 2008 and 4 on July 1, 2010. A total of 46 species and 232 individuals were recorded, including five species ranked "Sensitive. Several of the point counts are located within the Project Study Region; one of these contains a species ranked Sensitive (Ruby-crowned Kinglet). Results are included in Table 5.9.

#### **5.4.1.2 Existing Reports**

A number of field investigations have been completed in the general vicinity of the Project that provide information on bird use and risk to wind turbine operation of the Project, due to the proximity and similarity in habitat. The following data sources were reviewed:

- Blaney, S. 2005. Breeding Bird and Vascular Plant Inventory for wind turbine sites on Fitzpatrick's Mountain, NS. June 15, 2005. Appendix C5 in Dalhousie Mountain Wind Farm Environmental Assessment and Registration Document. July 30, 2008.
- Blaney, S. 2007. A vascular plant inventory of the proposed wind turbine array, Dalhousie Mountain, Nova Scotia with notes on plant communities and breeding birds. July 27, 2007. Appendix C4 in Dalhousie Mountain Wind Farms Environmental Assessment and Registration Document. July 30, 2008.
- Vines, S. 2008a. Dalhousie Mountain Bird Monitoring 2007/2008. Appendix C6 in Dalhousie Mountain Wind Farms Environmental Assessment and Registration Document. July 30, 2008.
- Vines, S. 2008b. Pre-construction Bird Monitoring: Dalhousie Mountain Wind Farm Project. July 2008. Appendix Supplement 5 in Dalhousie Mountain Wind Farms Environmental Assessment and Registration Document. July 30, 2008.
- Desjardins, G. 2012a (in press). Dalhousie Mountain Wind Farm Post Construction Bird Survey -2010. Draft Report.
- Desjardins, G.. 2012b. (in press) Dalhousie Mountain Wind Farm Post Construction Bird Survey – 2011. Draft Report.
- Desjardins, G. 2012c (in press) Clydesdale Ridge Wind Farm Pre-Construction Bird Survey Draft Report -2011/2012.

Presence/absence information on birds collected from each of these sources is presented in Table 5.9.

#### **5.4.1.3 Field Surveys**

A pre-construction (baseline) bird monitoring program was conducted between March 2011 and February 2012 by a local RMSenergy employee experienced in bird identification. The scope of the monitoring program and the survey protocol used was based on previous protocols used in support of the EA of the adjacent Dalhousie Mountain Wind Farm, and took into consideration Environment Canada's Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds (Environment Canada 2007). Bird surveys conducted included fall and spring migration surveys, raptor watches, overwintering surveys and breeding bird surveys. Surveys of overwintering bird activity in the Project Study Area in support of the Dalhousie Wind Farm EA were considered applicable to the Clydesdale Ridge Wind Farm Project. Incidental observations were also recorded by Stantec biologists completing plant surveys in June and August. In parallel to the pre-construction monitoring, post-construction monitoring was conducted for the associated Dalhousie Mountain Wind Farm (Desjardins 2012a, b). A separate report on the pre-construction bird monitoring program is presented in **Appendix H**,

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and results (including incidental observations and the 2010 post-construction monitoring of Dalhousie Mountain Wind Farm) are summarized in Table 5.9 and below. Figure 5.5 shows the bird survey point count locations.

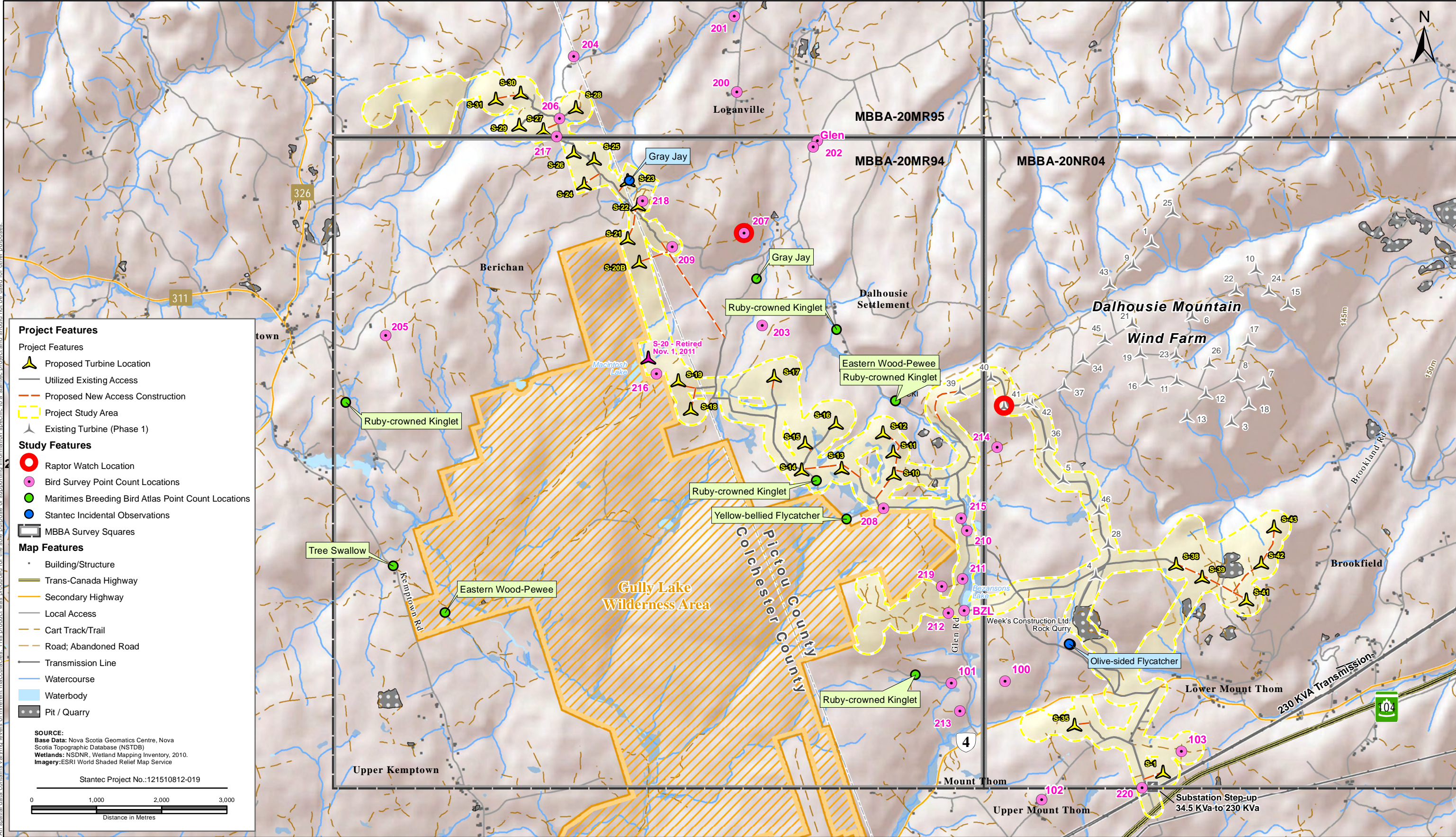
### **Breeding Birds**

Breeding surveys, consisting of point counts and incidental observations, were conducted for this assessment in June and July of 2011, including observations in August. Surveys were conducted over four days in June and July at selected point count locations, for a total of 21 point counts. An additional breeding bird survey will be conducted in 2012 and will involve additional point count locations and birding staff. A total of 39 bird species and 272 individuals were recorded during the 2011 surveys (Table 5.9), which is comparable to the MBBA point count results for square 20MR94 (46 species and 232 individuals over 16 point counts). Considering the breeding bird surveys conducted in 2011, as well as the MBBA point count data, the most common species identified included American Robin (*Turdus migratorius*), Dark-eyed Junco (*Junco hyemalis*), White-throated Sparrow (*Zonotrichia albicollis*), and American Goldfinch (*Carduelis tristis*).

Few raptors were recorded in the Study Area during the breeding season, including Northern Harrier (*Circus cyaneus*), Red-tailed Hawk (*Buteo jamaicensis*) and American Kestrel (*Falco sparverius*). Breeding activity was not confirmed for any of these raptors, though Northern Harrier and Red-tailed Hawk have been confirmed in square 20MR94 during the MBBA (2006-2010). The breeding status of American Kestrel is listed as probable. No raptor nests were found in the Study Area.

Notable observations among other bird groups in the vicinity of the Study Area included five Species at Risk and/or Species of Conservation Concern: the Olive-sided Flycatcher (*Contopus cooperi*), ranked At Risk provincially and Threatened by SARA with one pair recorded late in the breeding season; Eastern Wood-Pee-wee (*Contopus virens*), ranked Sensitive provincially with five records recorded during the pre-construction surveys and two more during the MBBA point counts; Eastern Phoebe (*Sayornis phoebe*), ranked Sensitive with five records; Tree Swallow (*Tachycineta bicolor*), ranked Sensitive with three records from pre-construction surveys and one record during the MBBA point counts; and Ruby-crowned Kinglet (*Regulus calendula*), also ranked Sensitive provincially with four records during pre-construction breeding surveys and eight more during MBBA point counts.





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CLIENT:	Dalhousie Mountain Wind Farm

Clydesdale Ridge Wind Farm Project

Bird Survey Locations

FIGURE NO.:	5.5
DATE:	May 15, 2012



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*Olive-sided Flycatchers*

Habitats where Olive-sided Flycatchers nest include forest clearings such as wooded swamps, the edges of rivers and streams, the edges of clear-cuts, and burned areas containing large numbers of snags. Suitable habitat includes clearings with scattered snags or tall living trees with adjacent mature forest. The trees or snags in the clearing are used as perching sites by hunting Olive-sided Flycatchers which wait for flying insects to pass by and capture them on the wing. Hymenoptera such as flying ants, bees and wasps are the preferred food although other flying insects are eaten. Nests are situated in trees with conifers; spruce and fir being preferred.

Olive-sided Flycatchers have recently (2010) been assigned Threatened status by COSEWIC and are listed under Schedule 1 of the SARA, but are not listed under the Nova Scotia *Endangered Species Act*. They have been, however, considered At Risk by NSDNR since 2010 and are ranked as "S3B" by the ACCDC indicating that breeding populations are uncommon throughout their range in the province and are of long-term concern. Breeding Bird Survey (BBS) data (Environment Canada 2010) indicates that Olive-sided Flycatcher abundance in Canada has declined steadily from the early 1970s until the early 2000s. The abundance of this species has remained relatively stable since then. In Nova Scotia, Olive-sided Flycatcher abundance increased from the early 1970s to 2000 after which there was a substantial decline.

The causes of the declines in Olive-sided Flycatcher populations are unclear but are probably related to loss of habitat. It is unclear if habitat loss on the breeding grounds is a significant factor affecting the abundance of this species since there has been relatively little loss of preferred habitat in the breeding grounds and a general increase in the abundance of some habitat types such as areas harvested for timber. Some research has indicated that breeding success in clear-cuts may not be as high as in natural habitats (SARA registry). Habitat loss in the wintering grounds in the montane forests (highland area below the subalpine zone) of the Andes may also be a factor affecting the abundance of this species. It is estimated that approximately 85% of this forest has been significantly altered. However, good estimates of the amount of habitat lost in the wintering grounds are not available. Declining insect populations in either the breeding or wintering areas may also be an important factor affecting the abundance of this species.

A pair of Olive-sided Flycatchers was recorded in a patch of remnant forest in the middle of a regenerating clear cut, during surveys conducted by Stantec biologists late in the breeding season in August. Based on the behaviors recorded, and their presence for several days thereafter, the breeding evidence was considered Probable. This location is outside the Project Study Area, and is located adjacent the Week's Construction Ltd. quarry site. The nearest active turbine is P-04 from the Dalhousie Mountain Wind Farm site, located more than 1.2 km to the north east, and the nearest proposed turbine is more than 1.2 km to the south.

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*Eastern Wood Pewee*

Eastern Wood Pewees are typically associated with deciduous or mixed wood forest although they often nest in ornamental groves, particularly those dominated by elms. They are often associated with forest edges. This species was listed as Sensitive under the NSDNR General Status Ranks in 2010 but is not listed under SARA or the Nova Scotia *Endangered Species Act*. ACCDC lists this species as S3S4B indicating that it is an uncommon to fairly common breeding bird species in Nova Scotia. BBS data for Canada (Environment Canada 2010) reveals that Eastern Wood Pewee abundance has declined steadily since 1970. The trend for Nova Scotia is different with a rapid decline from 1970 to 1976 followed by slower decline between 1976 and 1989 followed by a period from 1989 until 2009 in which the population was relatively stable. The cause of the decline in Eastern Wood Pewee abundance are poorly understood but are believed to be related to habitat loss.

Five Eastern Wood Pewees were recorded during the 2011 field surveys in June and July, at four different point count locations; two within and two outside the Project Study Region. The two sites within the PSR were existing roadways adjacent to mature hardwood within the Gully Lake Wilderness Area. One of these locations is no longer near the proposed Project, and the other is located where only a collector line is proposed, more than 400 m from the nearest turbine. Two Eastern Wood Pewees were also recorded during the MBBA, outside the PSR, near mature hardwood forest. All of the Eastern Wood Pewees recorded during the June and July field surveys were heard singing in suitable nesting habitat. As such, this species is considered as a possible breeder, and were not confirmed breeders in the overlapping MBBA squares.

*Eastern Phoebe*

Eastern Phoebes are typically associated with bridges and buildings, found near woodlands and along forest edges often near water. This species was listed as Sensitive under the NSDNR General Status Ranks in 2010 but is not listed under SARA or the Nova Scotia *Endangered Species Act*. ACCDC lists this species as S3S4B indicating that it is an uncommon to fairly common breeding bird species in Nova Scotia. BBS data for Canada (Environment Canada 2010) reveals that Eastern Wood Pewee abundance has been variable with an overall decline since 1970. The trend for Nova Scotia is different low numbers in the 70s, fluctuating wildly in 80s and 90s before holding steady with low abundance since 1998. In the Birds of Nova Scotia (Tufts 1998), Eastern Phoebe was described as an uncommon transient, rare in summer, in NS.

There were five records of Eastern Phoebe at four locations during the 2011 pre-construction monitoring in June and July, and none recorded at MBBA point counts. Several records were found near potential nesting sites, such as buildings, though at least 500 m or more from the nearest potential turbine location. There are scattered buildings, camps, and other structures throughout the region that may provide potential habitat for Eastern Phoebe, however no bridge structures along the proposed roads to be upgraded, that would likely be used by Eastern

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Phoebe. For the construction of the Clydesdale Project, all watercrossings will be open-bottom arch design, or cross-over circular steel culverts. No bridges will be required.

*Tree Swallow*

Tree Swallows were listed as a Sensitive species in Nova Scotia by NSDNR in 2010. Tree Swallows nest in unoccupied woodpecker holes and will also use nest boxes. They feed largely over lakes, rivers and wetlands containing open water. Their nests are often situated near these foraging sites. Tree Swallows were recorded flying near Bezansons Lake wetland on two occasions, as well as near forest edge habitat located at least 700 m from the nearest Dalhousie Mountain Wind Farm turbine and more than 1.5 km from the nearest proposed turbine location. No new roads are proposed in these areas. The one MBBA point count record was located to the west, near Upper Kemptown.

*Ruby-crowned Kinglet*

Ruby-crowned Kinglets have been recently ranked as Sensitive by NSDNR (2010) and are given a rank of "S4B" by the ACCDC indicating that they are fairly common throughout their range in the province, but are of long-term concern. For reasons unknown, the population of this species has shown a steady decline in Nova Scotia during the last several decades (Environment Canada 2010). The population for Canada as a whole has remained relatively stable.

Ruby-crowned Kinglets were only noted in one general area, outside the PSR during 2011 pre-construction surveys, however were relatively common in the MBBA point counts, with 8 records at five point count locations, both inside and outside the Project Study Area. This species can be found in a variety of forested habitat types including mature and immature softwood forest, mature and immature mixedwood forest, and mixedwood treed swamp. Ruby-crowned Kinglets have been confirmed as breeders in the MBBA square 20MR94. Plantations and regenerating softwood stands under 25 years old are common in the region, and therefore potential habitat for this species will likely increase in the near future.

*Yellow-bellied Flycatcher*

Yellow-bellied Flycatchers have also been recently assigned a status of Sensitive by NSDNR. In addition, they are assigned a rank of "S3S4B" by the ACCDC indicating that they are uncommon to fairly common throughout their range in the province and are of long-term concern. This species is associated with a variety of habitats, including swamps and damp coniferous woods. Yellow-bellied Flycatcher abundance in Nova Scotia has generally decreased since the mid-1980s. The sensitive ranking assigned to this species by NSDNR is expected to reflect loss of lowland coniferous forest and possible long-term loss of coniferous forest habitat as a result of climate change.

Yellow-bellied Flycatchers were not recorded during the 2011 pre-construction surveys, however were noted during the Dalhousie Mountain Wind Farm Post-construction monitoring,

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and the one MBBA record is located at the edge of the Gully Lake Wilderness Area, 500 m from a planned road upgrade and 800 m from the nearest proposed turbine location.

*Wood Thrush*

Wood Thrushes have an assigned rank of “S1B”, however their general status remains Undetermined. No trend information in Nova Scotia is available from the Breeding Bird Survey (Environment Canada 2010). This species is a species of mature hardwoods in both urban and rural areas, though the Study Area is at the northeastern limit of its natural range. Wood Thrush was detected as a probable breeder in square 20MR94 during the first MBBA, and a possible breeder during the second MBBA, with additional records in adjacent squares to the south east. The large stands of mature hardwoods in the Gully Lake Wilderness Area would be expected to provide the best potential habitat for this species. An individual was detected late in the breeding season outside of the Project Study Area near the adjacent points 203 and 207 (approximately 1.6 km from the nearest proposed turbine or access road). There is little potential nesting habitat for Wood Thrush within the Project Study Area.

*Eastern Kingbird*

Eastern Kingbirds have been recently assigned a status of Sensitive by NSDNR. In addition, they are assigned a rank of “S3S4B” by the ACCDC indicating that they are uncommon to fairly common throughout their range in the province and are of long-term concern. This species is associated with open habitats, including fields, orchards and forest edges, and will also use urban parks and golf courses. Eastern Kingbird abundance in Nova Scotia has generally decreased since the mid-1980s.

A single Eastern Kingbird was recorded late in the breeding season (July 25) during the pre-construction surveys in 2011, in suitable breeding habitat (old pasture) at point 209, located more than 600 m from the nearest proposed turbine. It has otherwise not been noted by any of the identified surveys with the exception of the MBBA, where it was recorded during the second atlas as territorial singing in one of the overlapping MBBA squares (20MR95).

*Gray Jay*

Gray Jays are listed as a Sensitive species by NSDNR and ranked as a “S3S4” species by ACCDC. They are a resident species of coniferous forest, and Nova Scotia represents the southeastern extent of its range. Gray Jays were not detected during pre-construction surveys during the breeding season however were recorded as an incidental observation in August, and were counted on a MBBA point count in 2008 outside of the Project Study Region, more than 1.5 km from the nearest proposed turbine.

**Wintering Birds**

The abundance and diversity of wintering birds is largely dictated by weather conditions, time of year, available habitat and the biological cycle of each species. Owls, crossbills, and finches

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dramatically fluctuate in numbers depending upon conditions elsewhere in their ranges. As a result, one may find many individuals of a certain species in one winter and none the next winter.

Wintering bird surveys were conducted by Vines (2008) in support of the Dalhousie Mountain Wind Farm, which partially overlaps the Clydesdale Project Study Area. Winter bird surveys consisted of standardized area searches from December to March, sampling a variety of habitats in the Project Study Area. The surveys were conducted over one day each month. Additional overwintering bird surveys were conducted for Clydesdale in January and February 2012.

Winter monitoring in 2008 identified small resident species populations, dominated by Boreal Chickadees and Golden-crowned Kinglets. Other bird species recorded in low numbers included Black-capped Chickadee (*Parus atricapillus*), Black-backed Woodpecker, Blue Jay, American Crow, Common Raven, and Red-breasted Nuthatch. Despite an eruptive year for winter finches in Nova Scotia in 2007/2008, only three finch species were recorded at the Dalhousie Mountain Wind Farm site, including relatively small numbers of Pine Grosbeaks, White-winged Crossbills, and a single Common Redpoll.

From local knowledge, it is known that a large flock of Snow Buntings frequents the Week's Construction Ltd. rock quarry at the entrance to the Dalhousie Mountain Wind Farm. A pair of Common Raven is also known to inhabit the Bezansons Lake area year round.

Winter bird surveys conducted in December 2011 and January/February 2012 support the results of previous winter bird surveys conducted in the area. Winter birds detected in the area included the expected Common Ravens, American Crows, Pileated Woodpeckers, and Black-capped Chickadees. American Goldfinches were heard once, and a flock of 40 unidentified gulls were observed flying southerly on January 30 at an altitude of approximately 240 m. A flock of 15 black capped chickadees were seen in flight over forest. Snow Buntings frequent a farm located 900 m southwest of the substation. Other species occasionally noted include Blue Jay, Gray Jay, Ring-necked Pheasant, and Bald Eagle.

Although they will occasionally range across the general area, most of the land birds that linger in the Project Study Area during the winter remain close to vegetation cover, which provides shelter, food, and protection from predators. The Project Study Area does not provide important wintering habitat for birds, and provides foraging habitat similar or lower in quality to that present elsewhere in the region.

**Spring Migration**

Six spring migration surveys were conducted between late April and the end of May. The surveys consisted of primarily surveying a subset of the 21 point count locations plus incidental observations in transit.

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There was a total of 32 species of birds observed during the spring monitoring period, totaling 195 individual birds. The majority of birds observed were recorded as flying or residing below 30 m. The most frequently recorded birds were American Robin, American Crow, Dark-eyed Junco (*Junco hyemalis*), and White-throated Sparrow (*Zonotrichia albicollis*). There were few large flocks observed in the spring, with eight American Robins being the largest single species flock observed. Waterfowl observations were rare (five Ring-necked Ducks were the only waterfowl), with Wilson's Snipe being the only species of waterbird observed.

Species of conservation concern that were observed during spring migration included Wood Thrush (an S1 species with an undetermined general status rank) and Wilson's Snipe (ranked Sensitive), of which there was a single observation each.

There is no evidence of a migratory peak of passage in any of the species or groups (**Appendix H**). This was also the conclusion of Vines (2008), who determined that the birds observed near the Dalhousie Mountain Wind Farm were primarily arriving breeding populations.

### **Fall Migration**

Eleven fall migration surveys were conducted between mid-August and mid-November, following the same approach as the spring migration surveys.

There was a total of 51 species of birds observed during the fall migration surveys, totaling 844 individual birds. The most numerous species identified included American Robin, Cedar Waxwing, Blue Jay, Black-capped Chickadee and American Goldfinch. The largest flock observed was a group of 300 Common Grackles. Waterfowl recorded during fall migration included Canada Goose (including a flock of 11) and American Black Duck, while one species of waterbird, and four species of raptors were observed.

Species of conservation concern that were observed during fall migration include five Sensitive ranked species: Eastern Wood-Pewee, Eastern Phoebe, Gray Jay, Boreal Chickadee, and Pine Siskin. A group of four Common Loons was observed on one occasion in October, and two Gray Jays were observed on one occasion in September. None were detected in large numbers. Between one and four Eastern Wood Pewees were noted regularly between August 12 and September 20, for a total of nine birds.

Likewise with the spring migration, the counts generally show no evidence of major peaks of arrival or departure.

### **Raptor Watch**

Raptor watches were conducted from two high vantage points that permitted panoramic views of the Project Study Region, Dalhousie Mountain Wind Farm turbine number P-41 and Point count number 207. Few raptors were recorded during the watches, with the most commonly observed raptor being Bald Eagles (both mature (5) and immature (2)). Other raptors recorded included a pair of circling Red-tailed Hawks, a Broad-winged Hawk and an American Kestrel both hunting at

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low elevation on separate occasions, and a Rough-winged Hawk observed in flight late in the season.

There was no evidence of major raptor flights over the Study Area during the fall migration period (**Appendix H**).

### **Survey Summary**

The survey data suggests that the Project Study Area is not a major “corridor” or stopover site for waves of migrants arriving or leaving the province. The counts generally show little evidence of major peaks of arrival or departure of the sort observed in other areas of the province. Only a single instance of a major flock of migrants was observed (an estimated 300 Common Grackles observed on August 23, 2011 in a low-lying area). There was no evidence of major raptor flights over the Project Study Area.

#### **5.4.1.4 Interior Forest**

Forest interior birds are particularly sensitive to habitat loss since they are affected both by direct habitat loss and through the adverse effects of habitat edge. Forest interior habitat for the purpose of this report is defined as mature forest that is free of edge and is greater than 10 ha in size. The distribution of mature forest habitat in the forest interior assessment area was determined using NSDNR forest inventory mapping. The area used for the forest interior assessment included a rectangular regional study area encompassing the Project Study Area and surrounding region, depicted as the map extents in Figure 5.3. The amount of forest interior habitat in the forest interior assessment area was determined by establishing 100 m buffers around edge producing features such as existing highways and streets, electrical transmission lines, railroads, heavily disturbed non-forested habitat, borrow pits, quarries, woods roads, and recent clear-cuts. Areas remaining after buffering these features were classed as forest interior habitat if they were mature forest 10 ha or greater in size. The total area of forest interior habitat in the large Regional Study Area surrounding the Project Study area is 8,397 ha which is 24.% of this area. The smaller Project Study Area contains 182 ha of forest interior habitat which represents 0.5% of the Regional Study Area and 10% of the Project Study Area. The lower proportion of forest interior habitat in the landscape of the Project Study Area is attributable to two factors. Firstly, the Project Study Area is located outside of the Gully Lake Wilderness Area which contains almost half of the forest interior habitat in the Regional Study Area. Secondly, the Project Study Area has been established along an existing road network in order to minimize the length of road that must be constructed to provide access to the turbine sites. The presence of these roads produces edge effect that extends into adjacent forested habitat and renders it non-forest interior habitat. In addition, most of the roads in the Project Study Area are logging roads that were used to harvest and transport timber in this area. As such, most of the forest habitat adjacent to these roads has been harvested over the past few decades reducing the amount of mature forest within the Project Study Area.

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There are 114 patches of forest interior habitat located within the Regional Study Area and 17 located in the Project Study Area. Construction of the proposed turbine array will result in direct loss of forest interior habitat in five of these forest interior patches resulting in the loss of 3.7 ha of forest interior habitat (note the previous layout resulted in a predicted loss of 9.43 ha of forest interior). A considerable amount of forest interior habitat will be salvaged with the construction of a new access road between S-19 and S-20B which has been shifted east of the original layout) (refer to Figure 5.3). As indicated in Section 5.3.1, these calculations are based on NSDNR forest inventory mapping which does not reflect recent landowner harvesting of trees and therefore the area of existing and predicted impacted forest interior habitat is expected to be overestimated.

In addition to the direct loss of forest interior habitat, construction of roads, transmission lines and turbine pads creates edge effects that project into adjacent habitat. For the purposes of this study and in accordance with the definition of forest interior habitat provided by CWS, the adverse effects of edge are considered to extend 100 m into surrounding habitat. When edge effects are taken into consideration, the amount of forest interior habitat likely to be adversely affected as a result of wind farm construction is estimated to be 39.2 ha, which is 21.5% of the forest interior habitat present in the Project Study Area. This is a reduction from 37.7% using the previous layout. It also should be noted that the forest data used to model and map the distribution of forest interior habitat does not reflect current conditions, as several areas shown as interior forest have in fact been recently harvested by the landowners, including forest in the vicinity of proposed Turbines S-12, S-31 and S-43. As such, prior to re-routing the turbine array, it will be necessary to confirm that the mature forests in the vicinity of turbines S-19, S-20B and S-21 are still intact.

## 5.4.2 Mammals

### 5.4.2.1 Overview

Nova Scotia is home to 57 species of terrestrial mammal (Davis and Browne 1996). The mammal fauna of Nova Scotia has been altered dramatically since the arrival of Europeans. A number of species have been extirpated, such as the caribou (*Rangifer tarandus*) and the wolf (*Canis lupus*), due to habitat destruction, human encroachment and hunting (Davis and Browne 1996; Banfield 1974). Others species, such as the white-tailed deer (*Odocoileus virginianus*) and eastern coyote (*Canis latrans*), appear to have benefited from human disturbance, and are relatively recent arrivals to the province (Davis and Browne 1996). The abundant mammal species are generally mobile and widespread in Nova Scotia, and the mammal fauna of the province has not been delineated into distinct communities (Davis and Browne 1996). However, a number of mammal species native to Nova Scotia currently have restricted ranges and exist in disjunct populations.

Information regarding the presence of mammals, including rare species, and sensitive mammal habitat within the Project Study Area was derived from existing data sources including the EA for the nearby Dalhousie Mountain Wind Farm, a review of data for the area obtained from

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ACCDC (Table 2 in **Appendix F**) and field surveys which were conducted in June and August of 2011.

Habitat types in the Project Study Area are described in Section 5.3.1. Given the types of habitat present in the Project Study Area, it can be expected to support a variety of mammal species characteristic of forested and open habitats. Although most of the Project Study Area is located in areas that have been heavily modified by various anthropogenic activities including forestry, agriculture and aggregate quarrying, it is located adjacent to the Gully Lake Wilderness Area which contains large tracts of mature deciduous forest. As such, there is potential for mammal species characteristic of remote areas or large tracts of mature forest such as fisher (*Martes pennanti*) and moose (*Alces americanus*) to be present.

Evidence of the presence of mammals was collected during the field surveys. This included visual sightings, distinctive calls, tracks, scat, dens, lodges and other distinctive spoor that could be used to identify mammals. A total of 11 mammal species were detected during the field surveys including white-tailed deer, moose, eastern coyote, red fox (*Vulpes vulpes*), black bear (*Ursus americanus*), meadow vole (*Microtus pennsylvanicus*), American beaver (*Castor canadensis*), meadow jumping mouse (*Zapus hudsonius*), eastern chipmunk (*Tamias striatus*), American red squirrel (*Tamiasciurus hudsonicus*), and varying hare (*Lepus americanus*) (Table 5.10). All of these species, with the exception of moose (mainland population), are considered to be secure in Nova Scotia by NSDNR.

Table 5.10 presents a list of mammals that are expected to make use of habitats in the Study Area. Most of these species are relatively common in the province; however, three species - little brown myotis (*Myotis lucifugus*) and northern long-eared myotis (*Myotis septentrionalis*) and tri-colored bat (*Perimyotis subflavus*) are Yellow listed by NSDNR indicating that they are sensitive to human activities and natural events. This general status designation is attributable to the fact that these bats gather in large numbers in a limited number of caves and abandoned mines to hibernate. This concentration of their populations places them at higher risk. These species are discussed in more detail in the following text.

**Table 5.10 Mammal Species Recorded in and/or Likely to Occur in the Project Study Area**

Common Name	Binomial	Habitat	NSDNR Ranking	ACCDC Ranking
Little Brown Myotis	<i>Myotis lucifugus</i>	In summer they inhabit forests, and inhabited areas. Natal colonies often established in houses. In winter they hibernate in caves and abandoned mines.	Sensitive	S4
Northern Long-eared Myotis	<i>Myotis septentrionalis</i>	In summer they inhabit forested areas. In winter they hibernate in caves and abandoned mine shafts.	Sensitive	S2
Star-nosed Mole	<i>Condylura cristata</i>	Low lying woods, meadows, marshes, lake and stream banks.	Secure	S5

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**CLYDESDALE RIDGE WIND FARM FINAL ENVIRONMENTAL ASSESSMENT**  
**REGISTRATION**

DESCRIPTION OF THE EXISTING ENVIRONMENT

**Table 5.10 Mammal Species Recorded in and/or Likely to Occur in the Project Study Area**

Common Name	Binomial	Habitat	NSDNR Ranking	ACCDC Ranking
Masked Shrew	<i>Sorex cinereus</i>	Wide variety of habitats including forest, fields, wetlands and seashores. Prefers areas with high humidity.	Secure	S5
Smoky Shrew	<i>Sorex fumeus</i>	Mature deciduous forest and under cover objects along stream banks.	Secure	S5
American Water Shrew	<i>Sorex palustris</i>	Lakeshores, stream banks and marshes. Can be found in forest habitat in close proximity to shores.	Secure	S5
Short-tailed Shrew	<i>Blarina brevicauda</i>	Hardwood forest, high humidity and loose humus.	Secure	S5
White-tailed Deer	<i>Odocoileus virginianus</i>	Forested habitat in various stages of succession. Also wetlands, agricultural land, suburban areas and seashores.	Secure	S5
Moose	<i>Alces americanus</i>	Forests providing both mature softwood cover and young hardwood browse. Also swamps, bogs and lakeshores, generally remote from human habitation.	At risk	S1
River Otter	<i>Lutra canadensis</i>	Rivers, lakes and coastal marine habitats.	Secure	S5
Ermine	<i>Mustella erminea</i>	Inhabit a wide range of habitats including coniferous and mixedwood forest, stream margins and lake shores.	Secure	S5
American Mink	<i>Mustela vison</i>	Near waterbodies.	Secure	S5
Fisher	<i>Martes pennanti</i>	Harwood, softwood and mixedwood forest in various stages of succession. Usually remote from human habitation.	Sensitive	S2
Striped Skunk	<i>Mephitis mephitis</i>	Forests, river valleys and agricultural areas.	Secure	S5
Bobcat	<i>Lynx rufus</i>	Swamps, woodlots, second growth forest and agricultural areas.	Secure	S5
Eastern Coyote	<i>Canis latrans</i>	A wide variety of habitats including forested areas, agricultural areas, wetlands, barrens, and suburban areas.	Secure	S5
Red Fox	<i>Vulpes vulpes</i>	Agricultural areas, lakeshores, river valleys, natural clearings.	Secure	S5
Black Bear	<i>Ursus americanus</i>	Coniferous or deciduous regions, swamps, barrens, and berry patches.	Secure	S5
Raccoon	<i>Procyon lotor</i>	Forested areas near watercourses, river valleys, trees in grasslands.	Secure	S5
Meadow Vole	<i>Microtus pennsylvanicus</i>	Wet meadows, grasslands, salt marshes, abandoned fields, prairies, vacant lots, edges and openings of forest.	Secure	S5
Red-backed Vole	<i>Clethrionomys gapperi</i>	Mainly found in coniferous forest but also occur in deciduous forest. Typically found near sources of water such as streams, springs and bogs.	Secure	S5

**Table 5.10 Mammal Species Recorded in and/or Likely to Occur in the Project Study Area**

Common Name	Binomial	Habitat	NSDNR Ranking	ACCDC Ranking
Southern Bog Lemming	<i>Synaptomys cooperi</i>	Bogs, grassy marshes, damp mixed forest.	Secure	S3/S4
Deer Mouse	<i>Peromyscus maniculatus</i>	Found in a wide variety of dry habitats including forests and grasslands.	Secure	S5
Woodland Jumping Mouse	<i>Napaeozapus insignis</i>	Forested habitat along the shores of streams, springs and lakes.	Secure	S5
Meadow Jumping Mouse	<i>Zapus hudsonius</i>	Moist grassland, grassy stream banks, marsh borders, alder-willow borders, low fields, edges of forests, and fence rows.	Secure	S5
Muskrat	<i>Ondatra zibethicus</i>	Lakes, rivers, ponds, and marshes.	Secure	S5
Beaver	<i>Castor canadensis</i>	Slow-flowing streams, lakes, rivers, and marshes.	Secure	S5
Porcupine	<i>Erethizon dorsatum</i>	Deciduous and coniferous regions, farmland.	Secure	S5
Eastern Chipmunk	<i>Tamias striatus</i>	Dry hardwood forest, hedgerows, fences, stone piles, gardens.	Secure	S5
Red Squirrel	<i>Tamiasciurus hudsonicus</i>	Boreal coniferous forest, eastern hardwood deciduous forest, mixed forests, urban areas with trees.	Secure	S5
Varying Hare	<i>Lepus americanus</i>	Forests, swamps, riverside thickets.	Secure	S5

#### 5.4.2.2 Mammal Species of Conservation Concern

The ACCDC data search indicated that moose (*Alces americanus*), long-tailed shrew (*Sorex dispar*), northern long-eared myotis (*Myotis septentrionalis*), tri-colored bat (*Perimyotis subflavus*), and hoary bat (*Lasiurus cinereus*) have been reported within a 100 km radius of the Project Study Area. Information collected as part of the Dalhousie Mountain Wind Farm EA indicate that several other sensitive mammal species may be present in the area including fisher (*Martes pennant*) and little brown myotis (*Myotis lucifugus*). The mainland moose population in Nova Scotia is listed as Endangered under the Nova Scotia *Endangered Species Act*. Fisher, tri-colored bat, northern long-eared myotis and little brown myotis are listed as Sensitive by NSDNR indicating that the Nova Scotia populations of these species are sensitive to human activities and natural events. The hoary bat is listed as status Undetermined due to the paucity of records of this migratory species which make it difficult to determine if this species breeds in Nova Scotia.

#### Mainland Moose

The Cobequid Hills are one of the areas on mainland Nova Scotia known to contain moose populations. The area around Dalhousie Mountain has traditionally supported a population of moose large enough to permit a hunting season. In the 1980s the moose population here and elsewhere on mainland Nova Scotia began to decline in concert with a large increase in the abundance of white-tailed deer. The reasons for the decline are not well understood and may include the interactions of a variety of factors including historic excessive hunting, poaching,

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climate change, parasitic brainworm (*Parelaphostrongylus tenuis*), increased road access to moose habitat, increased abundance of white-tailed deer, high levels of cadmium, dietary deficiencies, unknown viral disease, and disturbance.

The number of moose on mainland Nova Scotia has decreased from an estimated 2,500 to 4,000 animals in the 1960s and 1970s to approximately 1,000 animals as of 2007. The mainland moose population in Nova Scotia is listed as Endangered under the Nova Scotia *Endangered Species Act*.

In 2007 a moose pellet group survey was conducted as part of the EA for the Dalhousie Mountain Wind Farm (refer to **Appendix J**). Most of the Project Study Area is located within the area in which this moose pellet group survey was conducted. The survey included 15 transects, each 1 km long. No evidence of the presence of moose was encountered during the survey including the presence of tracks and browsing sign. Anecdotal evidence from local residents indicated that moose had disappeared from the area in the 1980s. The study concluded that the area around Dalhousie Mountain was no longer occupied by moose although suitable habitat was present and there was potential for moose to someday re-occupy this area.

Additional information regarding use of the Project Study Area by moose was compiled during the 2011 field surveys. Biologists conducting botanical and wetland surveys in the Project Study Area were instructed to record any sign of moose in the Project Study Area including the presence of tracks, faeces and evidence of moose browsing. During the late vegetation survey in early August 2011 a pile of summer type ungulate faeces was found near Turbine S-21. The pile of faeces was larger than would be expected from a white-tailed deer and was attributed to moose. No other evidence of moose presence was collected during the field surveys.

The new evidence collected in 2011 suggests that moose may occasionally pass through the Project Study Area but do not appear to spend much time there as evidenced by the very scanty evidence of moose occupancy. Results of an ongoing five-year moose study undertaken by the Proponent are sent directly to NSDNR.

**Fisher**

Fisher prefer habitat containing large expanses of mature mixedwood forest, particularly areas containing abundant prey and suitable denning sites such as hollow trees. Fisher were extirpated from Nova Scotia by the early 1920s but were reintroduced in southwestern Nova Scotia and central Nova Scotia. The two reintroductions were successful; however, the eastern population, located within Cumberland, Colchester and Pictou Counties has re-established much more successfully than the southwestern population which occupies the central portion of southwestern Nova Scotia. Although fishers prefer mature forests, they are able to make use of forests in a variety of age classes. Most of the Project Study Area has been subjected to forest harvesting and would be suboptimal habitat; however, the Project Study Area is located adjacent to the Gully Lake Wilderness Area which contains large areas of mature forest. As such, there is a high likelihood that fishers utilize the Project Study Area.

### **Long-tailed Shrews**

Long-tailed shrews are typically found in forested talus slopes and rock slide areas. They use both hardwood and softwood forest and will continue to occupy areas where the forest cover has been cut. Long-tailed shrews spend almost all of their lives in the interstitial spaces between stones. In Nova Scotia their distribution is highly localized and is dictated by the presence of suitable talus slope habitat. No suitable habitat was encountered during the field surveys and habitat suitable for long-tailed shrews would not be conducive to the establishment of wind turbines.

### **Bats**

All bat species native to Nova Scotia are considered to be sensitive to anthropogenic disturbance. However, the risk of bat collision with wind turbines is generally greater for migrating bats than for resident breeding, commuting or foraging bats, which generally forage between 1-10 m above ground level and seldom above 25 m, thus avoiding turbine blades (Erickson *et al.* 2002). Migratory bat species such as the hoary bat (*Lasiurus cinereus*), the red bat (*Lasiurus borealis*), and silver haired bat (*Lasionycteris noctivagans*) may be present in low numbers in the Study Area. These migratory bats are found across North America, but there have been few accounts of these species in the province.

Bats are cryptic, nocturnal animals that are difficult to study, and the technology that allows researchers to effectively study bats is relatively new. In the Maritimes, intensive research into bats and bat populations has only begun within the last 15 years. In that time, studies employing a broad range of techniques and tools including acoustic monitoring, netting, radio-tracking, DNA analysis, stable isotopes, and transponder (PIT) tags, have been undertaken. Seven species are known to occur in Nova Scotia including hoary bats, silver-haired bats, eastern red bats, big brown bats (*Eptesicus fuscus*), tricolored bat (*Perimyotis subflavus*), northern long-eared (*Myotis septentrionalis*) and little brown myotis (*Myotis lucifugus*) (Broders *et al.* 2003; Van Zyll de Jong 1985), although only the latter three species have confirmed populations within Nova Scotia (Broders *et al.* 2003; Burns and Broders 2010; Randall 2011). None of these three are considered migratory species or are typically at high risk of interaction with wind farms, with the possible exception of the tri-colored bat, which comprised 24% of bat mortality at a small wind development at Buffalo Mountain in eastern Tennessee where tri-colored bats are the most common local species. However, the distribution of tri-colored bats in Nova Scotia appears to be limited to the southwestern portion of the province (Farrow and Broders 2010).

To date, there have been few records of migratory bat species in Nova Scotia. The Nova Scotia Natural History Collections contain eight records of hoary bats and two records of silver-haired bats, although there are multiple records from ships and Cape Cod that suggest these species do migrate north across the Gulf of Maine (Brown 1953; Miller 1897; Norton 1930; Peterson 1970). However, in the course of more recent systematic surveys of bats in Nova Scotia suggest that these species rarely occur (Farrow 2007; Rockwell 2005). In 2001, Broders *et al.* (2003) recorded more than 30,000 echolocation sequences during migration periods in

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Kejimikujik National Park and Brier Island, of which less than 0.001% were attributable to migratory species. During the course of this study the first breeding record for red bat was incidentally recorded in Yarmouth, NS.

Likewise, there are very few records of big brown bats in Nova Scotia. They are known to occur in low numbers in New Brunswick, likely associated with human occupied buildings (McAlpine *et al.* 2002). In Nova Scotia, Taylor (1997) found three hibernating big brown bats, suggesting that there may be year round residents in the Province, although subsequent work at Nova Scotia hibernacula has provided no additional evidence of their overwintering presence (Randall 2011).

Broders and Henderson (2007) conducted pre-construction acoustic monitoring at a nearby proposed wind development near the community of Brookland. Over 31 detector nights, 461 bat calls were identified, of which all but one were from *Myotis* spp. The other call was not identified to species, but was attributed to either big brown bat or silver haired bat. The study concluded that the area was not likely an important migratory route, but that there may be some potential for fatalities of *Myotis* species at the site given their presence. In light of the recent invasion of White-nose fungus (*Geomyces destructans*) into the Maritimes and the devastating affect it appears to have on formerly common bats species, the potential for interaction with *Myotis* spp. warrants additional consideration going forward. The Committee on the Status for Endangered Wildlife in Canada (COSEWIC) assessed the status of little brown myotis, northern long-eared bats, and tri-colored bats and has given the three species an emergency designation of Endangered.

Post-construction monitoring efforts from the adjacent Dalhousie Mountain wind development have identified only one bat carcass, which was found on July 3, 2010 but was not identifiable (Dalhousie Mountain Wind Farm personnel, pers. comm. 2011). While this carcass survey study was not specifically targeting bats, it is likely that if there was significant mortality, more carcasses would have been found.

Based on current knowledge, it can be anticipated that the two sympatric *Myotis* species are present around the Project Study Area, as they are ubiquitous throughout the Maritimes and have been recorded nearby. It is unlikely that tri-colored bats occur in substantial numbers or that the Project Study Area is within an important corridor for migrating bats.

Pre-construction bat surveys were not undertaken at the proposed Clydesdale Wind Farm Project due to the:

- ineffectiveness of pre-construction surveys in predicting actual mortality;
- unlikelihood of the site being used as a migratory route due to its geographic location;
- The availability of recent acoustic monitoring data for the adjacent Dalhousie Mountain Wind Farm (**Appendix L**) which is applicable to the Clydesdale Wind Farm Project Study Area. This study indicates the presence of a simple bat community in the area of non-migratory species that is typical in much of the Maritimes.

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This study will consider the potential for effects of the proposed wind development on bats at the proposed Clydesdale Ridge Wind Farm based on the landscape level and habitat conditions at the site, in consideration of existing knowledge of bat demographics and movement in Nova Scotia.

*Landscape and Site Level Conditions*

Landscape and site level features identified as indicators for increased likelihood of presence of bats, have been assessed for the proposed Project Study Area. These features, as outlined by NBDNR (2009) include:

- Known hibernacula or potential caves or mines within 5 km of the site;
- Coastline, or major water bodies within 500 m; or
- Forested ridge habitat on or near the site.

Additionally, a standard level review of the Project Study Area was conducted to assess potential for summer maternity colonies for local bats species, and potentially heavy foraging areas.

Known or Potential Winter Hibernacula

With the recent spread of White-nose syndrome into the Maritimes, and the potential for catastrophic consequences on local bat populations, increased attention and concern has become focused on the winter hibernacula where the associated fungus *Geomyces destructans*, is thought to spread and propagate (Blehert *et al.* 2009). Hibernacula can house large concentrations of bats and may be the sites of swarming activity where large numbers of bats congregate near cave or mine openings in late summer or fall where they engage in social behaviours that include courtship and copulation (Rivers *et al.* 2005). In Nova Scotia, researchers at Dalhousie and Saint Mary's Universities have recently undertaken studies of bat movements among hibernacula in Nova Scotia and New Brunswick in an attempt to better understand the structure and movement of bat populations in the Region.

NSDNR has documented more than 600 mining areas, containing approximately 7,000 mining features which are or were at one time, open to the surface (NSDNR 1995). Some of these abandoned shafts are known to be used by hibernating bats. There may be additional mines that are not included within this database. Many of the mines that are recorded are of unknown status (in terms of depth, condition opening etc.) but most that are known are flooded, in-filled, or too shallow for the thermal conditions required by hibernating bats. Where known, the database records information on the abandoned mine opening that includes: depth, flooding, condition of opening, physical form (shaft/slope/adit), etc. One recent study by Randall (2011) considered known caves and abandoned mines in mainland Nova Scotia, and identified 30 of these as having potential importance to bats, 21 of which were previously unstudied. In the course of these surveys, no abandoned mines around the wind development area were identified as having high potential for swarming bats. There were four mine openings identified

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as having potential approximately 20 km to the southeast of the site near New Lairg and McLellan's Brook, but none of these openings were found to have swarming activity. The predictive model developed in this study suggested that caves must have a depth of at least 50 m to have greater than 10% chance to be used as a swarming site for bats. Suitable bat hibernacula must also be humid with consistent, cool temperatures (Brack 2007; Ingersoll *et al.* 2010).

The greater New Glasgow area has several abandoned mines, but within 5 km of the Project Study Area, there are only four known abandoned mines and no known natural winter hibernacula. The locations of these mines are shown on Figure 5.2. Two of the nearby mine openings are flooded and therefore cannot be used by bats. Of the two that area not flooded, one is recorded as having an original depth of only 4.5 m. The fourth mine, which is located approximately 4.5 km to the southeast of the Project Study Area has a recorded depth that is between 21 m and 60 m. This mine, located along Route 104, is listed as uninspected by NSDNR staff and little information is recorded for it. While this mine may have some minor potential to accommodate hibernating bats, it is nearly 5 km away from the southeastern corner of the Project Study Area, and is of low concern. A field investigation of its exterior may be warranted in the spring to gain an understanding of the current condition of the cave.

Species Status of Local Bats and White-Nose Syndrome

White-nose Syndrome is currently understood to be the primary threat to little brown myotis, northern long-eared myotis and the tri-colored bat. While none of these species are currently listed federally under SARA, or provincially under NS *Endangered Species Act*, they have recently been listed Endangered by COSEWIC following an emergency assessment on February 3, 2012. This emergency assessment and subsequent status change was largely the result of the threat from the rapidly spreading white-nose fungus, and the decimating effects it has on the populations of little brown myotis, northern long-eared myotis, and the tri-colored bats. The two *Myotis* species have historically been the most common species of bat in the Maritimes, but populations at affected hibernacula in the region have been decimated. No other bats species occurring in the Province have special status.

In 2006, the first case of white-nose syndrome was recorded in North America, in Albany, New York. This syndrome is caused by a fungus (*Geomyces destructans*) which grows in cold, humid environments, the same environments where cave-dwelling bats are known to hibernate. White-nose syndrome affects bats while they are hibernating, causing hibernating bats to become dehydrated and malnourished, which in turn causes bats to become active at a time when they are unable to survive winter conditions and food resources are non-existent (Forbes 2012a,b,c). White-nose syndrome has spread at an average rate of approximately 200-400 km each year, and has now been recorded in Canada, in Ontario, New Brunswick, and Nova Scotia. In these three provinces, many sites are averaging mortality rates above 90% (Forbes 2012a). The fungus responsible for white-nose syndrome is believed to have originated in Europe, and is spread both by bats that have been infected, and people visiting caves (Forbes 2012a).

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The fungus has been recorded in Nova Scotia, as of fall 2011, and it is anticipated that the effects throughout the Maritimes will be similar to that recently seen in northeastern United States and adjacent New Brunswick, where mortality rates in a single cave were over 94% over two years (Forbes 2012a, b). In order to reduce the risk of spreading the White-nose Syndrome, permission to enter caves and conduct surveys has been restricted throughout Nova Scotia (Forbes 2012a).

While direct interactions between these three species are anticipated to be minimal as discussed in Section 6.2.1, consideration must be given to the siting of turbines and associated infrastructure to avoid hibernacula and maternity colonies.

#### Major Water Bodies

There are no major water bodies within 5 km of the Project Study Area. The nearest major feature is the West River to the east that flows into the harbour near Pictou. The nearest coastline is the Northumberland Strait to the North which is more than 10 km away.

#### Forested Ridge Habitat

Most wind developments on eastern North America are located along forested ridgelines due to the geography of the region, and the wind speeds that can be found along these features. Wind developments along these features may experience elevated mortality levels when migrating bats exploit favorable air currents associated with the features, or use them as navigational markers. *Myotis* species mortality has been found at forested ridge wind development areas in eastern North America to a lesser extent than migratory bats, probably due to their tendency to fly close to the ground (Broders 2003). The nature and cause of mortality of non-migratory bats at wind developments is poorly understood, but research is currently underway in Nova Scotia to better understand the movements of bats to/from and between hibernacula in the fall and spring which may help to better predict the risk factors associated with placement of wind developments.

While the proposed Project is located along a predominantly forested ridge, the Project Study Area is largely in non-forested or immature stage of development (68%), and the ridge formations are non-linear and are arranged in a broken, southeast to northwest pattern, which is perpendicular to the direction that bats migrating towards the US would likely take.

#### Roosting and Foraging Habitat

Assuming that little brown and northern long-eared myotis are present, it is possible that maternity colonies may occur near the site which may be sensitive to construction activities, operational disturbance, or direct mortality from collisions with turbines. While male northern long eared and little brown myotis have less specific or limiting roosting requirements, maternity colonies of the local *Myotis* species are typically found in hollow, tolerant hardwood trees, or in the case of reproductive little brown myotis, in man-made structure where available (Broders and Forbes 2004). There are no buildings located within the Study Area, but there is mature hardwood forest habitat that may contain suitable trees for maternity colonies. However, within

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the Study Area, 68% of the area is non-forested and immature forested land. Only 20% of the Study Area is in mature hardwood stands with an additional 6% in mature mixedwood. This compares to the greater landscape, of which 37% falls within mature hardwood or mixedwood. While these figures do not indicate the actual presence of maternity colonies on the site, they suggest that relative to the surrounding landscape, the siting of the turbines has less potential for interaction with reproductive bats than other locations in the landscape might.

The turbine locations are predominantly sited along existing road networks along a mountain ridge. While some of the road network passes near wetland and riparian habitat which may represent heavy foraging areas for local bats, such habitat is less common along the ridge tops and where the turbines will be sited outside of wetlands where feasible.

While the potential for direct interaction with breeding and *Myotis* species is anticipated to be low, their recently updated COSEWIC status warrants precautions to avoid direct interaction with breeding *Myotis* bats. Clearing and other construction activities that produce high noise levels such as jack-hammering will be conducted outside the active season for bats. The Proponent has also committed to contributing to a regional study being undertaken by Hugh Broders of St. Mary's University, pending PPA award. This study is intended to characterize bat movement patterns and populations at a regional scale to help better inform which factors best predict bat mortality risks of wind farms.

### **5.4.3 Reptiles and Amphibians**

#### **5.4.3.1 Overview**

Amphibians and reptiles are normally treated together as herpetiles. There are 22 terrestrial and freshwater herpetile species recorded from Nova Scotia. The herpetofauna of Nova Scotia is relatively sparse when compared to adjacent mainland areas of the continent, mostly because of the difficulty of post-glacial colonization of this peninsula and a relatively harsh climate.

Information regarding the herpetofauna in the Project Study Area was obtained from existing information sources (e.g., ACCDC 2011; Gilhen 1984; Gilhen and Scott 1981; and Scott 1994) and field surveys. Ten herpetile species were encountered during the field surveys including green frog (*Rana clamitans*), pickerel frog (*Rana palustris*), wood frog (*Rana sylvatica*), northern spring peeper (*Pseudacris crucifer*), American toad (*Bufo americanus*), yellow spotted salamander (*Ambystoma maculatum*), redback salamander (*Plethodon cinereus*), common garter snake (*Thamnophis sirtalis*), redbelly snake (*Storeria occipitomaculata*), and smooth green snake (*Liophorophis vernalis*) (Table 5.11). None of these species is considered to be rare or sensitive to human activities in Nova Scotia. Table 5.11 also lists herpetile species that can be expected to occur in the Study Area.

**Stantec**  
**CLYDESDALE RIDGE WIND FARM FINAL ENVIRONMENTAL ASSESSMENT**  
**REGISTRATION**

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**Table 5.11 Herpetile Species Recorded in and Likely Occur in the Project Study Area**

Common Name	Binomial	Habitat	NSDNR Ranking	ACCDC Ranking
Common garter snake	<i>Thamnophis sirtalis</i>	Woods, meadows, marshes, lakes, farmlands, edges of developed areas and stream banks; wide ranging.	Green	S5
Ringneck Snake	<i>Diadophis punctatus</i>	Most commonly encountered in deciduous and mixedwood forest particularly near the shores of ponds, lakes, and streams. Also found near the edges of bogs, fields, pits and roads.	Green	S5
Red-bellied Snake	<i>Storeria occipitomaculata</i>	Prefer open habitats such as roadsides, grassy heaths, clear-cuts, abandoned gravel pits and the shores of lakes, ponds and streams	Green	S5
Smooth green snake	<i>Liophorophis vernalis</i>	Grassy and shrubby areas along the shores of watercourses, fields, and lawns in suburban areas.	Green	S5
Leopard frog	<i>Rana pipiens</i>	Forages in terrestrial habitats such as fields, woodlands and roadside ditches; breeds in the shallows of lakes and ponds.	Green	S5
Wood Frog	<i>Rana sylvatica</i>	Damp woodlands, particularly in deciduous and mixed woods; breeds in roadside ditches and ephemeral pools.	Green	S5
Pickerel Frog	<i>Rana palustris</i>	Agricultural areas, lakeshores, river valleys, natural clearings; breeds in ponds and small streams.	Green	S5
American Toad	<i>Bufo americanus</i>	Flexible habitat requirements; breeds in shallows of lakes, ephemeral pools, small streams.	Green	S5
Spring Peeper	<i>Pseudacris crucifer</i>	Forested areas near watercourses; breeds in standing water, often where there is dense submerged plant debris.	Green	S5
Red-spotted Newt	<i>Notophthalmus viridescens</i>	Red eft larval stage lives in damp deciduous, coniferous or mixed woodlands for approximately two years. Adults and aquatic larval stage live in ponds, vegetated coves of lakes and sluggish streams.	Green	S5
Yellow-spotted salamander	<i>Ambystoma maculatum</i>	Inhabits coniferous, deciduous and mixed woodlands adjacent to aquatic breeding sites; breeds in ponds and vegetated coves, in lakes and vegetated sluggish streams.	Green	S5
Red-backed salamander	<i>Plethodon cinereus</i>	Woodland areas; breeds under rocks or in decaying tree stumps. The larval stage occurs within the egg and the young hatch as juveniles.	Green	S5

#### 5.4.3.2 Herpetile Species of Conservation Concern

The ACCDC database search identified one rare or endangered herpetile species, wood turtle (*Glyptemys insculpta*), that has been recorded within a 100 km radius of the Project Study Area. The wood turtle is listed as vulnerable under the Nova Scotia *Endangered Species Act*. It is also listed under SARA as Threatened. No wood turtles were encountered during field surveys. Wood turtles are almost invariably associated with streams, creeks, and rivers and the adjacent rich

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intervale forest and shrub communities, as well as with the meadows and farmland terrestrial habitat associated with these watercourses. Streams with sand and/or gravel bottoms are preferred, but rocky streams are used occasionally. Wood turtles may wander some distance from watercourses during summer foraging, but characteristically remain within linear home ranges. These home ranges are 1 to 6 ha in size and are centered on a suitable river or stream where non-vegetated or sparsely vegetated sandy beaches and banks serve as nesting sites. Natural nesting sites consist of sandy river beaches, but may also include select disturbed sites, such as railway grades and roadsides. During the summer months some wood turtles may travel considerable distances up small tributaries that offer good foraging opportunities but lack suitable nesting and hibernation sites. These smaller streams may serve as dispersal corridors between populations on different river systems.

The Project Study Area is not located within a watershed known to harbor wood turtles; however, adjacent watersheds are known to contain this species (NSDNR 2003). It is possible that wood turtles foraging near the headwaters of streams in these adjacent watersheds may cross over into headwater streams in the Project Study Area during the summer months. In general, the Project Study Area does not provide good wood turtle nesting or hibernation sites.

The Proponent has commissioned a highly qualified biologist (author of provincial wood turtle annual studies and tracking program) to brief the permanent work team at Dalhousie Mountain on the wood turtle in a two-day interactive workshop. The turtle workshop, to be held in May 2012, will demonstrate actual species found well outside of the Project Study Area. The workshop will consist of a field visit to the turtle study area, a powerpoint presentation and general Q & A session. This interactive training will ensure that should the wood turtle be recorded or encountered within work activities (construction, operations, decommissioning) that proper precautions will take place on behalf of staff.

## **5.5 ATMOSPHERIC ENVIRONMENT**

The following section describes the climate and air quality of the site.

### **5.5.1 Climate**

Weather data was acquired from the Truro meteorological station, which is located approximately 27 km east of the Project site. Based on Environment Canada climate normals or averages for the period of 1971-2000, the average annual temperature in the region is 5.8°C, with the average daily maximum and minimum being 11.1°C and 0.5°C, respectively (Environment Canada 2011). The warmest period during the year is typically from June to August (daily mean of 17.0°C), while the coldest period is between December and February (daily mean of -5.6°C) (Environment Canada 2011).

According to 1971-2000 precipitation data at the Truro station, precipitation occurs approximately 174.7 days per year and averages approximately 1,202 mm of precipitation throughout the year, where 83% is rain and the remainder is snow (Environment Canada 2008).

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## 5.5.2 Air Quality

A network of ambient air monitoring stations is set up throughout the province to measure ambient concentrations of various air contaminants. The closest air quality monitoring station to the Project Study Area is located in Pictou. However, only ozone and PM is monitored at this location. The next closest ambient air quality monitoring stations to the Project Study Area are the Halifax and Port Hawkesbury monitoring stations. A list of the contaminants monitored at both of these locations, their distance to the Project Study Area, and annual averages is presented in Table 5.12.

**Table 5.12 Various Ambient Air Monitoring Stations Located Near the Study Area**

Monitoring Station	Contaminant	Approximate Distance from Project (km)	Annual Averages	
			2005	2006
Pictou	O <sub>3</sub> (ppb)	25	22.6*(7 months)	27.7*(10 months)
	PM <sub>2.5</sub> (µg/m <sup>3</sup> ) (BAM)		7	7.7*(9 months)
Halifax	SO <sub>2</sub> (ppb)	100	6	6
	CO (ppm)		0.5*(10 months)	0
	NO <sub>2</sub> (ppb)		16*(7 months)	16
	O <sub>3</sub> (ppb)		13	21
	PM <sub>2.5</sub> (µg/m <sup>3</sup> )(TEOM)		5*(9 months)	4*(9 months)
	PM <sub>2.5</sub> (µg/m <sup>3</sup> ) (BAM)		NA	7*(6 months)
	PM <sub>2.5</sub> (µg/m <sup>3</sup> )(Dichot)		NA	8*(9 months)
	PM <sub>10</sub> (µg/m <sup>3</sup> )(Dichot)		NA	14*(9 months)
Port Hawkesbury	SO <sub>2</sub> (ppb)	125	2.8*(10 months)	2
* - Annual mean calculated over the number of months indicated. NA - Data Not Available Reference: Environment Canada, 2008				

Based on monitoring results from the most recently published National Air Pollution Surveillance (NAPS) Network ambient air quality monitoring reports for 2005 and 2006 (Environment Canada 2008), the following general conclusions can be made:

- The monitored concentrations of particulate matter less than 2.5 microns in diameter (PM<sub>2.5</sub>) at the Halifax monitoring station have generally been low;
- None of the monitored concentrations of carbon monoxide exceeded the 1-hour or 8-hour objectives (35,000 µg/m<sup>3</sup> and 15,000 µg/m<sup>3</sup>, respectively);
- None of the monitored concentrations of nitrogen dioxide exceeded the 1-hour or Annual objectives (400 µg/m<sup>3</sup> and 100 µg/m<sup>3</sup>, respectively);
- None of the monitored concentrations of sulphur dioxide exceeded the 1-hour or 24-hour objectives (900 µg/m<sup>3</sup> and 300 µg/m<sup>3</sup>, respectively);
- In 2005 and 2006 the ambient air quality 1-hour objective for ozone of 82 ppb was not exceeded at any of the monitoring stations.

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Given the fact that there is no ambient air monitoring station located on or in the immediate vicinity of the Project Study Area, that there is limited data available from the ambient air monitoring station in Pictou, and that the Halifax ambient air monitoring stations include emissions from industrial activities (which is not characteristic of the Project Study Area), it can be reasonably estimated that the Project Study Area is representative of a rural environment where all contaminant concentrations would meet the Ambient Air Quality Objectives.

## **5.6 SOCIO-ECONOMIC CONDITIONS**

### **5.6.1 Population**

The Project Study Area is located near Mount Thom in Pictou County and Colchester County, Nova Scotia. Nearby communities include Mount Thom, Brookfield, Dalhousie Settlement, Loganville and Berichan. Population statistics for Pictou and Colchester County from the 2006 census are summarized in Table 5.13 below.

**Table 5.13 Population Statistics for the County of Pictou and County of Colchester**

<b>Population and Dwelling Counts</b>	<b>County of Pictou</b>	<b>County of Colchester</b>
Population in 2006	46,513	50,023
Population in 2001	46,965	49,307
2001 to 2006 population change (%)	-1.0	1.5
Total private dwellings	21,768	22,951
Population density per square kilometer	16.3	13.8
Land area (square km)	2,845.26	3,627.69

Source: Statistics Canada 2006 Census

Pictou County has experienced population decline from 2001 to 2006 of -1.0%. The 2006 population of Pictou County was distributed fairly evenly across various age groups with the age ranges 40-44, 45-49, 50-54 and 55-59 being higher than other age ranges. The median age of the population was 43.6, which is slightly older than the provincial median of 41.8. Approximately 16.7% of the population was over the age of 65, which is somewhat higher than the province's statistic of 15.1%. Approximately 1.7% of the population identified as Aboriginal, while 2.8% identified as foreign-born (Statistics Canada 2011).

Colchester County experienced an increase in population from 2001 to 2006 of 1.5%. The age groups with the age ranges 40-44 and 45-49 years were higher than the other age ranges with the median age of the population being 42.5. Approximately 16.3% of the population was over the age of 65, higher than the province's statistic. Approximately 2.6% of the population identified as Aboriginal, while 3.9% identified as foreign-born (Statistics Canada 2011).

### **5.6.2 Health, Industry, and Employment**

In Pictou County, the Pictou County Health Authority (PCHA) is responsible for delivering health care services to the county and regional programs to the larger population of northeastern Nova

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Scotia through the Aberdeen Hospital in New Glasgow, Sutherland Harris Memorial Hospital in Pictou, Addiction Services, Mental Health Services and Public Health Services.

Table 5.14 and Table 5.15 list the participation in local industry for Pictou and Colchester County. Tourism likely falls into the category of “Other Services”, as it is not specifically listed by Statistics Canada. The largest industry for both Pictou and Colchester County is the business services and manufacturing industries.

**Table 5.14 Employment by Industry in Pictou County**

Industry	Pictou County		
	Total Employed	Total Males Employed	Total Females Employed
Total – Experienced Labour Force 15 Years and Over	22,905	12,220	10,685
Agriculture and Other Resource-Based Industries	1,320	1,085	235
Construction	1,335	1,165	170
Manufacturing	3,805	3,190	615
Wholesale Trade	555	415	145
Retail Trade	3,430	1,410	2,020
Finance and Real Estate	650	320	325
Health Care and Social Services	2,675	295	2,380
Educational Services	1,350	475	875
Business Services	4,220	2,355	1,865
Other Services	3,555	1,500	2,055

Source: Statistics Canada 2011

**Table 5.15 Employment by Industry in Colchester County**

Industry	Colchester County		
	Total Employed	Total Males Employed	Total Females Employed
Total – Experienced Labour Force 15 Years and Over	25,160	13,245	11,915
Agriculture and Other Resource-Based Industries	1,460	1,135	325
Construction	1,685	1,510	165
Manufacturing	3,575	2,310	1,270
Wholesale Trade	1,470	1,120	345
Retail Trade	3,285	1,455	1,825
Finance and Real Estate	740	340	400
Health Care and Social Services	2,365	340	2,025
Educational Services	1,875	670	1,205
Business Services	3,905	2,265	1,645
Other Services	4,790	2,085	2,705

Source: Statistics Canada 2011

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As listed in Table 5.16, Michelin Tire is the top employer in Pictou County with 1,400 local employees (Pictou Regional Development Agency n.d.). Empire Company and Chignecto Regional School Board employ 942 and 923 employees, respectively (Pictou Regional Development Agency n.d.).

**Table 5.16 Top Employers in Pictou County**

Employer	Business	Number of Employees Locally
Michelin Tire	Tire Manufacturing	1,400
Empire Company	Sobeys (Grocery Retail) Crombie REIT (Real Estate) Empire Theatres	942
Chignecto Regional School Board	School Board	923
Convergys Inc	In-Bound Call Centre	500
Pictou County Health Authority	Hospital/Health Services	800
Northern Pulp	Pulp Manufacturing	340
ICT Group	Contact Centre	240
Advocate Printing & Publishing	Print & Marketing Communications	182
Maritime Steel & Foundries	Iron Steel Production	148
Nova Scotia Power Corp	Electric Utility	128
Scotsburn Dairy Group	Dairy Production	105
Wear Well Garments	Garment Manufacturing	100

In 2005, 24,860 residents of Pictou County and 27,370 residents of Colchester County, 15 years of age or more, earned an income (from either full time or part time jobs). The median income for all persons working in Pictou and Colchester County was \$20,762 and \$21,018 respectively, which is below the provincial median of \$22,608. For those in Pictou and Colchester who had full-time work all year-round, median earnings were \$35,300 and \$33,030, respectively, which is still well below the provincial average of \$36,917 (Statistics Canada 2011).

Based on the 2006 census, the unemployment rate for Pictou County is 9.5% which is slightly higher than the provincial unemployment rate of 9.1% where Colchester County is 7.9%, lower than the provincial unemployment rate.

### **5.6.3 Recreation and Tourism**

Pictou County is located along the Northumberland Shores which is known for its scenic views and warm waters. The County of Pictou offers a variety of accommodations, dining, museums, exhibits and heritage sites. A number of outdoor recreation and activities include hiking/walking on trails such as the Jitney Walking Trail, Short Line Trail and Fitzpatrick Trail, Kayaking,

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golfing, bird watching and visiting nearby beaches such as the Caribou Provincial Park, Munroe's Island Nature Reserve and Waterside Beach Provincial Park (Town of Pictou 2012).

Colchester County is bounded on the west by the Fundy Shore and on the northeast by the Northumberland Shore providing scenic views, warm waters and the world's highest tides from the Bay of Fundy. Colchester offers a variety of accommodations, dining, museums, exhibits and heritage sites including Mastodon Ridge, Glooscap Heritage Centre and Mi'kmaq Museum (Central Nova Tourist Association n.d.). A number of outdoor recreation and activities include hiking/walking on trails such as the Cobequid Trail, Five Island Provincial Park and the shores of Cape Chignecto, golfing, watching the tidal bore, white water rafting and skiing (Central Nova Tourist Association n.d.). Nearby parks include: Five Island Lighthouse Park, Nelson Memorial Park, Stewiacke Park, and Shubenacadie Wildlife Park.

The Gully Lake Wilderness Area is 3,810 ha located to the west from the Project Study Area. Gully Lake Wilderness Area is a protected area just north of Mount Thom consisting of hardwood and mixed forest hills and small flood plains which host a rich association of plants and some rarities (Nova Scotia Environment 2009). There is an old network of cart tracks and old woods roads which are now used for hiking, camping, cross-country skiing, and other low-impact recreation. Winter snow cover in this region is among the best in mainland Nova Scotia, allowing for excellent winter recreation (Nova Scotia Environment 2009). The Gully Lake Area consists of several trails, including MacIntosh Lake, Gully Lake, Salmon River, Juniper Brook, and Connector trail systems.

**5.6.4 Land Use**

The land uses in the Project Study Area over the last one hundred years have been farming, forestry, recreational uses, Christmas tree cultivation, maple syrup, blueberry harvesting, and hunting. All of these uses still exist, except for farming. The Project Study area was the last settled area in Pictou County in the 1800s. The land was cleared for farms, a school, a post office and a few saw mills that comprised the settlers' small community. The conditions were harsh, the winters long and poor soil productivity for farming crops, were the main reasons the farms were abandoned. The Canada Land Inventory, Soil Classification for Agriculture shows the area as being "Class 7" which does not support arable culture or permanent pasture. Most residents left in the early 1900s and the last settler left by horse and wagon in 1941, moving to Eureka. Over the years, the area has been over-grown with mostly Spruce, Fir, Poplar, and Maple. In 1990, thousands of acres were cleared and either replanted with Norway/White Spruce or left to naturally regenerate in Balsam Fir (Christmas Trees).

The existing Dalhousie Mountain Wind Farm is currently gated to vehicles. However, recreational trails run throughout the entire wind farm, and construction of gates have let room for access with ATVs or snowmobiles so there has been no effect on users. Roads have been greatly improved for vehicles, although vehicular traffic is limited (other than recreational vehicles). The back side of the Dalhousie Mountain Wind Farm is not gated, only privately owned land (owned by the Proponent) is gated to limit theft.

### **5.6.5 Property Values**

In 2006, there were 19,290 dwellings in Pictou County, of which 14,820 were owned and 4,365 were rented. Approximately 79% of the dwellings in Pictou County were constructed before 1986. The average value of a home in 2006 was \$114,744, approximately \$43,256 less than the provincial average (Statistics Canada 2011). In Colchester there were 20,855 dwellings of which 15,270 were owned and 5,445 were rented. Approximately 71% of the dwellings in Colchester were constructed before 1986. The average value of a home in 2006 was \$129,116, approximately \$28,884 less than the provincial average (Statistics Canada 2011).

At the existing Dalhousie Mountain Wind Farm, property values have not been affected. If property has turbine on it, the value has greatly increased as there is an added guaranteed income associated with the property. Since the Dalhousie project is over 1,500 m from the nearest house, and all of the local homeowners are happy with the project, there has been no negative effect on the property values. In addition, the increased exposure of the Dalhousie Mountain area through media and wind farm events have made this beautiful, quiet area of Nova Scotia more widely known and therefore, potentially has increased the value of the properties.

### **5.6.6 Acoustic Environment**

Background sound measurements were not taken as a component of this study however data collected during the Dalhousie Mountain Wind Farm EA has been reviewed and incorporated in this analysis to represent background conditions, along with the operation of the Dalhousie Mountain Wind Farm (see Section 6.2.1.7 and **Appendix L**).

This noise assessment relied on the approach used in Alberta and in British Columbia that recognizes that rural areas, with low housing density and local transportation noise can be characterized sufficiently by assuming nighttime background  $L_{eq}$  of 35 dBA, and daytime  $L_{eq}$  of 45 dBA. It is the experience of Stantec in numerous background sound level surveys in Nova Scotia that this assumption is valid. Based on the similarity of the landscapes of variable boreal forests, and professional experience of the Atmospheric Environment Study Team at similar areas, it was concluded that no substantive difference exists between the assumed ambient levels, such as implemented in western Canada, and the majority of the Study Area. As such, ambient sound levels within and surrounding the Project Study Area was assumed to be 45 dBA during the day (0700 to 2200 hrs) and 35 dBA during the night (2200 to 0700 hrs).

Note that these assumed ambient sound levels exclude the sound associated with the operation of the Dalhousie Mountain Wind Farm, which is adjacent to the proposed Project. The Ontario guidelines consider only the incremental change associated with the operation of the wind turbines. For the purposes of this assessment, therefore, the operation of the Dalhousie turbines is not assumed to be part of the background, but a part of the cumulative wind energy development. It is considered appropriate here, and in similar situations, to consider the cumulative impact of all wind turbines at the receptors that are influenced by the proposed

Clydesdale Ridge Wind Farm. Refer to Section 6.2.1.7 and **Appendix L** for information pertaining to the sound levels related to the operation of the Dalhousie Mountain Wind Farm.

### **5.6.7 Heritage Sites, Archaeological Sites and Other Cultural Resources**

The assessment of archaeological potential for the site considered both prehistoric and historic period resources. Archaeological potential modeling for prehistoric era sites is based largely on the identification of landscape features which are either known to have attracted past habitation or land use, or which appear to have potential for attracting human use. These features include the availability of potable water, suitability for habitation (e.g., ground conditions), proximity to desirable resources (such as workable stone), and proximity to water transportation routes, coastal areas, portage routes and food supplies. A desktop archaeological assessment (see **Appendix K**) was completed under Heritage Research Permit # A2011NS103 by professional archaeologist Laird Niven, with results summarized below.

#### **5.6.7.1 Historical Background**

Some of the earliest records of a French presence in the Project Study Area state that settlers probably came to Pictou County between 1725 and 1750. These accounts state that while settlement seems to have been concentrated in Merigomish and the French Channel area, the English that later settled Pictou County would find sporadic evidence of earlier French settlement outside of these areas. Because of these accounts and the fact that the true extent of the French presence in both Pictou and Colchester counties is unknown, it is possible that there may be some evidence of a French presence in the Project Study Area.

English settlers began coming to Nova Scotia in the early 1760s, and historical documents indicate that the first big wave of settlement was associated with the Philadelphia Grant. This grant was given to a group of 14 men, primarily from Philadelphia, for approximately 200,000 acres on October 31st, 1765. Many other land grants were given to people from England and the eastern United States at this time, signalling the early stages of a major wave of settlement in this area. In June of 1767 the Hope, a ship sent from Philadelphia, brought 6 families to Pictou Harbour. These families settled in the Mount Thom and Mount Ephriam areas and the names of these families (Harris, Patterson, McCabe, Rogers, Cumming and one family of unknown name) can be seen in these communities to this day. Records show that these settlers brought individuals of African descent with them to Pictou as 'chattel'. The Hector, a ship from Scotland, brought just under 200 immigrants to Nova Scotia who arrived in Pictou on September 15, 1773 and settled on the land that was allotted under the Philadelphia Grant.

Evidence of these settlements can be seen by looking at Crown Land Grant Maps (see Figure 2 in **Appendix K**), the A.F. Church maps (Figure 3 in **Appendix K**) and many historical records. These indicate who lived on which parcels of land, how large the plots were, and often where the main houses were located. In addition to these main residences, barns, outbuildings, churches, schoolhouses, mills, forges, cemeteries and other buildings were constructed in the Project Study Area. The Pictou County settlement features shown on the A.F. Church map are illustrated in Figure 3 alongside the approximate turbine locations. The names on the Church map include McCulloch, Dinwoodie, Creighton, McKeith, McLeod, Munro, and, McIntosh

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amongst others. The 1879 Meacham map seems somewhat more accurate than the Church map and shows the extent of all the land grants as well as the owner's name at the time. The Meacham and Church maps indicate that there was extensive Scottish settlement throughout the Project Study Area in the mid-to late-nineteenth century.

While some of these properties still remain in use, others were abandoned over the years for various reasons. All of these historical records illustrate the high potential for archaeological resources within the Project Study Area.

#### **5.6.7.2 Previous Archaeology**

An Archaeological Resource Impact Assessment was carried out by Davis Archaeological Consultants Limited for the Dalhousie Mountain Wind Farm (Davis Archaeological Consultants 2008). Discussions were held with landowners to identify any previous settlement foundations and cemeteries. The desktop study indicated that there were no registered Heritage Sites of any kind identified on the sites at the time. An archaeological field study in accordance with the Special Places Protection Act of Nova Scotia Tourism, Culture and Heritage (Permit # A2007NS40) was conducted at the selected turbine locations and along the access road corridor.

The Davis (2008) field study was conducted over and around the selected turbine locations and along the access road corridor to identify and map potential historical resources in the work areas. Discussions were held with landowners to identify any previous settlement foundations and cemeteries. Davis identified five sites of archaeological significance in the Dalhousie Mountain vicinity. None of these sites were within the Dalhousie Mountain Wind Farm footprint, and no disturbance of these sites occurred as a result of project activities. As well, none of these sites are within the footprint for the proposed Clydesdale Ridge Wind Farm.

#### **5.6.7.3 Archaeological Potential**

##### **First Nations**

While there are no First Nations sites recorded within or surrounding the Project Study Area, it is well known, and has been noted since the earliest written accounts of the area, that the Mi'kmaq were present in Pictou Harbour as well as the river valleys throughout Colchester and Pictou Counties. These areas would have been important to First Nations groups as both transportation routes and food sources are available in these areas.

##### **Historic**

There are no recorded historic archaeological sites within the Project Study Area. However the Maritime Archaeological Resource inventory lists seven archaeological sites recorded as being in the area surrounding the Project Study Area. Both surveys and speaking to local landowners led to these sites being recorded between 1997 and 2008. All of the identified archaeological sites date to the historic period and are of a residential/settlement and agricultural nature. While

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none of these sites are directly inside the Project Study Area, they are representative of some of the types of archaeological sites that are potentially present within the Project Study Area.

#### **5.6.7.4 Summary**

Both the historical documentation and the archaeological work done in this area to date demonstrate the potential for further archaeological resources within the study area. While the potential for First Nations resources varies based on location in the landscape as well as the availability of cultural resources, the potential for encountering these resources exists within the Project Study Area.

The documentary and archaeological records both show the history of settlement patterns in Pictou County and more specifically within the study area. Settlement began in the mid-eighteenth century with a small number of French settlers and intensified during the late eighteenth and early nineteenth centuries. Immigrants came from the eastern US, England and Scotland including groups of settlers on both the Hope and the Hector. The historical archaeological potential within the Project Study Area is considered to be high.

The Project Study Area has high potential for historical resources associated with English and Scottish settlement of the area. There is also an undetermined potential for First Nations resources associated with the landscape and natural resources available within the Project Study Area. An archaeological field survey will be undertaken by qualified archaeologists before any ground disturbance takes place. Such work could include more in-depth background research, a pedestrian survey of the high potential areas, possibly, sub-surface testing and/or monitoring of high potential areas subject to excavation.

#### **5.6.8 Land and Resources Used for Traditional Purposes by Mi'kmaq Persons**

Prior to the construction of the Dalhousie Mountain Wind Farm, a Mi'kmaq Ecological Knowledge Study (MEKS) was carried out by the Confederacy of Mainland Mi'kmaq (CMM) and the archaeological team at the Mi'kmaq Rights Initiative (KMKNO) (refer to **Appendix D**). The study revealed that there was potential for First Nations significance throughout the project area, although no evidence has been found in the area to date.

Clydesdale Ridge Wind LP will commission the CMM to conduct an MEKS on the Project Area for the Clydesdale Project (which overlap the study area for the 2008 MEKS) to determine traditional and current use of lands for traditional purposes for the proposed Clydesdale Ridge Wind Farm, pending award of a PPA for the Clydesdale Wind Farm. This study will take into account all available records from both Mi'kmaq and government/ cultural records, field studies and extensive interviews with elders from the Mi'kmaq communities, namely Pictou Landing.

#### **5.6.9 Transportation Infrastructure**

The Project Study Area receives little traffic other than movements of local residents and occasional visits by tourists and other outdoor enthusiasts, trucks hauling sand and gravels from quarries, trucks hauling timber and the transportation of heavy equipment for the construction

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and forest industries. The site is approximately 8 km from Highway 104. Route 4 will comprise the key transportation network expected to be used for transport of materials to the site. It is anticipated that the current road network (outside of onsite turbine access roads) will not require upgrades to accommodate construction traffic. This statement can be made in confidence as the transportation route used for the delivery of components for the Clydesdale Ridge Wind Farm Project will be the same as the transportation route used for the delivery of components for the Dalhousie Mountain Wind Farm Project. Existing roads within the Project boundary will have to be upgraded and some new roads constructed to deliver the machinery on sites.

#### **5.6.10 Safety Issues**

Lands within the Study Area could present safety issues (e.g., steep ridges). Construction and decommissioning activities associated with the wind farm may present some safety challenges with respect to these hazards and routine hazards associated with construction activities. In the operational phase, safety issues such as potential for ice throw must be considered in the context of local populace and public access issues. All safety issues will be addressed with the appropriate design and mitigation measures (e.g., setbacks, restricted access, public notification).

At the existing Dalhousie Mountain Wind Farm, the Proponent communicates any ice throw risks to the snowmobile clubs in the area as well as with the Gully Lake Ecotrails Society to promote safe use of the lands for winter purposes such as cross-country skiing and snow-shoeing. The Proponent and other site workers also patrol the site on snowmobile during the winter to promote safe distance parking.

#### **5.6.11 Visual Landscape**

The Project Study Area is located primarily on a forested ridge and the area is mostly forested but does support other vegetation types including wetlands, blueberry fields and disturbed areas such as roads and quarries.

A visual landscape assessment was conducted for the Project. This assessment was completed with the use of a computerized simulation that superimposed wind turbine images, which are located and scaled to size, onto a photograph of an existing view in the area for the purpose of creating a realistic representation of the proposed wind farm from a specific view.

Further information and viewshed photographs on the area's visual landscape are presented in Section 6.2.1.5.