residual effects of the Project will be determined using the criteria, based on federal and provincial EA guidance (Table 13.2).

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

Table 13.2: Criteria for Identification and Definition of Environmental Impacts

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

The potential level of impact after mitigation measures are applied (*i.e.,* residual effects) was identified based on the criteria and definitions provided in the Natural Resources Canada (NRCan) document, "Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the Canadian Environmental Assessment Act" (NRCan 2003), as shown in Table 13.3.

Table 13.3: Definition of Significant Residual Environmental Impact

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

13.2 Effects Assessment

Effects and mitigation measures related to each VEC are described below. Potential effects of the Project on the identified VECs are further analyzed in Tables 13.4 to 13.6 to identify and evaluate the significance of residual effects, based on the criteria listed above. Mitigation measures are also summarized.

Accidents and malfunctions are considered for each phase.

13.2.1 Species of Conservation Interest

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

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

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

Sensory Disturbance

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

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

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

Impacts to fauna SOCI during the decommissioning phase of the Project will be similar to those experienced during the site preparation/construction phase (Helldin *et al.* 2012). Namely, sensory disturbance due to the increased presence of on-site personnel and the operation of heavy equipment may elicit temporary displacement/avoidance behaviours in mobile wildlife species. No sensory disturbance impacts are expected for fish SOCI.

Habitat Loss/Alteration
Although the permanent footprint of a wind energy facility is generally estimated to be just 5 to 10% of the Project site (Arnett *et al.* 2007), there is the potential that significant habitat elements for certain fauna SOCI may altered/removed during site preparation activities, such as clearing, for turbine pads and access roads. However, the effects may be negligible if the habitat is in adequate supply in the general area surrounding the Project site (Arnett *et al.* 2007). Since the Project footprint represents approximately 2.5% of the Project site area and habitat types at the Project site are common in the surrounding landscape, the effects of habitat loss/alteration on terrestrial fauna SOCI will be minimized.

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

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

Removal of overhanging vegetation from stream banks decreases shade/cover for fish resulting in increased vulnerability to predators and potentially in increased localized water temperatures. Likewise, the removal of instream cover, such as coarse woody material or edge habitat (*e.g.*, undercut banks) may have a similar effect on fish habitat. Coarse woody material also provides habitat for aquatic invertebrates. Alterations to channel morphology and interference with sediment transport may also lead to fish habitat modification/degradation (MTO 2009). Many effects to fish habitat can be mitigated through thoughtful planning and the incorporation of standard mitigation and BMPs (refer to Section 4).

The potential effects of the Project on fauna SOCI habitat during the operational phase are likely to be minimal. Aside from surface disturbance and the possible removal of regenerated vegetation, decommissioning will not include additional habitat loss/alteration. Therefore, the impacts to fauna SOCI during this phase of the Project are not expected to be significant in magnitude or long-term in duration.

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

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

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

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

- Minimization of the footprint of physical disturbance by:
    - Alignment of access roads with existing roads and logging trails, wherever possible.
    - Where the aforementioned is not possible, designing and constructing access roads to avoid environmentally sensitive habitats, where possible, and ensuring the most efficient means to access turbines is achieved.
    - Maintenance of a buffer around sensitive habitats such as watercourses and wetlands, where possible.
    - Minimizing routine vegetation clearing:
        - clearing of land only if required for construction area footprint;
        - restoration of areas of disturbance where possible, post construction; and
        - siting construction compounds in/on non-sensitive areas.
- Completion of a comprehensive schedule and determination of timelines to efficiently complete Project activities within the shortest time frames possible.

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

Fisher:
- Project activities will be planned to minimize disturbance to Fisher habitat at the Project site, particularly in mature, mixed wood stands featuring large, hollow trees (suitable for denning) and areas of continuous canopy cover (Gilbert *et al.*1997).

Mainland moose:
- Project personnel will report any evidence of Mainland moose to NSDNR.

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

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

Fish SOCI (Atlantic Salmon, American Eel, Striped Bass)
- The siting, design, installation and decommissioning of all crossing structures will incorporate ongoing consultation with DFO, and NSE, and will avoid areas of sensitive habitat and ensure that fish passage is maintained;
- Additional mitigation for the protection of fish habitat will be ensured through the NS watercourse alteration permitting process.

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

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

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

Mature forest, for example, is present at the Project site and its removal may displace bird species into other mature stands in the general area. In addition, three of four turbines will be located in cutovers. Surface disturbance is greater in the construction phase than in the operational phase because large right of ways need to be created to accommodate large construction equipment and transport vehicles (Arnett *et al.* 2007). It can therefore be assumed that impacts associated from direct habitat alteration are greatest in the short-term, except when key habitat features are permanently removed. Depending on the availability of nearby alternative habitat, habitat alterations associated with wind energy infrastructure may have detrimental effects on local bird populations. The landscape of the Project site and immediately surrounding area features forest stands that would appear to provide suitable alternative habitat to bird species displaced due to habitat alteration at the Project site.

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

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

In summary, available research suggests that the probability of large-scale fatality events occurring at wind farms is extremely low (Kerlinger *et al.* 2010) and the observed mortality caused by wind energy facilities is low compared to other sources of human caused bird mortality (*i.e*., buildings, communications towers, vehicles, etc.) (Kingsley and Whittam 2005). Baseline information gained from avian surveys can be combined with site specific considerations to greatly reduce the risk of bird collisions.

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

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

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

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

- Post-construction monitoring will be implemented under direction from NSE and in consultation with CWS and NSDNR to monitor for significant mortality trends.

Species-Specific Mitigation
Bird surveys identified three species that are listed under either *SARA* or NS *ESA*. Addressing the potential impacts of the Project on these species will require species-specific mitigation techniques, as described below:

Canada Warbler:
- Project activities will avoid and/or minimize disturbance to Canada Warbler nesting habitat, including mature forest habitats with well-developed shrub layers and wetland habitats, and especially treed and shrub swamps.
- An increased buffer distance will be maintained between turbine locations and delineated wetland edges where evidence of breeding was identified during surveys.

Eastern Wood-Pewee:
- Project activities will avoid and/or minimize disturbance to Eastern Wood-Pewee nesting habitat, including areas of low canopy cover, near or within large deciduous or mixed wood forest stands.

Olive-sided Flycatcher:
- Project activities will avoid and/or minimize disturbance to Olive-sided Flycatcher resources and nesting habitat, including tall trees or snags within clearings (required for perching and foraging), especially near wetlands or edges of mature coniferous forest stands.

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

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

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

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

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

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

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

Research suggests that migratory tree-roosting species suffer the highest fatalities at wind farms (Kunz *et al.* 2007a; Kuvlesky *et al.* 2007; Cryan and Barclay 2009), although deaths of Tri-colored bats constituted 25.4% of total bat fatalities at wind facilities in the eastern United States (as cited in Arnett *et al.* 2007). Migratory species, including Hoary bat, Eastern red bat, and Silver-haired bat, accounted for 71% of 2,270 bat fatalities recorded at wind energy facilities across Canada between 2006 and 2010 (EC *et al.* 2012). Most bat fatalities are reported in the late summer months (Johnson 2005) coinciding with the start of swarming and autumn migration (Arnett *et al.* 2007: EC *et al.* 2012). Periods of high mortality may therefore be linked with the timing of large-scale insect migrations when bats feed at altitudes consistent with wind turbine heights (Rydell *et al.* 2010). It has been found that bat fatalities increase exponentially with wind tower height, with turbine towers 65 m or taller having the highest fatality rates (Barclay *et al.* 2007). This hypothesis is also supported by the findings of Horn *et al.* (2008), who reported that bats were not being struck by turbine blades when flying in a straight line en route to another destination, but were struck while foraging in and around the rotor-swept zone of the turbine.

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

Sensory Disturbance

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

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

General Mitigation Measures

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

- Use of lighting during construction and on turbine hubs and blades will be limited to minimum levels while still meeting requirements of Transport Canada.
- Where possible, placement of Project infrastructure in habitats significant to bat species will be avoided. These include hibernacula, wetlands, and lands directly adjacent to open bodies of water.
- Post-construction monitoring will be implemented under direction from NSE and in consultation with CWS and NSDNR to monitor for significant mortality trends.

13.3 Environmental Effects Analysis

The following tables (Tables 13.4 to 13.6) identify and evaluate the significance of residual effects for each phase of the Project on each VEC. Accidents and malfunctions are also analyzed. As most of the mitigation is the same for avifauna and bats, these VECs are considered together to decrease repetition.

Table 13.4: Environmental Effects Analysis – Construction Phase

Environmental Component	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
SOCI	• Sensory disturbance • Habitat loss/alteration/degradation and/or fragmentation. • Effects to fish passage/migration • Mortality.	*General Mitigation Measures* • Implementation of the EPP. • Minimize the footprint of physical disturbance to the extent possible. • Avoid disturbing sensitive/significant habitats during construction to the extent possible. • Minimize vegetation clearing, wherever possible. • Prompt restoration of cleared areas post-construction. • Maintain efficient timelines to complete Project activities within the shortest amount of time possible. *Species-specific Mitigation* • Avoid mature, mixed wood stands which may feature suitable denning trees for Fisher. • The EPP for the Project will require Project personnel to report any Mainland moose sightings to NSDNR. • Should large congregations of Monarchs be found at the Project site, Project activities in the area should cease until the migrating group has left the Project site. • Leave adequate, permanent buffers of vegetation around important Wood turtle habitat. • In the event that Wood turtles are confirmed at the site, an appropriate mixture of shrubs and trees will be planted to create a buffer. • Any wood turtles found will be relocated outside of the construction zone (as per guidelines outlined in MacGregor and Elderkin 2003, and NSTPW 2007). • Report any sightings of wood turtle to	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible-Low	No residual effect anticipated	Not applicable

Environmental Component	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
		the NS Wood Turtle Recovery Team (1-866-727-3447. • All watercourses on the Project site will be treated as fish bearing during all phases of the Project. • All in-stream work will be conducted "in-the-dry" and adhere to timing windows (fish SOCI). • Crossing structures will be designed and installed in consultation with DFO and NSE to ensure fish passage is facilitated (fish SOCI).			
Avifauna and Bats	• Habitat loss/Alteration • Mortality • Sensory disturbance.	• Implementation of the EPP. • Conduct vegetation clearing outside of the breeding and nesting season for birds (April to August). • If this is not possible, a mitigation plan will be developed in consultation with NSDNR and CWS prior to clearing activities. • Surveys for raptor nests will be completed prior to any clearing activities occurring during the main nesting season for this group (mid-February to mid-May). • Limit the use of lighting during construction to minimum acceptable levels. • Avoid placement of Project infrastructure in habitats significant to bird and bat species. These include wetlands, hibernacula, mature forests, land directly adjacent to open water and areas with large, hollow trees.	Scope: Local Duration: Short-term Frequency: Once Magnitude: Low	No residual effect anticipated	Not applicable

Environmental Component	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
Accidents and Malfunctions	• Accidental spill/release. • Failure of erosion and sediment /control measures.	• Implementation of the EPP, including the spill prevention plan and contingency plans (as necessary).	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible-Low	No residual effect anticipated	Not applicable

Table 13.5: Environmental Effects Analysis – Operation/Maintenance Phase

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

Environmental Component	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
		monitoring under direction of NSE and in consultation with CWS and NSDNR to monitor for significant mortality trends.			
Accidents and Malfunctions	• Accidental release. • Failure of erosion and sediment control measures.	• Implementation of the EPP, including the spill prevention plan and contingency plans (as necessary).	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible-Low	No residual effect anticipated	Not applicable

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Table 13.6: Environmental Effects Analysis – Decommissioning Phase

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

Environmental Component	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
Accidents and Malfunctions	• Accidental release. • Failure of erosion and sediment control measures.	• Implementation of the EPP, including the spill prevention plan and contingency plans (as necessary).	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible-Low	No residual effect anticipated	Not applicable

13.4 Follow-up Measures

A potential residual effect for avifauna and bats was noted in Table 13.5. The potential effect of collisions and/or fatalities to these VECs will be addressed in post-construction monitoring programs that will be implemented to assess the effects of the operation of the proposed wind farm.

14.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

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

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

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

Modern wind turbines are equipped with a number of mechanisms to reduce damage caused by extreme weather and are designed to shut down when certain thresholds are detected (CanWEA 2011). Further, best practices and industry standards will be applied to the operation of the Project to manage risks of damage from extreme events. Table 14.1 demonstrates potential effects resulting from environmental events and the mitigation associated with each.

Table 14.1 Effects of Environmental Events and Associated Mitigation

Environmental Event	Effect	Mitigation
Hurricane/ Extreme winds	Damage to blades.	• Turbine design equipped to shut down.
Hail	Damage to blades.	• Turbine maintenance according to best practices and industry standards. • Monitoring system for rotational imbalance caused by damage/ice
Ice storms	Ice formation. Potential ice throw.	• Turbine design equipped to shut down • Appropriate safety protocol • Restrict use of Project site • Signage to indicate potential falling ice
Heavy snow	Damage to turbines.	• Turbine design equipped to shut down

Environmental Event	Effect	Mitigation
Lightning strike	Potential fire during operation. Damage to electrical systems.	• Turbine design equipped with built-in grounding system • Turbine equipped with fire detection and suppression system. • Appropriate safety protocol.
Fire	Fire during construction due to materials and machinery	• Appropriate safety protocol • Fire prevention plan • Evacuation plan • Local training of first responders

15.0 CUMULATIVE EFFECTS ASSESSMENT

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

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

A search for existing or proposed wind farm developments was completed within the 20 km radius of the Project site. Two proposed projects, the Nine Mile River Community Wind Project (4 MW) and Chebucto-Pockwock Community Wind Project (10 MW), are located approximately 12 km to the north and 19 km to the southwest, respectively, which have the potential to act cumulatively with this Project. Both wind projects are of relatively small size, therefore the potential for cumulative effects related to avifauna and bat mortality as a result of both projects are considered not significant.

16.0 OTHER APPROVALS

Table 16.1: Future Approvals

Approval/Notification/Permit Required	Government Agency
Municipal	
Building Permit	HRM
Development Permit	HRM
Provincial	
EPP/Sediment and Erosion Control Plan	NSE
Watercourse Alteration Approval	NSE
Wetland Alteration Approval (if required)	NSE
Notification of Blasting (if required)	NSE
Overweight/Special Move Permit	Service Nova Scotia
Access Permit	NSTIR
Work within Highway Right-of-Way	NSTIR
Use of Right-of-Way for Pole Lines	NSTIR

Approval/Notification/Permit Required	Government Agency
Elevator/Lift License	Nova Scotia Department of Labour and Advanced Education
Federal	
Blasting Near Watercourses Approval (if required)	DFO
DND Radio Communications (awaiting response)	DND

17.0 CONCLUSIONS

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

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

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

The proposed capacity of the turbines will produce enough energy to power 2,700 households and will contribute to reaching Nova Scotia's renewable energy commitments.

18.0 REFERENCES

Allen, A.W. 1983. *Habitat suitability index models: fisher*. Fish and Wildlife Service, U.S. Department of the Interior. p 29.

Álvares F., Rio-Maior H., Roque S., Nakamura M., Cadete D., Pinto S. and F. Petrucci-Fonseca. 2011. Assessing ecological responses of wolves to wind power plants in Portugal: Methodological constrains and conservation implications. *Proceedings, Conference on Wind Energy and Wildlife Impacts*, Trondheim, Norway, 2–5 May 2011.

Arnett, E.B., Inkley, D.B., Johnson, D.H., Larkin, R.P., Manes, S., Manville, A.M., Mason, J.R., Morrison, M.L., Strickland, M.D., and R. Thresher. 2007. Impacts of wind energy facilities on wildlife and wildlife habitat. *Wildlife Society Technical Review* 07-2. The Wildlife Society, Bethesda, Maryland, USA. 49 pp.

ACCDC (Atlantic Canada Data Conservation Centre). 2012. *Data Report 4867: North Beaver Brook, NS*. Atlantic Canada Conservation Data Centre, New Brunswick Canada.

BAMP (Boreal Avian Modeling Project). 2013a. Canada Warbler. Retrieved October 2013 from http://www.borealbirds.ca/avian_db/accounts.php/Cardellina+canadensis.

BAMP (Boreal Avian Modeling Project). 2013b. Eastern Wood-Pewee. Retrieved October 2013 from http://www.borealbirds.ca/avian_db/accounts.php/Contopus+virens.

Baerwald, E.F., D'Amours, G.H., Klug, B.J., and R.M.R. Barclay. 2008. Barotrauma is a significant cause of bat fatalities at wind turbines. *Current Biology* 18: 695-696.

Baerwald, E.F. and R.M.R. Barclay. 2011. Patterns of activity and fatality of migratory bats at a wind energy facility in Alberta, Canada. *Journal of Wildlife Management* 75: 1103-1114.

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

Beazley, K.F., Snaith, T.V., MacKinnon, F., and D. Colville. 2004. Road density and potential impacts on wildlife species such as American moose in mainland Nova Scotia. *Proceedings of the Nova Scotian Institute of Science* 42: pp339-357.

Broders, H.G., and G.J. Forbes. 2004. Interspecific and intersexual variation in roost-site selection of Northern long-eared and Little brown bats in the Greater Fundy National Park ecosystem. *Journal of Wildlife Management* 68: 602-610.

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

Brody, A. J., and M. R. Pelton. 1989. Effects of roads on black bear movements in western North Carolina. Wildlife Society Bulletin 17:5–10.

Caceres, M.C., and R.M.R. Barclay. 2000. *Myotis septentrionalis*. *Mammalian Species* Account No. 634: 4 pp.

Cameron, R.P., and T. Neily. 2008. Heuristic model for identifying the habitats of *Erioderma pedicellatum* and other rare cyanolichens in Nova Scotia, Canada. *The Bryologist* 111: 650-658.

CanWEA (Canadian Wind Energy Association). 2006. *Community Benefits, Why Wind is Right – Right Now*. Retrieved from http://www.CanWEA.ca/images/uploads/File/12_community.pdf.

CanWEA (Canadian Wind Energy Association). 2011. *An Introduction to Wind Energy Development in Canada.* Ottawa, Ontario. 36 pp.

Carter, J. 2011. The effect of wind farms on residential property values in Lee County, Illinois. Illinois State University. 36 pp.

CCME (Canadian Council of Ministers of the Environment). 2009. *Canadian Water Quality Guidelines for the Protection of Aquatic Life*. Retrieved from http://st-ts.ccme.ca/?chems=allandchapters=1

CEAA (Canadian Environmental Assessment Act) 2012. Regulations Designating Physical Activities. Retrieved November 21, 2012 from http://laws-lois.justice.gc.ca/eng/regulations/SOR-2012-147/page-1.html

Colligan, M., Collins, M., Hecht, A., Hendrix, M., Kahnle, A., Laney, W., St-Pierre, R., Santos, R., and T. Squires. 1998. Status Review of Atlantic Sturgeon *Acipenser oxyrinchus oxyrinchus.* Retrieved from http://www.nmfs.noaa.gov/pr/pdfs/statusreviews/atlanticsturgeon.pdf

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2002. COSEWIC Assessment and Status Report on the Eastern Ribbonsnake *Thamnophis sauritus* in Canada. 24 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2004. COSEWIC Assessment and Status Report on the Striped Bass *Morone saxatilis* in Canada. 43 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2005. COSEWIC Assessment and Update Status Report on the Blanding's Turtle *Emydoidea blandingii* in Canada. 40 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2006. COSEWIC Assessment and Update Status Report on the Southern Flying Squirrel *Glaucomys volans* [Atlantic (NS) and Great Lakes Plains Populations] in Canada. 33 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2008a. COSEWIC Assessment and Status Report on the Snapping Turtle *Chelydra serpentine* in Canada. 47 pp.

COSEWIC ((Committee on the Status of Endangered Wildlife in Canada). 2008b. COSEWIC Assessment and Status Report on the Canada Warbler *Wilsonia canadensis* in Canada. 35 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2010a. COSEWIC Assessment and Status Report on the Atlantic Salmon *Salmo salar* in Canada. 136 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2010b. COSEWIC Assessment and Status report on the Monarch *Danaus plexippus* in Canada. 43 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2011a. COSEWIC Status Report on the Atlantic Sturgeon *Acipenser oxyrinchus* in Canada. 50 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2011b. COSEWIC Status Report on the Atlantic Whitefish *Coregonus huntsmani* in Canada. 41 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2012a. Wildlife Species Search. Retrieved from http://www.cosewic.gc.ca/eng/sct1/index_e.cfm

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2012b. Assessment and Status Report on the American Eel. *Anguilla rostrata*. 109 pp.

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

CWS (Canadian Wildlife Service). 2007. *Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds*. 33 pp.

Davis, D., and S. Browne. 1996. *The Natural History of Nova Scotia*. Nova Scotia Museum, Halifax, NS. 304 pp.

Davis MacIntyre and Associates Ltd. 2013. *North Beaver Bank Wind Project; Archaeological Resource Impact Assessment*.

de Lucas, M., Janss, G.F.E., Whitfield, D.P., and M. Ferrer. 2008. Collision fatality of raptors in wind farms does not depend on raptor abundance. *Journal of Applied Ecology* 45: 1695-1703.

Devereux, C.L., Denny, M.J.H., and M.J. Whittingham. 2008. Minimal effects of wind turbines on the distribution of wintering farmland brds. *Journal of Applied Ecology* 45: 1689-1694.

DFO (Fisheries and Oceans Canada). 2008. *Recovery potential assessment for Inner Bay of Fundy Atlantic salmon. Canadian Science Advisory Secretariat Science Report 2008/050.*

DFO (Fisheries and Oceans Canada). 2010a. *Blasting – Fish and Fish Habitat Protection.* Retrieved from http://www.nfl.dfo-mpo.gc.ca/e0005460

DFO (Fisheries and Oceans Canada). 2010b. *Recovery strategy for the inner bay of Fundy Atlantic Salmon [Final].*

Drewitt, A.L., and R.H.W. Langston. 2006. Assessing the impacts of wind farms on birds. *Ibis* 148: 29-42.

Eigenbrod, F., Hecnar, S., and L. Fahrig. 2008. Accessible habitat: an improved measure of the effects of habitat loss and roads on wildlife populations. *Landscape Ecology* DOI: 10.1007/s10980-007-9174-7

Endangered Species Act, 1998, SNS, 1998, c 11, as amended by 2010, c 2, s 99.

Environment Act, 1994-95, SNS, 1994-95, c 1, s 1, as amended by 2011, c 61.

Environmental Assessment Regulations, NS Reg 26/95, as amended by 2013, NS Reg 18/2013.

EC (Environment Canada). 2012a. *National Climate Data and Information Archive.* Retrieved from http://www.climate.weatheroffice.gc.ca/climate_normals/results_e.html?stnID=6413&lang=e&dCode=1&province=NS&provBut=Search&month1=0&month2=12

EC (Environment Canada). 2012b. *National Climate Data and Information Archive.* Retrieved from http://www.climate.weatheroffice.gc.ca/climate_normals/results_e.html?stnID=6358&lang=e&dCode=1&province=NS&provBut=Search&month1=0&month2=12

EC (Environment Canada). 2012c. *Air Quality Health Index – Halifax.* Retrieved from http://www.weatheroffice.gc.ca/airquality/pages/nsaq-001_e.html

EC (Environment Canada), Canadian Wind Energy Association, Bird Studies Canada and the Ontario Ministry of Natural Resources. 2012*. Wind Energy Bird and Bat Monitoring Database: Summary of the Findings from Post-construction Monitoring Reports*. p 22.

Farrow, L.J. 2007. *Distribution of the Tri-colored Bat (Perimyotis subflavus) in Southwest Nova Scotia Relative to Landscape Factors.* M.Sc. Thesis, Saint Mary's University, Halifax, Nova Scotia, Canada. 114 pp.

Farrow, L.J., and H.G. Broders. 2011. Loss of forest cover impacts the distribution of the forest-dwelling Tri-colored bat (*Perimyotis subflavus*). *Mammalian Biology* 76: 172-179.

Feetham, M., Ryan, R.J., Pe-piper, G., and A.M. O'Beirne-Ryan. 1997. Lithogeochemical characterization of the Beaverbank unit of the Halifax Formation, Meguma Group, and acid drainage implications. Atlanctic Geology, 33, 133-141.

Fenton, M.B., and R.M.R. Barclay. 1980. *Myotis lucifugus*. *Mammalian Species Account No. 142*. 8 pp.

Fisheries Act. RSC, 1985, c F-14, as amended by 2012.

Forman, R.T. and L.E. Alexander. 1998. Roads and their Major Ecological Effects. *Annual Review of Ecology, Evolution, and Systematics*. 29:207-31.

Fox, D., Robinson, C., and M. Zentilli. 1997. Pyrrhotite and associated sulphides and their relationship to acid rock drainage in the Halifax Formation, Meguma Group, Nova Scotia. *Atlantic Geology* 33: 97-103.

Fujita, M.S., and T.H. Kunz. 1984. *Perimyotis subflavus*. *Mammalian Species Account No. 228*. 6 pp.

Furlonger, C.L., Dewar, H.J., and M.B. Fenton. 1987. Habitat use by foraging insectivorous bats. *Canadian Journal of Zoology* 65: 284 284 288.

Garroway, C.J. and H.G. Broders. 2008. Day Roost Characteristics of Northern Long-eared Bats (*Myotis septentrionalisi)* in Relation to Female Reproductive Status. *Ecoscience* 15: 89-93.

Gilbert, J.H., J.L. Wright, D.J. Lauten, & J.R. Probst.1997. Den and Rest-site Characteristics of American Marten and Fisher in Northern Wisconsin. In *Martes: Taxonomy, Ecology, Techniques, and Management.* G. Proulx, H.N. Bryant, and P.M. Woodward (editors). Prov. Mus. Alberta, Edmonton, Alta., pp. 135–145.

Gilhen, J., Jones, A., McNeil, J., & A.W. Tanner. 2012. A Significant Range Extension for the Eastern Ribbonsnake, *Thamnus sauritus*, in Nova Scotia, Canada. *Canadian Field Naturalist* 126: 231-233.

Government of Canada. 2012. *Species at Risk Public Registry*. Retrieved from http://www.sararegistry.gc.ca/default_e.cfm.

Grindal, S.D., and R.M. Brigham. 1998. Short-term effects of small-scale habitat disturbance on activity by insectivorous bats. *Journal of Wildlife Management* 62: 996-1003.

Grodsky, S.M., Behr, M.J., Gendler, A., Drake, D., Dieterle, B.D., Rudd, R.J., and N.L. Walrath. 2011. Investigating the causes of death for wind-turbine associated bat fatalities. *Journal of Mammalogy* 92: 917-925.

Gulden, W.E., 2011. A review of the current evidence regarding industrial wind turbines and property values from a homeowner's perspective, *Bulletin of Science, Technology, and Society* 31: 363-368.

Halfyard, E.A. 2008. *Smallmouth Bass Report: Shubenacadie (Grand)* Lake. Inland Fisheries Division. Retrieved from http://www.gov.ns.ca/fish/documents/special-management-areas-reports/GrandLakeBassRpt265911.pdf

Hau, E. 2006. *Wind Turbines, Fundamentals, Technologies, Application, Economics*, 2nd Ed. Berlin, Germany: Springer Verlag.

Haugen K.M.B. 2011. International review of policies and recommendations for wind turbine setbacks from residences: setbacks, noise, shadow flicker, and other concerns. Minnesota Department of Commerce: Energy Facility Permitting. 43 pp.

Hegmann, G., C. Cocklin, R. Creasey, S. Dupuis, A. Kennedy, L. Kingsley, W. Ross, H. Spaling and D. Stalker. 1999. Cumulative Effects Assessment Practitioner's Guide. Retrieved from http://www.ceaa-acee.gc.ca/default.asp?lang=Enandn=43952694-1andprintfullpage=true

Helldin, J.O., Jung, J., Neumann, W., Olsson, M., Skarin, A. and F. Widemo. 2012. *The Impacts of Wind Power on Terrestrial Mammals: A Synthesis. Report 6510*. Swedish Environmental Protection Agency, Stockholm.

Hinman, J.L. 2010. *Wind Farm Proximity and Property Values: A Poole Hedonic Regressions Analysis of Property Values in Central Illinois.* Normal, Illinois: Illinois State University.

Hoen, B., Wiser, R., Cappers, P., Thayer, M., and S. Gautam. 2009.*The Impact of Wind Power Projects on Residential Property Values in the United States: A Multi-Site Hedonic Analysis.*Lawrence Berkeley National Laboratory. Prepared for the Office of Energy Efficiency and Renewable Energy Wind and Hydropower Technologies Program, U.S. Department of Energy, Washington, D.C. December, 2009. Retrieved from http://eetd.lbl.gov/ea/ems/reports/lbnl-2829e.pdf.

Hoen, B., Wiser, R., Cappers, P., Orlando, E., Thayer, M., and G. Sethi. 2010. Wind energy facilities and residential properties: the effect of proximity and view on sales prices. American Real Estate Society Annual Conference, Naples, Florida.

Hoen, B. 2011. Wind facility effects on nearby property values: the emerging "valley" landscape. New England Wind Energy Education Project Conference.

Hoen, B., Brown, J.P., Jackson, T., Wiser, R., Thayer, M., and P. Cappers. 2013. A spatial hedonic analysis of the effects of wind energy facilities on surrounding property values in the United States. Ernest Orlando Lawrence Berkeley National Laboratory Report LBNL-6362E. 58 pp.

Horn, J.W., Arnett, E.B., and T.H. Kunz. 2008. Behavioural responses of bats to operating wind turbines. *Journal of Wildlife Management* 72: 123-132.

HRM (Halifax Regional Municipality). 1999. By-law Number N-200 Respecting Noise. Retrieved from: http://www.halifax.ca/legislation/bylaws/hrm/bln200.pdf

HRM (Halifax Regional Municipality). 2011. *Beaver Bank, Hammonds Plains and Upper Sackville Land Use By-Law*. Retrieved from http://www.halifax.ca/planning/documents/BeaverBankHammondsPlainsUpperSackville_LUB.pdf

HRM (Halifax Regional Municipality). 2012. *Municipal Planning Strategy for Halifax*. Retrieved from http://www.halifax.ca/planning/documents/Halifax_MPS.pdf

HRM (Halifax Regional Municipality). 2013. *Our Fire Stations*. Retrieved from https://www.halifax.ca/fire/FireStations.html

IBA (Important Bird Areas) Canada. 2012. *Important Bird Areas in Canada*. Available from http://www.ibacanada.ca/

IPCC (International Panel on Climate Change). 2007. *Summary for Policymakers. In: Climate Change 2007: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 7-22.

Johnson, G.D. 2005. A review of bat mortality at wind-energy developments in the United States. *Bat Research News* 46: 45-49.

Keppie, J.D. (compiler). 2000. *Geological Map of the Province of Nova Scotia.* Nova Scotia Department of Natural Resources, Minerals and Energy Branch, Map ME 2000-1, scale 1:500 000. Available online as DP ME 43, version 2, 2006 at http://www.gov.ns.ca/natr/meb/download/dp043.htm.

Kerlinger, P. Gehring, J.L., Erickson, W.P., Curry, R., Jain, A., and J. Guarnaccia. 2010. Night Migrant Fatalities and Obstruction Lighting at Wind Turbines in North America. *The Wilson Journal of Ornithology* 122: 744-754.

Kingsley, A., and B. Whittam. 2005. Wind Turbines and Birds: A Background Review for Environmental Assessment. 81 pp.

Kirkland, Jr., G.L. 1981. *Sorex dispar* and *Sorex gaspensis*. Mammalian Species 155: 1-4.

Kunz, T.H., Arnett, E.B., Cooper, B.M., Erickson, W.P., Larkin, R.P., Mabee, T., Morrison, M.L., Strickland, M.D., and J.M. Szewczak. 2007a. Assessing Impacts of Wind-Energy Development on Nocturnally Active Birds and Bats: A Guidance Document. *Journal of Wildlife Management, 71*(8), 2449-2486.

Kunz, T. H., Arnett, E.B., Erickson, W.P., Hoar, A.R., Johnson, G.D., Larkin, R.P., Strickland, M.D., Thresher, R.W. and M. D. Tuttle. 2007b. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. *Frontiers in Ecology and the Environment, 5*, 315–324.

Kuvlesky W.P. Jr, Brennan L.A., Morrison M.L., Boydston K.K., Ballard B.M. and F.C. Bryant. 2007. Wind Energy Development and Wildlife Conservation: Challenges and Opportunities. *Journal of Wildlife Management* 71: 2487–2498.

Laposa, S.P., and A. Mueller. 2010. Wind farm announcements and rural home prices: Maxwell Ranch and rural northern Colorado. *Journal of Sustainable Real Estate* 2: 383-402.

Lavers, A.J. 2004. Spatial Ecology in a Northern Disjunct Population of Southern Flying Squirrel, *Glaucomys volans*. M.Sc. Thesis, Department of Biology, Acadia University. 184 pp.

Leddy, K.L., Higgins, K.F., and D.E. Naugle. 1999. Effects of wind turbines on upland nesting birds on conservation reserve program grasslands. *The Wilson Bulletin* 111: 100-104.

MacGregor, M.K and M.F. Elderkin. 2003. *Protecting and Conserving Wood Turtles: A Stewardship Plan for Nova Scotia*. Published by the Biodiversity Program, Wildlife Division. 23 pp.

Madsen, J., and D. Boertmann. 2008. Animal behavioral adaptation to changing landscapes: Spring-staging geese habituate to wind farms. *Landscape Ecology* 23: 1007-1011.

Maritime Butterfly Atlas.. 2012. *Monarch, Monarque, Danaus plexippus*. Retrieved from http://www.ontarioinsects.org/maritimesbutterflyatlas/atlas_online_mba.html.

Market and Opinion Research International. 2002. *Tourist Attitudes Toward Windfarms.* Retrieved from http://www.bwea.com/pdf/MORI.pdf

MBBA (Maritime Breeding Bird Atlas). 2012. *Maritime Breeding Bird Atlas – Second Edition*. Accessed on July 31, 2012 from http://www.mba-aom.ca/english/index.html.

McCarty, John P. 1996. Eastern Wood-Pewee (*Contopus virens*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/245
doi:10.2173/bna.245

Meyer, R. 2007. *Martes pennanti*. In: *Fire Effects Information System* (online). US Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. Retrieved from http://www.fs.fed.us/database/feis/animals/mammal/mape/all.html#BIOLOGICAL DATA AND HABITAT REQUIREMENTS.

Migratory Birds Convention Act (MBCA), 1994, S.C. 1994, Ch. 22, as amended 2010. (Published by the Minister of Justice). Retrieved from http://laws-lois.justice.gc.ca/PDF/M-7.01.pdf

Moseley, M. 2007. *Records of Bats (Chiroptera) at Caves and Mines in Nova Scotia. Curatorial Report Number 99*, Nova Scotia Museum, Halifax. 21 pp.

MTO (Ministry of Transportation of Ontario). 2009. Environmental Guide for Fish and Fish Habitat, Section 5: Impact Assessment and Mitigation. Retrieved from http://www.raqsb.mto.gov.on.ca/techpubs/eps.nsf/8cec129ccb70929b852572950068f16b/0aa15a0ed6652b50852572f3006a6bfd/$FILE/MTO%20Fish%20Guide%20Sec%205%20Impact%20Assess%20Mit_June09_FINAL.pdf

MTRI (Mersey Tobeatic Research Institute). 2008a. Species at Risk in Nova Scotia: Identification and Information Guide – Monarch Butterfly. pp 49-50.

MTRI (Mersey Tobeatic Research Institute). 2008b. Species at Risk in Nova Scotia: Identification and Information Guide – Olive-sided Flycatcher. pp 17-18.

Neily, P.D., Quigley, E., Benjamin, L., Stewart, B., and T. Duke. 2003. *Ecological Land Classification for Nova Scotia Volume 1 – Mapping Nova Scotia's Terrestrial Ecosystems*. Nova Scotia Department of Natural Resources, Renewable Resources Branch, Report DNR-2003-2. 62 pp.

NOAA (National Oceanic and Atmospheric Administration). 2006. *Status of fishery resources off the northeastern US. Atlantic and Shortnose sturgeons*. Prepared by the Resource Evaluation and Assessment Division.

Nova Scotia Lynx Recovery Team. 2006. Provincial Recovery Plan for the Canada Lynx (Lynx Canadensis), Nova Scotia. 32 pp.

NRC (National Research Council). 2007. *Environmental Impacts of Wind-Energy Projects.* National Research Council of the National Academies. Washington, DC: The National Academies Press. 394 pp.

NRCan (Natural Resources Canada). 2003. *Wind Power Production Incentive (WPPI). Environmental Impact Statement Guidelines for Screening of Inland Wind Farms Under the Canadian Environmental Assessment Act.* Retrieved from http://publications.gc.ca/collections/Collection/M144-9-2003E.pdf

NRCan (Natural Resources Canada). 2009. *About Renewable Energy*. Retrieved from http://www.nrcan.gc.ca/energy/renewable/1297

NSBS (Nova Scotia Bird Society). 2013. Winter season 2012/2013. *Nova Scotia Birds* 55: 43.

NSDE (Nova Scotia Department of Energy). 2007. *Nova Scotia Wind Atlas*. Retrieved from http://www.nswindatlas.ca/.

NSDE (Nova Scotia Department of Energy). 2008. *Renewable Energy – Wind Turbine Noise*. Retrieved from http://www.gov.ns.ca/energy/renewables/public-education/wind/turbine-noise.asp

NSDE (Nova Scotia Department of Energy). 2009. *An Approach to Regulating Electricity Sector Greenhouse Gas and Air Pollutant Emissions in Nova Scotia: A Discussion Paper*. Retrieved from http://www.gov.ns.ca/nse/dept/docs/Discussion.Paper.Environment.GreenhouseGas.pdf

NSDE (Nova Scotia Department of Energy). 2010. Renewable Electricity Plan: A Path to Good Jobs, Stable Prices and a Cleaner Environment. Retrieved from http://www.gov.ns.ca/energy/resources/EM/renewable/renewable-electricity-plan.pdf

NSDERDT. 2011. *Nova Scotia Visitor Exit Survey: Community Report.* Halifax, Nova Scotia.

NSDNR (Nova Scotia Department of Natural Resources). 2010. *Wild Species – The General Status of Species in Nova Scotia*. Retrieved from http://www.gov.ns.ca/natr/wildlife/genstatus/

NSDNR (Nova Scotia Department of Natural Resources). 2012a. Nova Scotia Pumping Test Database. Accessed on July 15, 2013.

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

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

NSDNR (Nova Scotia Department of Natural Resources). 2012d. *Hunter and Trapper Harvest Statistics Index*. Retrieved from http://novascotia.ca/natr/hunt/furbearerharvests.asp#bycounty

NSDNR (Nova Scotia Department of Natural Resources). 2012e. *Endangered Mainland Moose Special Management Practices*. Retrieved from http://www.gov.ns.ca/natr/wildlife/habitats/terrestrial/pdf/SMP_Mainland_Moose.pdf

NSDNR (Nova Scotia Department of Natural Resources). 2013. Nova Scotia Forest Inventory – Current Cycle. Retrieved from http://novascotia.ca/natr/forestry/gis/dl_forestry.asp.

NSFA. 2007. Atlantic Salmon (*Salmo salar*). Retrieved from http://www.gov.ns.ca/fish/aquaculture/species/salmon.shtml

NSE (Nova Scotia Environment). 2009a. *A Proponent's Guide to Environmental Assessment*. February 2001 (Revised September 2009). Retrieved from http://www.gov.ns.ca/nse/ea/docs/EA.Guide-Proponents.pdf

NSE (Nova Scotia Environment). 2009b. *Guide to Addressing Wildlife Species and Habitat in an EA Registration Document*. 8 pp.

NSE (Nova Scotia Environment). 2011. *Nova Scotia Wetland Conservation Policy*. 24 pp.

NSE (Nova Scotia Environment). 2012a. *A Proponent's Guide to Wind Power Projects: Guide for Preparing an Environmental Assessment Registration Document.* 20 pp. Retrieved from http://www.gov.ns.ca/nse/ea/docs/EA.Guide-Proponents-WindPowerProjects.pdf

NSE (Nova Scotia Environment). 2012b. *Well Logs Database – Groundwater (log data from 1966-2012).*Retrieved from http://www.gov.ns.ca/nse/welldatabase/wellsearch.asp.

NSE (Nova Scotia Environment). 2012c. *NS Groundwater Observation Well Network; Fall River 076*. Retrieved from http://www.gov.ns.ca/nse/groundwater/groundwaternetwork.asp

NS*EA (*Nova Scotia *Environment Act*). 1994-1995. *Environmental Assessment Regulations.* Retrieved from http://nslegislature.ca/legc/statutes/envromnt.htm

NS *ESA (*Nova Scotia *Endangered Species Act*). 2013. Retrieved July 11, 2013 from http://www.gov.ns.ca/natr/wildlife/biodiversity/species-list.asp.

NSPI (Nova Scotia Power Inc.). 2013. *A cleaner megawatt: Discussing Renewable Energy in Nova Scotia*. Retrieved from http://cleaner.nspower.ca/

NSTIR (Nova Scotia Transportation and Infrastructure Renewal). 2009. *Nova Scotia Temporary Workplace Traffic Control Manual*. Retrieved from http://www.gov.ns.ca/tran/tcm/Traffic%20Control%20Manual%2020100515.pdf

NSTPW (Nova Scotia Transportation and Public Works). 2007. Generic Environmental Protection Plan (EPP) for the Construction of 100 Series Highways. Retrieved from http://www.gov.ns.ca/tran/works/enviroservices/EPP100series/Generic%20EPP_July%202007.pdf

O'Farrell, M.J., Miller, B.W., and W.L. Gannon. 1999. Qualitative Identification of Free-flying Bats Using the ANABAT Detector. *Journal of Mammalogy* 80: pp11-23.

Office of the Deputy Prime Minister. 2004. Planning for renewable energy – a companion guide to PPS22. 186 pp.

OMNR (Ontario Ministry of Natural Resources). 2000. Conserving the forest interior: a threatened wildlife habitat. 12 pp.

Parker, G. 2001. *Status report on the Canada Lynx in Nova Scotia*. Submitted to Nova Scotia Species at Risk Working Group. 59 pp.

Parker, G. 2003. *Status report on the Eastern Moose (Alces alces americana Clinton) in Mainland Nova Scotia*. 77 pp.

Parker, G.R., J.W. Maxwell, L.D. Morton and G.E.J. Smith. 1983. The ecology of the lynx (Lynx canadensis) on Cape Breton Island. Canadian Journal of Zoology 61 (4): 770-786.

Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W., Bainbridge, I.P., and R. Bullman. 2009. The distribution of breeding birds around upland wind farms. *Journal of Applied Ecology* 46: 1323-1331.

Pittaway, R. 2013. Winter finch forecast 2013-2014. Retrieved October 2013 from http://www.jeaniron.ca/2013/forecast.htm.

Public Highways Act, RSNS, 1989, c 371, s 20.

Quinn, G.M., and H.G. Broders. 2007. *Roosting and Foraging Ecology of Tri-colored Bat (Perimyotis subflavus) in SW Nova Scotia*. Report prepared for the Nova Scotia Habitat Conservation Fund, c/o Nova Scotia Department of Natural Resources. 34 pp.

RABC (Radio Advisory Board of Canada) and CanWEA (Canadian Wind Energy Association). 2012. *Technical Information and Coordination Process Between Wind Turbines and Radio Communication and Radar Systems.* Retrieved from http://www.rabc-cccr.ca/Files/RABC%20CANWEA%20Guidelines.pdf

Reitsma, L.R., Hallworth, M.T., and P.M. Benham. 2008. Does age influence territory size, habitat selection, and reproductive success of male Canada Warblers in central New Hampshire? *The Wilson Journal of Ornithology* 120: 446-454.

Rollins, K.E., Meyerholz, D.K., Johnson. G.D., Capparella, A.P., and S.S. Loew. 2012. A forensic investigation into the etiology of bat mortality at a wind farm: barotrauma or traumatic injury? *Veterinary Pathology* 49: 362-371.

Rulifson, R. and M. Dadswell. 1995. Life History and Population Characteristics of Striped bass in Atlantic Canada. *Transactions of the American Fisheries Society* 124: 407-577.

Rydell, J., Bach, L., Dubourg-Savage, M.J., Green, M., Rodrigues, L., and A. Hedenström. 2010. Mortality of bats at wind turbines links to nocturnal insect migration? *European Journal of Wildlife Research* 56: 823-827.

Schaub, A., Ostwald, J., and B. M. Siemers. 2008. Foraging bats avoid noise. *Journal of Experimental Biology* 211: 3174-3180.

Scott, F.W. 1987. First record of the Long-tailed shrew, *Sorex dispar*, for Nova Scotia. *Canadian Field Naturalist* 101: 404-407.

Service Nova Scotia 2013. *Property Online*. Retrieved from http://www.gov.ns.ca/snsmr/property/default.asp?mn=282.46.1064

Shafer, A.B.A., and D.T. Stewart. 2006. A disjunct population of *Sorex dispar* (Long-tailed shrew) in Nova Scotia. *Northeastern Naturalist* 13: 603-608.

Snaith, T.V. and K.F. Beazley. 2004. The Distribution, Status, and Habitat Associations of Moose in Mainland Nova Scotia. *Proceedings of the Nova Scotian Institute of Science* 42: 263-317.

Species at Risk Act, 2002, SC 2002, c 29, as amended by 2012.

Statistics Canada. 2006. *2006 Census Data Products.* Retrieved from http://www12.statcan.gc.ca/census-recensement/2006/dp-pd/index-eng.cfm

Statistics Canada. 2011. *Population and Dwelling Count Highlight Tables, 2011 Census*. Retrieved from http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/hlt-fst/pd-pl/index-eng.cfm

Statistics Canada. 2013. *Labour Force Characteristics, Unadjusted, by Economic Region (3 month moving average) (Nova Scotia, New Brunswick)*. Retrieved from http://www40.statcan.gc.ca/l01/cst01/lfss05b-eng.htm

Stea, R.R., Conley, H., and Y. Brown. 1992. *Surficial Geology Map of the Province of Nova Scotia*. Nova Scotia Department of Natural Resources, Minerals and Energy Branch, Map ME 1992-3, scale 1:500 000. Available online as DP ME 36m version 36, 2006 at http://www.gov.ns.ca/natr/meb/download/dp036.asp.

Sulphide Bearing Material Disposal Regulations, NS Reg 57/95.

TBTRT (The Blanding's Turtle Recovery Team). 2012. *National Recovery Plan for the Blanding's Turtle (Emydoidea blandingii) Nova Scotia Population*. Nova Scotia, Canada. 73 pp.

Thomas, D.W. 1995. Hibernating bats are sensitive to nontactile human disturbance. *Journal of Mammalogy* 76: 940-946.

Transportation of Dangerous Goods Act, 1992. S.C. 1992, c. 34.

Trombulak, S.C., and C.A. Frissell. 2000. Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities. *Conservation Biology* 14: 18-30.

USDE (United States Department of Energy). 2008. *20% Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply.* Retrieved from:
at http://www.nrel.gov/docs/fy08osti/41869.pdf

Walter, W.D., Leslie Jr., D.M., and J.A. Jenks. 2006. Response of Rocky Mountain Elk (*Cervus elaphus*) to Wind-Power Development. *The American Midland Naturalist* 156: 363-375.

Webb, K.T. and I.B. Marshall. 1999. *Ecoregions and Ecodistricts of Nova Scotia. Crops and Livestock Research Centre, Research Branch, Agriculture and Agri-Food Canada, Truro, Nova Scotia*; Indicators and Assessment Office, Environmental Quality Branch, Environment Canada, Hull, Quebec. P 13.

Wind Turbine Facilities Municipal Taxation Act. 2006. C. 22, s.1.

Woolaver, L.G., Elderkin, M.F., and F.W. Scott. 1998. *Sorex dispar* in Nova Scotia. *Northeastern Naturalist* 5: 323-330.

Wright, D.G. and G.E. Hopky (DFO). 1998. *Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters*. Canadian Technical Report of Fisheries and Aquatic Sciences 2107. Retrieved from http://www.dfo-mpo.gc.ca/Library/232046.pdf

Personal Communication

M. Elderkin, personnel communications. June 13, 2012. Bat Monitoring.