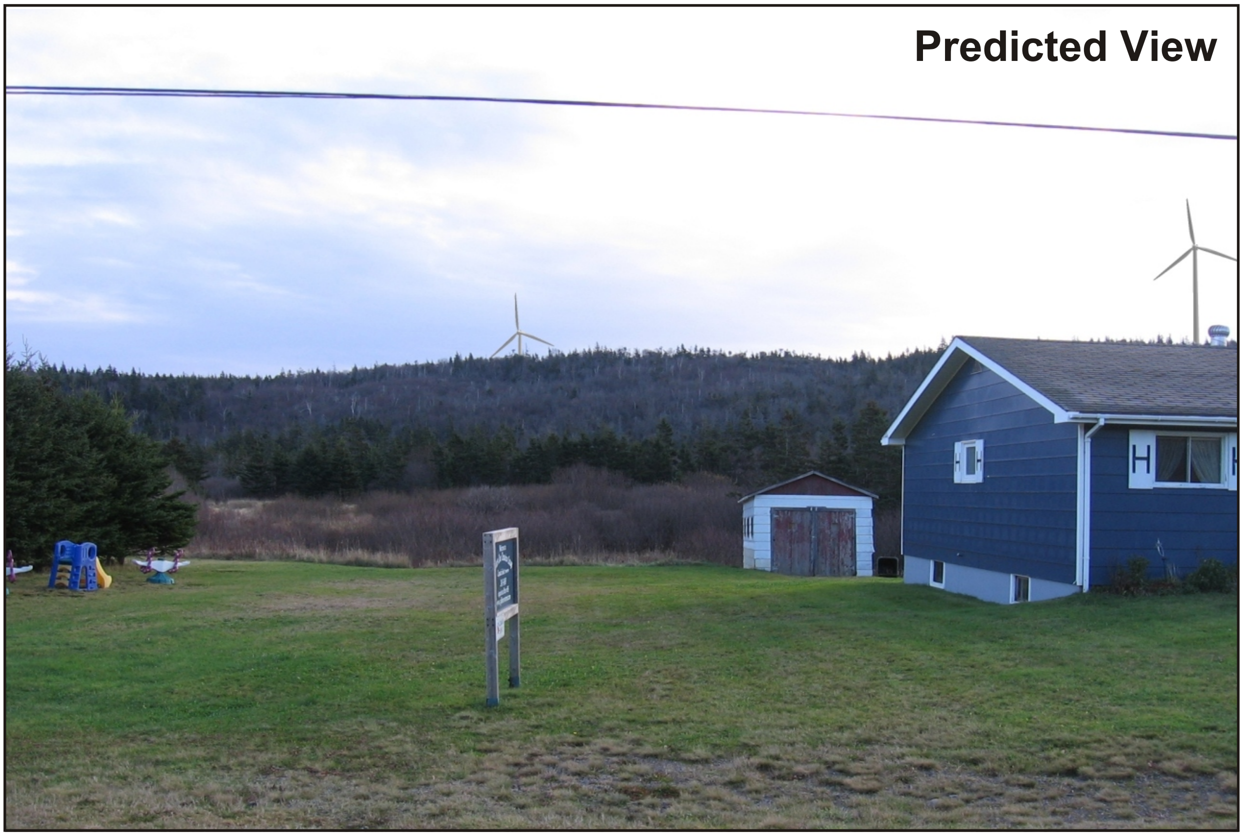


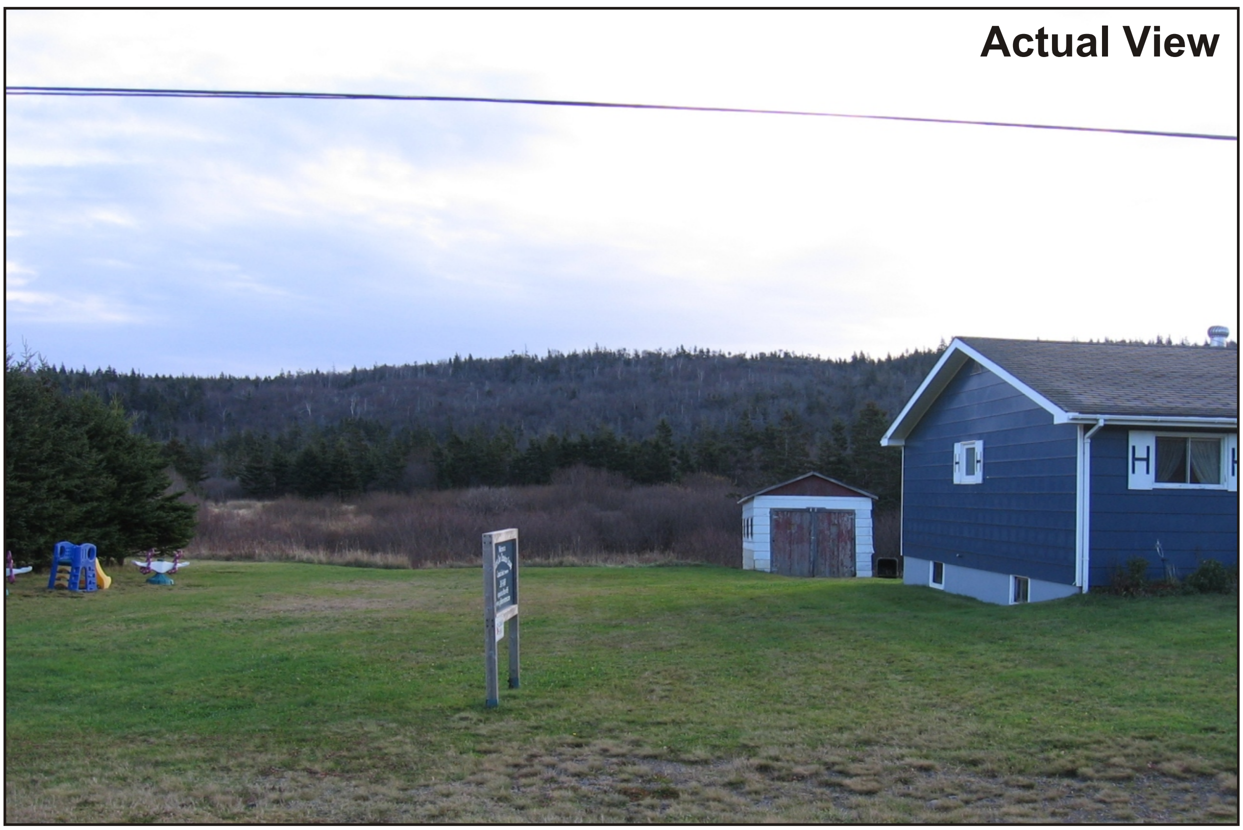


Figure 5.6

View from Viewpoint 5 Looking East

Digby Wind Power Project

Stantec

SKYPOWER

Figure 5.7

View from Viewpoint 6 Looking South East

Digby Wind Power Project

Stantec

SKYPOWER

Figure 5.8

View from Viewpoint 7 Looking West

Digby Wind Power Project

Stantec

SKYPOWER

Figure 5.9

View from Viewpoint 8 Looking North East

Digby Wind Power Project

Stantec

SKYPOWER

Lighting

The wind turbine generators will be lit to meet the requirements of Transport Canada's Canadian Aviation Regulations (CAR) 621.19. Lighting will be the minimum required to ensure the appropriate level of aeronautic safety and white strobe lights (CL-865) may be used with the minimum intensity and flashes per minute allowable.

The viewing distances from the locations analyzed in this report indicate that all of the residences within the Study Area will be greater than 600 m from the nearest wind turbine. Given the viewing distance of greater than 600 m combined with steep terrain, the presence of these lit towers will not place excessive nighttime visual pollution in the Study Area.

Shadow Flicker

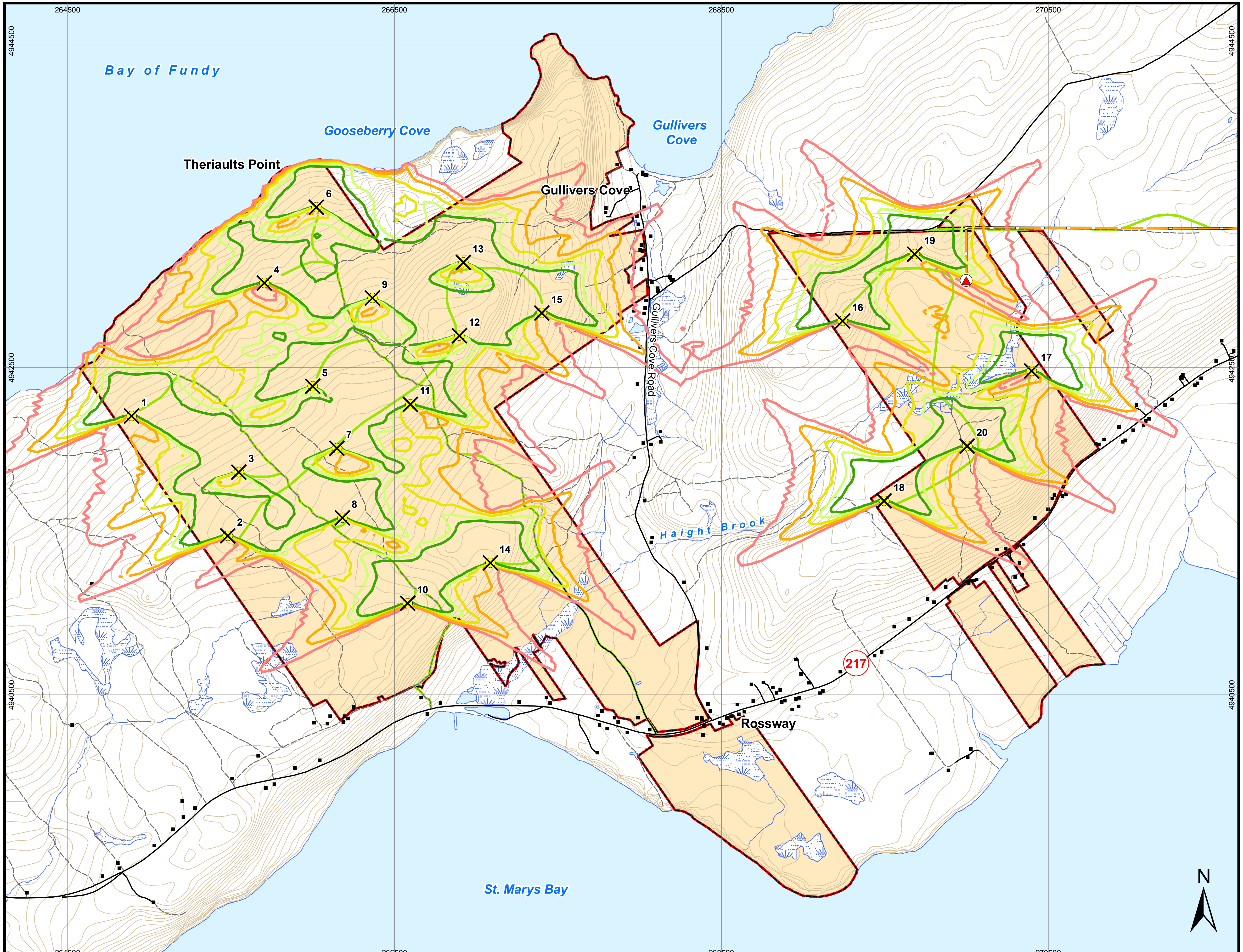
Shadow flicker caused by wind turbines is defined as alternating changes in light intensity due to the moving blade shadows cast on the ground and objects (including through windows of residences). There are obstacles such as terrain and vegetation which are located between the wind turbine and a potential shadow-flicker receptor, hence shadow-flicker will be either significantly reduced or eliminated at such receptors.

The modeling software WindPro 2.4 by EMD (Denmark) was used to model potential shadow flicker within the area. The model calculated the duration of shadow flicker various receptors receive within a year, given a number of assumptions. The model assumes a worst-case scenario, with the following conditions: the sun is fully shining all year (no clouds or fog), the absence of natural obstacles (no trees or terrain to block exposure), the rotor plane is perpendicular to the sun (biggest shadows), and the rotor is always turning (causing shadow movements). These assumptions therefore result in an overestimation of actual impacts. As a demonstration of the level of overestimation, the modeling software assumes approximately 4,000 hours of sun, while Canadian Climate Normals data (1961-1980) for the nearest weather station recording bright sunshine (Yarmouth) reports approximately 1,800 hours of sunshine per year.

Nova Scotia has no set regulatory limits for exposure to shadow flicker, however the industry commonly uses 30 hours per year as a limit to reduce nuisance complaints. Calculations of shadow flicker for all nearby residences, given a worst-case scenario as described above, determined that no residence will experience shadow flicker for more than 30 hours per year and approximately nine residences would experience shadow flicker for between 1 and 30 hours per year (Figure 5.10).

A registry will be created to document complaints of shadow flicker. When a complaint or complaints of shadow flicker are received from a receptor located within 1,000 m of the turbine, shadow flicker will be monitored from that receptor. Information collected from the shadow flicker monitoring will be used will be used to develop further mitigation, if warranted.

No mitigation measures are required for the residential receptors evaluated for the visual impact assessment. The residual effect of the Project on the area's visual aesthetics is considered to be **low** but **not significant**.



SKYPOWER

Figure 5.10

DIGBY WIND POWER PROJECT

Shadow Flicker

Shadow Flicker (Hrs/Year)

- 15
- 30
- 50
- 75
- 100

Project Components

- Proposed Turbine Location
- Proposed 69 kV Substation
- Proposed Turbine Access Road
- Proposed Transmission Route Nov. 28-08
- Proposed Site Development Area

Map Features

- Building
- Road
- Unpaved Road
- Railroad
- Contour (5m)
- Watercourse
- Wetland
- Waterbody

0 300 600 900 1,200

Meters

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:22,000
Date: April 2009
Project No.: 1030972.01

Stantec

5.2.1.6 Noise Impacts

Noise can be simply defined as "unwanted sound". Sound level limits are identified on an A-weighted decibel scale (abbreviated as dBA), which is generally accepted to reflect how humans perceive sound. Conversation in close quarters is usually at a sound level of 50 to 60 dBA and an alarm clock may emit sound to levels of approximately 80 dBA. Presently, the province of Nova Scotia does not have set sound level limits specific to wind turbine operations. In response to the growth of wind energy development in Ontario, the MOE identified the need to provide guidance as to how to apply their technical documents to wind turbines, and produced their technical document "Interpretation for applying MOE Technical Publications to Wind Turbine Generators" in 2004. This guidance was considered during the development of a noise impact assessment for the Digby Wind Power Project, completed by Jacques Whitford (see Appendix E).

Wind turbine generators produce sound through a number of different mechanisms which can be categorized into mechanical and aerodynamic sound sources. The major mechanical components including the gearbox, generator and yaw motors each produce their own characteristic sounds, including sound with tonal components. Other mechanical systems such as fans and hydraulic motors can also contribute to the overall sound emissions. Mechanical sound is radiated at the surfaces of the turbine, and by openings in the nacelle casing. Mechanical issues involving yaw motor supports or power train design can result in anomalous sounds such as periodic booming or tonal sounds.

The interaction of air and the turbine blades produces aerodynamic sound through a variety of processes as air passes over and passed the blades. The sound produced by air interacting with the turbine blades tends to be broadband sound, but is amplitude modulated as the blades pass the tower, resulting in a characteristic ‘swoosh’. Generally, wind turbines radiate more sound as the wind speed increases.

The manufacturer’s predicted operational sound levels were combined with background sound data obtained from receptor locations surrounding the Project site to obtain a more accurate representation of the potential sound levels at the selected receptor locations. Sound modelling was conducted using CadadA version 3.7, which includes the calculation methodology of the International Organization for Standardization (ISO) *Standard 9613 – Attenuation of Sound during Propagation Outdoors* (ISO 9613). Local terrain was considered in modelling. Sound resulting from construction activities was modeled. Sound power level data provided by the manufacturer were used to model operational sound at the selected receptors. Predicted sound levels at receptors increased with increasing wind speed due the fact that the sound power level of the wind turbine generators also increased with increasing wind speed.

The study results presented in Appendix E show that sound levels at the receptor locations are primarily dominated by existing background sound levels and not by the predicted sound produced from operations of the Digby Wind Power Project. Therefore, it is not expected that the Project will have a significant impact, with respect to sound, on nearby receptors.

Although there is no recommended setback distance, the nearest receptor is no closer than 600 m from any turbine. In addition, routine maintenance of the wind turbines and associated equipment will be conducted as recommended by the manufacturer to ensure the turbines operate efficiently and do not produce additional noise.

Provided these mitigation measures are followed, the potential residual effect of the Project on noise is considered to be **minimal** and **not significant**.

5.2.1.7 Recreation and Tourism

As indicated in Section 4.6.3, the Digby Neck and Islands area attracts tourists, particularly those interested in nature tours. It is expected that tourists travelling through the Study Area might be attracted to the Project and possibly tourism to the area could even increase as a result of the Project, as judged by the numbers of tourists that regularly visit existing wind power projects in Atlantic Canada. For example, North Cape Wind Farm in Prince Edward Island has become a tourist destination, attracting 60,000 visitors per year. The government has a restaurant gift shop at the site. The restaurant gift shop employs 20 people from mid-May to the end of October (CanWEA 2006). In the case of the Digby Wind Farm, where the Project is located on privately owned lands and viewing will be limited from adjacent public roads, the same level of tourism interest is not anticipated.

In a research study conducted in Scotland, 43% of respondents said a windfarm would have a positive effect on their inclination to visit the project area (Argyll), an area of high landscape value. About the same proportion of respondents said it would make no difference, while less than 8% felt it would have a negative effect (MORI Scotland 2002). In this particular study, the main aspect of the area that tourists found of particular interest was the “beautiful scenery and views”, not unlike tourists who may choose to visit the Study Area of Gulliver’s Cove. When asked whether the presence of wind farms in Argyll made any difference to the likelihood of them visiting the area, 91% of respondents indicated that it made no difference (MORI Scotland 2002). The Digby Project is not anticipated to have an adverse effect on the tourism industry (including recreational operations in Gulliver’s Cove), but may in fact have a minor positive effect.

With respect to informal recreational use of lands, the Project will, to the extent possible, maximize use of existing access roads in the area. In accordance with landowner agreements, access will be controlled so as to discourage trespass on private lands. Therefore the Project is not expected to increase recreational vehicle use in the area and trespass on private lands.

Visual and sound effects that could be experienced by tourists in the area are discussed Section 5.2.1.5 and 5.2.1.6, respectively.

The potential residual effect of the Project on tourism and recreation is considered to be **minimal** and **not significant**.

5.2.1.8 Health and Safety Issues

Safety issues are typically associated with construction and decommissioning activities associated with the wind farm. However, safety issues must also be considered as they pertain to the operational phase and the potential interaction with the local population and public access issues. Health and safety concerns related to shadow flicker, electromagnetic fields (EMFs) and ice throw are issues that have been raised by the public at other projects in Canada, and are considered here. The following sections provide a discussion on the potential environmental effects associated with electromagnetic fields, infrasound and ice throw, and general health and safety issues.

Shadow Flicker

Concerns have been raised about the potential for wind turbines to cause epileptic seizures as a result of shadow flicker. As discussed in Section 5.2.1.5, shadow flicker is caused by the rotating blades of the turbines interrupting sunlight causing flicker. Individuals diagnosed with photosensitive epilepsy (approximately 0.03% of the population) are at risk for seizures caused by flickering light at certain frequencies. Photosensitive epileptic patients are most sensitive to flickering light at 5-30 Hz, although some report sensitivity as low as 3 Hz or as high as 60 Hz (Epilepsy Action 2007). At 3 Hz or below, the cumulative risk of inducing a seizure is about 1.7 per 100,000 of the photosensitive population (Harding *et al.* 2008). At maximum rotational speeds, most turbines flicker at a frequency below 3 Hz. In particular, the GE 1.5sle model to be used in the Digby Wind Power Project, would create flicker at a frequency of 1.02 Hz at a maximum rotational speed of 20.4 revolutions per minute (RPM). It is therefore concluded that shadow flicker effects would represent, at worst, a visual annoyance, rather than a health impact (refer to Section 5.2.1.5 for a discussion of shadow flicker visual effects).

Electromagnetic Fields

Electromagnetic fields (EMFs) created by the operating wind farm will be localized and become weaker with distance. The strength of the EMF from equipment within the substation, such as transformers, decreases rapidly with increasing distance. Beyond the substation, the EMF produced by this equipment is typically indistinguishable from background levels. Similarly, the EMF produced by the equipment within the turbines will be very weak, reduced not just by distance, but also by objects such as trees and other objects that conduct electricity. Previous studies have shown that magnetic field levels as a result of the cable distribution system are a fraction of those found in household appliances such as hairdryers, blenders or televisions (National Institute of Environmental Health Sciences 2002). As a result, there is no evidence that the proposed Project will present any human health effects related to EMFs.

Infrasound

Recently there has been concern for the potential of wind turbines to generate infrasound and the potential for infrasound to result in health effects. Infrasound is defined as wave phenomenon with the physical nature as sound, but with frequencies below the range of human hearing (HGC 2006). A recent study commissioned by the Canadian Wind Energy Association (CanWEA) demonstrated that while wind turbines are capable of generating infrasound, the levels of infrasound near the wind turbine are similar to ambient infrasound levels extant in the natural environment. The study also found no evidence of adverse health effects due to infrasound from wind turbines (HGC 2006).

There is no evidence that the current wind turbine technology proposed for this Project presents any potential problems related to the generation of infrasound energy. Furthermore, research in Alberta has identified that wind turbines may reduce infrasound by extracting energy from the wind, thus reducing the amount of infrasound generated by strong winds (Hepburn 2005). It is also worth noting that there are no turbines located closer than 600 m to a residence in the Study Area.

Ice Throw

Accumulation of ice on the turbine blades is possible during the winter months with extreme weather events and likely limited to a few days per year (based on the right combination of air temperature, wind speed and moisture in the air). Falling ice and the throwing of ice therefore present a hazard to on-site personnel during maintenance and operation of the wind turbines.

Falling ice from an immobile turbine does not differ from other tall structures. The potential ground area affected by falling ice depends largely on the blade position and prevailing wind speed but could be in the range of 40-60 metres (Finnish Meteorological Institute 2000). Ice throw distance depends on a variety of factors including turbine specifications, wind speed and geometry and mass of the ice fragment itself. Conservative modelling studies have shown ice throw distance would be expected to be between 15 m and 100 m taking these various factors into account (Finnish Meteorological Institute 2000).

The wind turbines are engineered to sense an unbalanced condition of the blades if the turbine blades have a build-up of ice on them. The wind turbines will not operate in this unbalanced condition as it could create damage to the turbine. Considering the limited opportunity for occurrence as well as the limited area potentially affected, the hazard of ice fall and ice throw is not considered a common hazard. Nonetheless, measures will be taken to protect workers and the general public.

During construction and operation activities, access to the wind turbine facilities will be restricted to authorized personnel wearing proper personal protective equipment and who have had appropriate safety training. During site visits, vehicles will be parked up-wind of the turbines. Access will be controlled so as to discourage trespassing on private lands.

Health and Safety

Health and safety issues typically associated with construction and operational activities are a priority for SkyPower. During construction and operation activities, access to the wind turbine facility will be restricted to authorized personnel wearing proper personal protective equipment and who have had appropriate safety training. The Contractor will be required to have a safety manual in place prior to construction activities. With the implementation of these mitigation measures, **no residual effects** are anticipated.

5.2.1.9 Electromagnetic Interference

A potential effect of a wind farm is interference with radioelectric signals, such as television, radio, cellular telephone, microwave transmission and radar. The Radio Advisory Board of Canada (RABC) and Canadian Wind Energy Association (CanWEA) have provided proponents with a Coordination Contact List of all systems and agencies potentially affected by electromagnetic interference in the *Technical Information and Guidelines on the Assessment of the potential Impact of Wind Turbines on Radio Communication, Radar and Seismoacoustic Systems* (April 2007) document. In order to determine possible wind turbine effects on radio communication services or radar systems in the Digby Area, SkyPower submitted letters to each stakeholder on the Coordination Contact list informing them of the proposed turbine locations and turbine specifics. To date, five responses have been received; the Canadian Coast Guard and the Canadian Broadcasting Corporation/Radio-Canada have requested that SkyPower undertake a detailed interference study in accordance with the RABC/CanWEA guidelines.

Satellite television and radio, cable television and AM and FM radio signals should not be affected by the operation of the Digby Wind Power Project. However, a complaint resolution system will be in place to record and investigate complaints regarding telecommunications interference. Mitigation will be conducted on a case by case basis pending results of the investigation.

5.2.2 Maintenance Activities

The wind turbines will be visited approximately once every three months for routine servicing. Furthermore, the facility will include a sophisticated wind energy oriented Supervisory Control and Data Acquisition (SCADA) data analysis program, as well as alarm and notification protocols. With such a system, faults can be instantly detected and addressed, operations can be monitored, equipment performance can be analyzed, trend analyses can be performed and long-term records maintained. For service-oriented visits the site will be accessed via light trucks. Although sensory disturbance to wildlife is possible, it will be short in duration, infrequent, in a small geographic area and will not be noticeable above the existing disturbance created by existing and ongoing forestry activities.

5.3 Decommissioning Activities

Well-designed and constructed wind energy facilities may be operated for decades. SkyPower expects individual wind turbines to perform for up to 25 years without significant repair or replacement. Transformer facilities, electrical cabling and substation facilities are designed for at least a 50 year life span. Individual wind turbines may be replaced or repaired as their useful life comes to an end, or if more efficient and cost-effective technology becomes available. SkyPower makes commitments regarding decommissioning to the landowners on whose land the equipment is placed.

Upon a decision to decommission a single wind turbine or the entire wind farm, all equipment above ground, including towers, nacelles, transformers and controllers will be removed. Wind turbines that are operational and have market value would be carefully removed using a crane, essentially in a reverse process to assembly and installation. The resale value of such equipment would cover the cost of removal in such a case. A market for good, used wind turbines has developed in North America, and a number of wind turbines installed in Alberta in the early 1990s originated from the U.S. used wind turbine market.

5.3.1 Removal of Turbine and Ancillary Equipment

Wind turbines that are no longer operational may also be removed by crane, but with less attention to preserving individual components, labelling them and storing them. Inoperative wind turbines have high salvage value. Steel and copper components are easily recycled, and there is a ready market for such materials. The remaining materials are primarily fibreglass and plastic. These may be sold to recycling facilities, or crushed and deposited in landfill sites. Experience in the U.S. with decommissioning of wind turbines has shown that the salvage value of wind turbines typically exceeds the costs of decommissioning (Gipe 1995).

Other above-ground equipment in the wind farm, including transformers and wiring, has a ready market in either used equipment sales or in salvage. Transformers will be simply removed and sold. Wiring will be removed and sold to metal salvage companies.

Environmental components that potentially could be impacted as a result of turbine and ancillary equipment removal include soils, water quality/aquatic environment, birds and other wildlife, land use, and noise. Table 5.13 summarizes the potential environmental effects of activities associated with removal of turbine and ancillary equipment.

Table 5.13 Potential Effects of Turbine and Ancillary Equipment Removal

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds and Other Wildlife	Sensory disturbance	▪ Overall disturbance will be limited to designated workspaces, and performed in compliance with the *Migratory Birds Convention Act.*	3	1	1/2	R	2	Sensory disturbance may cause habitat avoidance but it is likely to be temporary in nature, small in magnitude and restricted to the Project footprint.
Soils	Soil disturbance and erosion	▪ Soils around the excavation will be disturbed but will be managed to minimize erosion and runoff.	2	1	1/2	R	2	By implementing these standard mitigation measures, the residual effect on soils will not be significant and will have a minimal level of impact.
Water Quality/ Aquatic Environment	Surface water contamination	▪ Watercourses will be avoided to the extent possible. ▪ All activities, including equipment maintenance and refueling, will be controlled, or will be done off-site, to prevent entry of petroleum products or other deleterious substances, including any debris, waste, rubble or concrete material, into a watercourse. ▪ Construction material, excess material, construction debris, and empty containers will be stored away from watercourses and	2	1	1/1	R	2	No residual effects are predicted.

Table 5.13 Potential Effects of Turbine and Ancillary Equipment Removal

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		watercourse banks. ▪ A contingency plan for accidental spills will be developed for the Project.						
	Sediment Loading	▪ Construction/ decommissioning will not take place in the immediate vicinity of a watercourse. Temporary erosion and sediment control measures, silt fence, straw bales (etc.) will be used and maintained until 100% of all work within or near a watercourse has been completed and stabilized. ▪ Temporary sediment control measures will be removed at the completion of the work but not until permanent erosion control measures, if required, have been established.	2	1	1/1	R	2	No residual effects are predicted.
Land Use	Remediation of land	▪ The small footprint will be disturbed but remediated in accordance with landowner agreements.	2	2	1/2	R	2	Due to the small proportion of land to be directly impacted by foundation construction/ decommissioning and its reversibility after decommissioning, the residual effect is expected to be minimal.

Table 5.13 Potential Effects of Turbine and Ancillary Equipment Removal

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Noise	Increases to sound levels due to operation of equipment	▪ All internal combustion engines will be fitted with appropriate muffler systems. ▪ Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project.	3	2	1/2	R	2	Increased sound levels caused by foundation construction will be temporary in nature and will be conducted during working, daylight hours. Due to the short nature of this disturbance, the residual effect is considered negligible and the level of impact will be minimal.

1 Note Geographic Extent 1 = <500 m^2, 2 = 500 m^2 – 1 km^2, 3 = 1 –10 km^2, 4 = 11 – 100 km^2, 5 = 101 – 1000 km^2, 6 = >1000 km^2

Magnitude 1 = Low: *e.g.,* specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: *e.g.,* portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: *e.g.,* affecting a whole stock, population or habitat outside the range of natural variation.

Duration 1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.

Frequency 1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.

Reversibility R = reversible, I = irreversible.

Ecological Context 1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

5.3.2 Removal of Power Line

Power poles and cabling will be removed and recycled/disposed of as required. Environmental components that potentially could be impacted as a result include soils, water quality/aquatic environment, birds and other wildlife, land use, and noise. Refer to Table 5.13 for a summary of the potential environmental effects of activities.

5.3.3 Site Remediation/Reclamation

Wind energy facilities do not use or produce harmful waste products. There is no need for concern about residual toxic chemicals or exhaust products. Aside from normal recovery of lubricants from the gearbox and yaw mechanism, decommissioning activities are not required for waste. Lubricants will not contain any PCBs. Site remediation/reclamation will be conducted in accordance with landowner agreements and in accordance with the applicable regulations at the time. Environmental components that potentially could be impacted as a result include soils, water quality/aquatic environment, birds and other wildlife, land use, and noise. Refer to Table 5.13 for a summary of the potential environmental effects of activities.

5.4 Accidents and Malfunctions

The plans described below are expected to mitigate any potential accidents and malfunctions that may occur. Therefore, the level of impact is considered **low** and **not significant**.

5.4.1 Corporate Environmental, Safety & Health Management Plan

An Environmental, Safety & Health (ESH) Management Plan will be developed and implemented to ensure that environmental, safety and health requirements are consistently met throughout the Project, specifically throughout the construction and operating phases. The ESH Management Plan will be developed in conjunction with Project contractors, and shall be at all times in strict compliance with all applicable Provincial and local requirements.

SkyPower will ensure that the construction and operation contractors will be duly certified by the appropriate safety associations. As part of the ESH Management Plan, the elements of an Environmental, Safety & Health Management System (ESH-MS) for the Project will include:

- Safety Management Statement, which shall clearly articulate the health and safety objectives and commitment to continually improve the effectiveness of the ESH-MS;
- Safety System Manual, which shall define the scope of the ESH-MS and describe the structure of the ESH-MS;
- Safety Project Plans, which shall explain the strategy and approach to be used in managing activities critical to delivery of work, containing as a minimum
  - Worksite Hazard Assessment Plan;
  - Fall Protection Plan;
  - Safety Emergency Response Plan, and
  - Safety Orientation and Education Plan;
- Safety Project Procedures, which shall contain where necessary documented procedures to ensure specific tasks will be successfully completed to a consistent level satisfying all the requirements of the agreements;
- Safety Records, which will establish and maintain safety records to provide evidence of conformity to agreements, applicable certification requirements and ESH-MS requirements;
- Accident and Incident Investigation, which shall contain a documented process to investigate, document and report all accidents and incidents, to be carried out by suitably trained personnel, and where corrective or preventative action is required, such action will be fully documented and completed;
- Joint Environmental, Safety & Health Committee, which shall consist of one or more members from each of various work groups to ensure all personnel have representation, members of which will receive appropriate training and meet monthly;
- Personal Protective Equipment, which shall assess worksites for hazards and establish the requirements for appropriate personal protective equipment, communicate such requirements to involved personnel and worksite visitors;
- Internal Auditing, which shall contain documented process to confirm compliance with ESH-MS processes, and identify necessary corrective / preventative actions; and
- Continual Improvement, which will initiate measures to continually the ESH-MS and the delivery of the work, to be implemented by a designated Environmental, Safety & Health Manager.

5.4.2 Emergency Response Planning

SkyPower will develop an emergency response plan for the unlikely event of a site emergency during any phase of the Project. The emergency response plan will include a report form and a map of the Project site, showing the most direct route from the site to an emergency resource such as a hospital. All on-site personnel and contractors will be required to complete a site safety and emergency response orientation prior to the start of pre-construction and construction activities. Prior to operation, SkyPower will provide specialized equipment and training to local fire department for rescue needs within the Project.

5.4.3 Project Environmental Protection Plan

SkyPower will prepare a Project-specific Environmental Protection Plan (EPP) that will be used on-site during all construction, operation and maintenance activities. The EPP will be written in construction specification format and will include the recommended mitigation measures in this EA report, as well as industry-accepted construction practices. The EPP will be used by the construction contractor and by all operations and maintenance workers during the life-of-the-Project.

5.5 Effects of the Environment on the Project

The following section outlines the effects of the environment on the Project, which includes climatic fluctuations and extreme events that are likely to occur in the Project area.

5.5.1 Climatic Fluctuations

Several aspects of the potentially changing climate have been considered, and must continue to be monitored during the lifetime of the Project. The potential rise of sea level is one such concern. The siting of the wind turbines on the high grounds in the area essentially removes the turbines themselves from this risk. Further protecting the Project, the infrastructure for transmission of the power is located such that it is safe from any foreseeable rise in sea level. Near the coast, the village of Gulliver's Cove may be at some risk, but this road is not required for access to the turbines.

The turbines are designed to have a safe upper working limit for windspeeds. As the frequency of storms increases, particularly the strong late summer hurricanes that are anticipated to retain strong windspeeds as tropical depressions as they move up the coast, there would be an associated increase in the frequency of conditions exceeding the safe operating envelope for the turbines. During such conditions, the turbines are halted and generation suspended until safe working conditions occur again. The lost generation due to the marginal increase in storm frequency is a relatively small quantity of generation time; that is, it is not anticipated to significantly negatively affect the economic viability of the Project. Similarly, any change in the frequency of freezing rain, or blade-icing conditions, is not anticipated to significantly affect operating times, and the monitoring instruments in place will allow the physical risk to the turbines to be managed effectively.

5.5.2 Extreme Events

Weather events that put wind turbines at risk include icing conditions, particularly freezing rain, lightning, and extreme winds. Although Nova Scotia has fewer lightning storms than, for example, central Canada, the lightning protection must, and will, be designed to cope with accepted industry standards. Freezing rain is an operations issue. Blade specifications are sufficient to cope with foreseeable icing loads, but it is possible that an event that exceeds this level could be encountered. In such an event, the turbine would have been halted, and the damage would be confined to the immediate vicinity of the turbine base, should ice falling, or structural damage occur.

The wind turbines will be the highest features in the surrounding landscape, and therefore it is necessary that a lightning protection system be incorporated into each turbine. For the Project, each turbine blade material is fibreglass-reinforced epoxy resin with integral lightning protection supply. Each blade and each turbine tower are grounded to prevent adverse effects from lightning strikes. Additional grounding rods can be installed at each turbine site. Most effects from a lightning strike would be dissipated. If lightning struck the generator at the top of the tower, serious damage could occur and the generator may be damaged.

The generator is designed to automatically shutdown at wind speeds that exceed 25 m/s. The turbine tower is designed to withstand excessive wind speeds. Comprehensive geotechnical work at each site will enable for proper design of wind turbine foundation. Extreme wind conditions are used as a parameter in this design.

In the event of a lightning strike that hits a wind turbine generator, severe damage could occur and a new generator may need to be installed. However, it is highly unlikely that lightning would hit a wind turbine generator accurately enough to severely damage it. Taking into consideration the design features that will be used in the Project, a significant environmental effect is unlikely to occur as a result of extreme weather events.

5.6 Cumulative Effects

Subsection 16(1)(a) of *CEAA* requires that every screening of a project include an assessment of the "cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out".

The evaluation of cumulative environmental effects follows five steps:

- Step 1- Identify environmental effects resulting from Project-related activities.
- Step 2- Identify other projects or activities that could interact with Project-related environmental effects.
- Step 3- Exclude environmental effects of other projects or activities that are not likely to act in combination with the environmental effects of the Project.
- Step 4- Identify the likely cumulative environmental effects that could result from the interaction of Project-related environmental effects with other past and future projects and activities.
- Step 5- Evaluate the significance of likely cumulative environmental effects.

Under *CEAA*, an environmental assessment must determine whether the project under review adds to the combined adverse effects of past, existing and imminent projects and activities. Specifically, the assessment determines the degree to which a single project is contributing to the total cumulative effects of human activities and developments in the region.

A critical step in any environmental assessment is determining what other projects or activities have reached a level of certainty (*i.e.,* will be carried out) such that they are required to be considered.

It is helpful to consider the clarification provided by the Joint Review Panel for the Express Pipeline Project in Alberta. Following an analysis of subsection 16(1)(a) of *CEAA*, the Joint Review Panel determined that certain requirements must be met for the Panel to consider cumulative environmental effects:

- there must be a measurable environmental effect of the project being proposed;
- that environmental effect must be demonstrated to interact cumulatively with the environmental effects from other projects or activities; and
- it must be known that the other projects or activities have been, or will be, carried out and are not hypothetical (NEB and CEA Agency 1996).

Furthermore, the Joint Review Panel indicated that it is an additional requirement that the cumulative environmental effect is *likely* to occur, that is, there must be some *probability*, rather than a mere possibility, that the cumulative environmental effect will occur. These criteria were used to guide the assessment of cumulative environmental effects of the proposed Project.

Environmental effects resulting from Project-related activities were identified and assessed in Sections 5.1 to 5.4. The evaluation of cumulative environmental effects is warranted for several environmental components discussed in these sections, namely birds and other wildlife, visual impact, noise and economic development.

This section outlines cumulative environmental effects that may result from the Project in combination with other projects or activities that have been or will be carried out, within the regional area. For the purposes of this cumulative effects assessment, the regional area is defined as Digby County.

5.6.1 Past, Present and Future Projects/Activities in the Regional Area

There is not a lot of industrial development within or surrounding the Study Area There are two other wind turbines in the vicinity of the Study Area, but no proposed wind farms at this time. Renewable Energy Services Limited (RESL) operates an 800 kW wind turbine approximately 8-10 km northeast of the Project Area near Digby. Vector Wind Energy/Springhill operates a 900 kW wind turbine in Tiverton Riverhurst, approximately 35 km from the Project Area.

Activities that would be expected to potentially interact cumulatively with the Project include the land use activities in and around the Study Area, including forestry, agriculture, and quarrying (*e.g.,* private gravel/sand pits). These activities have occurred in the past thereby influencing the current landscape and will continue to occur in the future (thereby overlapping temporally with the Project) and would have effects on bird and other wildlife, visual impact, noise and economic development that could potentially interact cumulatively with the effects predicted for the Digby Wind Power Project.

5.6.2 Interactions between Projects/Activities and Description of Cumulative Environmental Effects

Identifying potential cumulative effects is considered through a comparison of the temporal and spatial scope of the additional projects identified in the regional area. A qualitative assessment of these interactions is undertaken in the following section, using experience and professional opinion of the study team. Spatially, those projects that are within the regional area are considered to be relevant. Temporally, those projects that have existed in the past, exist presently, or are likely to exist in the near future are considered relevant.

5.6.2.1 Birds and Other Wildlife

Past and ongoing forestry and agricultural activities in the regional area has resulted in a loss of forest and wetland habitat and the active forestry of much of the Study Area has reduced the area of contiguous mature forest habitat. The Project is not expected to result in additional loss of high quality habitat or expected to contribute to the cumulative environmental effects of human activities on wildlife habitat.

Wildlife mortality, specifically bird and bat mortality, is a residual environmental effect associated with the proposed Project. Bird and bat mortality may also occur as a result of collisions with overhead power lines, vehicles and buildings resulting in a cumulative effect. Historical evidence (see Section 5.2.1.5) has shown that wind turbines typically do not kill large numbers of birds and bats compared with other structures. It is therefore unlikely that the incremental contribution of the Digby Wind Power Project to bird and bat mortality will affect these species on a population basis causing adverse cumulative effects. Bird surveys did not reveal extensive use of the site by species of conservation concern making it also unlikely that rare species would experience significant cumulative effects. A post-construction bird and bat monitoring program will confirm these predictions. As a result, the cumulative effects of this Project with other activities on birds and other wildlife is deemed to be **not significant.**

5.6.2.2 Visual Impact

The development of the Project, taken into consideration with forest harvesting activities, existing and future power lines, could be considered a further visual obstruction. However, since the landscape has already been influenced by human activities, the visual effect of the Project is incremental. As a result, the cumulative effect of this Project with the other existing structures in the landscape is deemed to be **not significant**.

5.6.2.3 Noise

Acceptable sound levels are expected to be produced by the Digby Wind Power Project. Although forestry and quarrying activities would create noise, they are not expected to generate sound levels above acceptable levels to nearby receptors. The Project is expected to only result in an incremental increase in sound and is considered to be **not significant**.

5.6.2.4 Economic Development

This Project will continue to contribute to the community through job creation for local contractors. It is estimated that the Project will provide 15 to 30 new or existing jobs during the construction phase, four new or existing jobs during the operation and maintenance phase, and two to ten new or existing jobs during the decommissioning phase. In addition, the Project will provide significant tax revenues and income for landowners. These increases in employment and economy will have a cumulative benefit for economic development in the region.

5.6.2.5 Summary

With the adherence to mitigation presented in this report, in addition to compliance with regulatory requirements (including terms and conditions of approval), the residual environmental effects of the Project, including cumulative effects, are predicted to be **not significant**.

5.7 Summary of Potential Environmental Impacts

A summary of recommended measures for managing and mitigating effects of the Project, based on the preceding analysis, is provided in Table 5.14.

Table 5.14 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
Birds and Other Wildlife	Construction & Decommissioning	Sensory disturbance	• Visitors will remain within relevant areas, both in-vehicle and on- foot and will aim to preserve the site's natural areas. • Ensure that overall disturbance will be limited to designated workspaces and performed in compliance with the *Migratory Birds Convention Act*. • Delivery vehicles will remain on designated roads.
		Habitat loss/alteration	• Habitat loss may be mitigated by only clearing the land necessary for construction activities and by limiting the overall land disturbance to within designated workspaces. • Upon completion of construction and/or decommissioning, habitat will be restored to the extent possible. • Areas of significance (*e.g.,* nesting sites) will be avoided, to the extent possible.
		Mortality	• In order to reduce the potential of bird mortality, land clearing and construction activities will be performed in compliance with the *Migratory Birds Convention Act (e.g.,* outside the critical time periods for breeding birds). If this is not possible during detailed layout surveying activities, a biologist, in consultation with NSDNR and CWS, will prepare and implement a monitoring and mitigation plan for breeding activity which may include: the identification nests within or immediately adjacent to work areas, and flaging them for avoidance during construction, to the extent possible.
	Operation	Sensory disturbance	• None required.
		Mortality	• To reduce the potential for increased bird fatalities due to collision with wind turbines, several decisions were made in the planning of the wind farm. The turbines to be used extend no higher than 120 m above the ground thus avoiding the flight height of nocturnally migrating landbirds. Lighting will be the minimum allowed by Transport Canada for aeronautical safety, and white strobe lights (CL-865) may be used with the minimum intensity and flashes per minute allowable. The turbines for this Project will be built using tubular steel towers, as some data indicate that lattice towers encourage perching by raptors during hunting and, as a result, may put these birds at risk of collisions. Post-construction monitoring will direct the need and form of further post-construction mitigation measures • A bird and bat monitoring program will be developed in consultation with NSDNR and CWS. Based on the

Table 5.14 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
			results of this program, necessary modifications to mitigation plans and/or wind farm operations will be undertaken.
Soils and Vegetation	Construction & Decommissioning	Soil erosion and compaction	• Limit access to the turbine sites via established access roads, where possible. • Size of access roads will be kept to the minimum required for the safe construction, operation and decommissioning of the equipment. • Whenever possible, clearing activities will be timed to periods when the ground surface is best able to support construction equipment (winter or dry season). • Replace topsoil stored on-site to enable the reclamation of land to its original condition. • Compacted soil will be reclaimed as required. • Topsoil will be stored onsite for future use in restoring the land to its original condition • Standard erosion and sediment control measures will be implemented as required. • Topsoil and subsurface soils will be separated and stored on-site to be replaced appropriately after the pouring of the concrete foundation. When the soils are stored they will be covered with a tarp or otherwise protected from erosion and runoff.
		Loss of plant species	• Follow- up vegetation surveys will be conducted where necessary. • Prior to construction, digital waypoint files for “Red”, “Yellow” and Undetermined” species identified during field surveys will be provided to NSDNR. • Where Plant Species of Conservation Concern are encountered, avoidance to the extent possible will be considered, especially where there maybe be a threat to the regional population.
Wetlands	Construction & Decommissioning	Loss of wetland area and/or function	• Avoid all wetlands, where possible. • Conduct functional analyses and obtain regulatory approval for wetland alteration as required, including compensation to ensure no net loss of function.
Water Quality/ Aquatic Environment	Construction & Decommissioning	Surface water contamination	• Watercourses will be avoided to the extent possible • If alteration of watercourses is required, regulatory approval from NSE of the proposed alteration will be obtained prior to construction. • All activities, including equipment maintenance and refuelling, will be controlled, or will be done off-site, to prevent entry of petroleum products or other deleterious substances, including any debris, waste, rubble or concrete material, into a watercourse. • Construction material, excess material, construction debris, and empty containers will be stored away from watercourses and watercourse banks. • A contingency plan for accidental spills will be developed for the Project.

Table 5.14 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
		Sediment loading	• Watercourses will be avoided to the extent possible. • If watercourse alterations are required, they will be done in consultation with NSE/DFO in accordance with regulatory requirements. • Instream work will occur between June and September 30 where possible unless otherwise approved by NSE. • Temporary erosion and sediment control measures, silt fence, straw bales (etc.) will be used and maintained until 100% of all work within or near a watercourse has been completed and stabilized. • Visual assessments will be completed on a quarterly basis and after severe storm events to ensure effectiveness of erosion and sedimentation controls. • Temporary sediment control measures will be removed at the completion of the work but not until permanent erosion control measures, if required, have been established.
		Surface water flow	• Watercourses will be avoided to the extent possible. • Access roads constructed across existing watercourse that require a culvert will follow standard industry practice, installing culverts of sufficient size to accommodate expected maximum flows within the watercourse. • A Water Approval will be obtained for all required watercourse crossings and the conditions of approvals will be followed.
		Fish mortality	• Watercourses will be avoided to the extent possible. • Watercourse crossings, where required, will occur between the period of June 1 to September 30 unless otherwise approved by NSE • Where possible, culverts will be installed during low flow periods. If water is present, watercourses will be dammed and flow will be preserved through water pumps. In this case, a biologist would be on site to facilitate fish rescue within the dammed area.
Noise	Construction & Decommissioning	Increases in sound levels due to the transportation and operation of clearing equipment	• Nearby residents will be advised of significant sound generating activities and these will be scheduled to create the least disruption to receptors. • Heavy equipment will be operated between 7:00 a.m. and 10:00 p.m., avoiding Sundays and holidays unless absolutely necessary. • Construction equipment will have mufflers. • Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project.
	Operation	Increase sound levels	• None required.
Tourism	Construction & Decommissioning	Effect on tourism (	• None required.
	Operation	Effect on tourism and recreation	• None required.
Visual	Operation	Change to visual	• Turbines will be all of the same type and model, and will

Table 5.14 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
		landscape	be painted light grey to reduce reflection. • Screening opportunities for adjacent residences through tree planting or other measures may be considered where post-construction evaluation indicates a legitimate concern.
		Lighting	• Lighting will be the minimum allowed by Transport Canada to ensure the appropriate level of aeronautical safety.
		Shadow flicker	• None required.
Archaeological and Cultural Resources	Construction	Disturbance	• Areas of significance will be avoided to the extent possible. • Additional follow-up work may be required depending on final design and layout. • Upon discovery of an artifact, work will be stopped in the immediate area and the appropriate authorities will be contacted.
Land Use	Construction	Reduction of forested land	• Existing forest roads will be used as access roads to the extent possible • New access roads will be constructed to minimize the Project footprint. • Turbines and substations, with their relatively small footprint on the land, have been sited with consideration for the potential impact to existing land uses • Existing logging and access roads built earlier in construction schedule will be used to install the collection system. • Existing RoWs will be used to the greatest extent possible.
	Operation	Disruption to undeveloped woodlands or infrastructure	• The Project has been designed to minimize impacts to the local land use. No mitigation, therefore, is required as no significant impacts are predicted.
Health and Safety	Operation	Electromagnetic Fields (EMFs)	• None required.
		Infrasound energy	• None required.
		Ice throw	• During construction and operation activities, access to the wind turbine facility will be restricted to authorized personnel wearing proper personal protective equipment and who have had appropriate safety training. • During site visits, vehicles will be parked up-wind of the turbines. • Warning signs will be posted at the perimeter of the Project area, discouraging trespassing on private lands.
Local Community	Construction	Hazards and/or inconveniences to forestry operation	• Road construction schedule will consider planned forestry operation in the area to ensure required access is maintained. • No modification to existing roads expected • A Special Move Permit and any associated approvals will

Table 5.14 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
			be obtained through the Department of Transportation and Infrastructure Renewal for heavy load transport.
	Operation	Effect on local economy	• Local residents will be employed to the extent possible during the construction, operation and decommissioning of the Project. • Municipal taxes will be remunerated, thus increasing the local tax base, which could be used to increase funding of local municipal initiatives.
		Effect on property values	• None required