5.0 ENVIRONMENTAL ASSESSMENT AND RESIDUAL EFFECTS

The following section describes the potential interactions between the proposed Amherst Wind Energy Project and the biophysical and socio-economic environment, and includes: an assessment of potential cumulative environmental effects; an assessment of the effects of the environment on the Project; and the potential effects of accidents and malfunctions. The structure of this chapter follows that recommended by NRCan in their 2003 guidance document "Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the *Canadian Environmental Assessment Act*" (NRCan 2003). The potential effects are described for the construction, operation and decommissioning phases of the Project and suggested mitigation is presented to reduce or eliminate these potential effects. The potential interactions between the Project and the environment are summarised, as are the proposed mitigation measures to reduce or eliminate residual (or net) effects.

The habitat in the Project area consists primarily of a sod farm with some pasture land located at the northern end of the site. A significant marshland area is located to the east of the Project site and will not be altered by Project activities. The LaPlanche River traverses the Project area in primarily an east-west direction. The area of habitat that will be altered due to land clearing and construction activities for access roads, turbines and the substation will be a very small proportion of what is available. No vascular plant species-at-risk were observed during the field survey.

Changes in habitat may also occur as a result of accidents and malfunctions. Accidents, such as hazardous material spills may affect wildlife through contamination of areas providing suitable habitat. An unplanned event, such as a fire, may also reduce the amount of available wildlife habitat in the short-term, although it may ultimately increase the productivity of that habitat in the long-term.

There are no nationally or provincially-designated heritage sites present in the general Project area. While no previously recorded archaeological sites are located within the Project area, the banks of the LaPlanche River have some potential for unknown heritage resources. Table 5-1 summarizes the potential interactions between the Project and VECs.

Table 5-1 Potential Interactions Between the Project and Valued Environmental Components

Project Activities	Valued Environmental Components												Section
	Soil	Water Quality	Aquatic Environment	Terrestrial Vegetation	Wildlife	Archaeological/ Cultural Resources	Land Use	Local Community	Visual Aesthetics	Noise	Recreation and Tourism	Safety	
Construction													
Surveying and Siting					X								5.1.1
Land Clearing (minimal clearing required)	X	X	X	X	X	X				X			5.1.2
Road Construction/ Modification and Culvert Installation		X	X		X	X	X	X		X			5.1.3
Delivery of Equipment					X			X		X			5.1.4

Table 5-1 Potential Interactions Between the Project and Valued Environmental Components

Project Activities	Valued Environmental Components												Section
	Soil	Water Quality	Aquatic Environment	Terrestrial Vegetation	Wildlife	Archaeological/ Cultural Resources	Land Use	Local Community	Visual Aesthetics	Noise	Recreation and Tourism	Safety	
Temporary Storage Facilities	X	X	X	X	X	X				X			5.1.5
Foundation Construction	X	X	X		X	X	X			X			5.1.6
Tower and Turbine Assembly	X				X					X			5.1.7
Interconnection (Turbine to Substation)	X	X	X	X	X	X	X			X			5.1.8
Substation Construction	X	X	X		X	X	X			X			5.1.9
Fencing/ Gates	X	X	X		X	X	X			X			5.1.10
Operation													
Operation & Maintenance					X		X	X	X	X	X	X	5.2.1, 5.2.2
Decommissioning													
Turbine and Ancillary Equipment Removal	X	X	X				X			X			5.3.1
Buildings and Waste Removal	X	X	X				X			X			5.3.2
Power Line Removal	X	X	X				X			X			5.3.3
Site Remediation/ Reclamation	X	X	X				X			X			5.3.4
Accidents and Malfunctions	X	X	X		X		X	X				X	5.4

5.1 Project Construction Activities – Environmental Effects

The following sections describe the main construction activities and the potential effects associated with each activity. All activities associated with the Project construction, including equipment maintenance and refuelling, will be controlled through standard mitigation to ensure that there is a low impact associated with construction of the Project. The construction zone of impact will be localized within the Project area, including the right-of-way for the distribution line.

Overall, potential environmental impacts will be mitigated using the following standard practices:

- limit access to the turbine site via an established access road, where possible;
- keep the size of access roads to the minimum required for the safe transportation of construction equipment;
- fence areas with valued environmental features, and exclude construction activities from within these fenced areas;
- whenever possible, time clearing activities to periods when the ground surface is best able to support construction equipment (winter or dry season) to prevent rutting and to avoid significant life history events, such as breeding seasons for resident wildlife; and,
- upon clean-up, replace topsoil stored on-site and re-vegetate areas that were temporarily cleared, where possible, with native seed mixtures or, with a mix of species similar to those on adjacent lands to restore affected lands to their previous condition.

The remainder of this section focuses on the individual phases of construction and operation, and details the potential environmental effects associated with each.

5.1.1 Surveying and Siting Operations

The siting of the wind turbines was initially carried out using computer software. This software, however, does not account for areas that are environmentally sensitive, and site visits by a biologist were conducted and combined with existing mapping data to identify environmental constraints. Prior to construction, surveyors will also conduct a site visit to identify the exact location of each turbine on foot. Survey stakes will be used to mark each turbine site, temporary workspace, substation site and trenches for the underground collector lines, as well as marking the location of any existing underground pipelines and cables. Table 5-2 summarizes the potential environmental effects of surveying and siting activities.

Table 5-2 Potential Effects of Surveying and Siting Activities

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	▪ Visitors will remain within relevant areas, both in-vehicle and on-foot and will aim to preserve the site's natural areas.	3	1	1/1	R	2	Sensory disturbance may cause habitat avoidance but it likely will be temporary in nature, small in magnitude and restricted to the Project footprint. The area to be subject to this disturbance has been previously disturbed by human presence (*i.e.,* agriculture) and disturbance will be reversible.

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.

The net effects of siting and surveying activities will be spatially limited to certain areas within the Project footprint, as well as temporally limited to within the siting and surveying visits (up to two visits). Overall the level of impact will be **minimal** and **not significant**, especially considering that the area birds and wildlife already experience a certain level of sensory disturbance due to ongoing agricultural

activities (*i.e.,* sod farm) and associated human presence. It should be noted that this phase is very important in ensuring that the overall Project is carried out with the least possible disturbance to birds and wildlife. Appropriate construction work zones will be chosen, to the extent possible, in order to limit the degree of disturbance.

5.1.2 Land Clearing

The lands within the Project area are agricultural. Overall, the majority of the Project area land does not require alteration, and agricultural activities can be maintained to within very close proximity of the turbines. Areas exist, however, where land clearing and minor vegetation removal (a few small trees) may be required for the construction of access roads, installation of interconnection cables, turbine foundation construction and the construction of the substations. Table 5-3 summarizes the potential environmental effects of land clearing activities.

Table 5-3 Potential Effects of Land Clearing Activities

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	▪ Ensure that overall disturbance is limited to designated workspaces, and performed in compliance with the *Migratory Birds Convention Act*.	2	1	2/1	R	2	Sensory disturbance may cause habitat avoidance but it likely will be temporary in nature, small in magnitude and restricted to the Project footprint. The area to be subject to this disturbance is largely agricultural land that has minimal ecological value, and disturbance will be reversible.
	Habitat Alteration and Loss	▪ 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.	2	1	2/1	R	2	The area of habitat that will be altered due to land clearing activities for access roads, turbines and the substation will be a very small proportion of what is available and principally on cultivated land, and therefore the impact will be minimal.

Table 5-3 Potential Effects of Land Clearing Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
	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*.	2	1	2/1	I	2	It is predicted that there will be no residual effect on bird mortality.
Soils and Vegetation	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 conducted during 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.	2	1	2/1	R	2	Implementation of mitigation measures will ensure that soil quality within the Project area will be preserved, and no residual effects will exist.
	Loss of Plant Species	▪ Avoid the clearance of any of the areas immediately surrounding the River (with the exception of the culvert construction and upgrades to access road over old aboiteau).	2	1	2/1	R	2	As indicated in Section 4.3, no provincially or nationally rare plant species or plant communities were identified within the Project area during the field survey. Establishment of a buffer zone around the river will help ensure that the vegetation resources within the Project area are adequately protected.

Table 5-3 Potential Effects of Land Clearing Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Water Quality/ Aquatic Environment	Contamination of surface water	▪ All activities, including equipment maintenance and refuelling, will be controlled 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.	2	1	2/1	R	2	By following mitigation measures, negative interactions with surface water quality and fish habitat in the Project area will be minimized and no significant residual effects will result.
	Sediment Loading	▪ Land clearing and construction will not take place immediately adjacent to the watercourse, with the exception of the culvert construction and upgrades to access road over old aboiteau. ▪ 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	2/1	R	2	By following mitigation measures, negative interactions with surface water quality and fish habitat in the Project area will be minimized and no significant residual effects are predicted.

Table 5-3 Potential Effects of Land Clearing Activities

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 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 only 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. ▪ Adhering to the recommended setback between the Project site and receptors (*i.e.*, at least 500 m from houses). ▪ Attending to routine maintenance of the wind turbines and associated equipment, as recommended by the manufacturer.	3	2	2/1	R	2	Increased sound levels caused by land clearing will be temporary in nature and will be caused by activities conducted during working, daylight hours. Due to the short nature of this disturbance and its limited geographic range, the residual effect is considered acceptable and the level of impact will be minimal.
Archaeological and Cultural Resources	Disturbance	▪ Areas of significance (*i.e.,* river banks) will be avoided, to the extent possible.	2	1	2/1	R	2	Implementation of mitigation measures will be adequate to resolve any concerns for archaeological and cultural resources within the Project area. To this end, no significant residual effects to archaeological and cultural resources are anticipated.

Table 5-3 Potential Effects of Land Clearing Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	

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.

The net effects of clearing activities will be spatially limited to certain small areas within the Project footprint. Overall the level of impact will be **minimal** and **not significant**, especially considering that the area's birds and wildlife already experience a certain level of sensory disturbance due to ongoing agricultural activities and associated human activities. Standard mitigation measures to protect aquatic resources, archaeological resources and humans from increased sound levels will be adequate to effectively reduce or eliminate residual effects.

5.1.3 Road Construction/Modification, Parking Lot and Culvert Installation

Existing access roads will be upgraded and as required, new roads may be installed on private land for vehicles and equipment access. Access roads will be surveyed and staked/flagged. The roads are based on a proposed layout at this time and may require alterations as the Project proceeds. Roads on the wind farm site will be a maximum of 12 m wide to accommodate maintenance vehicles and equipment for repairs/replacements. In special cases if difficult turns are required, roads may be wider than 12 m. Construction roads will be designed to accommodate the crane types that will be required to erect the wind turbine generators and towers. Roads will be constructed by placing a layer of geogrid on the native soil, followed by layers of compacted shale or sandstone with a screened stone topping. The thickness of the layers will be in accordance with the geotechnical report's recommendations for Project road construction. The roads will generally follow the routing of the existing sod farm roads, with new roads added as required. Once Project construction is complete, the construction roads will be removed and the topsoil replaced across approximately three-quarters the width, leaving single lane tracks to allow access to the turbines for maintenance purposes.

Temporary improvements in roads may be necessary in some areas to enable access to the site by articulated (multi-axle) trucks carrying the turbine components, the largest component of which is the nacelle. These improvements may include widening the turning radius of the corners by adding fill to the ditches. None of these modifications are expected to be permanent and the corners will be remediated.

There may be a requirement for a parking lot associated with the maintenance building. It is anticipated that the parking lot will be near turbines 19 and 20 in the northwest corner of the site. Preliminary design indicates the parking lot would be approximately 380 m^2. Road construction/modification, parking lot and culvert installation are anticipated to be within the upper 3 m of the ground surface. Site geotechnical work to-date indicates that bedrock is much deeper (*i.e.,* 10 mbg). These activities are expected to have no impact on local water supply wells within 1.5 km of the site and will have no impact on wells within the North Tyndall Well Field.

Existing ditching will be improved and new ditches and culverts installed as required to provide proper drainage of roads and farm fields. The river crossing to the turbines on the western side of the LaPlanche River will be by a land bridge constructed in a similar fashion as the old existing aboiteau that is approximately 1 km upstream and the new aboiteau, approximately 1 km downstream. In the comments received from NSEnv on the draft EA document, it was suggested that alternatives to the land bridge be considered, however, alternatives proved not to be feasible for this Project.

The culvert will be at least as wide as the stream and will be properly sized to ensure fish passage. The culvert will be installed in the dry (with water control in place). The culvert will be embedded to ensure natural sediment coverage on the bottom and that the culvert is not higher than the natural river bed (which could impede fish passage). River water flows, which are greatly reduced due to the new aboiteau operation and seasonally lower summer flows, will be dealt with by the use of temporary water channels around the installation work. More detailed plans on culvert design are provided in Appendix B. Flow monitoring was attempted in order to confirm the assumptions regarding the river and watershed characteristics utilized in the design of the culvert, as the new aboiteau is expected to have an effect on water levels in the river, however, this approach was abandoned due to safety concerns for the field crew. The hydrologists will examine river and watershed characteristics to determine whether or not changes have occurred since the 1983 data were collected and utilize flow modeling to confirm assumptions. Should the characteristics differ from assumptions used; current river characteristics established through flow modelling will be used to modify the size of the culver to accommodate maximum predicted flows.

The potential environmental effects associated with road construction, the parking lot and culvert installation includes impacts to birds and other wildlife, water quality/aquatic environment, noise levels, archaeological/cultural resources, land use and traffic. Table 5-4 summarizes the potential environmental effects of road construction/modification activities.

Table 5-4 Potential Effects of Road Construction/Modification, Parking Lot and Culvert Installation Activities

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	▪ Ensure that overall disturbance is limited to designated workspaces, and performed in compliance with the *Migratory Birds Convention Act*.	2	1	2/1	R	2	Sensory disturbance may cause habitat avoidance but it likely will be temporary in nature, small in magnitude and restricted to the Project footprint. The area to be subject to this disturbance is cultivated land that has minimal ecological value, and disturbance will be reversible.
	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.	2	1	2/1	R	2	The area of habitat that will be altered due to land clearing activities for access roads, turbines and the substation will be a very small proportion of what is available, and therefore the impact will be minimal.
	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*.	2	1	2/1	I	2	It is predicted that there will be no residual effect on bird mortality.

Table 5-4 Potential Effects of Road Construction/Modification, Parking Lot and Culvert Installation Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Soils and Vegetation	Soil Erosion and Compaction	▪ Access to the turbine sites will be limited to established access roads, where possible. ▪ The 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 for periods when the ground surface is best able to support construction equipment (winter or dry season). ▪ Topsoil will be stored on-site and re-used to enable the restoration of land to its original condition.	2	1	2/1	R	2	Implementation of mitigation measures will ensure that soil quality within the Project area will be preserved, and no residual effects will exist.
	Loss of Plant Species	▪ Clearing of any of the riverbank areas will be avoided, with the exception of the area of culvert installation and upgrades to the old aboiteau crossing.	2	1	2/1	R	2	As indicated in Section 4.3, no provincially or nationally protected plant species or plant communities were identified within the Project area during the field survey.
Water Quality/ Aquatic Environment	Surface Water Contamination	▪ All activities, including equipment maintenance and refuelling, will be controlled 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.	2	1	2/1	R	2	No residual effects are expected.

Table 5-4 Potential Effects of Road Construction/Modification, Parking Lot and Culvert Installation Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		▪ A contingency plan for accidental spills will be developed for the Project.						
	Sediment Loading	▪ Land clearing and construction will not take place in the immediate area of a watercourse, with the exception of the culvert construction and upgrades to the old aboiteau crossing. ▪ 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. ▪ Culvert will be installed in the dry and during a time when fish runs are not an issue (ideally mid-July through September).	2	1	2/1	R	2	No residual effects are predicted.
Noise	Increases to 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 only be operated between 7:00 a.m. and 10:00 p.m., avoiding Sundays and holidays unless absolutely necessary.	3	2	2/1	R	2	Residual effects are expected to be minimal, as discussed in Table 5-2.

Table 5-4 Potential Effects of Road Construction/Modification, Parking Lot and Culvert Installation Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		▪ Construction equipment will have mufflers. ▪ Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project. ▪ Adhering to the recommended setback between the Project site and receptors (*i.e.*, at least 500 m from houses). ▪ Attending to routine maintenance of the wind turbines and associated equipment, as recommended by the manufacturer.						
Archaeological and Cultural Resources	Disturbance	▪ Areas of significance (*i.e.,* river banks) will be avoided, except during the culvert construction and upgrades to the old aboiteau crossing.	3	1-2	2/1	R	2	No residual effects are expected.
Land Use	Reduction of agricultural land	▪ Any new access roads will be constructed to follow lot lines to the extent possible and to minimize the amount of active agricultural land that will be taken out of production.	3	2	2/1	R	2	The area of agricultural land that will be lost due to access road construction will be a very small proportion of what is available; roads will be a maximum width of 12 m, unless otherwise required for safety on difficult turns.

Table 5-4 Potential Effects of Road Construction/Modification, Parking Lot and Culvert Installation Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Local Community	Hazards and/or inconveniences to traffic	▪ No modifications to existing roads expected. ▪ A Special Move Permit and any associated approvals will be obtained through the Department of Transportation and Infrastructure Renewal for heavy load transport. ▪ Any additional measures required by local government and/or regulatory agencies will be used to mitigate any effects on traffic.	3	1	2/1	R	2	The haul route is along Highway 104 which typically supports large hauls. No significant impact on road use is expected.

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.

The construction of access roads on individual landowner's private property will comprise a relatively small portion of the Project area, and thereby should not jeopardize species habitat. The Proponent will take advantage of exiting access roads and upgrade those as necessary. Sensory disturbance and habitat loss/alteration for birds and other wildlife will be temporary in nature and not significant. The area's birds and wildlife already experience a certain level of sensory disturbance due to ongoing agricultural activities and associated human activities. Upon completion of construction, and after consulting with the appropriate landowners, the Proponent intends to reclaim property access roads, if the landowner is in agreement, thereby limiting any long-term impacts. Overall it is anticipated that with implementation of the above-stated mitigation measures, the environmental impact associated with access road construction and modification activities will be **minimal** and **not significant**.

5.1.4 Delivery of Equipment

Currently, traffic patterns in and around the Project area, are largely related to agricultural operations. With the exception of its boundary roads, the Project area receives very little traffic other than movements of local residents and occasional visits by tourists and other outdoor enthusiasts. The site

is immediately adjacent to Highway 104 and trucking the equipment to the site should be accommodated relatively easily.

The trucks used for the heavy loads have multiple axles, with the potential to add more, and have steering capability at the back end, allowing them to turn corners much tighter than trucks without such rear steering capability. A large mobile crane will also be required, approximately the size of a standard semi-trailer. Acciona does not anticipate the requirement for upgrades or modifications to existing roads for the purposes of transporting facility components to the site, with the exception of the main access road to the site, near the Wandlyn Inn. The proponent may request the Nova Scotia Department of Transportation and Infrastructure Renewal to conduct road grading and widening of this road.

The turbine nacelles (which house the gearbox and the generator) and hubs will likely follow one of the following routes:

Option A - From Bilbao, Spain: the parts will be delivered via ship to port in St. John, NB and then trucked to Amherst, NS; or

Option B – From West Branch, Iowa, USA: the parts will be delivered via St. Lawrence Seaway to port in St. John, NB and then trucked to Amherst, NS.

It is planned that the parts will then be trucked along Provincial Route 1E and TransCanada Highway E to Amherst, NS (approximately 217 km).

The turbine blades will likely be trucked from Gaspe, Quebec along Provincial secondary Route 132, Provincial Route 11, and TransCanada Highway 104 E to Amherst, NS.

It is anticipated that the turbine towers will likely be trucked from Ft. Erie, Ontario to Amherst, NS, via one of the following routes:

Option A – Truck within Canada (approximately 1,749 km)

1. QEW
2. 427 N
3. 401 E / AutoRoute 20 E
4. Provincial Secondary Route 185 S / TransCanada Highway 104 E

Option B – Truck in both Canada and United States (approximately 1,661 km)

1. QEW through Peace Bridge to United States
2. I-90 E
3. I-495 N / I-95 N
4. I-295 N / I-95 N / I-95 E (Cross into Canada)
5. TransCanada Highway 104 E

Approvals for transporting these materials will be sought from the provincial transportation departments. As the turbine components are oversized, a Special Move Permit and any associated approvals will be obtained through the Department of Transportation and Infrastructure Renewal for heavy load transport.

The tower sections, the nacelles, and rotor parts will be moved to each turbine site within the Project area by flatbed truck and placed into an exact position for picking using cranes. One flatbed truck will be used for each of the four tower sections. In addition, a flatbed truck will be used for the nacelle, and one flatbed truck will be required to transport each of the three rotor blades. An additional three truckloads will be required for the rotor hub, small parts and the erection equipment for each turbine. This site preparation will require approximately ten people for five days for each turbine. All the equipment at the site will be cleaned using a pressure washer and biodegradable truck wash.

There is the possibility for impacts to local sound levels and traffic due to the transportation of materials. In addition, the potential increase in sound levels may cause sensory disturbance to birds and other wildlife. Table 5-5 summarizes the potential environmental effects of activities associated with the delivery of equipment to the site.

Table 5-5 Potential Effects of Delivery of Equipment

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	▪ Delivery vehicles will remain on designated roads.	3	1	1/1	R	2	Sensory disturbance may cause habitat avoidance but it likely will be temporary in nature, small in magnitude and restricted to the Project footprint. The area to be subject to this disturbance is cultivated land that has minimal ecological value, and disturbance will be reversible.
Noise	Increase in sound levels	▪ Equipment will be delivered between 7:00 a.m. and 10:00 p.m., avoiding Sundays and holidays unless absolutely necessary.	3	2	1/1	R	2	Increased sound levels caused by delivery of equipment 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 acceptable and the level of impact will be minimal.

Table 5-5 Potential Effects of Delivery of Equipment

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Local Community	Hazards and/or inconveniences to traffic	▪ No modifications to existing roads expected. ▪ A Special Move Permit and any associated approvals will be obtained through the Department of Transportation and Infrastructure Renewal for heavy load transport.	2	1	1/1	R	2	The haul route is along Highway 104 which typically supports large hauls. No significant impact on road use is expected.
		▪ Any additional measures required by local government and/or regulatory agencies will be used to mitigate any effects on traffic.						

Note 1 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.

It is anticipated that with implementation of the above-mentioned mitigation measures, the residual effects of the delivery of equipment will be **minimal** and **not significant**. The site is conveniently located immediately adjacent to Highway 104, which can easily accommodate oversized loads.

5.1.5 Temporary Storage Facilities

To create a safe and level work area for storing and assembling the wind turbine generators and towers, an area of approximately 100 m x 250 m may require the sod to be harvested and the surface levelled, depending on the local conditions. Sod harvesting will take place at the discretion of the landowner. Each of the turbines and generators will be trucked on a flat-deck trailer to the site and assembled within an area of approximately 60 m x 50 m.

Temporary storage facilities/equipment lay-down will comprise a small portion of the Project area, and should not jeopardize species habitat. Sensory disturbance and habitat loss/alteration for birds and other wildlife will be temporary in nature and not significant. The area's birds and wildlife already experience a certain level of sensory disturbance due to ongoing agricultural activities and associated

human activities. Upon completion of construction, the temporary storage facilities will be removed and the ground will be remediated to its previous agricultural use. The environmental effects of temporary storage facilities are principally due to land clearing and delivery of equipment, and are discussed in Sections 5.1.2 and 5.1.4. Overall it is anticipated that with the implementation of the above-stated mitigation measures, the environmental impact associated with the temporary storage facilities will be **minimal** and **not significant**.

5.1.6 Foundation Construction

The turbine foundations will be determined by the final geotechnical report and structural engineering at each turbine site, as is necessary to properly support the loads. Based on preliminary geotechnical investigations at the site, the foundations will likely be a combination of gravity base spread footing foundations, steel pipe or H-piles (this remains to be determined) driven to suitable bearing strata, and/or expanded base concrete piles. The closest home/well is approximately 0.7 km northwest, along the south western end of Fort Lawrence Road; this well is approximately 10 m topographically above the site. Static water levels in wells within 1.5 km of the site were previously identified (Table 4-1) as approximately 8.5 m below grade. Additionally, the North Tyndall Well Field is approximately 15 km northeast of the Project at an elevation approximately 20 m above the site. The foundation footprint would be approximately 15 m in diameter and 2 to 3 m deep. Site geotechnical work to-date indicates that bedrock is much deeper (*i.e.,* 10 mbg) and foundation activities are expected to have no impact on local water supply wells within 1.5 km of the site and within the North Tyndall Well Field.

Some of the excavated soil material will be stockpiled near the excavation for backfill and restoration purposes. Farmer(s) will be notified of the layout and potential crop losses prior to construction and the surplus material will be turned over to the farmer for his sod farming operation. Arrangements will be made for the future use of some of this material for site restoration during decommissioning. The substation area will consist of a raised pad approximately 6000 m^2 as described above, some excavation will be necessary.

After excavation and piling installation, foundation forms and rebar will be installed. Approximately 235 m^3 of concrete will be poured into the pile cap forms continuously. Forms will be removed after the concrete is cured and the excavated area is back-filled and compacted such that only the tower base portion of the foundation is above ground.

Foundations of turbines and substations will leave a small footprint on the landscape that will last the extent of the Project's life. Excavation of soils and installation of the engineered foundations have the potential to interact with several environmental components. Environmental components that potentially could be impacted as a result of foundation construction include birds and other wildlife, soils, water quality/aquatic environment, land use, noise and archaeological/cultural resources. Table 5-6 summarizes the potential environmental effects of activities associated with foundation construction.

Table 5-6 Potential Effects of Foundation Construction

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. The area to be disturbed is primarily cultivated land that has minimal ecological value, and disturbance will be reversible.
	Habitat Loss	▪ The footprint for excavation will be restricted to the minimum required for the safe and proper installation of the turbine/substation foundation.	2	1	1/2	R	2	The area of habitat that will be lost due to foundation construction will be a very small proportion of what is available and principally on cultivated land. Therefore the impact will be minimal.
	Mortality	▪ Construction activities will be performed, to the extent possible in compliance with the *Migratory Birds Convention Act*.	2	1	1/2	I	2	It is predicted that there will be no residual effect on bird mortality.
Soils	Soil Disturbance and Erosion	▪ 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.	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	▪ All activities, including equipment maintenance and refueling, will be controlled to prevent entry of petroleum products or other deleterious substances, including any debris, waste, rubble or concrete material, into a watercourse.	2	1	1/1	R	2	No residual effects are predicted.

Table 5-6 Potential Effects of Foundation Construction

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		▪ 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.						
	Sediment Loading	▪ Land clearing and construction will not take place in the immediate vicinity of a watercourse, with the exception of the culvert construction and upgrades to the old aboiteau crossing. ▪ 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	Reduction of agricultural land	▪ Turbines and substations, with their relatively small footprint on the land, have been sited with consideration for the potential impact to existing agricultural operations. Area surrounding these foundations will be remediated at the end of the construction phase, allowing for existing	2	2	1/2	R	2	The area of agricultural land that will be lost due to foundation construction will be a very small proportion of what is available and will be situated to minimize disturbance to existing agricultural operations. Due to the limited footprint, its reversibility after decommissioning and small proportion of

Table 5-6 Potential Effects of Foundation Construction

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		agricultural activities to persist immediately adjacent to the structures during the operation of the Project.						agricultural land to be directly impacted by foundation construction, the residual effect is expected to be minimal.
Noise	Increases to sound levels due to operation of 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 only be operated between 7:00 a.m. and 10:00 p.m., avoiding Sundays and holidays unless absolutely necessary. ▪ 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 acceptable and the level of impact will be minimal.
Archaeological and Cultural Resources	Disturbance	▪ Areas of significance (*i.e.,* river banks) will be avoided, with the exception of culvert construction and upgrades to the old aboiteau crossing.	3	1-2	2/1	R	2	No residual effects are predicted.

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.

The foundations will comprise a relatively small portion of the Project area land, and thereby their presence, while permanent, should not jeopardize species habitat. Sensory disturbance for birds and other wildlife will be temporary in nature. The area's birds and wildlife already experience a certain level of sensory disturbance due to ongoing agricultural activities and associated human activities. Upon completion of construction, the ground surrounding the foundations will be restored to its agricultural use, allowing for existing agricultural activities immediately adjacent to the foundations. Overall, it is anticipated that with the implementation of the above-stated mitigation measures, the residual effects associated with foundation construction will be **minimal** and **not significant**.

5.1.7 Tower and Turbine Assembly and Installation

The tower comes in three or four sections that will be assembled on site. The rotor blade system, consisting of three blades and a hub, will also be assembled on site, attached to the generator and lifted into place at the top of the tower by a large hydraulic crane. This will require approximately ten people for three days per turbine. An additional 1-2 days will be required to install the remainder of the turbine assembly. Control and switching equipment will be placed on each turbine pad by a crane. A large crawler crane with a hydraulic crane will be used to install each tower section. Each tower section will be lifted and secured with bolts to the section below, followed by the nacelle secured to the top tower section. Finally, the assembled rotor will be lifted and attached to the nacelle.

This phase of construction could potentially have impacts on birds and other wildlife, soils and vegetation, and sound levels. Table 5-7 summarizes the potential environmental effects of activities associated with tower and turbine assembly and installation.

Table 5-7 Potential Effects of Tower and Turbine Assembly and Installation

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	2/1	R	2	Sensory disturbance likely will be temporary in nature, small in magnitude and restricted to the Project area. The residual effect is considered minimal.
Soils	Soil Compaction and Contamination	▪ Trucks and equipment will remain in designated workspaces. ▪ Whenever possible, delivery will be timed for periods when the ground surface is best able to support construction equipment (winter or dry season).	3	1	2/1	R	2	No residual effects are expected.

Table 5-7 Potential Effects of Tower and Turbine Assembly and Installation

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		▪ Compacted soil will be reclaimed as required.						
Noise	Increases to sound levels due to the transportation and operation of equipment	▪ Heavy equipment will only be operated between 7:00 a.m. and 10:00 p.m., avoiding Sundays and holidays unless absolutely necessary. ▪ 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. ▪ Adhering to the recommended setback between the Project site and receptors (*i.e.,* at least 500 m from houses). ▪ Attending to routine maintenance of the wind turbines and associated equipment, as recommended by the manufacturer.	3	2	2/1	R	2	Increased sound levels caused by equipment assembly and installation 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 acceptable 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.

Sensory disturbance for birds and other wildlife will be temporary in nature, and not significant. The area's birds and wildlife already experience a certain level of sensory disturbance due to ongoing agricultural activities and associated human activities. Compacted or contaminated soil will be remediated and reclaimed as appropriate, and measures will be in place to decrease the likelihood of this occurring. Overall it is anticipated that with the implementation of the above-stated mitigation

measures, the residual effects associated with the tower and turbine assembly and installation will be **minimal** and **not significant**.

5.1.8 Interconnection from Turbine to Substation

Underground 12 kV electrical cables will be installed running from each turbine to the on-site substation, largely following existing linear disturbances. A combination of ploughing and/or trenching will be used, depending on terrain. Typically, trenching is only done over short distances and where maneuverability of the ploughing equipment is difficult.

A cat-mounted plough mechanism, which essentially cuts a narrow furrow behind the cat, may be used to install the underground collection cables. A plough seam will be cut per the applicable standards and regulations. The distribution lines will be lowered-in and the plough seam will be backfilled immediately to prevent soil loss and erosion. It is anticipated that this may be the predominant method used, due to the favourable characteristics of the soft marsh soils to this type of installation methodology. This type of operation minimizes disturbance, due to the one-pass operation and absence of open trenches.

Where trenching is appropriate, it will be performed using backhoes or excavators with narrow buckets. Basically an open trench is excavated, the cables laid, and the trench backfilled. The fine-grained marsh soils will be very suitable for this.

Where the underground cable must be spliced (*e.g.,* at the end of a reel or to pass underneath another utility cable) a splice pit will be required. At these locations, the soil will be excavated and placed in a pile immediately adjacent to the excavation. After the procedure is complete, the soil is placed back in the trench and the surface is smoothed.

Interconnection from turbine to substation is anticipated to be within the upper 3 m of the ground surface. Preliminary site geotechnical work to-date indicates that bedrock is much deeper (*i.e.,* 10 mbg). These activities are expected to have no impact on local water supply wells within 1.5 km of the site and will have no impact on wells within the North Tyndall Well Field.

It will be necessary to cross the LaPlanche River with electrical cables. The cables will run across the land bridge to minimize the potential for impact to the watercourse.

Potentially affected environmental components include birds and other wildlife, vegetation and soils, water quality/aquatic environment, noise, land use and archaeological/cultural resources. Table 5-8 summarizes the potential environmental effects of activities associated with interconnection of the turbine and substation.

Table 5-8 Potential Effects of the Interconnection from Turbines to Substation

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 be performed in compliance with the *Migratory Birds Convention Act*.	3	1	2/1	R	2	Sensory disturbance likely will be temporary in nature, small in magnitude and restricted to the Project area. The residual effect is considered minimal.
Soils	Compaction and contamination – via heavy equipment used for trenching	▪ Whenever possible, trenching activities will be timed for periods when the ground surface is best able to support construction equipment (winter or dry season). ▪ Topsoil will be stored on-site for future use in restoring the land to its original condition. ▪ Standard erosion and sediment control measures will be implemented as required.	3	1	2/1	R	2	No residual effects are expected.
Water Quality/ Aquatic Environment	Contamination of surface water	▪ All activities, including equipment maintenance and refuelling, will be controlled to prevent entry of petroleum products or other deleterious substances, including any debris, waste, rubble or concrete material, into a watercourse.	2	1	2/1	R	2	No residual effects are expected.
	Sediment Loading	▪ Land clearing and construction will not take place within the immediate vicinity of a watercourse, with the exception of the culvert construction and upgrades to the old aboiteau crossing. ▪ 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.	2	1	2/1	R	2	No residual effects are expected.

Table 5-8 Potential Effects of the Interconnection from Turbines to Substation

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		▪ 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.						
Noise	Increases to sound levels due to the transportation and operation of equipment	▪ Heavy equipment will only be operated between 7:00 a.m. and 10:00 p.m., avoiding Sundays and holidays unless absolutely necessary. ▪ 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	2/1	R	2	Increased sound levels caused by trenching and ploughing 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 acceptable and the level of impact will be minimal.
Land Use	Reduction of agricultural land	▪ Underground electrical cables have been sited with consideration for the potential impact to existing agricultural operations. Following installation of the electrical cables, the soils will be replaced to pre-construction conditions, allowing for agricultural operations to continue through the area. ▪ If underground drainage tiles are damaged, they will be repaired to facilitate drainage to pre-construction levels.	3	1	2/1	R	2	Provided these mitigation measures, and considering the temporary and reversible nature of this effect over a small spatial scale, no residual effects are expected.
Archaeological and Cultural Resources	Disturbance	▪ Areas of significance (*i.e.,* river banks) will be avoided.	3	1-2	2/1	R	2	No residual effects are expected.

Table 5-8 Potential Effects of the Interconnection from Turbines to Substation

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	

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.

Overall it is anticipated that, with the implementation of the above-mentioned mitigation measures, the residual effects of the trenching and ploughing will be **minimal** and **not significant**.

5.1.9 Substation and Maintenance Building Construction

The substation will contain transformers to convert the voltage from 12 kV to 138 kV, which is required for connection to the existing overhead lines. The size of the excavation for the substation yard in the Project area will be approximately 150 m by 50 m. Topsoil excavated from the substation site will be re-distributed to adjacent lands. Substation equipment will be installed within the 6000 m^2 fenced yard that will be surfaced with gravel. Since this will be a high voltage area, similar to all transformer substations, it will be surrounded by a high locked fence to prevent accidental access to the high voltage equipment.

There will be a maintenance building constructed near turbines 19 and 20 in the northwest corner of the site. It is estimated that the maintenance building would be approximately 2100 m^2.

The effects associated with substation and maintenance building construction are principally due to the construction of the foundation, as discussed in Section 5.1.6. Potentially affected environmental components as a result of the construction of the substation for this Project include birds and other wildlife, soils, water quality/aquatic environment, noise, land use and archaeological/cultural resources. Proposed mitigation measures and discussion regarding residual effects of substation construction are discussed in Section 5.1.6.

The substation and maintenance building will have a footprint that is relatively small compared to the Project area. Given appropriate mitigation measures, the small spatial scale and footprint of the substation, and the temporary nature and reversible nature of many of the interactions with the environment, the residual effects associated with substation construction will be **minimal** and **not significant**.

5.1.10 Fencing/Gates

Fencing will be installed around the substation and maintenance area which is discussed in Section 5.1.9 above.

5.2 Operational Activities – Environmental Effects

The environmental components that may be adversely affected by the operation of the Amherst Wind Energy Project include land use, local community, recreation, visual aesthetics, ambient sound levels, birds and other wildlife and health and safety. In addition, its operation may raise certain health and safety issues, both for Project personnel and landowners. Table 5-9 provides a general overview of these components and associated impacts. The remainder of Section 5.2 describes these interactions and potential effects in greater detail.

Table 5-9 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Land Use	Disruption to agricultural lands or infrastructure	▪ The Project has been designed to minimize impacts to the local land use (agricultural activities). No mitigation, therefore, is required as no significant impacts are predicted.	2	2	5/1	R	2	The effect of wind turbines on prime agricultural lands is negligible with only a small portion of the available land required for wind turbines, ancillary equipment and access roads. Farming will be allowed to continue up to the base of towers and related buildings, leaving the vast majority of the land available for agricultural purposes while providing landowners with an additional source of income. The primary land use in the area can continue around Project facilities.
Local Community	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.	4	1	5/6	R	2	A positive residual effect would be realised by the operation of the Project, through increases in employment opportunities, increases in private spending due to an influx of Project personnel, and an increase in the municipal tax base.

Table 5-9 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
	Effect on Property Values	▪ None required	4	1	5/6	R	2	Existing information indicates that property values are not adversely affected by the construction and operation of wind farms.
Recreation and Tourism	Effect to tourism and recreation	▪ None required.	4	2	5/6	R	2	The Project is sited along Highway 104, the primary route between Nova Scotia and New Brunswick. It is expected that tourism to the area would increase as a result of the Project, as judged by the numbers of tourists that regularly visit existing wind power Projects in Atlantic Canada.
Visual	Change to Visual Landscape	▪ Turbines will be all of the same type and model, and will 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.	4	2	5/6	R	2	Given the viewing distances and sparse population, the visual impact will not be significant. Many landowners within the Project area will have views of the wind turbines from the residences, but many views will be obstructed by existing human structures, existing vegetation and distance. There will be a residual effect, but the support for wind power in the local community indicates that the impact should be judged as low.
	Lighting	▪ Lighting will be the minimum allowed by Transport Canada to ensure the appropriate level of aeronautical safety.	4	2	5/6	R	2	Given the viewing distance of approximately greater than 500 m, the presence of these lights will not place excessive nighttime visual pollution in the Project area.
	Shadow Flicker	▪ None required.	3	2	5/1	R	2	Modeling of shadow flicker indicates there are minimal potential visual impacts at the locations throughout the Project area caused by shadow flicker due to the limited duration and distance of visibility under "ideal" viewing conditions as well as the presence of existing

Table 5-9 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
								vegetation which would effectively mitigate potential negative impacts. 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.
Noise	Increases to Sound Levels	▪ None required.	3	2	5/6	R	2	Modelling of predicted sound levels caused by the operation wind turbines indicated that all the receptors within the Project area are expected to receive sound exposures from the proposed wind farm within acceptable sound limits. As a result, any increase in sound levels due to the operation of the Project will be acceptable and not significant.
Birds	Sensory Disturbance	▪ None required.	3	2	5/6	R	2	It is anticipated that sensory disturbance during Project operations may cause birds to change their flight patterns in order to avoid the towers and rotating blades. This will serve to reduce the number of bird collisions.
	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. Turbines were sited away from the banks of the river, no	3	2	5/6	I	2	Given existing information from operating wind energy facilities elsewhere in North America, it is anticipated that fatalities due to avian collision with wind turbines will not cause significant bird fatalities, either of sensitive

Table 5-9 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		closer than 37 m, which is the blade length, to reduce the likelihood birds flying in close proximity to turbines. This separation distance was determined through observations and discussions with CWS. The turbines to be used extend no higher than 120 m above the ground thus avoiding the flight height of nocturnally migrating land birds. 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. Electrical cables will be buried underground within the wind farm, to reduce perching opportunities for birds and to reduce the likelihood of collision with the wires. Where aboveground electrical lines are necessary, they will be to the minimum extent required. Post-construction monitoring will direct the need and form of further post-construction mitigation measures.						species or large numbers of birds. The Project area does not contain any landform features or other human-made features that would concentrate birds. Post-construction monitoring will be implemented to confirm that the effect of the Project on bird populations is not significant.

Table 5-9 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Other Wildlife	Sensory Disturbance	▪ None required.	3	2	5/1	R	2	Studies of game animals in western North America (*e.g.,* Anderson *et al.* 1999) have shown that species are either unaffected by wind energy facilities, given their small footprint and the preservation of existing land use, or that they can readily adapt to the presence of wind turbines. At this site, habitat avoidance will most likely occur during periods of construction, and may be more intermittent during periods of operation, when on-site human activities are less frequent and would occur on a short-term basis. The Project site is presently an active sod farm and as such a certain amount of sensory disturbance is already present.
	Mortality							
	Electromagnetic Fields (EMFs)	▪ Post-construction monitoring (*e.g.*, bat monitoring) will direct the need and form of further post-construction mitigation measures.	3	2	5/1	I	2	Based on existing information from monitoring programs elsewhere in North America, it is anticipated that the impact of wind farm operations on bat mortality will not be significant. However, post-construction monitoring will be implemented to confirm this expectation. The risk of bat collisions is greater for migrating bats than for resident breeding, commuting or foraging bats. Therefore, post-construction monitoring will be conducted in the fall in order to correspond to migration activities by migratory species and the movement of resident species to hibernacula.

Table 5-9 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Health & Safety	Infrasound Energy	▪ None required.	2	1	5/1	R	2	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. Overall the EMF is not anticipated to have any negative results on human health and safety.
	Ice Throw	▪ None required.	3	1	5/1	R	2	There is no evidence that the wind turbine technology proposed for this Project presents any potential problems related to the generation of infrasound energy.
		▪ 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. ▪ During operation, access to the wind turbine sites will be restricted to authorized personnel only.	3	1	5/1	R	2	Due to the setback distance to the nearest residence, a minimum of 500 m, it is extremely unlikely that ice throw would present a risk to landowners. The landowner of the site would be farming the land only during the growing season when icing of blades would not be an issue. Furthermore, there are only a few days a year where ice could potentially form on turbines based on the right combination of air temperature, wind speed and moisture in the air. For maintenance personnel, the potential of ice throw presents a greater risk to health and safety. With the implementation of the mitigation measures

Table 5-9 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
								proposed herein, the risk of injury and property damage will be reduced.

1 Note Geographic Extent

Magnitude 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

Duration 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.

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

Reversibility 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.

Ecological Context R = reversible, I = irreversible.

5.2.1 Wind Turbine Operation

The following sections discuss the potential effects of the operation of the Project on the natural and socioeconomic environment.

5.2.1.1 Land Use

As indicated in Section 4.5.4 of this report, the majority of the land required for Project development is in sod production. The effect of wind turbines on prime agricultural lands within the Project area is negligible with only a minor portion of land use required to house turbines and their ancillary equipment. Farming will continue up to the base of towers and related buildings, leaving the vast majority of the land available for agricultural purposes while providing landowners with an additional source of income. The primary land use in the area can continue around Project facilities and distribution feeder lines. Land use impacts associated with construction and operation of the Project will be negligible since it will not impair or impact current land uses, change land use patterns, or be incompatible with existing uses. Any required permits (*e.g.,* for watercourse crossing) will be obtained. A zoning by-law amendment was made to re-zone the Project area from Rural Resource Zone to Utility Zone to allow for the operation of the wind turbines on what is presently identified as agricultural land. This zoning permit also serves as the building permit. Since that time, the land use by-law has been revised. The updated Strategy By-Law provides that wind farms may be constructed in rural areas as of right, subject to certain requirements including that turbines be set back 500 m from buildings. Given these steps to mitigate impact to existing land use, the residual impact is considered to be **minimal** and **not significant**.

5.2.1.2 Property Values

Prior to 2003, there was a general lack of empirical data assessing the impact of wind energy facilities on the economic value of properties whether within a wind farm or within site of a wind farm. However, Sterzinger *et al*. (2003) undertook such a study, statistically testing whether the perception that property values are negatively affected by wind farms is true or false. For their study, Sterzinger *et al.* (2003) compiled data on every U.S. wind energy development commissioned between 1998 and 2001 that was of a capacity of 10 MW or greater. Property sales records for the area within 5 miles (8 km) of the wind farm were collected for the three years prior to commissioning and the three years following commissioning, to determine if there was a difference between pre-construction and post-construction property sales. For comparison, sales records were also collected for the same time period from communities comparable to that included for each wind farm. A total of 10 wind power projects were analysed, including two projects from New York, two projects in Pennsylvania and one project in Vermont (Sterzinger *et al*. 2003).

Overall, property values increased with the same rate in wind farm communities within 8 km of a wind farm compared to similar communities without wind farms (Sterzinger *et al.* 2003). Nine of the ten projects showed a greater increase in property values after commissioning compared to the period prior to commissioning, and when looking at the rate of increase in property values after commissioning of the wind farm, communities near a wind farm actually had greater increases to property values than those without a nearby wind farm (Sterzinger *et al.* 2003). These findings indicate that there is no support for the notion that the development of wind farms decreases property values.

Further assessment of the potential impact of wind farms on property values was conducted by ECONorthwest (2002). For this assessment, interviews were conducted with tax assessors from 13 counties in the United States for which wind farms had been developed during the previous 10 years. Based on these interviews with unbiased and trained assessors of property values, ECONorthwest (2002) concluded that there is no loss of value for those residential properties with views of wind turbines (*i.e.,* views of wind turbines do not negatively impact property values).

A report conducted by the Renewable Energy Policy Project (REPP 2003) concluded that, based on a study of nine different communities from across the United States, property values of homes within a wind farm's viewshed were not harmed by the construction and operation of the wind energy facility. To the contrary, for the majority of the projects analyzed, property values actually rose more quickly in the viewsheds than in comparable communities outside of the viewsheds (REPP 2003). Furthermore, statistical evidence does not support the idea that property values within the viewshed of wind farms suffer or perform poorer than in comparable regions (REPP 2003). This statistical analysis is supported by a literature review conducted as part of the REPP (2003) study.

The proposed Amherst Wind Energy Project is located in a rural setting, and is surrounded by a mix of farmland and few residential properties. The setback required for the turbines and the limited number of surrounding residential properties, together with the experience at other sites, all suggest that the impacts on property values as a result of the wind farm are likely to be negligible.

The Project has the potential to represent a long-term land use, which may conversely have the effect of promoting some stability in land values. It is conceivable that the value of specific properties could even rise as a result of an increase in the potential for tourist related commercial activities in this area.

5.2.1.3 Visual Impacts

Due to the importance of assessing the potential impact to the area's visual aesthetics, a visual impact assessment was completed. The approach to conducting the assessment involved the mapping of the landscape of the Project area, then assessing these specific components of the landscape with respect to the proposed wind farm, as viewed from selected points of view outside the immediate Project area boundary.

The following section summarizes the visual assessment with respect to the three photographic viewshed locations as identified on Figures 5-1, 5-2, 5-3, and 5-4.

Viewsheds

The turbines are designed to rotate and be oriented in rows facing the prevailing wind direction at any given time. The towers themselves will be light grey and made out of rolled steel. The housing at the top of the tower, which contains the generator, is fiberglass and will also be light grey. The base of the tower is approximately 7 m across, while the height of the turbine towers will be approximately 80 m, with rotor blades that are approximately 37 m long.

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 Project area will be greater than 500 m from the nearest wind turbine. Given the viewing distance of greater than 500 m combined with the presence of hedgerows along the road, the presence of these lit towers will not place excessive nighttime visual pollution in the Project area.

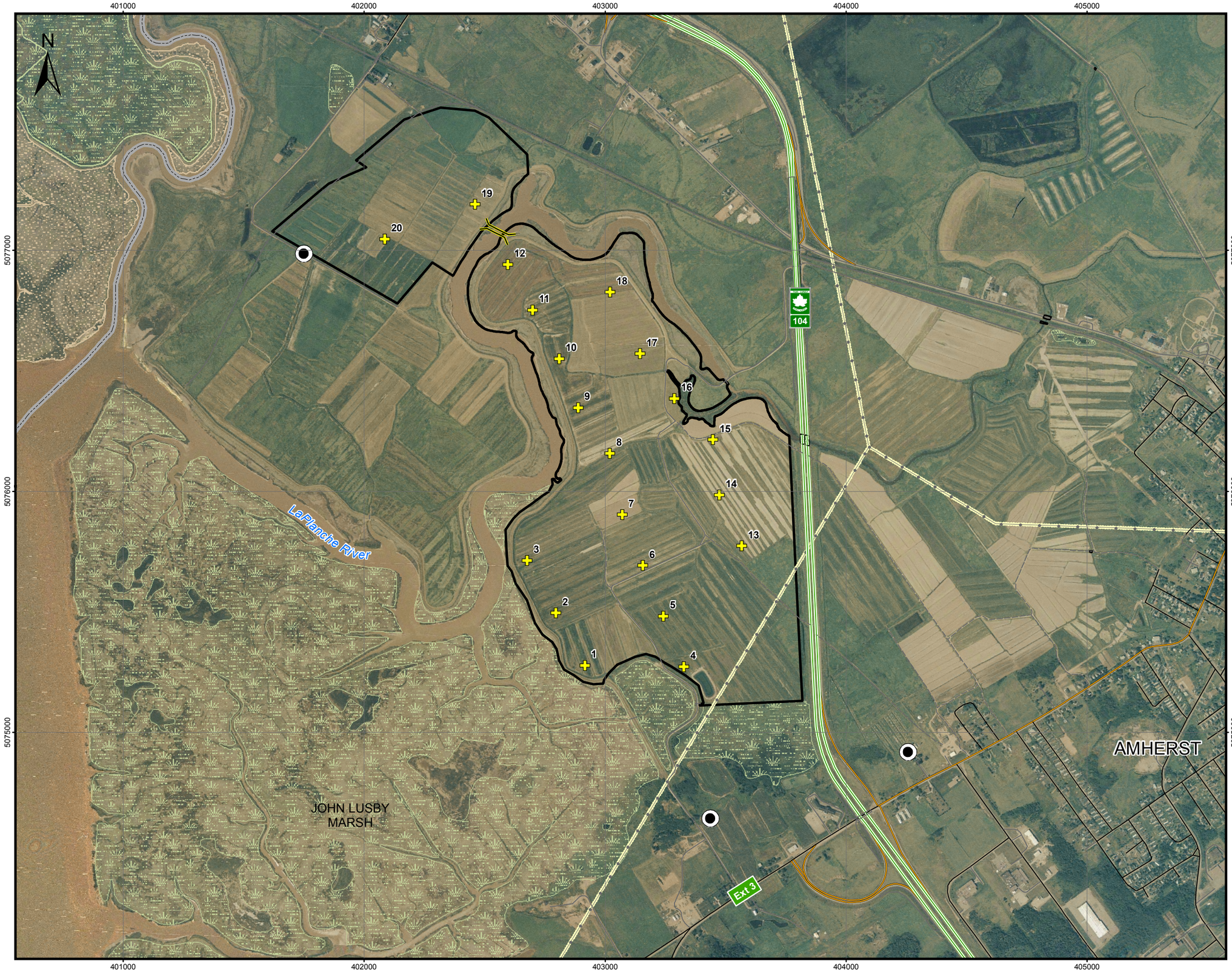

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Figure 5-1

Viewpoint Locations

Amherst Wind Energy Project

Map Features

- Viewpoint Locations
- Proposed Turbines
- Highway
- Major Road
- Secondary Road
- Tertiary Road
- Bridge
- Railway
- Trail/Track
- Proposed Culvert
- Utility Line
- Provincial Border
- Project Area (250.5 ha)
- Mud Flat
- Wetland

Spatial Data Source: Service Nova Scotia

0 200 400 800

Metres

Map Parameters
Projection: UTM, NAD83, Zone 20
Scale 1:15,000
Date: January 2008
Project No.: 1005774.

Jacques Whitford

Map Parameters
Projection: UTM, NAD83, Zone 20
Scale NTS
Date: January 16, 2008
Project No.: 1005774.

Figure 5-2

View from the Northwest End of Site

Amherst Wind Energy Project

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Map Parameters
Projection: UTM, NAD83, Zone 20
Scale NTS
Date: January 16, 2008
Project No.: 1005774.

Figure 5-3

View from the South End of Site

Amherst Wind Energy Project

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Jacques Whitford

Map Parameters
Projection: UTM, NAD83, Zone 20
Scale NTS
Date: January 16, 2008
Project No.: 1005774.

Figure 5-4

View from the Southeast End of Site

Amherst Wind Energy Project

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