NextEra Energy Canada, ULC

DRAFT Project Description Report – Goshen Wind Energy Centre

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Project Number:

60155032

Date:

September, 2012

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Glossary of Terms

ABCA ..... Ausable Bayfield Conservation Authority
ANSI ..... Area of Natural and Scientific Interest
DFO ..... Federal Department of Fisheries and Oceans
GE ..... General Electric
kV ..... Kilovolt
mbgs ..... metres below ground surface
MOE ..... Ontario Ministry of the Environment
MNR ..... Ontario Ministry of Natural Resources
MTCS ..... Ontario Ministry of Tourism, Culture and Sport
MTO ..... Ontario Ministry of Transportation
MW ..... Megawatt
NextEra ..... NextEra Energy Canada, ULC
O.Reg. 359/09 ..... *Ontario Regulation 359/09*
PDR ..... Project Description Report
The Project ..... Goshen Wind Energy Centre
REA ..... Renewable Energy Approval
TC ..... Transport Canada
UTRCA ..... Upper Thames River Conservation Authority

1. General Information

This Project Description Report (PDR) was prepared in accordance with the requirements of the Renewable Energy Approval Process outlined in *Ontario Regulation 359/09* (*O.Reg. 359/09*) and the Technical Guide to Renewable Energy Approvals (Ministry of the Environment (MOE), 2011).

1.1 Name of Project and Applicant

Goshen Wind, Inc., a wholly owned subsidiary of NextEra Energy Canada, ULC (NextEra), is proposing to construct a wind energy project in Bluewater and South Huron, Huron County, Ontario. The Project will be referred to as the Goshen Wind Energy Centre (the "Project") and will be located on private lands in the vicinity of the shoreline of Lake Huron (see **Figure 1-1**).

The Project will be owned and operated by Goshen Wind, Inc., a subsidiary of NextEra. NextEra's parent company is NextEra Energy Resources, LLC, a global leader in wind energy generation with a current operating portfolio of over 85 wind energy projects in North America. In Canada, wind energy centres currently owned and operated by NextEra Energy Canada include: Mount Copper and Mount Miller, (both 54 megawatts (MW)) located in Murdochville, Quebec; Pubnico Point, (31 MW) located near Yarmouth, Nova Scotia; and Ghost Pine (82 MW), located in Kneehill County, Alberta.

1.2 Project Study Area

The proposed Project is located in Huron County, within the Municipalities of Bluewater and South Huron (refer to **Figure 1-1**). The Project Study Area consists of the areas being studied for the wind farm components (Wind Energy Centre Study Area), as well as for the interconnection route (i.e., the area being studied for transmission lines to connect the Project to the electrical grid) (Transmission Line Study Area). The Wind Energy Centre Study Area is generally bounded by Klondyke Road to the west, Rogerville Road to the north, Parr Line to the east, and Mount Carmel Drive to the south, in the Municipalities of Bluewater and South Huron. The Transmission Line Study Area is located to the east of the Wind Energy Centre Study Area, and is generally bounded by Parr Line to the west, Thames Road to the north, Perth 164 Road to the east, and Park Road to the south, extending into the Municipality of South Huron.

The location of the Project Study Area was defined early in the planning process for the proposed wind energy facility, based on the availability of wind resources, approximate area required for the proposed project, and availability of existing infrastructure for connection to the electrical grid. The Project Study Area was used to facilitate information collection.

The following co-ordinates define the external boundaries of the Project Study Area:

Longitude	Latitude
-81.6753290	43.4155312
-81.3011931	43.3810955
-81.3303330	43.3036317
-81.7743607	43.2379854

1.3 Description of Energy Source, Nameplate Capacity and Class of the Facility

The wind turbine technology proposed for this Project is the GE 1.6-100 Wind Turbine and the GE 1.56-100 Wind Turbine. With a total nameplate capacity of 102 MW, the Project is categorized as a Class 4 facility. The technical specifications for these models of turbines are detailed in Section 2.1.1 of this PDR.

Lake Huron

Bluewater

Huron East

West Perth

Lambton Shores

South Huron

Perth South

North Middlesex

Lucan Biddulph

Middlesex Centre

Bayfield South

Datars-Logan Swamp

Chiselhurst Sinkhole

McGrath Swamp

Staffa Kame Complex

Sink Hole Forest Swamp

Ausable River Sinkhole

St. Joseph Till

Hibbert Swamp

Hay Swamp

Hay Swamp

Datars-Miller Swamp

Dashwood Area

Keller Swamp

Centralia

Lucan Moraine

Khiva Conservation Forest

O'Brien Swamp Complex

MacDonald Marsh Wetland

Biddulph 12

MCGILL 4

North Parkhill

Parkhill Creek Wetland Complex

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Legend

- Wind Energy Centre Study Area
- Transmission Line Study Area
- Municipal Division

Natural Features

- Natural Features (ABCA)
- Provincially Significant Life Science ANSI
- Regionally Significant Life Science ANSI
- Regionally Signficant Candidate Life Science ANSI
- Regionally Signficant Candidate Earth Science ANSI
- Provincially Significant Wetland
- Locally Significant Wetland
- ESA (ABCA)
- Waterbody
- Cartographic Wetland

Basemapping from Ontario Ministry of Natural Resources

Kilometers

0 1.5 3 6

1:125,000

UTM Zone 17 N, NAD 83

Goshen Wind Energy Centre

Project Study Area

August 2012
Project 60155032

AECOM

Figure 1-1

1.4 Key Contacts

Project Proponent	Project Consultant
Derek Dudek Community Relations Consultant NextEra Energy Canada, ULC 5500 North Service Road, Suite 205 Burlington, Ontario L7L 6W6 Phone: 1-877-257-7330 Email: Goshen.Wind@NextEraEnergy.com Website: www.NextEraEnergyCanada.com	Marc Rose Senior Environmental Planner AECOM 300-300 Town Centre Blvd. Markham, Ontario L3R 5Z6 Phone: 905-477-8400 x388 Email: marc.rose@aecom.com

1.5 Other Approvals Required

In addition to the REA, permits and authorizations will be required from approval agencies before construction can begin. These may include: an Oversize/Overweight Permit from the Ontario Ministry of Transportation (MTO); Archaeological Clearance from the Ontario Ministry of Tourism, Culture and Sport (MTCS); Fisheries Act Authorizations from the Federal Department of Fisheries and Oceans (DFO); Aeronautical Obstruction Clearance and Navigable Waters Protection Act Request for Work Approval from Transport Canada; a Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Permit from the Ausable Bayfield Conservation Authority (ABCA) and Upper Thames River Conservation Authority (UTRCA); and lastly, other permits or authorizations from the Ontario Ministry of Natural Resources (MNR) and Huron County.

1.6 Federal Involvement

An environmental assessment under the *Canadian Environmental Assessment Act, 2012,* will not be required, as the project is not listed in the *Regulations Designating Physical Activities*.

1.7 Commitments for Future Studies

NextEra has identified future studies that will need to be carried out before and during the construction, operation, and decommissioning of the Project based on the results of the effects assessment. These studies are listed in **Table 1-1** below.

Table 1-1 Commitments for Future Studies

No.	Timing of Commitment	Location within the Project	REA Commitment	REA Report Reference
1	Pre-Construction	Disturbance Areas	Undertake surveys to locate all project infrastructure.	Construction Plan; Section 2.2.1
2	Pre-Construction	Turbine Foundation	Conduct geotechnical sampling for all turbine foundation locations.	Construction Plan; Section 2.2.1
3	Pre-Construction	Culvert	Determine specific culvert details and erosion control measures in conjunction with the Ausable Bayfield Conservation Authority (ABCA) & Upper Thames River Conservation Authority (UTRCA).	Construction Plan; Section 2.2.2
4	Pre-Construction	Project Study Area	Develop a Traffic Management Plan and provide to Huron County.	Construction Plan; Section 2.2.5/3.6.2
5	Pre-Construction	Project Study Area	Conduct a Stormwater Pollution Prevention Study to address potential effects of stormwater runoff during construction, operations and decommissioning.	Construction Plan; Section 2.2.11 Design & Operations; Section 3.7, 6.3.2 Decommissioning Plan; Section 2.4

Table 1-1 Commitments for Future Studies

No.	Timing of Commitment	Location within the Project	REA Commitment	REA Report Reference
6	Pre-Construction	Disturbance Areas	Complete Stage 3 Archaeological Assessment and potentially Stage 4 Archaeological Assessment to avoid displacement or disturbance of any archaeological resources identified in Stage 2 Archaeological Assessment by the construction of Project infrastructure.	Construction Plan; Section 3.1.2
7	Pre-Construction	Candidate Significant Wildlife Habitats	Complete Evaluation of Significance studies for: • Waterfowl stopover and staging areas (terrestrial); • Reptile hibernacula; • Bat maternity colonies; • Amphibian woodland breeding habitat; • Turtle over-wintering habitat ; and, • Habitats of insect species of conservation concern.	Natural Heritage Assessment; Section 4.3.4
8	Pre-Construction	Disturbance Areas	Develop an erosion and sediment control plan.	Construction Plan; Section 3.2.2
9	Pre-Construction	Disturbance Areas	Develop a Spill Response Plan.	Construction Plan; Section 3.2.2 Design & Operations; Section 6.2.1/6.3.2
10	Construction	Disturbance Areas	Undertake active nest surveys if clearing of vegetation cannot be avoided during breeding season for migratory birds.	Construction Plan; Section 3.2.2
11	Pre-Construction	Disturbance Areas	Prepare a Compensation Plan and provide to the MNR and Conservation Authorities.	Construction Plan; 3.2.2 Design and Operations; 6.2.1
12	Pre- and Post-Construction	Project Study Area	Undertake roads condition survey pre- and post-construction.	Construction Plan; Section 3.6.2 Design and Operation; 6.2.1
13	Post-Construction	Disturbance Areas	Conduct post-construction monitoring to assess potential negative effects to significant wildlife habitats: • Waterfowl stopover and staging areas (terrestrial) • Bat maternity colonies • Amphibian woodland breeding habitat • Reptile hibernacula • Habitat for bird species of conservation concern (Red-headed Woodpecker) (SCB-03)	Design and Operations; Section 6.2.1
14	Post-Construction	Disturbance Areas	Conduct post construction bird and bat mortality monitoring at specific turbine locations.	Design and Operations; Section 6.2.1

2. Project Information

2.1 Facility Components

As shown in **Figure 2-1**, the major components of the Project are proposed to be:

- Up to 71 GE 1.6-100 Wind Turbine generator locations and pad mounted step-up transformers and one GE 1.56-100 Wind Turbine generator location and pad mounted step-up transformer (however, only 63 turbines will be constructed);
- Laydown and storage areas (including temporary staging areas, crane pads and turnaround areas surrounding each wind turbine);
- Temporary electrical service line for the purpose of providing power to the construction trailers located at the laydown area;
- A transformer substation;
- Underground 34.5 kV electrical collection lines to connect the turbines to the transformer substation and other ancillary equipment such as above-ground junction boxes;
- 115 kV transmission line to run from the transformer substation to a breaker switch station which will connect the electricity generated by the project to the existing Hydro One 115 kV transmission line;
- Turbine access roads;
- Three permanent meteorological towers; and
- An operations and maintenance building including an electrical service line connected to the local distribution service.

The Project components, in addition to the Disturbance Area, as shown on **Figure 2-1**, occupy approximately 623 hectares (1,539 acres) of land in the Municipalities of Bluewater and South Huron.

2.1.1 Turbine Specifications

With a total nameplate capacity of 102 MW, the Project is categorized as a Class 4 facility under *O. Reg. 359/09*. Although NextEra is seeking an REA for up to 72 wind turbines, only 63 are proposed to be constructed for the Project.

The wind turbine technology proposed for this Project is the GE 1.6-100 Wind Turbine and GE 1.56-100 Wind Turbine (one turbine only). The turbines are 3-bladed, upwind, horizontal-axis wind turbines that are state of the art technology. The turbines have a 100 m rotor diameter with a swept area of 7,854 m; each blade is connected to the main shaft via the hub. The turbine is mounted on an 80 m tubular steel tower which contains an internal ladder provided for maintenance access. The turbine will be constructed on a foundation that is approximately 400 m^2. The foundation consists of poured concrete and steel rebar to provide added strength.

The nacelle houses the main components of the wind turbine such as the rotor shaft, gear box, couplings, control panel, bearing brackets and the generator. The nacelle is equipped with sound-proofing, is ventilated and the interior is illuminated with electric lights. Some of the wind turbines will have external lighting in accordance with the requirements of Transport Canada (TC).

Table 2-1 below provides a summary of the turbine specifications. Please refer to the Wind Turbine Specifications Report (AECOM, 2012) for more detailed information on the wind turbines proposed for the Project.


Legend
Wind Energy Centre Study Area
Goshen Transmission Line Study Area
120 m Area of Investigation
Municipal Division
Roads
Freeway
Expressway / Highway
Major Road
Local Road
Natural Features
Watercourse (ABCA, UTRCA)
Watercourse (MNR)
Waterbody
Cartographic Wetland
Contour (5 m)
Woodlot
Project Location
GE Turbine
Permanent Meterological Tower
Access Road
Collection Line
Transmission Line
Disturbance Area
Breaker Switch Station
Transformer Substation
Temporary Laydown Area
Lake Huron
Basemapping from Ontario Ministry of Natural Resources
Metres
0 500 1,000 1,500 2,000
1:50,000
UTM Zone 17N, NAD 83
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Goshen Wind Energy Centre
Project Location
August 2012
Project 60155032
AECOM
Figure 2-1

Table 2-1 Summary of Technical Specifications

Specification	GE 1.6-100 Wind Turbine	GE 1.56 Wind Turbine
Make	General Electric	General Electric
Model	1.6-100	1.56-100
Name Plate Capacity	1.62 MW	1.56 MW
Hub Height	80 m	80 m
Rotor Diameter	100 m	100 m
Minimum Rotational Speed	9.75 rpm	9.75 rpm
Maximum Rotational Speed	15.33 rpm	16.2 rpm

2.1.2 Laydown and Storage Areas

A temporary laydown and storage area will be constructed on privately owned land for the purpose of staging and storing equipment during the construction phase. Activities on this site will include materials storage, equipment refuelling, and construction offices. The area will be approximately 4 hectares (10 acres) in area. In addition, a 122 m by 122 m square around each wind turbine will be established for the laydown and assembly of the wind turbine components. The construction trailers will receive electrical power through a temporary electrical service line connected to the local distribution line.

2.1.3 Collection Lines

The system that connects each turbine to the transformer substation will consist of 34.5 kV electrical collection lines that will be buried 1 m below grade on private property adjacent to the turbine access roads, where feasible. In some locations, the collection lines will be buried within the municipal road right-of-way. Above ground electrical junction boxes will be used to connect sections of underground collection lines.

2.1.4 Transformer Substation and Breaker Switch Station

Approximately two to three hectares in size, the transformer substation will either be located on privately held lands through a lease agreement or on land purchased by Goshen Wind, Inc. The electricity collected via the 34.5 kV underground collection lines will converge at the transformer substation where the electricity will be “stepped-up” to 115 kV for transmission and then routed to a breaker switch station. The breaker switch station will occupy less than 0.4 hectares (1 acre) of land and is the connection point with the existing Hydro One 115 kV transmission line. The substation equipment will include an isolation switch, a circuit breaker, a step-up transformer, transmission switch gear, instrument transformers, grounding and metering equipment. All substation grounding equipment will meet the Ontario Electrical Safety Code. The substation will be connected to the existing electrical distribution line to supply power for the control housing lighting and equipment.

2.1.5 Electrical Transmission

A 115 kV electrical transmission line from the step-up transformer substation to the connection point with the Provincial electricity grid is proposed to be located on private property, or within existing road right-of-ways. It is anticipated that the transmission line will be mounted on new transmission line poles. The poles are proposed to be constructed of wood, concrete or steel and will be between 18 and 30 m tall.

The interconnection plan for any wind energy centre is subject to study, design and engineering by the Integrated Electricity System Operator which manages the province’s electricity grid, Hydro One which owns the transmission lines, the local distribution company and the Ontario Energy Board, which regulates the industry through the Transmission System Code and the Distribution System Code.

2.1.6 Access Roads

On-site access roads to each turbine will be constructed to provide an access point to the properties for equipment transport during the construction phase and for maintenance activities during operation. Typically the access roads will be 11 m wide during the construction phase to accommodate the large cranes (with an additional 2 m clearance on each side for travel), and may be reduced in width at the landowner's request following construction. Roads will be wider where they intersect with existing municipal roads to accommodate the turning radii needed for wind turbine component delivery.

2.1.7 Operations and Maintenance Building

An operations building, approximately 30 m by 15 m in size, will be constructed on privately held lands or an existing suitable structure will be purchased/leased for the purpose of monitoring the day-to-day operations of the wind energy centre and supporting maintenance efforts. A small parking lot will be constructed to accommodate staff vehicles. Prior to the construction phase, a Stormwater Pollution Prevention Study will be conducted to address any potential effects associated with stormwater runoff.

Potable water will be supplied by a well or through the municipal water system and a septic bed will be constructed for the disposal of sewage. The septic bed will be constructed to the minimum size required for the size of the operation and maintenance building. It is the Project owner's responsibility to ensure proper maintenance of the septic system. The operations and maintenance building, septic system and water supply will be constructed in accordance with applicable municipal and provincial standards.

2.1.8 Permanent Meteorological Towers

Permanent meteorological towers are an operational requirement of the Independent Electricity System Operator (IESO) as an electricity market participant (this includes all generators of electricity) and allow the IESO to operate the system reliably and safely.

Three permanent meteorological towers will be installed at the Project. The towers will be connected to the project via buried electrical and communication cables. The towers are typically up to 80 m in height. No significant soil or vegetation disturbance is anticipated. The use of meteorological data are key to the safe and efficient operation of a wind energy centre. Some operational decisions made using meteorological data include:

- Cut-in wind speed;
- Cut-out wind speed;
- Turbine shut down during potential icing conditions; and,
- Turbine shut down during extreme weather events.

2.1.9 Water Crossings

To the extent possible, Project infrastructure has been sited to minimize the number of water crossings. The Water Assessment and Water Body Report, which has been developed as part of the REA, describes all water crossings and associated mitigation measures.

2.2 Project Activities

The following sections outline the anticipated activities for the Construction, Operation and Decommissioning phases of the Project.

2.2.1 Project Timing

Subject to the receipt of the necessary permits and approvals, site work for the Goshen Wind Energy Centre is expected to begin in 2013 and last for approximately 6 months. **Table 2-2** presents the currently anticipated construction schedule and approximate order of construction activities for the proposed Project.

Table 2-2 Construction Schedule

Activity		Timing of Activity	Duration
Surveying		Prior to construction – preference is winter months	Less than one day per turbine location
Geotechnical Sampling		Prior to construction – preference is winter months	One to two hours per turbine location
Land Clearing and Construction of Access Roads		Late spring or summer – preference is to conduct during drier months	One to three days per access road to each turbine
Installation of Culverts		Late spring or summer – preference is to conduct during drier months	One to two days per culvert
Construction Laydown Area		Late spring or summer – preference is to conduct during drier months	One week
Turbine Site and Crane Pad Construction		Late spring or summer – preference is to conduct during drier months	Two to four days per turbine location
Delivery of Equipment		Throughout construction phase as needed, and in compliance with Traffic Management Plan	As needed throughout construction phase
Turbine Foundations		Late spring or summer – preference is to conduct during drier months	Three to four days (excluding curing)
Wind Turbine Assembly and Installation		Late spring or summer – preference is to conduct during drier months	Four to five days per turbine location
Electrical Collector System	**Pad Mount Transformers**	Late spring or summer – preference is to conduct during drier months	Four to six days
	Collection Lines	Late spring or summer – preference is to conduct during drier months	Dependent upon the required length of the lines; however, between 4 and 8 km of collector lines can be installed in a week.
Transformer Substation and Breaker Switch Station		Late spring or summer – preference is to conduct during drier months	15 – 20 weeks
Operations Building		Late spring or summer – preference is to conduct during drier months	Eight weeks
Clean-up and Reclamation		Following turbine construction	Will be conducted as site is constructed
Turbine Commissioning		Late spring or summer – preference is to conduct during drier months	One to three days

2.2.2 Construction

2.2.2.1 Surveying and Geotechnical Study Activities

Existing buried infrastructure located on public property will be identified using the Ontario One Call service and buried infrastructure located on private property will be identified by private contractors prior to construction and updated throughout construction, as required.

Geotechnical sampling will be required for turbine foundation locations. Typically, a truck-mounted drill rig visits the sampling locations, drills the borehole and collects geotechnical information. This operation typically uses two operators and requires one to two hours per turbine location.

Equipment will include, at a minimum, trucks, a truck mounted drill rig, and possibly a track-mounted drill rig. The trucks will be driven to the site via existing municipal roads. No materials will be brought on site for these activities and any waste generated would be comprised of drill cuttings which will be scattered in the vicinity of the boreholes.

The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment. Fuel-handling for all construction activities will be conducted in compliance with the mitigation measures outlined in the Construction Plan Report (AECOM, 2012).

2.2.2.2 Land Clearing and Construction of Access Roads

Access roads will be constructed to transport equipment to the construction sites. There will be a 60 m wide area for construction of the access roads. The access road will be sited within this area of disturbance in consultation with the landowner and taking into consideration potential environmental effects.

The construction of the access road will typically require clearing and grubbing of any vegetation, excavation of the topsoil layer and adding a layer of compacted material to a typical thickness of 300 to 600 mm, depending upon site specific geotechnical conditions. Clean granular material (typically “A” or “B” gravel) will be brought to the site as needed and will not be stockpiled onsite. The topsoil will be kept and re-used on site. The access road to each turbine will typically require one to three days of construction time. Depending on the length of the access roads, construction may require approximately 25 trucks of gravel.

New culverts may be required to maintain drainage in ditches at junctions with roadways and these will be constructed to support the construction equipment and delivery trucks. The location of proposed water crossings is summarized in the Water Assessment and Water Body Report (AECOM, 2012) and the potential effects are summarized below in Section 3. The exact details of culverts and their installation in addition to erosion control measures will be determined in conjunction with the Ausable Bayfield Conservation Authority (ABCA) and the Upper Thames River Conservation Authority (UTRCA) as part of their permitting process; however, the culverts are proposed to be open bottom and left in place following the operation phase.

Once the construction activities have been completed, the granular base of the access roads will be removed and distributed to the landowners, if desired, or removed from the site and disposed of in an approved and appropriate manner. The disturbed area will have the topsoil replaced from stockpiled material and will be reseeded in consultation with the landowner.

Equipment will include, at a minimum, trucks, graders, and bulldozers. Municipal and provincial roads will also be used for transporting equipment, and minor modifications may be required to some of the existing roads (e.g., widening the turning radius) to handle the oversized loads. Any road damages associated with the Project will be repaired prior to the completion of the construction phase. The trucks and graders will be driven to the site and the bulldozers will be transported via trailers. The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment. Fuel-handling will be conducted in compliance with the mitigation measures outlined in the Construction Plan Report (AECOM, 2012).

2.2.2.3 Construction of Laydown Areas

A 4 hectare (10 acre) site will be constructed for the temporary storage of construction material (i.e., no turbine components) and as a site for the construction office trailers. Following clearing and grubbing of any vegetation, the topsoil at the temporary laydown area will be removed and approximately 600 mm of clean compacted crushed gravel will be imported as needed. The excavated topsoil will be re-used on site as feasible. A temporary electrical service line will be connected to the existing distribution line adjacent to the laydown area for the purpose of providing power to the construction office trailers. Construction activities are expected to last approximately one week and will require approximately 100 loads of gravel, and a crew of six people. Following the construction phase, the gravel will be removed from the site or re-used, to be determined in consultation with the landowner. The

temporary electrical service line and poles will be removed. The stockpiled topsoil will then be redistributed throughout the temporary laydown area.

Equipment will include, at a minimum, trucks, graders, and bulldozers. The trucks and graders will be driven to the site and the bulldozers will be transported via trailers. The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment. Fuel-handling will be conducted in compliance with the mitigation measures outlined in the Construction Plan Report (AECOM, 2012).

2.2.2.4 Construction of Turbine Site and Crane Pad

Prior to construction, the construction area will be cleared and grubbed. In order to provide sufficient area for the laydown of the wind turbine components and its assembly, a 122 m by 122 m square around the wind turbine must be cleared, levelled, and be accessible during the construction phase. The topsoil is typically removed and some soil stabilizing material (i.e. crushed gravel or clean back fill) may need to be added depending upon site specific geotechnical conditions. Where the site laydown areas are close to watercourses, erosion control measures will be implemented, as outlined in Section 3.

Crane pads will be constructed at the same time as the road and will be located adjacent to the turbine locations. The crane pads will typically be 15 m by 35 m in area. The topsoil at the crane pad will be removed and approximately 600 mm of clean compacted crushed gravel will be imported as needed. The excavated topsoil will be re-used on site as feasible. Once the turbine erection is complete, the crane pad will be removed and will be restored to prior use. The construction crew is anticipated to require four to six people and construction activities are expected to last for approximately one to two days.

Equipment will include, at a minimum, trucks, graders, and bulldozers. The trucks and graders will be driven to the site and the bulldozers will be transported via trailers. The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment. Fuel-handling will be conducted in compliance with the mitigation measures outlined in the Construction Plan Report (AECOM, 2012).

2.2.2.5 Delivery of Equipment

Equipment will be delivered by truck and trailer throughout the construction phase and stored at the temporary lay-down sites surrounding each turbine. A road use agreement and Traffic Management Plan will be developed in consultation with the municipalities. Alternative traffic routes will be prepared to address traffic congestion, as needed.

2.2.2.6 Construction of Turbine Foundations

A backhoe will be used to excavate an area approximately 3 m deep x 20 m x 20 m with the material being stockpiled for future backfilling. Stockpiled material will have topsoil and subsoil separated out and surplus excavated material will be removed from the site for disposal in an approved manner. The foundation, with an approximate footprint of 400 m^2, will be constructed of poured concrete and reinforced with steel rebar to provide strength. The construction timeframe for turbine foundations is three to four days, excluding curing time. After construction the foundation will be backfilled and the surface will be landscaped for drainage. The only surface evidence of the foundation will be a small protrusion of concrete to which the tower is attached; as such land can be cultivated to within a few metres of the turbine. Any wood-waste generated will be removed from the site and recycled unless the landowner otherwise directs. Spent welding roads will be disposed of as hazardous waste by a licensed contractor.

Typical construction equipment, on a per turbine basis, will include:

- Excavator for removing material;
- Flatbed trucks (four to six) for delivery of rebar, turbine mounting assembly and forms;
- Truck mounted crane or rough terrain forklift for unloading and placement of rebar and forms;
- Concrete trucks for delivery of concrete (30-40 loads);
- Construction trucks (three to four vehicles with multiple visits); and,
- Dozer, loader and trucks to backfill and compact foundation and remove surplus excavated materials.

The trucks and graders will be driven to the site and the bulldozers will be transported via trailers. The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment. Fuel-handling will be conducted in compliance with the mitigation measures outlined in the Construction Plan Report (AECOM, 2012).

2.2.2.7 Wind Turbine Assembly and Installation

Turbine components will arrive on-site using flat bed and other trucks and will be temporarily stored on-site in the immediate vicinity of the base prior to assembly. Typically two cranes will be used to install the turbines. The larger crane is usually a crawler type with a capacity of 400 tonnes or larger, and is used for the higher lifts.

Clearing and grubbing will be required for the erection area. The erection cranes and crew will follow the foundation crew and erect the wind turbines once the foundations are completed and the concrete has set. This will typically be in five lifts (three for the towers, one for the nacelle and one for the rotor) over a period of two to three days. The lower tower sections may be installed several days before the upper tower sections and the turbine to optimize installation sequence. The lower tower section will also include electrical and communications equipment. Total turbine assembly and installation will typically require four to five days for each turbine. Fifteen to twenty people may be required at the site during the turbine installation; they will be transported using light duty vehicles.

Packing frames for the turbine components are returned to the turbine vendor. Following commissioning, the surrounding area will be returned to its original use.

Equipment will include, at a minimum, trucks, two cranes, graders, and bulldozers. The trucks and graders will be driven to the site and the bulldozers will be transported via trailers. The larger track mounted crane can move from turbine site to turbine site; however, it will need to be disassembled to move it along roadways and from the Project site. Alternatively, cranes may be moved between turbine sites without disassembly along crane paths. In such instances, no additional infrastructure is required to support the crane movement. The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment. Fuel-handling will be conducted in compliance with the mitigation measures outlined in the Construction Plan Report (AECOM, 2012).

2.2.2.8 Construction of Electrical Collector System

The electrical collector system will consist of pad mounted transformers, underground cabling for use on private property, above ground junction boxes and a buried collection system running along turbine access roads or municipal road right-of-ways. These components are described below.

- Pad Mount Transformers: A concrete transformer pad, approximately 2.2 m by 2.5 m in size, will be installed adjacent to each turbine at the same time as the turbine base installation. The construction will consist of excavation, soil storage, installation of the buried electrical grounding grid, installation of the concrete pad, installation of the transformer, and electrical connections. Transformer installation and

cabling between the turbine and transformer is expected to take three days per turbine. Equipment will include flatbed trucks to transport the equipment to site, and a truck-mounted crane for the installation. These activities will likely require four to six trucks, a work force of two people per vehicle per day, and will last between four to six days.

- Collection Lines: Cables and fibre optics lines (for communications) from each turbine to the transformer substation will be buried and will be located adjacent to the turbine access roads, where feasible. There will be a 20 m wide area for construction of the collection lines. The collection lines will be sited within this area of disturbance in consultation with the landowner and taking into consideration potential environmental effects. The excavated soil will be stored temporarily and then reused as backfill. Power conductors will be approximately 0.9 m below grade and the location will be marked. Farming practices will not be affected by the underground cabling due to the depth of the cables and location of the cable beneath the access roads. Additional ancillary equipment such as above ground junction boxes may be required. Equipment will include trenchers or diggers (depending on soil type) and construction will require a crew of six people. The construction timeframe is dependent upon the required length of the lines.
- Horizontal Directional Drilling: Electrical cables may need to be installed using horizontal directional drilling to minimize effects to woodlots or watercourses. Erosion control devices will be installed at the drill location and drill cuttings will be collected and removed from the site for disposal in an approved and appropriate manner. An entrance and exit pit will be excavated on either side of the feature to be bored under. The directional drilling equipment will be set up at the entrance pit and a drill bit attached to rod segments is advanced until it reaches the exit pit. A slurry of bentonite and/or polymer mixed with water will be injected into the hole while drilling to help stabilize the bore hole and reduce friction. Once the drill bit has reached the exit pit the drill bit will be removed and a “reamer” attached and pulled back through the hole to enlarge the bore by 120-150%. The electrical cable will then be installed through the hole. Equipment will include a directional drilling rig and two to three support trucks to carry drilling rods, drilling supplies and cable.

The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment, and the polymer used for directional drilling. Fuel-handling will be conducted in compliance with the mitigation measures outlined in the Construction Plan Report (AECOM, 2012).

2.2.2.9 Construction of Electrical Transmission Line

Holes for new transmission line poles are typically augured in the ground using a truck mounted auger device. The poles will then be inserted using special cranes to a typical depth of 2 to 3 m below grade. The poles are typically “dressed” (made ready to accept conductors) on the ground prior to installation. In locations where the transmission line makes a turn, guy wires may be used to anchor the corner pole in place. At times, when guy wires cannot be used at corner poles, the steel poles may be mounted on concrete pier foundations. Typically, one crew will install the poles and one crew will dress them. Approximately six construction vehicles (including trucks and a pole loader) and a crew of 12 to 15 people are anticipated for construction of the transmission lines. A maximum of twelve to sixteen poles can be installed and dressed in one day. Once the poles are in place and dressed, cables will be strung in place using boom trucks and special cable reel trucks. Finally, any pre-existing poles that are no longer in use will be removed.

The transmission line will be directionally drilled in one location to avoid affecting a Provincially Significant Wetland. Construction will follow the same process described in Section 2.2.2.8 for directionally drilling the collector system.

Some packing-material waste may be generated from construction. All recyclable materials will be separated from non-recyclable materials and both streams will be removed from the site and disposed of at an approved and licenced facility.

Equipment will include, at a minimum, a truck mounted crane, a drill rig, flatbed trailers and a truck mounted auger. The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment. A lubricant is likely to be used when the cables are pulled in through the conduit. Fuel-handling will be conducted in compliance with the mitigation measures outlined in the Construction Plan Report (AECOM, 2012).

2.2.2.10 Construction of Transformer Substation and Breaker Switch Station

During construction of the substation and breaker, topsoil and subsoils will be stripped and stockpiled separately. Stripped topsoil and subsoil will be placed in the temporary storage facility area and topsoil stripped from the substation area will be distributed on other Project properties. An electrical service line of approximately 9 m and associated poles will likely be connected to the existing distribution line adjacent to the substation for the purpose of providing house service power to the substation control building. The construction crew will consist of approximately 25 to 40 people and construction is expected to last for about four months. Some packing-material waste may be generated. All recyclable materials will be separated from non-recyclable materials and both streams will be removed from the site and disposed of at an approved and licensed facility.

Construction equipment will include small trenchers, a small crane, a backhoe, forklifts, concrete trucks, auger truck and a bulldozer. The trucks and graders will be driven to the site and the bulldozers will be transported via trailers. The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment and transformer oil. Fuel-handling will be conducted in compliance with the mitigation measures outlined in the Construction Plan Report (AECOM, 2012).

2.2.2.11 Construction of Operations and Maintenance Building

Construction of the operations building may take up to three months to complete and will require a crew of approximately 10 to 15 people.

Equipment will include, at a minimum, forklifts, concrete trucks and smaller crew trucks. The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment. Fuel-handling will be conducted in compliance with the mitigation measures outlined in the Construction Plan Report (AECOM, 2012).

2.2.2.12 Construction of Permanent Meteorological Towers

The towers will be erected using winches and secured with guy wires tied off to anchors or a monopole foundation. No significant soil or vegetation disturbance is anticipated. Construction of each meteorological tower will take approximately two days and require a crew of six people.

2.2.2.13 Clean-up and Reclamation

Site clean-up will occur throughout the construction phase and site reclamation will occur after construction has been completed. Waste and debris generated during the construction activities will be collected by a licensed operator and disposed of at an approved facility. All reasonable efforts will be made to minimize waste generated and to recycle materials including returning packaging material to suppliers for reuse/recycling.

Stripped soil will be replaced and re-contoured in the construction areas and disturbed areas will be re-seeded, as appropriate. Erosion control equipment will be removed once inspections have determined that the threat of erosion has diminished to the original land use level or lower. High voltage warning signs will be installed at the transformer substation and elsewhere, as appropriate. At the conclusion of construction vehicles and construction equipment will be removed from the site.

2.2.2.14 Turbine Commissioning

Turbine commissioning will occur once the wind turbines and substation are fully installed and Hydro One is ready to accept grid interconnection. The commissioning activities will consist of testing and inspection of electrical, mechanical and communications systems. Some packing-material waste may be generated. All recyclable materials will be separated from non-recyclable materials and both streams will be removed from the site and disposed of at an approved and licenced facility.

Temporary portable generator sets may be used to electrically commission the turbines prior to connection to the grid. The generators will be required for approximately one day per turbine. The generators may require an Environmental Compliance Approval. Following the commissioning phase, the portable generators will be removed from the site and returned to the owners.

Equipment will include support trucks which will be driven to the construction site. The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment and portable generators, gearbox oil, and lubricants. Fuel-handling will be conducted in compliance with the mitigation measures outlined in the Construction Plan Report (AECOM, 2012).

2.2.3 Operation

2.2.3.1 General Operation

The wind energy centre will require full time technical and administrative staff to maintain and operate the facility. The primary workers will be wind technicians (i.e., technicians who carry out maintenance on the turbines) along with a site supervisor. The Project will be operated by a staff of five to eight people who will work out of the operations and maintenance building.

The wind turbines will be operating (i.e., in “Run” mode and generating electricity) when the wind speed is within the operating range for the turbine and there are no component malfunctions. Each turbine has a comprehensive control system that monitors the subsystems within the turbine and the local wind conditions to determine whether the conditions are suitable for operation. If an event occurs which is considered to be outside the normal operating range of the turbine (such as low hydraulic pressures, unusual vibrations or high generator temperatures), the wind turbine will immediately take itself out of service and report the condition to the Operations Centre, located in the operations and maintenance building. A communication line connects each turbine to the Operations Centre, which closely monitors and, as required, controls the operation of each turbine. The wind turbine system will be integrated with the electric interconnection Supervisory Control and Data Acquisition (SCADA) to ensure that the Project critical controls, alarms and functions are properly co-ordinated for safe, secure and reliable operation. The wind turbine will also report to NextEra’s Central Operations Facility during non-working hours.

2.2.3.2 Routine Turbine Maintenance

Routine preventative maintenance activities will be scheduled at six month intervals with specific maintenance tasks scheduled for each interval. Maintenance will be done by removing the turbine from service and having two to three technicians climb the tower to spend a full day carrying out maintenance activities.

Consumables such as the various greases used to keep the mechanical components operating and oil filters for gearboxes and hydraulic systems will be used for routine maintenance tasks. Following all maintenance work on the turbine, the area will be cleaned up. All surplus lubricants and grease-soaked rags will be removed and disposed of

as required by applicable regulations. All maintenance activities will adhere to the same spill prevention protocols undertaken during the construction phase.

2.2.3.3 Unplanned Turbine Maintenance

Modern wind turbines are very reliable and the major components are designed to operate for approximately 30 years. However, there is a possibility that component failure may occur despite the high reliability of the turbines fleet-wide. Most commonly, the failure of small components such as switches, fans, or sensors will take the turbine out of service until the faulty component is replaced. These repairs can usually be carried out by a single crew visiting the turbine for several hours.

Events involving the replacement of a major component such as a gearbox or rotor are rare. If they do occur, the use of large equipment, sometimes as large as that used to install the turbines, may be required.

It is possible that an access road, built for construction and returned to farmland when the construction phase is completed, would need to be rebuilt to carry out repairs to a damaged turbine. Typically only a small percentage of turbines would need to be accessed with large equipment during their operating life.

2.2.3.4 Electrical System Maintenance

The collector lines and substation will require periodic preventative maintenance activities. Routine maintenance will include condition assessment for above-ground infrastructure and protective relay maintenance of the substation, in addition to monitoring of the secondary containment system for traces of oil. Finally, vegetation control will be required around the transmission line to prevent any damage to the line and ensure safe operation. Any vegetation that has the potential to grow to more than 4.3 m above grade will be cleared. The vegetation is typically cleared by mechanized equipment (e.g., chainsaw / hydro axe).

2.2.3.5 Waste Management

Waste generated during the operations phase will be removed from the operations and maintenance building by a licensed operator and disposed of at an approved facility. Any lubricants or oils resulting from turbine maintenance will be drummed on site and disposed of in accordance with applicable Provincial regulations. All reasonable efforts will be made to minimize waste generated and to recycle materials including returning packaging material to suppliers for reuse/recycling. The spill prevention protocols followed during construction will continue to be observed throughout the facility's operations and maintenance activities.

2.2.4 Decommissioning

2.2.4.1 Procedures for Decommissioning

Decommissioning procedures will be similar to the construction phase. More detailed information on decommissioning will be available in the Decommissioning Plan Report (AECOM, 2012).
The procedures will include:

1. The creation of temporary work areas. In order to provide sufficient area for the lay-down of the disassembled wind turbine components and loading onto trucks, a 122 m by 122 m square must be cleared, levelled and made accessible to trucks. The topsoil will be removed and some material may need to be added.

2. The creation of crane pads. The crane pads will typically be 15 m x 35 m in size and will be located within the temporary work area around each wind turbine. The topsoil at the crane pad will be removed and approximately 600 mm of compacted crushed gravel will be added. Once the turbine disassembly is complete, the gravel area around each turbine will be removed and the area will be restored to prior use using stockpiled topsoil.
3. The use of cranes to remove the blades, hub and tower segments.
4. The use of trucks for the removal of turbines, towers and associated equipment.
5. The removal of the top 1 m of the turbine foundations and replacement with clean fill and stockpiled topsoil. The fill and topsoil will be contoured to allow cultivation in the case of agricultural lands.
6. Road bedding material will be removed and replaced with clean subsoil and topsoil for reuse by the landowner for agricultural purposes. It is proposed to leave culverts in place following the operations phase.
7. Cutting underground electrical lines, burying the ends to 1 m below grade, and leaving the lines in place with the consent of the landowner. Above-ground lines and poles that are not shared with another Transmission/Distribution Operator will be removed and the holes will be filled with clean fill.
8. The demolition of the substation, breaker switch station and operations building (if the latter was built specifically for the Project). These will be decommissioned in a manner appropriate to and in accordance with the standards of the day. All materials will be recycled, where possible, or disposed off-site at an approved and appropriate facility.

2.2.4.2 Land Restoration Activities

Once all of the turbines and ancillary facilities are removed, the remaining decommissioning work will consist of shaping and grading the areas to, as near as practicable, the original contours prior to construction of the wind turbines and access roads. Existing agricultural capacity will be restored and the land graded to maintain proper drainage. All areas, including the access roads, transformer pads and crane pads will be restored to, as near as practical, their original condition with native soils and seeding. If there is insufficient material onsite, topsoil and/or subsoil will be imported from a source acceptable to the landowner.

Although strict spill prevention procedures will be in place, there is the potential through the decommissioning process for small spills of solvents or fuels. The soil conditions of the turbine areas will be surveyed to determine if any effects have occurred. Should soil effects be noted, the affected soils will be identified, excavated, and removed to the applicable standards from the site for disposal at an approved and appropriate facility. The removed soils will be replaced with stockpiled subsoil and topsoil, if available. If none are available, clean fill and topsoil will be imported.

Decommissioning may temporarily affect the agricultural practices directly around the access roads, substation and turbine locations, but only during their removal. Limited effects to terrestrial vegetation are expected since the majority of the Goshen Wind Energy Centre infrastructure will be located exclusively on agricultural land; however, wildlife, including birds and bats, inhabiting nearby natural features, may be disturbed by decommissioning.

The most significant risk to the aquatic environment will be when the access roads near drains or municipal drain crossings are removed. Similar to the construction phase, decommissioning will follow a stormwater protection plan that will ensure proper steps are followed to mitigate erosion and silt/sediment runoff. This plan will incorporate the best management practices outlined in the Water Assessment and Water Body Report.

As with the Project's construction, noise levels around the decommissioning work will be higher than average. Proper steps will be followed to minimize this disturbance, such as avoiding work outside of daylight hours. All decommissioning project activities will conform to applicable local municipal noise by-laws. Also, as with the Project's construction, road traffic in the area will increase temporarily due to crews and heavy equipment movements. If required, a traffic management plan will be prepared to mitigate the effects of increased road traffic, in consultation with the local municipality.

Decommissioning of the wind turbines should not result in any effects to surface or groundwater quality. As noted above, after the decommissioning process is completed the land will be returned to existing agricultural conditions.

2.2.4.3 Procedures for Managing Waste Generated

As discussed above, the waste generated by the decommissioning of the Project is minimal, and there are anticipated to be no toxic residues. Any waste generated will be disposed of according to the applicable standards with the emphasis on recycling materials whenever possible.

The major components of the wind turbines (tower, nacelle, blades) are modular items that allow for ease of construction and disassembly of the wind turbines during replacement or decommissioning. Dismantled wind turbines have a high salvage value due to the steel and copper components. These components are easily recyclable and there is a ready market for scrap metals. Transformers and transmission lines are designed for a 50 year lifespan so these items could be refurbished and sold for reuse.

Based on the construction details for the GE wind turbines and associated tower and components, it is assumed that both the tower and nacelle will yield approximately 80% salvageable materials. Since the hub assembly and bedplate is manufactured steel, it is anticipated that the hub will yield 100% salvageable metallic materials. Copper salvage estimates were derived by assuming 5% of the total tower and nacelle weight consists of salvageable copper bearing materials. Since the rotor/blades are constructed of predominantly non-metallic materials (fiberglass reinforced epoxy and carbon fibres), no salvage for the rotor or blades is currently assumed.

It is assumed that 75% of the aggregate material from the decommissioning of the crane pads can be salvaged for future use as aggregate base course. The remaining materials would be viable for general fill on non-structural fill areas. The geotextile fabric cannot be salvaged.

3. Potential Environmental Effects

An effects assessment for the construction, operation and decommissioning phases of the Project has been completed in accordance with the requirements of *O. Reg. 359/09*. This section provides a summary of the potential effects and any residual effects of each phase as they relate to specific environmental conditions. For further detail on specific mitigation measures and monitoring plans, reference should be made to the Construction Plan Report (AECOM, 2012) and Design and Operations Report (AECOM, 2012).

As outlined previously, the procedures for decommissioning will be similar to the construction phase. As such, the potential effects for each of these phases are also deemed to be similar.

3.1 Cultural Heritage

Construction and Decommissioning

The potential effects from construction and decommissioning activities include:

- Disturbance or displacement of 28 archaeological resources identified through the Stage 2 Archaeological Assessment due to construction of project infrastructure.

No effects to protected properties or heritage resources are anticipated. The Project Location was selected to avoid these features.

There is a low likelihood of occurrence and limited magnitude of the effect on archaeological resources due to the application of mitigation measures.

Operation

No effects to protected properties, archaeological resources or heritage resources are anticipated as a result of the operational phase of the Project.

3.2 Natural Heritage

3.2.1 Potential Effects to Generalized Candidate Significant Wildlife Habitat

Construction and Decommissioning

The potential effects from construction and decommissioning activities on Generalized Candidate Significant Wildlife Habitat include:

- Increased erosion and sedimentation resulting in increased inputs of nutrients and contaminants to wetlands, woodlands and other significant natural features, resulting from:
  - clearing and grubbing for construction of turbines, access roads, pads/turnaround areas, collection lines, transmission line, operations building and substation;
  - excavation and backfilling for construction of turbines, collection lines, transmission line, operations building and substation;

- Removal/disturbance of topsoil and increased soil compaction from manoeuvring of heavy machinery, excavation and backfilling of turbine foundation for construction of turbines, access roads, pads/turnaround areas, collection lines, transmission line, operations building and substation;
- Disturbance and/or mortality to terrestrial wildlife, including barriers to wildlife movement from construction of turbines, access roads, pads/turnaround areas, collection lines, transmission line, operations building and substation;
- Disturbance to or loss of wildlife habitat from construction of turbines, access roads, pads/turnaround areas, collection lines, transmission line, operations building and substation;
- Damage to vegetation while operating equipment used in construction of turbines, access roads, pads/turnaround areas, collection lines, transmission line, operations building and substation;
- Soil / water contamination by oils, gasoline, grease and other materials from:
  - construction equipment, material stockpiling and handling for construction of turbines, access roads, pads/turnaround areas, collection lines, transmission line, operations building and substation; and
- Changes in surface water drainage patterns (e.g., obstruction of lateral flows in surface water to wetlands) from construction of turbines, access roads, pads/turnaround areas, resulting in effects to soil moisture and species composition of vegetation.

There is a low likelihood of occurrence and limited magnitude of these effects due to the application of mitigation measures.

- Increased erosion and sedimentation resulting in increased inputs of nutrients and contaminants to wetlands, woodlands and other significant natural features, resulting from:
  - directional drilling for construction of collection lines;
- Soil / water contamination by oils, gasoline, grease and other materials from:
  - bentonite or polymer used during directional drilling of collection lines, resulting from the escape of drilling mud into the environment as a result of a spill, tunnel collapse or the rupture of mud to the surface in the event of a “frac-out”.

There is a moderate likelihood of occurrence; if accidental damage occurs, negative effects may be measurable but would likely represent a small change relative to existing conditions.

3.2.2 Potential Effects to Significant Wetlands, Woodlands, Valleylands and Wildlife Habitat

Construction and Decommissioning

The potential effects from construction and decommissioning activities on Significant Wetlands, Woodlands, Valleylands and Wildlife Habitat include:

- Noise disturbance to breeding Red-headed Woodpeckers during transmission line construction within Red-headed Woodpecker Habitat Feature;
- Noise disturbance to bats and/or avoidance behaviour during transmission line construction within Bat Maternity Colony Features; and
- Noise disturbance to bats during turbine construction near Bat Maternity Colony Features.

There is no likelihood of occurrence due to the application of mitigation measures.

- Accidental intrusion into natural features resulting in damage to vegetation or wildlife habitat form or function resulting from:
  - turbine construction near Significant Wetland Features, Significant Woodland Features, and Bat Maternity Colony Features;
  - access road construction near Significant Wetland Features, Significant Woodland Features, Amphibian Woodland Breeding Habitat Features, Reptile Hibernaculum, and Turtle Over-wintering Habitat Features;
  - breaker switch station construction near a Significant Wetland Feature and a Significant Woodland Feature;
  - collection line construction near Significant Woodland Features;
  - transformer substation construction near Significant Woodland Features;
  - meteorological tower construction near a Significant Woodland Feature;
- Increased erosion and sedimentation resulting from:
  - turbine foundation excavation and construction near a Significant Wetland Feature and a Significant Valleyland Feature;
  - access road construction near Significant Wetland Features, with increased potential for sediment and erosion where construction will occur as close as 5 m from the dripline;
  - access road construction near Amphibian Woodland Breeding Habitat Features and Turtle Over-wintering Habitat Feature;
  - breaker switch station construction near a Significant Wetland Feature;
  - collection line construction near Significant Wetland Features;
  - transmission line construction near Significant Wetland Features with increased potential for sediment and erosion where the transmission line will be installed by directional drilling under Significant Wetland Features;
  - transmission line construction within a Significant Valleyland Feature, Azure Bluet habitat Feature, a Turtle Over-wintering Habitat Feature, and Amphibian Woodland Breeding Habitat Features;
- Soil/water contamination resulting from accidental spills during:
  - construction of turbines near Significant Wetland Features;
  - access road construction near Significant Wetland Features;
  - directional drilling of collection lines under Significant Wetland Features and Significant Woodland Features;
  - directional drilling of transmission line under Significant Woodland Features;
  - transmission line construction near Significant Wetland Features with increased potential for soil/water contamination where the transmission line will be installed by directional drilling under Significant Wetland Features;
- Changes in surface water drainage patterns resulting in effects to soil moisture and species composition of vegetation where construction will occur as close as 5 m from the dripline of Significant Wetland Features; Changes to surface water hydrology resulting from turbine and transmission line construction near a Significant Valleyland Feature; and
- Disruption of Tundra Swan use of Waterfowl Stopover and Staging Area Features resulting from turbine, access road and collection line construction.

There is a low likelihood of occurrence and limited magnitude of these effects due to the application of mitigation measures.

- Unintended damage to adjacent vegetation due to small size of the right-of-way, constrained work area and proximity of transmission line to:
  - Significant Wetland Features; and
  - Significant Woodland Features.

There is a low likelihood of occurrence; however, if accidental damage occurs, negative effects may be measurable but would represent a small change relative to existing conditions.

- Changes to surface water drainage patterns resulting in indirect effects on habitat condition from:
  - turbine, access road and collection line construction causing indirect effects on Waterfowl (Tundra Swan) Stopover and Staging Area Features;
  - transmission line construction within Amphibian Woodland Breeding Habitat Features;
  - access road construction near a Turtle Over-wintering Habitat Feature;
  - access road construction near Amphibian Woodland Breeding Habitat Features;
  - transmission line construction within Azure Bluet Habitat Feature;
  - transmission line construction within a Turtle Over-wintering Habitat Feature;
- Disruption of amphibians moving between breeding pools and home range resulting from access road construction near Amphibian Woodland Breeding Habitat Features and from transmission line construction within Amphibian Woodland Breeding Habitat Features;
- Risk of mortality from construction equipment to:
  - amphibians during construction of access roads near a Amphibian Movement Corridor Feature;
  - reptiles during construction of access roads near a Reptile Hibernaculum Feature;
  - turtles during construction of the transmission line within a Turtle Over-wintering Habitat Feature;
- Disruption of turtles moving between over-wintering ponds and other areas from:
  - access road construction near a Turtle Over-wintering Habitat Feature; and
  - transmission line construction within a Turtle Over-wintering Habitat Feature.

There is a moderate likelihood of occurrence of these effects; however, the magnitude of these effects will be limited due to the application of mitigation measures and the short-term nature of effects.

- Unplanned intrusion into woodlands/wetlands in event of equipment malfunction during directional drilling for:
  - construction of collection lines under Significant Woodland Features and Significant Wetland Features;
  - construction of the transmission line under Significant Woodland Features and a Significant Wetland Feature;
- Increased erosion and sedimentation resulting from:
  - directional drilling of collection lines under Significant Wetland Features.

There is a moderate likelihood of occurrence; if accidental damage occurs, negative effects may be measurable but would represent a small change relative to existing conditions.

- Increased dust accumulation on peripheral wetland vegetation resulting from construction of access roads where construction will occur as close as 5 m from the dripline of Significant Wetland Features.

There is a high likelihood of occurrence but limited magnitude of the effect due to the application of mitigation measures.

- Removal of vegetation within significant feature resulting in habitat damage from clearing for transmission line within:
  - Azure Bluet Habitat Feature;
  - Turtle Over-Wintering Habitat Feature; and
- Loss of up to 2.86 ha of forest cover within Significant Woodland Features from clearing for the transmission line.

There is a high likelihood of occurrence; however, the magnitude of these effects will be moderate due to the application of mitigation measures, and if required, compensation measures.

- Removal of vegetation within significant feature resulting in habitat damage from clearing for transmission line within:
  - Amphibian Woodland Breeding Habitat Features;
  - Red-headed Woodpecker Habitat Feature;
- Displacement and/or mortality of nursing female and juvenile bats resulting from vegetation clearing for transmission line construction within Bat Maternity Colony Features; and
- Removal of confirmed significant cavity trees or other suitable cavity trees resulting from vegetation clearing for transmission line construction within Bat Maternity Colony Features.

The significance of residual effects will be determined based on the results of post-construction monitoring.

Operation

Potential effects from operational and maintenance activities on Significant Wetlands, Woodlands, Valleylands and Wildlife Habitat include:

- Risk of disturbance to breeding Red-Headed Woodpecker habitat resulting from transmission line maintenance within a Red-Headed Woodpecker Habitat Feature.

There is no likelihood of occurrence due to the application of mitigation measures.

- Soil / water contamination by oils, gasoline, grease and other materials (e.g., turbine lubricant and maintenance personnel) resulting from:
  - turbine operation and maintenance near Significant Wetland Features;
  - substation operation and maintenance near a Significant Wetland Feature;
  - transmission line maintenance within a Significant Valleyland Feature;

- Changes in surface water drainage patterns resulting in effects to soil moisture and species composition of vegetation from access road operation and maintenance at:
  - Significant Wetland Features;
  - Significant Woodland Features;
  - A Significant Valleyland Feature;
- Introduction of invasive species into wetland communities resulting from access road operation and maintenance near Significant Wetland Features;
- Risk of mortality to turtles moving between over-wintering ponds and other areas resulting from:
  - access road operation and maintenance near Turtle Over-wintering Habitat Features;
  - transmission line maintenance within Turtle Over-wintering Habitat Feature;
- Risk of mortality / disturbance to breeding amphibians or amphibians moving between breeding pools and home range resulting from:
  - access road operation and maintenance near Amphibian Woodland Breeding Habitat Features;
  - access road operation and maintenance near an Amphibian Movement Corridor Feature;
  - transmission line maintenance within Amphibian Woodland Breeding Habitat Features;
- Risk of disturbance and/or mortality of amphibians from herbicide spraying along transmission line within Amphibian Woodland Breeding Habitat Features;
- Risk of mortality to reptiles from vehicles resulting from access road operation and maintenance near a Reptile Hibernaculum Feature;
- Disturbance to Tundra Swan stopover and staging habitat due to increased vehicular traffic on access roads near Waterfowl Stopover and Staging Habitat Features;
- Clearing of vegetation for maintenance of the transmission line, resulting in accidental damage to woodlands and disturbance to wildlife within Significant Woodland Features; and
- Disturbance to vegetation as result of spraying of herbicide for maintenance of the transmission line at Significant Woodland Features.

There is a low likelihood of occurrence and limited magnitude of these effects due to the application of mitigation measures.

- Increased erosion and sedimentation to Amphibian Woodland Breeding Habitat Features, Azure Bluet Habitat Feature, and a Turtle Over-wintering Habitat Feature resulting from transmission line maintenance activities including vegetation removal.

There is a moderate likelihood of occurrence of this effect; however, the magnitude of this effect will be limited due to the application of mitigation measures and the short-term nature of effects.

- Loss of forest cover through vegetation clearing in significant woodlands due to construction of the transmission line within Significant Woodland Features;
- Removal of vegetation resulting in habitat damage from clearing for the transmission line within:
  - Azure Bluet Habitat Feature; and
  - Turtle Over-Wintering Habitat Feature.

There is a high likelihood of occurrence; however the magnitude of these effects will be moderate due to the application of mitigation measures, and if required, compensation measures.

- Risk of bird collisions with turbines;
- Risk of bat collisions with a turbine;
- Avoidance by Tundra Swans of staging and stopover habitat during migration due to the proximity of turbines to Waterfowl Stopover and Staging Habitat Features;
- Bats may be disturbed by noise resulting from turbine operation near Bat Maternity Colony Features;
- Bats may display avoidance behaviour due to lighting resulting from turbine operation near Bat Maternity Colony Features;
- Removal of cavity trees as a result of vegetation removal for the transmission line within Bat Maternity Colony Features;
- Removal of vegetation resulting in habitat damage from clearing for the transmission line within:
  - Red-headed Woodpecker Habitat Feature; and
  - Amphibian Woodland Breeding Habitat Features.

Effects from bird and bat collisions will be minimized through the application of mitigation measures. The significance of residual effects will be determined based on the results of post construction monitoring.

3.3 Surface Water and Groundwater

3.3.1 Surface Water

Construction and Decommissioning

The potential effects from construction and decommissioning include:

- Reduced groundwater upwelling areas (and hence stream base flows) from groundwater dewatering activities (if required) for excavation of foundation area, resulting in increased surface water temperatures from reduced groundwater contributions;
- Increased streamflows in watercourses that receive temporary groundwater dewatering discharge (if required). Groundwater discharge has potential to cause streambed and/or bank erosion and downstream sedimentation if not managed properly;
- Increased erosion, sedimentation and turbidity in watercourses from:
  - clearing and grubbing for construction of turbines and pads/turnaround areas, access roads, transmission line pole installation, the substation and laydown area, and a meteorological tower;
  - directional drilling activities for the transmission line, collection line crossings and for collection lines within a water body buffer;
- Soil compaction, which may result in increased runoff into watercourses from turbine construction;
- Release/discharge of sediment-laden runoff from the construction area, which has the potential to transport nutrients and contaminants into the watercourse due to construction of turbines, road crossings and for roads within a water body buffer, collection line crossings and for collection lines within a water body buffer, the transmission line, substation and laydown area; and a meteorological tower;

- Soil/water contamination by oils, grease and other materials from accidental spills and release of contaminants from construction equipment at water body locations for turbine construction, road crossings and for roads within a water body buffer, directional drilling of collection line crossings, collection lines within a water body buffer, the transmission line, substation and laydown area, and a meteorological tower;
- Reduction of streamflow due to the withdrawal of surface water for construction activities such as dust suppression, equipment washing and land reclamation (e.g. hydroseeding);
- Loss of riparian habitat adjacent to watercourses for installation of transmission line poles;
- Damage to stream banks from the use of heavy machinery; and
- Obstruction of lateral flows in watercourses from water crossings.

There is a low likelihood of occurrence and limited magnitude of these effects due to the application of mitigation measures.

- Temporary disruption of substrates/habitat at locations where in-water work is required.

There is a moderate likelihood and magnitude of this effect due to the number of watercourse crossings where in-water work is required.

- Degradation and loss of fish habitat for water crossings.

There is a moderate likelihood of this effect occurring due to the number of watercourse crossings; however, the magnitude of this effect is limited due to the marginal habitat and common species that may be affected; as such fish passage will be maintained and will continue to provide habitat.

- Release of pressurized drilling fluids into watercourse due to fractures in the substrate resulting in a “frac out” for directional drilling of the transmission line and for collection line crossings.

There is a low likelihood of this effect occurring due to the application of mitigation measures; however the magnitude of this effect could be high as benthic invertebrates, aquatic plants and fish and their eggs could be smothered by the fine particles if bentonite were discharged to waterways.

Operation

The potential effects from operational and maintenance activities include:

- Obstruction of lateral flows in watercourses and other waterbodies due to the design of culverts and debris build-up at water crossings.

There is no likelihood of occurrence of this effect due to the application of mitigation measures.

- Soil / water contamination by oils, gasoline, grease and other materials (e.g., turbine lubricant and maintenance activities, use of access roads); and
- Increase in impervious surfaces from the presence of turbine foundations and access roads, resulting in increased water temperatures, increased surface runoff and stream peak flows, and reduced infiltration, base flows and upwelling.

There is a low likelihood of occurrence and limited magnitude of these effects due to the application of mitigation measures.

3.3.2 Geology and Groundwater

Construction and Decommissioning

The potential effects from construction and decommissioning include:

- Dewatering when excavating and constructing the turbine bases, resulting in a reduction in quality and quantity of groundwater; and
- Increase in impervious area created by the turbine base and access roads resulting in reduced infiltration near to groundwater recharge areas.

Low likelihood and negligible magnitude of effects based on the limited amount of dewatering required and the distance between known water wells, buildings, and significant natural features (> 120 m) and dewatering activities.

Operation

The potential effects from operational and maintenance activities include:

- Soil / water contamination by oils, gasoline, grease and other materials (e.g., turbine lubricant and maintenance activities, use of access roads); and
- Increase in impervious surfaces from the presence of turbine foundations and access roads, resulting in increased water temperatures, increased surface runoff and stream peak flows, and reduced infiltration, base flows and upwelling.

There is a low likelihood of occurrence and limited magnitude of these effects due to the application of mitigation measures.

3.4 Emissions to Air

3.4.1 Potential Effects

Construction and Decommissioning

The potential effects from construction and decommissioning activities include:

- Emissions of contaminants from portable generator sets, truck traffic and other construction vehicles, including but not limited to, nitrogen dioxide, sulphur dioxide, suspended particulates, emissions of greenhouse gases (carbon dioxide, methane); and
- Dust as a result of vehicle traffic over gravel roads and/or cleared areas.

No odour emissions are anticipated.

There is a high likelihood of occurrence; however the magnitude of these effects will be limited due to the application of mitigation measures and the short-term nature of effects.

Operation

The potential effects from operational and maintenance activities are as follows:

- Emissions of contaminants from maintenance vehicles and portable generator sets, including but not limited to, nitrogen dioxide, sulphur dioxide, suspended particulates, emission of greenhouses gases (carbon dioxide, methane); and
- Dust as a result of vehicle traffic over gravel roads and/or cleared areas.

No odour emissions are anticipated.

There is a low likelihood of occurrence and limited magnitude of these effects due to the application of mitigation measures.

3.5 Noise

3.5.1 Potential Effects

Construction and Decommissioning

The potential effects from construction and decommissioning activities are as follows:

- An increase in noise levels due to trucks, cranes and other equipment used to construct the turbines and ancillary infrastructure.

There is a high likelihood of occurrence of this effect; however, the magnitude of this effect will be limited due to the application of mitigation measures and the short-term nature of effects.

Operation

The potential effects from operational and maintenance activities include:

- An increase in noise levels due to the aerodynamic noise generated from wind turbine blades, and mechanical noise associated with each turbine and from the transformer located at the substation. Specifically, the noise modelling results show that the noise levels for all non-participating receptors are below 40 dBA.

There is a high likelihood of occurrence of this effect as these project components contribute to increased noise levels; however, the magnitude of this effect will be limited due to the application of mitigation measures and adherence to the 40 dBA threshold.

3.6 Local Interests, Land Use and Infrastructure

3.6.1 Existing Land Uses

Construction and Decommissioning

The potential effects from construction and decommissioning activities are as follows:

- Minor reduction in usable agricultural land; and
- Increased congestion due to an increase in truck traffic and short-term lane closures on local roads during delivery of project components.

There is a high likelihood of occurrence; however the magnitude of these effects will be limited due to the application of mitigation measures.

- Disruption or damage to local infrastructure such as roads, water and sewage pipelines.

There is a moderate likelihood of occurrence and moderate magnitude of these effects occurring due to the presence of oversize loads during delivery of turbine components.

Operation

The potential effects from operational and maintenance activities are as follows:

- Damage to crops or trees due to turbine malfunction or failure associated with 16 turbines that are located within 80 m of neighbouring property lines (refer to the Property Line Setback Assessment Report in the Design and Operations Report).

There is no likelihood of occurrence of this effect due to the application of mitigation measures.

- A minor reduction in usable farmland as a single turbine, together with its access road, will take up on average only 1.0 to 1.5% of a typical 40 hectare farm parcel.

There is a high likelihood of occurrence of this effect; however, the magnitude of this effect will be limited due to the application of mitigation measures and size of the overall footprint in relation to the entire Project Study Area.

- Reduction in aesthetic quality of landscape which may affect the use and enjoyment of private property and recreational amenities.

The likelihood of occurrence and magnitude of this effect is dependent upon the perception of residents and visitors to the presence of turbines.

3.6.2 Stray Voltage and Effects to Livestock

Construction and Decommissioning

Potential effects from stray voltage are not anticipated during the construction or decommissioning phase of the Project.

Operation

The potential effects from operational and maintenance activities are as follows:

- Mild electric shocks to livestock, which may cause behavioural changes, and changes in production performance.

At a voltage difference above about 10 volts, people may detect a tingle. This is not a health hazard to humans.

There is a low likelihood of occurrence and limited magnitude of this effect due to the application of mitigation measures.

3.7 Other Resources

Construction and Decommissioning

No effects on open or closed landfills, aggregate resources, forest resources or petroleum wells are anticipated as a result of the construction phase of the Project due to the distance between the Project and these resources. An Engineer's Report will be submitted to the MNR prior to construction to confirm that there are no effects on the one petroleum resource located within 75 m of Project infrastructure.

Operation

No potential effects on landfills or petroleum wells are anticipated as a result of the operation phase of the Project due to the distance between the Project and these resources.

3.8 Public Health and Safety

Construction and Decommissioning

Effects on public health and safety have been described in previous sections, including Emissions to Air, Noise, and Local Interests, Land Use and Infrastructure.

Operation

The potential effects from operational and maintenance activities are as follows:

- Ice formation on turbine blades resulting in ice shed; and
- Shadow flicker causing disturbance at nearby residences and businesses. Shadow flicker occurs when, at precise latitude, wind direction, and height of the sun, rotating wind turbine blades cast shadows upon stationary objects.

There is a low likelihood of occurrence and limited magnitude of these effects due to the application of mitigation measures.

3.9 Areas Protected Under Provincial Plans and Policies

The Project is not proposed in any protected or plan areas. As such, there are no potential effects on these areas as a result of the Project.

4. Summary and Conclusions

Field work and data collection were undertaken to determine the potential effects of this Project during the construction and operation / maintenance phases. Mitigation measures to manage these potential effects have been identified and monitoring and contingency plans proposed to ensure effects are minimized.

Significant adverse effects have been avoided through careful site selection, facility layout planning and strict adherence to all regulatory requirements. All turbines, access roads, and ancillary facilities have been sited with landowner consultation to minimize the impact to current agricultural operations.

The overall conclusion is that this project can be constructed, installed and operated without any significant adverse residual effects to the environment. Post-construction monitoring related to effects on wildlife, including birds and bats, will be undertaken to confirm this conclusion.

5. References

AECOM, 2012:
Draft Goshen Wind Energy Centre Construction Plan Report

AECOM, 2012:
Draft Goshen Wind Energy Centre Decommissioning Plan Report

AECOM, 2012:
Draft Goshen Wind Energy Centre Design and Operations Plan Report

AECOM, 2012:
Draft Goshen Wind Energy Centre Water Assessment and Water Body Report

AECOM, 2012:
Draft Goshen Wind Energy Centre Wind Turbine Specification Report

Ontario Ministry of the Environment, 2011:
Technical Guide to Renewable Energy Approvals. Available: http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/stdprod_088422.pdf