NextEra Energy Canada, ULC

Final Project Description Report – Bluewater Wind Energy Centre

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60155032

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Glossary of Terms

ABCA .... Ausable Bayfield Conservation Authority
DFO .... Federal Department of Fisheries and Oceans
GE .... General Electric
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 .... Bluewater Wind Energy Centre
REA .... Renewable Energy Approval
TC .... Transport Canada

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), 2001).

1.1 Name of Project and Applicant

Varna Wind, Inc., a wholly owned subsidiary of NextEra Energy Canada, ULC (NextEra) is proposing to construct a wind energy centre project in the Municipalities of Bluewater and Huron East in Huron County, Ontario. The project will be referred to as the Bluewater Wind Energy Centre (the “Project”) and will be located on private lands east of Highway 21 in the vicinity of the shoreline of Lake Huron (see **Figure 1-1**).

The Project will be owned and operated by Varna 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 is North America. In Canada, wind energy centres currently owned and operated by NextEra 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.

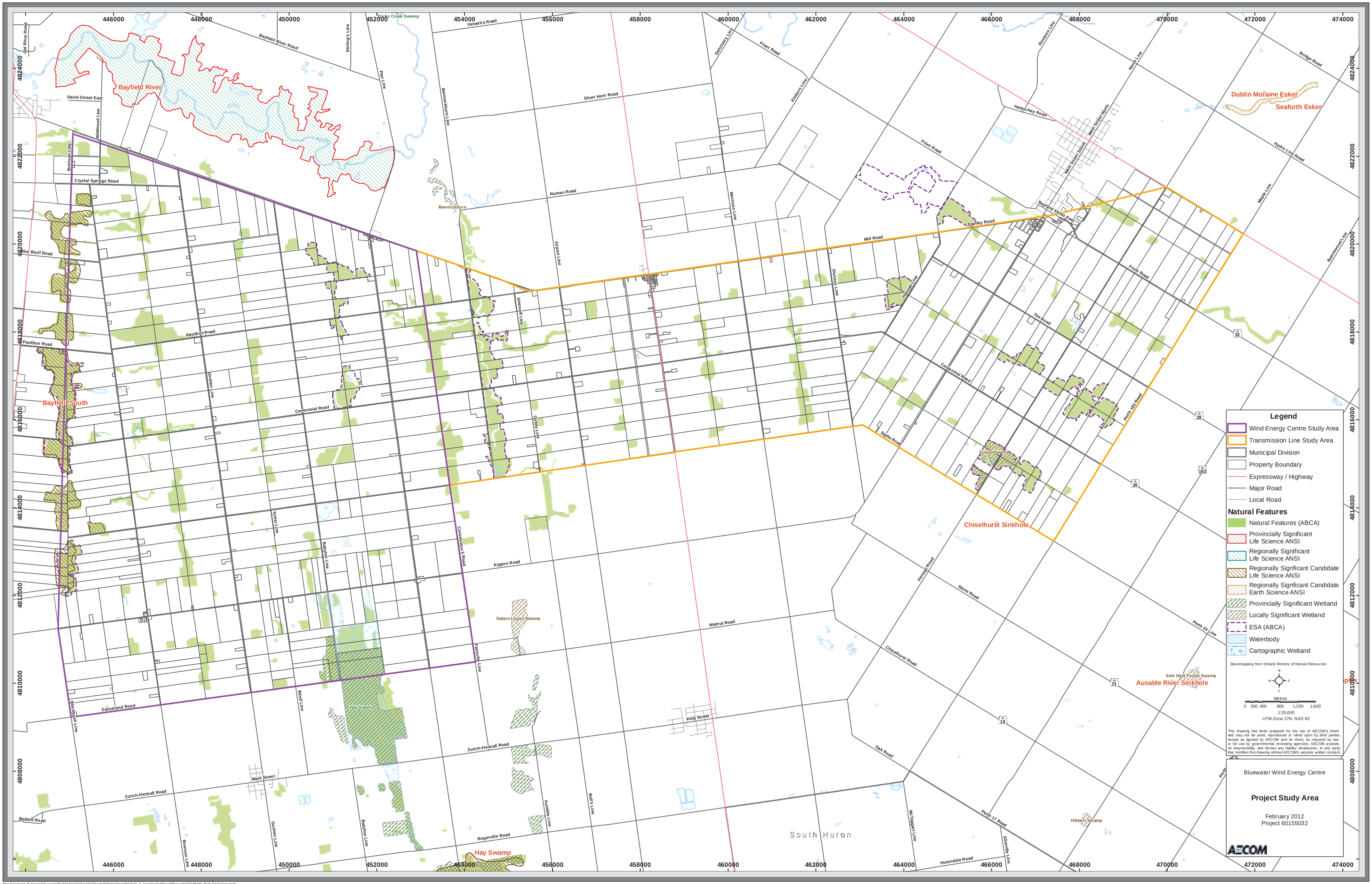
1.2 Project Study Area

The proposed Project is located in Huron County, within the Municipalities of Bluewater and Huron East (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 Blackbush Line/Bronson Line to the west, Mill Road to the north, Concession 5 Road to the east, and Danceland Road/Staffa Road to the south, in the Municipality of Bluewater. The Transmission Line Study Area is located to the east of the Wind Energy Centre Study Area, and is generally bounded by Concession 5 Road to the west, Mill Road to the north, Huron Road and Perth 183 Road to the east, and Staffa Road to the south, extending into the Municipality of Huron East.

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 coordinates define the external boundaries of the Study Area:

Longitude	Latitude
-81.680043	43.553413
-81.350138	43.534437
-81.402727	43.471275
-81.679229	43.433866


Legend
Wind Energy Centre Study Area
Transmission Line Study Area
Municipal Division
Property Boundary
Expressway / Highway
Major Road
Local Road
Natural Features
Natural Features (ABCA)
Provincially Significant Life Science ANSI
Regionally Significant Life Science ANSI
Regionally Significant Candidate Life Science ANSI
Regionally Significant Candidate Earth Science ANSI
Provincially Significant Wetland
Locally Significant Wetland
ESA (ABCA)
Waterbody
Cartographic Wetland
Basemapping from Ontario Ministry of Natural Resources
Metres
0 200 400 800 1,200 1,600
1:35,000
UTM Zone 17N, NAD 83
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Bluewater Wind Energy Centre
Project Study Area
February 2012
Project 60155032
AECOM
Bayfield River
Bayfield South
Hay Swamp
Chiselhurst Sinkhole
Ausable River Sinkhole
Dublin Moraine Esker
Seaforth Esker
South Huron

1.3 Land Ownership

The following table provides a legal description of the properties on which project infrastructure will be sited. All properties are privately owned and are under agreement with NextEra.

Legal Description
PT LT 12 CON 13 STANLEY; PT LT 13 CON 13 STANLEY AS IN R215471; MUNICIPALITY OF BLUEWATER
LT 23 CON 12 STANLEY; MUNICIPALITY OF BLUEWATER
LT 22 CON 12 STANLEY; MUNICIPALITY OF BLUEWATER
PT LT 21 CON 12 STANLEY AS IN R320291; MUNICIPALITY OF BLUEWATER
LT 20 CON 12 STANLEY; MUNICIPALITY OF BLUEWATER
LT 19 CON 12 STANLEY S/T RESERVATIONS OF MINES & MINERALS IN R321751; MUNICIPALITY OF BLUEWATER
LT 15 CON 12 STANLEY; MUNICIPALITY OF BLUEWATER
LT 14 CON 12 STANLEY; MUNICIPALITY OF BLUEWATER
PT LT 13 CON 12 STANLEY AS IN R238412; MUNICIPALITY OF BLUEWATER
PT LT 11 CON 12 STANLEY; PT LT 12 CON 12 STANLEY AS IN R290531; MUNICIPALITY OF BLUEWATER
PT LT 21 CON 11 STANLEY AS IN R292792; MUNICIPALITY OF BLUEWATER
PT LT 11 CON 11 STANLEY AS IN R227173; MUNICIPALITY OF BLUEWATER
LT 17 CON 12 STANLEY EXCEPT PT 1, 22R4966; PT LT 18 CON 12 STANLEY AS IN R291623; MUNICIPALITY OF BLUEWATER
LT 22 CON 10 STANLEY EXCEPT HWP2218; MUNICIPALITY OF BLUEWATER
LT 13 CON 9 STANLEY; PT LT 13 CON 10 STANLEY AS IN R223778; S/T HWP3174, SYA8975; MUNICIPALITY OF BLUEWATER
PT LT 11 CON 10 STANLEY AS IN R266555 EXCEPT PT 1, 22R3034; S/T HWP3162; MUNICIPALITY OF BLUEWATER
PT LT 20 CON 9 STANLEY AS IN R61381, R45916; S/T SYA8967; MUNICIPALITY OF BLUEWATER
S 1/2 LT 20 CON 9 STANLEY; S/T SYA8967; MUNICIPALITY OF BLUEWATER
LT 19 CON 9 STANLEY; MUNICIPALITY OF BLUEWATER
LT 18 CON 9 STANLEY; MUNICIPALITY OF BLUEWATER
N 1/2 LT 17 CON 9 STANLEY; MUNICIPALITY OF BLUEWATER
S 1/2 LT 17 CON 9 STANLEY; MUNICIPALITY OF BLUEWATER
N 1/2 LT 16 CON 9 STANLEY; MUNICIPALITY OF BLUEWATER
S 1/2 LT 16 CON 9 STANLEY; MUNICIPALITY OF BLUEWATER
LT 15 CON 9 STANLEY; MUNICIPALITY OF BLUEWATER
LT 11 CON 9 STANLEY; MUNICIPALITY OF BLUEWATER
LT 17 CON 8 STANLEY; MUNICIPALITY OF BLUEWATER
LT 13 CON 8 STANLEY; MUNICIPALITY OF BLUEWATER
PT LT 17 CON 7 STANLEY AS IN R337477 EXCEPT PT 1, 22R4033; MUNICIPALITY OF BLUEWATER
LT 12 CON 8 STANLEY; MUNICIPALITY OF BLUEWATER
PART LOT 21, CONCESSION 10 STANLEY AS IN R292792 SAVE & EXCEPT PART 1,PLAN 22R-5226; S/T HWP3168; MUNICIPALITY OF BLUEWATER
PT LT 8 CON 6 STANLEY AS IN R81217; MUNICIPALITY OF BLUEWATER
PT LT 9 CON 10 STANLEY AS IN R282117; S/T HWP3167; MUNICIPALITY OF BLUEWATER
PT LT 8 CON 10 STANLEY AS IN R238913, EXCEPT PT 1, 22R2244; S/T HWP3161 MUNICIPALITY OF BLUEWATER
PT LT 5 CON 10 STANLEY AS IN R177752; S/T HWP3159; MUNICIPALITY OF BLUEWATER
PT LT 10 CON 9 STANLEY AS IN R309032; MUNICIPALITY OF BLUEWATER
PT LT 9 CON 9 STANLEY; PT LT 10 CON 9 STANLEY AS IN R339460; S/T SYA9705; MUNICIPALITY OF BLUEWATER
LT 5 CON 9 STANLEY, EXCEPT SYC34; S/T HWP3178; MUNICIPALITY OF BLUEWATER
LT 4 CON 9 STANLEY; PT LT 3 CON 9 STANLEY AS IN R316339; S/T HWP3172 MUNICIPALITY OF BLUEWATER
LT 9 CON 8 STANLEY; MUNICIPALITY OF BLUEWATER
LT 6 CON 10 STANLEY , EXCEPT HWP2188; PT LT 7 CON 10 STANLEY; PT LT 7 CON 9 STANLEY; PT LT 6 CON 9 STANLEY AS IN R132371, EXCEPT R257525; S/T R132371; S/T INTEREST IN R132371; S/T HWP3164 MUNICIPALITY OF BLUEWATER
PT LT 8 CON 7 STANLEY AS IN R324514; MUNICIPALITY OF BLUEWATER
PT LT 9 CON 7 STANLEY AS IN R324514; MUNICIPALITY OF BLUEWATER
LT 17 SOUTH BOUNDARY CON STANLEY EXCEPT PT 1, 22R5793; PT LT 18 SOUTH BOUNDARY CON STANLEY; PT LT 16 SOUTH BOUNDARY CON STANLEY; PT LT 3 CON 9 STANLEY AS IN R312901; S/T HWP3173 MUNICIPALITY OF BLUEWATER
PT LT 26 CON SOUTH BOUNDARY STANLEY AS IN R311840; MUNICIPALITY OF BLUEWATER
PT LT 5 CON 13 STANLEY AS IN 218268; MUNICIPALITY OF BLUEWATER
PT LT 5 CON 13 STANLEY AS IN R324764; MUNICIPALITY OF BLUEWATER
PT LT 9 CON 12 STANLEY; PT LT 10 CON 12 STANLEY AS IN R80324 EXCEPT PT 2, 22R2180; MUNICIPALITY OF BLUEWATER
PT LT 8 CON 12 STANLEY AS IN R71651; MUNICIPALITY OF BLUEWATER

Legal Description
LT 4 CON 12 STANLEY EXCEPT PT 1, 22R3726; MUNICIPALITY OF BLUEWATER
LT 3 CON 12 STANLEY; MUNICIPALITY OF BLUEWATER
LT 23 CON SOUTH BOUNDARY STANLEY EXCEPT PT 1, 22R4493; MUNICIPALITY OF BLUEWATER
PT LT 6 CON 11 STANLEY AS IN R336608; MUNICIPALITY OF BLUEWATER
PT LT 10 CON 11 STANLEY AS IN R331180; MUNICIPALITY OF BLUEWATER
PT LT 25 NORTH BOUNDARY CON HAY; PT LT 24 NORTH BOUNDARY CON HAY AS IN R260942; MUNICIPALITY OF BLUEWATER
PT LT 27 CON 13 HAY AS IN R173289; S/T R173289; MUNICIPALITY OF BLUEWATER
LT 28 CON 13 HAY MUNICIPALITY OF BLUEWATER
PT LT 23 NORTH BOUNDARY CON HAY AS IN R227171; MUNICIPALITY OF BLUEWATER
PT LT 18 NORTH BOUNDARY CON HAY AS IN R326743; MUNICIPALITY OF BLUEWATER
PT LT 16 NORTH BOUNDARY CON HAY; PT LT 28 CON 9 HAY AS IN R203841 EXCEPT TRAVELLED RD; S/T HWP3254; MUNICIPALITY OF BLUEWATER
PT LT 26 CON 9 HAY; PT LT 27 CON 9 HAY; PT LT 28 CON 9 HAY AS IN R273071; S/T HWP3250; MUNICIPALITY OF BLUEWATER
LT 17 NORTH BOUNDARY CON HAY EXCEPT PT 1, 22R5294; MUNICIPALITY OF BLUEWATER

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

The wind turbine technology proposed for the Project is the 1.6 MW GE model wind turbine. With a total nameplate capacity of 60 MW, the Project is categorized as a Class 4 facility. The technical specifications for this model of turbine are detailed in Section 2.1.1 of this PDR and in the Wind Turbine Specification Report.

1.5 Key Contacts

Project Proponent	Project Consultant
Nicole Geneau Project Director NextEra Energy Canada, ULC 5500 North Service Road, Suite 205 Burlington, Ontario, L7L 6W6 Phone: 1-877-257-7330 Email: Bluewater.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

1.6 Other Approvals Required

It is anticipated that in addition to the REA, permits and certificates of approval may 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 from Transport Canada; a Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Permit from the Ausable Bayfield Conservation Authority (ABCA); and lastly, other permits or authorizations from the Ontario Ministry of Natural Resources (MNR) and Huron County.

1.7 Federal Involvement

It is not anticipated that a Federal Screening under the Canadian Environmental Assessment Act will be triggered; however, this will be confirmed once the Project layout has been finalized and the appropriate agencies have been consulted.

1.8 Commitments for Future Studies

NextEra has identified future studies that will need to be followed through 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).	Construction Plan; Section 2.2.2
4	Pre-Construction	Project Study Area	Develop a Traffic Management Plan using MTO Book 7 standards 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 3.6 Decommissioning Plan; Section 2.4
6	Pre-Construction	Disturbance Areas	Complete Stage 3 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: - Reptile hibernacula (RH-01 and RH-02); • Bat maternity colonies (BMA-02, BMA-03, BMA-10, BMA-12 and BMA-14); • Amphibian woodland breeding habitat (AWO-03, AWO-04, AWO-05, AWO-06 and AWO-08); and • Amphibian wetland breeding habitat (AWE-01).	Construction Plan; Section 3.2 Design & Operations; Section 6.2
8	Pre-Construction	Disturbance Areas Features WET-01 / VAL-01 / WET-01/ WET-04 / WET-05/ WET-06/ WET-12 / WET-13	Develop an erosion and sediment control plan.	Construction Plan; Section 3.2.2.1/3.2.2.2
9	Pre-Construction	Disturbance Areas	Develop a Spill Response Plan.	Construction Plan; Section 3.2.2.1 Design & Operations; Section 6.2.1/6.3.2.1
10	Construction	Disturbance Areas	Undertake active nest surveys if clearing of vegetation cannot be avoided during breeding season for migratory birds.	Construction Plan; Section 3.2.2.1
11	Pre- and Post-Construction	Project Study Area	Undertake roads condition survey pre- and post-construction.	Construction Plan; Section 3.6.2

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 41 1.6 MW GE model wind turbine generator locations and pad mounted step-up transformers are proposed for permitting (a maximum of 37 turbines will ultimately be constructed);
- Laydown and storage areas (including temporary staging areas, crane pads and turnaround areas surrounding each wind turbine);
- Approximately 52 km of 34.5 kV underground electrical collection lines to connect the turbines to the proposed transformer substation;
- Approximately 24 km of 115 kV transmission line proposed along Centennial Road and Hensall Road from the proposed transformer substation to the existing Hydro One Seaforth Transformer Station;
- Approximately 40 km of turbine access roads; and
- An operations and maintenance building.

The project components, in addition to the Disturbance Area, as shown on Figure 2-1, occupy approximately 263 hectares (650 acres) of land in the Municipalities of Bluewater and Huron East.

2.1.1 Turbine Specifications

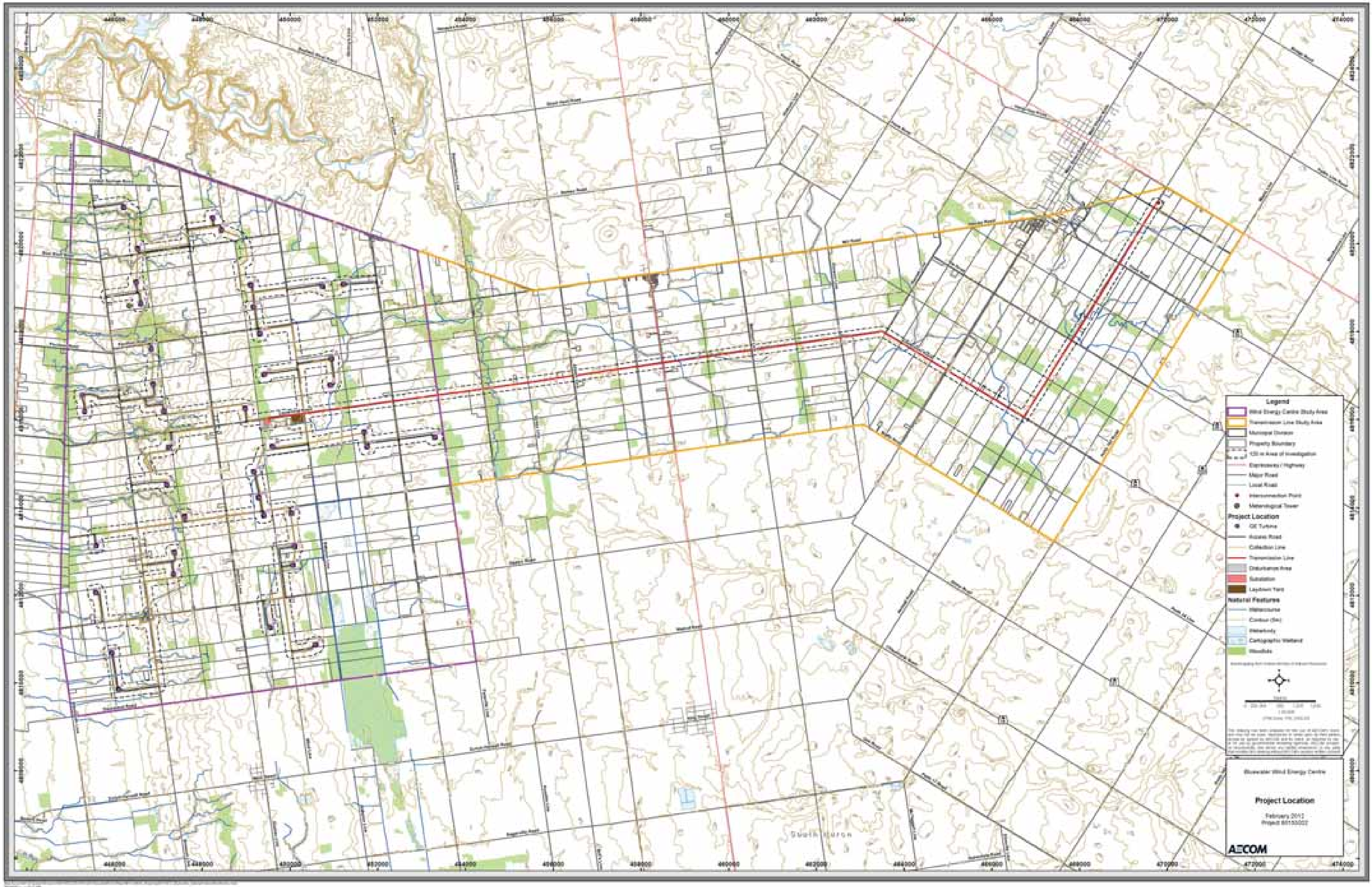
The 1.6 MW GE model wind turbines are 3-bladed, upwind, horizontal-axis wind turbines that are state of the art technology. The turbines have a 100 m rotor diameter with a swept area of 7,854 m; each blade is connected to the main shaft via the hub. The turbine is mounted on an 80 m tubular steel tower which contains an internal ladder for maintenance access. The turbine will be constructed on a foundation that is approximately 400 m^2. The foundation consists of a wooden frame, 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).

A summary of the turbine specifications is provided in **Table 2-1** below. Please refer to the Wind Turbine Specification Report for further information.

Table 2-1 Summary of Turbine Specifications

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



Legend
Wind Energy Centre Study Area
Transmission Line Study Area
Municipal Division
Property Boundary
120 m Area of Investigation
Expressway / Highway
Major Road
Local Road
Interconnection Point
Meteorological Tower
Project Location
GE Turbine
Access Road
Collection Line
Transmission Line
Disturbance Area
Substation
Laydown Yard
Natural Features
Watercourse
Contour (5m)
Waterbody
Cartographic Wetland
Woodlots
South Huron
Bluewater Wind Energy Centre
Project Location
February 2012
Project 60155022
AECOM

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.

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 on private property adjacent to the turbine access roads, where feasible. The locations of the underground cables and access roads were determined in consultation with the landowners and in accordance the setback requirements defined in O. Reg. 359/09.

2.1.4 Electrical Transmission

The 115 kV electrical transmission line that will be built from the transformer substation to the connection point at the Hydro One Seaforth Transformer Station is proposed to be located within the existing road right-of-ways along Centennial Road and Hensall Road in the Municipalities of Bluewater and Huron East. It is anticipated that the transmission line will be mounted on new hydro 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.

2.1.5 Transformer Substation

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 Varna 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 to the Seaforth Transformer Station via the above-ground transmission line proposed along Centennial Road and Hensall Road. 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.

A secondary containment system will be installed to capture any leaks from the transformer. Water in the containment system will be visually inspected for any evidence of oil (as oil would float to the top). If oil is present, a tank truck will be brought to site to pump the water/oil mix into it. The water/oil mix will then be disposed of off-site at a licensed facility. If no oil is detected in the water, the water will be pumped out to an adjacent swale and then allowed to infiltrate into the ground.

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 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.

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

Two permanent meteorological towers will be installed at the Project. These are typically up to 80 m in height. No significant soil or vegetation disturbance is anticipated. The use of meteorological data is 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 icing conditions; and
- Turbine shut down during extreme weather events.

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.

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 activities anticipated 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 Bluewater Wind Energy Centre is expected to begin in approximately May 2013 and last for approximately 6 months. **Table 2-2** presents the 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	< 1 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
Temporary Crane Paths		Late spring or summer – preference is to conduct during drier months	One to two days
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		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

Surveys will be required to locate the turbines, crane pads, access roads, electrical lines and the substation. Crews will drive light trucks to reach sites primarily using existing roads. They will then walk the site for the surveying and mark the locations using stakes. For the wind energy centre site, the surveys will typically take one to two days per turbine location.

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 will be conducted in compliance with the mitigation measures outlined in the Construction Plan Report.

2.2.2.2 Land Clearing and Construction of Access Roads

Access roads will be constructed to transport equipment to the construction sites. Typically the access roads will be 11 m wide to accommodate the large cranes (with an additional 2 m clearance on each side for travel). The road length will be different for each turbine according to its location.

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 steel 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 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) as part of their permitting process; however, the culverts are proposed to be open bottom and left in place following the operation phase.

Temporary crane paths will also be constructed. These will be 11 m wide and constructed in a manner similar to the other roads described above. Once the construction activities have been completed, the granular base 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 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.

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). Following clearing and grubbing of any vegetation, the topsoil at the Construction 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. Construction activities are expected to last approximately one week and will require 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 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.

2.2.2.4 Turbine Site and Crane Pad Construction

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 material 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 described in the Construction Plan Report.

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 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.

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 Traffic Management Plan will be developed using MTO Book 7 standards and will be provided to Huron County. 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 a wooden frame, 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. 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 to 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.

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. 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.

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 and a buried collection system running along turbine access roads and 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 on private property adjacent to the turbine access roads, where feasible. 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. 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.

2.2.2.9 Construction of Electrical Transmission Line

Holes for new hydro 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 1 to 2 m below grade and “dressed” (made ready to accept conductors) using a boom truck. 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. 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. 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.

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.

Equipment will include, at a minimum, a truck mounted crane, flatbed trailers and a truck mounted auger. 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.

2.2.2.10 Construction of Transformer Substation

During construction of the substation, 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. 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, forklifts, concrete trucks 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.

2.2.2.11 Construction of Operations and Maintenance Building

Potable water will be supplied by a well or through the municipal water system and if required, 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. Both will be constructed in accordance with applicable municipal and provincial standards. 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.

2.2.2.12 Construction of Permanent Meteorological Towers

The towers will be erected using winches and secured with three guy wires tied off to anchors or a small monopole foundation. No significant soil or vegetation disturbance is anticipated. Construction of the 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 licensed facility.

Temporary portable generator sets may be used to electrically commission the turbines prior to connection to the grid. The generators are required for approximately one day per turbine. The generators are supplied with a Certificate of Approval to the owners. 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.

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.

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 involves removing the turbine from service and having two to three wind 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 is cleaned up. All surplus lubricants and grease-soaked rags are removed and disposed 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 technician 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, will need to be rebuilt to carry out repairs to a damaged turbine. Typically only a small percentage of turbines will 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.

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, but in reverse order. More detailed information on decommissioning is located in the Decommissioning Plan Report.

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. 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.
7. Cutting underground electrical lines, burying the ends to 1 m below grade, and leaving the lines in place. Above-ground lines and poles that are not shared with Hydro One will be removed (or sold to an acceptable Transmission/Distribution Operator) and the holes will be filled with clean fill.

8. The demolition of the substation 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 and Water 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 practical, the original contour prior to construction of the wind turbines and access roads. Existing agricultural capacity will be restored and the land re-contoured 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 impacts have occurred. Should soil impacts 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.

2.2.4.3 Procedures for Managing Waste Materials 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 and Design and Operations Report.

As outlined previously, the procedures for decommissioning will be similar to the construction phase, but in reverse order. 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 are as follows:

- Disturbance or displacement of 4 archaeological resources (i.e., historic Euro-Canadian sites) identified through the Stage 2 Archaeological Assessment due to construction of project infrastructure.

There is a low likelihood of occurrence and limited magnitude of this effect 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 are as follows:

- Increased erosion, sedimentation and turbidity 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, temporary crane paths and 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;
  - directional drilling for construction of collection lines;
- 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, temporary crane paths and 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, temporary crane paths and pads/turnaround areas, collection lines, transmission line, operations building and substation;
- Disturbance to or loss of wildlife habitat from construction of turbines, access roads, temporary crane paths and pads/turnaround areas, collection lines, transmission line, operations building and substation;
- Damage to vegetation while operating equipment used in construction of turbines, access roads, temporary crane paths and 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, temporary crane paths and pads/turnaround areas, collection lines, transmission line, operations building and substation; and
  - 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”; and
- Changes in surface water drainage patterns (e.g. obstruction of lateral flows in surface water to wetlands) from construction of turbines, access roads, temporary crane paths and 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.

Operation

The potential effects from operational and maintenance activities on generalized candidate significant wildlife habitat are as follows:

- Disturbance and/or mortality to wildlife from operation of roads;
- Soil / water contamination by oils, gasoline, grease and other materials (e.g., turbine lubricant and maintenance personnel); and
- Changes in surface water drainage patterns 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.

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 are as follows:

- Disturbance to or loss of wildlife habitat and damage to vegetation while operating equipment within significant wetlands and / or woodlands.

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

- Noise disturbance to bats during turbine construction.
- Sedimentation and erosion affecting function of significant wetland (Feature WET-01).
- Sedimentation and erosion affecting function of significant valleyland (Feature VAL-01).
- Disruption of amphibians moving to breeding pools and home range from Amphibian Woodland Breeding Habitat Features and Amphibian Wetland Breeding Habitat Features and possible indirect threats by changes to surface water drainage patterns.
- Accidental intrusion into Features RH-01 and RH-02 resulting in habitat damage, or possible mortality to reptiles within feature from construction equipment.
- Unplanned intrusion into significant woodlands in event of equipment malfunction due to directional drilling.

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

- Sedimentation and erosion associated with directional drilling affecting function of significant Wetland Complexes.
- Sedimentation and erosion associated with transmission line construction affecting function of significant Wetland Complexes.
- Unplanned intrusion into significant wetlands in event of equipment malfunction due to directional drilling.
- Unintended damage to adjacent vegetation within significant wetlands and woodlands due to transmission line construction.

There is a low likelihood of occurrence of these effects due to the application of mitigation measures; however, if accidental damage occurred, negative effects may be measurable but would represent a small change relative to existing conditions.

Operation

Potential effects from operational and maintenance activities on Significant Wetlands, Woodlands, Valleylands or Wildlife Habitat are as follows:

- Bats may be disturbed by noise from operations;
- Risk of bird collisions with turbines; and
- Risk of bat collisions with the turbine.

These effects will be minimized through the application of mitigation measures. The significance of any effects will be determined based on the results of the monitoring plans.

- Changes in surface water drainage patterns resulting in effects to soil moisture and species composition of vegetation;
- Risk of mortality to amphibians moving between breeding pools and home range on the access roads related to amphibian woodland breeding habitat and amphibian wetland breeding habitat; and,
- Reptile hibernacula mortality from vehicles using the access roads (Features RH-01 and RH-02).

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

3.3 Surface Water and Groundwater

3.3.1 Surface Water

Construction and Decommissioning

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

- Obstruction of lateral flows in watercourses from water crossings.

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

- Reduced stream baseflows, groundwater upwelling areas and increase in water temperatures due to discharge from dewatering activities (if required) for excavation of foundation area at water body locations;
- Increased flows to watercourses from temporary groundwater dewatering (if required) discharges for excavation of foundation causing streambed and/or bank erosion and downstream sedimentation if not managed properly at water body locations;
- Increased erosion, sedimentation and turbidity from:
  - clearing and grubbing for construction of turbines, and pads/turnaround areas at water body locations;
  - clearing and grubbing for construction of access roads, temporary crane paths and pads/turnaround areas at water body locations for road crossings and for roads within a water body buffer; and
  - directional drilling activities at water body locations for collection line crossings and for collection lines within a water body buffer;
- Soil compaction, which may result in hardening of surfaces and increased runoff into watercourses from turbine construction at water body locations;
- Release or discharge of sediment laden surface water into the adjacent watercourse or drainage features transporting nutrients and contaminants into the watercourse from:
  - turbine construction at water body locations;
  - road crossings at water body locations and for roads within a water body buffer; and
  - collection line crossings at water body locations and for collection lines within a water body buffer;
- Increase sediment runoff and decrease bank stability from stream diversion for the installation of watercourse crossing resulting in changes in water chemistry and temperature; and
- Soil/water contamination by oils, grease and other materials from construction equipment at:
  - water body locations for road crossings and for roads within a water body buffer; and
  - water body locations for directional drilling of collection line crossings and for collection lines within a water body buffer.

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 at water body locations.

This effect will be minimized through the application of mitigation measures; however, there remains a moderate likelihood of occurrence and moderate magnitude of effect due to the number of water crossings.

- Degradation of fish habitat for water crossings at water body locations.

The magnitude of this effect is limited due to the application of mitigation measures; however, there remains a moderate likelihood of occurrence due to the number of water crossings.

- Fractures in substrate releasing pressurized drilling fluids into watercourse and causing potential change to groundwater flow patterns at the following collection line crossings for water body locations.

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

Operation

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

- Obstruction of lateral flows in watercourses and other waterbodies from water crossings.

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

- Water contamination by oils, gasoline, grease and other materials (e.g., turbine lubricant and maintenance activities, use of access roads) at watercourses due to their proximity to the project; and,
- Increase in impervious surfaces from the presence of turbine foundation and access roads, resulting in increased water temperatures, increased surface runoff and stream peak flows.

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 activities are as follows:

- Formation of sinkholes during foundation construction.

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

- Dewatering when excavating and constructing the turbine bases, resulting in a reduction in quality and quantity of groundwater.

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

- Increase in impervious area created by the turbine base and access roads resulting in reduced infiltration near to the noted groundwater recharge areas (beach ridge and glacial outwash deposits).

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

Operation

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

- Increase in impervious surfaces from presence of turbine foundations overlaying high permeability surficial materials (such as: sands, gravels and silty sands) and access roads, resulting in reduced infiltration to groundwater.
- Groundwater contamination by oil, gasoline, grease or other material from construction activities

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

Construction and Decommissioning

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

- 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 (CO2, methane).
- Dust as a result of vehicle traffic over gravel roads and/or cleared areas.

There is a high 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.

Operation

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

- Emissions of contaminants from maintenance vehicles, including but not limited to, nitrogen dioxide, sulphur dioxide, suspended particulates, emission of greenhouses gases (CO2, methane).
- Dust as a result of vehicle traffic over gravel roads and/or cleared areas.

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

3.5 Noise

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 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.
- Increased congestion due to 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. The overall footprint of the reduction in agricultural land will be relatively minor in comparison to the entire Project Study Area. Congestion effects will be limited due to the size of the Project Study Area and dispersed nature of construction/decommissioning, while the duration of lane closures will be short-term.

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

This effect will be minimized through the application of mitigation measures; however there remains a moderate likelihood of occurrence and moderate magnitude of effect due to the presence of oversize loads during the delivery/removal 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 9 turbines that are located within 80 m of neighbouring property lines (refer to 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.

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 potential effects on aggregate resources or petroleum wells are anticipated as a result of the construction or decommissioning phase of the Project due to the distance between the Project and these resources. In addition, there are no effects on landfills or forest resources as none are present.

Operation

No potential effects on aggregate resources or petroleum resources are anticipated as a result of the operation of the Project due to the distance between Project components 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.
- 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 was undertaken to determine the potential effects to the various environmental and social features that may be affected by this Project during the construction and installation phase. 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.