NextEra Energy Canada, ULC

# Project Description Report – East Durham Wind Energy Centre

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## Glossary of Terms

DFO .....Federal Department of Fisheries and Oceans
GE.....General Electric
kV.....Kilovolt
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.....East Durham Wind Energy Centre
REA.....Renewable Energy Approval
SVCA .....Saugeen Valley Conservation Authority
TC .....Transport Canada
V .....Volt

# 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

East Durham Wind, Inc., a wholly owned subsidiary of NextEra Energy Canada, ULC (NextEra), is proposing to construct a wind energy project in the Municipality of West Grey, Grey County, Ontario. The Project will be referred to as the East Durham Wind Energy Centre (the "Project") and will be located on private lands east of the Community of Durham and west of the Village of Priceville.

The Project will be owned and operated by East Durham 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 100 wind energy projects in North America. Wind farms 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 the Municipality of West Grey, east of the Community of Durham and west of Village of Priceville within Grey County. The Project Study Area consists of the area being studied for the wind farm components (Wind Energy Centre Study Area). The Wind Energy Centre Study Area is generally bounded by:

- → Concession Road 6 to the north
- → Sideroad 40, Townline Artemesia-Glenelg and Sideroad 50 to the east
- → The West Grey – Southgate municipal boundary to the south
- → Baseline to the west

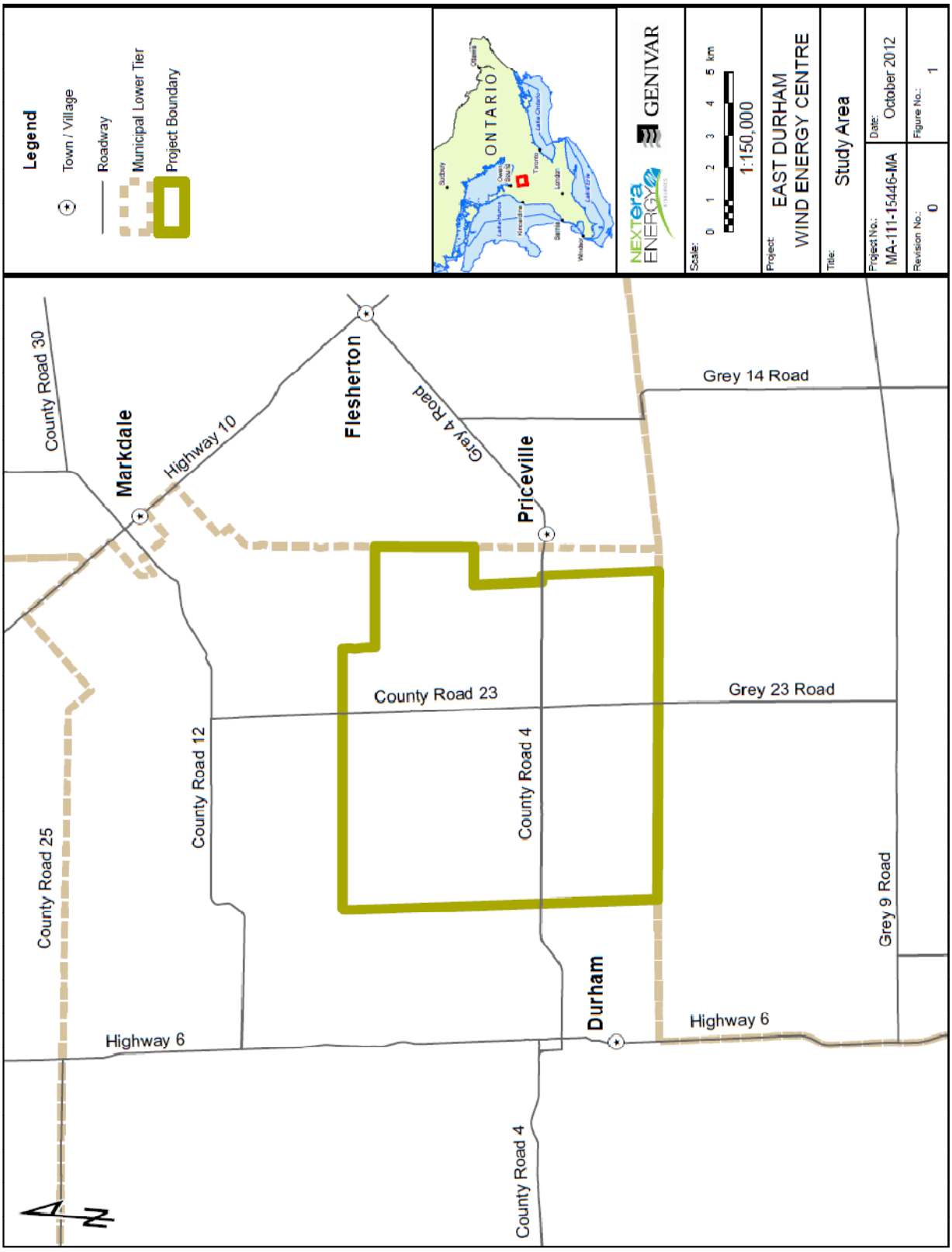
The location of the Project Study Area was defined early in the planning process for the proposed wind energy facility, based on the availability of wind resources, approximate area required for the proposed project, and availability of existing infrastructure for connection to the electrical grid. The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

The following co-ordinates define the external boundaries (corners) of the Project Study Area, as shown in **Figure 1-1**:

| Study Area Corner | Easting NAD83 UTM17 | Northing NAD83 UTM17 |
|---|---|---|
| Northwest | 517446 | 4898788 |
| Northeast | 528740 | 4899612 |
| Southeast | 529409 | 4890833 |
| Southwest | 519266 | 4889235 |

Some sections of electrical collection line are expected to be located in the municipal right-of-way. The electrical substation will be located on privately owned lands with lease arrangements.

**Figure 1-1 Project Study Area**



## 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.

| Infrastructure Type | Legal Description |
|---|---|
| T10, Collection Line, Access Road | PT LT 20 CON 1 SDR GLENELG; PT LT 19-20 CON 2 SDR GLENELG PT 1 & 2 17R2360 & PT 1 16R8532; S/T GS160110; WEST GREY |
| T2, Collection Line, Access Road | LT 28 CON 2 NDR GLENELG EXCEPT PT 1 17R3090 & PT 1 16R6477; PT LT 29-30 CON 2 NDR GLENELG PT 1 17R2968 & AS IN GS70768 EXCEPT PT 2 17R807 & PT 1 & 2 17R2787; S/T DEBTS IN GS70768; S/T INTEREST IN GS70768; WEST GREY |
| T4, T3, T5, Collection Line, Access Road | PT LT 21-27 CON 1 NDR GLENELG AS IN R428714; WEST GREY |
| T14, Collection Line, Access Road | LT 25 CON 4 NDR GLENELG; WEST GREY |
| T12, T15, Collection Line, Access Road | LT 24 CON 4 NDR GLENELG; PT LT 23 CPN 4 NDR GLENELG AS IN R502326; WEST GREY |
| T7, Collection Line, Access Road | PT LT 34 CON 1 NDR GLENELG AS IN R434625, PT 1 16R5178; WEST GREY |
| T6, Collection Line, Access Road | PT LT 31-33 CON 1 NDR GLENELG AS IN GS94959, PT 4 16R5177, EXCEPT GL3416 & GL12567 MUNICIPALITY OF WEST GREY |
| T11, Collection Line, Access Road | PT LT 35 CON 1 SDR GLENELG AS IN R508782, S/T INTEREST IN GS70896; WEST GREY |
| T13, Collection Line, Access Road | LT 48-49 CON 2 SDR GLENELG; WEST GREY |
| T16, T17, Collection Line, Access Road | PT LT 43-45 CON 1 SDR GLENELG AS IN GS128681; WEST GREY |
| MET 1, T1, Collection Line, Access Road | LT 21-23 CON 2 NDR GLENELG EXCEPT PT 1-8 17R2606; WEST GREY |
| T8, Collection Line, Access Road | LT 39-40 CON 1 NDR GLENELG; PT LT 37-38 CON 1 NDR GLENELG AS IN GS44871, EXCEPT R419249, PT 1 17R439, PT 2 17R945 LYING S OF PT 4 16R5178; WEST GREY |
| Laydown Area | PT LT 46 CON 1 NDR GLENELG PT 1 16R9271; WEST GREY |
| MET 2, Collection Line, Access Road | PT LT 46 CON 1 NDR GLENELG PT 1 16R9271; WEST GREY |
| Substation | PT LT 28 CON 1 NDR GLENELG AS IN R470379; WEST GREY |

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

This facility will convert wind energy into electricity to be fed into the Hydro One grid. The wind turbine technology proposed for this Project is the GE 1.6-100 model wind turbine. With a total maximum nameplate capacity of up to 23 MW, the Project is categorized as a Class 4 facility. The project consists of up to 16 GE model wind turbines (14 turbines are 1.6-100 models (1.62 MW), Turbine 6 is a 1.34-100 model (1.34 MW) and Turbine 2 is 1.39-100 model (1.39 MW); 16 wind turbine generator locations and pad mounted step-up transformers are proposed for permitting, though a maximum of 14 turbines and associated pad mounted step-up transformers will ultimately be constructed. The sound power level of the turbine model is expected to be greater than 102 dBA. The technical specifications for this model of turbine are detailed in Section 2.1.1 of this Project Description Report and in the Wind Turbine Specification Report (Appendix A).

## 1.5 Key Contacts

| Project Proponent | Project Consultant |
|---|---|
| Derek Dudek<br>Community Relations Consultant<br>NextEra Energy Canada, ULC<br>390 Bay St, Suite 1720<br>Toronto, ON M5H 2Y2<br>Phone: 1-877-257-7330<br>Email: EastDurham.Wind@NextEraEnergy.com<br>Website: www.NextEraEnergyCanada.com | Patricia Becker, MES<br>Project Manager (Energy)<br>GENIVAR Inc.<br>5th Floor, 600 Cochrane Drive<br>Markham, Ontario, L3R 5K3<br>Phone: 905-713-2837<br>Email: pat.becker@genivar.com |

## 1.6 Other Approvals Required

It is anticipated that in addition to the Renewable Energy Approval (REA), the East Durham Wind Energy Centre Project will need a Notice to Proceed from the Ontario Power Authority, building permits and road use / entrance permits from the Municipality of West Grey and Grey County, permits from the Electrical Safety Authority (ESA) and the Ontario Energy Board (OEB), an Oversize/Overweight Permit from the Ontario Ministry of Transportation (MTO); Archaeological Clearance and Heritage Clearance from the Ontario Ministry of Tourism, Culture and Sport (MTCS); Interference with Wetlands and Alterations to Shorelines and Watercourses Permits from the Saugeen Valley Conservation Authority (SVCA) and other permits or authorizations from the Ontario Ministry of Natural Resources (MNR) and Grey County.

## 1.7 Federal Involvement

There is no expectation for any federal environmental assessment under the Canadian Environmental Assessment Act. Nor is there any expectation for the requirement of federal permits or approvals under the Fisheries Act or Species at Risk Act or the Navigable Waters Protection Act. There will be a requirement for an Aeronautical Obstruction Clearance from Transport Canada for turbine lighting. In addition, a Land Use Clearance will be required from NAV CANADA for aeronautical safety.

## 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 Saugeen Valley Conservation Authority (SVCA). | Construction Plan; Section 2.2.2 |
| 4 | Pre-Construction | Project Study Area | Develop a Traffic Management Plan and provide to | Construction Plan; |

## Table 1-1 Commitments for Future Studies

| No. | Timing of Commitment | Location within the Project | REA Commitment | REA Report Reference |
|---|---|---|---|---|
| | | | Grey County and Municipality of West Grey. | 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 decommissioning. | Decommissioning Plan; Section 2.4 |
| 6 | Pre-Construction | Disturbance Areas | Complete Stage 3 Archaeological Assessment (and Stage 4 if necessary) 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 |
| 8 | Pre-Construction | Disturbance Areas | 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 |
| 12 | Pre- and Post-Construction | Disturbance Areas | Undertake bird and bat monitoring as required by MNR. | Construction Plan; Section 3 Design & Operations; Section 6 Appendix B |

# 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 16 GE model wind turbines (14 turbines are 1.6-100 models (1.62 MW), Turbine 6 is a 1.34-100 model (1.34 MW) and Turbine 2 is 1.39-100 model (1.39 MW); 16 wind turbine generator locations and pad mounted step-up transformers are proposed for permitting, though a maximum of 14 turbines and associated pad mounted step-up transformers will ultimately be constructed;
- Turbine laydown and storage areas (including temporary staging areas, crane pads and turnaround areas surrounding each wind turbine);
- Construction laydown area (including staging areas for construction materials, construction trailers and associated facilities and a temporary electrical service line to provide power to the construction trailers);
- Approximately 28.3 km of 34.5 kV underground electrical collection lines and ancillary equipment (e.g., above ground electrical junction boxes) to connect the turbines to the proposed transformer substation;
- Pad mounted 690 V/ 34.5 kV step up transformers located at or near the base of each turbine;
- A transformer substation to connect to the Hydro One distribution system;
- Overhead 44 kV line to connect the transformer substation to the Hydro One electrical grid;
- Approximately 13.8 km of turbine access roads;
- An operations and maintenance building (located outside the project location – shared use of land and building approved and currently operational for the Conestogo Wind Energy Centre); and
- One to two meteorological towers.

The major project components, in addition to the disturbance area, as shown on Figure 2-1, occupy approximately 122 hectares (300 acres) of land in the Municipality of West Grey.

### 2.1.1 Turbine Specifications

The wind turbine technology proposed for this Project is the GE 1.6-100 model with 14 turbines 1.62 MW, 1 1.34 MW and 1 1.39 MW for a total maximum nameplate capacity of up to 23 MW.

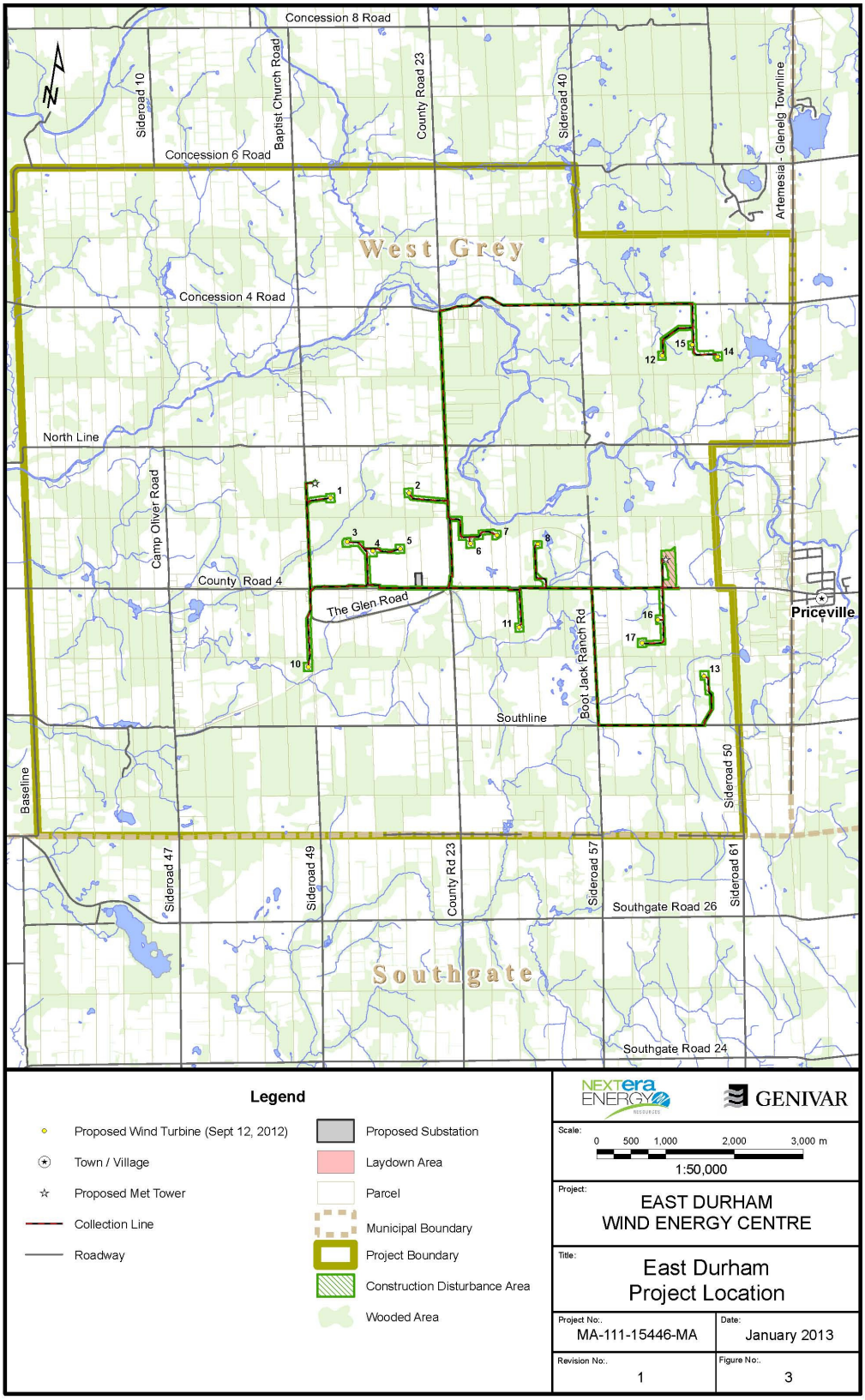
The wind turbines are 3-bladed, upwind, horizontal-axis wind turbines that are state of the art technology. The turbines have a 100 m rotor diameter with a swept area of 7,854 $m^2$; each blade is connected to the main shaft via the hub. The nacelle houses the main components of the wind turbine such 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).

The following table provides a description of the GE 1.6-100 MW model wind turbine that will be used for the Project.

## Summary of Technical Specifications

| Specification | Turbine | Turbine | Turbine |
|---|---|---|---|
| **Make** | General Electric | General Electric | General Electric |
| **Model** | 1.34-100 | 1.39-100 | 1.6-100 |
| **Name Plate Capacity** | 1.34 MW | 1.39 MW | 1.62 MW |
| **Hub Height** | 80 m | 80 m | 80 m |
| **Rotor Diameter** | 100 m | 100 m | 100 m |
| **Minimum Rotational Speed** | 9.75 rpm | 9.75 rpm | 9.75 rpm |
| **Maximum Rotational Speed** | 12.8 rpm | 13.2 rpm | 15.33 rpm |

## Figure 2-1 Project Location



### 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. 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.

An 8 hectare (22 acre) site will be constructed for the temporary storage of construction material and as a site for the construction office trailers. The Draft REA documents (October 2012) identified the laydown area in the same location however the size was 6 hectares. This has been increased to the 8 hectare size to include the land that was previously set aside for the substation at this location.

The Construction laydown area will include staging areas for construction materials, construction trailers and associated facilities and a temporary electrical service line to provide power to the construction 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. Typical equipment for the construction of the laydown area includes trucks, graders, and bulldozers. It is anticipated it will take 1 week to construct the laydown area by a crew of six people.

### 2.1.3 Electrical System

The electrical collection system from each turbine to the step-up transformer station will be buried on private property adjacent to the turbine access roads, where feasible; otherwise the collection lines will be buried in the municipal right-of-ways. The location of the underground cables and ancillary equipment (e.g., above ground electrical junction boxes) to connect the turbines to the proposed transformer station and access roads were determined in consultation with the landowners and also respect the setback requirements defined.

A 44 kV electrical line will connect the transformer substation to the existing Hydro One 44 kV line (which is located on the south side of Grey Road 4). This electrical line will extend from the substation A-frame pull-off structure to the 44 kV line located along the south side of the municipal road right-of-way. This will include a number of poles on the south side of Grey Road 4 that the conductor strings across Grey Road 4.

Temporary power (for electrical service to the construction trailers) will likely come from the corner of the substation, where the distribution line crosses Grey Road 4. It is likely that 11 m high wood poles will be constructed for the temporary power.

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.

### 2.1.4 Transformer Substation

The electricity collected via the 34.5 kV underground collection lines will converge at the transformer substation where it will be stepped up from 34.5 kV to 44 kV. A 44 kV electrical line (approximately 300 m in length) will connect the transformer to the Hydro One distribution system using standard poles within the municipal road right-of-way (as described above in sub-section 1.5.3). Above ground electrical junction boxes will be used to connect the

turbines to the proposed transformer station. An electrical service line will be connected to the local distribution lines in order to provide electrical power to the substation control housing.

Requiring approximately two hectares in size, the East Durham transformer substation will either be located on privately held lands through a lease agreement or on land purchased by East Durham Wind, Inc. The Draft REA documents (October 2012) located the substation on the same property as the laydown area on Grey Road 4. The substation has now been relocated farther west along Grey Road 4 (west of County Road 23) to be more central to the project infrastructure. Refer to Figure 2-1 for the modified location of the substation.

The substation equipment will include an isolation switch, a circuit breaker, a step-up power transformer (34.5 to 44 kV), switch gear, instrument transformers, grounding and metering equipment. All substation grounding equipment will meet the Ontario Electrical Safety Code. The substation will be surrounded by a chain link fence with a locked gate to permit authorized entry and required signage.

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.

### 2.1.5 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).

### 2.1.6 Operations and Maintenance Building

An operations building will be located outside of the project study area and will have the purpose of monitoring the day-to-day operations of the wind energy centre and supporting maintenance efforts. This Project will utilize the building developed and approved for the Conestogo Wind Energy Centre. The operations and maintenance building currently utilized by the Conestogo Wind Energy Centre has been sited and sized to also monitor the East Durham Wind Energy Centre.

### 2.1.7 Permanent Meteorological Towers

One to two permanent meteorological towers will be installed at the Project. These are typically up to 80 m in height and use either a monopole or lattice structure with support guy wires. 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.

The Draft REA documents (October 2012) identified the location of one of the proposed meteorological towers. The second proposed meteorological tower (if required) has now been sited on the north end of the property proposed for the laydown area (Grey Road 4). Refer to Figure 2-1 for the location of both proposed 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. The decision on whether to construct one or two meteorological towers will be based on IESO requirements.

### 2.1.8 Communications and SCADA

A communication line connects each turbine to the Operations and Maintenance 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-ordinate for safe, secure and reliable operation.

### 2.1.9 Water Crossings

To the extent possible, Project infrastructure will be sited to minimize the number of water crossings. As most of the wind turbines are likely to be located on agricultural lands, most of the access roads and electrical cables will also be on agricultural fields where fewer watercourses will be encountered. 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 Project will be composed of the following general activities:

1. Land acquisition
2. Planning and Resource Assessment
3. Permitting
4. Detailed Design
5. Construction
6. Operations
7. Decommissioning

Currently, the expected timeline for these activities are Fall 2013 for construction, March 2014 until Fall 2038 for Operation, and Winter and Spring 2039 for decommissioning.

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 East Durham Wind Energy Centre is expected to begin in approximately October 2013 and last for approximately 6 months. The proposed Project schedule sets the commercial operation date in March 2014.

**Table 2-1** presents the anticipated construction schedule and approximate order of construction activities for the proposed Project.

**Table 2-1 Construction Schedule**

| Activity | | Timing of Activity | Duration |
|---|---|---|---|
| **Surveying** | | Prior to construction | Less than 1 day per turbine location |
| **Land Clearing and Construction of Access Roads** | | Summer, Fall or Winter | One to three days per access road to each turbine |
| **Installation of Culverts** | | Simmer, Fall or Winter | One to two days per culvert |
| **Construction Laydown Area** | | Summer, Fall or Winter | One week |
| **Turbine Site and Crane Pad Construction** | | Summer Fall or Winter | 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** | | Summer, Fall or Winter | Three to four days (excluding curing) |
| **Wind Turbine Assembly and Installation** | | Summer, Fall or Winter | Four to five days per turbine location |
| **Electrical Collector System** | **Pad Mount Transformers** | Summer, Fall or Winter | Four to six days |
| | **Collection Lines** | Summer, Fall or Winter | 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 Construction** | | Summer, Fall or Winter | 15 – 20 weeks |
| **Clean-up and Reclamation** | | Following turbine construction | Will be conducted as site is constructed |
| **Turbine Commissioning** | | Summer, Fall or Winter | One to three days |

### 2.2.2 Construction Activities

#### *2.2.2.1 Surveying and Geotechnical Study Activities*

Surveys will be required to locate the turbines, crane pads, access roads, temporary laydown areas, 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 farm site, the surveys will typically take 1 to 2 days per turbine location.

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

#### *2.2.2.2 Land Clearing and Construction of Access Roads*

No permanent paved roads will need to be constructed for the turbines. Municipal and provincial roads will be used for transportation of equipment to the construction sites. Any road damages will be repaired and any road improvements will be left in place.

On-site access to the turbines will require new access roads and following completion of the construction phase, the access roads will be used for maintenance activities (i.e., inspection of the turbines) at the turbines for the duration of the Project. 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. Typically the access roads will be 11 metres wide during the construction phase for access by the large cranes (with an additional 2 metres 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 typically requires clearing and grubbing of any vegetation, excavation of the topsoil layer and addition of 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 on an as need basis 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 truckloads 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 (Appendix E)** 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 SVCA as part of their permitting process; however, the culverts are proposed to be open bottom and left in place following the operation phase.

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*

An 8 hectare (22 acre) site will be constructed for the temporary storage of construction material. A portion of this site is proposed for the second Meteorological Tower (if required). The Construction laydown area will include staging areas for construction materials, construction trailers and associated facilities and 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 trailers. 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 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 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

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 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 and will be discussed with Grey County and the Municipality of West Grey. 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 (precise size of excavation area to be determined by geotechnical analysis of the soil) 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 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. Alternatively, cranes may be moved between turbine sites without disassembly along crane paths. 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: Underground 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 and in the road right-of-way when necessary. Above ground electrical junction boxes will be installed where necessary to connect sections of the underground cabling. 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.

- The collection line will cross the Saugeen River on Concession 4. It was determined that the river crossing was not suitable for underground cables due to the presence of bedrock in the location. The collection line is now proposed to be connected to underside of the bridge structure. If the collection line cannot be attached to the bridge structure the alternative proposed is an overhead line with likely one pole on either side of the river (within the existing road right-of-way) with the collection line becoming an underground cable on either side of the crossing of the river. 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 Transformer Substation*

Approximately two hectares in size, the transformer substation will include an isolation switch, a circuit breaker, a step-up power transformer, transmission switch gear, instrument transformers, grounding and metering equipment and a control housing which will be supplied with power from the local distribution line. Substation grounding will meet the Ontario Electrical Safety Code. The substation area will be gravelled with clean material imported to the site on an as needed basis and sloped to facilitate drainage. A secondary containment system will be installed around the transformer in the event of an oil leak to prevent any soil contamination.

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. 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, 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.

#### 2.2.2.10 Construction of Permanent Meteorological Towers

One to two 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.

#### 2.2.2.11 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.

#### 2.2.2.12 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 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.

### 2.2.3 Operation Activities

#### 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 two to three people who will work out of an Operations and Maintenance Building. The East Durham Wind Energy Centre plans to use the land and building for the Operations and Maintenance building that was already permitted under a separate REA and is now operational for the Conestogo Wind Energy Centre. This shared use of the building will have low use (approximately 2 people) and will not change or result in additional mitigation measures being required.

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 Use of Meteorological Data*

The use of meteorological data is key to the safe and efficient operating of a wind farm. The East Durham Wind Energy Centre is proposing to have one permanent meteorological tower to provide real time data. This will be used to operate the turbines efficiently. Depending on the turbine technology used, some operational decisions made using meteorological data include:

- Cut-in wind speed Cut-out wind speed
- Turbine shut down during icing conditions
- Turbine shut down during extreme weather events

#### *2.2.3.3 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.

#### *2.2.3.4 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, 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.

#### 2.2.3.5 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.

#### 2.2.3.6 Waste Management

Waste generated during the operations phase will be removed from the operations and maintenance building (located outside of the project location) 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 Activities

#### 2.2.4.1 Procedures for Decommissioning

Decommissioning procedures will be similar to the construction phase. 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 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 1.2 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 1.2 m below grade, and leaving the lines in place with consent of the landowner. Above-ground lines and poles (that are not shared with another Distribution Operator) will be removed and the holes will be filled with clean fill.

8. The substation will be demolished. This 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 collection 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. 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 3 archaeological sites (determined to be 19th century historic Euro-Canadian sites) identified through the Stage 2 Archaeological Assessment due to construction of project infrastructure.
- Visual impact on the McKechnie Cemetery due to use of the adjacent property as a temporary laydown area during construction.

**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 and substation;
  - excavation and backfilling for construction of turbines, collection lines 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 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 and substation;
- Disturbance to or loss of wildlife habitat from construction of turbines, access roads, temporary crane paths and pads/turnaround areas, collection lines and substation;
- Damage to vegetation while operating equipment used in construction of turbines, access roads, temporary crane paths and pads/turnaround areas, collection lines 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 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.
- Sedimentation and erosion affecting function of significant valleyland.
- 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 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 collection line construction affecting function of significant Wetland Complexes.
- Removal of wetland habitat or encroachment into wetlands.
- 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 collection line construction.
- Vegetation removals in significant woodlands at Turbines 10 and 17.

**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; and
- 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.

**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 ($CO_2$, methane).
- 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 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 and portable generator sets, including but not limited to, nitrogen dioxide, sulphur dioxide, suspended particulates, emission of greenhouses gases ($CO_2$, methane).
- 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

*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.
- 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 and water and/or 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 5 turbines that are located within 80 m of neighbouring property lines (refer to the Property Line Setback Assessment Report in the Appendix F).

**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 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. There are three closed landfill sites located within the Project Boundary but none of them are within the Project Location and will not be impacted by construction or operation of the wind farm. Two are located on the south side of Concession (greater than 1 km from the Project Location) and the third one is on the west side of Baptist Church Road

south of North Line, approximately 50 m from the proposed collection line and approximately 400 m from the nearest proposed turbine to the landfill property boundary.

*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 were undertaken to determine the potential effects of this Project during the construction and installation operation and maintenance 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.**