
# K2 WIND POWER PROJECT
# DESIGN AND OPERATIONS REPORT

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# 1.0 INTRODUCTION

## 1.1 Project Overview

K2 Wind Ontario Inc., in its capacity as general partner of K2 Wind Ontario Limited Partnership (the Proponent or K2 Wind), is proposing to develop, construct and operate the K2 Wind Power Project (the Project) in the Township of Ashfield-Colborne-Wawanosh (Township of ACW) within the County of Huron, north of Goderich, Ontario (see Figure 1, Appendix A for a map of the Project Location). The Proponent is a limited partnership formed under the *Limited Partnerships Act* (Ontario), with K2 Wind Ontario Inc. as general partner and CP K2 Holdings Inc. (an affiliate of Capital Power Corporation), Samsung Renewable Energy Inc., and Pattern K2 LP Holdings LP (an affiliate of Pattern Renewable Holdings Canada ULC), as limited partners. The Project would supply approximately 270 megawatts (MW) of electricity to the Ontario power grid. The development of the Project would help the province of Ontario meet its goal of increasing the proportion of electricity generated from renewable sources. The Project is subject to Ontario Regulation 359/09 – Renewable Energy Approvals under Part V.0.1 of the *Environmental Protection Act* (O. Reg. 359/09).

Key Project components would consist of up to 140 wind turbines, electrical collection and communications systems including a transmission line, a transformer station, a substation, an operation and maintenance building, meteorological towers (met towers), access roads, and temporary construction and laydown areas.

The Proponent has elected to assess and seek approval for some alternative Project configurations. The Renewable Energy Approval (REA) application process will consider two potential transmission line voltages (138 kV vs. 230 kV), two potential transmission line routes, and several alternate access road and collector line alignments. Final selection of the sites to be used would be based on the results of consultation activities, detailed design / engineering work, and the conditions experienced during construction.

The Proponent retained Stantec Consulting Ltd., SENES Consultants Limited, and AMEC Environment & Infrastructure, a division of AMEC Americas Limited (AMEC) to assist in the preparation of the REA application with input from Timmins Martelle Heritage Consultants Inc., Selde Corporation and Zephyr North Canada.

## 1.2 Report Requirements

The purpose of the *Design and Operations Report* is to provide the public, Aboriginal communities, municipalities, and regulatory agencies with an understanding of the design and operations components of the Project.

The *Design and Operations Report* has been prepared in accordance with Item 4, Table 1 of O. Reg. 359/09 and in consideration of the Ministry of the Environment's (MOE's) guidance document *Technical Guide to Renewable Energy Approvals*.

The following table provides the requirements of the *Design and Operations Report* as prescribed in the Regulation and the relevant sections where it can be found within this document.

**Table 1-1: Design and Operations Report Requirements per Ontario Regulation 359/09**

| ID | Requirements | Section Number |
|---|---|---|
| **1** | **Set out a site plan of the project location at which the renewable energy project will be engaged in, including,** | |
| | i. one or more maps or diagrams of, | |
| | A. all buildings, structures, roads, utility corridors, rights of way and easements required in respect of the renewable energy generation facility and situated within 300 metres of the facility, | Appendix A |
| | B. any ground water and surface water supplies used at the facility, | Appendix A<br>Appendix B |
| | C. any things from which contaminants are discharged into the air, | Not Applicable |
| | D. any works for the collection, transmission, treatment and disposal of sewage, | Appendix B |
| | E. any areas where waste, biomass, source separated organics and farm material are stored, handled, processed or disposed of, | 4.5.1, 4.5.4 |
| | F. the project location in relation to any of the following within 125 metres:<br>- the portion of the Oak Ridges Moraine Conservation Plan Area that is subject to the Oak Ridges Moraine Conservation Plan,<br>- the area of the Niagara Escarpment Plan,<br>- the Protected Countryside,<br>- the Lake Simcoe watershed, and | Appendix A |
| | G. any noise receptors or odour receptors that may be negatively affected by the use or operation of the facility, | Appendix A |
| | ii. a description of each item diagrammed under subparagraph i, | 3.0 and 4.0 |
| | iii. one or more maps or diagrams of land contours, surface water drainage and any of the following, if they have been identified in complying with this Regulation:<br>- properties described in Column 1 of the Table to section 19,<br>- heritage resources,<br>- archaeological resources,<br>- water bodies,<br>- significant or provincially significant natural features and<br>- any other natural features identified in the Protected Countryside or in the portion of the Oak Ridges Moraine Conservation Plan Area that is subject to the Oak Ridges Moraine Plan, | Appendix A |
| | iv. a description, map or diagram of the distance between the base of any wind turbines and any public road rights of way or railway rights of way that are within a distance equivalent to the length of any blades of the wind turbine, plus 10 metres, | Appendix A |
| | v. a description, map or diagram of the distance between the base of any wind turbines and all boundaries of the parcel of land on which the wind turbine is constructed, installed or expanded within a distance equivalent to the height of the wind turbine, excluding the length of any blades, and | Appendix A |
| | vi. a description, map or diagram of the distance between the base of each wind turbine and the nearest noise receptor. | Appendix A |

| ID | Requirements | Section Number |
|---|---|---|
| **2** | **Set out conceptual plans, specifications and descriptions related to the design of the renewable energy generation facility, including a description of:** | |
| | i. any works for the collection, transmission, treatment and disposal of sewage, including details of any sediment control features and storm water management facilities, | 3.5.1, 3.6, 4.5.4, 4.5.5 and Appendix B |
| | ii. any things from which contaminants are discharged into the air, | 4.5.2 |
| | iii. any systems, facilities and equipment for receiving, handling, storing and processing any waste, biomass, source separated organics, farm material and biogas, and | Not Applicable |
| | iv. if the facility includes a transformer substation, the works, facilities and equipment for secondary spill containment. | 3.5, 3.6.1 and 3.8 |
| **3** | **Set out conceptual plans, specifications and descriptions related to the operation of the renewable energy generation facility, including,** | |
| | i. in respect of any water takings, | |
| | A. a description of the time period and duration of water takings expected to be associated with the operation of the facility, | 4.5.3 |
| | B. a description of the expected water takings, including rates, amounts and an assessment of the availability of water to meet the expected demand, and | 4.5.3 |
| | C. an assessment of and documentation showing the potential for the facility to interfere with existing uses of the water expected to be taken, | 4.5.3 |
| | ii. a description of the expected quantity of sewage produced and the expected quality of that sewage at the project location and the manner in which it will be disposed of, including details of any sediment control features and storm water management facilities, | 4.5.4, 4.5.5 |
| | iii. a description of any expected concentration of air contaminants discharged from the facility, | 4.5.2 |
| | iv. in respect of any biomass, source separated organics and farm material at the facility, | Not Applicable |
| | A. the maximum daily quantity that will be accepted, | Not Applicable |
| | B. the estimated annual average quantity that will be accepted, | Not Applicable |
| | C. the estimated average time that it will remain at the facility, and | Not Applicable |
| | D. the estimated average rate at which it will be used, and | Not Applicable |
| | v. in respect of any waste generated as a result of processes at the project location, the management and disposal of such waste, including, | |
| | A. the expected types of waste to be generated, | 4.5.1 |
| | B. the estimated maximum daily quantity of waste to be generated, by type, | 4.5.1 |
| | C. processes for the storage of waste, and | 4.5.1 |
| | D. processes for final disposal of waste, | 4.5.1 |
| | vi. if the facility includes a transformer substation, | 3.6.1 and 3.8 |
| | A. a description of the processes in place to prevent spills, | 3.6.1 and 3.8 |
| | B. a description of the processes to prevent, eliminate or ameliorate any adverse effects in the event of a spill, and | 3.6.1 and 3.8 |
| | C. a description of the processes to restore the natural environment in the event of a spill. | 3.6.1 and 3.8 |

| ID | Requirements | Section Number |
|---|---|---|
| **4** | **Include an environmental effects monitoring plan in respect of any negative environmental effects that may result from engaging in the renewable energy project, setting out,** | |
| | i. performance objectives in respect of the negative environmental effects, | 5.0, 6.0 |
| | ii. mitigation measures to assist in achieving the performance objectives mentioned in subparagraph i, | 5.0, 6.0 |
| | iii. a program for monitoring negative environmental effects for the duration of the time that the project is engaged in, including a contingency plan to be implemented if any mitigation measures fail. | 5.0, 6.0 |
| **5** | **Include a response plan setting out a description of the actions to be taken while engaging in the renewable energy project to inform the public, aboriginal communities and municipalities, local roads boards and Local Services Boards with respect to the project, including,** | |
| | i. measures to provide information regarding the activities occurring at the project location, including emergencies, | 7.0 – 7.3 |
| | ii. means by which persons responsible for engaging in the project may be contacted, and | 7.2 |
| | iii. means by which correspondence directed to the persons responsible for engaging in the project will be recorded and addressed. | 7.3 |
| **6** | **If the project location is in the Lake Simcoe watershed, a description of whether the project requires alteration of the shore of Lake Simcoe, the shore of a fresh water estuary of a stream connected to Lake Simcoe or other lakes or any permanent or intermittent stream and,** | |
| | i. how the project may impact any shoreline, including the ecological functions of the shoreline, and | Not Applicable |
| | ii. how the project will be engaged in to, | Not Applicable |
| | A. maintain the natural contour of the shoreline through the implementation of natural shoreline treatments, such as planting of natural vegetation and bioengineering, and | Not Applicable |
| | B. use a vegetative riparian area, unless the project location is used for agricultural purposes and will continue to be used for such purposes. | Not Applicable |
| **7** | **If it is determined that the project location is not on a property described in Column 1 of the Table to section 19, provide a summary of the matters addressed in making the determination.** | 5.1 and *Built Heritage and Cultural Heritage Landscape Assessment* |
| **8** | **If section 20 applies in respect of the project and it is determined that the project location does not meet one of the descriptions set out in subsection 20 (2) or that the project location is not in an area described in subsection 20 (3), provide a summary of the matters addressed in making the determination.** | Not Applicable |
| **9** | **If subsection 21 (3) or 23 (2) applies, provide a summary of the matters addressed in making the determination** | Not Applicable |
| | i. under subsection 21(3) or clause 23(2)(a), as the case may be, including a copy of the document completed under the applicable provision, and | Not Applicable |
| | ii. under clause 23(2)(b), if applicable. | 5.1 and *Built Heritage and Cultural Heritage Landscape Assessment* |

## 2.0 SITE PLAN

### 2.1 Site Plan Mapping and Descriptions

The Site Plan is provided in Appendix A, and is presented as a series of three figures:

- Figure 1: Project Location - Overview
- Figure 2: Socio-Economic Features
- Figure 3: Natural Heritage Features & Water Bodies

The Site Plan provides the following information applicable to the Project, as required under O. Reg. 359/09. A detailed description of Project components is included in the *Project Description Report.*

**Table 2-1: Site Plan Components**

| Site Plan Component | Additional Information and Site Plan Reference |
|---|---|
| **Proposed Project Components** | |
| Buildings or structures | The following buildings or structures are shown on all Site Plan figures:<br>Turbines<br>Substation property (includes operations and maintenance and protection and control buildings, and substation transformers )<br>Transformer Station Site (includes substation transformer and associated control buildings)<br>Meteorological towers<br>Electrical and data collection and transmission system (includes utility boxes and buried splices)<br>Temporary construction areas |
| Roads | Permanent Project access roads for turbine and site access are shown on all Site Plan figures. |
| Utility corridors, rights of way or easements | Easements associated with participating properties are for certain access roads and collector system elements. |
| Groundwater supplies used at the facility | A water well is planned for installation or recommissioning to service the operations and maintenance building, and will be located on the substation property shown on all Site Plan figures. A preliminary drawing of the general arrangement of the substation property is provided in Appendix B. |
| Works for the collection, transmission, treatment and disposal of sewage | A septic system is planned for installation or recommissioning to service the operations and maintenance building, and will be located on the substation property shown Figures 2-J, 2-L, 3-L, and 3-L. A preliminary drawing of the general arrangement of the substation property is provided in Appendix B. |
| **Existing Features within 300 m of the Project Location** | |
| Buildings or structures | Buildings are shown on the aerial imagery on the Site Plan figures; these are primarily rural residences, but also include other types of buildings such as agricultural outbuildings and commercial and/or institutional buildings. |
| Roads | Roads in the vicinity of the Project Location are primarily Township roads. County Roads include Amberley Road (County Road 86) and Belgrave Road (County Road 20).<br>Provincial Highway 21 (Bluewater Highway) runs at the western boundary of the Project Location. |

| Site Plan Component | Additional Information and Site Plan Reference |
|---|---|
| Utility corridors, rights of way, and easements | A 500 kV Hydro One corridor traverses the Project Location, to which the Project would connect.<br>Rights of way would be associated with the Northern Cross pipelines located in the area.<br>Utilities are located within the road allowances. |
| **Other Site Plan Components** | |
| Land contours | Shown at 5 m intervals on Figures 2 and 3. |
| Noise receptors | Noise receptors are shown on Figure 2 as per the Noise Assessment, and include:<br>Participating receptors: properties participating in the Project, and to which noise setbacks and limits do not apply;<br>Non-participating receptors: properties not participating in the Project that have dwellings, buildings used for institutional purposes (educational facility, day nursery, health care facility, community centre or place of worship), and buildings planned for construction that have a building permit; and<br>Vacant lot receptors: vacant land zoned to allow construction of potential noise receptors; location selected with regard to the typical building pattern in the area. |
| Protected properties and heritage resources | Cultural heritage resources are shown on Figure 2, as per the Built Heritage and Cultural Heritage Landscape Assessment. |
| Archaeological resources | The locations of archaeological sites are sensitive information, and therefore mapping of these locations has been omitted. |
| Surface water drainage and water bodies | Surface water drainage and water bodies are shown on Figure 3 as per the Water Assessment. |
| Significant or provincially significant natural features | Significant natural features are shown on Figure 3 as per the Natural Heritage Assessment. |
| Public road rights of way and railway rights of way | Shown on Figure 2. |
| Property lines | Shown on Figure 2. |

## 2.2 Setback Distances

O. Reg. 359/09 provides setback distances between the Project Location and proposed Project infrastructure. Within O. Reg. 359/09, there are some setbacks for which studies can be conducted in lieu of meeting the setback requirements. In some instances in the proposed design, Project components are proposed within the defined setbacks for natural features, water bodies and property lines. In these instances additional assessments have been conducted as per the requirements of O. Reg.359/09 to identify potential negative environmental effects and mitigation measures.

Some setbacks are established from the Project Location:

- Significant and provincially significant natural features (120 m; 50 m for earth science Areas of Natural & Scientific Interest (ANSI));
- Provincial parks and conservation reserves (120 m); and
- REA defined water bodies (120 m; 30 m for turbines).

Some setbacks are provided from the turbine base:

- Property lines (hub height);
- Public road right-of-ways (blade length plus 10 m);
- Railway right-of-ways (blade length plus 10 m); and
- Non-participating receptors (550 m).

Visual representation of the setback distances is illustrated on the Site Plan for the above listed features.

## 3.0 FACILITY DESIGN PLAN

This section provides a description of the key facility design components identified on the Site Plan (Appendix A). A detailed description of each Project component is provided in the *Project Description Report*.

During siting of the Project the key mitigation strategy used to address potential environmental effects from operation of the facility was avoidance of natural environment features and cultural heritage features to the extent possible. The Project was designed to meet the mandatory setbacks within O. Reg. 359/09 in all cases. Within O. Reg. 359/09 there are some setbacks that are not mandatory, for which studies that identify potential negative environmental effects and mitigation measures can be conducted in lieu of meeting the setback requirements. In some instances in the facility design, Project components are proposed within the defined setbacks for natural features, water bodies, and property lines. In these instances, additional assessments have been conducted as per the requirements of O. Reg.359/09.

### 3.1 Turbines

The proposed Project design was based on the use of Siemens SWT-2.3 wind turbines. Each of the turbine sites would occupy approximately 0.2 ha (excluding the access road) to accommodate a crane pad for erection. Each of the turbine installations would consist of the following key components:

- Concrete foundation;
- Steel support tower comprising 5 sections;
- Nacelle containing the gearbox and electrical generator;
- Hub (rotating structure that holds the turbine blades);
- 3 rotor blades;
- A padmount transformer to convert power from 690 kV to 34.5 kV; and
- Electrical controls and connections.

Table 3-1 provides the basic specifications for the Siemens turbines. Detailed specifications are provided in the *Wind Turbine Specifications Report*.

**Table 3-1: Basic Wind Turbine Specifications – Siemens SWT-2.3**

| **Manufacturer** | **Siemens** |
|---|---|
| Model | SWT-2.3-101 |
| Individual turbine nameplate capacity (MW) | 1.824 to 2.300 MW |
| Hub height above grade | 99.5 m |
| Blade length | 49 m |
| Full blade diameter | 101 m |
| Blade sweep area | 8,000 $m^2$ |
| Nominal revolutions (rotational speed) | 6-16 rpm |
| Frequency spectrum | 60 Hz |

| Manufacturer | Siemens |
|---|---|
| Sound power (nameplate 1.824 MW) | 3 m/s – 91.4 dBA; 4 m/s – 95.3 dBA; 5 m/s – 98.1 dBA; 6 m/s – 100.5 dBA; >7 m/s – 101.0 dBA |
| Sound power (nameplate 1.903 MW) | 3 m/s – 91.4 dBA; 4 m/s – 95.5 dBA; 5 m/s – 99.0 dBA; 6 m/s – 101.5 dBA; >7 m/s – 102.0 dBA |
| Sound power (nameplate 2.030 MW) | 3 m/s – 91.4 dBA; 4 m/s – 95.6 dBA; 5 m/s – 99.8 dBA; 6 m/s – 102.5 dBA; >7 m/s – 103.0 dBA |
| Sound power (nameplate 2.126 MW) | 3 m/s – 91.4 dBA; 4 m/s – 95.7 dBA; 5 m/s – 100.3 dBA; 6 m/s – 103.5 dBA; >7 m/s – 104.0 dBA |
| Sound power (nameplate 2.221 MW) | 3 m/s – 91.4 dBA; 4 m/s – 95.7 dBA; 5 m/s – 100.5 dBA; 6 m/s – 104.5 dBA; >7 m/s – 105.0 dBA |
| Sound power (nameplate 2.300 MW) | 3 m/s – 91.4 dBA; 4 m/s – 95.7 dBA; 5 m/s – 100.6 dBA; 6 m/s – 105.4 dBA; >7 m/s – 106.0 dBA |

The foundation for each turbine would be comprised of a reinforced concrete base approximately 19 m across, lying approximately 3 m below ground. The foundation pedestal would be approximately 5.3 m in diameter and sit approximately 0.3 m above grade. An alternate foundation design that may be required at some turbine sites would include a larger approximately 21 m diameter foundation. Foundations will be designed based on site specific geotechnical assessment; conceptual drawings of possible designs that could be used for the foundations are provided in Appendix B.

Grounding is required for each padmount transformer and tower. Depending on the system design, this consists of approximately 4 ground rods that are 19 mm in diameter by 3 m long ground rods which are driven vertically into the ground, forming a square pattern around the padmount transformer and tower. The grounding required for the transformer and tower consists of grounding rods and bare copper that is connected to both the transformer and tower. There could be a need for an alternative grounding configuration depending on site-specific soil conditions. Mechanical protection for the padmount transformer in the form of bollards may be installed around the entire padmount transformer assembly. During the operation of the turbines, most of the foundation will be covered with topsoil to enable landowners to continue using the land for agricultural purposes.

Transport Canada, NAV Canada, Department of Defence, and the Goderich Municipal Airport were contacted during the design to ensure that the locations of turbines would not present any aviation hazards. Lighting of turbines would be in accordance with Transport Canada Regulations, described in Section 5.6.3.

## 3.2 Access Roads and Construction Pads

Access roads are required to access each turbine from existing municipal roads during the operation phase of the Project to complete turbine maintenance activities. The gravel access roads to be used during operations will be approximately 5 to 8 m wide, and are the same access roads that would be installed during the construction phase of the Project. An approximately 3 to 5 m gravelled collar would surround each turbine to allow for maintenance

service. See Appendix B for a typical access road cross-section, crane pad layout and laydown area.

Construction pads will be re-constructed during operation to accommodate crane use during maintenance activities, if required, according to the methods outlined in the *Construction Plan Report*.

### 3.3 Water Crossings

Culverts would be required at some water crossings. The culverts would be sized to meet flow conditions and design would meet requirements of the Maitland Valley Conservation Authority (MVCA) where required. A typical design drawing of a culvert with access road is provided in Appendix B. Electrical and data cabling would either be installed in conduits below streams using directional drilling or trenching, or would be installed above ground on utility poles.

### 3.4 Electrical Infrastructure

#### 3.4.1 Padmount Transformers and Collector System

A padmount transformer, located on the ground adjacent to the tower of each Siemens wind turbine, is required to transform the electricity created in the nacelle to a standard operating power line voltage (i.e. 690 V to 34.5 kV). A separate concrete pedestal would be installed to receive the padmount transformer. Typical sizes of the pedestal are 2.4 m x 2.4 m x 1.5 m. Based on standard industry practices, secondary oil containment should not be necessary for the padmount transformers. A schematic of a typical padmount transformer is provided in Appendix B.

From the padmount transformer, underground 34.5 kV collector lines carry the electricity to the municipal road allowances generally following the turbine access roads. Where necessary, a partially buried fibreglass junction box and/or disconnecting switch box would be placed at the junction of the collector line from the turbine and the collector line in the road allowance. The junction box/disconnecting switch box would be located either on the participating private land or within the road allowance. Junction boxes and disconnecting switch boxes will require an excavation approximately 4 m long x 4 m wide x 3 m deep with the above ground portion measuring approximately 2.5 m long x 1.5 m wide x 1.0 m high (see Appendix B for a schematic of a typical junction box). Both the junction boxes and disconnecting switch boxes are enclosed in tamper resistant outdoor above-ground enclosures. Underground collector lines have been incorporated into the design of the access roads to reduce the area required for construction and minimize potential construction impacts. The cables would be installed immediately to one side of the access road, just off the gravelled surface.

A predominantly underground 34.5 kV collector system will be located within the municipal road allowance or on participating private land. To allow for the collector system to be predominantly buried (as opposed to above ground on wooden poles) as requested by the Township of ACW and local residents, and to reduce the number of circuits entering the substation, approximately

one half of the 34.5 kV lines would be routed to the transformer station where there would be a step-up to 138 kV or 230 kV. All circuits (138 kV or 230 kV and 34.5 kV) would then feed into the substation, which is located adjacent to an existing Hydro One 500 kV transmission line (see Appendix B for a typical buried cable plan).

At each end of a cable run a junction box (see description above), disconnecting switch box, or a buried splice would be required to allow for splicing of cable reels. If buried splices are used, they will be buried at same depth as the cable, potentially with concrete block protection laid around them.

Wherever possible, junction boxes/disconnecting switch boxes at the end of access roads would be used for cable splice locations to reduce the number of junction boxes/disconnecting switch boxes required. Junction boxes/disconnecting switch boxes would be located primarily on participating private lands associated with turbine access roads where they connect to the main collector system. Where junction boxes/disconnecting switch boxes are required at splice points within the main collector system, they would be located within the municipal road allowance. Every effort would be made to locate the junction boxes/disconnecting switch boxes within the road allowance away from lands fronting non-participating residences.

Some sections of the collector system may have to be installed above ground on wooden poles or on existing infrastructure (i.e., bridges) if required to pass sensitive natural features or other obstacles to underground cables. See Appendix B for a typical above ground collector system plan.

The data communication system would run with the collector lines throughout the Project, both above and below grade.

### 3.4.2 Transformer Station and Transmission Line

A 138 or 230 kV transformer station is required to allow for the collector system to be predominantly buried (as opposed to above ground on wooden poles) as requested by the Township of ACW and local residents. The transformer station site would be located on the southwest corner of Lanesville Line and Belgrave Road and would be approximately 4.05 ha in size. Several of the 34.5 kV circuits from the turbines in the northern section of the Project Location would be connected into the transformer station to step-up the voltage to 138 or 230 kV to reduce the number of collector lines entering the substation. The site would be largely covered with gravel and underlain by a grounding grid. The transformer station would be surrounded by a chain-link fence for security, equipped with a locked vehicle gate to allow for maintenance access. For a conceptual drawing of the general arrangement of the transformer station, and a typical schematic of a transformer, see Appendix B. The transformer station may be surrounded by berms and/or landscaping to mitigate the visual impact of the site. Berms would be set back from the municipal road allowance based on municipal requirements.

An underground 138 or 230 kV transmission line would connect the transformer station to the substation. The transmission line would be buried underground, both within the municipal road

allowance and on private lands. Two routings are currently proposed. The preferred routing is following Lanesville Line and Glens Hill Road to connect at the substation. An alternate routing has been proposed in the event that the preferred routing cannot be accommodated. The alternative route is proposed to run eastward from the transformer station along Belgrave Road and then southward along Tower Line Road to the substation. The cable splices would be located in either splice vaults or they would be directly buried. An excavation approximately 5 m wide x 3 m long x 3 m deep will be required at the splice locations. If in vaults, the vaults would be pre-cast or poured in place concrete and would be approximately 3 m long x 2 m wide x 2 m deep. If directly buried, they would be buried at the same depth as the cable, placed in beds of crushed limestone, or similar material, and backfilled to grade with native soil. They would also potentially have concrete blocks or concrete slabs forming a wall around them for in-ground protection. The bedding containing the cable splices will also be covered with concrete blocks or slabs for protection. Warning tape would be installed along the length of the splice locations, approximately 300 mm above the top concrete protection. Each splice location would be marked with above ground markers.

### 3.4.3 Substation

The substation facility would be located on a property located at the northwest corner of the Tower Line and Glens Hill Road intersection. The substation yard would comprise a portion of the property and will be used for other Project facilities. The substation yard would house the switching, control, protection, communication and metering system required to support the operation of the substation. The substation yard (including space to allow for development of the Hydro One switching station described in Section 3.4.4) would be approximately 18.5 ha in size. At the substation, the voltage is stepped up from either 34.5 kV or 138/230 kV to 500 kV via main output transformers.

The substation yard would be largely covered with gravel and underlain by a grounding grid. The substation yard would be surrounded by a chain-link fence equipped with a locked vehicle gate to allow for maintenance access for security. For a conceptual drawing of the general arrangement of the substation, and a typical schematic of the transformers, see Appendix B. The entire substation yard including both the substation and Hydro One switching station (see Section 3.4.4) may be surrounded by berms and/or landscaping to mitigate the visual impact of the site. Berms would be set back from the municipal road allowance based on municipal requirements.

### 3.4.4 Hydro One Switching Station

A Hydro One switching station will be located adjacent to the Project's substation yard to connect power to the provincial transmission grid. The switching station would be permitted, built and operated by Hydro One. The switching station would have its own security fencing and access gate. The switching station is included in the 18.5 ha footprint described in Section 3.4.3 of this report. The entire site including both the substation and switching station may be surrounded by berms and/or landscaping to mitigate the visual impact of the site. Berms would be set back from the municipal road allowance based on municipal requirements.

## 3.5 Operation and Maintenance Building

The operation and maintenance building would be the on-site operational hub of the completed Project, and would be located on the same property as the substation. This facility is currently envisioned as either a one or two storey building (approximately 32 m x 16 m) and would provide space for: office, control room, workshop, kitchen, restrooms, warehouse facilities and associated parking. The wind farm would be operated, monitored and controlled from the operation and maintenance building. The site would also be monitored 24 hours a day from a remote wind operations and monitoring centre (see Section 4.2).

The operation and maintenance building would also include areas for storage of Project equipment and spare parts, and would have a secure area for hazardous materials and lubricant storage (refer to Appendix B for preliminary building layout plans). Drainage design of the warehouse and storage spaces is expected to be to the sump/drainage pit and then to the septic system.

### 3.5.1 Septic System

To support the operation and maintenance building, a septic system expected to consist of a septic tank and weeping bed would be installed. If, after assessment, the existing septic system meets the needs of the operation, the systems will be recommissioned and permitted as appropriate. If the existing septic system does not meet the requirements for the operations facility, it will be decommissioned and a new septic system would be installed. The septic tank would be required for primary treatment and the weeping bed for secondary treatment of the wastewater. Conforming to the current guidelines, it is anticipated that each employee would generate 125 L of wastewater per day. Based on a projection of a maximum of 25 employees the septic system would require a capacity of 3,125 L, as a worst case scenario. For non-residential use a septic tank must have a working capacity of 9,375 L.

An effluent filter would be installed in the outlet flow path of the septic tank which discharges effluent to the weeping bed. The effluent filter would be sized to accommodate the daily design sewage flow of 3,125 L/day. A Polylok PL-122 effluent filter or equivalent is anticipated to be installed.

It is anticipated that effluent from the septic tank will flow by gravity through the grit filter to a pump chamber from where it will need to be pumped to the partially raised leaching bed as the tile in the leaching bed will be at a higher elevation than the outlet of the septic tank.

The pressured effluent will be delivered to a distribution box via flexible PVC or polyethylene tubing. The distribution box will allow the pressure to be dissipated so that the effluent will flow by gravity to the headers of the weeping tile.

Based on the design sewage flow of 3,125 L/day and a design percolation rate of 12 min/cm, 188 m of distribution tile are required. It is anticipated that seven lines of 30 m of distribution tile, or a total of 210 m, would be required. At a minimum spacing of 1.6 m between the

distribution lines, then an area 30 m by 9.6 m is required for the distribution piping. An area 40 m x 60 m is reserved for the weeping bed.

The maximum volume of effluent that can be delivered to the weeping bed is based on the volumetric capacity of the distribution tile. For the 210 m of distribution tile, when 7.6 cm diameter tile are used, then a maximum 715 L is calculated, based on ¾ of their volumetric capacity.

If the building is occupied on a single shift basis, all the sewage will be generated over this period time. It is anticipated that a control panel with timers would be used to activate the effluent pumps at set times for a set duration. As the majority of the sewage is expected to be generated over a ten hour period, the timer be set to deliver a 500 L dose every hour.

The final design of the septic system would conform to local building code and health unit requirements. A conceptual design of a typical septic system is provided in Appendix B.

### 3.5.2 Water Well

If, after assessment, the existing water well meets the needs of the operation, the well will be recommissioned and permitted as appropriate. If the existing well does not meet the requirements for the operations facility, it will be decommissioned and a new well would be installed. The water well at the operation and maintenance building will be used for kitchen and washroom facilities, general grounds keeping, and washing of equipment and the floor of warehouse and storage spaces. The well would be used for drinking water if water quality meets regulatory requirements for potable water.

The well would be used periodically for some small scale industrial uses, such as to hose down warehouse and storage floor areas. Water used to clean the floor would drain to the sump / drainage pit and then to the septic system. These uses would be kept to a minimum and would not exceed 50,000 L/day of total water use at the site. A schematic of a typical water well with ancillary equipment such as pumps and piping is provided in Appendix B.

## 3.6 Stormwater Management and Spill Containment

*Stormwater Management (SWM) Plans* (see Appendix C) were developed for runoff from the substation property and the transformer station in accordance with the *Stormwater Management Planning and Design Manual* (MOE 2003) and MVCA guidelines. Additional details regarding the SWM facilities are provided in the *SWM Plans*.

### 3.6.1 Substation Property

The *SWM Plan* is provided in Appendix C. The primary component of the *SWM Plan* at the substation property is a stormwater retention pond, located at the southwest corner of the main operations area, which would receive all runoff from the site. The stormwater retention pond would reduce peak stormwater flows and promote sedimentation prior to discharge to the drainage along Glens Hill Road. The retention pond would provide quantity control for

stormwater runoff from developed areas of the site. The total storage volume of the SWM pond would be approximately 730 $m^3$ and would have continuous side slopes of 3:1 (H:V) resulting in an overall top of pond surface area of about 900 $m^2$. The SWM pond would have a total depth of 1.3 m comprised of active storage (1.0 m) and freeboard (0.3 m). Stormwater runoff from the developed site area would be conveyed to the SWM pond via drainage ditches. The storm sewer system would be sized to convey the 100 year design storm. The SWM pond would discharge to the existing Glens Hill Road roadside ditch.

The outlet structure is designed as a detention control device consisting of one 650 mm diameter culvert with an inlet elevation of approximately 245 m. As appropriate, a shut-off mechanism will be incorporated into the design of the SWM pond outlet chamber to provide the opportunity to close off discharge from the substation property in the event of an emergency during which material other than stormwater enters the SWM system. An oil/grit separator (OGS) for control of stormwater runoff quality from the Site is considered appropriate given the low imperviousness (about 10%) in this area.. An OGS traps and retains oil and sediment in a detention chamber. It operates based on the principles of gravity-based sedimentation for the grit and phase separation for the oil.

A 2 m long overflow broad-crested weir with a crest elevation set at 245.7 m will be a component of the outlet configuration. This weir will assist in limiting the maximum depth of the SWM pond. It will also serve the secondary purpose as emergency overflow bypass.

Four diversion ditches will be constructed along the north, west, south and east development perimeter to convey “clean” surface runoff from the upstream undeveloped areas of the substation property around the developed area.

Design of spill containment for transformers at the Substation Property is addressed in Section 3.8.

### 3.7 Transformer Station Property

The *SWM Plan* for the transformer station (Appendix C) determined that the change in post-development flows versus predevelopment flows was minimal and that a retention pond would not be required to control peak runoff. Details regarding the design of the stormwater management system are provided in the *SWM Plan* (Appendix C). See Appendix B for a preliminary layout of the transformer station property.

Belgrave Road and Lanesville Line represent the upstream boundary for localized drainage at the proposed transformer site. As such, no perimeter ditches will be necessary to route “clean” runoff from un-developed upstream areas of the site. The site will be developed to ensure that on-site drainage will follow, to the extent possible, the existing drainage pattern.

Vegetated filter strips and grass lined drainage ditches are a low-cost best management practice designed to improve the quality of stormwater runoff by using biological and chemical processes in soils and vegetation to filter out contaminants. They function by slowing runoff

velocities and filtering out sediment and other pollutants, and providing some infiltration into underlying soils. Filter strips were originally used as an agricultural treatment practice, and have more recently evolved into an urban practice.

Grassed swales are most effective for quality control when the depth of flow is minimized, bottom width is maximized (≥0.75 m) and channel slope is minimized (e.g. ≤1%). Grassed swales with a slope up to 4% can be used for water quality purposes, but effectiveness diminishes as velocity increases. As appropriate, grass lining will be allowed to grow higher than 75 mm to enhance the filtration of suspended solids.

Vegetated filter strips (minimum 10 m wide) will be integrated into the drainage design for the development.

Design of spill containment for transformers at the Transformer Station Property is addressed in Section 3.8.

## 3.8 Spill Containment Design for Transformers

At both the substation property and the transformer station property, a 'double containment system' would be implemented for the transformers at the Sites (one at the Transformer Station, two at the Substation). In addition to containment of oils within the transformer (conservator, tank, etc.), the transformer would be installed in a concrete containment pit, to provide secondary containment in the event of a transformer leak. The containment pit around each transformer would be sized to hold the transformer oil held in the unit plus stormwater runoff (i.e. an accommodation for 250 mm of rainfall in 24 hours).

Drainage from the container pit would be removed by either manually operating a sump pump to discharge the liquid to the internal stormwater drainage system if there is no oil/grease in the liquid or automatically operating the pump. In either case, an oil/grease sensor would be mounted on the pump to detect any oil/grease in the liquid. If there is oil/grease detected, the liquid would be removed via a licensed waste hauler and the source of the leakage would be identified.

## 3.9 Met Towers

Three met tower locations are required for this Project to collect meteorological data during operation of the facility. These towers would be approximately 100 m high and consist of either steel lattice or tubular structures. They would be mounted on a concrete foundation and be either free-standing or supported laterally by guy wires. The towers would carry instrumentation for collecting wind data to support operation of the Project. Power and data cabling would be installed underground to the nearest road and collector network. A schematic of a typical met tower is provided in Appendix B.

## 4.0 FACILITY OPERATIONS PLAN

Operation activities include daily monitoring of the wind turbines, function of the operation and maintenance building, maintenance activities, and monitoring of meteorological data. To ensure that the appropriate assessment and maintenance of the facility are undertaken, an Operations Plan would be implemented. Operations Plans create consistent expectations of activities at the facility and help mitigate environmental effects.

### 4.1 Site Supervision

The Proponent may retain one or more specialized Operations and Maintenance Contractors for specific maintenance tasks. The Proponent and/or its Operations and Maintenance Contractors would carry out the daily operations and maintenance tasks for the facility. It is expected that approximately 18 to 24 personnel would be required for Project operations.

Prior to contracted operation of the Project, an operations and maintenance program would be developed. The program would be designed to ensure compliance with relevant regulatory requirements. The program would include policies and procedures to cover:

- Staff training;
- Environmental compliance;
- General facility maintenance;
- Spill containment and response;
- Maintenance - predictive/preventative, routine, unscheduled;
- Annual overhauls;
- Inspection of equipment and components;
- Schedule for maintenance and inspections; and
- Spare parts – inventory and procurement.

### 4.2 Planned Maintenance

The Project would have a supervisory control and data acquisition (SCADA) system with data cable links between each turbine and the control room within the operation and maintenance building. The SCADA system would be designed to provide real time monitoring of each turbine's performance. Monitoring of the turbines would occur within the operation and maintenance building and/or from a remote location. The SCADA system would identify any potential problems so that proactive inspection and maintenance could occur. Potentially damaged turbines would be shut down for a detailed inspection and any necessary repair; as damaged turbines could result in increased noise levels, fire or failure. Implementation of the above operations and maintenance program (see Section 4.1) would mitigate these environmental effects.

Scheduled maintenance would be based on the operating hours or conditions of the equipment. This would include:

- Visual inspections;
- Mechanical inspections;
- Electrical inspections; and
- Lubrication and routine maintenance.

The annual requirements for oil and grease are not precisely known but would be expected to be in the order of 10,650 L and 3,550 kg respectively based on other projects. The need for oil changes would be determined by oil analysis recommendations. An oil change is not likely to occur until the findings of the annual oil analysis indicate that it is required, which could be after years of operation. The volume in inventory would be based on transportation, availability and service schedules. Waste oils would also be stored in the designated area at the operation and maintenance building until removed by a licensed waste hauler in accordance with the requirements of Ontario Regulation 347.

### 4.3 Unscheduled Maintenance

Occasional breakdowns of the turbines or related infrastructure could be expected during the life of the Project. Unscheduled maintenance of the turbines would be carried out by the Proponent and/or an Operations and Maintenance Contractor. Where maintenance of a turbine necessitates the use of cranes, a temporary construction pad would be constructed of gravel in the same location used during Project development wherever possible. The design of the temporary construction pad would be equivalent to that used during the construction phase. Upon completion of the work the construction pad would be removed and the site restored. The environmental effects of constructing and removing the construction pad and the recommended mitigation measures would be the same as described in the *Construction Plan Report*. Disturbed areas would be restored immediately following completion of the maintenance activities in the same manner as described in the *Construction Plan Report*.

Other unscheduled maintenance activities will include ongoing upkeep of other Project facilities including repairs to electrical infrastructure, operations and maintenance building, snow removal, and landscaping.

### 4.4 Meteorological Monitoring

Each turbine would have instrumentation mounted on the nacelle to measure wind speed and direction. This data would control the operation of the turbine including the pitch of the blades, orientation of the turbine into the wind and would also shut the turbine down during low and high wind conditions.

Additional data would be captured by instrumentation on the met towers. This would be relayed to the operation and maintenance building for use by the SCADA system for:

- Providing wind direction, wind shear, air temperature and barometric pressure to optimize Project performance; and
- Providing back up information should there be a problem with an individual turbine's sensors.

The Independent Electricity System Operator, which manages Ontario's power supply, would require the Proponent to provide the real-time information gathered at the met towers, along with real-time generation data to provide input to their central generation forecasting model.

## 4.5 Key Process Features and Mitigation Measures

Key process features are those processes identified in O. Reg. 359/09 and MOE guidance documents as having specific information requirements if they occur as part of Project activities. These processes include: waste management, air emissions, water taking, wastewater management, and stormwater management.

The sections below describe key process features as they relate to the Project, and outline the proposed environmental protection and mitigation measures that would be implemented during Project operation.

### 4.5.1 Waste Management

The Project's waste management program would be designed to prevent potential effects to natural and socio-economic features associated with the improper collection, storage, and disposal of wastes.

Lubricating and hydraulic oils associated with turbine maintenance and operation would be used for the facility, and waste materials, such as oil, grease, batteries, and air filters and a minor amount of domestic waste (i.e. garbage, recycling, and organics), would typically be generated during standard operation and maintenance activities. It is estimated that the amounts of oil and grease used for semi-annual maintenance would be approximately 10,650 L and 3,550 kg, respectively.

Waste materials would be temporarily stored at the operation and maintenance building and would require reuse, recycling, and/or disposal at an appropriate off-site facility. There would be no on-site disposal of waste during the operation of the facility. Used oil would be stored in a secondary containment structure until removal by a certified contractor with the appropriate manifests in place.

During operations, the Proponent and/or the Operation and Maintenance Contractors would implement a site-specific waste collection and disposal management plan, which may include good site practices such as:

- Systematic collection and separation of waste materials within on-site storage areas in weather-protected areas located at the operation and maintenance building;

- Contractors would be required to remove all waste materials from the turbine siting areas during maintenance activities;
- All waste materials and recycling would be transported off-site by licensed private waste material collection contractors;
- Labelling and proper storage of liquid wastes (e.g. used oil, drained hydraulic fluid, and used solvents) in a secure area that would ensure containment of the material in the event of a spill. As per s.13 of the *Environmental Protection Act*, all spills that could potentially have an adverse environmental effect, are outside the normal course of events, or are in excess of the prescribed regulatory levels would be reported to the MOE's Spills Action Centre;
- As appropriate, spill kits (e.g., containing absorbent cloths and disposal containers) would be provided on-site during maintenance activities and at the operation and maintenance building;
- Dumping or burying wastes within the Project sites would be prohibited;
- Disposal of non-hazardous waste at a registered waste disposal site(s);
- If waste is classified as waste other than solid non-hazardous, a Generator Registration Number is required from the MOE and the generator would have obligations regarding manifesting of waste. Compliance with Schedule 4 of Regulation 347 is mandatory when determining waste category; and
- Implementation of an on-going waste management program consisting of reduction, reuse, and recycling of materials.

### 4.5.2 Air Emissions

In accordance with s.8 of O. Reg. 419/05, air emission rate calculations and dispersion modeling do not have to be performed for emissions from negligible sources or for the emission of negligible contaminants from significant sources.

Based on the preliminary facility design, the following sources of air contaminant emissions have been identified:

- Fuel combustion from on-site vehicles;
- Maintenance use of solvent-based cleaners;
- Maintenance welding activities (no dedicated fume hoods);
- Maintenance building ventilation exhausts;
- Dead tank circuit breakers ($SF_6$/CFC containing breakers); and
- Batteries.

Based on the guidance given in Table B-3 of Procedure for Preparing an Emission Summary and Dispersion Modelling (ESDM) Report (Version 3, February 2009), the following facility sources are defined as sources that emit contaminants in negligible amounts:

- Small maintenance and janitorial activities;
- Maintenance welding stations;
- Dead tank circuit breakers ($SF_6$/CFC containing breakers);and

- Batteries.

Therefore, as O. Reg. 419/05 does not apply to discharges of contaminants from motor vehicles and all other facility sources can be considered negligible per the information provided above, no further assessment is required.

### 4.5.3 Water Taking

The water well installed at the operation and maintenance building will be used for kitchen and washroom facilities, general landscaping requirements, and washing of equipment and the floor of warehouse and storage spaces. The well would be used as a drinking water source if the water is confirmed to be potable. Water takings would not exceed 50,000 L/day and, therefore, a Ministry of Environment Permit to Take Water (PTTW) will not be required to operate the well. The water well would be maintained, inspected, and sampled in accordance with provincial and local requirements.

### 4.5.4 Wastewater Management

The operation and maintenance building would contain restroom and shower facilities that would be serviced by a septic system. Based on the Ontario Building Code criteria, it is anticipated that each employee will generate 125 L of wastewater per shift with the use of showers. A conservative estimate of 25 employees was assumed to calculate total sewage generation at 3,125 L/day. Therefore, the septic system would have a minimum capacity of three times that volume, for a working capacity of 9,375 L for non-residential use.

The operation and maintenance building will be equipped with an area in which a vehicle can be driven and allowed to drip dry during the winter. A sump/drainage pit will collect the residues and drain to the septic system.

As appropriate, the contents of the tank will be pumped and hauled for off-site disposal by a licenced waste hauler. It is not anticipated that any chemical inputs will be required for the proper functioning of the septic system.

### 4.5.5 Stormwater Management

Maintenance requirements for the stormwater management facilities located at the Substation Property and the Transformer Station Property are provided in the following sections.

#### 4.5.5.1 Substation Property

Maintenance is important for any stormwater management facility in order to ensure its continued operation and efficiency. The following minimal maintenance items have been recommended for the Project:

- Inspect the integrity of the side slopes and vegetation viability of the SWM Pond and the drainage ditches for erosion, on a quarterly basis during the first two years of operation and

as a minimum annually thereafter. Inspection should be completed after all significant rainfall events (e.g., 13 mm or greater) and repairs completed as required.

- Inspect the integrity of culverts on a quarterly basis during the first two years of operation and as a minimum annually thereafter. Repair as required.
- Suggested oil and grit separator maintenance recommendations include:

  - Compliance with maintenance information/procedures/schedules obtained from the manufacturer.
  - Units should be inspected post construction, prior to being put into service.
  - Inspect every six months for the first year to determine the oil and sediment accumulation rate.
  - In subsequent years, inspections can be based on first-year observations or local requirements.
  - Cleaning is required once the sediment depth reaches 15% of storage capacity, (generally taking one year or longer). Inspect the unit immediately after an oil, fuel or chemical spill.
  - A licensed waste management company should remove oil and sediment and dispose responsibly.
  - Annual inspections should be conducted during the spring.

Monitoring will consist of the visual inspections of the stormwater management facility as well as testing of water quality pond effluent. The monitoring program will also include regular inspections of the erosion and sediment control features described in the following section.

#### 4.5.5.2 Transformer Station Property

Proper maintenance is required for maximum filter-strip effectiveness. The maintenance requirements for the grass filter strips within this development will be based on information provided in MOE (2003). The following minimal maintenance items will be implemented:

- Inspect filter strips and grass lined drainage ditches frequently, especially after intense rainfall events and runoff events of long duration. Small breaks in the sod and small erosion channels quickly become large problems.
- Minimize the development of erosion channels within the filter. Even small channels may allow much of the runoff to bypass the filter. These areas would be repaired and reseeded immediately to help ensure proper flow of runoff through filter strips.
- Reseed or inter-seed bare areas of the filter. Since it may be difficult to re-establish vegetation in an established filter strip, the use of mulch or sod can help to reduce some problems.
- Mow and remove vegetation as required to maintain moderate vegetation height.
- Soil test periodically and apply soil amendments according to test results and recommendations.
- Control trees, brush, noxious weeds, and Canada thistle in the filter strip and ditches using either mechanical means or herbicides.

Monitoring will consist of visual inspections of the vegetated areas adjacent to drainage ditches.

The monitoring program will include regular inspections of the erosion and sediment control features described in the following section.

#### 4.5.5.3 Erosion and Sedimentation

Erosion and sedimentation are naturally occurring processes that involve particle detachment, sediment transport and deposition of soil particles. The erosion and sediment control plan for the Project will be compliant with the following guidelines:

- Erosion and Sediment Control practices study technical report, MOE, 1995;
- Guidelines for Evaluating Construction Activities Impacting on Water Resources, MOE, 1995;
- Stormwater Management Planning and Design Manual, MOE, 2003; and
- Conservation Authority Guidelines on Erosion and Sediment Control for Urban Construction Sites, 2006.

Development of the Transformer Station Property should not contribute to erosion and transport and deposition of suspended sediment downstream into surrounding natural areas, including watercourses (fish habitat), woodlots and wetlands as well as adjacent private lands.

To minimize the potential operation and environmental impacts, the following erosion and sedimentation control practices have been proposed in the *SWM Plan* for the construction of the SWM pond and ditches at the substation property:

- The SWM pond should be excavated in the first stages of pre-grading, and should function as a temporary sediment control pond until grading and servicing are completed;
- The SWM pond embankments not scheduled for construction within 30 days should be stabilized and seeded immediately;
- Storm drain outfalls at the location of the pond and ditch are required to have erosion protection. Riprap stone must be underlain with a geotextile. The minimum diameter of riprap stone should be 300 mm; and
- Rock check dams consisting of granular material should be placed across the ditches to reduce the velocity of runoff to reduce the potential for ditch erosion.

See Appendix C for more information on the *SWM Plan*.

### 4.6 Spill Response

Some materials, such as fuel, lubricating oils and other fluids associated with turbine maintenance, transformers and/or the septic system, have the potential for discharge to the on-site environment through accidental spills. Design features to prevent and contain spills are discussed in Section 3.0.

Standard containment facilities and emergency response materials (spill kits) will be maintained on-site as required. Refuelling, equipment maintenance, and other potentially contaminating activities will occur in designated areas and, as appropriate, spills will be reported immediately to the MOE Spills Action Centre.

In the event of a potential discharge of fluids associated with Project operation, a contractor or employee will immediately stop work, when safe to do so, and rectify the accidental spill. Once the spill is under control an appropriately trained Contractor will retained to remove contaminated soil and dispose of it in accordance with the current appropriate provincial legislation, such as O. Reg. 347, the General – Waste Management Regulation. The operations and maintenance program will contain procedures for spill contingency and response plans, spill response training, notification procedures, and necessary cleanup materials and equipment. As per s.13 of the Environmental Protection Act, all spills that could potentially have an adverse environmental effect, are outside the normal course of events, or are in excess of prescribed regulatory levels will be reported to the MOE's Spills Action Centre.

An Emergency Response and Communications Plan would be developed by the Proponent and/or the Operation and Maintenance Contractor and would include protocols for the proper handling of material spills and associated procedures to be undertaken in the event of a spill. See Section 7.0 for more information on the Emergency Response and Communications Plan.

## 5.0 POTENTIAL EFFECTS AND MITIGATION

O. Reg. 359/09 requires that adverse environmental effects that may result from operational activities be described. Generally, an area at least 300 m around the Project Location has been considered in the assessment. The term "environment" in O. Reg. 359/09 has the same meaning as in the *Environmental Protection Act*, and includes the natural, physical, cultural, and socio-economic environment.

In order to identify potential negative environmental effects that may result from operation of the Project, the following high level summary of the methodology was applied:

- Collect information on the existing environment using available background information, consultation with stakeholders, and site investigations;
- Review proposed Project activities in order to predict the potential interactions between the Project and environment;
- Identify potential interactions that could cause an adverse effect on the environment; and,
- Develop measures to avoid, mitigate, and monitor potential adverse effects.

Based upon a screening of the existing environment, experience gained during Project planning, and the requirements of the REA process, the following environmental features have been assessed as part of the REA process, and are described in the following sections:

- Archaeological and Cultural Heritage Resources;
- Natural Heritage Resources;
- Water Bodies and Aquatic Resources;
- Air Quality;
- Environmental Noise;
- Land Use and Socio-Economic Resources;
- Existing Local Infrastructure;
- Public Health and Safety; and
- Contaminated Lands.

For some natural environment and socio-economic features, avoidance during Project siting and planning are anticipated to eliminate all potential effects. The application of these principles has greatly reduced the potential for adverse environmental effects from the Project as demonstrated in the following subsections.

The key performance objective for each of the features discussed below is avoiding and/or minimizing potential effects (through the use of appropriate mitigation measures) to the features throughout the operation phase of the Project. The proposed mitigation measures would assist in achieving this performance objective. A summary of potential effects and mitigation strategies is provided in Section 6.0 and Appendix F, with corresponding performance objectives, monitoring plans and contingency measures.

## 5.1 Cultural Heritage and Archaeological Resources

### 5.1.1 Protected Properties and Cultural Heritage Resources

A *Built Heritage and Cultural Heritage Landscape Assessment* was undertaken for the Project, to meet the O. Reg. 359/09 requirements for a Cultural Heritage Assessment and a Protected Properties Assessment. The *Built Heritage and Cultural Heritage Landscape Assessment* was completed and submitted to the Ministry of Tourism, Culture and Sport (MTCS), who provided written comments. A subsequent addendum to the report was prepared to address changes to the Project layout and was submitted to the MTCS, who indicated the layout changes did not affect the comments the MTCS had previously provided. The following provides a summary of the potential effects and the associated mitigation measures as described in the *Built Heritage and Cultural Heritage Landscape Assessment* and addendum. Cultural heritage resources are shown in Appendix A, Figure 2.

The *Built Heritage and Cultural Landscape Assessment Report* determined that:

- No protected properties as defined by O. Reg. 359/09 are located near the Project Location.
- Built heritage resources are located in the vicinity of the Project Location, and include 3 barns, 1 commercial building, 4 churches, 7 schools, and 43 dwellings.
- 15 cultural heritage landscapes were identified in the vicinity of the Project Location, including 10 cemeteries.

**Potential Effects**

The wind turbines would be visible from different vantages around the Project Location potentially resulting in visual disturbances. Visual effects of the turbines would occur to some of the properties and some visual effects have already occurred as a result of other wind farms in the area. Visual impacts will also result from installation of the transformer station and substation. These effects are not considered to have a permanent, negative impact on cultural heritage properties.

The *Built Heritage and Cultural Heritage Landscape Assessment* identifies one site with cultural heritage value or interest, Landscape L09, the former site of the Port Albert Air Navigation School. At the time the report was written (February 2012) T224 and T229, and the associated access road and collector lines were in the vicinity of L09. With changes to the proposed Project infrastructure in this area, there is no longer proposed Project infrastructure at this location. The addendum to the *Built Heritage and Cultural Heritage Landscape Assessment* (June 2012) notes the lack of impact on any heritage resources.

**Mitigation Measures**

Mitigation measures to minimize potential effects from visual disturbances during operation of the facility are discussed in Section 5.5.7. In particular, the visual impact of the substation to cultural heritage resources would be minimized with appropriate landscape design such as

massing and screening. Other more structural solutions are not necessary and would bring added and unnecessary change to the visual character of agricultural land use.

Mapping and surface survey of the Port Albert Air Navigation School lands was recommended as part of the Stage 2 Archaeological Assessment for the Project to mitigate impacts to this cultural landscape, as artefacts and cultural features may be encountered during this assessment. A Stage 2 Archaeological Assessment was conducted at this site and no artefacts were discovered.

**Net Effects**

While visual impacts are unavoidable, the potential adverse net effects on heritage resources are anticipated to be minimal as visual impacts would not affect the heritage values of the properties.

### 5.1.2 Archaeological Resources

In accordance with O. Reg. 359/09, a *Stage 1 Archaeological Assessment* and a *Stage 2 Archaeological Assessment* were completed for the Project. The reports were completed and submitted to the MTCS, who provided written comments. Subsequent addenda to the *Stage 2 Archaeological Assessment* were prepared to address changes to the Project layout and MTCS has provided written comments. The following provides a summary of the potential effects and the associated mitigation measures as described in those reports. The locations of archaeological sites are sensitive information, and therefore mapping of these locations has been omitted to ensure the safety of the sites.

The *Stage 2 Archaeological Assessment* and associated addenda indicate that the potential for the presence of archaeological sites within the proposed construction areas would be low. Where required, Stage 3 and 4 archaeological investigations will be conducted prior to construction of the Project.

Although the Project Location contains multiple hamlets and villages, which have altered the landscape, the majority of the lands are still under agricultural production.

**Potential Effects**

Given the results of the *Stage 2 Archaeological Assessment* and associated addenda, there is a low probability that archaeological resources would be excavated during the operation phase of the Project. Therefore no potential effects are anticipated to archaeological resources during operation.

**Mitigation Measures**

No potential effects are anticipated and therefore no mitigation measures are necessary.

**Net Effects**

There will be no net effects to archaeological resources.

## 5.2 Natural Heritage Resources

In accordance with O. Reg. 359/09, a *Natural Heritage Assessment and Environmental Impact Study* (*NHA/EIS*) was undertaken for the Project. The report was completed and submitted to the MNR, who confirmed that the methodology, recommendations, and conclusions were to their standards. Four addenda were prepared to address changes to the Project layout and were submitted to the MNR for confirmation. The following provides a summary of the potential effects and the associated mitigation measures as described in those reports. Potential effects and mitigation measures are also identified for significant natural features and other natural features which are not considered in the *NHA/EIS*. Significant natural heritage features are shown in Appendix A, Figures 3A through to 3-P.

### 5.2.1 Significant Natural Heritage Features

The *NHA/EIS* and subsequent addenda identified the following types of significant or provincially significant natural heritage features in or within 120 m of the Project Location (referred to as the zone of investigation):

- Provincially significant wetlands (PSW);
- Areas of Natural and Scientific Interest (ANSI) – life science and earth science;
- Significant woodlands;
- Significant valleylands; and
- Significant wildlife habitat (SWH) – seasonal concentration areas, specialized habitat for wildlife, habitat for species of conservation concern, and animal movement corridors.

#### Potential Effects

The *NHA/EIS* report (dated May 2012) and subsequent addenda to the report provide a detailed assessment of potential effects to each feature identified in the zone of investigation. Table 5-1 below provides an overview of the potential effects as detailed in the *NHA/EIS* report and addenda. Direct effects were primarily avoided through siting Project infrastructure outside of significant features.

#### Mitigation Measures

Table 5-1 below provides an overview of the potential effects and recommended mitigation measures as a result of Project operation.

**Table 5-1: Summary of Potential Effects and Recommended Mitigation Measures for Significant Natural Heritage Features during Operation of the K2 Wind Power Project**

| Significant Natural Feature Type | Potential Effects of Operation of the Project | Mitigation Measures |
|---|---|---|
| Provincial Parks and Conservation Reserves | • None identified. | • Not applicable. |
| Wetlands | • Accidental chemical and/or fuel spills and contamination.<br>• Improper waste disposal (fluids, containers, cleaning materials) could also have a negative impact. | • Mitigation measures for spills as detailed in Section 4.6.<br>• Mitigation measures for waste as detailed in Section 4.5.1. |
| ANSI – earth science | • No operational impacts are predicted. | • None. |
| Woodlands | • Accidental chemical and/or fuel spills and contamination.<br>• Improper waste disposal (fluids, containers, cleaning materials) could also have a negative impact. | • Mitigation measures for spills as detailed in Section 4.6<br>• Mitigation measures for waste as detailed in Section 4.5.1. |
| Valleylands | • Accidental chemical and/or fuel spills and contamination.<br>• Improper waste disposal (fluids, containers, cleaning materials) could also have a negative impact. | • Mitigation measures for spills as detailed in Section 4.6.<br>• Mitigation measures for waste as detailed in Section 4.5.1. |
| SWH – seasonal concentration areas | • Potential direct mortality of herons, waterfowl, raptors, bats.<br>• Avoidance behaviour of herons, waterfowl, raptors, bats. | • Post-construction monitoring for mortality, as detailed in the Environmental Effects Monitoring Plan (*NHA/EIS*).<br>• Three-year post-construction monitoring plan on natural features where avoidance behaviour of significant wildlife habitat has been identified as a potential effect of operations. |
| SWH – rare vegetation communities and specialized habitat for wildlife | • Accidental chemical and/or fuel spills and contamination to rare vegetation communities.<br>• Direct mortality of amphibians may result due to vehicles using the access roads. | • Mitigation measures for spills as detailed in Section 4.6.<br>• Vehicle traffic shall primarily be restricted to daytime hours. Speed limit signage will be erected and shall be restricted to 30 km/h or less, where appropriate. |
| SWH – habitat for species of conservation concern | • Risk of collision on access roads to Snapping Turtle. | • Vehicle traffic shall primarily be restricted to daytime hours.<br>• Speed limit signage will be erected and shall be restricted to 30 km/h or less, where appropriate. |
| SWH – animal movement corridors | • Sensory disturbance of amphibians using the corridors. | • Three-year post-construction monitoring plan on natural features where avoidance behaviour of significant wildlife habitat has been identified as a potential effect of operations. |

**Net Effects**

A combination of avoidance and implementation of mitigation measures described above will ensure that the anticipated adverse effects to significant natural features are minimized or avoided during operation of the Project.

### 5.2.2 Other Natural Heritage Features

In addition to natural features identified as significant during the Evaluation of Significance additional natural features (including woodlands and wildlife habitat) occur within 120 m of the Project Location. All natural features occurring within 120 m of the Project Location are detailed in the *NHA/EIS*.

**Potential Effects**

Indirect effects to natural communities from operation of the Project could occur from accidental spills and/or improper waste disposal (fluids, containers, cleaning materials).

There is the potential for mortality to birds and bats from collisions with wind turbines during operation of the facility.

**Mitigation Measures**

Mitigation measures for accidental spills and waste are detailed in Sections 4.6 and 4.5.1, respectively.

Post-construction monitoring for mortality is detailed in the *Environmental Effects Monitoring Plan* (*NHA/EIS*). To address the potential effects to birds and bats, the MNR has developed standard monitoring requirements for all wind projects in Ontario. In accordance with O. Reg. 359/09, an *Environmental Effects Monitoring Plan* (*EEMP*) for birds and bats was prepared for the Project and submitted to the MNR for comment. The *EEMP* was confirmed by the MNR as having been prepared in accordance with their guidelines and is provided in *NHA/EIS*. Refer to the *NHA/EIS* for further detail.

**Net Effects**

Implementation of the mitigation measures described above ensure anticipated adverse effects to natural features are minimized or avoided during operation of the Project.

## 5.3 Water Bodies and Aquatic Resources

### 5.3.1 Groundwater

**Potential Effects**

The water well installed at the operation and maintenance building will be used for kitchen and washroom facilities and general grounds keeping, as well as for periodic washing of equipment, and the floor of warehouse and storage spaces. No notable interference to surrounding private water well or local surface water features quantities are anticipated as large volumes of water

will not be withdrawn from the well to meet the daily demands of the facility (i.e., water use will remain below 50,000 L/day).

The final design of the septic system would conform to local building code and health unit requirements.

Some materials, such as fuel, lubricating oils and other fluids associated with turbine maintenance have the potential for discharge to the on-site environment through accidental spills.

**Mitigation Measures**

Mitigation measures for accidental spills are listed in Section 4.6. No mitigation measures are required for water use associated with the water well at the operation and maintenance building. The well will be designed and operated in accordance with municipal, provincial, and local health unit requirements as appropriate.

**Net Effects**

Based on the proposed mitigation measures outlined in Section 4.6, it is anticipated that accidental spills would be spatially limited and of short duration. Protocols to minimize impact of accidental spills would be provided in the Emergency Response Plan. For more information on the Emergency Response and Communications Plan refer to Section 7.0. No net effects are anticipated for water well usage.

### 5.3.2 Surface Water Bodies, Fish and Fish Habitat

The Project area is crossed by numerous watercourses with flows from east to west and discharging into Lake Huron. A study of the water courses and aquatic habitat was completed as part of the inventory of natural features and reported in the *Water Bodies/Assessment Report*.

**Potential Effects**

The potential for effects on watercourses during operations exists from soil erosion which in turn results from unavoidable removal of stabilizing vegetative cover during maintenance activities. Erosion can cause downstream sediment transport and a short-term increase in surface water turbidity, including associated impacts to fish and fish habitat. Due to the Project Location's rural and agricultural land uses, the watercourses are not highly sensitive to temporary disturbances. However, the magnitude and duration of potential effects to watercourses depend on the specific characteristics of each watercourse (e.g. flow regime, water velocity, bed substrates, bank conditions, local soils and the extent and duration of exposure). Some materials, such as fuel, lubricating oils and other fluids associated with turbine maintenance and/or the septic system, also have the potential for release to the environment in the event of accidental spills.

The presence of Juvenile Coho Salmon and year of young (YOY) Rainbow Trout in Kerry's Creek suggest that salmonid spawning and/or rearing habitat is present in the vicinity of the

Project Location at the proposed sites of turbines 252 and 373. Since no in-water work is proposed at these locations, it is very unlikely that any long-term negative impacts will occur given the implementation of the standard mitigation measures outlined in below and in the *Water Bodies Report*. Given the sensitive nature of the habitat located within 120 m of the Project Location, it is possible that any silt/sediment releases or construction-related activities *Water Bodies Report* could impact the spawning and/or rearing habitat that is likely present.

Turbine access roads cross several water bodies, and in some cases, crane paths and underground collector lines are associated with the access roads. Culverts installed for the Project would be designed and installed in a manner that would not impede fish movement or water passage and, where possible, habitat enhancement measures would be incorporated into the design.

For the substation property and for the transformer station, a *SWM Plan* has been prepared in accordance with MOE guidelines for inclusion with the REA application. For the substation property, the *SWM Plan* would provide a permanent retention pond for reducing peak runoff from that site and allow sedimentation prior to discharge.

**Mitigation Measures**

To minimize the risk of slope failure and siltation, vegetation removal on the slopes of watercourses would be minimized to the greatest extent possible. Stream banks (i.e. the area between erosion control fences) would not be disturbed until necessary for maintenance activities. Materials removed or stockpiled (e.g. excavated soil, backfill material, etc.) would be deposited and contained to ensure sediment does not enter a watercourse.

As soon as possible, following completion of the maintenance activity, stream banks would be restored to their original grade.

Even with properly installed erosion and siltation control measures, extreme runoff events could result in collapse of silt fencing, slope or trench failures and other problems which could lead to siltation of waterbodies. If siltation to a watercourse occurs, activities would cease immediately until the situation is rectified. Silt fencing would be inspected regularly to ensure proper function, particularly during heavy rainfall events.

To ensure impacts do not occur to the sensitive salmonid spawning and/or rearing habitat in Kerry's Creek near T252 and T373, post-construction monitoring (at least once a month) is recommended.

Mitigation measures related to accidental spills are outlined in Section 4.6.

No additional mitigation measures are required for correctly installed culverts.

### Net Effects

The application of the above mitigation measures as necessary during maintenance activities would ensure that effects to surface water are minimized, and that any potential net effects are spatially limited and of a limited duration.

## 5.4 Air Quality and Environmental Noise

### 5.4.1 Air Emissions

### Potential Effects

During operations, minor localized air emissions would occur from several sources including: the periodic use of maintenance equipment to repair the wind turbines over the life of the Project and from personnel vehicles and waste management haulers travelling to and from the substation area during regular business hours. For more information regarding potential effect of air emissions please refer to Section 4.5.2.

### Mitigation Measures

To reduce emissions from equipment and vehicles, the following mitigation measures would be employed:

- Multi-passenger vehicles would be utilized to the extent practical;
- Company and maintenance personnel would avoid idling of vehicles when not necessary for operations activities;
- Equipment and vehicles would be maintained in good working order with functioning mufflers and emission control systems as available; and
- All operations equipment and vehicles would meet the emissions requirements of the MOE and/or Ministry of Transportation (MTO).

### Net Effects

The application of the recommended mitigation measures during operations would limit air emissions to the work areas and limit the magnitude of combustion emissions. As a result, any adverse net effects to air quality from air emissions during operation of the Project are anticipated to be short-term in duration and highly localized.

### 5.4.2 Dust and Odour Emissions

### Potential Effects

Operations related traffic and maintenance activities have the potential to create nuisance dust effects in the immediate vicinity of the Project. Unpaved road surfaces exposed to wind can also be a source of fugitive dust emissions.

No odour emissions are anticipated during operation of the Project.

**Mitigation Measures**

To protect adjacent receptors from potential off-site dust concerns, the Proponent and/or the Operation and Maintenance Contractor would implement good site practices during operations which may include:

- Maintaining equipment in good running condition and in compliance with regulatory requirements;
- Dust suppression (e.g. water and/or calcium chloride) of source areas; and
- Covering loads of friable materials during transport.

**Net Effects**

The application of the recommended mitigation measures during operations would limit fugitive dust emissions to the work areas. As a result, any adverse net effects to air quality from dust emissions during operation of the Project are anticipated to be short-term in duration and highly localized.

### 5.4.3 Environmental Noise

**Potential Effects**

During operation of the Project, sound would be generated by the periodic use of maintenance equipment to repair the wind turbines over the life of the Project. Personnel vehicles and waste management haulers would also travel to and from the substation property during regular business hours. The audible sound at receptors beyond the turbine siting areas and substation property is expected to be a minor, short-term disruption.

Mechanical and aerodynamic sound would be emitted from the wind turbines in addition to sound from transformers. A *Noise Assessment Report* has been completed for the Project (Appendix D) in accordance with the MOE's *Noise Guidelines for Wind Farms* (October 2008) and O. Reg. 359/09. All turbines proposed as part of the Project are located at a distance of at least 550 m from the nearest non-participating noise receptor. The *Noise Assessment Report* indicated the broadband source sound power level for transformers would be a maximum of 79 dBA.

Based on the Project design, the analysis carried out in the *Noise Assessment Report* indicates that sound produced by the Project will be within the acceptable limits established by the MOE at all noise receptors. The analysis includes the associated transformers of 50 kV or more, and other wind turbines within a three kilometre radius.

**Mitigation Measures**

To minimize inconvenience caused by noise from vehicles during the operations phase of the Project, all engines associated with maintenance equipment would be equipped with mufflers and/or silencers in accordance with MOE and/or MTO guidelines and regulations. Noise levels arising from maintenance equipment would also be compliant with sound levels established by the MOE.

To the greatest extent possible, operations activities that could create excessive noise would be restricted to regular business hours, when residents are less sensitive to noise, and adhere to any local noise by-laws as appropriate. If maintenance activities that cause excessive noise must be carried out outside of these time frames, adjacent residents would be notified in advance and by-law conformity would occur, as required.

Routine facility maintenance to ensure infrastructure is operating properly and efficiently would be performed as required.

The noise assessment has concluded that the environmental noise effect from the operation of the Project would be in compliance with the applicable MOE environmental noise guidelines at all wind speeds modelled for the transformers, the Project wind turbines and other wind turbines within a three kilometre radius.

The Project would be required to operate according to the terms and conditions of the REA. In the event the Project does not operate according to the terms and conditions of the REA, the Proponent will contact the MOE to determine the best path forward for resolving the issue. The resolution of the issue could include shutting down the non-compliant turbine(s) until the problem is resolved. A regular maintenance program, as described in Section 4.2, would largely mitigate potential effects related to noise from damaged turbines.

**Net Effects**

Application of the recommended mitigation measures during operations would limit noise emissions to the general vicinity of the turbine locations, transformer station site and substation property. Given that the facility must comply with MOE environmental noise requirements, no significant net effects are anticipated.

Intermittent noise would increase during regular business hours at the turbine locations, transformer station site and substation property during maintenance activities. Any adverse net effects due to noise during maintenance activities are anticipated to be short-term in duration and intermittent.

## 5.5 Land-use and Socio-Economic Resources

### 5.5.1 Existing Land Uses

Several communities are located throughout the Project Location. Current and historical settlement areas include Nile, Sheppardton, Cransford, Crewe, Kingsbridge, Mafeking, Zion, Kintail, Corrie's Corners, Lothian, Lochalsh, and Amberley. Some industry (e.g. salvage yard, resource extraction, industrial agriculture operations) is located in the vicinity of the Project Location and resort/residential areas (e.g. golf course, Point Farms Provincial Park, flea market, Lake Huron Resort) are concentrated along the Lake Huron shoreline, outside of the Project Location.

The general region is dominated by rural and agricultural land use. Within the 300 m study area there are several land use designations, including Natural Environment, Agriculture, and Extractive, as identified in the Township of ACW's *Official Plan* (October 2003).

All of the turbines, as well as the associated buildable areas, are located on lands designated as Agriculture in the Township of ACW's *Official Plan* (October 2003), with the exception of the buildable areas for T252, T349 and T350 which extend slightly onto lands designated as Natural Environment.

Within 300 m of Project infrastructure, there are two cemeteries and one school.

The Project is not located within the Oak Ridges Moraine, Niagara Escarpment, Protected Countryside of the Greenbelt, or the Lake Simcoe watershed.

**Potential Effects**

During the operation phase of the Project, the lands which are occupied by surface facility components would be removed from their present land-use; however, existing surrounding land uses would remain unchanged.

During operations there would be a temporary increase in noise and dust around the work and haul areas used by maintenance equipment, personnel vehicles, and waste management haulers. This temporary increase in noise and dust would result in a potential effect to adjacent land uses, including the use of local businesses.

There is potential for a minor increase of traffic during operations on roadways within the Project Location due to the commuting workforce, maintenance equipment and removal of waste materials. No adverse effects on existing land uses, including local businesses, are anticipated from increased traffic during operations of the Project. Therefore, no mitigation measures are required.

**Mitigation Measures**

Operational and maintenance activities would be restricted to the areas where Project components are located such as access roads and turbine locations. Under O. Reg. 359/09, the centre of the turbine base should be at least hub height (99.5 m) from adjacent property lines, in order to mitigate potential effects on adjacent land uses. If this distance cannot be achieved, a *Property Line Setback Assessment* must be completed for the turbines located closer to the property line. A minimum distance of blade length plus 10 m must be maintained, which equates to 59 m for the proposed turbines. This assessment is included in Appendix C to this report. All turbines have been sited in accordance with O. Reg. 359/09 setback requirements from road allowances, representing a distance of 59 m from centre of turbine base for this Project.

Mitigation measures have been identified for noise in Section 5.4.3, dust in Section 5.4.2, and traffic in Section 5.5.6.

### Net Effects

Although some disturbance to adjacent land uses from noise and dust during maintenance activities is unavoidable, it is expected to be short-term in duration, temporary, highly localized, and would be minimized through the implementation of good site practices, transportation planning, and communication with the community.

## 5.5.2 Recreation Areas and Cultural Features

There are no Provincial Parks within the 300 m study area. Point Farms Provincial Park is located west of the Bluewater Highway between Gore Road and Golf Course Road which is 3 km outside of the Project Location. Within the Township of ACW, there are a number of festivals and other community events that are held throughout the year. In the winter, recreational opportunities exist in the form of snowmobiling, ice fishing and other winter sports as weather conditions permit. Cycling routes, museum attractions, golf courses, and bed and breakfasts are also located in the general vicinity of the Project Location. Refer to Section 5.5.5 for information regarding potential effects to hunting and fishing activities.

### Potential Effects

Operations activities would be limited to private land and therefore are not expected to directly affect recreation areas. There is, however, the possibility that increased noise, dust and traffic volumes during some activities related to maintenance equipment and vehicles, may interfere with nearby recreational uses.

### Mitigation Measures

Mitigation measures related to noise, dust, and traffic are identified in Sections 5.4.3, 5.4.2, and 5.5.6, respectively.

### Net Effects

Noise, dust and traffic effects on the use of recreation areas during maintenance activities are anticipated to be short term and intermittent.

## 5.5.3 Agricultural Lands and Operations

All participating properties for the Project are located on agricultural lands. The lands in the vicinity of the Project Location are dominated by prime agricultural land as defined by the Canada Land Inventory. Crops are currently dominated by corn, wheat and soy.

### Potential Effects

Potential effects to the agricultural land used for the turbines, access roads and collector lines are related to the change in use from agricultural land use to industrial use – as renewable energy development. However, where lands are being used for Project infrastructure, landowners are being financially compensated for the lease of the private lands and thus offset the effect of removing the land from agricultural production. Project infrastructure would occupy a small footprint and would not interfere with continued production on agricultural lands.

Impacts to livestock during the operations of the Project as a result of dust and noise produced during maintenance activities are anticipated to be minimal.

**Mitigation Measures**

To the greatest extent possible, efforts have been made to site the turbines, access roads, collector lines, and the transmission line in such a way as to minimize disturbances to existing agricultural operations. In particular, siting of turbines and access roads is completed in consultation with participating landowners.

The Proponent and/or the Operation and Maintenance Contractor will maintain regular communication with property/livestock owners in order to ensure a minimum level of impact on livestock during operations.

**Net Effects**

Disturbances to agricultural lands and operations are expected to be spatially limited for the life of the Project.

### 5.5.4 Mineral, Aggregate, and Petroleum Resources

The Township of ACW identifies mineral aggregates as an important resource in its *Official Plan* (October 2003), as does the County of Huron in its *Summary of the Draft Aggregate Resource Strategy Report* (2005). The locations of identified primary aggregate deposits were considered during the siting of Project infrastructure in response to consultation with the Township of ACW.

**Potential Effects**

Only one turbine, T231, is located within a Primary Aggregate Deposit as shown on Figure 2-J, Appendix A. However, a significant wetland is located in the vicinity of T231 (Figure 3-J, Appendix A) which, in accordance with the policies of the Township of ACW and the County of Huron, would preclude this area for resource extraction.

Lands designated as Potential Aggregate Resources according to the Township of ACW's *Official Plan* (October 2003) are situated in the Project Location. While lands designated for resource extraction are present in the Project Location, operation of the Project is not anticipated to have any effects on mineral and aggregate resources as the lands required for the Project have been optioned for renewable energy development by the landowner. Furthermore, while the wind turbines used for the Project can be expected to be in service for the 20 year term of the Ontario Power Authority Power Purchase Agreement, the infrastructure is not considered permanent on the landscape. There are oil and gas pipelines and petroleum wells within the Project Location. Petroleum resources have been identified in the Project Location based on consultation activities with owners of petroleum infrastructure, information obtained from the Oil, Gas and Salt Resources (OGSR) library and the Township of ACW *Official Plan* mapping. Additional studies to verify the location of known petroleum resources in proximity to Project components will be undertaken as part of the MNR's Approval, Permitting and Requirements Document (APRD) process. Work will be conducted prior to construction of

the Project to identify potential effects to the petroleum resources. Operations and mitigation measures will be implemented to minimize or eliminate any potential effects. Therefore, no adverse effects are anticipated to petroleum resources during operation of the facility.

**Mitigation Measures**

As no potential effects are anticipated to existing mineral or aggregate resources, no mitigation measures are necessary.

**Net Effects**

No adverse net effects are anticipated to mineral, aggregate or petroleum resources during operation of the Project.

### 5.5.5 Game and Fishery Resources

**Potential Effects**

Since the Project has been sited outside of wetlands, other naturally vegetated areas and parallel to lot lines, most potential effects to mammals, amphibians, reptiles and their habitats are expected to be temporary, as the wildlife present on the agricultural lands are common in southern Ontario and tend to be well-adapted to human-influenced landscapes and disturbance.

Studies related to the sensory effects of constructing and operating wind farms on big game resources, have shown that there is no significant effect (Austrian Wind Power, 2007; Strickland and Erickson, 2003) and no reduction in use of the area immediately within wind project locations (Arnett *et al.*, 2007; Austrian Wind Power, 2007). These studies indicate that species are either unaffected by this type of development, given their small footprint and preservation of the existing land-use, or that they can readily adapt to the presence of the wind project.

Sensory disturbance to game species may occur during the operations phase due to noise. A certain level of sensory disturbance to wildlife in the regional area already exists from existing turbines and ongoing agricultural, rural, and domestic activities.

From the few studies that are available, mammals were able to adapt to various noises. Noise and its effects on wildlife appear to be habitat and species specific. Studies conclude that if species are able to adapt easily to human-modified habitats, generally they do not seem to be adversely affected by noise.

Improperly installed culverts have the potential to affect fish habitat and may impose barriers to fish passage.

**Mitigation Measures**

All turbine locations are proposed in agricultural lands. Siting the Project outside of wetlands and naturally vegetated areas has largely precluded disturbance to local flora, small mammals and amphibians, natural habitat, and corridor functions. No further mitigation measures are required.

Culverts would be designed and installed such that there is no restriction of flows through the culvert resulting in upstream pooling, erosion at the culvert inlets and outlets and barrier to fish passage to upstream environments.

**Net Effects**

Once the Project is in operation, human activity, resulting from construction activities, around the facilities would decrease, thus allowing local wildlife movement patterns to quickly re-establish.

Considering the periodic nature of maintenance activities, it is likely that resident game species would adapt to the Project quickly. With the proper installation of culverts, no effects on fish habitat or passage of fish are anticipated. Consequently, no net adverse effects are anticipated during the Project to game and fishery resources.

### 5.5.6 Local Traffic

**Potential Effects**

There is potential for an increase of traffic during operations on roadways within the Project Location due to the commuting workforce, maintenance equipment and removal of waste materials. The number of vehicles required during operation would be minimal. A small number of light trucks would be required for typical maintenance activities, however occasionally larger vehicles would be required to transport turbine and transformer components if required. Waste management vehicles would typically access the operation and maintenance building on a weekly basis for waste collection and the contractor responsible for collecting used oil would likely be required on a semi-annual basis.

The increase in traffic may result in short-term, localized disturbance to traffic patterns or increases in traffic volume, and/or create potential traffic safety hazards. Project related traffic would be restricted to a small, defined workforce.

There may be instances during maintenance activities where excess loads (e.g. turbine and transformer components) would require special traffic planning. Widening turning radiuses and road widths, and the creation of new ingress/egress nodes from the work areas may also be required temporarily.

**Mitigation Measures**

As appropriate, permits would be obtained to implement activities requiring special traffic planning. As appropriate, for public safety all non-conventional loads would have front and rear escort or “pilot” vehicles accompany the truck movement on public roads.

Although there are no requirements for formal public notification of wind turbine component load movements, the Proponent will provide notification of non-conventional load movements that may significantly interfere with local traffic, with potential methods of notification including

postings on the Project website. This notification would be provided in the interest of public safety, minimization of disruption of other road users, and good community relations.

**Net Effects**

Road safety is not expected to be an issue during operations; however, the potential for accidents along the haul routes and on-site cannot be totally disqualified. Truck traffic would increase on some roads during maintenance activities and from personnel vehicles, and waste management haulers, however this traffic would be short-term in duration and intermittent.

Typical operation activities for the wind farm are anticipated to have a limited and insignificant effect on traffic.

### 5.5.7 Viewscape

**Potential Effects**

Siting of turbines, met towers and ancillary facilities would alter the visual landscape. However, visibility of the turbines and met towers would vary from receptor to receptor based on the following factors:

- Surficial patterns: landform – largely determined by physiography and tree cover;
- Topography: slope – the greater the slope the greater the visibility of the turbines from more vantage points;
- Observer position: viewing – distance from the turbines reduces scale and the apparent size of a project is directly related to the angle between the viewer's line-of-sight and the slope upon which the project is to take place;
- Atmospheric conditions: clarity – air pollution, natural haze, fogging, snow affect daytime and night-time visibility; and
- Turbine marking: lighting – primarily affecting night-time visibility.

**Mitigation Measures**

The operation and maintenance building construction and finishes would be chosen to be compatible with the rural setting of the Project Location and other buildings in the locale.

Landscaping at the substation and transformer station properties may include the planting of various trees and shrubs where appropriate, while still ensuring that the site visibility and building security are maintained. The substation and transformer station may be surrounded by berms to mitigate the visual impact of the site.

A description of turbine lighting requirements is provided in Section 5.6.3. The Proponent has committed to consider reducing effects from turbine lighting (fewer lights and explore lighting technologies), however the Project must remain compliant with Transport Canada requirements.

A change to the view scape is unavoidable given the height of the turbines and met towers, and the landscape patterns.

**Net Effects**

Some disturbance to the viewscape is unavoidable due to the height of the turbines and met towers. The changed visual landscape would be present during the life of the facility.

### 5.5.8 Local Economy

**Potential Effects**

Operation of the facility is expected to begin in 2014 and continue for approximately 20 years. The Proponent may hire a specialized Operation and Maintenance Contractor for specific maintenance tasks. During operations, it is expected that approximately 18 to 24 operation and maintenance staff from the Proponent and the Operation and Maintenance Contractor would be employed by the wind project during the operation phase.

Operation of the Project would also result in indirect and induced employment, the majority of which is anticipated to be provided by local businesses. Indirect employment is jobs and income in other businesses/industries in the community that supply inputs to the Project and Project employees. Induced employment includes jobs and income changes occurring in other businesses/industries in the community from spending activities of directly and indirectly employed individuals.

To the extent practicable, local hiring would be maximized during the operations period, providing work for existing tradespersons and labourers. Trades that could be provided locally may include pipefitters, electricians, ironworkers, millwrights and carpenters.

Function of the operation and maintenance building and scheduled maintenance activities are anticipated to occur during regular business hours.

Since it is likely that the majority of the labour force would be supplied through local and neighbouring communities, no special housing, healthcare or food facilities would be required as part of the Project operations activities.

The increased number of personnel present in the area during operations would increase the demand for some goods and services from the local area (e.g. lodging, food, and banking). This demand would generate local benefits to business and services from Project spending.

Local economic benefits would also include ongoing property tax income from the Project for the County of Huron and the Township of ACW, participating landowners would receive land lease payments, and owners of residences within a specified distance of a Project wind turbine would receive Community Renewable Energy Benefit payments.

**Mitigation Measures**

To the extent practicable the Proponent and/or the Operation and Maintenance Contractor would source required goods and services from qualified local suppliers where these items are available in sufficient quantity and quality and at competitive prices.

### Net Effects

A positive net effect is anticipated on the local economy during operations of the facility.

The operation of the Project would provide positive income, employment, and fiscal benefits to the local area, including the County of Huron and the Township of ACW, and participating landowners. Local government would receive ongoing property tax income from the Project. Participating landowners would receive land payments based on agreements with the Proponent and owners of residences within a specified distance of a Project wind turbine would receive Community Renewable Energy Benefit payments.

No increased demands for municipal services are anticipated for the County of Huron or the Township of ACW.

Existing businesses within the local communities could benefit from the demands of the Project workforce during operations.

## 5.6 Existing Infrastructure

### 5.6.1 Provincial, Municipal and Other Major Infrastructure

### Potential Effects

No potential effects are anticipated during operations of the Project on provincial, municipal or other major infrastructure other than to roadways. There may be instances during maintenance activities where excess loads (e.g. turbine and transformer components) would require special traffic planning and that may have potential to damage municipal roads.

Potential effects to traffic during the operation of the Project are discussed in Section 5.5.6.

### Mitigation Measures

Permits from the MTO may be required to facilitate the transportation of excess loads required for maintenance (e.g., cranes) on provincial highways. The Proponent would consult with the appropriate local municipality regarding excess loads required during operation that have potential to damage municipal roads.

### Net Effects

The effect of operating the wind farm is anticipated to have a limited, short term effect on infrastructure.

### 5.6.2 Telecommunication and Radar Systems

### Potential Effects

Wind turbines have the potential to interfere with telecommunication and radar systems, including:

- Cable distribution off-air (over-the-air, OTA) receive systems (Head-ends);
- Satellite uplinks and receive systems;
- Direct-to-home (DTH) receive systems (Shaw Direct, Bell TV);
- Radar (weather, defence and air traffic);
- Airport communications and guidance systems;
- Broadcasting – radio (AM, FM) and TV (analog and digital);
- Coast Guard communications and vessel traffic radar systems;
- Point-to-point radio communication systems;
- Point-to-multipoint radio communication systems, and
- Cellular and land mobile networks.

Wind turbines can affect radio communication and radar signals in a number of ways including shadowing, mirror-type reflections, clutter or signal scattering (RABC, 2010).

**Mitigation Measures**

The Proponent has consulted with relevant agencies and licensed providers to identify any likely effects to telecommunication and radar systems. Although no effects are anticipated, in the unlikely event that signal disruption is experienced, mitigation measures are available to alleviate the impact. This may include replacing the receiving antenna with one that has a better discrimination to the unwanted signals, relocating either the transmitter or receiver, or switching to an alternate means of receiving the information. The Proponent would review potential incidents of telecommunication or radar system interference on a case by case basis.

**Net Effects**

Any interference with telecommunication or radar systems would be limited and of short-term duration.

### 5.6.3 Aeronautical Systems

**Potential Effects**

The presence of wind turbines presents a potential hazard to low flying aircrafts. Aviation safety lighting and marking of the turbines is required by Transport Canada's Aerodrome Safety Branch as specified in the Canada Aviation Regulations and Standards. Aviation safety lights, which serve to increase night-time visibility of the turbines to aviators, are required at the top of turbines as part of the lighting requirements. These safety lights may also brighten the night sky. Transport Canada standards state that wind farms require a red obstruction lighting system consisting of fading on and off aviation red beacons. These are used for night marking of wind turbines between the heights of 90 m and 150 m (including blade length) above ground level and spaced approximately 900 m apart. Final aviation lighting requirements would be in accordance with Transport Canada Regulations and Standards and would be confirmed prior to construction.

There are no active airstrips in the vicinity of the Project Location. The Goderich Municipal Airport is located approximately 7 km from the Project Location. No adverse effects are anticipated to aeronautical activities at the Goderich Municipal Airport during operation of the facility based on consultation to date with NAV Canada and the Goderich Airport Manager.

**Mitigation Measures**

According to Transport Canada's Aerodrome Safety Branch guidelines, a wind turbine more than 900 m from another wind turbine with a light requires its own lighting. Turbine lighting must conform to Transport Canada standards. In order to reduce rural light pollution, lights would be selected with the minimal allowable flash duration, narrow beam, and would be synchronized.

The Proponent has committed to consider reducing effects from turbine lighting (fewer lights and explore lighting technologies), however the Project must remain compliant with Transport Canada requirements.

It should be pointed out that turbine marking and lighting are secondary safety measures for aircraft. With certain exceptions, it is illegal for aircraft to fly within 500 feet (152.4 m) of any person, vehicle or structure. Therefore, aircraft will normally not fly below 500 feet (152.4 m) above ground level. The turbines are approximately 140 m tall with one blade upright, and will therefore be below normal flight altitudes. Low-level aircraft such as ultra-lights and crop dusters will be familiar with the area they are flying over and are prohibited from night-time flights. NAV Canada would be responsible for updating all aeronautical charts with the turbine locations.

**Net Effects**

With the application of the above mitigation measures, no adverse net effects on aeronautical activities are anticipated during operation of the facility.

## 5.7 Contaminated Lands

Two closed landfills were identified from the Ministry of the Environment's Waste Disposal Site Inventory and are located in proximity to the collector line system (Figures 2-B and 2-L, Appendix A). A site visit was conducted to determine the current status of the closed landfills.

The closed landfill on Figure 2-B, Appendix A is within 120 m of the collector line system and approximately 300 m from T335, the nearest turbine. This closed landfill site was 2 ha in size and has not received non-hazardous waste since 1985. A monitoring program has been in place since 1991 and there have been no off-site migration of leachate and no impacts to ground or surface water have been identified.

The closed landfill illustrated on Figure 2-L is approximately 350 m from the collector line system and approximately 500 m from T218, the nearest turbine. During the site visit, no records could be found that identify this site as a former landfill. Current employees from the Township of ACW did not know that this site was identified as a closed landfill. A visual inspection of the top most north-east section of the site was undertaken, and there are no visual implications that this site was a landfill.

An operating landfill (Appendix A, Figure 2-L) is located approximately 1 km from the nearest turbine, T225. The landfill site is 36 ha with a fill area of 3.4 ha. It accepts both municipal and commercial solid, non-hazardous waste. Groundwater flow is identified as moving east to west, whereas overburden regional flow is west to southwest. There is no evidence of off-site impacts from the current landfill and no landfill gas has ever been detected beyond the fill area.

**Potential Effects**

The MOE's *Guideline D4: Land Use On or Near Landfills and Dumps* (1994) provides direction on the various factors that should be considered for land use in the vicinity of landfills. In *Guideline D4: Land Use on or Near Landfills and Dumps* (1994), the MOE identifies the most significant contaminant discharges and visual problems generally occur within 500 m of the perimeter of a fill area and uses this distance as a study area for land use proposals. Since the operating landfill falls outside of this 500 m study area, no potential effects are anticipated during operation. The landfill site does not currently affect ground or surface waters, ground settlement, or the visual landscape. There is no identified off-site soil contamination, hazardous waste or landfill gas migration.

For the non-operating site, which is located within 500 m of Project infrastructure, *Guideline D4: Land Use On or Near Landfills and Dumps* (1994) identifies the following factors to be considered for adjacent land use: ground and surface water contamination by leachate, surface runoff, ground settlement, visual impact, soil contamination and hazardous waste and landfill generated gases. No potential effects are anticipated to the Project, or to the closed landfill from the Project, as the closed landfill does not currently affect ground or surface water, ground settlement, or the visual landscape. There is no identified off-site soil contamination, hazardous waste or landfill gas migration.

**Mitigation Measures**

No potential effects are anticipated and therefore no mitigation measures are necessary.

**Net Effects**

No adverse net effects are anticipated to or from contaminated lands during operation of the Project.

## 5.8 Public Health and Safety

### 5.8.1 Turbine Blade and Structural Failure

**Potential Effects**

The potential exists, although remote, for full or partial blade detachment from the turbine structure or met tower collapse, resulting in damage to the landing area from the impact. Garrad Hassan Canada undertook a review of publicly-available literature on turbine rotor failures resulting in full or partial blade throws (Garrad Hassan Canada, 2007). Such events were found to be very rare; therefore data describing these events are scarce.

Root causes of blade failure have been continuously addressed through developments in best practice in design, testing, manufacture and operation; much of these developments have been captured in the International Electrotechnical Commission (IEC) standards to which all current large wind turbines comply (Garrad Hassan Canada, 2007). There has been widespread introduction of turbine design certification and approval that certifies compliance with standards and requires a dynamic test that simulates the complete life loading on the blade (Garrad Hassan Canada, 2007). The certification body also performs a quality audit of the blade manufacturing facilities and performs strength testing of construction materials. This approach has effectively eliminated blade design as a root cause of failures (Garrad Hassan Canada, 2007).

The reported main causes of blade failure include:

- Human interference with the control system;
- A lightning strike; and
- A manufacturing defect in the blade.

Turbine control systems are subjected to rigorous specification in the design standards for wind turbines (IEC 61400-1) and exhaustive analysis in the certification process. Turbines with industry certification must have a safety system completely independent of the control system. In the event of a failure of one system, the other is designed to control the rotor speed.

Lightning protection systems for wind turbines have developed significantly over the past decade and best practices have been incorporated into the industry standards to which all modern turbines must comply. This has led to a significant reduction in events where lightning causes structural damage. A review of available literature, conducted by the Chatham-Kent Public Health Unit (2008), revealed only four documented turbine failure issues in Ontario due to lightning strikes that required the turbine to be shut down for repair and no blade liberation.

The occurrence of structural manufacturing defects in rotor blades has also diminished significantly due to experience and improved quality control in the industry. Design practice has evolved to improve structural margins against any manufacturing deficiencies. Even in the rare event of a blade failure in modern turbines, it is much more likely that the damaged structure would remain attached to the turbine rather than separating (Garrad Hassan Canada, 2007). Reviews of available information did not find any recorded evidence of injury to the public as a result of turbine blade or structural failure (Garrad Hassan Canada, 2007; Chatham-Kent Public Health Unit, 2008).

Given that accidents or malfunctions of the turbines are considered to be infrequent events, and turbines would be located at least the minimum regulated setback distance from any residence, the event of a failure of the structure would likely not fall beyond the setback distance and would, therefore, not affect public health and safety.

**Mitigation Measures**

Modern wind turbines meet strict international engineering standards. Standards include the ability to withstand the forces of a Level 2 tornado (i.e. wind speeds of approximately 55 m/s), and structures must be built to meet earthquake loads as per the *Ontario Building Code*. The structural integrity of the turbines is designed to withstand wind speeds of approximately 55 m/s. However, during high wind events (i.e. greater than 25 m/s) the turbines are designed to cease operation. Turbine braking is accomplished by aerodynamic (blade pitch) control and friction brakes. The wind turbines and met towers would be designed, installed, operated and maintained according to current applicable industry standards/certifications.

The Proponent and/or the Operation and Maintenance Contractor would aim to minimize accidents and malfunctions with proper training and education of staff operating the control system. In addition, the turbines would be equipped with lightning protection systems and located at least the minimum regulated setback distance from receptors.

**Net Effects**

As a result of the structural integrity and design features of the turbines and met towers, no adverse net effects from structural failure of the turbines or met towers are anticipated during operation of the facility.

### 5.8.2 Ice Fall and Shed

**Potential Effects**

Another potential public health and safety issue could result from the accumulation of ice on the turbine blades and/or met tower. This can occur when specific conditions of temperature and humidity exist. This condition is not unique to wind turbines and/or met towers and has the potential to occur on any structure that is exposed to the elements. In Ontario, this condition is most likely to occur in the winter months in extreme weather events. Under these conditions the turbines and/or met towers may be subject to ice coating from freezing rain or interception of low clouds containing super-cooled rain.

There are two potential hazards associated with ice accumulation on wind turbines and met towers:

- The danger of falling ice that may accumulate on the turbine itself or met tower as a result of freeze-thaw of snow and ice; and
- The throwing of ice from the moving turbine blades.

Falling ice from an immobile turbine or met tower does not differ from other tall structures like telecommunication towers, power lines, and antenna towers. The potential ground area affected by falling ice from wind turbines depends to a large extent on the blade position and the prevailing wind speed and direction. Garrad Hassan Canada (2007) estimated that only very high winds may cause ice fragments of any significant mass to be blown beyond 50 m of the

base of a modern, stationary 2 MW turbine. Operating staff and landowners are briefed on this situation; therefore the risk is considered minimal (Garrad Hassan Canada, 2007).

Wind turbines typically operate when the wind speed is within the range of 4 m/s to 25 m/s; when turbines are in operation they can accumulate ice on the rotor blades. Ice fragments which detach from the rotor blades can be thrown from the wind turbine; any fragments would land in the plane of the wind turbine rotor or downwind (Garrad Hassan Canada, 2007). Throwing distance varies depending upon the rotor azimuth, rotor speed, local radius, and wind speed. Also, the geometry of the ice fragments and its mass would affect the flight trajectory.

Observations have shown that the ice fragments do not maintain their shape and immediately break into smaller fragments upon detaching from a blade. This would decrease the ice fragment's drag and potentially allow the ice fragment to be thrown greater distances. For human injury to result from wind turbine ice shed from the Project, several conditions would have to exist simultaneously:

- Sustained weather condition conducive to icing;
- Ice dislodging from the turbine blade;
- Ice pieces large enough to remain intact through the air;
- Ice traveling in a particular direction past setback guidelines; and
- A person in the path of the ice as it lands (Garrad Hassan Canada, 2007).

A risk assessment methodology was developed by Garrad Hassan Canada and Partners, in conjunction with the Finnish Meteorological Institute and Deutsches Windenergie-Institut, as part of a research Project on the implementation of *Wind Energy Production in Cold Climates (WECO) Guidelines* produced in the WECO Project were based on a combination of numerical modelling and observations. The WECO database of observed ice fragments determined that recorded ice fragments are typically thrown to distances less than 125 m from the base of the turbine (Seifert *et al.*, 2003).

Garrad Hassan Canada developed an Ontario-specific risk assessment methodology for ice shed based on the findings of the WECO Project. Modelling was undertaken to determine the probability of an ice fragment landing within one square metre of ground area, as a function of distance from the turbine. The model result determined that the critical ice shed distance would be approximately 220 m from a turbine. At distances greater than 220 m, the probability of ice shed reaching ground level at a mass that would cause injury decreases rapidly. The critical distance can effectively be regarded as a "safe" distance, beyond which there is a negligible risk of injury from ice shed (Garrad Hassan Canada, 2007).

Example calculations were presented in the Garrad Hassan Canada (2007) report, using data representative of a typical wind farm project in rural southern Ontario. These conditions would be considered representative of the Project. Risk to a fixed dwelling, vehicle travelling on a road, and individual person from being struck by an ice fragment thrown from an operating wind turbine were modelled, with the following results:

- Fixed dwelling: equivalent to 1 strike per 500,000 years;
- Vehicle travelling on a road: equivalent to 1 strike per 260,000 years; and
- Individual person: equivalent to 1 strike in 137,500,000 years.

These predictions seem markedly low; however, it is due to the fact that icing events are limited to only a few days per year. For example, Vestas Canada, which maintains turbines across Canada, has experienced no incidents related to falling ice in Canada (Jacques Whitford, 2006).

**Mitigation Measures**

Unlike telecommunication towers, the wind turbines proposed to be used for this Project would have a solid conical tower. This design reduces the potential for ice buildup on the tower itself since there is no lattice or crevices where ice can accumulate.

In terms of ice shed, several control mitigation strategies are available to wind turbine operators. For example, when the rotor becomes unbalanced due to a change in blade weighting (e.g. caused by ice buildup), the turbine brake is automatically applied to stop the blades from turning (i.e. it shuts itself off). The blades would not restart their movement until the imbalance is removed (e.g. the majority of ice is removed). This design feature greatly reduces the potential ice shed from the turbines on the few days per year when icing is possible. Established protocols and procedures would make operational staff aware and take appropriate action when weather conditions could likely lead to ice accumulation on the blades.

**Net Effects**

Considering the design features of the turbines which act to reduce or eliminate the potential for ice accumulation, that the nearest receptors are located at minimum required setbacks from the turbines, and that there is no potential for ice throw from the met towers, no adverse net effects are expected due to ice fall and shed from turbines and/or the met towers during operation of the Project. Consequently, no additional mitigation measures have been identified.

### 5.8.3 Extreme Weather Events

**Potential Effects**

Extreme weather events that could occur during operation of the Project include rain, hail, ice storms, fire, tornadoes, earthquakes, and lightning strikes.

**Mitigation Measures**

Project components have been designed to withstand the effects from extreme weather events as follows:

- Rain – surficial drainage patterns would remain intact and continue to convey rain water;
- Hail – the turbine blades, nacelle, and tower are constructed of materials able to withstand damage from the impact of hail;
- Ice storms/freezing rain – as noted above, the turbines are designed to automatically shut down when ice load on the blades exceeds a predetermined threshold;

- Tornadoes – the blades would stop moving at wind speeds greater than 25 m/s, and generally, the structural integrity of turbines is designed to withstand gusts of greater than 55 m/s;
- Earthquakes – as noted above, structures would be designed to meet the earthquake loads as per the Ontario Building Code; and
- Lightning – The turbines are also equipped with sophisticated lightning protection. Lightning strikes are safely absorbed by lightning conductors and the lightning current is conducted via a spark gap and cables into the ground surrounding the foundation.

**Net Effects**

Considering the design features of the turbine, which act to reduce or eliminate the potential for damage from extreme weather events, no adverse net effects from extreme weather events are anticipated during operation of the facility.

## 6.0 ENVIRONMENTAL EFFECTS MONITORING PLAN

The environmental effects monitoring plan for Project operation has been designed to monitor implementation of the proposed protection and mitigation measures and to verify compliance of the Project with O. Reg. 359/09. The Proponent and/or the Operation and Maintenance Contractor would be the primary party responsible for the implementation of operational effects monitoring. Implementation of these measures would be undertaken in compliance with applicable municipal, provincial, and federal standards and guidelines.

Appendix F summarizes operation-specific potential effects and mitigation measures outlined in Section 5.0, and provides the performance objectives, monitoring plans, and contingency measures associated with these mitigation measures.

## 7.0 EMERGENCY RESPONSE AND COMMUNICATIONS PLAN

The following sets out a description of the actions to be taken during all Project phases to inform the public, Aboriginal communities, the Township of ACW and the County of Huron, leaseholders and relevant Ministries of the Ontario Government regarding activities occurring at the Project site (including emergencies), means by which stakeholders can contact the Proponent and/or the Contractor, and means by which correspondence sent to the Proponent and/or the Contractor would be recorded and addressed.

A detailed Emergency Response and Communications Plan for use by employees will be prepared and/or approved by the Proponent for each Project phase (construction, operation, decommissioning), and will include up-to-date contact information and be maintained at the operation and maintenance building (at minimum). As appropriate, the Proponent and/or the Contractor for each Project phase would review the Emergency Response and Communications Plan prior to and during each phase of the Project. Notification of any changes to the Emergency Response and Communications Plan would be provided to stakeholders as outlined in Section 7.2.

### 7.1 Communication Plan for Emergencies

The Proponent and/or the relevant Contractor would develop the detailed Emergency Response Plan for each Project phase in consultation with the Township of ACW's and the County of Huron's Emergency Services Departments.

The Emergency Response Plan would include a plan for the proper handling of material spills and associated procedures to be undertaken during a spill event. The Emergency Response Plan would also specify containment and clean-up materials and their storage locations. The Emergency Response Plan would include general procedures for personnel training. As appropriate, the Emergency Response Plan may cover response actions to high winds, fire preparedness, evacuation procedures, and medical emergencies. Developing this plan with local emergency services personnel would allow the Proponent to determine the extent of emergency response resources and response actions of those involved.

The Emergency Response Plan would include key contact information for emergency service providers, a description of the chain of communications and how information would be disseminated between the Proponent and/or the relevant Contractor and responders. The plan would also indicate how the Proponent and/or the relevant Contractor would contact (via phone or in-person) Project stakeholders who may be directly impacted by an emergency so that the appropriate actions can be taken to protect stakeholders' health and safety.

### 7.2 Communication Plan for Project Updates and Activities

The Proponent and/or the relevant Contractor would engage with Project stakeholders (public, Aboriginal communities, and the Township of ACW and the County of Huron) during all phases of the Project including providing updates on the Project website (www.K2Wind.ca). As a long-

term presence in the Township of ACW and the County of Huron, the Proponent would continue to develop contacts and to develop local relationships and channels of communication. Additional updates may be provided to stakeholders via letters/newsletters, newspaper notices, and/or direct contact.

## 7.3 Communications Received by Proponent

The following has been developed for all Project phases to outline how Project stakeholders will be directed to correspond with the Proponent to provide questions, feedback, and complaints.

### Project Contact Information

A telephone number for contacting the Proponent and/or the Contractor along with the mailing/e-mail address would be posted on the Project website (www.K2Wind.ca) and provided directly to the Township of ACW, the County of Huron and the MOE. These would be the direct contact points for the Proponent and/or the Operation and Maintenance Contractor during all phases of the Project.

### Complaint Response Protocol

The following has been developed for all Project phases to address any reasonable concern from the public and would be implemented by the Proponent and/or the relevant Contractor.

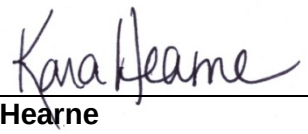
The telephone number provided for the reporting of concerns and/or complaints would be equipped with a voice message system used to record the name, address, telephone number of the complainant, time and date of the complaint along with details of the complaint. All messages would be recorded in a Complaint Response Document to maintain a record of all complaints. The Proponent and/or the Contractor would endeavour to respond to messages within 48 hours. All reasonable commercial efforts would be made to take appropriate action as a result of concerns as soon as practicable. The actions taken to remediate the cause of the complaint and the proposed actions to be taken to prevent reoccurrences of the same complaint in the future would also be recorded within the Complaint Response Document. The local district MOE office would be notified of receipt of public complaints, and the MOE's Spills Action Centre notified as appropriate. Records of complaints and actions taken to address them by the Proponent would be made available to MOE staff on request.

Ongoing stakeholder communication would allow the Proponent and/or the Operation and Maintenance Contractor to receive and respond to community issues on an ongoing basis.

## 8.0 CLOSURE

K2 Wind Ontario Limited Partnership, in association with Stantec Consulting Ltd., SENES Consultants Limited, and AMEC Environment and Infrastructure, has completed this report for the exclusive use of the Proponent for specific application to the Project. The work has been completed in accordance with Ontario Regulation 359/09, and in consideration of the guidance document *Technical Guide to Renewable Energy Approvals*.

Prepared by:



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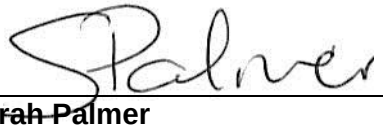

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