



**GRAND RENEWABLE ENERGY PARK
PROJECT DESCRIPTION REPORT**

DRAFT

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Prepared for:

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Executive Summary

Samsung C&T (Samsung), Korea Power Electric Corporation (KEPCO) and Pattern Energy (Pattern) are proposing to develop, construct, and operate the Grand Renewable Energy Park (the “Project”) in response to the Government of Ontario’s initiative to promote the development of renewable electricity in the Province. Together, these companies (referred to herein as “SPK”) will be involved in the development of the first phase of the energy cluster development.

The Project is proposed within the County of Haldimand and is generally bounded by Townline Road to the north, Haldimand Road 20 to the west, the Grand River to the east and Lake Erie to the south. It consists of a 148.6 MW (nameplate capacity) wind project, a 100 MW (nameplate capacity) solar project located on privately owned and Ontario Realty Corporation (ORC) managed lands and a transmission line to convey electricity to the existing power grid.

The basic components of the Project include 67 wind turbines, approximately 425,000 photovoltaic (PV) solar panels installed on fixed ground-mounted racking structures organized into 100-1 MW solar modules, a collector sub-station, interconnect station and Operations and Maintenance building, temporary storage and staging areas, approximately 20 km of 230 kV transmission lines along Haldimand Road 20, approximately 82 km of new overhead and/or underground 34.5 kV collector lines along public roads, approximately 48 km of new underground collector lines along turbine access roads, approximately 45 km of turbine access roads and 40 km of solar panel maintenance roads.

SPK has retained Stantec Consulting Ltd. (Stantec) to prepare a Renewable Energy Approval (REA) application, as required under Ontario Regulation 359/09 - Renewable Energy Approvals under Part V.0.1 of the Act of the *Environmental Protection Act* (O. Reg. 359/09). According to subsection 6(3) of O. Reg. 359/09, the wind component of the Project is classified as a Class 4 Wind Facility and the solar component of the Project is classified as a Class 3 Solar Facility. This Draft Project Description Report is one component of the REA application for the Project, and has been prepared in accordance with O. Reg. 359/09, the Ontario Ministry of Natural Resources’ (MNR’s) *Approval and Permitting Requirements Document for Renewable Energy Projects* (APRD) (September 2009), and MOE’s draft “*Technical Bulletin One: Guidance for preparing the Project Description Report* (March 2010)”.

The following table summarizes the documentation requirements as specified under O. Reg. 359/09.

Project Description Report Requirements (as per O. Reg. 359/09 – Table 1)

Requirements	Completed	Section Reference
1. Any energy sources to be used to generate electricity at the renewable energy generation facility.	✓	2.2
2. The facilities, equipment or technology that will be used to convert the renewable energy source or any other energy source to electricity.	✓	2.3
3. If applicable, the class of the renewable energy generation facility.	✓	3.1.2
4. The activities that will be engaged in as part of the renewable energy project.	✓	2.5
5. The name plate capacity of the renewable energy generation facility.	✓	2.1
6. The ownership of the land on which the project location is to be situated	✓	1.2
7. Any negative environmental effects that may result from engaging in the project.	✓	4.0
8. An unbound, well marked, legible and reproducible map that is an appropriate size to fit on a 215 millimetre by 280 millimetre page, showing the project location and the land within 300 metres of the project location.	✓	Attachment A

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1.0 Introduction

1.1 PROJECT OVERVIEW

Samsung C&T (Samsung), Korea Power Electric Corporation (KEPCO) and Pattern Energy (Pattern) are proposing to develop, construct, and operate the Grand Renewable Energy Park (the “Project”) in response to the Government of Ontario’s initiative to promote the development of renewable electricity in the Province. Together, these companies (referred to herein as “SPK”) will be involved in the development of the first phase of the energy cluster development.

The Project is proposed within the County of Haldimand and is generally bounded by Townline Road to the north, Haldimand Road 20 to the west, the Grand River to the east and Lake Erie to the south. It consists of a 148.6 MW (nameplate capacity) wind project, a 100 MW (nameplate capacity) solar project located on privately owned and Ontario Realty Corporation (ORC) managed lands and a transmission line to convey electricity to the existing power grid.

The basic components of the Project include 67 wind turbines, approximately 425,000 photovoltaic (PV) solar panels installed on fixed ground-mounted racking structures organized into 100-1 MW solar modules, a collector sub-station, interconnect station and Operations and Maintenance building, temporary storage and staging areas, approximately 20 km of 230 kV transmission lines along Haldimand Road 20, approximately 82 km of new overhead and/or underground 34.5 kV collector lines along public roads, approximately 48 km of new underground collector lines along turbine access roads, approximately 45 km of turbine access roads and 40 km of solar panel maintenance roads. The Project site plan which depicts the Project Location during construction and operation is provided in **Attachment A**.

The Project Location includes all land and buildings/structures associated with the Project and any air space in which the Project will occupy. This includes structures such as turbines, solar panels, access roads and power lines as well as any temporary construction zones surrounding infrastructure (constructible areas) which will be required during the construction of the Project. This also includes the corridors surrounding infrastructure such as access roads in which the final infrastructure may be located.

For the purposes of the identification of natural heritage features and the assessment of potential effects, a “Zone of Investigation” has been identified based on the requirements of Ontario Regulation 359/09 (O. Reg. 359/09) and the Ministry of Natural Resources’ (MNR’s) *Approval and Permitting Requirements Document for Renewable Energy Projects* (APRD) (September 2009). The Zone of Investigation encompasses the Project Location and an additional 120 m surrounding the Project Location. This ensures that adverse environmental effects that may result from construction and operational activities have been assessed within this report.

SPK has retained Stantec Consulting Ltd. (Stantec) to prepare a Renewable Energy Approval (REA) application, as required under O. Reg. 359/09. According to subsection 6.(3) of O. Reg. 359/09, the wind component of the Project is classified as a Class 4 Wind Facility and the solar component of the Project is classified as a Class 3 Solar Facility. This Draft Project Description Report is one component of the REA application for the Project, and has been prepared in accordance with O. Reg. 359/09, the MNR's APRD, and the Ministry of the Environment's (MOE) draft "*Technical Bulletin One: Guidance for preparing the Project Description Report*" (March 2010)".

1.2 PROJECT LOCATION

The Project will be located on privately owned and Ontario Realty Corporation (ORC) managed lands within Haldimand County, Ontario, north of the Lake Erie shoreline and west of the Grand River (see **Attachment A**).

The boundary of the Project Location is used for defining setback, records review and site investigation distances and notification areas according to O. Reg. 359/09. The Project Location is generally bounded by Townline Road to the north, Haldimand Road 20 to the west, the Grand River to the east and Lake Erie to the south.

See **Attachment B** for a legal description of parcels of land that will be used by the Project.

1.2.1 Wind Component

The 67 wind turbines will be located at the following coordinates:

Turbine ID Number	Easting	Northing	Turbine ID Number	Easting	Northing
1	607287	4746785	37	602481	4749039
2	605035	4746639	38	602608	4749469
3	606942	4746830	39	603875	4749401
4	604861	4746993	40	604239	4749614
5	602757	4745791	41	590395	4753879
6	606513	4747319	42	600381	4750377
7	608495	4747949	43	588466	4752970
8	607477	4747512	44	599489	4748483
9	600283	4745004	45	590085	4753880
10	593994	4748442	46	590582	4751836
11	603472	4748075	47	604740	4750499
12	601479	4747111	48	594126	4750504
13	594663	4751618	49	608750	4749784
14	603952	4750047	50	609091	4749844
15	608232	4749798	51	601762	4745085

Turbine ID Number	Easting	Northing	Turbine ID Number	Easting	Northing
16	594379	4749955	52	599708	4748016
17	598651	4747922	53	600301	4748359
18	587941	4753452	54	607370	4746400
19	606357	4749366	55	600136	4746677
20	592562	4749469	56	598686	4750284
21	602672	4746244	57	606647	4751294
22	601756	4751401	58	589733	4750362
23	591178	4751634	59	614345	4748206
24	592285	4749800	60	614974	4747470
25	599130	4750267	61	614326	4747732
26	607589	4749481	62	614680	4748176
27	598999	4748313	63	614750	4747811
28	591339	4752273	64	614705	4747338
29	599967	4750467	65	611480	4747403
30	606959	4749603	66	611758	4747387
33	589588	4755581	67	612236	4747633
34	589790	4753921	68	602131	4748909
35	602880	4749652	69	606923	4747368
36	590002	4755767			

1.2.2 Solar Component

The solar power generation component of the Project will include the installation of approximately 425,000 solar photovoltaic (PV) panels on land designated for this purpose bounded by Mt. Olivet Rd on the west, Meadows Rd on the north, Sutor Rd on the east and Haldimand Rd 20 on the south (see **Attachment A**).

The coordinates of the solar component of the Project are as follows:

- Northwest corner – 596145 E, 4750403 N
- Northeast corner – 598018 E, 4750552 N
- Southwest corner – 596760 E, 4747950 N
- Southeast corner – 597571 E, 4748056 N

1.2.3 Electrical Transmission Component

The substation will be located near Haldimand Road 20 and Mt. Olivet Road (see **Attachment A**) within the solar lands of the Project.

The 230 kV transmission line will be located along Haldimand Road 20 within the municipal road right-of-way (see **Attachment A**).

The operations and maintenance building will be constructed on land on the south side of Haldimand Rd 20 opposite the solar farm land area, just east of Mt. Olivet Rd (see **Attachment A**).

1.3 CONTACT INFORMATION

Applicant

The proponent for the Project is Samsung C&T (Samsung), Korea Power Electric Corporation (KEPCO) and Pattern Energy (Pattern). The contact for the Project is:

Name: Adam Rosso
Title: Manager, Business Development
Company: Samsung Renewable Energy Inc.
Address: 55 Standish Court
Mississauga, ON L5R 4B2

Consultant

The lead consultant for preparation of the Renewable Energy Approval (REA) application is Stantec Consulting Ltd. (Stantec). Stantec provides professional consulting services in planning, engineering, architecture, interior design, landscape architecture, surveying, environmental sciences, project management, and project economics for infrastructure and facilities projects. The consultant's office and Project contact is:

Name: Rob Nadolny
Title: Senior Project Manager
Company: Stantec Consulting Ltd.
Address: Suite 1 - 70 Southgate Drive
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Project

Project Email: GrandRenewable@SamsungRenewableEnergy.ca
Project Telephone: (877) 536-6050 or 519-836-6050 (collect)

2.0 Project Information

2.1 NAME PLATE CAPACITY OF THE PROJECT

The Project will consist of 148.6 MW (nameplate capacity) of wind power, 100 MW (nameplate capacity) of solar power, and electrical transmission components. This will be achieved via the utilization of 67 wind turbines, approximately 800 acres occupied by solar panels, and the creation of a 20 km long transmission line which will connect the Project to the provincial grid.

2.2 ENERGY SOURCES

The Grand Renewable Energy Park will utilize wind and sunlight as sources of energy for the Project. A very small amount of electricity will be required to operate the Project's electronic control equipment. No additional supplementary fuel sources would be used to generate electricity for the Project.

2.3 PROJECT COMPONENTS

The basic Project components include wind turbines, access roads, underground and overhead electrical collector lines, solar panels, transformers and a substation, an operation and maintenance building, and a 230 kV transmission line. No equipment in the facility design relate to groundwater and surface water supplies, air discharges and/or water and biomass management.

This section provides a general description of the major equipment and infrastructure associated with operation of the Project.

2.3.1 Wind Component

2.3.1.1 Turbines

The Project will include 67 Siemens SWT-2.3 wind turbines (65 with a nameplate capacity of 2.221 MW and 2 with a nameplate capacity of 2.126 MW) with a total nameplate capacity of 148.6 MW. Details of the turbine are provided below in Table 2.1. The nacelle for the turbine includes the electric generator, as well as blade and turbine control equipment, wind speed and direction sensing equipment, and auxiliary equipment. These components are located at the top of the 100 m supporting tower, and are connected to the blades via a main shaft. Each tower has a concrete foundation which is buried to a depth of up to approximately 2.4 m and is approximately 16.7 m wide depending upon subsurface conditions (land base is approximately 0.02 hectares per turbine foundation). Detailed information about the turbine model is provided in the **Draft Wind Turbine Specifications Report**, which will be completed as part of the REA.

Table 2.1 Turbine Description – Siemens SWT-2.3

Operating Data	Specification
General	
Rated capacity (kW)	2221 and 2126
Cut-in wind speed (m/s)	3-5
Cut-out wind speed (m/s)	25
Rotor	
Number of rotor blades	3 (49 m long each)
Rotor diameter (m)	101
Swept area (m ²)	8000
Rotor speed (rpm)	6-16
Tower	
Hub height (m)	100
Tip height (m)	149

Specifications of the turbines can also be found in **Attachment C**.

2.3.1.2 Turbine Access Roads and Crane Pads

Access roads are required to access each turbine site from existing roads during both the construction and operation phases of the Project. Access roads are approximately 5 m wide (see drawings in **Attachment A**). Access roads will be constructed of native materials or engineered fill and generally consist of approximately 750 mm of granular material. Alternatively, a woven geotextile or cement stabilized soil could also be utilized with a reduced granular material depth. Turbine laydown (prior to turbine erection) will take place adjacent to the access roads and has been incorporated into the Project Location design by designating a 50 m wide “constructible area” for the access roads (see **Attachment A**). A total of approximately 45 km of access roads will be required.

Crane pads will be constructed at the same time as the access roads and will be adjacent to turbine locations (within the constructible area around each turbine as shown in **Attachment A**). The general crane pad area will be approximately 20 m x 40 m, and will typically consist of the same make up as the access road, whereas the crane platform (where the crane sits) may consist of a heavier granular make up depending on site conditions. Once the turbine erection is complete, the crane pads will be removed, the area restored and farming activities will resume. If necessary the crane pads will be rebuilt if maintenance activities are needed.

2.3.1.3 Step-up Transformers and Collector Circuits (Lines)

A generator step-up transformer (GSU), located immediately adjacent to each turbine, is required to transform the electricity generated in the nacelle of each turbine to a common collection system line voltage (i.e. 690 V to 34.5 kV). From each GSU, 34.5 kV underground and overhead collector circuits carry the electricity to the Project’s substation located near Haldimand Road 20 and Wilson Road. The collector lines will be buried underground on private property, where applicable, from the turbines to the municipal road rights-of-way at which time

the lines will be switched to overhead lines or may remain buried. The overhead lines will be constructed on single wooden pole structures, similar to existing distribution lines located throughout the area. In most cases, the underground lines will be built within the proposed access roads to minimize the amount of land disturbed during construction of the Project. Typically the collector lines will be buried at a minimum depth of 1.2 m so that agricultural production can continue on the lands above the collector lines. A total of approximately 130 km of collector lines will be required (48 km underground and 82 km aboveground and/or underground).

2.3.2 Solar Component

2.3.2.1 Solar Panels

The solar power generation part of the Project will include the installation of approximately 425,000 solar photovoltaic (PV) panels on land designated for this purpose bounded by Mt. Olivet Rd on the west, Meadows Rd on the north, Sutor Rd on the east and Haldimand Rd 20 on the south (see **Attachment A**). Some additional solar PV panels will be located south of Haldimand Rd 20 on land facing the solar farm to the north. Each solar PV panel is fabricated using multicrystalline manufacturing techniques and is mounted on structural aluminum or galvanized steel racks in rows. Each rack is fixed position, facing south and angled 28 - 35 degrees to the horizon. The rows of racks are supported by vertical structural steel posts that are founded in the ground to a depth below the frost line, nominally 1.2 m.

The basic building block of the solar farm is a 1 MW rated solar units. There are 100 solar units forming the entire solar farm. A 1 MW solar unit consists of rows of 60 solar PV panels mounted on racks in straight rows. Approximately 72 rows of solar PV panels constitute a solar unit of 1 MW. Physical arrangements may vary slightly from unit to unit to accommodate physical, environmental and archaeological constraints within the designated solar farm area and may also slightly vary based on the manufacturer's panel specifications. Each solar PV panel in a row generates Direct Current (DC) power and the power is collected through a low voltage wiring system along a row and interconnected to the adjacent rows within the typical unit.

A 2.4 m high chain link fence will be installed around the entire perimeter of the solar farm to prevent unauthorized access to the solar panel area. In addition, a 6 m wide berm will be constructed to provide a landscaping barrier for landowners of adjacent residences where close proximity occurs to the solar PV panels.

2.3.2.2 Solar Land Stormwater Management System

The solar land stormwater management system will be a passive system comprised of local vegetated ditches/swales alongside the access roads constructed through the area. Because the solar cells are mounted above the ground, infiltration, filtration through vegetation and other natural hydrologic process will continue similar to existing conditions. Drainage will generally be

directed to existing receiving systems (drainage paths, roadside ditches, etc.) as under current conditions. Therefore, a general area-wide stormwater treatment and/or detention systems are not required. The small increase in runoff from the gravel access roads will be attenuated and filtered through local ditches and no formal basins or other management techniques are required.

2.3.2.3 Solar Farm Access Roads

Solar access roads (laneways) are required to access each row of solar PV panels during the construction and maintenance phase of the Project. The minimum road width between solar panel rows will be 3 m; however these access roads will not be gravelled. Instead, the roads will be seeded with native grassland species following construction and used sparingly during maintenance activities. Solar panel support structures including racks will take place adjacent to the access roads at selected areas within the solar farm land area. Snowmobiles and ATV's will be used to access the laneways during operation.

Around the outside of each 1 MW solar unit, a 4 m wide gravel road will be constructed for construction and operational purposes. Approximately 40 km of graveled access road will be required.

2.3.2.4 Step Up Transformers and Collector Circuits

The power from each solar PV panel row is collected by a wiring system and this wiring system is connected to one of two 500 Kilowatt (kW) DC to Alternating Current (AC) power inverter panels located at each of the 100 solar units. Each power inverter panel is mounted on a precast concrete base foundation at a central point of each solar unit. The AC output from the inverter panels is connected to an adjacent solar step up (SSU) pad-mounted transformer rated at 1 MW. Each SSU is mounted on a precast concrete vault to facilitate cable entry/exit. Each SSU is positioned in close proximity to the solar inverter panels to minimize power loss. The output voltage of the SSU is 34,500 Volts. The power output from each of the 1 MW SSUs (100 MW in total) is connected via 5 underground 34.5 kV power cable circuits to the collector substation located within the solar farm land area.

2.3.3 Electrical Transmission Component

2.3.3.1 Collector Substation

A Collector substation will be built to accumulate the power circuits from the wind and solar generation equipment outlined above. The accumulated power of approximately 253 MW at 34.5 kV will arrive via both underground cable collector circuits and overhead pole line conductor circuits. The power will be transformed from a 34.5 kV collection voltage to a 230 kV transmission voltage. The substation will be located near Haldimand Road 20 and Mt. Olivet Road (see **Attachment A**) within the solar lands of the Project.

The Collector substation will consist of a prepared area of approximately 85 m by 85 m in size. It will be built on a prepared base of engineered fill and crushed stone to a depth of approximately 600 mm. A grounding grid will be built within the crushed stone and extend to 1 m beyond the 2.4 m high perimeter chain link fence for the substation.

Within the substation will be located a prefabricated modular electrical building (EHouse) wherein all the incoming underground 34.5 kV collector circuits will terminate on interior switchgear. The EHouse will be founded on concrete foundations that are constructed below grade to below frost depth. Cable vaults will be installed beneath the EHouse to facilitate cable entry.

Reactive Power Capacitors and control will be located within the Collector Substation. Either one of D-VAR or S-VAR will be installed as approved by local authority(s). The capacitors will be 34.5 kV rated and there will be up to 6 capacitor banks installed in separate concrete containment foundations, founded below grade to below the frost line. The containment will be large enough to hold any insulating fluid that may leak from the capacitors. The dynamic controller will be a Statcom (or similar) controller located adjacent to the capacitors within the substation and on its own concrete foundation founded below grade to below the frost line.

There are two power transformers within the collector substation that will be used to step up the power to 230 kV. The wind power transformer is rated 100/133/166 MVA while the solar power transformer is rated 65/86/108 MVA. Each transformer is mounted on a concrete base foundation within an oil containment facility that would capture all of the oil insulating fluid within each transformer in the event of a leak. A sound attenuation wall will be constructed around the perimeter of the two power transformers to minimize the escape of transformer noise into the surrounding environment. The sound attenuation wall will be constructed with a minimum density of 20 kg/m² that will break the line of sight with any noise receptors.

Each of the 230 kV outputs of the two transformers are delivered via a 3 phase air bus (aluminum pipe) to a 1200 Amp 230 kV circuit breaker, isolation disconnect switch and Capacitive Voltage Transformers (CVT). The 230 kV outputs from the final isolation disconnect switches are coupled and connected to a 230 kV termination gantry complete with 230 kV lightning arrestors. The 230 kV termination gantry facilitates the connection of the collector substation to the overhead transmission tower adjacent to the substation. Each of the 230 kV devices located within the collector substation are founded on concrete foundations that extend below finished grade to below the frost line.

2.3.3.2 Collector Substation Stormwater Management System

Area drainage from the collector substation will be accomplished through a series of swales adjacent to the proposed access road that will collect and convey runoff from the substation area and associated access road west and south towards Haldimand Rd 20. The total drainage area associated with the substation and access road "hard" surfaces is less than 2 ha and therefore a "wet" water quality control pond (i.e. one containing a permanent pool) is

inappropriate, as per the MOE *SWM Planning and Design Guidelines Manual (2003)*. In addition to the conveyance of runoff, the series of grassed swales will also provide water quality control, which is a suitable stormwater management practice for such an area according to the MOE guidelines. Water quantity control will be provided using a dry detention pond for the storage and slow release of runoff to the existing ditch and drainage system along Haldimand Road 20. Drainage from the solar lands will largely be conveyed around the substation facility, access road, and associated stormwater management measures through the use of diversion swales given that it does not require treatment or detention.

Within the substation footprint itself, the two transformers will be equipped with oil containment storage areas to capture oil in the event of a leak. Additionally, an oil/water separator will be incorporated into the design to treat any effluent before it enters the storm drainage swales.

2.3.3.3 Collector Substation Access Road

An access road for the collector substation and main access to the solar lands will be constructed from Haldimand Rd 20 (see **Attachment A**). The gravel surface of the access road is approximately 8 m wide with grassed swale drainage ditches of variable top width on either side, for stormwater runoff conveyance and treatment. The depth of the roadbed will generally consist of 750 mm of granular material. During construction it will be used to transport all the materials for construction of the substation including the two heavy power transformers and for maintenance purposes during operation.

2.3.3.4 Transmission Line

From the substation, a 20 km long overhead 230 kV transmission line, consisting of single, 3 conductor aluminum circuit will be constructed to connect the power generated by the wind and solar generation equipment to the Ontario electricity grid that is accessible at a location south of Hagersville, Ontario. The transmission line will be located along Haldimand Road 20 within the municipal road right-of-way (see **Attachment A**).

The transmission line will be constructed overhead using bare aluminum conductors. They are vertically isolated from ground via 230 kV insulators and monopole structures measuring 28 m in height. The monopole structures will be erected on concrete foundations located within the existing Haldimand Rd 20 right-of-way. The structures will be spaced approximately 200 m apart except where significant changes in line direction occur along the route. In these cases, the spacing will be closer to reduce the overhead line tension to a practical construction limit. There will also be closer spacing of the structures at the collector substation, the transition stations around Nelles Corners and the interconnect station near the transmission corridor east of Hagersville.

At a location just east of Nelles Corners (intersection of Haldimand Rd 20 and Highway 3), the overhead transmission line will make a transition to underground cable housed within a concrete encased ductbank. The underground cable is required as the overhead transmission line would

violate safety clearances over the built infrastructure of Nelles Corners. The 230 kV ductbank would be constructed a minimum of 1.2 m below grade and be backfilled with thermal fill to dissipate heat of cable power losses throughout the ground.

The ductbank will be nominally 700 m long and will be constructed entirely within the Haldimand Rd 20 right-of-way beneath the village of Nelles Corners. To facilitate the transitioning of the overhead transmission line to underground cable east of Nelles Corners and to overhead line from underground cable west of Nelles Corners, two transitioning stations will be required to be constructed.

The transitioning stations will contain an A-frame galvanized steel lattice type structure complete with 230 kV lightning arrestors. The structure will be anchored to a concrete foundation that is founded to a depth of ground below the frost line. Each transitioning station will consist of a prepared area of 20 m by 20 m in size. It will be built on a prepared base of engineered fill and crushed stone to a depth of approximately 600 mm. A grounding grid will be built within the crushed stone and extend to 1 m beyond the 2.4 m high perimeter chain link fence for each station.

2.3.3.5 Transmission Line Interconnect Station

The 230 kV transmission line will terminate at an interconnect station located on the north side of Haldimand Rd 20, just east of the transmission corridor east of Hagersville. The transmission line overhead conductors will terminate on a termination gantry (structure) contained within the station area. The station will be enclosed by a chain link fence measuring 40 m wide x 40 m long x 2.4 m high. The station will contain two termination gantries complete with 230 kV lightning arrestors. One will be used for the termination of the 230 kV transmission line and the other will be used to facilitate Hydro One's connection of the power collection circuit to the existing transmission circuit originating at the Nanticoke Power Generating Station. Each gantry will be anchored to a concrete foundation that is founded to a depth of ground below the frost line. The station will consist of a prepared area of 40 m by 40 m in size. It will be built on a prepared base of engineered fill and crushed stone to a depth of approximately 600 mm. A grounding grid will be built within the crushed stone and extend to 1 m beyond the 2.4 m high perimeter chain link fence.

In addition, a 230 kV isolation switch and 230 kV-1200 amp circuit breaker will be installed on a concrete foundations between the two termination gantry structures. The foundation will extend below grade to below the frost line. A small EHouse will be installed within the fenced enclosure for the station. The EHouse will be founded on concrete foundations that are constructed below grade to below frost depth. Cable vaults will be installed beneath the EHouse to facilitate control cable entry.

2.3.3.6 Interconnect Station Stormwater Management System

The interconnect station has a small footprint (less than 0.3 ha of disturbed area) and therefore requires minimal stormwater management infrastructure and no water quantity controls. Water quality control will be provided through the use of grassed swales alongside the proposed access roads that convey drainage from the site to the existing ditches alongside Haldimand Road 20.

2.3.3.7 Operations and Maintenance Building

A building will be constructed on land on the south side of Haldimand Rd 20 opposite the solar farm land area, just east of Mt. Olivet Rd (see **Attachment A**). The building will be a prefabricated engineered structure likely measuring 24 m wide by 85 m long by 7 m high. It will be founded on concrete foundations that are extended below grade to below the frost line. The building will be used as an operations and maintenance facility and it will likely contain several offices, employee welfare facilities, control facilities, solar farm and wind farm spare parts storage space, a public greeting centre, common areas, maintenance work area and vehicle storage facilities.

The employee welfare facilities will be supported by an aboveground potable water tank, filled by tanker trucks, as well as septic system for approximately 20 workers.

An access road to the operations and maintenance building will intersect with Haldimand Rd 20 and proceed south to the building parking area located directly south of the woodlot on the north end of the property. The outdoor vehicle and parts storage areas surrounding the operations and maintenance building will be graveled and fenced in by a 2.4 m high chain link fence.

Electrical power for the operations and maintenance facility will be provided from Haldimand County Hydro power circuits located on Haldimand Rd 20. The power will be delivered by overhead wires on overhead poles installed adjacent to the access road from Haldimand Rd 20. The overhead line will terminate on a transformer pole adjacent to the operations and maintenance building. The transformer will step down the power supply to a voltage that can be utilized within the building. The final connection of the power will be made through underground cable from the transformer pole to the building electrical service located within the building.

2.3.3.8 Operations and Maintenance Building Stormwater Management System

The operations and maintenance facility has a total area of about 3.2 ha including building storage and parking areas as well as the access road, plus a septic system and stormwater management facility. Total impervious coverage of the facility and access road footprints is expected to be about 90%. Drainage from this area is generally southerly towards the existing channel at the south property limit. Stormwater management (conveyance, treatment, and detention) will be achieved through a combination of grassed swale drainage ditches and an end-of-pipe constructed wetland stormwater management facility. While the developed

drainage area is slightly less than that recommended by the MOE *Design Manual* for application of a 'wet' end-of-pipe facility, the relatively high degree of impervious coverage and 'tight' nature of on-site soils mean that the drainage area ought to generate sufficient flows to maintain a permanent pool. Drainage from the access road and operations and maintenance building/parking areas will be conveyed to the end-of-pipe facility through grassed swale drainage ditches which themselves provide water quality treatment benefits, in addition to moderate peak flow reduction. Swale runoff to the stormwater management facility will discharge into a small inlet micropool / forebay for energy dissipation and sediment retention prior to passing through the constructed wetland cell, which contains a permanent pool depth of approximately 0.3 m. The basin will provide both water quality treatment (sediment removal) and water quantity control (discharge rate restricted to existing conditions) and will be planted with vegetation species tolerant to a variety of moisture conditions. The basin will discharge in a non-erosive fashion to the existing channel at the southern site boundary.

2.3.4 Water Crossings

Typical culvert requirements for any water crossings are summarized within **Section 4.4** and are described within the **Draft Water Body and Water Assessment Report**. Permits for the water crossings will be obtained from the Grand River Conservation Authority (GRCA) and Long Point Region Conservation Authority (LPRCA) prior to Project construction.

2.4 TEMPORARY COMPONENTS

Lands to be temporarily used during the construction of the Project include the temporary laydown areas paralleling the access roads and turbine locations, the turbine crane pads, the transmission construction staging and laydown area at the interconnect station, the operations and maintenance building construction staging area, and the solar land staging area. The requirements for these temporary areas including upgrades and restoration are described below and within the **Draft Construction Plan Report**. The land use prior to construction at all of these areas is agricultural.

2.4.1 Temporary Turbine Laydown Areas

Turbine laydown (prior to turbine erection) will take place adjacent to the access roads to each turbine location and has been incorporated into the Project Location design by designating a 50 m wide "constructible area" for the access roads (see **Attachment A**). Turbine components will be temporarily placed in these locations prior to erection. No site preparation is required within these laydown areas, however in locations where turbine components are temporarily stored; these areas will be restored following turbine erection to pre-existing conditions.

2.4.2 Operations and Maintenance Building and Solar Panel Construction Staging Areas

A temporary construction staging area for the construction of the Project will be located on the land south of Haldimand Rd 20 at Mt Olivet Rd where the operations and maintenance building will be located. The staging area will be located adjacent to the operations and maintenance building completely within the outer boundary of the proposed solar unit that is to be adjacent to the operations and maintenance building. The staging area will be graveled with compacted surface material suitable for vehicular truck traffic. Prior to installation of the solar unit at this staging area location, the gravel material will be removed and the site will be prepared in the same manner as the other solar unit sites (e.g. gravel road around the solar unit and grassed laneways between each row). The staging area will be approximately five acres in size and it will support the following construction operations:

- Portable construction and Owner's offices and lunch rooms;
- Parking areas for Contractor, Subcontractors and Other Contractors;
- Portable generators;
- Maintenance and tool sheds;
- Water and rinsing facilities (water to be brought in by tanker);
- Equipment storage and maintenance area;
- Approved temporary fuel tanks, in properly contained spill containment structures;
- Disposal facilities for various solid wastes;
- Temporary toilet facilities – self-contained with no on-site disposal;
- Waste disposal containers;
- Laydown areas for small scale solar and wind farm materials, equipment; and,
- Laydown areas for electrical power collection materials.

During the construction of the graveled surface areas forming the construction staging area, surface material will be stripped and stockpiled for reuse (note that only the land to be used by the graveled areas will be stripped). The depth of the graveled areas will vary and will be dependent upon site conditions/requirements at the time of construction. Once the majority of Project construction is complete and the staging area is required for solar unit installation, as described above all facilities will be removed including the graveled areas and the area will be

used for the installation of a solar unit. The stockpiled soil stripped at the beginning of construction operations will be placed back to its original position on the land.

An additional temporary staging area within the solar farm area will be constructed and removed in the same manner as described. This additional staging area will also be located in an area to be ultimately used for the installation of a solar unit.

2.4.2.1 Transmission Construction Staging and Laydown Area

A temporary construction staging area for the construction of the transmission line will be located on land on the north side of Haldimand Rd 20, adjacent to the east side of the transmission corridor, just east of Hagersville. The temporary construction staging and laydown area will be adjacent to the interconnect station. It will be a graveled compacted surface suitable for vehicular truck traffic. The staging laydown area will be approximately 2 acres in size and it will support the following construction operations:

- Portable construction staff lunch rooms;
- Parking areas for Contractor, Subcontractors and Other Contractors;
- Portable generators;
- Maintenance and tool storage;
- Water and rinsing facilities (water to be brought in by tanker);
- Equipment storage and maintenance area;
- Approved temporary fuel tanks, in properly contained spill containment structures;
- Disposal facilities for various solid wastes;
- Temporary toilet facilities – self-contained with no on-site disposal;
- Waste disposal containers;
- Laydown areas electrical power collection materials.

During the construction of the graveled surface areas forming the transmission construction staging area, surface material will be stripped, stockpiled for reuse when the Project is completed (note that only the land to be used by the graveled areas will be stripped). The depth of the graveled areas will vary and will be dependent upon site conditions/requirements at the time of construction. Once construction is complete, all facilities and the storage area will be removed including the graveled areas. The stockpiled soil stripped at the beginning of construction operations will be placed back to its original position on the land.

2.5 PROJECT ACTIVITIES

2.5.1 Description of Regulated Activities

A general overview of the activities during construction, operation, and decommissioning phases of the Project are provided below.

Table 2.1 Key Project Activities

Project Phase	Activities
Construction	Turbine and Solar Sites
	Delineation of temporary work areas
	Access road construction
	Completion of necessary site grading
	Installation of tower and panel foundations
	Installation of crane pads
	Tower/turbine erection and panel installation
	Installation of step-up transformer and required wiring
	Installation of collector lines, usually parallel to access roads
	Reclamation of temporary work areas
	Site landscaping (final grading, topsoil replacement, etc.)
	Substation Site
	Preparation of laydown area
	Installation of substation and connection with grid
	Construction of operations and maintenance building
	Reclamation of temporary work areas
Off-Site Activities	
Installation of collector lines and transmission line in municipal road right of way	
Operation	Turbine and Solar Sites
	Preventative maintenance
	Unplanned maintenance
	Meter calibrations
	Grounds keeping
	Substation Site
	Preventative maintenance for substation
	Unplanned maintenance for substation
	Remote wind farm condition monitoring
	Operations and maintenance building maintenance
Off-Site Activities	
Electrical line maintenance	
Decommissioning	Turbine and Solar Sites
	Removal of turbine and solar panel infrastructure
	Removal of step-up transformer
	Site grading (dependent upon new proposed use)
	Possible removal of access roads dependent upon agreement with property owner
	Possible excavation and removal of collector lines depending upon agreement with property owner

Table 2.1 Key Project Activities

Project Phase	Activities
	Off-Site Activities
	Possible removal of collector system and transmission line in municipal right of way (remove wires and poles)
	Disconnection of substation from provincial grid
	Removal of substation
	Removal of operation and maintenance building, dependent upon agreement with property owner

2.5.2 Facility Phases, Timing & Scheduling

The table below provides an overview of the projected dates associated with the Project.

Table 2.2 Project Schedule Overview

Milestone	Approximate Date
Initiate Public REA Process	June 2010
REA technical studies	June 2010 to February 2011
Public Meeting #1	July 8, 2010
Draft REA Reports to Public	July 2011
Public Meeting #2	September 2011
REA Submission	October 2011
Start of Construction	March 2012
Commercial Operation Date (COD)	March 2013
Repowering/Decommissioning	Approximately 20-25 years after COD

2.5.3 Waste Generation

2.5.3.1 All Project Components

Construction and Decommissioning

During construction and decommissioning, waste material would be generated at, and transported from, the Project Location. Waste material produced by the Project is expected to consist of construction material (e.g. excess fill, soil, brush, scrap lumber and metal, banding, plastic wrap removed from palletized goods, equipment packaging, grease and oil, steel, etc.) and a minor amount of domestic waste (i.e. garbage, recycling and organics). Similar waste material may be generated during decommissioning.

Operation

Lubricating and hydraulic oils associated with Project 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 be generated during standard operation and maintenance activities. Although the exact oil and grease requirements for the wind component of the Project are not known at this time, oil changes will be completed

in accordance with oil analysis recommendations. The amount of oil and grease stored on site would depend on availability, transportation schedules, and the service cycle. Used oil would be stored in a designated area of the operation and maintenance building, and picked up by certified contractor with the appropriate manifests in place.

During operation, the operation and maintenance building will produce waste materials typical of an office setting, including recyclables and domestic waste.

2.5.4 Air Emissions and Dust Generation

2.5.4.1 All Project Components

Construction and Decommissioning

Construction and decommissioning activities would rely on the utilization of a wide range of mobile equipment, such as bulldozers, dump trucks, and cranes. The engine exhaust from these vehicles, especially from those operating on diesel fuel, represents a source of particulate and other emissions.

Additionally, construction and decommissioning related traffic and various construction activities (e.g. excavation, grading, and exposed areas) have the potential to create short-term nuisance dust effects in the immediate vicinity of the Project.

Traffic delays also result in increased emissions from vehicles traveling slowly through construction zones. The delivery of materials to construction sites can also generate significant amounts of emissions, especially for sites that are relatively far from material manufacturers.

The application of recommended mitigation measures during construction and decommissioning (contained within the **Draft Construction Plan Report**) should limit fugitive dust emissions to the work areas and limit combustion emissions.

Operation

During operations, minor localized air emissions would occur from the periodic use of maintenance equipment to repair Project infrastructure over the life of the Project and from personnel vehicles and waste management haulers travelling to and from the operations and maintenance building during regular business hours.

2.5.5 Noise Emissions

2.5.5.1 All Project Components

Construction and Decommissioning

During construction and decommissioning, noise will be generated by the operation of heavy construction equipment at each of the work areas and associated vehicular traffic on-site. The audible noise at receptors beyond the construction areas is expected to be a minor, short-term disruption consistent with noise generated by any construction project.

Operation

Mechanical and aerodynamic sound would be emitted from the wind turbines and their associated transformers. 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. In addition, a Noise Assessment Report has been completed for the Project in accordance with the MOE "*Noise Guidelines for Wind Farms*", dated October 2008 and O.Reg 359/09, and is provided as an appendix in the **Draft Design and Operations Report**.

The solar panels themselves do not generate noise; however the two associated inverter panels will generate noise. Additional noise will be generated by the solar step up (SSU) pad-mounted transformer. Additional noise will be generated by the Project's collector substation

During operations of the Project, sound would be generated by the periodic use of maintenance equipment in addition to personnel vehicles and waste management haulers that would travel to and from the operations and maintenance building during regular business hours.

Based upon the Project design, the analysis carried out in the Noise Assessment Report indicates that sound produced by the Project was found to be within the acceptable limits established by the MOE at all noise receptors. The analysis includes the combined impacts of the substation, solar components, wind turbines, and other wind turbines within a three kilometre radius. The Noise Assessment Report has been completed for the Project in accordance with the MOE "*Noise Guidelines for Wind Farms*", dated October 2008 and O.Reg 359/09, and is provided as an appendix in the **Draft Design and Operations Report**.

2.5.6 Hazardous Materials

2.5.6.1 All Project Components

Construction and Decommissioning

Hazardous materials are limited to fuels and lubricants that will be on-site for use in construction and decommissioning equipment. These materials will be stored in appropriate storage units during construction and decommissioning of the Project. Designated storage unit areas and the

type of storage units will be confirmed by the Contractor prior to construction and decommissioning.

Operation

Hazardous materials to be used during the course of Project operation are limited to fuels, lubricating oils and other fluids associated with overall Project maintenance. No hazardous materials or wastes will be stored on-site during operation and maintenance of the Project. SPK and/or the Operation and Maintenance Contractor would be responsible for implementing environmental procedures during the operation phase of the Project for hazardous waste management.

2.5.7 Sewage

2.5.7.1 All Project Components

Construction and Decommissioning

Sanitary waste generated by the construction and decommissioning crews would be collected via portable toilets and wash stations supplied by a contracted third party. Disposal of these wastes would be the responsibility of the contracted party and would be done in accordance with regulatory requirements.

Operation

No sanitary waste will be generated by the wind and solar components during operations.

The operation and maintenance building will have rest rooms which would be serviced by a septic system. The septic system would have capacity for storage only, with its contents being emptied at regular intervals using tankers.

2.5.8 Stormwater Management

2.5.8.1 Wind Component

Construction and Decommissioning

During construction and decommissioning, proper grading would be conducted and mitigation measures implemented to reduce potential for runoff at the work areas. Runoff will be directed to swales and erosion control berms (where necessary) to ensure that no untreated runoff is discharged from the area.

Operation

Runoff will be directed to swales to ensure that no untreated runoff is discharged from the area.

2.5.8.2 Solar Component

Construction and Decommissioning

The solar farm land area will be graded by earth moving equipment to the elevations determined by the storm water management and grading plans. The stormwater runoff from the solar farm access roads and the solar unit access roads will accumulate in the stormwater management ditches adjacent to the road surfaces and be sloped to the stormwater management ponding facilities which will limit the flow of stormwater into the nearby watercourses.

Operation

Because the solar cells are mounted above the ground, infiltration, filtration through vegetation and other natural hydrologic process will continue similar to existing conditions. Drainage will generally be directed to existing receiving systems (drainage paths, roadside ditches, etc.) as under current conditions. Therefore, a general area-wide stormwater treatment and/or detention systems are not required. The small increase in runoff from the gravel access roads will be attenuated and filtered through local ditches and no formal basins or other management techniques are required.

2.5.8.3 Electrical Transmission Component

Construction and Decommissioning

During construction and decommissioning, proper grading would be conducted and mitigation measures implemented to reduce potential for runoff at the work areas. Runoff will be directed to swales to ensure that no untreated runoff is discharged from the area.

Operation

Area drainage from the collector substation will be accomplished through a series of swales adjacent to the proposed access road that will collect and convey runoff from the substation area and the access road towards Haldimand Rd 20.

The interconnect station has a small footprint (less than 0.3 ha of disturbed area) and therefore requires minimal stormwater management infrastructure.

Stormwater management (conveyance, treatment, and detention) for the operations and maintenance area will be achieved through a combination of grassed swale drainage ditches and an end-of-pipe constructed wetland stormwater management facility.

Drainage from the operations and maintenance access road and operations and maintenance building/parking areas will be conveyed to the end-of-pipe facility through grassed swale drainage ditches. Swale runoff to the stormwater management facility will discharge into a small inlet micropool / forebay for energy dissipation and sediment retention prior to passing through the constructed wetland cell. The basin will discharge in a non-erosive fashion to the existing channel at the southern site boundary.

A Stormwater Management Plan has been completed for the Project, and is provided as an appendix in the **Draft Design and Operations Report**.

2.5.9 Water-taking Activities

2.5.9.1 All Project Components

Construction and Decommissioning

There is potential for groundwater to be encountered during the installation of the turbine foundations, turbine access roads, underground collector lines, solar panel foundations, solar panel access roads, transmission line tower foundations, substation, and operations and maintenance building. As such, it is possible that some dewatering activities may be required when installing these project components. All water pumped during dewatering activities will be directed away from natural features and not directly into wetlands. Due to the dominance of clay soils within the Project Location, seepage is anticipated to be nominal and controllable with standard sump pumps and is anticipated to be below the threshold of 50,000 L/day.

Operation

No water is required for operation and maintenance of the turbines, solar panels, or the electrical transmission component of the Project. Water is not anticipated to be required for solar panel washing as rain water and snow should be sufficient for the cleaning of panels.

Water withdrawal will not be required for the operations and maintenance building staff (approx. 20 workers) as water will be provided via tanker truck from a third party source.

3.0 Regulatory Framework

At the federal, provincial and municipal level multiple permits and approvals may be required to facilitate the development of the Project, in addition to the REA. The ultimate applicability of all permits and approvals will be determined and based on the Project’s detailed design.

3.1.1 Government of Canada

It is expected that a Federal Screening report will not be required for the Project, as it is not anticipated that it will cause a ‘trigger’ under the *Canadian Environmental Assessment Act* (CEAA), such as a Harmful Alteration, Disruption or Destruction of fish habitat under the *Fisheries Act*, or application for project funding under a future program similar to *ecoEnergy for Renewable Power*. However, the agency consultation program for the Project includes all federal departments and agencies typically interested in wind power projects (e.g., Department of National Defense, Environmental Canada, Transport Canada, etc.). All required federal permits and approvals required for the Project will be determined during the REA process, but may include those listed in Table 3.1.

Table 3.1 Key Federal Permits and Authorizations

Permit / Authorization	Administering Agency	Rationale
Aeronautical Obstruction Clearance	Transport Canada – Aviation Division	Turbine lighting and marking
Land Use Clearance	NavCanada	Aeronautical safety mapping and designations
Navigational Clearance	Transport Canada – Marine Division	Crossing a navigable watercourse

3.1.2 Government of Ontario

This document provides a summary of the Project as required by the Ontario Regulation 359/09 – Renewable Energy Approvals under Part V.0.1 of the Act of the Environmental Protection Act (“the Regulation”). According to subsection 6.(3) and 4.(3) of O. Reg. 359/09, the wind component of the Project is classified as a Class 4 Wind Facility and the solar component of the Project is classified as a Class 3 Solar Facility. As agreed upon with the Ministry of the Environment, one REA Application will be submitted for the Project consisting of information related to both the wind and solar projects. In return, two separate Renewable Energy Approvals are being sought, one for the wind project and one for the solar project.

The characteristics of a Class 4 Wind Facility, as described in the Regulation, are as follows:

Class of Wind Facility	Location of Wind Turbines	Name Plate Capacity of the Facility (expressed in kW)	Greatest Sound Power Level (expressed in dBA)
Class 4	At a location where no part of a wind turbine is located in direct contact with surface water other than in a wetland	≥ 50	≥ 102

The characteristics of a Class 3 Solar Facility, as described in the Regulation, are as follows:

Class of Solar Facility	Location of Solar Photovoltaic Collector Panels or Devices	Name Plate Capacity of the Facility (expressed in kW)
Class 3	At a location other than mounted on the roof or wall of a building	>10

At the provincial level there are multiple permits and approvals that may be required to facilitate the development of the Project, in addition to the REA. Their ultimate applicability will be determined during the REA process and based upon the Project's detailed design. The following is a list of key permits and approvals that may be required; however additional permits may also be required.

Table 3.2 Key Provincial Permits and Authorizations

Key Permit / Authorization	Administering Agency	Rationale
Approval of Connection	IESO	Electrical interconnect with IESO regulated network
Connection Assessment	IESO	Integration of project with IESO-controlled transmission system
Customer Impact Assessment	Hydro One Networks Inc. (HONI)	Integration of project with Hydro One and effects to customers
Connection Cost Recovery Agreement (CCRA)	HONI	Recovery of costs to grid operator of changes to allow connection
System Impact Assessment	IESO	Integration of project with IESO-controlled transmission system
Development, Interference with Wetlands, and Alterations to Shorelines and Watercourses Permit	Grand River Conservation Authority and Long Point Conservation Authority	Work within floodplains, water crossings, river or stream valleys, hazardous lands and within or adjacent to wetlands. Projects requiring review, <i>Fisheries Act</i> authorization and/or assessment under the <i>Canadian Environmental Assessment Act</i> are forwarded to the Department of Fisheries and Oceans (DFO)
Certificate of Inspection	Electrical Safety Authority (ESA)	A record that electrical work complies with the requirements of the Ontario Electrical Safety Code.
Generator's License	Ontario Energy Board (OEB)	Generation of electrical power for sale to grid
Leave to Construct	OEB	Authorization to construct power transmission lines
Notice of Project	Ministry of Labour	Notify the Ministry of Labour before construction begins.

Table 3.2 Key Provincial Permits and Authorizations

Key Permit / Authorization	Administering Agency	Rationale
Special vehicle configuration permit	Ministry of Transportation (MTO)	Use of non-standard vehicles to transport large components
Transportation Plan	MTO	Adherence to road safety and suitability
Highway Entrance Permit	MTO	Entrance permit for new or upgraded road entrances onto a provincial highway Interference or obstruction of the highway
Change of Access and Heavy/Oversize Load Transportation Permit	MTO	Compliance with provincial highway traffic and road safety regulations
Wide or excess load permit	MTO	Transportation of large or heavy items on provincial highways

3.1.3 Municipal

Several permits and authorizations may also be required from Haldimand County (Table 3.3).

Table 3.3 Key Municipal Permits and Authorizations

Key Permit / Authorization	Rationale
Municipal Consent, Work with the R.O.W	Required for works in municipal road allowances
Consent/Severance Application	Required if easements over private lands required
Road Cut Permit	May be required for access roads off of county roads or works to county roads
Pre-Condition Survey	Assessment of pre-construction conditions for engineering staff
Building Permit	Compliance with building codes
Entrance Permit	Entrance from county roads
Transportation Plan	Adherence to road safety and suitability
Additional Plans related to general engineering (e.g. siltation control, lot grading, plan of services, etc.), water, wastewater, storm water, transportation, and geotechnical	Required supporting information/plans required by Haldimand County

4.0 Description of Potential Environmental Effects

The effects of constructing, operating, and decommissioning a wind farm, solar project and transmission systems is well understood and can be typically mitigated through well known and accepted techniques and practices. For example, siting turbines away from residential (sound) receptors reduces the potential for adverse environmental effects.

Based upon agency guidance and Stantec's understanding of the potential effects of constructing, operating, and decommissioning a wind farm, solar project and transmission systems, the following Project-specific issues and potential effects have been identified and are further analyzed as part of the Renewable Energy Approval (REA) application process. Please note that below is a summary of the potential effects during the construction, operation, and decommissioning of the Project. Detailed descriptions of all potential effects, mitigation measures, and monitoring plans are provided in the:

- Construction Plan Report;
- Design and Operations Report;
- Decommissioning Report;
- Natural Heritage Assessment/Environmental Impact Study (NHA/EIS);
- Water Body and Water Assessment Report; and,
- Archaeological and Heritage Report.

In addition, a description of the natural features including the results of the findings of the records review and site investigations is provided in the **Draft NHA/EIS**. The Project Site Plan (**Appendix A**) shows the Project Location as well as all natural features within the Project Location. The Zone of Investigation is also shown to identify where natural features are within a 120 m of the Project Location. Where natural features are within the Zone of Investigation, additional analysis is provided within the **Draft NHA/EIS** and **Draft Water Body and Water Assessment Report**.

Monitoring plans have been developed for the various stages of the Project and are identified within the **Draft Construction Plan Report**, **Draft Design and Operations Report**, and **Draft NHA/EIS**. This includes the identification of performance objectives, monitoring requirements, contingency plans, as well as various management systems/programs/plans/procedures. A Complaint Response Protocol has also been developed and will be implemented during all stages of the Project's lifecycle.

4.1 PROJECT RELATED SETBACKS

A key component of the REA process is the establishment of common setbacks for all renewable energy facilities in the Province. The Project was designed to meet the mandatory setbacks within O. Reg. 359/09 in all cases. Within the regulation there are some setbacks for which studies that identify potential adverse environmental effects and mitigation measures 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 and results have established that impacts would be low or not expected. The results of the assessments are provided in the **Draft NHA/EIS**, the **Draft Water Body and Water Assessment Report**, and the Property Line Setback Assessment which is provided as an appendix to the **Draft Design and Operations Report**.

4.2 HERITAGE AND ARCHAEOLOGICAL RESOURCES

A Stage I and II Archaeological Assessment has been completed for the Project and is provided in the **Draft Archaeological and Heritage Report**. In addition, a Built Heritage and Cultural Landscape Inventory Draft Report and a Protected Properties Assessment Draft Report have also been completed for the Project and are provided in the **Draft Archaeological and Heritage Report**.

The results of the Stage 1 Archaeological Assessment indicated that most of the proposed project area demonstrated the potential for the presence of significant and intact archaeological resources. During the completion of the Stage II Archaeological Assessment, a total of 128 archaeological sites were located within or adjacent to the Project Location.

A total of 609 potential built heritage resources and 36 cultural heritage landscapes were identified within or adjacent to the general Project area (not specifically within the Project Location). Ten (10) designated properties were also found in the general Project area.

Archaeological resources located during the course of on-site archaeological assessments will be documented and/or removed (as appropriate) from the Project Location prior to construction in accordance with Ministry of Tourism and Culture guidelines. As such, there are no anticipated significant effects to known archaeological resources during the construction of the Project.

Project related works such as construction activities will avoid the built heritage and cultural resources and protected properties and resources where possible. Additional information is provided within the **Draft Archaeological and Heritage Report**.

4.3 NATURAL HERITAGE RESOURCES

Natural features which were considered in the assessment of potential effects included species at risk, wildlife, habitat, wetlands, sensitive areas, migratory and breeding birds, bats, and fish and fish habitat. The potential effects along with associated mitigation measures are fully described within the **Draft Construction Plan Report**, **Draft Design and Operations Report**, and the **Draft NHA/EIS**. Additional baseline information regarding significant natural features such as significant wildlife habitat and significant woodland based upon records reviews and site investigations are provided within the **Draft NHA/EIS**.

An assessment of how the Project may cause potential effects was conducted and some of the identified potential effects ranged from but were not limited to construction activities such as vegetation clearing; installation of turbines, installation of solar panels, access roads, accidental spills; and turbine operation.

The following provides a summary of the key findings within the **Draft Construction Plan Report**, **Draft Design and Operations Report**, and the **Draft NHA/EIS** related to natural features within the Zone of Investigation.

4.3.1 Wildlife and Wildlife Habitats

4.3.1.1 Construction and Decommissioning

There is some potential for disturbance to wildlife during construction of the wind, solar and electrical transmission components as a result of the limited amount of vegetation removal, increased human activity and increased traffic, noise and dust.

Overall, the total vegetation clearing will represent a very small proportion of the habitat in the general area, and any wildlife that will be displaced will have adequate habitat alternatives. Disturbance effects are expected to be short-term in duration and spatially limited to the work areas and their immediate vicinity

Some limited mortality is possible, however potential long-term effects to wildlife populations from this mortality and from barrier effects is anticipated to be minimal because of the temporary nature of the increased traffic activity.

4.3.1.2 Operation

There is some potential for disturbance to wildlife during construction of the wind, solar and electrical transmission components as a result of the limited amount of vegetation removal, increased human activity, increased traffic, noise, and collisions with turbines.

The installation of the fence around the solar area may disrupt animal movement, however a corridor has been maintained across the site to allow deer to move freely in an east-west direction. Small rodents, amphibians, and mammals will be able to cross the site.

An Environmental Effects Management Plan for Wildlife and Wildlife Habitats (see **Draft Design and Operations Report**) will be implemented which includes post-construction monitoring plan for mortality monitoring and disturbance effects monitoring for birds through point count and transect studies.

MNR, along with the proponent and other relevant agencies, will collectively review the results of the post-construction disturbance effects monitoring to determine if an ecologically significant disturbance/avoidance effect to birds or amphibians is occurring, and whether such effect is attributed to the Project and not external factors. These discussions will determine whether contingency measures, which may include operational controls, will be undertaken.

Most North American studies have shown that direct bird mortality attributable to wind facilities is low, especially when compared to other anthropogenic structures (Arnett et al., 2007; Kingsley and Whittam, 2007; National Academy of Sciences, 2007), and for birds, is not expected to be significant at a population level (Arnett et al., 2007). Mortality of bats is anticipated to be focused in late summer and to primarily affect migratory species.

Potential effects and mitigation measures associated with endangered and threatened species are being addressed as part of a separate process in conjunction with the MNR. Where potential effects indicate that approvals or permits are required for endangered and threatened species, these will be addressed separately through the applicable statute and corresponding permit and approval process.

4.3.2 Wetlands and Woodlands

4.3.2.1 Construction and Decommissioning

All components of the Project (turbines, access roads, substation etc.) are located outside of all wetland boundaries. While the majority of the Project infrastructure has been sited outside of significant woodlands, there is one new access road and turbine within a plantation, one access road along an existing farm laneway through a deciduous forest and three buried collector lines proposed along existing farm laneways through significant woodlands. Additional Project components (e.g. turbines, access roads and corresponding buried collector lines) are found within 120 m of significant woodlands and as a result, potential impacts and mitigation measures are detailed in the **Draft NHA/EIS**. Proposed clearing will result in the removal of approximately 1.72 ha of plantation in areas identified as significant woodland (please see **Draft NHA/EIS**).

Though the effects are anticipated to be minimal, there is some potential for disturbance of natural features during construction of the wind, solar and electrical transmission components as a result of the limited removal of vegetation and increased human activity, traffic, noise and dust. However, these effects are expected to be short-term in duration and spatially limited to the work areas and their immediate vicinity. The relatively small amount of woodland to be removed represents a very small proportion of the available habitat in the general area and is not anticipated to have a significant effect on the ecological functions these features support.

Setbacks from wetlands and mitigation measures for infrastructure within 30 m of wetlands will ensure that there is no disruption of wetland function and no net loss of wetland area.

4.3.2.2 Operation

As stated above, all components of the Project are located outside of all wetland boundaries and the majority of components have been sited outside of significant woodlands. During operation of the Project, some materials such as lubricating oils and other fluids associated with turbine maintenance have the potential for discharge to the on-site environment through accidental spills resulting in a potential impact to the natural features. Improper disposal of wastes (fluids, containers, cleaning materials) could also have an adverse impact on the features. With the implementation of good maintenance practices, it is anticipated any potential effects from an accidental spill would be short term in nature and have little to no effect.

Stormwater management systems will also be incorporated into the Project design to ensure that natural flow patterns and hydrological functions of wetlands and woodlands are not adversely impacted during operation of the Project. Where required, contingency measures will be developed on a site-specific basis, and may include installation of additional culverts or other stormwater management systems to preserve pre-construction flow patterns.

An Environmental Effects Management Plan for Wildlife and Wildlife Habitats (see **Draft Design and Operations Report**) will be implemented which includes post-construction monitoring plan for visual observations of wetland and woodland hydrology to ensure proposed culverts beneath access roads will convey flows and avoid flooding that may impact such features.

Disturbance effects to the wildlife inhabiting the wetlands and woodlands are addressed in Section 4.3.1. The dust and disturbance to vegetation as a result of maintenance vehicle traffic is expected to be negligible due to the infrequency of these activities.

4.4 WATER BODIES AND AQUATIC RESOURCES

Potential effects to surface and ground water features were assessed for all stages of Project development and all project components.

There is potential for groundwater to be encountered during the installation of the turbine foundations, turbine access roads, underground collector lines, solar panel foundations, solar panel access roads, transmission line tower foundations, substation, and operations and maintenance building. As such, it is possible that some dewatering activities may be required when installing these project components. All water pumped during dewatering activities will be directed away from natural features and not directly into wetlands. Due to the dominance of clay soils within the Project Location, seepage is anticipated to be nominal and controllable with standard sump pumps and is anticipated to be below the threshold of 50,000 L/day.

Some materials, such as fuel, lubricating oils and other fluids associated with turbine construction and maintenance have the potential for discharge to the on-site environment through accidental spills. With the implementation of good construction and maintenance practices, it is anticipated any potential effects from an accidental spill would be short term in nature and have little to no effect on surface and/or groundwater quality and adjacent private water wells.

Where culverts are required for watercrossings, culverts will be designed and installed such that there is no restriction of flows through the culvert resulting in upstream pooling, no erosion at the culvert inlets and outlets, and that there is no barrier to fish passage to upstream environments. Mitigation measures will be implemented for construction activities within and near watercourses to protect fish and fish habitat from potential effects including the adherence to timing windows. Culverts will be sized according to hydrologic requirements and will be determined during the permit application stage with the conservation authorities. As described above, stormwater management systems will be incorporated into the Project design to ensure that natural flow patterns and hydrological functions of wetlands and woodlands are not adversely impacted during operation of the Project. Where required, contingency measures will be developed on a site-specific basis, and may include installation of additional culverts or other stormwater management systems to preserve pre-construction flow patterns.

An evaluation of the site's erosion potential yielded a general conclusion of 'low' (as described in the **Draft Design and Operations Report**), owing primarily to the flat character of the areas and the low erodibility of in-situ Haldimand / Lincoln clay soils. In all instances where the potential for erosion is identified a series of control measures will be implemented to protect surface water features from experiencing sediment transport and/or siltation.

4.5 AIR, ODOUR, DUST

4.5.1 Construction and Decommissioning

Construction and decommissioning activities would rely on the utilization of a wide range of mobile equipment, such as bulldozers, dump trucks, and cranes. The engine exhaust from these vehicles, especially from those operating on diesel fuel, represents a source of particulate and other emissions.

Additionally, construction and decommissioning related traffic and various construction activities (e.g. excavation, grading, and exposed areas) have the potential to create short-term nuisance dust effects in the immediate vicinity of the Project.

Traffic delays also result in increased emissions from vehicles traveling slowly through construction zones. The delivery of materials to construction sites can also generate significant amounts of emissions, especially for sites that are relatively far from material manufacturers.

The application of recommended mitigation measures during construction and decommissioning (contained within the **Draft Construction Plan Report**) should limit fugitive dust and odour emissions to the work areas and limit combustion emissions. As a result, any net effects are expected to be short-term in duration and highly localized.

4.5.2 Operation

During operations, minor localized air emissions would occur from the periodic use of maintenance equipment to repair Project infrastructure over the life of the Project and from personnel vehicles and waste management haulers travelling to and from the operations and maintenance building during regular business hours.

The application of recommended mitigation measures during operations (contained within the **Draft Design and Operations Report**) should 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.

4.6 ENVIRONMENTAL NOISE

4.6.1 Construction and Decommissioning

During construction and decommissioning, noise will be generated by the operation of heavy construction equipment at each of the work areas and associated vehicular traffic on-site. The audible noise at receptors beyond the construction areas is expected to be a minor, short-term disruption consistent with noise generated by any construction project.

The application of recommended mitigation measures during construction and decommissioning (contained within the **Draft Construction Plan Report**) should limit noise emissions to the general vicinity of the work areas. Any net effects are expected to be limited to short-term, intermittent noise increases during daylight hours at the work areas and/or along the haul routes.

4.6.2 Operation

Mechanical and aerodynamic sound would be emitted from the wind turbines and their associated transformers. 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. In addition, a Noise Assessment Report has been completed for the Project in accordance with the MOE "*Noise Guidelines for Wind Farms*", dated October 2008 and O.Reg 359/09, and is provided as an appendix in the **Draft Design and Operations Report**.

The solar panels themselves do not generate noise; however the two associated inverter panels will generate noise. Additional noise will be generated by the solar step up (SSU) pad-mounted transformer. Additional noise will be generated by the Project's collector substation.

During operations of the Project, sound would be generated by the periodic use of maintenance equipment in addition to personnel vehicles and waste management haulers that would travel to and from the operations and maintenance building during regular business hours.

Based upon the Project design, the analysis carried out in the Noise Assessment Report indicates that sound produced by the Project was found to be within the acceptable limits established by the MOE at all noise receptors. The analysis includes the combined impacts of the substation, solar components, wind turbines, and other wind turbines within a three kilometre radius. The Noise Assessment Report has been completed for the Project in accordance with the MOE "*Noise Guidelines for Wind Farms*", dated October 2008 and O.Reg 359/09, and is provided as an appendix in the Design and Operations Report.

4.7 LAND USE, RESOURCES AND INFRASTRUCTURE

4.7.1 Construction and Decommissioning

There are no anticipated net effects related to land use, resources and infrastructure as a result of construction of the wind, solar, and electrical transmission components of the Project. The Project's effect on the rural community during construction, including the suspension of recreational uses, traffic, and some disturbance to adjacent land uses, these effects will be temporary and will be minimized through the implementation of good site practices, transport planning, and good communication with the community. Road safety is not expected to be an issue during the construction phase; however, the potential for accidents along the haul routes and on-site cannot be totally avoided.

A positive net effect is anticipated on the local economy during construction of the Project. The Project provides positive income, employment, and fiscal benefits to the local area, including the County and participating landowners. The County would receive ongoing property tax income and participating landowners would receive land lease payments. A nominal increase in municipal services is possible. Existing businesses within local communities could benefit from the demands of the Project workforce during construction.

4.7.2 Operation

Disturbances to agricultural lands and operations are expected to be temporary and spatially limited. With the application of recommended mitigation measures during operation (contained within the **Draft Design and Operations Report**) no adverse net effects on telecommunications and radar networks are anticipated during operation of the facility. No net effects are anticipated to provincial and local infrastructure during operation of the Project. Some disturbance to the viewscape is unavoidable due to the height of the turbines, the solar panels, the size of the

operations and maintenance building, and location of the transmission line. Application of mitigation measures such as a berm and buffer area around the solar are will assist in minimizing the potential visual obtrusiveness of the Project. The changed visual landscape would be present during the life of the facility.

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 and participating landowners. The County would receive ongoing property tax income from the Project and participating landowners would receive land lease payments.

4.8 TRAFFIC AND ROAD USAGE

4.8.1 Construction and Decommissioning

Abnormal wear (e.g. rutting) on municipal roads may be unavoidable. However, the effect of constructing the various Project components is anticipated to have a limited, short term effect on local roads given SPK's commitment to developing maintenance and/or repair plans or agreements with the County. Truck traffic would increase on some roads during Project component deliveries, but would be restricted to predetermined routes and times to the greatest extent possible. Road safety is not expected to be an issue during the construction phase due to the implementation of a Traffic Management Plan (details provided within the **Draft Construction Plan Report**); however, the potential for accidents along the haul routes and on-site cannot be totally avoided.

The effect of constructing the various Project components is anticipated to have a limited, short term effect on traffic during construction and will also be managed through the implementation of the Traffic Management Plan.

4.8.2 Operation

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.

The effect of operating the Project is anticipated to have a limited, short term effect on traffic only during non-conventional load movements.

4.9 PUBLIC HEALTH AND SAFETY

4.9.1 Construction and Decommissioning

During construction/decommissioning, potential effects to public health and safety are largely in the form of increased construction related traffic and unauthorized access of the public to the work sites.

The application of recommended mitigation measures (contained within the **Draft Construction Plan Report**) including implementing transportation planning and safety measures during construction, and controlling land access to the construction sites would minimize the potential for public health and safety concerns. A detailed Traffic Management Plan and a detailed Health and Safety/Emergency Response Plan will be prepared and implemented by the Construction Contractor (details provided within the **Draft Construction Plan Report**).

4.9.2 Operation

4.9.2.1 Wind Component

With the implementation of appropriate operations protocols and routine maintenance there is minimal increased or new risk to public health and safety from the operation of the Project. In addition, under O. Reg. 359/09, minimum setback requirements (in which this Project meets) were introduced specifically to ensure the protection of people and the environment from wind farm projects. An extensive review of potential effects to public health and safety as a result of environmental noise, low frequency noise, infrasound, shadow flicker, electric and magnetic fields, and stray voltage is provided within the **Draft Design and Operations Report**. With the implementation of appropriate operations protocols there is minimal increased or new risk to public health and safety from the operation of the Project.

4.9.2.2 Solar Component

The operation of the solar panels does not pose a threat to human and environmental health and safety as no emissions are produced. For public safety reasons, a 2 m high chain link fence will be installed around the entire perimeter of the solar farm to prevent unauthorized access to the solar panel area.

With the implementation of appropriate operations protocols and fencing around the solar panels, there is minimal increased or new risk to public health and safety from the operation of the Project.

4.9.2.3 Electrical Transmission Component

A review of potential effects to public health and safety as a result of Electromagnetic Fields is provided within the **Draft Design and Operations Report**. With the understanding that the

Project will operate well within the range of voluntary standards in North America, and that the potential health effects from Electromagnetic Fields remain inconclusive, no adverse net effects on human health are expected from operation of the Project. A fence will be installed around the substation and interconnect station in order to limit the proximity to which members of the public may approach these facilities.

4.10 WASTE MATERIAL DISPOSAL

4.10.1 Construction and Decommissioning

During construction, the Construction Contractor would implement a site-specific waste collection and disposal management plan. The plan may include practices for the systematic collection and separation of waste materials within on-site storage areas, labelling and proper storage of hazardous and liquid wastes, and disposal of non-hazardous waste at a registered waste disposal site(s).

There will be no on-site disposal of waste generated by the Project. It is assumed that licensed waste disposal sites are compliant with Provincial and County regulations.

With the application of recommended mitigation measures (contained within the **Draft Construction Plan Report**) no adverse net effects are anticipated from waste material.

4.10.2 Operation

During operations, SPK and/or the Operation and Maintenance Contractor would implement a site-specific waste collection and disposal management plan, which may include good site practices such as: the systematic collection and separation of waste materials within on-site storage areas, contractors would be required to remove all waste materials from Project sites during maintenance activities, and implementation of an on-going waste management program consisting of reduction, reuse, and recycling of materials.

With the application of the mitigation measures (contained within the **Draft Design and Operations Report**), no adverse net effects from waste material disposal would occur on-site during operation. However, as with all wastes, it is possible that disposal would have a minor incremental effect on soil, groundwater, and surface water at the waste disposal site(s) depending on municipal on-site containment practices and quality of the landfill protection mechanisms (e.g. use of geotextiles to contain leachate). It is assumed that licensed waste disposal sites are legally compliant.

4.11 ACCIDENTS AND MALFUNCTIONS

Though the possibility of injury from full or partial blade detachment from the turbine or collapse of the entire structure exists, the likelihood of this happening with the built in safety features to the structures and ongoing maintenance of the equipment is very low. In accordance with O.

Reg. 359/09, the turbines are located at least the minimum regulated setback distance from any receptor and the event of a failure of the structure would likely not fall beyond the setback distance and not affect public health and safety.

There is the potential for exposure to toxic vapours should a fire consume the solar panel. However, given the melting points of the potentially harmful substances within the photovoltaic cells (Fthenakis, 2003) and the lack of burnable materials in a solar panel, the risk of fires and the generation of hazardous fumes are extremely limited.

It is anticipated that the probability of transmission tower failure occurring during operation is low, i.e., one occurrence in 150 years. The transmission and collector lines will be designed and constructed in accordance with applicable regulatory guidelines (e.g. International Electrical Commission standards) minimizing the risk of tower failure.

SPK and the Operation and Maintenance Contractor would aim to minimize accidents and malfunctions with proper training and education of staff operating the control system. County emergency response staff would also be trained to appropriately deal with any potential accidents and malfunctions resulting from the operation of the turbines.

With the implementation of an Emergency Response Plan which would include protocols for the proper handling of material spills and associated procedures to be undertaken in the event of a spill no adverse net effects are anticipated from spills during the Project.

4.12 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Though the possibility of injury from ice falling or shed from the turbine tower or blades, the likelihood of this happening with the built in safety features of the structures and ongoing maintenance of the equipment is very low. In addition, in accordance with under O. Reg. 359/09, the turbines are located at least the minimum regulated setback distance from any receptor and the event of falling ice or ice shed would likely not fall beyond the setback distance and not affect public health and safety.

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

4.13 AREAS PROTECTED UNDER PROVINCIAL PLANS AND POLICIES

The Project does not fall within any parts of land protected under the following provincial plans: Greenbelt Plan and *Greenbelt Act*, Oak Ridges Moraine Conservation Plan Area, Niagara Escarpment Plan Area, and the Lake Simcoe Watershed Plan Area.

5.0 Closure

This report has been prepared by Stantec for the sole benefit of SPK, and may not be used by any third party without the express written consent of SPK. The data presented in this report are in accordance with Stantec's understanding of the Project as it was presented at the time of reporting.

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