Windrush 4.5 MW Wind Turbine Project
Environmental Assessment
Draft Screening Document

WPPI Registration No. 5902-W6-1

Windrush Energy
3042 Concession 3 Adjala
Adjala, RR1
Palgrave, Ontario
L0N 1P0

November 10, 2004

Prepared by
Environmental Business Consultants
for
Windrush Energy
Division of Land's End Corporation

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1.0 PROJECT SUMMARY

This report documents the assessment of the environmental effects of the proposed construction and operation of up to FIVE wind turbines at 3042 Concession 3, Adjala, RR1, Palgrave, Ontario. This assessment was conducted in accordance with the requirements of the *Canadian Environmental Assessment Act* (CEAA), Regulations and Wind Power Production Incentive Guidelines. It is also meets the requirements of the Ontario *Environmental Assessment Act*.

1.1 Project Proponent

The project proponent is Windrush Energy, a division of Land's End Corporation Contact information is as follows:

John Pennie, Chairman
Windrush Energy
Division of Land's End Corporation
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1.2 Title of Project

The title of the project is *Windrush 4.5 MW Wind Turbine Project.*

1.3 Project Location

The Wind farm will be located at 3042 Concession 3 Adjala, RR1, Palgrave, Ontario. A centered landmark is the meteorological tower located at UTM 17 5 84020 E and 48 77409 N (base elevation 290m). A map of the showing the location of the site can be found in Appendix A.

1.4 Estimated Capacity of the Wind Farm

The site is expected to consist of 3 wind turbines manufactured by GE Wind with an expected capacity of 4.5 MW.

1.5 Construction Schedule

The preliminary engineering will occur November 2004. The start of construction will be April 2005 and the expected commissioning of the last turbine will be July-Nov 2005.

1.6 NRCan's Involvement in the Project

The total requested incentive funding of $0.01/KWh expected over the 10-year period is $950,000.

1.7 Provincial Government/Agencies Involved in Environmental Assessment

The Canadian Environmental Assessment Agency, the Ontario Ministry of the Environment as well as other government ministries and groups. A notice of commencement concerning the project was sent to the following government Ministries and Agencies:

- Oak Ridges Moraine Foundation;
- Ontario Native Affairs Secretariat;
- Ontario Ministry of Natural Resources;
- Ontario Ministry of Energy;
- Ontario Ministry of Agriculture, Food and Rural Affairs;
- Ontario Ministry of Culture, Tourism and Recreation;
- Environmental Commissioner of Ontario;
- Niagara Escarpment Commission
- Nottawasaga Valley Conservation Authority;
- Ontario Energy Board;
- The Township of Adjala-Tosorontio;
- The County of Simcoe;
- Simcoe County District School Board;
- Simcoe County Historical Association
- NRCAN; and
- Environment Canada

Windrush has submitted a proposal in response to the Request-for-Proposal issued by the Ontario Ministry of Energy for 300 MW of renewable energy.

Besides conducting an environmental assessment to fulfill the requirements of the *CEAA* and the Ontario *EAA*, Windrush will also apply for a Certificate of Approval (noise) under the Ontario *Environmental Protection Act*.

Before construction can commence, Windrush will need a building permit from The Township of Adjala-Tosorontio.

1.8 Author of EIS

The author of the environmental impact statement is as the following:

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2. PROJECT DESCRIPTION

2.1. Presentation of Proponent

Windrush Energy, a Division of Land's End Corporation was incorporated in Ontario on October 7, 2002 to develop residential recreational horse farms and wind energy projects.

The Shareholders of Land's End Corporation include: J.C.Pennie, Chairman of Windrush Energy and spouse Marilyn J. Field, M.S.M., founder of the DAREarts Foundation for Children; Robert T. Gillespie, Chairman & CEO, GE Canada; Todd Latham, General Manager of Ecolog; Brian Boake, Principal the Boake Group & President Adjala Power Corp.; Meyer Florence, President, Sherfam Inc., an investment company; and Barry Cracower, President Marketing Alternatives Inc., & retired President of Rexall Drug Stores.

2.2. Background of Project

Virtually all regions of Canada have areas with good wind resources. Production from wind increases with the cube of the wind speed, so doubling the wind speed increases electricity generation by a factor of eight. It is therefore important to find the best winds. Oceans and large lakes, wide open prairies and hill or mountain areas that act as a funnel often have good winds. High pressure, cold air has the most wind energy.

The Ontario Ministry of Energy has stated that the benefits of wind energy to include the following:

- A renewable energy source that does not create emissions or hazardous waste.
- Provides local employment in a potentially long-term industry. Wind energy produces more jobs than conventional energy generation.
- Offers the potential for Ontario communities to be leaders in developing an industrial cluster.
- Can increase municipal tax base.
- Create the potential for a second income for landowners/farmers through land rental/lease.
- Can co-exist with existing agricultural practices or support restoration of agricultural lands.

Wind turbines produce electricity from generators in much the same manner as other types of electricity generation plants in Ontario. Electricity is produced when wind propels the blades of wind turbines. A shaft rotates a dense coil of insulated wire between the poles of a powerful magnet in the generator, which creates an electrical current. A wind speed of 15 kilometers per hour is the minimum required for effective electrical generation. The more constant the wind, the better the generation potential.

The idea for the project was initiated several years ago. Windrush Energy was formed to develop wind turbine farms in rural areas on a small scale (1 to 5 turbines).

The local municipal government had indicated its support of the project. The mayor sent a letter to Windrush offering his support. The Township of Adjala-Tosorontio is an award winning "green municipality" and would like to be self-sufficient. This stems from the rural community and farming attitude of the residents.

The Province of Ontario is in support of wind energy projects. The project is pre-qualified for bidding on the Ontario Ministry of Energy RFP for 300 MW of Renewable Energy Supplies and a proposal has been submitted.

The federal government is in support of wind energy projects. During the 2004 federal election, the currently elected government had a policy platform to support wind farms in Canada. Federally, the project is eligible for funding under the WPPI.

2.3. Purpose of Project

The purpose of the project is to generate 4.5 MW of electricity to meet the growing demand for power in the province of Ontario.

The objectives of the project are to generate 4.5 MW and over the project life (20 years), promote clean energy and supplant the electricity produced by coal-fired generating stations. Another goal of the project is to assist the local municipality in its vision of becoming a leader in sustainable development.

2.4. Summary of Project

As a general overview, the site is at the crest of the Hockley Valley, about one-hour drive north of Toronto.

Presently, the land is zoned Rural which allows the installation of wind turbines. The Chairman and CEO for Windrush recently built his principle residence on the site.

There will be either 3 GE 1.5MW or 5 900KW Direct Wind (Lagerway) turbines. The overall capacity will be 4.5 MW. A decision on which of the two models of wind turbine is chosen will be based on economics. The environmental impact of three larger wind turbines or five smaller ones is negligible.

Connection to the grid will be by a transmission line carried by wooden hydro poles. The connection point to the grid be at the foot of the property on the 3rd Concession of Adjala. HydroOne has completed a System Impact and connection assessment and has determined that the output of the turbines will be controlled at the Colgan DS on feeder F1 approximately 12km from the site. The EG facility is 1 km north of Hockley Valley Road (nearest 27.6kV line). Each turbine will be connected to a local 27.6kV bus through (HV/LV) Delta/Wye transformers. The bus will then tap to a HONI 27.6KV line which can span 1 km south of the feeder F1 on Hockley Valley Road. Other than a proposed 220v feed to a co-op of up to a dozen local neighbours of the turbine site, all connections are proposed to the 27.6kV feeder.

2.5. Location of Project

The location of the project is UTM 17 5 84020 E 48 77409 N. A legal description of the property is described in Adjala-Tosorontio By-Law 02-52 as Part of Lots 17 and 18, Concession 2, 3042 Concession Road 3, PIF/5-160-00.

An attached map shows the geographical context of the site and the environmental features that could be affected by the project.

The nearest environmental and/or cultural site is the Niagara Escarpment, located approximately 3 kilometers from the site.

First Nations reserves and lands currently used by aboriginal peoples are not within the proximity of the site. The nearest First Nation are Georgina Island on Lake Simcoe, Chippewas of Saugeen on Lake Simcoe and Beausoleil (north of Barrie).

A site plan and photos with project location, features and activities are seen in Appendix A.

2.6. Detailed Project Activities

The information below details the construction, operation and decommissioning phases and the timing and scheduling of each phase. The project components are described in detail including any permanent and temporary structures associated infrastructures and associated construction work. The type of equipment used is listed for the location. The capacity and size of the various components is also provided.

2.6.1. Construction Phase

Prior to initiating construction, a number of surveys will be required including, but not limited to site survey, geotechnical survey and grid construction survey.

Site preparation activities will include preparing a point of access to the site (i.e, temporary road), preparation of the site (e.g., placement of temporary snow fencing), and mobilization of construction equipment.

Depending on the type of the base to be constructed, some degree of excavation will be needed. The most significant amount of excavation will be associated with the construction of concrete foundations. Foundation holes will be excavated using an excavator. Excavated materials will be disposed of in accordance with *the Environmental Protection Act* and its regulations (i.e., General – Waste Regulation). Excavation will likely be completed in less than one week.

The wind turbine, including tower, will be brought on site by the supplier in sections on flatbed trucks.

A large crane will be brought on site. It will lift and bolt tower sections into place. The nacelle, which contains the gear box, generator and yawing mechanism, will then be placed onto the top of the tower. The next step will be to assemble or partially assemble the rotor (i.e. the blades of the turbine) on the ground. It will then be lifted to the nacelle and bolted in place.

A small crane will likely be needed for the assembly of the rotors while a large crane will be needed to put it in place. It will take approximately 2 days to erect each turbine. The proposed turbines will be between 80 and 120 metres tall (depending on the model chosen). The blade length will be approximately 25-41 metres while the diameter of each tower will be 3-4 metres.

A transformer, that will be approximately 1.5 cubic metres, will be sited within or proximal to the tower base. This transformer will have approximately a 20-year life span. The transformer will be connected to the power grid via a bus duct cabling arrangement.

The trench for the power cables will be dug using heavy equipment. The trench will be 1.5 metres below the surface to carry the bus duct and associated power cables. The power cables will then be placed in the trench and the trench filled. The power cables will be installed at the turbine and connected with the grid. It is expected that the conduit would be placed in existing road allowance to the extent possible. This activity will take approximately 1 to 2 weeks.

Prior to the start up of the wind turbine, a series of checks and tests will be carried out. This will include both static and dynamic tests to make sure the turbine is working within appropriate limits. Grid interconnection and unit synchronization will be undertaken to confirm the turbine and unit performance. Physical adjustments may be needed such as changing the pitch of the blades. The schedule for this activity will be subject to site and weather conditions. Approximately 10% of the 121 acres of the site will be secured behind a silt fence during construction.

The site will be demobilized when the work is completed. Backfill will be placed over the base and the ground will be remedied with appropriate vegetation. Fencing will be removed, and any access points to the site will be remediated. It is expected that this will take approximately one week. In some cases, these activities may be carried out concurrently to optimize scheduling of equipment.

Parking lots will not be required for this project.

The project schedule is in the process of being prepared.

2.6.2. Operation Phase

The following activities will be required for the wind turbine operation:

A. ONGOING OPERATION
The wind turbine will be operational except under circumstances of mechanical breakdown, extreme weather conditions or maintenance activities.

B. MAINTENANCE
The wind turbine will be subject to periodic maintenance and inspection. Periodic oil changes will be required. Any waste products (e.g. oil) will be disposed of in accordance with Ontario's General – Waste Management Regulation (Reg. 347).

2.6.3. Decommissioning Phase

The expected lifetime for the project is 20 years. When the useful life of the existing wind turbines is reached, they will be replaced

A reconditioning schedule for the wind turbines will be followed in accordance with the requirements of the manufacturers.

Decommissioning involves the following activities:

A. SITE PREPARATION
Site preparation activities will include preparing a point of access to the site (i.e. temporary road), preparation of the site (e.g. placement of temporary snow fencing) and the mobilization of construction equipment.

B. DISASSEMBLE AND REPLACE EXISTING TURBINES
A large crane will be brought on site. It will be used to disassemble towers' sections. The sections will be reused, recycled or disposed of in accordance with regulatory requirements. All parts of the turbines are reusable or recyclable except for the blades. Some of the parts (cabling, generator) will have high economic value. There are ongoing programs in Europe to develop blades that are recyclable.

2.6.4. Future Phases of Project

Once the project is completed, no further expansion on the site beyond a possible maximum of 6 turbines, depending on the size and type, is planned. In 20 years, the plan would be to replace the current wind turbines with new ones.

3. SCOPE OF THE ASSESSMENT

3.1. Scope of the Project and its Assessment

CEAA requires the Responsible Authority (RA) to define the scope of the project that will be assessed. The "scope of the project" refers to those components of the undertaking that will be assessed for environmental effects. The scope of the project should include elements of the principal undertaking as well as any other physical work or activity that will be needed for the project to proceed. The scope of the project includes construction and decommissioning activities.

For a screening, CEAA requires the RA(s) to, among other things:

- determine the scope of the project and the scope of the criteria to be considered in the screening;
- determine if any criteria in addition to those required to be considered under the screening process should be considered;
- consider the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project;
- consider any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;
- consider the significance and likelihood of the environmental effects of the project and the cumulative environmental effects referred to above;
- consider comments from interested parties;
- consider measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project;
- ensure that a screening report is prepared;
- make a decision on whether the project is likely to cause significant adverse environmental effects after taking into account mitigation measures; and
- ensure that any mitigation measures that the RA considers appropriate are implemented.

3.2. Methodology of Environmental Assessment

The environmental assessment methodology for the Project was developed to satisfy regulatory requirements of a screening level assessment under *CEAA* and the Ontario *EAA*.

The methodology used in this report has evolved from methods proposed by Beanlands and Duinker (1983), who stressed the importance of focusing the assessment on environmental components of greatest concern. In general, the methodology is designed to produce an environmental assessment document that:

- is focused on issues of greatest concern;

- addresses regulatory requirements;
- addresses issues raised by the public and other stakeholders;
- integrates engineering design and mitigative and monitoring programs into a comprehensive environmental management planning process; and
- integrates cumulative effects assessment into the overall assessment of residual environmental effects.

The environmental assessment screening methodology for this Project includes an evaluation of the potential effects, including cumulative effects, of each Project phase – construction, operation and decommissioning – as well as malfunctions and accidents, with regard to Valued Environmental Components (VECs) and Valued Socio-economic Components (VSCs). Project related effects are assessed within the context of temporal and spatial boundaries established for the assessment.

The investigation comprised a review of documentation, field investigation and a series of interviews. The available documentation supplied much objective information about the effect of the project on the environment.

Documentation Review
A review of existing information on wind turbines and their environmental effects was undertaken.

Only documentation that was part of the public process was included in this review. Section 10 includes a list of documentation reviewed.

Document review included the following
- a review of relevant provincial and federal websites (e.g. Department of Natural Resources, Environment Canada);
- review of listed species and/or species at risk found within the Project area using existing regional information and/or site surveys;
- a review of environmental assessment documentation for a similar projects.

Interviews
Interviews were conducted with those associated with the project and with interested parties. The goals of the interviews were to (1) explore the effect of the project on the environment; (2) seek suggestions for mitigation of any environmental impacts, and (3) gather input about the project. Interviews were conducted in an informal setting that allowed persons to raise points and explain issues that they considered important.

The following persons were interviewed
- John Pennie, Windrush Energy
- Ariane Heisy, MOE
- Paul Shafer, CEAA
- participants at an open public meeting, and
- Neighbours.

Field Investigation

A field investigation of the subject property was undertaken during the month of June and July 2004 to document of the characteristics of the natural environment related to the proposed undertaking. The timing of the field investigation did not allow for a complete inventory of plant species or wildlife on the subject lands. However, this was not seen as a limitation to the study since general characteristics of the vegetation communities could be observed and many species were present at the peak of their reproductive period.

The VECs considered in the environmental and socio-economic assessment, as determined through the issues scoping exercise described above, are:

- noise and vibration;
- birds;
- flora and fauna; and
- community infrastructure (social infrastructure and services; physical infrastructure).

These VECs were selected based upon expressed public concerns as well as previous project experience related to social, cultural, economic, or aesthetic values and scientific community concerns.

On-site field investigations were completed on June 10 and June 29, 2004. During these field surveys, the following tasks were conducted:

- Vegetation communities on the subject property and immediately adjacent lands were described;
- All species of vascular flora were recorded; and
- Breeding bird species were recorded, using two methods (i) bird species observed throughout the site were recorded along with breeding evidence using the Ontario Breeding Bird Atlas methodology (CWS 2001), (ii) point counts were done at four stations on-site following the standard Forest Bird Monitoring Protocol (CWS 1997). Four 100m radius plots were used which corresponded to four of the five locations being considered for wind turbines.

4. ENVIRONMENTAL CHARACTERISTICS

4.1 Geophysical Environment

4.1.1 Physiography and Topography

The subject property is currently undeveloped and is comprised primarily of old-field successional meadows that were likely historically utilized for grazing lifestock. An abandoned barn located along the portion of the property to be retained and a house located along the eastern boundary are shown on the map NN. These structures have frontage on Concession Road 3 (Figure NN).

A fringe of natural forest vegetation associated with the valley corridor of a tributary of the Nottawasaga River and a small area of a pine plantation are located in the northern portion of the subject property. A small forested tract area is located to the southwest of the residence.

A previous aggegrate extraction pit is located to northwest of the subject property. An un-maintained, sand access road is associated with the area of former extraction. The pit is sparsely vegetated and has not been rehabilitated. The pit is approximately 30 to 40 feet deep and 350 feet in width and is characterized by exposed sands with sparse weedy vegetation invading from the margins of the pit. At the time of the investigation, there was no water in the pit, indicating that it is not close to surface groundwater.

Adjacent Land Use
The subject property is located in a rural area characterized by a combination of agricultural and rural residential land use. Rural residential properties are located along both sides of Concession Road 3 located at the east of the subject property. Concession Road 3 terminates at the existing cattle barn. A sand driveway is currently located at the eastern property boundary (north of paved portion of Concession Road 3) and provides limited access to the subject property.

Lands to the north of the subject property are forested and form part of a steeply – sloped valley corridor associated with a tributary of the Nottawasaga River. These lands are included in the County of Simcoe's Greenlands designation according to mapping provided by the County of Simcoe.

Topography
The subject land exhibits a strong undulating topography with steep slopes located within the tributary valley corridor that runs along the northern portion of the property. No active areas of erosion were noted during field investigations because the steep slopes were fully vegetated with shrubs and herbaceous species to the south of the top of the bank. Along the northern boundary, the land rises sharply to form a ridge, corresponding

to the highest elevation of the forested lands. The sides of the valley corridor in proximity to the ridge are steeply sloped and impassable.

4.1.2 Soil Quality

Areas of exposed soils at the study site confirm that the surficial soils are well-drained and sandy in texture. An engineering report was prepared by Egmond Associates Ltd. (November 1999) to assess aggregate resources on the site and a slope stability assessment was performed by Geospec Engineering Ltd. (May 15, 2003).

The site stratigraphy included top soil over layered sand with occasional sand and gravel and silt seams.

A 10 cm layer of topsoil was encountered at the surface of the borehole The toposil was brown to black in colour and highly compressible. Due to the compressible nature of the topsoil, it is considered to be void of engineering considerations but is suitable for agriculture and landscaping purposes.

Underlying the toposoil is a deposit of layered sand that extends to a depth of five metres below grade, resumes at a depth of about 8 metres and extends beyond the final depths of both investigations. Based on Grain Size Distribution Analysis, there is 69 to 96 percent sand, 3 to 30 percent silt and less than 1 percent gravel. The Moisture Content ranges from 2 to 17 percent, indicative of a moist state. Standard Penetration Tests indicate that the Relative Density of the deposit varies from compact to very dense, being generally dense.

Underlying the upper sand layer is a deposit of sand and gravel that extends to a depth of 8.1 metres below grade. Based upon Grain Size Distribution Analysis, the deposit was comprised of 51 sand, 43 percent gravel and 6 percent silt. The Moisture Content ranged from 2 to 4 percent indicative of a slightly moist state. Finally, Standard Penetration Test results indicate that the Relative Density of the deposit varied from compact to dense.

4.1.3 Geology

The original soil is comprised of a compact to very dense sand with occasional sand and gravel and silt seams. Moreover, the types of soil encountered at the slope exhibit Angles of Internal Friction in excess of 35 to 46 degrees in an unconsolidated and saturated sate. Steeper angles are expected if the soil is consolidated, drained and slightly moist, such as the sate at the subject site. The Angle of Internal Friction, without the influence of seepage planes, provides an indication of the anticipated long-term stability of a slope comprised of a particular soil.

At the subject site, the range of angles represent a slope, horizontal to vertical ratio, ranging from 1.4:1 to 1.0:1.03. Finally, although sand is considered to be cohesionless and permeable, the borehole revealed an absence of seepage planes. Moreover, no groundwater seeps or slough zones were observed on the slope adjacent to the borehole.

4.1.4 Seismicity

The Southern Ontario Seismic Network (SOSN) consists of 11 three component short period seismic stations located mainly in the Toronto-Hamilton-Niagara area of Ontario, Canada. The network is operated by the University of Western Ontario for Ontario Power Generation and has been in operation since 1991. Its purpose is to obtain information on the seismicity and seismic hazards of a region of Southern Ontario in which a number of nuclear power stations are located. Although the region covered by the network is not as active as other areas of Canada such as the St. Lawrence Valley, it has still experienced a number of small earthquakes in the past. Larger earthquakes have occurred in adjacent areas of New York State (Attica, 1929, M=5.7), Northern Ontario (Temiscaming 1935, M=6.2), Eastern Ontario (Cornwall, 1944, M=5.7), Leroy, Ohio (near Cleveland, 1986, M=5.0), Pennsylvania-Ohio border (1998, M=5.4), and Northern Ontario (70 km NE of North Bay, Jan. 1 2000, M=5.2).

Over the past 9 years the network has been in operation more than a 100 local earthquakes have been detected and more than half of these have been located in the western Lake Ontario area. The largest earthquake (M = 3.8) in western Lake Ontario region happened on Nov. 26, 1999 in Lake Ontario at a distance of 16 km SE from the town of Pickering.

4.1.5 Hydrogeology

The presence of sand – gravel sand (Egmond Associates, 1999) indicates the property has a high infiltration capability and the area would act as a recharge area. The landforms in the area of Adjala – Tosorontio were formed by glaciofluvial deposits. These landforms generally contain large volumes of potable groundwater and provide an important groundwater discharge function as demonstrated by the presence cold-water stream.

4.1.6 Groundwater

Geospec Engineering Ltd. performed a slope stability assessment in May 2003 that included a discussion of groundwater conditions at the subject property. Although moist conditions were observed during the investigation, free flowing groundwater was not encountered. Drilling at the subject site was to depths of up to 28 metres.

4.2 Aquatic Environment

4.2.1 Aquatic Habitats

The subject property contains a tributary of the Nottawasaga River. The tributary on the property is suitable for fish spawning and would include aquatic species found in the Nottawasaga River.

The Nottawasaga Valley Watershed lies within the Counties of Simcoe (74%), Dufferin (22%), and Grey (4%). The northern boundary of the Conservation Authority's jurisdiction is Nottawasaga Bay. The watershed is bounded to the south by the Humber and Credit River Watersheds. The Niagara Escarpment forms part of the western boundary, separating the Nottawasaga from the Grand and Saugeen Watersheds. On the east, the Nottawasaga Watershed is bounded by the numerous streams which drain into Lake Simcoe. There are 3 counties and 18 municipalities within the Watershed that are entirely or partially within the jurisdiction of the Nottawasaga Valley Conservation Authority (NVCA).

The Nottawasaga Valley Watershed contains a wide variety of provincially significant fish habitat. Significant recreational fishing opportunities are provided in the abundance of coldwater streams and rivers throughout the Watershed. Salmon, rainbow trout, and brook trout are relatively common in the headwater reaches of most coldwater rivers and streams. The warm water rivers and streams in the Watershed are also highly productive and contain a diverse fish community. These streams and rivers are generally located in the lower reaches of the Simcoe Lowlands and the M.N.R. notes that in most cases, coldwater species migrate through these reaches to get to upstream spawning beds.

4.2.2 Aquatic Fauna

The aquatic fauna in the tributary is in its natural state. It is will undisturbed by any project activities.

4.2.3 Aquatic Vegetation

The vegetation in the nearby stream is in its natural state. The vegetation will undisturbed by any project activities.

4.2.4 Surface Hydrology

The surface hydrology for the Nottawasaga River watershed is monitored by the NVCA. Data on surface hydrology is available from the NVCA. Surface hydrology will be unaffected by project activities.

The Nottawasaga River is approximately 122 km in length along its main channel and has a drainage area of 3,361 sq. km. The main branch of the river's source is in the till moraines of Amaranth Township at an elevation of almost 490 metres. The Nottawasaga River has a total drop of 310 metres to its outlet into Georgian Bay and has an average gradient of 2.6 metres per km. However, in the upper reaches of the river, the gradient is as much as 19 metres per km (at its outlet in Georgian Bay).

The Nottawasaga River has 6 primary tributaries; the Boyne River the Mad River, the Pine River, Innisfil Creek, Bear Creek, and Willow Creek. In addition to the Nottawasaga's major drainage basin, four streams draining directly into Georgian Bay from the Niagara Escarpment are in the Nottawasaga Valley Conservation Authority's jurisdiction. These watercourses, all located in the north western section of the Authority's jurisdiction include; the Pretty River, Batteaux River. Silver Creek, and Black Ash Creek.

4.2.5 Surface Water Quality

The surface water on the subject property is not affected by activities at the site.

NVCA keeps a map records on the stream health status for classified streams (i.e. impaired, unimpaired, below potential) within the NVCA watershed. The map records integrates all data collected since 1996, including BioMAP, fisheries, water temperature, chemical, and other. Classified stream reaches are categorized as follows:

- Total length of classified reaches: 1452 km
- Unimpaired: 463 km (32%)
- Impaired: 170 km (12%)
- Below Potential: 819 km (56%)

Therefore, 68% of NVCA streams are currently "unhealthy" (impaired + below potential).

4.2.6 Sediment Quality

The sediment quality in the nearby stream is in its natural state and has been undisturbed by activities at the site.

4.3 Terrestrial Environment

4.3.1 Flora

Vegetation

The subject property is generally open with undulating topography. The soils were described as sandy and well-drained in a report prepared for the site by Azimuth Environmental Consulting Inc (2002). An oblique aerial view of the property is shown on Appendix A (which includes conceptual turbine locations).

Six vegetation communities are found on, or immediately adjacent to, the site:

CUM1-1 Cultural Meadow
The dominant vegetation on-site is open field, with scattered shrubs such as sumacs, (Rhus ssp.), Large-toothed Aspen (Populus grandidentata), White Ash (Fraxinus Americana), Apples (Malus ssp.). In many areas scattered planted Scots Pines (Pinus Sylvestris) are found, especially in the western end of the site. Common invasive herbaceous plant species such as wild carrot (Daucus carota), Vetch (Vicia ssp.), Mixed Grasses (Grasses ssp.), Raspberry (Rubus ssp.), Blueweed (Echium vulgare), etc are found in these areas. An abandoned gravel pit is located near the northern boundary. This area includes many areas of exposed soils as well as open field vegetation.

FOD3-1 Dry-Fresh Poplar (Populus ssp.) Deciduous Forest
The perimeter of the open field area is dominated by woodland in the north. This woodland edge is dominated by Large-toothed Aspen (ranging in size from 4 to 20cm diameter at breast height).

FOD5-1 Dry-Fresh Sugar Maple (Acer Saccharum) Deciduous Forest
A maple dominated woodland is found off-site bordering the southwest corner of the property.

CUP3 Pine Plantation
A Red Pine (Pinus resinosa) plantation is found in the northern portion of the study area as well as along the southern boundary. In some areas Jack Pine (Pinus banksiana) and White Pine (Pinus strobus) are found in the surrounding plantations.

FOC4-1 Dry-Fresh White Cedar (Thuja occidentalis) Coniferous Forest
In the northwest corner of the site is a ravine with steeply sloped lands (in some locations >45 degrees) dominated by White Cedar and mixed deciduous tree species including White Elm (Ulmus Americana) and Ash, Aspen, Maples, and Basswood (Tilia Americana). The bottom of the ravine is dominated by open meadow, especially Goldenrods (Solidago ssp.) and wetland cattail (Typha ssp.), Joe-pye-Weed (Eupatorium maculation), Sedges (sedges spp.)

Vascular Flora
A total of 150 species of vascular flora were recorded on-site during the field surveys. A list of these species is appended to this report in Appendix B. None of the plant species recorded were provincially or regionally rare (NHIC 2004, Oldham 1999, Riley 1989).

Approximately 50% of these species are non-native. This relatively high percentage of non-native species is indicative of disturbed habitats in southern Ontario.

4.3.2 Fauna

Breeding Birds

A list of birds reported from the 10km x 10km Ontario Breeding Bird Atlas square which overlaps this site is appended to this report (see Appendix B). A total of 95 species were found from this source. During the field surveys for breeding birds in June 2004, a total of 24 species were observed. Appendix B includes a listing of these bird species as well as an indication of whether they were observed from the open field portions of the site versus the perimeter woodlands. None of the bird species observed during the June 2004 field surveys are provincially rare species. Azimuth Environmental Consulting Inc (2002) conducted a site survey later in the year (mid July 2002) and they noted a short list of resident bird species.

The majority of bird species observed are typical of open field habitats, scattered small woodlands or woodland edges. A number of woodland species, such as Wood Thrush (Hylocichla mustelina), Red-eyed Vireo (Vireo olivaceus) and Black and White Warbler (Mniotilta varia) were noted in the woodlands surrounding the site.

Point counts were conducted at our stations corresponding to the four outer proposed turbine locations. These counts were used to provide a quantification of breeding bird use in these areas. A summary of the point count data is included in Appendix B. This data clearly indicates that Goldfinch (Carduelis tristis) and Redwing Blackbirds (Agelaius phoeniceus) are most abundant. This data can be used as a basis for assessing changes in relative abundance post-construction if warranted.

During the field surveys, bird behavior was recorded to determine breeding evidence, as well as to provide information on behaviors that may lead to conflict with the proposed turbines. Specific attention was placed on raptor behavior. During the June 2004 site surveys, two species of raptor were observed to be using the site. The proximity of the elevated open field to surrounding woodland and the ravine feature in the northwest corner of the site provides attractive habitat for both raptor breeding as well as hunting. During the June 2004 surveys two species of raptor were observed, Northern Harrier (Circus cyaneus) and Red-tailed Hawk (Buteo jamaicensis). On June 10th a single harrier was observed hunting in the open field areas at a low altitude. Some flights were noted extending over the woodlands to the south. On June 29th, a harrier and a single Red-tailed Hawk were observed flying fairly southwest along the ravine.

Other Wildlife

Although not a main focus of the 2004 study, observations of other wildlife were made during all field surveys. White-tailed Deer (Odocoileus viginianus), Coyote (Canis latrans), Red Fox (Vulpens vulpens), Skunk (Mephities mephitis), Eastern Cottontail (Sylviagus floridanus), Groundhog (Marmota monax) and Red Squirrel (Tamiasciurus hudsonicus) were observed on the property. Similar species were anticipated to use the site by Azimuth Environmental Consulting Inc (2002).

White-tailed Deer tracks were noted throughout the site, especially associated with the woodland edges. This was noted especially along the top of the slope of the ravine in the northwest corner of the site. Several deer were observed on the site as were numerous deer bedding areas. Azimuth Environmental Consulting Inc (2002) did not observe evidence of deer during their investigation, but did recognize that the Greenlands designation of the woodlands along the north o the property and the ravine identified that the area provided winter cover and movement habitats for deer. This is consistent with the findings of our study.

4.3.3 Endangered Species

No rare breeding bird species or species that perform aerial breeding displays are known for the open habitats proposed for the turbines. Therefore special consideration of these types of species is not required for this undertaking.

4.4 Atmospheric Environment

4.4.1 Climate

The climate at the site is typical of that in southern Ontario. Data on wind speeds and directions at the proposed site has been collected and is favourable for the placement of wind turbines.

4.4.2 Air Quality

The air quality at the proposed site is typical of that found in southern Ontario. The generation of electricity by the wind turbines will displace the release of CO2, NOx, and SO2 into the environment through conventional means of electricity generation (i.e., coal).

4.5 Socio-Economic Conditions

4.5.1 Population

The area around the proposed site is a sparsely populated rural setting. The nearest major urban setting is the Town of Alliston, approximately 10 km to the northwest.

4.5.2 Land Use

The area surrounding the subject site is sparsely populated with few neighbours or businesses relying on roads and infrastructure.

An 850 acre tree farm is immediately north of the subject site and farming occurs to the west.

The communities of Hockley, Connor, Achill, and Loretto are over 1 km from the site.

4.5.3 Cultural Resources

Hockley and Connor are minor centres of social, economic and religious activities. There is a school in Hockley and other institutions on country roads leading to the site

Hunting for food and recreation occurs on the surrounding properties.

4.5.4 Existing Noise Level

Other than industrial noise from a stamping plant on the 3rd Concession and the summer use of an industrial sized pumping system at the bridge on the Nottawasaga River, both ½ km from the site, the land around site area has noise levels consistent with a rural environment. Data on the sound levels in the area can be found in the attached noise study report.

4.5.5 Heritage Sites, Archaeological Sites & Cultural Resources

Due to the location of the site, no archaeological resources would be expected.

The Niagara Escarpment lies 3km to the west of the property. It is considered a United Nations Heritage Site and is designated by the Province of Ontario as a protected area.

The property is not located in the Oak Ridges moraine.

4.5.6 Recreation Areas Used for Traditional Purposes by Aboriginal Persons

The subject site and surrounding lands are privately owned and are not considered recreational areas for aboriginal persons.

4.5.7 Safety Issues

As the site is fenced and isolated ½ km east on a plateau rising from its single county road access (3rd Concession Adjala) and as the westerly 2nd Concession Adjala is unopened leaving a distance of 1.5 km from the Adjala-Mono Townline road with

escarpments prohibiting southerly or northerly access, there are no safety issues at the subject site. It is in a rural-agricultural setting.

4.5.8 Visual Landscape

The visual landscape is that of a rural-agricultural setting.

5. ASSESSMENT OF ENVIRONMENTAL IMPACTS, MITIGATION REQUIREMENTS AND RESIDUAL EFFECTS

5.1. Project Construction Activities – Environmental Effects

The following sections describe the environmental impacts of the proposed construction, of up to five wind turbines at the site. Table II, located at the end of this chapter, summarizes the environmental effects of the project.

5.1.1. Surveying and Siting Operations

There are no environmental impacts expected from the surveying and siting operations at the subject property.

5.1.2. Land Clearing

There are minor environ mental impacts expected from the land clearing at the subject property. The amount of clearing is minimal and will not significantly affect habitat. Existing vegetation will be removed from a small area at the construction site, and at the access to the site. Such removal as may be necessary is not considered to be significant since the species involved are common plants, and disturbance is temporary. The disturbed sites can be re-vegetated quickly.

There will minimal impact on wildlife from land clearing. Very few, if any, animals will be incapable of moving away from the site in order to avoid construction activities. Construction is limited in extent and time, and is expected to have very little direct affect on any species at the time.

5.1.3. Road Construction/Modifications

There are minor environmental impacts expected from the road construction and modifications at the subject property. There are currently temporary roads at the site, but they will need to be re-enforced with gravel. The environmental impact of road construction will be minimal and restricted to the subject property.

The amount of clearing is minimal and will not significantly affect habitat. Existing vegetation will be removed from a small area at the construction site, and at the access to the site. Such removal as may be necessary is not considered to be significant since the species involved are common plants, and disturbance is temporary. The disturbed sites can be re-vegetated quickly.

The noise impacts associated with road construction will be limited and temporary. It can be expected that the most intense noise would occur during site preparation, assembly

of the turbine towers, and the mounting of the turbine nacelle. During this period a variety of light and heavy-duty construction vehicles would be operated within and through the project area.

The following is a list of construction vehicles/machines/activities that will be used in construction:

- bulldozer
- backhoe
- large crane
- small crane
- dump truck
- ready-mix concrete truck
- flat-bed truck

Noise impacts to local residents will be equivalent to noise levels associated with common road construction. Construction activities related to the project should be no greater than one month.

5.1.4. Delivery of Equipment

There are minor environmental impacts expected from the delivery of equipment to the subject property. Specifically, there will be noise impacts.

5.1.5. Temporary Storage Facilities

There will be no temporary storage facilities at the site. If the project demands temporary storage facilities, the size of the facilities will be such that there would be minimal environmental impact.

5.1.6. Foundation Construction

The construction of the foundation will have minimal environmental impact. Existing vegetation will be removed from a small area at the construction site, and at the access to the site. Such removal as may be necessary is not considered to be significant since the species involved are common plants, and disturbance is temporary. The disturbed sites can be re-vegetated quickly.

The use of ready-mix concrete trucks will result in noise impacts slightly exceeding typical noise pressures. Construction of each foundation, however, will take only 1 week.

5.1.7. Tower and Turbine Assembly and Installation

The tower and turbine assembly and installation will have minimal environmental impact. Existing vegetation will be removed from a small area at the construction site, and at the access to the site. Such removal as may be necessary is not considered to be significant since the species involved are common plants, and disturbance is temporary. The disturbed sites can be re-vegetated quickly.

5.1.8. Interconnection from Turbines to Substation

Interconnection from the turbines to the substation will have minimal environmental impact. Existing vegetation will be removed from a small area at the construction site, and at the access to the site. Such removal as may be necessary is not considered to be significant since the species involved are common plants, and disturbance is temporary. The disturbed sites can be re-vegetated quickly.

5.1.9. Substation Construction

Substation construction will have minimal environmental impact. Existing vegetation will be removed from a small area at the construction site, and at the access to the site. Such removal as may be necessary is not considered to be significant since the species involved are common plants, and disturbance is temporary. The disturbed sites can be re-vegetated quickly.

5.1.10. Transmission Line to Power Line

The transmission line to the power line will have minimal environmental impact. Such removal as may be necessary is not considered to be significant since the species involved are common plants, and disturbance is temporary. The disturbed sites can be re-vegetated quickly.

5.1.11. Fencing/Gates

The fencing and gates will have minimal impact on the environment. Disturbance will also occur during temporary placement of fencing, and where construction equipment is used near the site. Such removal as may be necessary is not considered to be significant since the species involved are common plants, and disturbance is temporary. The disturbed sites can be re-vegetated quickly.

5.1.12. Parking Lots

There will be no parking lots constructed and hence there will be no impact on the environment from this non-activity.

5.2. Operational Activities – Environmental Effects

5.2.1. Wind Turbine Operation

5.2.1.1. Land Use

There will be minimal environmental impacts on land use as the of the wind turbines. The land was used for farming and can still be farmed.

5.2.1.2. Visual Impacts

There will be minimal visual impacts. The turbines are set back from major roads and will be visual to only a small minority of people. Neighbours living in the valley will not be able to see the wind turbines due to the fact that they are in the valley and the turbines are situated on top of plateau. Those neighbours on the plateau will be able to see the wind turbines as well as those driving on portions of Hockley Valley Road near Concession Road 3.

Visual issues and concerns are subjective, and very largely a matter of individual taste. Clearly, some people dislike the visual appearance of windmills. Equally, some people like the visual appearance of windmills, siting the modern sculptural lines of a pro-environmental mechanism in a pastoral rural setting, and siting the educational value of the presence of a clearly identifiable energy alternative structure adjacent to areas such as farm land.

The pro-environment view is that small windmill projects are essential in urban areas to satisfy the need to put an energy alternative before the energy consuming public. Under this view, locating windmills at gateways to urban parks, and especially at gateways to natural heritage areas is a major benefit and goal.

Literature concerning the sociological impacts of wind farms suggests that the most commonly identified issues relating to social effects of siting wind turbines are noise and aesthetics. Further, it is well recognized in the literature that these concerns, while apparent in advance of the actual installation of the turbines, are significantly reduced once the turbines are installed and in operation.

Several studies have been carried out to evaluate the experiences of people who live near wind turbines. Generally, residents have responded quite favourably to local wind turbines, especially if they provided their homes with some electricity. One study

surveys the attitudes of people living near the 24 wind turbine Cemmaes Wind farm in Wales both immediately after construction (Phase 1) and one year later (Phase 2). When asked the question "broadly speaking, are you for or against the Cammaes Wind farm?", the majority of respondents (86%) were in favour in both Phase 1 and Phase 2 of the survey; 12% Phase 1 and 11% Phase 2 were "neither for nor against"; 1% in both Phase 1 and Phase 2 "didn't know"; and 1% in Phase 1 and 2% in Phase 2 were "against" the wind farm. Hence, both immediately after construction and one year later, very few local people surveyed (1%, 2%) felt negative about the wind farm.

With respect to the visual impact of the Cemmaes Wind farm, visual appearance was the potential effect most commented on before the wind farm had been constructed. Most comments were either neutral or positive. A few people (4%) had more serious reservations as to the potential negative visual impact but said they were "pleasantly surprised" by what they saw after they were built (Phase 1). Of the respondents who could see the wind turbines from their house, 75% made favourable statements about the wind farm.

The study summary states, "Being able to see wind turbines did not bother the majority of people and led in some cases to respondents expressing increased interest and even pride in the machines". The most common word (62%) chosen to describe the look of the turbines was "interesting".

A Taff Ely residents' survey, based on 336 face-to-face interviews carried out in homes near the Taff Ely wind farm, indicates that only 4% of the respondents opposed the development once it was in operation and 71% of residents couldn't identify any drawbacks to the wind farm. When asked if they thought the wind farm fit into the scenery, many residents thought it made the scenery more interesting.

Hence, once the wind farm had been constructed and was in operation, the majority of local residents were either neutral or supportive of it. This is despite the "extreme opposition to the windfarm" expressed when it was first proposed. The local Mayor, Kate Rees and local Councilor, Mr. Scovie, recall there was a lot of controversy about the wind farm. Councilor Scovie stated he could not remember anybody who was for the wind farm when it was first proposed.

In response to a question regarding what Cemmaes windfarm respondents had heard about other local residents' experiences of wind farms, noise problems were most frequently recounted. Hence, respondents surveyed at the Cemmaes windfarm tended to believe that other people's experiences of windfarms were that they are noisy. When asked if the Cemmaes wind farm is noisy, 1% strongly agreed and 1% agreed at Phase 1 of the study and 2% strongly agreed and 14% agreed at Phase 2. Of the 14% who agreed that the windfarm is noisy, the majority did not live within earshot of the windfarm. Hence, 98% of the respondents at Phase 1 and 84% at Phase 2 felt that either the wind farm was not noisy or that they did not know, despite noise being originally identified as a common concern to communities living near windfarms.

A before and after study of opinion in Cornwall and Devon of the Delabole windfarm states that attitudes of residents living in the area of the wind farm changed significantly in the period between the two surveys, becoming more favourable towards the use of wind energy (e.g. 90% of those who changed their minds did so in favour of wind energy). The response to the question, "In general do you approve or disapprove of wind power?", the response was 84% approve (40.1% approve strongly, 44.5% approve) 11.4% were not sure and 4% disapprove (3.3% disapprove, 0.7% disapprove strongly).

Research regarding public attitudes towards the three wind farms in Wales based on a sample of 208 local residents indicates an overwhelming support for wind power in Wales and the three local wind farms upon which the research was centered. Respondents had become more positive towards wind power following construction of their local wind farm and, even where the turbines could be heard inside or outside of respondents' homes, this did not necessarily turn them against the wind farm. Indeed, 70% were in favour of expansion (some subject to conditions), 22% against, 8% no opinion.

It is well recognized in the literature pertaining to the sociological impacts of wind farms that these concerns, while apparent in advance of the actual installation of the turbines, are significantly reduced once the turbines are installed and in operation.

The above data suggests that while there may be concerns about the potential for the wind turbines to be intrusive, this is not going to a significant environmental effect around any of the proposed sites.

5.2.1.3. Noise Impacts

A noise study and data obtained from the manufacture indicates that the wind turbines will have minimal noise impact. The noise study can be found in Appendix C.

5.2.1.4. Wildlife Disturbance

The operation of the wind turbines will have minimal disturbance on wildlife. There will be no environmental effects expected on the aquatic environment since there will be minimal potential for negative interactions between wind turbine components and the aquatic environment.

A primary concern with the operation of wind turbines is the potential for adverse effects on wildlife. This is particularly true in connection with avian mortality. However, studies of wind turbines at many sites from across North America and Europe have indicated that avian mortality is not significant to bird populations. On sites with a small number of turbines, there is often no recorded mortality. Even at larger sites the

mortality is usually less than one bird killed per turbine per year. The maximum rate at any wind farm site in North America was 1.9 birds/year/turbine. In Europe, most mortality rates were also below the maximum recorded in North America.

The usual low rate of mortality is particularly relevant in light of the fact that studies to date have been almost entirely with variable speed turbines. The variable speed turbine is a more serious threat as there is a correlation between the speed of rotation and the number of birds killed (Orloff and Flannery 1995). A fixed speed rotation of only 28-RPM, such as the turbines being proposed, should have an even lower mortality. Up to 80% of birds can fly through the rapidly rotating blades of variable speed turbines and remain unharmed (Winkelman 1992b). Birds have much more time to evade the blades of a fixed speed turbine.

Most birds are flying during daylight, have excellent vision, and can easily see and avoid obstacles, even slowly moving ones. In good weather, even in coastal areas, the chance of a strike in daylight is virtually zero (Crockford 1992, Winkelman 1985). The birds most likely to suffer mortality are small nocturnal migrants, flying in poorer light and in large numbers. However, even these birds are largely flying too high (Able 1999), but when low can usually still see and avoid structures in good weather conditions. Only in poor flying conditions of fog and rain are they more susceptible to strikes at tall structures (Winkelman 1995). But the timing and location of such weather conditions is not predictable. Collisions could occur no matter where turbines are placed (Hanowski and Hawrot, in press).

Even in poor flying conditions there has never been a mass kill of nocturnal migrants such as are commonly associated with tall buildings or communication towers (Gipe 1995, Winkelman 1992a). Even in poor flying conditions the vast majority of birds can fly unharmed through slowly rotating turbine blades.

Avian mortality is far higher at other structures. Tall communications towers in Canada were estimated to be killing more than 1,000 birds each per year (Weir 1976). A relatively few tall buildings in Toronto are estimated to be killing more than 10,000 birds per year (FLAP), the taller ones each killing hundreds (Evans Ogden 1996). Even low buildings, such as houses, are estimated to be killing from 100 million to 1 billion birds across North America with each house killing between 1 and 10 birds (Klem 1989, Dunn 1993). Bird mortality, even at its highest rate in Europe, was considered to kill no more birds per kilometer of turbines than per kilometer of highway, or per kilometer of power transmission lines (Winkelman 1995). House cats, which many households have, are estimated to be killing as many as 140 million birds a year in Canada (www3.sympatico.ca/samgreen/webcats.html).

Every structure that is put up is likely to kill some birds; however, the above figures clearly indicate that every average house, directly or indirectly, is killing more birds per year than any average wind turbine. In fact, the average house is probably killing far more birds.

Even in European situations that have recorded the highest avian mortality rates ever, studies have repeatedly considered that avian mortality was not significant to bird populations, and that disturbance effects were a larger issue (Winkelman 1995, Crockford 1992). This is an important consideration since most European wind turbines have been place in coastal areas, even in harbours on breakwalls. Thousands of birds can fly close past turbines with no problems (e.g. Mossop 1998, Howell and Noone 1992, Still et al. 1994, Lowther in press).

Avian mortality should not be serious for the placement of turbines at the site. Unless turbines are placed directly in a confined flight of birds, mortality will be low. There are no structures around the proposed sites that would confine birds, or direct them toward the turbine. Collisions with wind turbines are statistically rare events (Curry 1994).

There is no evidence that terrestrial mammals, reptiles or amphibians are likely to be affected at all by wind turbines. Small mammals have been reported living in close proximity to operating turbines (Orloff 1992).

A number of studies in North America and Europe, have indicated that there is generally little or no effect to birds nesting close to and right below operating turbines (Bureau of Reclamation 1984, Howell and Noone 1994, Kerlinger, in press, Percival 1998, Karlsson 1983, Meek 1993, Vauk 1990, Winkelman 1992d). Where breeding birds were disturbed at a site, it was because of extensive disturbance to the surroundings, or the continued presence of people and vehicles (Leddy et al. 1999, Percival 1999), not the turbines themselves. The placement of turbines in a rural setting such as at the subject property will not have any effect on breeding bird colonies

Birds will nest right below operating turbines (Percival 1998). Several studies in Europe have indicated that the most serious affect in their situation was disturbance to resting or staging birds (Benner 1993, Crockford 1992, Winkelman 1994). Avoidance reactions have been considered important in European situations where wind farms were placed in estuaries in coastal areas where large numbers of staging waterfowl and shorebirds traditionally gather to feed on tidal mudflats. For flying birds, avoidance reactions have been observed in some species as far as 800 metres away, but most respond only at much closer distances, and many show no avoidance response at all. The response is variable, even within species, and may vary with time of day. Avoidance would mean birds could not take advantage of foraging areas near turbines. But, even where birds avoided turbines at some distance in flight, they were not disturbed when they did land, and would often swim or walk much closer to feed (Percival 1998, Winkelman 1985).

Such disturbance effects are not going to be of concern at the proposed site. Towers will not be located in areas providing rich food sources, and are not located close enough to feeding sites to cause any appreciable loss of foraging opportunities. Avoidance of towers by flying birds reduces the risk of collisions.

Siting guidelines have been established in various places in Europe and North America. Unless turbines are placed in a microhabitat where large numbers of birds are confined by

topography or structures, avian mortality is going to be rare. The proposed site does not exhibit characteristics likely to enhance avian mortality. The tubular type of turbine to be used, with no guy wires or overhead transmission lines (far more deadly as they are much less visible – Bevanger 1994), and a fixed slow speed of blade rotation that make them easily visible, are the least likely to cause mortality to flying animals.

The minimum red or strobe lights needed to meet Transport Canada regulations will also have minimal impact to nocturnal migrants (Evans Ogden 1996).

No additional precautions are needed to mitigate against bird strikes.

Bats are at some risk as with other flying animals. But they have excellent navigation skills and generally mortality seems to be less than that of birds (Howell and DiDonato 1991, Strickland et al. 1998). They are at low risk at the proposed site.

Butterflies, dragonflies and other flying insects are likely to be at very low risk of collision with wind turbines, certainly at much lower risk than they experience on highways. What studies there are have indicated negligible effects to insects (Gipe 1995).

5.2.1.5. Safety Issues

Icing is the predominant safety concern expressed by the public with respect to wind turbines. Since there have been no recorded incidents of injury by ice from an operating wind turbine, this aspect of safety has received little regulatory attention in the world-wide wind energy community.

Questions of safety arise in respect to those who maintain and operate windmill equipment, and in respect to members of the general public who come into the vicinity of the equipment. Safety issues potentially arise if anyone is in the vicinity of a windmill when ice, which may under rare conditions, accumulate on the tower or the blades and subsequently slide or be thrown off by the rotating blades.

Ice may accumulate under conditions of freezing rain, sleet or melting snow. Operators of the Tacke turbine installation at Kincardine, on the Bruce Peninsula, report a frequency of three such icing events every year. Ice accumulation events should be similar at the subject site.

Safety issues can be addressed either by operational avoidance or set-back criteria.

Windmills have wind sensors mounted on their nacelles. When wind is not detected, the windmill ceases operation. Such a sensor will almost always commonly “ice-up” before any rotating blades become coated with ice and the blades will stop rotating. However, “almost always” can be improved upon by installing similar icing sensors as are used on aircraft to warn of the need for de-icing measures.

Once stopped, the blades can restart either automatically or by manual control only, depending on equipment specifications.

Colin Morgan et al of Garrad Hassan and Partners have presented a paper (Morgan et al., 1999) sponsored under the Non-Nuclear Energy Programme of the European Commission, DGXII, and by the UK Department of Trade and Industry which assesses the safety risks arising from wind turbine icing. They present recommendations on the mitigation of icing risk as including:

- The use of warning signs alerting anyone in the area of risk.
- Operational staff should be aware of the conditions likely to lead to ice accretion on the turbine, of the risk of ice falling from the rotor and of the areas of risk.

For proposed turbines, the following measures will be put in place from the beginning of operation of each turbine:

1. The turbine control system will be programmed to recognize icing conditions through the conditions of rotor blade (im)balance (which is constantly monitored), vibration, wind speed reporting, wind direction reporting and any other control system function that can assist in recognizing icing on the turbine blades.
2. As soon as an icing condition is recognized, the control system will perform a safe shutdown of the turbine. (The operator will also be able to initiate this shutdown either on site or remotely.)
3. The turbine will remain shut down until an operator travels to the site to inspect the condition of the turbine blades. When the operator deems that a re-start is safe, he/she will post the area with signs advising that the turbine is about to be re-started and the public should stay behind the signs until the signs are removed. The operator will ascertain whether any members of the public are within the signed area and if not, will re-start the turbine and remove the signs.

In addition, the following measures will be in place.

1. The area will be posted with signage that informs the public of the potential danger from falling ice should icing conditions exist.
2. The turbine operator will be trained to be aware of the conditions likely to lead to ice accretion on the turbine, of the risk of ice falling from the rotor, and of the areas of risk.

Safety concerns regarding structural stability and ability to withstand wind force's will be addressed as part of there required technical specifications.

5.2.2. Maintenance Activities

There are no environmental effects on the aquatic environment expected from the decommissioning of the wind turbines since no materials from the wind turbine site are expected to enter the water as long as proper maintenance practices are adhered to (e.g. proper disposal of waste).

5.3. Decommissioning and Abandonment Plans – Environmental Effects

As with construction, there are no significant environmental effects expected from the decommissioning of the wind turbines. In addition, decommissioning activities are limited in extent and time.

5.3.1. Removal of Turbines and Ancillary Equipment

The removal of the turbines and ancillary equipment will have minimal environmental impact. Some of the vegetation surrounding the turbines may be disturbed but only from a small area immediately surrounding the turbines. Removal of the vegetation will not be significant since the species involved are common plants, and disturbance is temporary. The disturbed sites can be re-vegetated quickly.

5.3.2. Removal of Buildings and Waste

The removal of the buildings and any waste will have minimal environmental impact. Some of the vegetation surrounding the buildings may be disturbed but only from a small area immediately surrounding the turbines. Removal of the vegetation will not be significant since the species involved are common plants, and disturbance is temporary. The disturbed sites can be re-vegetated quickly.

5.3.3. Removal of Power Line

The removal of the power lines will have minimal environmental impact. Some of the vegetation surrounding the buildings may be disturbed but only from a small area immediately surrounding the turbines. Removal of the vegetation will not be significant since the species involved are common plants, and disturbance is temporary. The disturbed sites can be re-vegetated quickly.

5.3.4. Site Remediation

It is possible to remediate the site to its former condition. The concrete base from each turbine can be removed and the area restored to its former state.

5.4. Accidents and Malfunctions

Possible accidents and malfunctions at the subject property include catastrophic failure of the wind turbines. It this should occur, the environmental impact would be minimal. Metal debris could be removed and any spilled liquids remediated.

An emergency and environmental protection plan will be part of the operation and maintenance manual for the wind turbines.

5.5. Effects of the Environment on the Project

5.5.1. Climate Fluctuations

Climate fluctuations will have an effect on the operation of the wind turbines, but will not cause any detrimental environmental effects.

5.5.2. Extreme Events

Extreme events such has hail storms, ice storms, fire and earthquakes may damage or destroy the wind turbines. In such cases, the metal debris would be removed and any spilled materials remediated.

5.6. Cumulative Effects

5.6.1. Past, Present & Future Projects at the Site

The cumulative effects of past (agriculture), present (non-farming agriculture) and future (wind turbine site) are minimal.

Other projects in the area (i.e., farming) combined with the wind turbines will have a minimal environmental impact.

5.6.2. Interaction Between Projects and Description of Cumulative Effects

The proposed wind turbine project is the only known undertaking in the area. The cumulative effect of the project with other undertakings in the future will be minimal due to the nature of the project, the rural setting and the zoning restrictions of the township.

5.7. Summary of Potential Environmental Impacts and Cumulative Effects

The construction phase of the project will take approximately 4 weeks. During this time, only half of the time spent will involve the effects that are typically associated with construction. The environmental effects that have been predicted through this environmental assessment are not only limited in time, they are also limited spatially. They can be characterized as temporary increases in noise levels, some dust created

from excavation activities and the movement of a few additional trucks, beyond what is already experienced on the roads leading to these sites. Given the short-term frame, the minor nature of the effects and the spatially limited range of these environmental effects, cumulative effects with other developments are not expected.

Table I
Summary of Environmental Impacts

Project Activities	Env. Components Subject to Impacts	Impacts – Short Description	Mitigation Measures	Residual Env. Effects	Level of Residual Impact
Construction Activities					
Tower Construction – vehicle & equipment travel	Soil and terrain	Soil compaction Surface disturbance Soil erosion	Limit vehicles to existing trails Build temporary road using geotextile material Avoid slopes greater than 15% Use low impact trucks	None anticipated	Minimal
Tower Construction – vehicle & equipment travel	Local residents	Creation of noise Creation of dust on access roads	Vehicles will be properly maintained Vehicles driven in proper manner Trail and gravel roads will be watered down Reasonable construction hours	Some impact, but short construction duration	Minimal
Tower Construction – vehicle & equipment travel	Wildlife (birds, burrowing animals and other small animals)	Increases wildlife morality due to vehicle use Disrupts wildlife Relocation of wildlife	Spring/summer surveys conducted prior to construction. Follow-up and monitoring will be done after construction is completed Construction will avoid burrow colonies and den sites Vehicle speed will be less than 30 km/hr.	Some impact, but short construction duration	low
Operation Activities					
Land Use	Terrain & vegetation	Reduction of land for agriculture	Land occupied by equipment will be less than 5 percent of site Agricultural activities are possible near turbines	None anticipated	Minimal
Wildlife disturbance	Birds	Bird collision	Siting of turbines away from migratory bird corridors and in area of low topographic relief, away from potential	Monitoring to de done for one year	Low

			nesting areas with low diversity and natural vegetation Monitoring of bird collisions using carcass surveys Turbines have a tubular structure which will deter birds from landing or perching on them		
Decommissioning					
Turbine Removal	Terrain & vegetation	Reduction of land for agricultural use Soil compaction	Plan to remove all above-surface equipment Use of low-impact trucks Reseeding Turbine foundations left but marked	Under-ground structure left in but marked	Minimal

Summary of Cumulative Effects

Valued Ecosystem Component	**Description of Project Activity**	**Other Activities**	**Assessment of Cumulative Effects**	**Level of Cumulative Effect**
Bird habitat	Project construction	Farming	Farming activity has already affected bird habitat Mitigation measures will be put in place (e.g., project construction will occur outside bird-nesting times and will avoid nesting areas where possible) No cumulative increase in the destruction of bird habitat is anticipated	Low
Bird population	Presence of turbines	Silos Other farm buildings Transmission lines	Collision hazard for birds is expected to increase in proportion to the number of turbines added. Turbines will not be clustered in one location Mitigation measures include siting turbines away from migratory bird corridors Little cumulative increase in bird collisions is anticipated	Low
Noise level	Noise from turbine	Farming operation	Sound produced by turbines will be added to the noise produced by farming activities Sound from turbines dissipates rapidly and turbines are set away from residences, therefore no cumulative increase in ambient sound levels is anticipated	low
Property Value	Presence of Turbines		Studies undertaken in the U.S. conclude that the presence of wind turbines does not harm property values (Sterziner et. al., 2003)	low
Asthetics	Presence of turbines	Silos Other tall structures	Turbine visibility from nearby roads and residences is limited Turbine installation will contribute to a limited cumulative effect on the visual landscape	low

The concerns associated with the operation of the wind turbines are limited to noise, visual/social effects and bird disruption/mortality. Studies presented in this document show that the disruption /mortality associated with bird (particularly birds) is in fact less than what would be expected from a typical house. The presence of the wind turbines

in combination or with any other developments in the future should not result in cumulative effects.

Based on studies it is expected that there will not be adverse social effects associated with the wind turbines.

Finally, the sound emulating from the wind turbine will be consistent with the sound levels in the environment. The nature of sound is such that it does not accumulate should there be other developments.

No cumulative effects are expected since the environmental effects of this wind turbine are minor.

6. FOLLOW-UP MEASURES

Follow-up measures will include the preparation of construction, operation and maintenance, and decommissioning protocols.

7. PUBLIC CONSULTATION

Public consultation comprises the activities carried out by a proponent to provide a two way communication process to involve interested stakeholders in the planning, implementation and monitoring of an undertaking. The purpose of public consultation in the Environmental Screening Process is to allow the proponent to identify and address public concerns and issues and to provide the public with an opportunity to receive information about and make meaningful input into the project review and development. Windrush Energy has developed and is in the process of implementing a consultation program that provides appropriate opportunities and forums for the public to participate in the planning and approvals for the Wind Turbine project.

Public Consultation Activities to Date

Open House

On August 17, 2004 an Open House was held by Windrush Energy. The Open House was held from noon until 2 pm at the site of the proposed wind turbines. Invitations to the Open House were publicized in two local newspapers as well as a notice was placed at the General Store in Hockley Valley. The notice for the Open House can be found in Appendix E.

The Open House was conducted in order to introduce the project to the community and ensure early consultation and feedback. Over 40 members of the public attended the Open House. A good discussion regarding the project took place where the proponent, Windrush Energy, was able to hear the thoughts of the community on the proposed

project. The main concerns identified at this event included the following: noise, wildlife protection, aesthetics, administration of the project and property values. The Table below summarizes the concerns raised from the Open House and how the proponent plans on addressing the concerns.

Kitchen Table Meeting

Following the Open House, a "kitchen table" meeting was held on August 24, 2004. The adjacent property owners and other interested members of the public were invited, by a mailed invitation, to the project site to further discuss any concerns related to the project. Approximately 20 adjacent property owners and interested members of the public attended. The mail-out invitation can be found in Appendix E.

The Kitchen Table meeting was conducted to further discuss with the adjacent property owners any concerns they may have with the proposed project and to ensure early consultation and feedback. The main concerns raised at this meeting surrounded the fear of property values being affected due to the project, noise, aesthetics and the affect of the project on birds. The Table below summarizes the concerns raised from the Kitchen Table meeting and how the proponent plans on addressing the concerns.

Table II
Summary of Concerns Raised from Open House and Kitchen Table Meetings

Public Concern	Response
Concern with Noise Levels	Noise study conducted and conclude that noise generated from the wind turbine will not be audible at 300 metres.
Concern with Turbine Height	Lagerway is 75m and GE is 100m. The heights are required to access greater wind velocities at greater heights.
Concern with aesthetics	The aesthetic value of a wind turbine is matter of personal opinion. Those living in the valley will not be able to see the wind turbines.
Wind Turbines will take away from property values	Studies indicate no loss in property value Also, adjacent land owners are eligible to join an energy co-op and receive reduced electricity rates.
Was the land zoned to incorporate wind turbines?	The current zoning allows for the construction of wind turbines.
Concern with electromagnetic radiation	The electromagnetic radiation generated from the wind turbines and transmission lines are in compliance and well below federal regulations, less than a hair dryer of 0.4mG at the base, zero at 10m.
Do not want wind turbines near property	The wind turbines will be set back from the property line to ensure sufficient buffering from noise and vibration.
Concern with affect of turbines on birds	Numerous studies have shown that wind turbines do not effect bird populations.
Concern with affect of turbines on wildlife	Numerous studies have shown that wind turbines do not effect wild life.

How far away are turbines from property line?	The wind turbines will be situated such that they are a minimum of 200 metres from the property line.
Is anyone opposed to windpower in general?	At the kitchen table meeting, no one was opposed to wind power in general. People usually raise concerns if a wind turbine proposed near them.
Is the wind turbine financially viable?	A cost analysis was performed and the investors in the project believe it is financially viable.
Is the Township liable for maintenance?	Windrush has to post bond for decommissioning i.e. $1 million to take it down, so likely a $1 million dollar bond.
Is this initiative profitable?	The investors in the project believe the wind turbine project will be profitable.
Can smaller turbines be erected rather than the current planned size?	Smaller turbines can be erected at the site, but it would not be economically viable.
What is to stop the expansion of the site to twenty turbines or more?	The size of the site is such that only 3 to 5 turbines are viable. If more were placed on the site, there would be interference.
Why is this a suitable site?	There is a sufficient wind regime; the turbines can be easily connected to the power grid; and access to the site is limited (there is no open line to the North and West)
Will the bridge need upgrading?	No. The bridge is rated for 30 tonnes and the largest piece of equipment weighs 30 tonnes.
Are there any more suitable places to build the wind turbine?	The ideal location for wind turbines in Ontario is along the lake. However, monitoring has shown that this location has sufficient winds to justify a wind turbine.
Does the township have issues with this?	The mayor has come out in support of the project.
What are the administration costs of the cooperative and how is the price guaranteed?	Adjacent neighbours can join the cooperative. It would be administrated through members of the cooperative and Windrush would provide the price guarantee through a legal contract.
What is the contract and consultation schedule?	There will more opportunity to comment on the proposed project when the draft Environmental Assessment report is released. Construction is tentatively planned to begin in the Summer of 2005.
What are the construction logistics?	Construction will take approximately one month. Concrete bases will be poured and the turbines mounted onto the bases. A transmission line will be constructed from the wind turbines to the power grid.
What about costs for single person selling back to the grid? Will it be cost prohibitive?	Hydro One currently does not allow single persons to sell power back to the grid.
Who protects the public interest? How can you ensure credibility?	The Windrush Wind Turbine project is undergoing various municipal, provincial and federal approvals. These processes ensure that studies are completed and reviewed by government agencies. The government agencies protect the public interest and ensure that the project and subsequent studies are credible through the granting of the approval.
Is five the maximum number of turbines?	Yes. Five is the maximum planned for the site.
What are the approvals required from the Township?	A building permit is required from the Township before the project can proceed.
Any upgrade for the roads?	The bridge on Concession Road 3 will need to be upgraded to accommodate some of the construction

	equipment.
What is the cost of the EA?	Environmental Assessments cost a proponent thousands of dollars.
Who would direct the cooperative?	A Board would be formed by the energy cooperative and would direct activities.
Who owns Windrush?	Windrush is a private company with six investors. John Pennie is the President and CEO.
What is the elevation of the plateau?	The elevation of the plateau is 80-120 metres above the valley floor.

Notice of Commencement

A formal Notice of Commencement was published in a local newspaper in September 2004. A Notice of Commencement is published at the beginning of an Environmental Screening to satisfy the Ontario *Environmental Assessment Act* (*EAA*) requirements for Electricity Projects. The notice formally announces the project being subject to an Environmental Screening Process under the Ontario EAA and that this project is commencing a review under this process. The Notice of Commencement, in addition to being published, was mailed to the adjacent neighbours and government agencies. For a list of government agencies involved in the process, please see Appendix E.

Public and Agency Review of Draft Windrush Energy Wind Turbine Environmental Assessment Screening Report

Prior to a formal submission of the Windrush Energy Wind Turbine EA Screening Report, a draft has been circulated to appropriate government agencies and key stakeholders for comment. This consultative period ensures that all comments and concerns from the government agencies and interested parties can be identified and addressed prior to a formal submission under the *EAA*. Written comments on the Draft Environmental Screening Report will be requested in order to ensure that all outstanding concerns are addressed.

Future Public Consultation Activities

Open House

A second Open House is planned for the late Fall of 2004 following the circulation and comment of the Draft EA Screening Report. An invitation for this Open House will be published in local newspapers, posted on the Windrush web site (http://www.windrush-energy.com/), mailed to the adjacent neighbours and persons who attended the first Open House, and sent to appropriate government agencies. This Open House will include a further discussion of any of the concerns that were not addressed through the Draft Screening Report document and associated studies. Subject matter experts may be invited to attend depending on the nature of the comments that emerged from the review of the Draft Screening Report. It is the intention of this Open House to ensure that all relevant concerns related to the environmental assessment are resolved. A tour of the site will also be offered to the participants of the Open House.

Field Trip of Wind Turbine at Toronto's Exhibition Place
A field trip was offered at the kitchen table meeting to adjacent property owners to examine the wind turbine at Toronto's Exhibition Place or to any of the ones located on Lake Huron. The purpose of this field trip is to inspect a wind turbine in motion, hear and feel the noise and vibration generated, and witnesses any effects on wildlife.

Notice of Completion of Screening Report and Public Review
Following the review of the draft Screening Report, a Notice of Completion will be published in the local newspaper and circulated to all people that have expressed an interest in the project. The Screening Report will be made available for public and agency review for a period of 30 calendar days. The report will be available on the Windrush web site (http://www.windrush-energy.com/) and at the local library. The Notice of Completion will identify that if any outstanding environmental concerns remain about the project, it should be raised with the proponent. If these concerns still remain unresolved, the Notice of Completion identifies an appropriate course of action.

The Public Consultation Plan outlined above will provide several opportunities for resolving concerns raised by the Windrush Energy Wind Turbine Project. The proponent is available to hear all comments and concerns and commits to an open and consultative process. Technical reports and other supporting information are not required to be included in the Screening Reports. This information along with copies of all correspondence related to the Environmental Screening Process is available however for public or agency review if requested.

8. FIRST NATION CONSULTATION

In addition to public consultation, First Nations must be consulted if the project is near their community. In this case, the project is not in the vicinity of any First Nation community.

9. CONCLUSION

The project is not likely to cause important environmental effects, taking into account the implementation of appropriate mitigation measures.

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11. SIGNATURE

Environmental Assessment conducted by:

Windrush Energy
Name of Proponent

_____
Date

_____
Signature

Environmental Business Consultants
Name of Consultant

12. Appendices

Appendix A: Site Plan and Photos
Appendix B: Bird and Floral Investigations Study
Appendix C: Noise Study
Appendix D: Magnetic Field Study
Appendix E: Public Consultation Documents

Location map of project

Map showing location of turbines, access roads, substation and transmission lines

Vascular Flora Observed On-site

Breeding Bird Report From Vicinity and Observed On-Site

Breeding Bird Point Count Data