Large Filing Separator Sheet

Case Number : 08-666-EL-BGN

File Date : 4/24/2009

Section : 1 of 7

Number of Pages : 200

Description of Document :
Application

FILE

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April 24, 2009

Ms. Reneé Jenkins
Docketing Division
Power Siting Board
180 E. Broad Street
Columbus, OH 43215

Re: Ohio Power Siting Board - Case No. 08-666-EL-BGN

Dear Ms. Jenkins:

Accompanying this letter for filing are an original and twenty-six copies of an application by Buckeye Wind, LLC, a wholly owned subsidiary of EverPower Wind Holdings, Inc. for a Certificate to Install Numerous Electricity Generating Wind Turbines in Champaign County to be Collected at an Electric Substation in Union Township, Champaign County, Ohio. In accordance with Rule 4906-5-03 of the Ohio Administrative Code, I would like to make the following declarations:

Name of the applicant:

Buckeye Wind, LLC
a subsidiary of EverPower Wind Holdings, Inc.
44 East 30th Street, 10th Floor
New York, New York 10016

Name and location of the proposed facility:

Buckeye Wind project
Goshen, Rush, Salem, Union, Urbana and Wayne Townships,
Champaign County, Ohio

Name of the authorized representative:

M. Howard Petricoff
Vorys Sater Seymour and Pease LLP
52 East Gay Street
Columbus, Ohio 43215
614-464-5414
mhpetricoff@vorys.com

Notarized Statement:

See attached Affidavit of James Spencer
President of Buckeye Wind, LLC

Sincerely,

M. Howard Petricoff

MHP/jab

Enclosure

BEFORE THE OHIO POWER SITING BOARD

In the Matter of the Application of Buckeye Wind, LLC for a Certificate to Install Numerous Electricity Generating Wind Turbines in Champaign County to be Collected at An Electric Substation in Union Township, Champaign County.	)))))))	**Case No. 08-666-EL-BGN**

<u>CHIEF EXECUTIVE OFFICER'S AFFIDAVIT</u>

STATE OF NEW YORK)
) SS:
COUNTY OF NEW YORK)

Now comes James Spencer, President of Buckeye Wind, LLC, a wholly-owned subsidiary of EverPower Wind LLC which is a wholly-owned subsidiary of EverPower Wind Holdings, Inc., having been first duly sworn, declares and states as follows:

1. He is the highest ranking executive officer in charge of the Buckeye Wind project in the Townships of Goshen, Rush, Salem, Union, Urbana and Wayne in Champaign County, Ohio.

2. He has reviewed the Application for a Certificate to Install Numerous Electricity Generating Wind Turbines in Champaign County to be Collected at a single Electric Substation in Union Township, Champaign County.

3. To the best of his knowledge, the information and statements contained in the Application are true and correct.

4. Save for the items for which a waiver has been requested, the Application is complete.

James Spencer
President
Buckeye Wind, LLC, an indirect
subsidiary of EverPower Wind Holdings, Inc.

Sworn to before me and signed in my presence this 23rd day of April 2009.

Notary Public
My Commission Expires 10-01-2011

ROSIE ROMAN
NOTARY PUBLIC STATE OF NEW YORK
NO. 01RO6175017
QUALIFIED IN NEW YORK COUNTY
MY COMMISSISSION EXPIRES OCT 1, 2011

04/22/2009 10622811

APPLICATION

TO THE

OHIO POWER SITING BOARD

FOR A

CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY & PUBLIC NEED

FOR THE

BUCKEYE WIND PROJECT

Townships of Goshen, Rush, Salem, Union, Urbana, and Wayne
Champaign County, Ohio

Case No. 08-666-EL-BGN
April 2009

Applicant: Buckeye Wind, LLC a subsidiary of EverPower Wind Holdings, Inc.
44 East 30th Street, 10th Floor
New York, New York 10016
Contact: Michael Speerschneider, Development Director
646.839.8928

Prepared By: Environmental Design & Research, Landscape Architecture, Planning, Environmental Services, Engineering and Surveying, P.C. (EDR)
217 Montgomery Street, Suite 1000
Syracuse, New York 13202
Contact: Benjamin Brazell, Project Manager
315.471.0688

TABLE OF CONTENTS

TABLES

FIGURES and EXHIBITS

FIGURES

EXHIBITS

COMMONLY USED ACRONYMS and ABBREVIATIONS

AEPS	Alternative Energy Portfolio Standard
AMSL	Above Mean Sea Level
ASTM	American Society for Testing and Materials
BBA	Ohio Breeding Bird Atlas
BBS	North American Breeding Bird Survey
dBA	Decibels, A-weighted
DEM	Digital Elevation Model
DPL	Dayton Power and Light
EDR	Environmental Design & Research, Landscape Architecture, Planning, Environmental Services, Engineering and Surveying, P.C.
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Administration
GIS	Geographic Information System
GPS	Global Positioning System
JCARR	Joint Committee on Agency Rule Review
kV	Kilovolt
kW	Kilowatt
MW	Megawatts
MWh	Megawatt hours
NAAQS	National Ambient Air Quality Standards
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NTIA	National Telecommunications and Information Administration
NWI	National Wetlands Inventory
O&M	Operations and Maintenance
OAC	Ohio Administrative Code
ODNR	Ohio Department of Natural Resources
ODOT	Ohio Department of Transportation
OGRIP	Ohio Geographically Referenced Imagery Program
OPSB	Ohio Power Siting Board
ORAM	Ohio Rapid Assessment Method
SIS	System Impact Study
SPCC	Spill Prevention Control and Countermeasure Plan
SWP3	Stormwater Pollution Prevention Plan
SWPA	Source Water Protection Area
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish & Wildlife Service
USGS	U.S. Geological Survey
VIA	Visual Impact Assessment

4906-13-01 PROJECT SUMMARY AND FACILITY OVERVIEW

(A) PROJECT SUMMARY AND FACILITY OVERVIEW

Buckeye Wind, LLC, a wholly owned subsidiary of EverPower Wind Holdings, Inc., (hereafter referred to as the "Applicant") is proposing to construct a wind-powered electric generation facility located in Champaign County. The energy generated at the wind farm (hereafter referred to as the "Facility") will collect to an electric substation in Union Township, Champaign County (Ohio Power Siting Board [OPSB] docket 08-666-EL-BGN). The proposed Facility consists of 70 wind turbine generators, along with access roads, electrical interconnect, construction staging areas, an operations and maintenance facility, and the substation[1]. The "Project Area" is defined as the Facility including the area 914 feet from the turbines[2].

The materials contained herein and attached hereto constitute the Applicant's submittal for a Certificate of Environmental Compatibility and Public Need, in accordance with Chapter 4906-13 of the Ohio Administrative Code (OAC), Instructions for the Preparation of Certificate Applications for Electric Power Generating Facilities ("Certificate Application" or "Application"). This Certificate Application has been prepared by Environmental Design & Research, *Landscape Architecture*, Planning, Environmental Services, Engineering and Surveying, P.C. (EDR) of Syracuse, New York. EDR has over 10 years experience with siting and permitting wind-powered electric generation facilities.

(1) General Purpose of the Facility

The general purpose of the Facility is to produce wind-powered electricity that will maximize energy production from wind resources in order to deliver clean, renewable, low cost electricity to the Ohio bulk power transmission system. The electricity generated by the Facility will be transferred to the transmission grid operated by PJM Interconnection for sale at wholesale.

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[1] This definition of "Facility" is consistent with the definition of "wind-powered electric generation facility" or "wind-energy facility" or "facility" as defined in proposed rules 4906-17-01(B)(2).

[2] This definition of "Project Area" is derived from the definition of "project area" in proposed rules 4906-17-01(B)(1); "Project area means the total wind-powered electric generation facility, including all associated setbacks." Section 4906-17-08(C)(1)(c)(ii) of the proposed rule requires that "the wind turbine shall be at least seven hundred fifty feet in horizontal distance from the tip of the turbine's nearest blade at ninety degrees to the exterior of the nearest habitable residential structure, if any, located on adjacent property at the time of certificate application." The maximum rotor diameter of turbine under consideration for the Facility is 328 feet (100 meters) (see Section 4906-13-02(A)(1)(a)). If the turbine blade were at ninety degrees, the tip would extend from the base of the tower one-half the length of the rotor diameter, or 164 feet, which added to 750 feet, yields a total setback of 914 feet.

(2) Description of the Facility

The proposed Facility is located within approximately 9,000 acres of leased private land in the townships of Goshen, Rush, Salem, Union, Urbana, and Wayne. The proposed Facility consists of 70 wind turbine generators and associated infrastructure (i.e., access roads, electrical interconnect, construction staging areas, an operations and maintenance facility, and the substation). Each turbine will have a nameplate capacity rating of 1.8 to 2.5 MW, depending on the final turbine model selected. This will result in a total generating capacity of 126 to 175 MW. The Facility is expected to operate at an average annual capacity factor greater than 30%, and therefore the 70 turbines will collectively generate approximately 331,000 to 460,000 megawatt hours (MWh) of electricity each year. Figure 1 depicts the proposed Facility, and also shows 50-foot contours, land cover, roads, and water features. A detailed description of the Facility, including each Facility component, can be found in Section 4906-13-02(A) of this Application.

(3) Description of Site Selection Process

The selection of possible sites for development of wind power facilities is constrained in that projects must be located in areas with adequate wind resource; which are proximate to electric transmission lines; and which are situated in locations which can accommodate setback, land use, and environmental restrictions. Once a project site has been selected (macro-siting), there is some ability to alter turbine and other component locations on the properties that are participating in the project (micro-siting), within the confines of the private agreements that the Applicant has obtained. The micro-siting of project components within a given project site is governed by site-specific factors, including land use constraints, noise constraints, wind resource constraints, wetland constraints, agricultural constraints, and landowner considerations. As is typical in this industry, additional micro-siting will occur as the final design is completed. Such micro-siting will be in accordance with all required setbacks and/or waivers associated with issuance of the Certificate.

Given the unique nature and constraints associated with the siting of wind-powered electric generation facilities, the Applicant has requested a waiver of the requirement for a fully developed site alternative analysis. This waiver request is included in Exhibit Y. Although a waiver request has been submitted, the Applicant has provided general information in this Certificate Application regarding the site selection process for the Facility, along with associated siting constraints and requirements. The primary factors[3] used in selection of the Facility and Project Area are described briefly below:

- Adequate wind resource – the Applicant determined through initial screening and on-site measurements that the Project Area has an adequate wind resource.
- Adequate access to the bulk power transmission system – from the standpoints of proximity and ability of the system to accommodate the interconnection, and to accept and transmit the power from the Facility at a reasonable cost, the Applicant determined that the existing transmission infrastructure was adequately accessible.
- Willing land lease participants and host communities – the Applicant has obtained private lease agreements, and the Applicant has made significant efforts to engage with local and state leaders and the local community to educate and share information.
- Site accessibility – the Project Area is served by an existing network of public roads.
- Appropriate geotechnical conditions - significant geotechnical constraints for the planned construction of the Facility are not anticipated.
- Limited population/residential development – the Project Area and the surrounding communities have a low population density as compared to statewide estimates.
- Compatible land use – the Project Area is predominately rural agricultural, which is compatible with the proposed Facility.
- Limited sensitive ecological resources – the proposed Facility is not expected to result in adverse impact to ecological resources.

Additional information about the site selection process can be found in Section 4906-13-03 of this Application.

(4) Environmental and Socioeconomic Considerations

A socioeconomic analysis was prepared to evaluate the area within a five-mile radius of the proposed Facility. The survey analyzed the following socioeconomic considerations: demographics, existing tax base and revenues, municipal budgets, land use, economic

[3] The draft rules 4906-17-02(A)(3) request description of the primary factors considered for the project area selection process rather than a description of the major alternatives that is requested in 4906-13-01(A)(3) of the current rules.

impact of the Facility, benefits to local communities, and potential regional impacts. Ecological studies of the Project Area include wetland and surface water delineations, evaluation of habitat for threatened and endangered species, and various bird and bat surveys. Each of these reports is discussed in detail in Section 4906-13-07 of this Application. A brief summary of the major environmental and socioeconomic considerations is provided below.

(a) *Land Use Impacts*

The Facility is located in Champaign County, in the townships of Goshen, Rush, Salem, Union, Urbana, and Wayne. The land is made up of flat and rolling terrain consisting of croplands, farmsteads, meadows, and forests. Agricultural uses are the predominant land use as measured by percent area of each township and county within five miles of the Facility. Residential development within and around the Facility consists almost entirely of single-family homesteads along rural roads. Construction of the proposed Facility will involve the leasing of private land from nearly 60 landowners, collectively comprising approximately 9,000 acres. This land is overwhelmingly zoned as agricultural, and is currently being used primarily for agricultural purposes.

The Facility will be compatible with the agricultural land uses that dominate the Project Area, as well as with the established long-range plans for continuation of such land uses in the surrounding local and regional communities. Construction impacts will be temporary in nature, and confined to the properties of participating landowners. Only very minor changes in land use within the Project Area are anticipated as a result of Facility operation. The presence of the turbines bases, substation, and other ancillary structures will result in the cumulative conversion of approximately 72 acres of land from its current use to built facilities (0.8% of the 9,000 acres of leased land). During Facility operation, additional impacts over the years on land use should be infrequent and minimal. Aside from occasional maintenance and repair activities, Facility operation should not interfere with on-going land use (i.e., farming activities).

(b) *Economic Impact*

The proposed Facility will have a positive impact on the local economy. Construction will employ a total work force of approximately 131-182 employees. Although Project construction will require some workers with specialized skills, the Applicant will employ local labor to the extent practicable. Construction employment will likely be available to local equipment operators, truck drivers, laborers, and electricians. Approximately 12 full-time jobs will be created once the Facility is fully operational. In addition to the jobs created during construction and the wages paid to the work force, the Facility will have a direct economic benefit from the first round of buying/selling, which includes the purchase of goods from local sources (such as fuel), the spending of income earned by workers, annual labor revenues, and the income effect of taxes. These direct effects will result in additional, subsequent rounds of buying and selling in other sectors.

The construction and operation of the Facility is anticipated to produce numerous tax benefits to the Townships of Goshen, Rush, Salem, Union, Urbana, and Wayne in Champaign County; as well as the Mechanicsburg Exempted Village School District, the Triad Local School District, the Urbana City School District, and the West-Liberty Salem Local School District. While the tax treatment of wind facilities in Ohio is unclear, the Applicant assumes that the tax payments generated from the Facility will be proportional to and competitive with those from similar facilities in neighboring states. As used in this document, "Alternative Tax" is meant to approximate the expected tax for this Project, and is not necessarily a direct reflection of current Ohio tax code. Although the exact terms of the Alternative Tax payment are not yet known, it is projected that total annual payments will range from a low value of $6,000/megawatt (MW) to a high value of $8,000/MW. Alternative tax income from the proposed Facility will represent significant increases to local municipal budgets.

Additionally, first year annual lease payments will be provided to local landowners participating in the project. Leases to landowners will be based on a percentage of gross revenues, and are initially expected to total approximately $1.5-2 million per year. These payments will be distributed among all property owners where turbines are located, with exact lease payments to vary depending on annual production and power purchase agreements. Local lease payments are a direct financial benefit to all participating landowners and will enhance the ability of those in the agricultural industry to continue farming.

(c) *Ecological Impact*

A survey of areas within 0.25 miles of the Facility boundary was performed to characterize ecological communities, delineate wetlands and surface waters, and to assess habitat for threatened and endangered species. Six plant community types were identified and mapped within 0.25 mile of the Facility boundary: old field, scrub-shrub, young woods, upland ridge, upland woods, and riparian woods. Facility construction is anticipated to result in a total disturbance of approximately 6.7 acres of ecological communities. These impacts will be comprised of 6.4 acres of temporary impacts and 0.3 acres of permanent impacts. Through careful Facility design, all temporary and permanent impacts to identified wetlands will be avoided during Facility construction. For all identified stream crossings, in-water work will be avoided through the use of special crossing techniques. No stream impacts are anticipated that would require Section 404 or 401 permits under the Clean Water Act.

Additional on-site ecological investigations include visual, radar, and acoustic monitoring studies of bird and bat migration conducted during the fall of 2007, along with acoustic bat monitoring, diurnal raptor and sandhill crane surveys, and breeding bird surveys conducted during the spring/summer/fall of 2008. Details of these surveys are provided in Section 4906-13-07 of this Application.

Construction-related impacts to wildlife are anticipated to be minimal, but could include incidental injury and mortality to slow moving animals due to construction activity and vehicular movement, construction-related silt and sedimentation impacts on aquatic organisms, habitat disturbance/loss associated with clearing and earth-moving activities, and displacement of wildlife due to increased noise and human activities. Operational impacts to wildlife are expected to be limited to possible displacement of wildlife due to the presence of the wind turbines, and some level of avian and bat mortality as a result of collisions with the wind turbines. Each of these potential impacts is discussed in detail in Section 4906-13-07(B) of this Application, along with mitigation measures to minimize such impacts.

The Project Area is within the range of three federally-listed species: Indiana bat (endangered), eastern massasauga (candidate), and rayed bean mussel (candidate). In addition, the Ohio Division of Natural Areas and Preserves Natural Heritage Database contains records of three state-listed species in the vicinity of the proposed Facility: lake chubsucker and tongue-tied minnow (threatened), and flat-stemmed pondweed (potentially threatened). No impacts to any of these species or their habitats are anticipated. More information about rare species can be found in Section 4906-13-07 of this Application.

(d) *Cultural Impacts*

A cultural resources literature review and impact assessment was prepared for the Facility. The purpose of the literature review was to identify known cultural resources that may be historically significant, so that impacts to these resources can be minimized. The cultural resources impact assessment evaluates anticipated impacts to both archaeological and historical resources in the vicinity of the Project Area.

The literature review identified 33 cultural resources listed in the National Register of Historic Places (NRHP) and one NRHP determination of eligibility within five miles of the Project. However, none of these sites occur within one mile of the Facility, so potential impacts to historical landmarks will be limited to indirect visual effects. Of the 34 NHRP landmarks within five miles of the Facility, 20 are located in the village of Mechanicsburg, nine are in the city of Urbana, and the remaining five are located outside of incorporated communities. The proposed Facility is not expected to impact the preservation and continued meaningfulness of any historic landmarks.

Based on the siting of the Facility in upland areas and design criteria that minimized ground-disturbing activities to the extent possible, construction and operation of the proposed Facility is expected to have a low risk of impacting archaeological resources.

(e) *Environmental Impacts*

Wind turbines generate electricity without releasing pollutants into the atmosphere, and in fact have a positive impact on air quality. The proposed Facility will produce approximately 331,000 to 460,000 MWh of emission-free electricity annually (assuming a nameplate capacity of 126 to 175 MW, operating at 30% capacity). Power delivered to the grid from this Facility will directly offset the generation of energy at existing conventional power plants.

Construction activities will be dispersed over a large area, resulting in a relatively low level of soil disturbance. Soil disturbance from Facility construction will be a small fraction of the acreage of soil routinely exposed through plowing and other agricultural activities within the area. Additionally, impact minimization and avoidance measures described in 4906-06(C)(2)(c) will be utilized to further reduce potential impacts to receiving water bodies. Facility operation will not involve the discharge of water or waste into streams or water bodies, nor will Facility operation require the use of water for cooling or any other activities. Furthermore, the Facility will add only small areas of impervious surface, which will be dispersed throughout the Project Area, and will have a negligible effect on surface water runoff and groundwater recharge. Therefore, measurable impacts on the quality of surrounding water resources are not anticipated.

Facility construction will generate some solid waste, primarily packaging materials, construction scrap, and general refuse. This material will be collected from turbine sites and other Facility work areas, and disposed of in dumpsters located at the construction staging areas. A private contractor will empty the dumpsters on an as-needed basis, and dispose of the refuse at a licensed solid waste disposal facility. Operation of the Facility will not result in significant generation of debris or solid waste. The O&M building will generate solid wastes comparable to a typical small business office, and will likely utilize local solid waste disposal services.

(5) Project Schedule

Acquisition of land and land rights began in 2006 and continued through early 2009. A public information meeting was held on June 28, 2008 at Triad High School in North Lewisburg to facilitate public interaction with the Applicant and expert consultants, and included information on visual/aesthetics, ecological studies, and wind turbine technology. Pre-Application meetings with OPSB staff were conducted on November 20, 2008 and February 23, 2009. This Certificate Application was officially submitted in April 2009, and it is anticipated that the Certificate will be issued by the beginning of 2010. Final designs will be prepared in late 2009 to early 2010. Construction is anticipated to begin in mid 2010 and run through mid 2011, at which point the facility will be placed in service. Additional information about the Project schedule can be found in Section 4906-13-02(B)(1) of this Application.

(B) GENERAL

Information filed by the Applicant in response to the requirements of this section are intended to provide an overview of the proposed Facility, and are not intended as responses to any other sections of the Application requirements.

(C) ELECTRONIC COPY OF DATA

The Applicant prepared the required hard copy maps using digital, geographically referenced data. An electronic copy of all such data has been provided to the board staff concurrently with the filing of this Application (excluding data obtained under a licensing agreement which prohibits distribution).

(D) EXPLANATION OF WHY CERTAIN REQUIREMENTS ARE NOT APPLICABLE

Given the unique nature of the Facility (i.e., wind generation), various requirements of Chapter 4906-13 of the OAC are not applicable to the Facility. For example, certain requirements of Chapter 4906-13 addressing fuel quantity and quality, pollutant emissions and water use (4906-13-02(A)(1)) are not applicable because wind turbines generate electricity without burning fuels, generate clean, emission-free electricity without releasing airborne pollutants and generate electricity without the use of water. Accordingly, explanations as to why certain requirements of Chapter 4906-13 of the OAC are not applicable to the Facility have been provided in the corresponding sections of the Application. Also, the Applicant is seeking waivers from certain requirements in Chapter 4906-13 for various reasons. The Applicant's Motion for Waiver, attached as Exhibit Y to this Application, lists the sought waivers and the underlying rationale for each waiver request.

4906-13-02 PROJECT DESCRIPTION AND SCHEDULE

(A) DETAILED FACILITY DESCRIPTION

The Applicant is proposing to construct a wind-powered electric generation facility located in Champaign County. The energy generated at the Facility will collect to an electric substation in Union Township, Champaign County. The Facility presented in this Certificate Application consists of 70 wind turbine generators, each with a nameplate capacity rating of 1.8 to 2.5 MW, depending on the final turbine model selected. This would result in a total generating capacity of 126 to 175 MW. The Facility is expected to operate at an average annual capacity factor greater than 30%, and therefore the 70 turbines would collectively generate approximately 331,000 to 460,000 MWh of electricity each year.

(1) Description Details

The descriptions provided below apply to the proposed Project Area, as defined in Section 4906-17-01(B)(1) of the OAC draft rules, Instructions for the Preparation of Certificate Applications for Wind-powered Electric Generation Facilities. The Applicant has requested a waiver of the requirement for a fully developed site alternative analysis (Exhibit Y). Therefore, this section only contains information for the Facility. .

(a) *Type of Turbine*

Facility construction is not scheduled to begin until 2010, and due to market factors such as availability and cost, a specific turbine model has not been selected for the Facility. However, the Nordex (model N100 or N90) and Repower MM92 (or similar) have been determined to be suitable turbines for this site. Any turbine ultimately selected will be similar in design, appearance, and operating characteristics to these turbines. Each wind turbine consists of three major components: the tower, the nacelle, and the rotor. The height of the tower, or "hub height" (height from foundation to top of tower) will be up to 328 feet (100 meters). The nacelle sits atop the tower, and the rotor hub is mounted to the front of the nacelle. The rotor diameter will be up to 328 feet (100 meters). The total turbine height (i.e., height at the highest blade tip position) will be up to 492 feet (150 meters). Additional turbine detail is provided below in Section 4906-13-02(A)(2) of this Application. Heat rate is not applicable to wind turbine generators given the generation source (i.e., wind energy).

The Facility as presented herein is expected to generate approximately 331,000 to 460,000 MWh of electric power each year, accounting for capacity factors and anticipated operating times. Preliminary production models indicate that the turbines will have a capacity factor greater than 30%, and that the Facility will produce electricity for an approximate average of 8,000 hours each year. It is expected that the Applicant will remain as the Facility owner and the Facility developer for both construction and operation of the facility.

(b) *Land Area Requirements*

The Facility is located in Champaign County, within the townships of Goshen, Rush, Salem, Union, Urbana, and Wayne. The Facility is located within approximately 9,000 acres of leased private land. However, the actual Facility -related impact consumes a much smaller area. Table 02-1 presents the impact assumptions for each Facility component, based on EDR's years of experience with construction and operation of numerous wind power facilities. The predicted construction impact area and permanent Project footprint were calculated using these assumptions, and are outlined below the table.

Table 02-1. Impact Assumptions and Calculations

Facility Components	Typical Area of Vegetation Clearing	Area of Total Soil Disturbance (temporary and permanent)	Area of Permanent Disturbance (fill/structures)
Wind Turbines and Workspaces	200' radius per turbine	200' radius per turbine	0.2 acre (pedestal plus crane pad)
Access Roads	55' wide per linear foot of road	40' wide per linear foot of road	20' wide per linear foot of road
Buried Electrical Interconnects (except where located parallel to access roads)	15' wide per linear foot of cable	15' wide per linear foot of cable	none
Overhead Electrical Interconnects	clearing restricted to existing right-of-ways	< 1 acre per pole	< 0.1 acre per pole
O&M Building and associated Storage Yard (4,000 - 6,000 sf)	2.5 acres	2.5 acres	2 acres
Staging Areas	4 acres	4 acres	none

Facility Components	Typical Area of Vegetation Clearing	Area of Total Soil Disturbance (temporary and permanent)	Area of Permanent Disturbance (fill/structures)
Substation	3 acres	3 acres	1.75 acres

A total of 373 acres of soil will be disturbed during construction. Much of this disturbance will be temporary, and subject to restoration activities at the end of Facility construction. Following restoration, the permanent operating footprint of the Facility will be approximately 72 acres of built facilities, or 0.8% of the total leased lands.[4]

(c) *Fuel Quantity and Quality*

Wind turbines generate electricity without burning fuels. Therefore, this section is not applicable to the Facility.

(d) *Pollutant Emissions*

Wind turbines generate clean, emission-free electricity without releasing airborne pollutants. Therefore, this section is not applicable to the Facility.

(e) *Water Requirements*

Wind turbines generate electricity without the use of water. Therefore, no water is treated or discharged, and this section is not applicable to the Facility.

(2) Description of Major Equipment

As previously indicated, the Facility consists of 70 wind turbines, along with approximately 23.3 miles of access roads, 65.4 miles of 34.5 kV electrical interconnect, a substation, three construction staging areas, and an Operations and Maintenance (O&M) facility. Of the 65.4 total miles of electrical interconnect, approximately 39.8 miles will be overhead lines in public road right-of-ways[5] (mostly collocated with existing electric distribution facilities), with the remaining 25.6 miles buried underground on private land. Approximately 21.4 miles (84%) of the buried electrical interconnect will be installed parallel to Facility access roads, and will

[4] Information regarding the construction impact area and the basis for how the estimate was calculated, and the size of the permanent project area in acres are not required per rule 4906-13-02(A)(1)(b). However, this information is provided in accordance with proposed rule 4906-17-03(A)(1)(b).

[5] The Applicant is in negotiations with Dayton Power & Light (DPL) to enter into an agreement whereby DPL would operate and maintain the overhead portion of the collection system (see letter from DPL in Exhibit Z).

require no additional clearing or soil impacts beyond those required for access road construction, as shown above in Table 02-1.

Wind Turbines

The final manufacturer of the wind turbine has not been selected; however, included in Exhibit A are details of the Nordex N100, Nordex N90, and Repower MM92, which are representative of the type of turbine anticipated to be used for the Facility. Because Facility construction is not scheduled to begin until 2010, market factors such as availability and cost could dictate use of an alternate turbine. However, any turbine ultimately selected will be essentially equivalent to those referenced above in terms of its dimensions, appearance, and electrical output. Each wind turbine results in an operational footprint of approximately 0.2 acre (see Table 02-1 above), and consists of three major components: the tower, the nacelle, and the rotor. The height of the tower, or "hub height" (height from the tower's base, excluding the subsurface foundation, to top of tower) will be a maximum of 328 feet (100 meters). The nacelle sits atop the tower, and the rotor hub is mounted to the front of the nacelle. The rotor diameter will be a maximum of 328 feet (100 meters). The total turbine height (i.e., the height at the highest blade tip position) will be a maximum of 492 feet (150 meters). Descriptions of each of the turbine components are provided below.

Tower: The tubular towers used for megawatt-scale turbines are conical steel structures manufactured in multiple sections. Each tower will have an access door and internal lighting, along with an internal ladder and mechanical lift to access the nacelle. The towers will be painted off-white in accordance with Federal Aviation Administration (FAA) regulations designed to make the structures more visible to aircraft when viewing from above, as light colors contrast sharply against the dark-colored ground. This also has the benefit of reducing visibility from ground vantage points, which are generally viewed against the background of the sky.

Nacelle: The main mechanical components of the *wind turbine* are housed in the nacelle. These components include the drive train, gearbox, and generator. The nacelle is housed in a steel reinforced fiberglass shell that protects internal machinery from the environment and dampens noise emissions. The housing is designed to allow for adequate ventilation to cool internal machinery. The nacelle is equipped with an external anemometer and a wind vane that signals wind speed and direction information to an electronic controller. Attached to the top of some of the nacelles, per specifications of the FAA, will be a single, medium intensity aviation warning light. These lights are anticipated to be flashing red strobes (L-864) that operate only at night. The nacelle is mounted on a bearing that allows it to rotate ("yaw") into the wind to maximize wind capture and energy production.

Rotor: A rotor assembly is mounted to the nacelle to operate upwind of the tower. Each rotor consists of three composite blades that will be up to 164 feet (50 meters) in length, with a total rotor diameter of up to 328 feet or 100 meters. The rotor attaches to the drive train at the front of the nacelle. Hydraulic motors within the rotor hub feather each blade according to wind conditions, which enables the turbine to operate efficiently at varying wind speeds. The rotor can spin at varying speeds to operate more efficiently. Depending on the turbine model selected, the wind turbines will begin generating energy at wind speeds as low as 3-3.5 meters per second (m/s) or 7 miles per hour (mph), and cut out when wind speeds reach 20-25 m/s (54 mph). The maximum rotor speed is approximately 15 revolutions per minute (rpm).

Electrical System

A Generation Interconnection Feasibility Study was prepared by PJM Interconnection (2007) to determine the means of connecting the Project to the PJM network (see Exhibit B). This study was limited to short-circuit analyses and load flow analyses of probably contingencies, and includes preliminary estimates of type, scope, cost, and lead time for construction of facilities. PJM (2009) also completed a Generation Interconnection System Impact Study, to determine a plan, with approximate cost and construction time estimates, to connect the generation interconnection to the PJM network (see Exhibit C). The proposed Facility will have an electrical system that consists of two parts: (1) a system of 34.5 kV shielded and insulated cables that will collect power from each wind turbine, and (2) a substation that will transfer the power from the 34.5 kV collector cables to existing transmission lines and the regional power grid. Each component is described below.

Collector System: The wind turbine transformer will raise the voltage of electricity produced by the turbine generator up to the 34.5 kV voltage level of the collection system. From the transformer, cables will join the collector circuit and turbine communication cables to form the electrical interconnect system.

The location of the proposed collection system is depicted on Figure 1. This 34.5 kV collection system will connect the individual turbines to the substation. The total length of 34.5 kV collection lines carrying electricity to the substation will be approximately 65.4 miles. It is currently anticipated that approximately 39.8 miles of the 34.5 kV interconnects will be above ground (on rebuilt distribution poles in public road right-of-ways[6]) and approximately 25.6 miles will be buried underground. Of the 26.7 miles of buried interconnect, approximately 21.4 miles (84%) will be installed co-linear with Project access roads, and 4.1 miles (16%) will be installed in separate locations.

Substation: The substation will be located near the intersection of Pisgah Road and Route 56 in the Town of Union, adjacent to the Givens to Mechanicsburg section of the Urbana – Mechanicsburg – Darby 138 kV transmission line. The substation will step up voltage from 34.5 kV to 138 kV to allow connection with the existing transmission line. The substation will include dead-end structures, circuit breakers, air break switches, metering units, relaying, communication equipment, and a control house. The substation will be approximately 350 by 200 feet in size, enclosed by a chain link fence, and accessed from Pisgah Road by a new gravel-surfaced road approximately 0.1 mile in length. The enclosure surrounding the substation will be divided by additional fencing into two separate areas: (1) the DPL section, containing the 138 kV three ring bus and a control house, and (2) the Project substation, consisting of a step up transformer, switches and breakers, and a control house.

<u>Access Roads</u>
The Facility will require the construction of new or improved roads to provide access to the proposed turbine and substation sites. The proposed location of Facility access roads is shown on Figure 1. The total length of access road required to service all proposed wind turbine locations is approximately 23.3 miles, some of which will be upgrades to existing farm lanes. The roads will be gravel-surfaced and typically 16 feet in finished width; however, to assure a worst-case analysis and to account for side slope grading, a maximum finished width of 20 feet is assumed for purposes of impact calculation.

<u>Staging Areas</u>
It is currently anticipated that Facility construction will require the development of three construction staging areas to be located on leased private lands along Ludlow, Perry, and Pisgah Roads (see Figure 1). These sites will accommodate material storage, parking for construction workers, and construction trailers (at the Ludlow Road site only). The staging areas are anticipated to be approximately 3.75 acres each, with an additional 0.7 acre at the Ludlow Road site for trailers, for a cumulative total of approximately 12 acres. Construction

[6] The Applicant is in negotiations with DPL to enter into an agreement whereby DPL would operate and maintain the overhead portion of the collection system (see letter from DPL in Exhibit Z).

trailers at the Ludlow Road site will be enclosed by fencing. No lighting of the staging areas is currently proposed, but could be added if vandalism or similar problems are experienced.

Operations and Maintenance Building

An O&M building and associated storage yard will be required to house operations personnel, equipment, and materials, and to provide operations staff parking. It is anticipated that an existing structure in the vicinity of the Facility will be purchased or leased and refurbished for O&M activities. If a new building is needed, it is not expected to exceed 6,000 square feet or permanently disturb an area of greater than 2 acres, and will be designed to resemble an agricultural building similar in style to those found throughout the area (see Exhibit D, which provides photographic examples of O&M buildings and a typical schematic).

(3) Need for New Transmission Lines

No new transmission lines will be associated with the Project. A new substation (OPSB docket 08-666-EL-BGN) will be built adjacent to the existing Urbana-Mechanicsburg-Darby 138 kV transmission line, and will transmit the power carried by the 34.5 kV collection lines servicing the Facility.

(B) DETAILED PROJECT SCHEDULE

(1) Schedule

Acquisition of land and land rights began in 2006 and continued through early 2009. Wildlife surveys/studies[7] were conducted in the fall of 2007, and throughout 2008. Preparation of the Certificate Application began in 2008 and continued into early 2009, with data and analyses added as various studies were completed. A public information meeting was held on June 28, 2008 at Triad High School in North Lewisburg to facilitate public interaction with the Applicant and expert consultants, and included information on visual/aesthetics, ecological studies, and wind turbine technology. Pre-Application meetings with OPSB staff were conducted on November 20, 2008 and February 23, 2009. This Certificate Application was officially submitted in April 2009. It is anticipated that the Certificate will be issued by the beginning of 2010. The final designs will be prepared in late 2009 to early 2010. Construction is anticipated to begin in mid 2010 and run through mid 2011, at which point the facility will be placed in service.

[7] While not required in Section 4906-13-02(B)(1), the draft rules Section 4906-17-03(B)(1) request information on wildlife surveys/studies. Therefore, the associated schedule is included herein.

The project schedule is presented below in bar chart format.

(2) Impact of Critical Delays

The Facility is the first application submitted to the OPSB for a large-scale commercial wind-powered electric generation facility. The Facility has been in the planning and development phase for nearly three years, including the voluntary participation of nearly 60 private landowners to date. Electricity generated by the Facility will directly displace electricity generated at fossil-fueled plants, which have higher operating costs due to fuels (Jacobson & High, 2008), and thereby displace less efficient and dirtier sources of power. Table 02-2 summarizes anticipated emission displacements for the 70-turbine Facility, showing the range of air quality benefits for each turbine model/capacity under consideration, based on emissions rates for electricity used in Ohio.

Table 02-2. Estimated Annual Emission Displacements from the Facility.

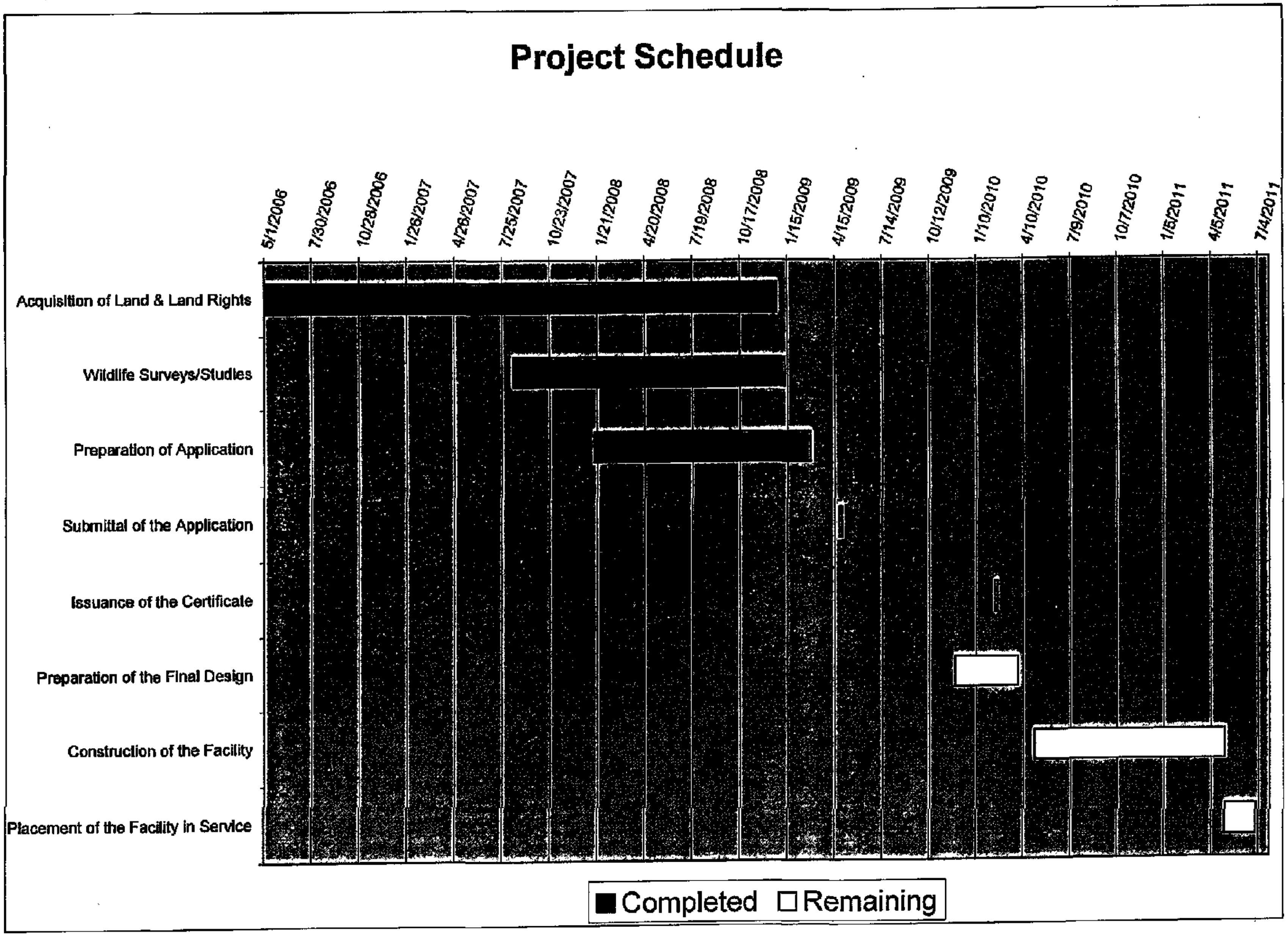
Pollutant	Estimated Annual Displacement in Tons		
	1.8 MW Turbines (331,128 MWh)	**2.0 MW Turbines (367,920 MWh)**	**2.5 MW Turbines (459,900 MWh)**
CO_2 (carbon dioxide)	299,174	332,416	415,520
NO_x (nitrogen oxides)	1,142	1,269	1,587
SO_2 (sulfur dioxide)	2,633	2,925	3,656
Mercury Compounds	3,328	3,693	4,623
Lead Compounds	4,699	5,221	6,526

Sources: Abraxas Energy, 2009; Leonardo Academy, 2004.

Critical delays may have material, adverse effects on Facility financing, including the Applicant's ability to procure turbines and other Facility components. Such delays may push the eventual in-service date back. Considerable cost for delays would be incurred if the delays prevented the Project from meeting deadlines for federal incentive programs. Delays could result in lost opportunities to monetize the Investment Tax Credit or other associated credits and grants that are available for a limited time under the American Recovery and Reinvestment Act of 2009. This could ultimately interfere with the Applicant's ability to build the Facility, and provide emissions-free, renewable energy to the people of Ohio in accordance with Senate Bill 221, which mandates that at least 12.5% of the electricity sold in Ohio must be generated from renewable resources by 2024.

As stated above, the Applicant has been engaged in Facility -related activities since 2006 using the existing Ohio regulatory structure as a guide. On October 28, 2008, the OPSB adopted proposed rules 4906-17 to implement certification requirements for wind-powered electric generation facilities. Several applications for re-hearing were filed during November 2008; these applications were granted on December 17, 2008, to allow the Board additional time to consider the issues, and the entry on rehearing was filed on January 26, 2009. The proposed rules were filed with the JCARR for review on February 19, 2009. Rules are not codified in the Ohio Administrative Code until they have been approved by JCARR. Therefore, because the rule-making process is still underway for proposed rule 4906-17, uncertainty exists with regard to certification requirements for wind-powered electric generation facilities. The new rules include requirements not contemplated by the Applicant upon commencement of development activities some three years ago. The uncertainty associated with evolving regulatory requirements could result in delays to the issuance of the Certificate for the Facility.

As required by existing law, this Certificate Application has been submitted under Chapter 4906-13 of the Ohio Administrative Code. In addition to conforming to the requirements of 4906-13, the information and analyses contained herein and attached hereto also conform, to the extent practicable, to the requirements of proposed rule 4906-17, as currently written as of the date of this submission (April 2009).


Project Schedule
5/1/2006
7/30/2006
10/28/2006
1/26/2007
4/26/2007
7/25/2007
10/23/2007
1/21/2008
4/20/2008
7/19/2008
10/17/2008
1/15/2009
4/15/2009
7/14/2009
10/12/2009
1/10/2010
4/10/2010
7/9/2010
10/7/2010
1/5/2011
4/5/2011
7/4/2011
Acquisition of Land & Land Rights
Wildlife Surveys/Studies
Preparation of Application
Submittal of the Application
Issuance of the Certificate
Preparation of the Final Design
Construction of the Facility
Placement of the Facility in Service
Completed
Remaining

4906-13-03 SITE ALTERNATIVES ANALYSES

Given the unique nature and constraints associated with the siting of wind-powered electric generation facilities, the Applicant has requested a waiver of the requirement for a fully developed site alternative analysis. This waiver request is included in Exhibit Y. Although a waiver request has been submitted, the Applicant has provided general information in this section regarding the site selection process for the Facility, along with associated siting constraints and requirements.

(A) SITE SELECTION ANALYSIS

The selection of appropriate sites for a wind-powered electric generation facility is constrained by numerous factors that are essential for the Facility to operate in a technically and economically viable manner. This section describes the site selection process, along with associated siting constraints and requirements in relation to Project objectives.

(1) Project Purpose and Objectives

A principal impetus for clean renewable energy in Ohio comes from the Alternative Energy Portfolio Standard (AEPS), signed into law by Governor Strickland on May 1, 2008 (substitute Senate Bill 221). The law mandates that by 2025, at least 25% of all electricity sold in the state come from alternative energy resources. At least half of that standard, or 12.5% of electricity sold, must be generated by renewable resources, and at least half of this renewable energy must be generated in-state. In addition to renewables, the additional 12.5% of the overall 25% standard can also be met through alternative energy resources like third-generation nuclear power plants, fuel cells, energy efficiency programs, and clean coal technology that can control or prevent carbon dioxide emissions.

Further, Federal policy has recognized the need for increased supply of energy to the U.S., and for new renewable energy resources. The Facility fulfills a need for the production and transmission of renewable energy, which would serve the public interest. The Facility is consistent with Executive Order 13212 (dated May 18, 2001), which states:

> "The increased production and transmission of energy in a safe and environmentally sound manner is essential to the well being of the American people. In general, it is the policy of this Administration that executive departments and agencies shall take appropriate actions, to the extent consistent with applicable law, to expedite projects that will increase the production, transmission, or conservation of energy."

In addition, it is anticipated that the Obama-Biden administration will enhance the previous administration's policy. According to www.whitehouse.gov:

> "The energy challenges our country faces are severe and have gone unaddressed for far too long. Our addiction to foreign oil doesn't just undermine our national security and wreak havoc on our environment – it cripples our economy and strains the budgets of working families all across America. President Obama and Vice President Biden have a comprehensive plan to invest in alternative and renewable energy, end our addiction to foreign oil, address the global climate crisis and create millions of new jobs."

The Obama-Biden comprehensive New Energy for America plan has a number of objectives, which include creating five million new jobs over the next ten years, and ensuring that 10% of our electricity comes from renewable sources by 2012, and 25% by 2025 (http://www.whitehouse.gov/agenda/energy_and_environment).

The objectives of the Applicant in developing the Facility are an important factor in selection of a suitable site for construction and operation of a wind-powered electric generation facility. The objectives of the Applicant are 1) to develop a for-profit wind-powered electric generation facility that will maximize energy production from wind resources in order to deliver clean, renewable, low cost electricity to the Ohio bulk power transmission system ("the Grid"); 2) to provide economic benefits to the local economy; and 3) to provide a fair investment return. Locations that will not allow the Applicant to achieve all three of these objectives are not considered practicable sites for a project of this nature.

(a) *Description and Rationale for Selecting Study Area*

In 2006, the Applicant began a search for appropriate sites for a wind-powered electric generation facility in Ohio. Quality of wind resource, proximity to the bulk power transmission system, and availability of land are the preliminary screening criteria evaluated in the site selection process for any wind power project. The Applicant's initial evaluation was based on publicly available data, such as the Wind Resource of Ohio map (AWS, 2007), along with site visits and thermal loading analysis for nearby transmission lines.

With elevations exceeding 1,300 feet above mean sea level (AMSL), the glacial tills of Champaign County contain some of the highest elevations in the state. Since wind speeds are generally greater in higher elevation locations, the topographic features of the study area suggested a high quality wind resource compared to other areas in the state. The wind resource map (see Exhibit E) served to reinforce this assessment, and indicated this area would provide among the most suitable wind resource in Ohio.

Adequate access to the bulk power transmission system is an important siting criterion, as the system must be able to accommodate the interconnection, and accept and transmit power from the Facility. As depicted on the wind resource map in Exhibit E, existing bulk transmission lines occur in the Champaign County study area.

As discussed in 4906-13-07(C)(1), land use in Champaign County is primarily agricultural, and characterized by open spaces suitable for hosting a wind power project. Initial site visits to the area provided visual verification that the study area is dominated by agricultural use and that the land use would be compatible with wind project development.

Another feature of the study area that provided rationale for selection as a potential site for the Facility is the proximity of major transportation routes. Located approximately 25 miles west-northwest of Columbus, the study area is in close proximity to I-70 to the south, US-33 to the north and US-68 to the West. These major roads provide accessibility for the transportation of turbine parts, construction equipment, and staff.

(b) *Map of Project Area and General Wind Resource Map*

The Project Area is depicted on the Figure 1. In addition, a statewide wind resource map, which is typical of the type of data used in initial screening evaluations, is included in Exhibit E.

(c) *List and Description of Siting Criteria*

Siting criteria used for the selection of a particular area (i.e., macro-siting) to host a viable wind power project, such as the Facility proposed herein, include a number of factors/requirements, which are presented below in their general order of importance:

- Adequate wind resource – the Applicant determined through an initial screening process utilizing a statewide wind resource map (see Exhibit E), and subsequent on-site measurements, that the Project Area has an adequate wind resource.
- Adequate access to the bulk power transmission system – from the standpoints of proximity and ability of the system to accommodate the interconnection, and to

accept and transmit the power from the Facility at a reasonable cost, the Applicant determined that the existing transmission infrastructure was adequately accessible. This determination was made through an initial internal preliminary assessment and subsequent interconnect request filed with PJM. See Section 4906-13-04(D) of this Application for additional detail.

- Willing land lease participants and host communities – the Applicant has obtained private lease agreements, which constitute contiguous areas of land necessary to support the Facility. See Section 4906-13-05(A) of this Application for additional detail. In addition, the Applicant has made significant efforts to engage with local and state leaders and the local community to educate and share information. Support for the Facility on both the state and local level has been strong. See Section 4906-13-07(E)(1) of this Application for additional detail.
- Site accessibility – the Project Area is served by an existing network of public roads, which will facilitate component delivery, construction, and operation and maintenance activities (see Exhibit W).
- Appropriate geotechnical conditions - significant geotechnical constraints for the planned construction of the Facility are not anticipated (see Exhibit F).
- Limited population/residential development – the Project Area and the surrounding communities have a low population density as compared to statewide estimates. See Section 4906-13-07(A)(1) of this Application for additional detail.
- Compatible land use – the Project Area is predominately rural agricultural, which is compatible with the proposed Facility (see Exhibit I).
- Limited sensitive ecological resources – the proposed Facility is not expected to result in adverse impact to ecological resources (see Exhibit M).

Once it was determined that the Project Area is suitable for development of a wind power facility, various siting factors and constraints were identified and evaluated in order to appropriately micro-site the Facility components. Micro-siting efforts are discussed in detail below.

(d) *Description of Siting Factors and Constraints*

As noted above, the selection of possible sites for development of wind power facilities is constrained in that projects must be located in areas with adequate wind resource; which are proximate to electric transmission lines with unused capacity sufficient to accept energy from the facility; and which are situated in locations which can accommodate setback, land use, and environmental restrictions imposed by local, state and federal laws. Once a project area has been selected (macro-siting), there is some ability to alter turbine and other component locations on the properties that are participating in the project (micro-siting), within the confines of the private agreements that the Applicant has obtained. The micro-siting of project components within a given project site is governed by site-specific factors, including land use constraints, noise constraints, wind resource constraints, wetland constraints, agricultural constraints, and landowner considerations. Each of these constraints is discussed in additional detail below.

Land Use Constraints

A graphic study of turbine siting constraints for the Facility is included as Figure 2, as required by 4906-13-03(A)(2) below. This graphic study depicts suitable areas for Facility components in orange. These areas are restricted by setbacks from right-of-ways, railroads, transmission lines, and structures (including residences, schools, libraries, hospitals, health care facilities, and religious institutions), along with and need to avoid delineated wetlands, surface waters, and fresnel zones. Illustrative as it is, this graphic cannot show all the site-specific constraints and considerations, such as steep slopes, landowner preferences, turbine engineering factors (e.g., minimum separation distances to avoid wake loss), shadow flicker assessments, access road engineering requirements (e.g., slope restrictions), and minimizing impacts to forested areas and agricultural lands, all of which further limit siting alternatives within the participating parcels.

Unlike state or municipal entities, private developers do not have the power of condemnation or eminent domain. Consequently, the Applicant does not have the unfettered ability to locate projects in any area or on any parcel of land. Facilities can only be sited on private property where the landowner has agreed to allow such construction. Moreover, with respect to private landowner agreements, such agreements are strictly limited to a wind power project, and as such, do not allow for the siting of alternative energy production facilities (e.g., solar, hydro, biomass, fossil fuel). Consequently, other power generation technologies are not reasonable alternatives that warrant consideration in this Application.

In addition to investigating the layout within the constraints discussed above, numerous expert analyses and field studies have been conducted to assure that the individual turbines are sited so as to minimize environmental impacts to the maximum extent practicable, while still allowing for a successful project. The pertinent studies and analyses are attached hereto as Exhibits and discussed in various sections of the Certificate Application.

Noise Constraints

No existing national, state, or local laws specifically limit Facility noise levels. Therefore, potential noise from the Facility was evaluated in terms of its likely audibility or perceptibility at nearby residences, relative to the background sound level. As described in Section 4906-13-07(A)(3)(b) of this Application, a nominal impact threshold of 5 dBA above the measured ambient background sound level was determined to be a reasonable design target for occupied residences. Using that nominal threshold, significant site-specific mitigation efforts have occurred during the design phase for the proposed Facility. The Facility layout presented herein is the result of multiple iterations and analyses designed to minimize noise impacts. To reduce the potential for adverse noise impacts, many turbines have been moved further away from residences or to entirely different properties, and an even larger number have been completely removed from the Facility. For additional information on noise, see Section 4906-13-07(A)(3) of this Application.

Wind Resource Constraints

The wind resource assessment of the proposed Facility site was quite complex. This type of evaluation is necessary to optimize the turbine layout and assess the energy yield estimation within the context of the existing, site-specific constraints. The objective of micro-siting is to locate wind turbines in the highest energy yield positions with the lowest shadowing and wake loss influence between these turbines. During the course of the wind analysis, micro-scale modeling tools including WAsP (www.wasp.dk) and WindPRO (www.emd.dk) were utilized to develop the energy yield assessment for the layout proposed herein, that is itself a result of a comprehensive management of the local constraints with the goal of achieving high energy yield. The WAsP tool is a flow model used to determine the resultant wind regime for a region. Inputs to the WAsP include wind data from on-site meteorological towers and high-resolution terrain/roughness/land cover data from a digital elevation model.

Two 60-meter and one 80-meter temporary meteorological towers were erected to collect the site-specific wind data necessary for modeling purposes. The turbine layout was then devised utilizing the resulting wind map from the WAsP model. The software model was also used to determine energy loses due to wake effects. Since each turbine affects the downwind wind flows, relative positions of the entire layout array were analyzed in order to minimize the wake loses and thereby maximize Facility efficiency and energy yield. From a wind resource perspective, the final layout was determined by overlaying the most energetic layouts with the most constructible designs.

Wetland Constraints

The Facility site contains a number of State and Federal wetlands. Federal and State law discourages development in wetlands and advocates that such impacts be avoided or minimized. Section 404 of the Clean Water Act establishes a program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands (www.epa.gov/owow/wetlands/pdf/reg_authority.pdf). The basic premise of the program is that no discharge of dredged or fill material may be permitted if: (1) a practicable alternative exists that is less damaging to the aquatic environment, or (2) the nation's waters would be significantly degraded. In other words, an Applicant must show that they have, to the extent practicable:

- Taken steps to avoid wetland impacts,
- Minimized potential impacts on wetlands, and
- Provided compensation for any remaining unavoidable Impacts.

In order to maximize wetland avoidance, on-site investigations were conducted in accordance with the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory, 1987). Wetland boundaries were defined in the field and mapped using a portable mapping-grade global positioning system (GPS) units. This methodology was applied to areas in the vicinity of proposed Facility components including turbines, access roads, buried and above-ground electrical interconnect lines, and the substation. Once wetland boundaries were defined, Facility components were sited so as to maximize wetland avoidance.

Agricultural Constraints

The Applicant has designed the facility footprint in order to minimize impacts to active agricultural land. These efforts include placement of turbines and access roads along field edges, utilizing the routes of existing farm lanes for Facility access roads, and minimizing temporary disturbance to, and permanent loss off, active agricultural land to the maximum extent practicable.

Landowner Considerations

The Applicant has and will continue to meet with various participating landowners to review the Facility footprint on their respective parcel(s) to assure that landowners' requirements are met. Among other things, these meetings often involve field analysis to ensure that Facility components avoid site features of importance to the landowner, or to ensure adequate separation distances from such site features.

(e) *Description of Project Area Selection Process*

Based on the criteria listed in 4906-13-03(A)(1)(c), the site selection analysis concluded that the site presented herein meets all the factors necessary to support a viable wind energy facility. The proposed site possesses some of the best terrestrial wind resource in the state (see Exhibit E), manageable access to the bulk power transmission system, sufficiently low population density, positive feedback from landowners and town officials, highly compatible land-use characteristics, and few environmental sensitivities.

Once it was determined that the project site was adequate, the Applicant then worked with various consultants to conduct detailed assessments, which identified and defined the siting factors and constraints described above. Through the use of geographic information system (GIS) tools and consultant assessments, the Applicant performed numerous iterations to determine the proposed Facility layout as presented in this Certification Application.

(f) *Ranking of Sites Selected for Evaluation*

This section is not applicable given the lack of an alternative site analysis (see Exhibit Y). All site selection factors, requirements, and criteria utilized in siting the Facility have been described in 4906-13-03(A)(1)(a) through (e) above.

(g) *Qualitative or Other Factors Utilized in Site Selection*

All site selection factors, requirements, and criteria have been described in 4906-13-03(A)(1)(a) through (e) above.

(2) Constraint Map

A Constraint Map, including setbacks from residences, property lines (where applicable) and public rights-of-way, is included as Figure 2.

(B) SUMMARY

The site analysis described above provides a qualitative and quantitative assessment of the site selection process on a macro and micro level. This analysis/development activity was conducted over the course of multiple years. In addition to the assessment procedures outlined above, significant landowner agreements and site-specific pre-construction assessments are required for utility scale wind projects. To obtain additional viable Facility alternatives, extensive pre-certification tasks would have to be completed for each alternative. It is simply not practicable to procure land contracts, perform environmental and engineering studies, enter into (and progress through) multiple interconnection permit processes, and conduct community outreach and education campaigns for additional Facility alternatives. In fact, because of the need for wind energy development in the state as dictated by the AEPS (substitute Senate Bill 221), truly viable alternative sites will be considered as options to be developed in addition to, rather than in lieu of, the proposed Facility.

(C) SITE SELECTION STUDIES

As previously indicated, a map showing available wind resources and regional transmission lines is attached as Exhibit E.

4906-13-04 TECHNICAL DATA

(A) SITE

The following sub-sections provide information on the location, major features, and the topographic, geologic, and hydrogeologic suitability of the proposed site. With respect to alternative sites, please refer to Exhibit Y.

(1) Geography and Topography

Figure 3 depicts the geography and topography of the Project Area, and the surrounding area within a 5-mile radius. This mapping was developed from the following United States Geological Survey (USGS) 7.5 minute, 1:24,000 topographic quadrangles, which occur within five miles of the Facility boundary: Kingscreek, Mechanicsburg, Milford Center, New Moorefield, North Lewisburg, Northville, Plumwood, Springfield, South Vienna, Urbana East, Urbana West, and Zanesfield. Due to the scale of the mapping, the edges of the proximity map also incorporates portions of other quadrangles that do not fall within a 5-mile radius, including: Bellefontaine, Charleston, Clifton, De Graff, Donnelsville, East Liberty, Florence, Huntsville, London, Peoria, Rushsylvania, Russells Point, Saint Paris, Thackery, Walnut Run, West Mansfield, Yellow Springs, and York Center. Among other information, Figure 3 shows the following features:

(a) *The proposed Facility.*

(b) *Major population centers and geographic boundaries.*

(c) *Major transportation routes*[8] *and utility corridors*[9].

(d) *Surface waters*[10].

(e) *Topographic contours.*

(f) *Major institutions, parks, and recreation areas.*

[8] While USGS base mapping indicates the presence of transportation routes, Figure 1 depicts these routes in more detail.

[9] Due to the expanse of the area and difficulties in acquiring accurate digital data, not all utility corridors are shown. No additional utility corridors (outside of roadways) are believed to be located in the Project Area; however, final project design will include identification of any affected corridors through coordination with Ohio Utilities Protection Service and/or the Ohio Public Utilities Commission. Please see Exhibit Y for associated waiver.

[10] While USGS base mapping indicates the presence of surface waters, Figure 1 depicts these features in more detail.

(g) *Residential, commercial, and industrial buildings and installations*[11].

(h) *Air transportation facilities, existing or proposed*[12].

(2) Aerial Photograph

Figure 4 depicts the location of the proposed Facility in relation to surface features. This mapping was developed using 2006 aerial photographs from the Ohio Geographically Referenced Imagery Program (OGRIP).

(3) Existing Features Map

Figure 1 depicts the proposed Facility and existing features. This mapping is depicted at a 1:12,000 scale in accordance with draft rules 4906-17-05(A)(3) (see Exhibit Y for the associated waiver). Among other information, Figure 1 shows the following features:

(a) *Topographic contours.*

(b) *Existing vegetative cover.*

(c) *Land use and classifications*[13].

(d) *Individual structures and installations*[14].

(e) *Surface bodies of water.*

(f) *Water and gas wells.*

(g) *Vegetative cover that may be removed during construction*[15].

(4) Geology and Seismology

Figure 4 depicts the proposed Facility in relation to geological features including bedrock contours and karst areas. As described above, this mapping was developed using 2006 OGRIP aerial photographs. As part of final project design, a geotechnical engineer will identify test boring locations and conduct geotechnical surveys. The resulting cross-

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[11] For the purposes of more efficiently producing the required mapping, residential, commercial and industrial installations are shown in Figure 4 rather than Figure 3 as indicated.

[12] Information regarding air transportation facilities, existing or proposed, is not required by rule 4906-13-04(A)(1). However, this information is provided in accordance with proposed rule 4906-17-05(A)(1)(h), and includes manned airports with facilities. Unmanned airports without facilities (e.g., Weller Airstrip) are not depicted, but will be included in all aviation hazard assessments.

[13] Agricultural land uses are depicted in Figure 1, while other land use classifications are depicted in Figure 3.

[14] The majority of this information is primarily depicted on Figure 3.

[15] The "vegetative cover that may be removed during construction" is not shown in Figure 1; however, vegetation disturbed by construction activities is quantified in Tables 07-12 (Impacts to Ecological Communities) and 07-23 (Impacts to Agricultural Land), based on the assumptions set forth in Table 02-1 (Impact Assumptions and Calculations). A waiver request in included in Exhibit Y.

sectional view will be provided upon completion of that work (see Exhibit F for more information). A waiver request to these requirements can be found in Exhibit Y.

Hull & Associates, Inc. (2009a) prepared a desktop review of available geotechnical information, which is attached hereto as Exhibit F. The information was gathered by completing a literature search of existing and readily available documents and databases related to the surface and subsurface soils, agricultural resources, and geologic/bedrock conditions of the Project Area. This information was then reviewed to develop a generalized understanding of the suitability of the soils within the Project Area for grading, compaction, and drainage. Sources consulted included the Ohio Department of Transportation (ODOT) District 7 and the Office of Geotechnical Engineering; the USGS; the United States Department of Agriculture (USDA) Soil Conservation Service Soil Survey of Champaign County; the Ohio Department of Agriculture (ODA); the Federal Emergency Management Administration (FEMA); the Ohio Department of Natural Resources (ODNR); and the Champaign County Engineer.

(a) *Suitability of the Site Geology and Plans to Remedy any Inadequacies*

Existing Conditions

As presented in Exhibit F, the Project Area lies entirely within the glaciated Till Plains Section of the Central Lowland Physiographic Province. Topographic relief is characterized by gently rolling hills and moderate slopes, with elevations ranging from approximately 1080 feet AMSL to approximately 1335 feet AMSL. The area was passed over by both the Illinoian and Wisconsinan glaciers, and the surface topography of the region is the result of glacial end moraine deposits, which occur throughout west-central Ohio. According to the Glacial Geology of Champaign County (Quinn & Goldthwait, 1979), the surficial unconsolidated deposits over the eastern two-thirds of the Project Area are part of an end moraine complex known as the Cable Moraine, while that in the western one-third are part of another end moraine complex known as the Springfield Moraine.

The Cable Moraine is characterized by thick deposits of glacial till intermixed with relatively thin sand or sand and gravel layers. Glacial till is a heterogeneous mixture of all sizes of soil particles inclusive of clay, silt, sand, and gravel, with occasional cobbles and boulders. Glacial till deposits may also contain streaks, seams, layers or lenses of sand, and gravel, which may or may not be water-bearing. Discontinuous very thin to moderate lenses of sand and gravel deposits are common in this region. The till associated with the Cable Moraine is generally thicker in the southern portion of the

Project Area and thins to the north, but typically exceeds 200 feet in thickness throughout the Project Area. The Springfield Moraine is much thinner than the Cable Moraine (often less than ten feet in thickness), and overlies an outwash deposit called the Kennard Outwash. Outwash typically consists of coarser grained material, such as sand and gravel, deposited by the flowing water from melting ice. The Kennard Outwash is located between the two moraine complexes in the east-central portion of Champaign County and extends northward into the extreme southern portion of Logan County (Hull, 2009a).

The uppermost bedrock within the majority of the Project Area is comprised primarily of limestone and dolomite, although shale with interbedded limestone is the uppermost bedrock in the northern-most portion of the Project Area. The depth to bedrock is highly variable. Several ODNR well logs within or adjacent to the Project Area were also reviewed that are helpful in determining the approximate depth to bedrock and generalized geologic lithology. According to well information included in the Ground-Water Resources of Champaign County (Schmidt, 1985), limestone was encountered at a depth of approximately 345 feet in a domestic well located to the north of Mechanicsburg. These well logs also indicate that the subsurface soils are a combination of clay, sand, and gravel that extend to underlying limestone bedrock, encountered at depths in excess of 100 feet. This is consistent with the general geology as previously presented (Hull, 2009a).

Seismic information for the Project Area was obtained from the ODNR, Division of Geological Survey, Ohio Seismic Network. Figure 3 in Exhibit F shows known and speculated deep seismic structures within the State of Ohio. As shown on the map, features labeled the "Bellefontaine Outlier Faults" are located beneath the general Project Area. These features are reportedly located within the granitic basement rock in the area. See Exhibit F for additional information.

Site Suitability

Based on their experience with earthwork in the region, Hull (2009a) indicates that conventional, shallow foundations may be able to support the turbines. However, this assumption will need to be confirmed by a detailed geotechnical exploration and evaluation. If it is determined that shallow foundations are not suitable for structural support, extended type foundation systems (such as driven H-piles or auger cast piles) may be necessary to bear in suitable material or on bedrock. Additionally, other suitable foundation types may be utilized according to their compatibility with the geotechnical parameters of the specific turbine site.

The geotechnical engineer, or a designated representative, will examine foundation designs and compatibility with the supporting soils, and approve the work prior to placement of foundation components. See Exhibit F for additional information.

Hull contacted the Champaign County Engineer's Office regarding their knowledge and experience of previous construction projects, subsurface conditions, and maintenance history within the Project Area, and to ask about permits that may be necessary for construction. A representative from the Champaign County Engineer's office indicated that, based on their experience and the general description of the proposed Facility provided by Hull, significant geotechnical constraints for the planned construction are not anticipated. The exceptions mentioned by the Engineer's Office representative were for caves and the potential for underground mines, which would constitute significant geotechnical constraints if encountered. It was stated that the expectation is that only typical construction permits would be necessary (Hull, 2009a).

Due to the anticipated depth of bedrock in the Project Area, bedrock blasting will probably not be necessary (Hull, 2009a). Initial geotechnical investigation and test borings will be conducted prior to construction to confirm/refine the information presented in Exhibit F, and to facilitate final foundation design and engineering. The locations of test borings will be at appropriate turbine sites as determined necessary by the geotechnical engineer. In addition, road borings will be conducted approximately every 1,000 feet along county and township roads that will be used for transport of Facility components. These road borings will allow the Applicant and the County Engineer to determine suitability of the roads and the appropriate steps to ensure the roads are returned to pre-construction quality.

(b) *Suitability of Soil for Grading, Compaction, Drainage, and Description of Plans to Remedy any Inadequacies*

<u>Existing Conditions</u>

The USDA Soil Conservation Service Soil Survey for Champaign County was reviewed by Hull to obtain existing data for the Project Area. Soil surveys furnish surface soil maps and provide general descriptions and potentials of the soil to support specific uses, and can be used to compare the suitability of large areas for general land uses. Surface soils in the Project Area are comprised mostly of Celina, Fox, and Miami silt loams. The soil survey information suggests the Celina and Miami silt loams are well drained, have a moderately high capacity to transmit water (0.20 to 0.60 inch/hour), with the depth to water table being 24 to 36 inches below surface. The Fox silt loams are well drained, have a moderately-high to high capacity to transmit water (0.60 to 2.0 inch/hour), with the depth to water table being more than 80 inches below surface. The soil surveys also indicate that the soils do not frequently flood or pond surface water runoff. See Exhibit F for additional information.

Site Suitability

To maintain soil stability during construction, adequate surface water run-off drainage will be established and properly controlled at each proposed construction site to minimize any increase in the moisture content of the subgrade material. Positive drainage of each construction site will be created by gently sloping the surface toward drainage swales. It should be noted that sub-grade soils are subject to shrinking and swelling whenever their seasonal moisture contents vary, and consideration should be given during constructability reviews to determine how best to deal with potential moisture fluctuations (Hull, 2009a).

ODOT District 7 was contacted by Hull in order to review boring logs from historic projects that were located near and within the Project Area. The projects included the original roadway soil profile reports for portions of State Routes 29, 56, and 296 (circa 1960's) as well as several structure soil profiles for bridges and abutments over King's Creek and its tributaries. The soil profile drawings reviewed by Hull (2009a) suggest non-conventional foundation design or roadway subgrade improvements are not necessary for the proposed Facility.

Based on a review of the soil survey information and Hull's experience with earthwork in the area, the soils on-site should be suitable for grading, compaction, and drainage when each site is prepared as discussed in Appendix B of Exhibit F. In addition, the Applicant has developed Agricultural Mitigation Provisions (see Exhibit G) for construction activities occurring on privately owned agricultural land. These provisions will ensure that construction activities and mitigation measures are compatible with future agricultural land use.

(5) Hydrology and Wind

(a) *Water Budgets*

The Facility will not utilize or discharge measurable quantities of water. Water quantities and/or flow rates within water bodies will not be affected by the proposed Facility. Therefore, water budget information is not applicable.

(b) *Floods and Winds*

Floods

Information on floodways and floodplains was obtained from the ODNR and FEMA[16], as part of the Groundwater Hydrogeology Desktop Review Summary Report prepared by Hull (2009b) and attached hereto as Exhibit H. A floodplain is flat land adjacent to a stream or river that experiences occasional or periodic flooding. For regulatory purposes, the floodplain is divided into two areas based on water velocity: the floodway and the flood fringe. The floodway includes the channel and the portion of the adjacent floodplain required to pass the 100-year flood without increasing flood heights. Typically, this is the most hazardous portion of the floodplain where the fastest flow of water occurs. Due to the high degree of hazard, most floodplain regulations require that proposed floodway developments do not block the free flow of flood water, as this could dangerously increase that water's depth and velocity. The flood fringe is the remaining portion of the floodplain, outside of the floodway, that usually contains slow-moving or standing water. Development in the fringe will not normally interfere as much with the flow of water. Therefore, floodplain regulations for the flood fringe typically allow development to occur, but require protection from floodwaters through flood proofing so that water cannot enter the structure (ODNR, 2009b).

In general, it appears there is limited potential for the proposed turbine locations to be impacted by flooding. However, as shown in Figure 1 in Exhibit H, there are several mapped floodplains in the vicinity of the Project Area. No turbines are located in floodways. However, several turbine clusters are located within the flood fringes of mapped 100-year floodplains, including six turbines northeast of the City of Urbana, four turbines west of the Village of Mutual, and two turbines southwest of the Village of Mechanicsburg. Surface and subgrade soils in these areas are susceptible to being soft

[16] FEMA is currently undergoing a Map Modernization program to convert the National Flood Insurance Program maps to a digital format. The 100-year flood plains used for this analysis are the published preliminary version that has been released for review purposes and are subject to change.

and loose, and typically contain a higher content of vegetation and organics due to the more frequent presence of water in these soils. These unsuitable surface soils may need to be undercut and replaced with suitable soil material during sub-grade preparation for roadways and staging areas (Hull, 2009b). As described in 4906-13-13(A)(4)(a), geotechnical investigations and test borings will be conducted on-site prior to construction to provide relevant engineering properties of the soils, which will be used to refine structural designs.

Winds

Wind turbines such as those proposed for the Facility are typically rated to withstand wind speeds well in excess of those that may occur in the Project Area. For example, the Nordex N100 is certified according to International Electromechanical Commission (IEC) class 3a winds. Class 3a provides that the structure is designed to withstand an extreme (once per 50 years) 10 minute average wind speed of 37.5 meters per second (83.9 miles per hour) at 80 meters or an extreme 3 minute average wind speed of 52.5 meters per second (117.4 miles per hour) at 80 meters. These are minimum design values, and do not indicate that turbines would fall over if these values were exceeded. In fact, Nordex turbines erected in Japan have survived typhoon force winds in excess of design values.

(c) *Aquifers*

Based on the reported depth to groundwater throughout the Project Area, it does not appear that construction, including blasting as required, will have a significant adverse effect on groundwater quality or yield. The Silurian Aquifer is a regional carbonate (limestone and/or dolomite) aquifer that is the most productive source of groundwater in the Project Area. This aquifer is represented on Figure 4 in Exhibit H, which was compiled from an ODNR database and shows bedrock aquifers within the Project Area. Shale is the predominant bedrock type first encountered below the unconsolidated glacial deposits. However, the shale is relatively unproductive compared to the underlying limestone/dolomite and few wells have been completed in this formation. Well information included on the Ground-Water Resources maps for Champaign County indicates that the shale is reportedly capable of producing yields of three to five gallons per minute (gpm). Deep wells completed below 200 feet in the underlying limestone are reportedly capable of producing yields approaching 300 gpm. As shown on Figure 4 in Exhibit H, an additional bedrock aquifer, designated as the Devonian Aquifer, also occurs in the northern portion of the Project Area where bedrock is closer to the ground surface (Hull, 2009b).

Although the limestone/dolomite aquifer is typically the most productive aquifer within the Project Area, the depth to bedrock is highly variable and often prohibitive for private wells. In general, bedrock is typically encountered at depths in excess of 100 feet below the surface in the central and southern portion of the Project Area. In addition, well drilling reports indicate that groundwater obtained from limestone at such depths often contains hydrogen sulfide, which produces an objectionable "rotten egg" odor and taste (Hull, 2009b).

As a result, many private wells within the Project Area have been developed in unconsolidated sand and gravel deposits intermixed in the thick deposits of till. Although these wells are typically not capable of producing yields in excess of 25 gpm, the yields are reportedly sufficient to meet the demands for domestic and agricultural use in the area. Figure 4 in Exhibit H shows that wells can be developed in the unconsolidated deposits throughout the Project Area. The most productive areas are the buried valley, outwash, and kame aquifers associated with the Mad River. Yields in these buried valley deposits range from approximately 25 to 100 gpm. Two small areas in the southeastern portion of the Project Area contain glacial kame and outwash deposits capable of producing 100 to 500 gpm. The Mad River Buried Valley Aquifer, located in the western portion of the Project Area near the City of Urbana, is also capable of producing up to 500 gpm (Hull, 2009b).

The Project Area lies within a rural portion of Champaign County. There are few urban areas in close enough proximity to the Project Area that are large enough to extend municipal water service out into the rural areas. Consequently, residents in the Project Area rely upon private wells for their groundwater. The well locations depicted on Figure 4 in Exhibit H were compiled from information provided by ODNR, Ohio EPA, and the county health departments. As shown on the figure, there are hundreds of private wells located within the Project Area. Due to the high number of wells in the area, Hull has not reviewed the specific information associated with any of the wells depicted on the figure. Nor has there been an attempt to differentiate between wells installed in the unconsolidated aquifers or wells installed within the underlying bedrock (Hull, 2009b).

Figure 4 in Exhibit H also includes information regarding Source Water Protection Areas (SWPAs), as defined and approved by Ohio EPA for the protection of drinking water sources. As shown on Figure 8 in Exhibit H, there are multiple Ground Water SWPAs located in eastern Champaign County, with one in the vicinity of the Project Area in Goshen Township. However, no Facility structures are proposed to be located within any designated Ground Water SWPAs. Also depicted on Figure 4 in Exhibit H is a surface water SWPA that covers approximately 35% of the Project Area, comprising the entire extent of the Big Darby Creek watershed within in the Project Area. According to information provided by Ohio EPA, the SWPA depicted on the figure is a small portion of the Cincinnati Public Water Supply SWPA. The area included in the SWPA for this public water supply includes the entirety of the Ohio River drainage basin upstream of the city of Cincinnati (Hull, 2009b).

Environmental regulatory programs within the Ohio EPA, as well as other regulatory agencies such as the Ohio Bureau of Underground Storage Regulations, restrict specific activities within SWPAs. These activities include concentrated animal feeding operations; sanitary, industrial or residual waste landfills; land application of biosolids; and voluntary brownfield cleanups. The restrictions typically apply to the groundwater SWPAs that provide a source of drinking water. Hull (2009b) reviewed the range of programs which have adopted rules related to SWPAs, and concluded that construction of the proposed wind energy facility will not constitute an activity that would be restricted within either a surface water or groundwater SWPA.

(B) LAYOUT AND CONSTRUCTION

(1) Site Activities

The order of information below does not strictly comply with the order of information contained in rule 4906-13-04(B)(1), but rather is presented to facilitate understanding of the activities associated with the proposed wind energy facility. All sub-sections required under 4906-13-04(B)(1) are included, but not in the prescribed sequence. Additional sub-sections are included for (e) Foundation Excavation, (f) Buried Collection System Installation, and (g) Overhead Collection System Installation.

(a) *Test Borings.*

After the geotechnical engineer has reviewed all available desktop information, s/he will determine the number of borings to be drilled for the initial geotechnical investigation. In addition, borings will be taken at the proposed substation locations. The borings will extend to the proposed depth or competent bedrock, whichever is encountered first. Split-barrel sampling of soil will be performed in accordance with American Society for Testing and Materials (ASTM) D1586 for each boring in increments of 2.5 feet to the depth of 10 feet, and at 5-foot intervals below 10 feet to the depth of the borings. In all the borings, Standard Penetration Test (SPT) data will be developed and representative samples preserved. Water observations in the boreholes will be recorded during (and at the completion of) drilling. A truck-mounted drill rig will be used to perform the borings, unless unfavorable weather conditions make the site inaccessible, in which case an ATV-mounted drill rig will be used. All borings will be backfilled at the completion of drilling with bentonite chips and drill cuttings (Hull, 2009a).

A laboratory testing program will be established by the geotechnical engineer based on the observations made during the drilling activities and experience. All samples will be classified in the laboratory based on the visual-manual examination (ASTM D 2488) Soil Classification System and the laboratory test results. Formal boring logs will be prepared using the field logs and the laboratory classifications. For a limited number of samples considered to be representative of the foundation materials encountered by the borings across the Project Area, laboratory testing will include moisture content, particle-size analyses and Atterberg limits. Unconfined compression and consolidation tests will be performed if low strength and/or highly compressible cohesive soils are encountered, as deemed necessary by the geotechnical engineer. All laboratory testing will be performed in accordance with ASTM or other specified standards. A report will be prepared documenting the findings of the borings and laboratory testing, along with recommendations on construction considerations and foundation designs (Hull, 2009a).

(b) *Removal of Vegetation*

Facility construction will be initiated by clearing (as necessary) all tower sites, access roads, and interconnect routes. As described in Table 02-1, it is assumed that a 200-foot radius will be cleared around each tower, a 55-foot-wide corridor will be cleared along access roads, and a 15-foot-wide corridor will be cleared along all underground electric interconnect routes that do not parallel access roads. Limited clearing may also occur as necessary along overhead interconnect routes, but will be restricted to existing public road right-of-ways. The actual cleared area will vary on a case-by-case basis, and will depend on factors such as topography and vegetation. In addition, approximately 3 acres will be cleared for the substation and approximately 12 acres for the construction staging areas. Section 4906-13-07(B)(2)(a) of this Application quantifies anticipated temporary and permanent impacts from construction activities, including vegetation removal, to ecological communities in the Project Area.

(c) *Grading and Drainage Provisions*

Graded areas will be smoothed, compacted, freed from irregular surface changes, and sloped to drain. Final earth grade adjacent to equipment and buildings will be below the finished floor slab and sloped away from the building to maintain proper drainage. Slopes of embankments shall be protected against rutting and scouring during construction in a manner similar to that required for excavation slopes. Site grading will be compatible with the general topography and use of adjacent properties, right-of-way, setbacks, and easements.

In addition, a stringent soil erosion and sedimentation control plan will be developed and implemented as part of the Stormwater Pollution Prevention Plan (SWP3) required by the National Pollutant Discharge Elimination System (NPDES) General Permit for the Facility. To protect surface waters, wetlands, and groundwater and storm water quality, silt fence, hay bales, and temporary siltation basins will be installed and maintained throughout site development. The location of these features will be detailed on the construction drawings, approved by the Ohio EPA as part of the NPDES review, and reviewed by the contractor prior to construction. A duly qualified individual will also inspect these features throughout the period of construction to assure that they are functioning properly until completion of all restoration work (final grading and seeding). Based upon field conditions, the inspector may require additional sediment and erosion control, beyond what is depicted on the drawings. Further information on storm water drainage can be found in 4906-13-06(C)(1)(e).

(d) *Access Roads*

Wherever feasible, existing roads and farm drives will be upgraded for use as Facility access roads in order to minimize impacts to both active agricultural areas and wetland/stream areas. Where an existing road or farm drive is unavailable or unsuitable, new gravel-surfaced access roads will be constructed, also in locations selected to minimize potential impacts. Access road locations, as depicted and analyzed herein, are the result of numerous site visits/investigations conducted by EDR personnel, and are based on years experience with developing/siting wind energy facilities.

Road construction will involve topsoil stripping and grubbing of stumps, as necessary. Stripped topsoil will be stockpiled along the road corridor for use in site restoration. Any grubbed stumps will be removed, chipped, or buried. Following removal of topsoil, subsoil will be graded, compacted, and surfaced with gravel or crushed stone (depth to be determined on a case by case basis), and a geotextile fabric or grid will be installed beneath the road surface if necessary, to provide additional support. To the extent practicable, local sources will be used to obtain gravel and other construction materials that may be needed (e.g., sand) in support of Facility construction.

The typical finished access road will be 16 feet in width, with occasional wider pull-offs to accommodate passing vehicles, and earthen shoulders on either side to accommodate crane traffic. Maximum permanent road width will be 20 feet. Appropriately sized culverts (minimum 12 inch) will be placed in any wetland/stream crossings in accordance with state and federal permit requirements. In other locations, culverts may also be used to assure that the roads do not impede cross drainage. Where access roads are adjacent to, or cross, wetlands, streams or drainage ditches/swales, appropriate sediment and erosion control measures (e.g., silt fence) will be installed.

During construction, access road installation and use could result in temporary disturbance of a maximum width of 40 feet, with temporary road horizontal radii of 200 feet. In agricultural areas, topsoil will be stripped and wind-rowed along the access road to prevent construction vehicles from driving over undisturbed soil and adjacent fields. Once construction is complete, temporarily disturbed areas will be restored (including removal of excess road material, de-compaction, and rock removal in agricultural areas) and returned to approximately their pre-construction contours. Typical access road details and photos of access road construction are included in Exhibit D.

(e) *Foundation Excavation*

Once the access roads are complete for a particular group of turbine sites, the respective turbine foundation construction will commence on that completed access road section. Foundation construction occurs in several stages, as dictated by the type of foundation to be used. These stages could include hole excavation, outer form setting, rebar and bolt cage assembly, casting and finishing of the concrete, removal of the forms, backfilling and compacting, and site restoration. Excavation and foundation construction will be conducted in a manner that will minimize the size and duration of excavated areas required to install foundations.

Initial activity at each tower site will involve removing vegetative cover and grading topsoil within a 200-foot radius workspace around each tower. In agricultural land, the topsoil within a 200-foot radius of each tower will be stripped and stockpiled. Backhoes will then be used to excavate a foundation hole. In agricultural areas, excavated subsoil and rock will be segregated from topsoil. If bedrock is encountered it is anticipated to be ripable, and will be excavated using mechanical means. If the bedrock is not ripable, it will be excavated by pneumatic jacking, hydraulic fracturing, or blasting. As indicated in section 4906-13-04(A)(4)(a) and Exhibit F of this Application, blasting is not expected to be necessary (Hull, 2009b). However, if blasting is required, it will be conducted in accordance with all applicable laws and regulations. If necessary, dewatering of foundation holes will involve pumping the water to a discharge point, which will include measures/devices to slow water velocities and trap any suspended sediment. Dewatering activities will not result in the direct discharge of water into any streams or wetlands.

Upon completion of the detailed geotechnical exploration, suitable foundation systems will be designed. Three possible types are currently under consideration: spread footing foundations, Patrick and Henderson, Inc. (P&H) post-tensioned foundations, and rock anchored pile-supported foundations. The excavation area around and over the foundation will be backfilled with material excavated from on-site. The top of the foundation will be a nominal 18-foot diameter pedestal that typically extends 6 to 8 inches above grade and is surrounded by a 6-foot wide gravel skirt. At the base of each tower an area approximately 100 feet by 60 feet will be developed as a level crane pad.

Beyond the tower, nacelle, and rotor blades, other smaller wind turbine components include hubs (center portion of the rotor assembly), cabling, control panels and internal facilities such as lighting, ladders, etc. All turbine components will be delivered to the Facility site on transport trucks, and the main components will be off-loaded at the individual turbine sites. Turbine erection is performed in multiple stages including setting of the bus cabinet and ground control panels on the foundation, erection of the tower sections, erection of the nacelle, assembly and erection of the rotor, connection and termination of the internal cables, and inspection and testing of the electrical system prior to energization.

Turbine assembly and erection involves mainly the use of large track-mounted cranes, smaller rough terrain cranes, boom trucks, and rough terrain fork-lifts for loading and off-loading materials. The tower sections, rotor components, and nacelle for each turbine will then be delivered to each site by specialized trailers and unloaded by crane. A large erection crane will set the tower segments on the foundation, place the nacelle on top of the tower, and following ground assembly, place the rotor onto the nacelle (see construction photos in Exhibit D). The erection crane(s) will move from one tower to another along Project access roads or temporary crane paths.

(f) *Buried Collection System Installation*

As mentioned previously, electrical interconnects will generally follow Facility access roads, but will also follow field edges and cut directly across fields in some places. The proposed layout of the collection system is illustrated on Figure 1. Where buried cable is proposed to cross active agricultural fields, the location of any subsurface drainage tiles will be determined (through consultation with the landowner) to avoid damaging these lines during cable installation.

Direct burial methods through use of a cable plow, rock saw, and/or trencher will be used during the installation of underground interconnect lines whenever possible. Direct burial with a cable plow will involve the installation of bundled cable (electrical and fiber optic bundles) directly into a "rip" in the ground created by the plow blade. The rip disturbs an area approximately 24 inches wide with bundled cable installed to a minimum depth of 36 inches. An area up to 15 feet wide must be cleared of tall-growing woody vegetation and will be disturbed by the tracks of the installation machinery. However, this disturbance does not involve excavation of the soil (see construction photos and typical detail in Exhibit D). Generally, no restoration of the rip is required, other than surficial compaction and smoothing. Similarly, surface disturbance associated with the passage of machinery is typically minimal. Should additional surface restoration be required, a small excavator or small bulldozer will closely follow the installation, smoothing the area. Direct burial with a trencher involves the installation of bundled cable in a similar fashion to cable plow installation. The trencher or rock saw uses a large blade or "saw" to excavate an open trench. A 24-inch-wide trench is generally opened with a sidecast area immediately adjacent to the trench. Similar to cable plow, this direct burial method installs the cable a minimum of 36 inches deep (48 inches in active agricultural fields) and requires only minor clearing and surface disturbance (up to 15 feet wide for the installation machinery and access).

Installation of utility lines in an open trench will be used in areas where the previously described direct burial methods are not practicable, or in areas where the location of subsurface drainage tiles cannot be confirmed. Areas appropriate for open trench installation will be determined at the time of construction and may include areas with unstable slopes, excessive unconsolidated rock, standing or flowing water, and/or suspected drainage tiles. Open trench installation is generally performed with a backhoe and generally results in a disturbed trench 36 inches wide and a minimum of 36 inches deep. The overall temporary footprint of vegetation and soil disturbance may be a maximum of 15 feet due to machinery dimensions and backfill/spoil pile placement during installation. In agricultural areas, all topsoil within the work area will be stripped and segregated from excavated subsoil. Replacement of spoil material will occur immediately after installation of the buried utility. Subgrade soil will be replaced around the cable, and topsoil will be replaced at the surface. Any damaged tile lines will be repaired, and all areas adjacent to the open trench will be restored to original grades and surface condition. Restoration of these areas will be completed through seeding and mulching of all exposed soils or by other appropriate farming methods in active agricultural fields.

(g) *Overhead Collection System Installation*

As indicated in 4906-13-02(A)(2), it is currently anticipated that approximately 39.8 miles of the 34.5 kV collection system will be overhead. The Applicant has been working in cooperation with Dayton Power and Light (DPL), and will address all the necessary and appropriate terms and conditions for permitting, design, construction, operation, and maintenance of the collection lines along the public roads. It is currently anticipated that the existing 40-foot poles would be replaced with approximately 50-foot poles, and would include single or double circuits with new 34.5 kV lines over the existing 12.4 kV distribution lines. This overhead line will be built and inspected to Rural Utilities Service (RUS) standard construction specifications.

The Applicant intends to work with DPL to arrange the permitting, design, construction, operation, and maintenance of the above ground 34.5 kV electrical interconnect associated with the Facility. It is anticipated that the 34.5 kV electrical interconnect will be consistent with the USDA Rural Electrification Administration Bulletin 50-4, which addresses "Specifications and Drawings for 34.5/19.9 kV Distribution Line Construction." As indicated in this bulletin, the "latest edition of the National Electrical Safety Code

(NESC), ANSI C2, shall be followed except where local regulations are more stringent, in which case local regulations shall govern" (USDA, 1986).

(h) *Removal and Disposal of Debris*

Facility construction will generate some solid waste, primarily plastic, wood, cardboard and metal packing/packaging materials, construction scrap, and general refuse. This material will be collected from turbine sites and other Facility work areas, and disposed of in dumpsters located at the construction staging area(s). A private contractor will empty the dumpsters on an as-needed basis, and dispose of the refuse at a licensed solid waste disposal facility.

(i) *Post-construction Reclamation*

Once construction is complete, temporarily disturbed areas will be restored (including removal of excess road material, de-compaction, and rock removal in agricultural areas) and returned to their approximate pre-construction contours. Exposed soils at restored turbine sites and along Facility access roads will be stabilized by seeding, mulching, and/or agricultural planting.

(2) Layout

The proposed layout of all Facility components is illustrated on Figure 1. Among other information, Figure 1 includes the following information:

(a) *Electric power generating plant*[17].

(b) *Fuel, waste, and other storage facilities.*

Fuel and waste storage facilities are not part of the Facility. The Facility's O&M building will be used for storage but its location has not been finalized (see Exhibit Y for waiver).[18].

(c) *Fuel and waste processing facilities, if any.*

The proposed Facility will not require and fuel or waste processing facilities, and therefore, none are depicted on Figure 1.

[17] Wind-powered electric generation turbines are included on Figure 1 to comply with the requirements of draft rule 4906-17-05(B)(2)(a).

[18] The lack of fuel, waste and other storage facilities for wind projects was recognized by the OPSB and is not listed as a Layout feature in proposed rule 4906-17-05(B)(2).

(d) *Water supply and sewage lines.*

With the possible exception of the O&M building (see Exhibit Y), water supply and sewage lines are not required for the Facility and therefore are not depicted in Figure 1[19]

(e) *Transmission lines.*

As described in Section 4906-13-02(A)(3) of this Application, no new transmission lines will be associated with the Facility. Therefore, none are mapped on Figure 1.

(f) *Substations.*

(g) *Transportation facilities and access roads.*

(h) *Security facilities.*

As described in Section 4906-13-02(A)(2) of this Application, the substation will be enclosed by chain link fencing. The fencing will be constructed around the perimeter of the substation, as depicted on Figure 1, sheet 1-13. In addition, fencing will also be used to enclose construction trailers at the Ludlow Road staging area during construction (see Figure 1, sheet 1-13). Gates may be constructed along access roads to turbines, at the discretion of the landowner. No additional security features are proposed.

(i) *Grade elevations where modified during construction* (see Exhibit Y).

(j) *Other pertinent installations*[20].

(k) *Transformers and collection lines*[21].

(l) *Construction laydown areas*[22].

As discussed in 4906-13-03(1), the proposed location and spacing of the wind turbines and support facilities is based on a wind resource assessment and guidance provided by expert consultants. Factors considered when siting the turbines included the following:

Wind resource assessment: Through the use of modeling software, meteorological data, and topographic data, the wind turbines are sited to optimize exposure to wind from all directions, with emphasis on exposure to the prevailing wind directions in the Project Area.

Sufficient spacing: Siting turbines too close to one another can result in decreased electricity production due to the creation of wind turbulence. Each wind turbine creates

[19] The lack of water supply and sewage lines for wind projects was recognized by the OPSB and is not listed as a Layout feature in proposed rule 4906-17-05(B)(2).

[20] Please also see Figure 3 for a depiction of major institutions/installations.

[21] Transformers and collection lines are included on Figure 1 to comply with the requirements of draft rule 4906-17-05(B)(2)(b). Transformers will be located within the confines of the substation with smaller transformers located near the base of each turbine.

[22] Construction laydown areas (staging areas) are included on Figure 1 to comply with the requirements of draft rule 4906-17-05(B)(2)(c).

turbulence in its wake. As the flow proceeds downwind, there is a spreading of the wake and recovery to free-stream wind conditions. Therefore, Facility turbines need to be sited with enough space between them to minimize wake losses and maximize the capture of wind energy.

Distance from Parcel Boundaries: Based on the requirements of proposed chapter 4906-17-08(C)(1)(c)(i) and the dimensions of the proposed turbines, setbacks from parcel lines must be at least 541 feet. In addition, based on an existing wind ordinance in Union Township and the dimensions of the proposed turbines, setbacks from parcel lines in this Township must be at least 590 feet. All turbine locations comply with these setbacks, unless excepted by waiver agreements with landowners.

Distance from residences: Based on the requirements of proposed chapter 4906-17-08(C)(1)(c)(ii) and the dimensions of the proposed turbines, setbacks from residences must be at least 914 feet. The proposed site for turbine 70 is very close this setback requirement, and technically falls within the setback. However, advanced engineering and micro-siting is expected to remedy this situation, and the turbine will not be constructed unless the setback requirement is ultimately met or an appropriate waiver is executed. All other proposed turbine locations comply with these setbacks, unless excepted by waiver agreements with the landowners, as permitted under 4906-17-08(C)(1)(c)(iii).

Environmental and Cultural Resources: Special consideration was given to siting project facilities to avoid environmental and cultural resource impacts to the greatest extent possible. For a more detailed discussion of minimizing/avoiding impacts to environmental and cultural resources, refer to Sections 4906-13-06 and 4906-13-07 of this Application.

(3) Structures

(a) *Estimated Overall Dimensions*

Each wind turbine consists of three major components: the tower, the nacelle, and the rotor. The height of the tower, or "hub height" (height from foundation to top of tower) will be up to 328 feet (100 meters). The nacelle sits atop the tower, and the rotor hub is mounted to the front of the nacelle. The rotor diameter will be up to 328 feet (100 meters). The total turbine height (i.e., height at the highest blade tip position) will be up to 492 feet (150 meters).

The O&M facility is not anticipated to exceed 6,000 square feet or permanently disturb an area of greater than 2 acres. An existing structure within or near the Project Area will likely be utilized to house O&M staff, equipment, and parts. When compared to constructing a new facility, this would have the advantage of reducing environmental impacts, and could also decrease the vacancy rate of commercial buildings in the area. A new building will only be constructed if a suitable existing structure cannot be located. A typical O&M building schematic and example photos are provided in Exhibit D.

The substation will consist of two areas, the utility substation and the Facility substation. The total area will be approximately 350 feet by 200 feet in size and enclosed and separated by a chain link fence. Equipment within the fenced area will include dead-end structures, circuit breakers, air break switches, metering units, relaying, communication equipment, a step up transformer, and a separate control house for each area.

(b) *Construction Materials*

All materials and construction practices used will meet or exceed safe and reliable engineering and design standards. The turbines will be installed on a concrete foundation of a shallow spread footing design, which will be surrounded by a gravel skirt. The turbine towers are conical steel structures manufactured in six sections. The rotor shaft is forged from heat-treated steel, and the rotor blades are manufactured from glass fiber reinforced polyester.

(c) *Color and Texture of Facing Structures*

The turbine towers are tubular steel structures manufactured in multiple sections. In accordance with FAA requirements, the towers will be painted off-white to make the structure visible to aircraft (viewing against the ground), while decreasing visibility from ground vantage points.

The O&M building may utilize an existing structure. If a new structure is required, it will be designed to resemble an agricultural building, similar in style to those found throughout the Project Area. Please see Exhibit D for additional information.

(d) *Photographic Interpretation or Artist's Pictorial Sketches of the Proposed Facility From Public Vantage Points*[23]

EDR prepared a Visual Impact Assessment (VIA) for the proposed Facility (Exhibit I). The purpose of this VIA is to:

- describe the appearance of the visible components of the proposed Facility,
- define the visual character of the Facility study area,
- inventory and evaluate existing visual resources and viewer groups,
- evaluate potential Facility visibility within the study area,
- identify key views for visual assessment, and
- assess the visual impacts associated with the proposed action.

The VIA procedures used for this study are consistent with the policies, procedures, and guidelines contained in established visual impact assessment methodologies, and the VIA was prepared under the direct guidance of a registered landscape architect with experience in visual impact assessment.

(i) Existing Visual Character

Based on established visual assessment methodology, the visual study area for the Facility was defined as the area within a 5-mile radius of each of the proposed turbines, and includes approximately 268 square miles in Champaign County. This area includes all or portions of the City of Urbana, the Villages of North Lewisburg, Woodstock, Mechanicsburg, Mutual, and Catawba, and the hamlets of Middletown, Fountain Park, Kennard, Cable, and Mingo. The location of the visual study area is illustrated on Figure 4 in Exhibit I.

<u>Landscape Similarity Zones</u>

Within the 5-mile radius visual study area, four major landscape similarity zones (LSZ) were defined, which includes rural residential/agricultural, city/village, suburban residential, and hamlet. The USGS Land Cover Data used to help define the location of these zones is illustrated in Exhibit I, Figure 5 (Sheet 1), along with representative photos of each (Exhibit I, Figure 5, Sheets 2 and 3). The general

[23] The sub-numeration within this section is not set forth in the rule 4906-13 or draft rule 4906-17, but rather is incorporated by the Applicant to clarify organization of this section.

landscape character, use, and potential views to the proposed Facility within each of the LSZs that occur within the study area are described below.

Zone 1: Rural Residential/Agricultural Zone. The Rural Residential/Agricultural LSZ is the dominant landscape type, and occurs throughout the study area. The landscape is characterized by level to gently rolling topography with a mix of farms and rural residences, open fields, hedgerows, and small woodlots. Open fields tend to occur on the more level ground, while woodlots and bands of forest vegetation occur more commonly on steeper slopes and poorly drained areas. Dominant agricultural uses include crop farming (primarily soybeans, corn, wheat and hay) along with pasture. Foreground (0-0.5 mile), midground (0.5-3.5 miles), and background (>3.5 miles) views of the proposed Facility will be available from many areas within the Rural Residential/Agricultural LSZ.

Zone 2: City/Village Zone. This LSZ includes the City of Urbana and the various villages within the visual study area, and is characterized by high to moderate-density residential and commercial development. Vegetation and landform contribute to visual character in the city and village areas, but within the majority of this zone, buildings (typically 2-3 stories tall) and other man-made features dominate the landscape. Views are most likely from open road corridors and the edges of the city/village zone, where structures and vegetation density decrease and therefore screening is reduced.

Zone 3: Suburban Residential Zone. This zone is dominated by low to medium-density residential neighborhood development that typically occurs along the main road frontage or in cul-de-sacs spurring off the main roads, such as on the outskirts of the City of Urbana and in Northridge. Buildings tend to be 1-2 stories in height, and more spread out than in a village setting. Consequently, open views to the surrounding landscape are generally more restricted than in open agricultural areas, but more available than in areas of more concentrated human settlement. Land use in this zone is almost exclusively residential, suggesting a relatively high sensitivity to visual quality and visual change.

Zone 4: Hamlet Zone. This zone includes the hamlets of Middletown, Fountain Park, Kennard, Cable and Mingo. The hamlets generally consist of a cluster of residential and municipal structures, often at the intersection of two or more highways.

Residences tend to have larger backyards and may border on active or inactive agricultural land and/or woodlots. Occasional commercial establishments, churches, and historic structures are found in some of these areas. Views are most likely from the edges of the hamlet zone, where housing and vegetation density decrease and therefore screening is reduced. Potential Facility visibility will vary based on distance between the hamlets and the proposed Facility.

Viewer/User Groups

Three categories of viewer/user groups were identified within the visual study area, consisting of local residents, through travelers/commuters, and tourists/recreational users. Each of these categories of is described below:

Local Residents. Local residents include those who live and work within the visual study area, and generally view the landscape from their yards, homes, local roads and places of employment. Residents are concentrated in and around the City of Urbana, and the various villages and hamlets, but occur throughout the visual study area. Except when involved in local travel, residents are likely to be stationary, and have frequent or prolonged views of the landscape. Local residents may view the landscape from ground level or elevated viewpoints (typically upper floors/stories of homes). Residents' sensitivity to visual quality is variable, however, it is assumed that residents may be very sensitive to changes in particular views that are important to them.

Through Travelers/Commuters. Commuters and travelers passing through the area view the landscape from motor vehicles on their way to work or other destinations. Commuters and through travelers are typically moving, have a relatively narrow field of view, and are destination oriented. Drivers on major roads in the area will generally be focused on the road and traffic conditions, but do have the opportunity to observe roadside scenery. Passengers in moving vehicles will have greater opportunities for prolonged off-road views than will drivers, and accordingly, may have greater perception of changes in the visual environment.

Tourists/Recreational Users. Recreational users and tourists include local residents and out-of-town visitors involved in cultural and recreational activities at parks, recreational facilities, and historic sites, as well as in undeveloped natural settings such as forests and fields. These viewers are concentrated in the recreational facilities/cultural sites located within and adjacent to the visual study area. Members of this group may view the landscape from area highways while on their way to these destinations, or from the sites themselves. This group includes, bicyclists, hikers, recreational boaters, hunters, fishermen and those involved in more passive recreational activities (e.g., picnicking, sight seeing, or walking). Visual quality may or may not be an important part of the recreational experience for these viewers. However, for some, scenery will be a very important part of their experience, and in almost all cases enhances the quality of recreational experiences. Recreational users and tourists will often have continuous views of landscape features over relatively long periods of time from ground-level vantage points.

Visually Sensitive Resources

The 5-mile radius visual study area includes several sites that could be considered scenic resources of statewide significance. These include 31 sites/districts listed on the National Register of Historic Places (including 21 in Mechanicsburg and eight in Urbana). Within the visual study area, there is one State Park (Buck Creek State Park), one State Nature Preserve (Prairie Road Fen), one parcel of Nature Conservancy land (Darby Wetlands Reserve) and one National Natural Landmark (Cedar Bog Nature Preserve). There are no State Forests, National Wildlife Refuges, National Park Service Lands, designated State or Federal trails, or designated scenic roads or overlooks. There are also no state or federally designated wild, scenic, or recreational rivers or national rivers inventory (NRI) designated rivers within the visual study area.

Beyond these scenic resources of statewide significance, the 5-mile radius study area also includes areas that are regionally or locally significant/sensitive, due to the type of land use they receive. These include Ohio Caverns, the C.J. Brown Reservoir, and various golf courses, local parks, schools, waterbodies, churches, cemeteries, areas of concentrated human settlement (City of Urbana and various villages and hamlets), and heavily traveled state highways.

These resources are listed in Table B1 of Exhibit I. The location of visually sensitive resources within the visual study area is illustrated in Exhibit I, Figure 6, and on the large-scale viewshed maps included as Appendix B of the VIA.

(ii) Visual Impact Assessment Methodology and Results

Facility Visibility

An analysis of Facility visibility was undertaken to identify those locations within the visual study area where there is potential for the proposed wind turbines to be seen from ground-level vantage points. This analysis included identifying potentially visible areas on viewshed maps, preparing technical cross sections, and verifying visibility in the field. The methodology and results for each of these assessment techniques are described below.

Viewshed Analysis. Topographic viewshed maps for the Facility were prepared using USGS digital elevation model (DEM) data (7.5-minute series), the location and height of all proposed turbines (see Exhibit I, Figure 2), and ESRI ArcView® software with the Spatial Analyst extension. *Two 5-mile radius topographic viewsheds* were mapped, one to illustrate "worst case" daytime visibility (based on a maximum blade tip height of 492 feet above existing grade) and the other to illustrate potential visibility of turbine lights (based on a nacelle height of 328 feet above existing grade).

The resulting topographic viewshed maps define the maximum area from which any turbine within the completed Facility could potentially be seen within the study area during both daytime and nighttime hours (ignoring the screening effects of existing vegetation and structures). Because the screening provided by vegetation and structures is not considered in this analysis, the topographic viewsheds represent a "worst case" assessment of potential Facility visibility.

A turbine count analysis was performed to determine how many wind turbines are potentially visible from various locations within the viewshed. This analysis was based on blade tip height and utilizes the same topographic viewshed methodology described above. As indicated by the turbine count analysis in Exhibit I, Table 3, in most areas where potential blade tip visibility is indicated by the topographic viewshed analysis, views to the majority (37-70) of the proposed turbines could be available. Only about 15% of the 5-mile radius study area has the potential for views that include fewer than 19 turbines (if screening by trees is not considered).

Two vegetation viewshed maps were also prepared to better illustrate the potential screening effect of forest vegetation. The vegetation viewsheds utilized a base vegetation layer created with USGS National Land Cover data (forests) with an assumed elevation of 40 feet.

Potential turbine visibility, as indicated by the viewshed analyses, is illustrated in Figure 7 and summarized in Table 2 of Exhibit I. As indicated by the topographic blade tip analysis, the proposed Facility could potentially be visible in approximately 95.5% of the 5-mile study area. This "worst case" assessment of potential visibility indicates the area where any portion of any turbine could possibly be seen without considering the screening effect of existing vegetation and structures. Areas where there is no possibility of seeing the Facility are generally limited to the backside of hills and some stream valleys primarily in the vicinity of Mingo and Catawba, and on some slopes along the far western edge of the study area. The vast majority of the visually sensitive sites within the 5-mile study area are indicated as having potential views of the Facility (based on blade tip height and topography alone). As indicated by the turbine count analysis in Exhibit I, Table 3, in most areas where potential blade tip visibility is indicated by the topographic viewshed analysis, views to the majority (37-70) of the proposed turbines could be available. Only about 15% of the 5-mile radius study area has the potential for views that include fewer than 19 turbines (if screening by trees is not considered).

Areas of potential nighttime visibility based on the topographic viewshed analysis (Exhibit I, Figure 7, Sheet 2) cover approximately 92.7% of the 5-mile radius study area, and are indicated in roughly the same locations shown by the blade tip analysis. However, areas where over 55 turbines could potentially be visible are reduced from 59% to 34% of the study area, and areas where fewer than 19 turbines could be visible are increased from 15% to 22% of the study area.

Factoring vegetation into the viewshed analysis reduces potential Facility visibility, and is a more accurate reflection of what the actual extent of Facility visibility is likely to be (Exhibit I, Figure 7, Sheet 3 and 4). Within a 5-mile radius, the vegetative viewshed analysis indicates that approximately 84.6% of the area will have potential views of some portion of the Facility. Visibility will be eliminated in small areas throughout the study area where blocks of forest vegetation occur. These areas occur most commonly in a north-south band that runs through the central portion of the study area. Compared to the topographic blade tip viewshed, areas where fewer than 19 turbines could potentially be visible increased from 15% to 31% of the study area simply by factoring in the screening effect of vegetation. Roughly the same is true when comparing the vegetation and topographic viewshed analysis of the nacelle height (see Exhibit I, Table 2). As indicated in Exhibit I, Table B2, considering the screening effect of vegetation in the viewshed analysis reduces potential Facility visibility from sensitive sites, but the majority of these sites are indicated as still having at least partial visibility.

Areas of actual visibility are anticipated to be much more limited than indicated by the viewshed analysis, due to the slender profile of the turbines (especially the blade, which make up the top 160 feet of the turbine), the effects of distance, and screening from hedgerows, street trees and structures, which are not considered in the viewshed analysis.

Cross Section Analysis. To further illustrate the screening effect of vegetation and structures within the study area, four representative line-of-sight cross sections (ranging from 6.1 to 9.8 miles long) were cut through the study area. Cross section locations were chosen so as to include visually sensitive areas (e.g., villages, water bodies, and major roads) and cover the various landscape similarity zones occurring within the 5-mile radius study area. The cross sections are based on forest vegetation and topography as indicated on the 7.5-minute USGS quadrangle maps and digital aerial photographs. For the purposes of this analysis, a uniform 40-foot tree height was assumed. A 10 fold vertical exaggeration was used to increase the accuracy of the analysis and facilitate reader interpretation.

Cross section analysis (Exhibit I, Figure 8) indicates that the Facility will be visible from between 55% and 66% of the area along the selected lines of sight. Although this conclusion only applies to the specific lines of sight evaluated, analysis suggests that views of the Facility from many of the visually sensitive sites within the study area are likely to be at least partially screened by buildings and trees. The cross sections indicate that views of turbines along the selected site lines will either not be available or will be partially screened from the Villages of Mutual and Woodstock, the City of Urbana, and most historic sites within that occur within the study area. It should be noted that views of other turbines, not located along the selected cross sections may be available from some of the sensitive receptors that are indicated as being screened along the selected section lines. The results of the cross section analysis are summarized in Exhibit I, Table 3.

Field Verification. Visibility of the proposed Facility was also evaluated in the field on January 24-25, 2008. The purpose of this exercise was to verify potential turbine visibility as indicated by viewshed analysis and to obtain photographs for subsequent use in the development of visual simulations. A mix of clear skies and high clouds resulted in good visibility and a representative variety of sky/lighting conditions.

During the field verification, an EDR field crew drove public roads and visited public vantage points within the 5-mile radius study area to document points from which the turbines would likely be visible, partially screened, or fully screened. This determination was made based on the visibility of existing structures located in proximity to the proposed turbine sites (communication towers, silos, houses, roads, etc.), which served as locational and scale references. Photos were taken from 116 representative viewpoints within the study area. All photos were obtained using Nikon D200 digital SLR camera with a focal length between 28 and 35 mm (equivalent to between 45 and 55 mm on a standard 35 mm film camera). This focal length most closely approximates normal human eyesight relative to scale. Viewpoint locations were determined using hand-held GPS units and high resolution aerial photographs (digital ortho quarter quadrangles). The time and location of each photo were documented on all electronic equipment (camera, GPS unit, etc.) and noted on field maps and data sheets (see Appendix C of Exhibit I). Viewpoints photographed during field review generally represented the most open, unobstructed available views toward the Facility.

Field review also suggested that actual Facility visibility is likely to be more limited than suggested by viewshed mapping. This is due to the fact that screening provided by buildings and trees within the study area is more extensive and effective than assumed in these analyses (e.g., vegetation is more extensive than indicated on the USGS maps, and often taller than 40 feet in height). The result is that certain sites/areas where "potential" visibility was indicated by viewshed mapping were actually well screened from views of the proposed Facility. Field review confirmed a lack of visibility from areas that were screened by structures and trees, particularly developed areas such as the City Urbana and the various villages within the study area. In general, only on the outskirts of these areas, where open fields adjoined residential areas, were open views available in the direction of the Facility site. Even in the more rural/agricultural portions of the study area, hedgerows and trees not indicated on the USGS maps often blocked/interrupted views toward the Facility site in many areas. However, open views that include at least some of the proposed turbines will be available from a broad range of distances/locations within the Rural Residential/Agricultural LSZ. A comprehensive summary of potential Facility visibility from sensitive sites is presented in the Exhibit I, Table B2.

(iii) Conclusions

Viewshed mapping, cross section analysis, and field verification indicate that the Facility has the potential to be visible from the majority of the 5-mile radius study area. In most locations where turbines will be visible, significant portions of the overall Facility are also likely to be visible. However, in many areas a significant number of the turbines will be at least partially screened by trees and structures.

Viewshed analysis indicates that views of the Facility are likely to be available from the majority of the visually sensitive resources and areas of intensive land use that occur within the 5-mile radius study area. However, for many sensitive sites within the study area, including National Register-listed historic sties and others that occur in the City of Urbana and the various villages, cross section analysis and field review suggest that the Facility will either not be visible or will be significantly screened by foreground vegetation and structures.

Simulations of the proposed Facility, indicate that the visibility and visual impact of the wind turbines will be highly variable, based on landscape setting, the extent of natural screening, the presence of other man-made features in the view, and distance of the viewer from the Facility.

Evaluation by a licensed EDR landscape architect indicates that the Facility's overall contrast with the visual/aesthetic character of the area will generally be moderate. Minimal contrast was noted for viewpoints over 3.5 miles from the Facility, while more appreciable contrast was noted where foreground and near mid-ground views of turbines (i.e., under 1.0 mile) are available, where substantial numbers of turbines span the field of view, Facility/or where the turbines appear out of context/character with the landscape (i.e., in more suburban residential areas). However, in most cases the reviewing landscape architect felt the Facility was compatible with the working agricultural landscape that makes up the majority of the visual study area.

Based upon the nighttime photos/observations of existing wind power projects, the red flashing lights on the turbines could result in a nighttime visual impact on certain viewers, and night lighting could be somewhat distracting and have an adverse effect on rural residents that currently experience dark nighttime skies. It should be noted that nighttime visibility/visual impact will be reduced on this Facility due to 1) FAA lighting guidelines which typically result in aviation warning lights on only about one third to one half the turbines, 2) the presence of yard trees and hedgerows that screen portions of the Facility from many locations, and 3) the concentration of residences in villages, hamlets, and along highways where existing lights already compromise dark skies and compete for viewer attention.

Mitigation options are limited, given the nature of the Facility and its siting criteria (tall structures typically located in open fields). However, various mitigation measures were considered. These included the following:

- **Screening.** Due do the height of individual turbines and the geographic extent of the proposed Facility, screening of individual turbines with earthen berms, fences, or planted vegetation will generally not be effective in reducing Facility visibility or visual impact. However, selective off-site planting could be effective in screening views from some cemeteries, local parks, or historic resources in the area (see Viewpoint 54 as an example).

- **Relocation.** Again, because of the extent of the Facility, the number of individual turbines, and the variety of viewpoints from which the Facility can be seen, turbine relocation will generally not significantly alter visual impact. Where visible from sensitive resources within the study area, (e.g., local parks. cemeteries, and heavily used roadways) numerous turbines are likely to be visible, and relocation of individual machines would have little effect on overall visual impact. Throughout the study area, views of the Facility are highly variable and include different turbines at different vantage points. Therefore, turbine relocation would generally not be effective in mitigating visual impacts.

- **Camouflage.** The white color of wind turbines (as mandated by the FAA to eliminate the need for day time lighting) minimizes contrast with the sky under most conditions, especially when viewed at distance against the horizon. Consequently it is recommended that this color be utilized on the Facility. The size and movement of the turbines prevents more extensive camouflage from being a viable mitigation alternative (i.e., they cannot be made to look like anything else).

- **Low Profile.** A significant reduction in turbine height is not possible without significantly decreasing power generation. To off-set this decrease, additional turbines would be necessary. There is not adequate land under lease to accommodate a significant number of additional turbines, and a higher number of shorter turbines would not necessarily decrease Facility visual impact.

- **Downsizing.** Reducing the number of turbines could reduce visual impact from certain viewpoints. However, unless this reduction was drastic, the visual impact of the Facility would change only marginally from most locations within the study area where numerous turbines are visible. A dramatic reduction in turbine number (e.g., reduction by 50%) would impact the Facility's economic viability.

- **Alternate Technologies.** Alternate technologies for power generation (fossil fuel, nuclear, solar, etc.) would have different, and perhaps more significant, visual impacts than wind power. Alternative utility-scale wind power technologies (e.g., vertical axis turbines), that could reduce visual impacts, do not currently exist.

- **Nonspecular Materials.** Where possible, non-reflective paints and finishes will be used on the wind turbines to minimize reflected glare. Where this is not feasible, natural weathering/dulling of any glossy surfaces will typically occur within one year following installation.

- **Lighting.** Turbine lighting will be kept to the minimum allowable by the FAA. Medium intensity red strobes will be used at night, rather than white strobes or steady burning red lights.

- **Maintenance.** The turbines and turbine sites will be maintained to ensure that they are clean, attractive, and operating efficiently. Research and anecdotal reports indicate that viewers find wind turbines more appealing when the rotors are turning (Stanton, 1996). In addition, the Facility developer will establish a decommissioning fund to ensure that if the Facility goes out of service and is not repowered/redeveloped, all visible above-ground components will be removed.

- **Offsets.** Correction of an existing aesthetic problem within the viewshed is a viable mitigation strategy for wind power projects that result in significant adverse visual impact. However, because the analysis presented herein does not indicate a significant adverse impact, offset mitigation is not proposed at this time.

In addition to the mitigation measures described above, other measures that will reduce or mitigate visual impact have been incorporated into the Facility design. These include the following measures: (1) all turbines will have uniform design, speed, color, height and rotor diameter; (2) towers will include no exterior ladders or catwalks; (3) the Facility operations and maintenance building will reflect the vernacular architecture of the area; (4) new road construction will be minimized by utilizing existing farm lanes whenever possible; and (5) the placement of any advertising devices on the turbines will be prohibited.

(e) *Any Unusual Features*

No unusual features are expected, as all Facility components are consistent with typical wind energy facilities.

(4) Plans for Construction

Facility construction is anticipated to proceed in the following sequence:

- Grading of the field construction office and collection substation areas;
- General clearing and construction of access roads, crane pads and turn-around areas;
- Construction of turbine tower foundations;
- Installation of the electrical collection system;

- Assembling and erection of the wind turbines;
- Construction and installation of the collection substation;
- Plant commissioning and energization;
- Final grading and drainage; and
- Restoration activities.

Please see 4906-13-04(B)(1) for additional detail.

(5) Future Plans

The Facility presented herein totals 70 turbines. Depending on the turbine model selected, the Project will have the capacity to generate 126 to 175 MW of emissions-free electricity that will collect to an electric substation in Union Township, Champaign County (OPSB docket 08-666-EL-BGN). This point of interconnection has a maximum capacity of 200 MW. The Applicant may eventually add additional turbines in the vicinity of the Project Area to assure that the interconnection capacity is fully utilized. However, no specific sites for future turbines have been identified at this time.

(C) EQUIPMENT

(1) Electric Power Generating Equipment

See 4906-13-02(A)(2) of this Application.

(2) Emissions Control and Safety Equipment[24]

(a) *Flue Gas Emission Equipment Including Tabulations of Expected Efficiency, Power Consumption, and Operating Costs for Supplies and Maintenance*

Wind turbines generate clean, emission-free electricity without releasing airborne pollutants and will not have emission control equipment installed. Therefore this section is not applicable.

[24] The subsections required under draft rules 4906-17-05(C)(2) do not correspond directly to the requirements of rule 4906-13-04(C)(2). Information is presented herein to comply with both rules.

(b) *Reliability of Emissions Equipment and the Reduction and Efficiency for Partial Failure*
Wind turbines generate clean, emission-free electricity without releasing airborne pollutants and will not have emission control equipment installed. Therefore this section is not applicable.

(c) *Equipment Proposed for Control of Effluence Discharged into Bodies of Water and Receiving Streams*
No effluents will be discharged into streams or water bodies.

(d) *Public Safety Equipment*
Public safety concerns associated with Facilityconstruction include 1) the movement of large construction vehicles, equipment, and materials, 2) falling overhead objects, 3) falls into open excavations, and 4) electrocution. These issues are most relevant to construction personnel who will be working in close proximity to construction equipment and materials and exposed to construction related hazards on a daily basis. However, the risk of construction-related injury will be minimized through regular safety training and use of appropriate safety equipment.

The general public could also be exposed to construction-related hazards due to the passage of large construction equipment on area roads and unauthorized access to the work site (on foot, by motor vehicle, ATV, or snowmobile). The latter could result in collision with stockpiled materials (soil, rebar, turbine components), as well as falls into open excavations. Because construction activities will adhere to industry safety standards and will occur primarily on private land well removed from adjacent roads and residences, exposure of the general public to construction-related risks/hazard is expected to be very limited.

Wind turbines, due to their height, physical dimensions, and complexity, have the potential to present response difficulties to local emergency service providers and fire departments. Although the turbines contain relatively few flammable components, the presence of electrical generating equipment and electrical cables, along with various oils (lubricating, cooling, and hydraulic) does create the potential for fire or a medical emergency within the tower or the nacelle. This, in combination with the elevated location of the nacelle and the enclosed space of the tower interior makes response to a fire or other emergency difficult, and beyond the capabilities of most local fire departments and emergency service providers. The presence of high voltage electrical equipment also presents potential safety risks to local responders.

All turbines and electrical equipment will be inspected by the utilities (for grid and system safety) prior to being brought on line. This, along with implementation of built-in safety systems, minimizes the chance of fire occurring in the turbines or electrical stations. However, fire at these facilities could result from a lighting strike, short circuit or mechanical failure/malfunction. Any of these occurrences at a turbine would be sensed by the System Control and Data Acquisition system and reported to the Facility control center. Under these conditions, the turbines would automatically shut down and Facility maintenance personnel would respond as appropriate.

Lightning protection systems were first added to rotor blades in the mid 1990s, and are now a standard component of modern turbines (Korsgaard & Mortensen, 2006). These systems rely on lightning receptors and diverter strips in the blades that provide a path for the lightning strike to follow to the grounded tower. Lightning is effectively and safely intercepted at several receptor points including the outermost blade tip and the blade root surface, and transmitted to the wind turbine's lightning conductive system. The turbines' blade monitoring system provides documentation of all critical lightning events. If a problem is detected, the turbine will shut down automatically, or at a minimum, be inspected to assure that damage has not occurred.

In the unlikely event that a wind turbine were to catch fire, it would typically be allowed to burn itself out while maintenance and fire personnel maintain a safety area around the turbine to protect against the potential for spot ground fires that might start due to sparks or falling material. Power to the circuit of the Facility with the turbine fire is also disconnected. An effective method for extinguishing a turbine fire from the ground does not exist, and the events generally do not last long enough to warrant attempts to extinguish the fire from the air (Global Energy Concepts, 2005). However, since the public does not have access to the private land on which the turbines are located, risk to public safety during a fire event is essentially non-existent. In addition, transformers at the substation are equipped with a fire suppression system. This system will quickly extinguish any fires that occur at the Facility substation, and shutdown power to the facility.

Generally, any emergency/fire situations at a wind turbine site or substation that are beyond the capabilities of the local service providers will be the responsibility of the Facility owner/operator. Construction and maintenance personnel (and properly trained and equipped regional responders) will be trained and will have the equipment to deal with emergency situations that may occur at the Facility site (e.g., tower rescue, working in confined spaces, high voltage, etc.). Consequently, such an incident would generally not expose local emergency service providers or the general public to any public health or safety risk. The Applicant will likely include local rescue workers in training for the emergency procedures specific to the turbine model used for the Facility. This would provide additional trained rescue personnel in the unlikely case of injury or other accident occurring in the turbines.

Exhibit J consists of the safety manual for Nordex turbines (representative of those that would be used for the proposed Facility), and addresses safety measures specific to the operations and maintenance employees, such as first aid, protection against falls, and personal protective equipment.

(3) Other Major Equipment

Other major equipment associated with the proposed Facility includes an electrical substation. As described in 4906-13-02(A)(2), the substation will be located near the intersection of Pisgah Road and Route 56 in the Town of Union, adjacent to the Givens to Mechanicsburg section of the Urbana – Mechanicsburg – Darby 138 kV transmission line. The substation will step up voltage from 34.5 kV to 138 kV to allow connection with the existing transmission line. The substation will consist of two areas, the utility substation and the Facility substation, and will include dead-end structures, circuit breakers, air break switches, metering units, relaying, communication equipment, a step up transformer, and a separate control house for each area. The substation will be approximately 350 by 200 feet in size, enclosed by chain link fencing, and accessed from Pisgah Road via a new gravel-surfaced road approximately 0.1 mile in length.

Substation construction will begin with clearing the site and stockpiling topsoil for later use in site restoration. The site will be graded, and a laydown area for construction trailers, equipment, materials, and parking will be prepared. Concrete foundations for major equipment and structural supports will be poured, followed by the installation of various conduits, cable trenches, and grounding grid conductors. Above-ground construction will involve the installation of structural steel, bus conductors and insulators, switches, circuit breakers, transformers, control buildings, and wiring. The final steps involve laying down crushed stone across the stations, erecting a chain link perimeter fence, connecting the high voltage links, and testing the control systems.

(D) REGIONAL ELECTRIC POWER SYSTEM

(1) Interconnect Queue(s)

(a) *Name of Queue*

Urbana – Mechanicsburg – Darby 138 kV circuit (Mechanicsburg to Givens section).

(b) *Web Link of Queue*

http://www.pjm.com/pub/planning/project-queues/feas_docs/r52_fea.pdf

(c) *Queue Number*

PJM queue R52.

(d) *Queue Date*

December 6, 2006.

(2) System Studies

PJM Interconnection (PJM) prepared a Feasibility Study (September 2007), which is attached hereto as Exhibit B. PJM also completed a Generation Interconnection System Impact Study Report (February 2009), attached as Exhibit C.

(a) *Feasibility Study*

The PJM Feasibility Study analyzed a 300 MW generating capability that would utilize two separate points of interconnection, 100 MW to be injected into the King's Creek substation and 200 MW to be injected along the Urbana – Mechanicsburg – Darby 138 kV circuit. However, for the purposes of this Certificate Application, only the 200 MW interconnection (injecting into the Mechanicsburg to Givens section of the Urbana – Mechanicsburg – Darby 138 kV circuit) is applicable. As indicated in electronic mail correspondence dated October 23, 2008 from PJM's Ken Mancini (see Exhibit B), the original 300 MW request was split into two separate projects. The 200 MW interconnection is retained the queue number R52, while the 100 MW King's Creek interconnection was assigned the queue number R52A. All future analyses, including the system impact study, will be conducted two separately for each interconnection point.

The feasibility study (see Exhibit B) evaluated compliance with reliability criteria for summer peak conditions in 2011. The report indicated normal interconnection-related costs, which were in the expected range. The report also described overloads for which the Facility may responsible for an allocated share of the mitigation. The overload of the Kammer 765/500 kV autotransformer was based on an old rating and should be removed from the list. The Kings Creek – Logan 69 kV overload was identified under the assumptions that both queues R52 and R52A would be in simultaneous service. The majority (approximately 75%) of the increased loading can be attributed to the R52A 69 kV project. Without the R52A queue, the loading may be below the emergency rating; if not, the identified mitigation would be significantly reduced.

The report also identified conditions under which Facility output could be curtailed. Several of these conditions are based on the outdated rating data, and should therefore be removed from the list. The remaining congestion issues identified are based on a snapshot of very specific system conditions, with a very low probability of occurrence at any given time. The likelihood of all projects modeled in the queue being available to generate at full output during the summer peak hour are slight. A curtailment of the Facility to something less than full output for a few hours, if these conditions ever exist, should not have an adverse affect on the overall operation of the Facility (PJM, 2007).

(b) *System Impact Study*

PJM Interconnection issued the System Impact Study (SIS) Report in February 2009. This report evaluated Queue R52 as a 200 MW injection into the Givens – Mechanicsburg 138 kV line. The Facility was studied with 87 2.3 MW turbines, for a total of 200 MW to be interconnected at a new switching station located along the DPL Urbana – Darby 138 kV circuit. The new switching station will be owned and operated by DPL, and will consist of three 138 kV breakers configured as a ring-bus, a 138 kV revenue meter, and other associated facilities. The interconnection of new generation also necessitates the installation of a transfer trip scheme between Darby and Urbana substations. DPL will engineer and field test the relaying and protection package at the point of interconnection. The collection system portion of the substation will consist of two 138-34.5 kV 66/88/110 Megavolt-ampere (MVA) transformers and a 34.5 kV collector system. Each turbine will have its own 34.5-0.69 kV 2.6 MVA transformer.

Compliance with reliability criteria was assessed for summer peak conditions in 2012. The report identified two facilities that would experience thermal overloads, and three breakers that would be over-dutied as a result of this generation Facility. The SIS indicated the following system upgrades to correct the violations: (1) replace line terminal equipment at Urbana substation, (2) re-conductor approximately 4.3 miles of circuit, and (3) replace three 69 kV circuit breakers at Urbana (PJM, 2009).

PJM also performed a stability study as part of the SIS. The results did not identify any operating issues other than identifying operating voltage and power factor ranges. In addition, PJM performed deliverability testing. No deliverability or transmission system congestion problems associated with this Facility were identified (PJM, 2009).

4906-13-05 FINANCIAL DATA

(A) OWNERSHIP

The Applicant will construct all structures and equipment associated with the Facility, and the Applicant will own and operate all such structures, with the likely exception of portions of the collection system and substation. It is anticipated that the overhead 34.5 kV electrical collection lines and the 138 kV portion of that substation will be owned and operated to DPL, depending on final operating arrangements currently under negotiation. The 34.5 kV portion of the substation also will likely be owned and operated by DPL.

The overhead 34.5 kV electrical collection lines will be located on rebuilt distribution poles located within public road right-of-ways. The proposed Facility will not change the ownership status of such right-of-ways. All other components of the Facility will be located entirely on privately owned land (plus collection line road crossings), and voluntary lease agreements between the Applicant and private landowners will accommodate the Facility. Lease agreements will cover 20 years from Commercial Operation Date, with a bilateral option to extend for an additional 20 years. The agreements will be recorded with the Champaign County Recorder's Office. The proposed Facility and associated lease agreements will not change the ownership status of such private lands, with the possible exception of the O&M facility for which the Applicant may either lease land or purchase an existing building and associated land. In addition, the proposed Facility will not change the ownership status of land (e.g., private parcels, public roads/right-of-ways) located within the Project Area[25].

The Applicant (Buckeye Wind LLC) is a wholly owned subsidy of Everpower Wind Holdings, Inc ("EverPower"). EverPower is a New York based developer of utility grade wind projects. The Company identifies or acquires early stage development opportunities across the United States. EverPower was established in 2002, and the principals of Everpower have a proven track record in permitting and developing large-scale energy projects. This experience has served as the foundation for EverPower's activities in wind energy, and the company has quickly amassed a large portfolio of wind projects. Everpower is primarily a green field developer. By identifying and

[25] Rule 4906-13-05(A) requires the applicant to state ownership status of the proposed "facility". However, proposed rule 4906-17-06(A) requires the applicant to state the ownership status of the proposed "project area", which is defined by proposed rule 4906-17-01(B) as "the total wind-powered electric generation facility, including associated setbacks". In some instances, such setbacks extend beyond the boundaries of leased private land into unassociated private land and/or public roads/right-of-ways.

developing project sites from early stages, EverPower seeks to manage the inherent risks of project development and maximize value in the process.

(B) CAPITAL AND INTANGIBLE COSTS

(1) Estimated Capital and Intangible Cost

The estimated capital and intangible costs of the Facility are summarized in Table 05-1. As alternative sites and facilities were not considered in this Certificate Application (see motion for waiver in Exhibit Y), the capital cost information in this section is limited to the Facility. Equipment includes turbines, electric collection and transmission infrastructure, and meteorological towers. Installation includes erection and installation labor, engineering, project management, and land acquisition.

Table 05-1. Estimated Capital and Intangible Costs.

Description	**Cost (126 MW)**	**Cost (140 MW)**	**Cost (175 MW)**
Equipment Costs			
Generator	[redacted]	[redacted]	[redacted]
Balance of Plant	[redacted]	[redacted]	[redacted]
Interconnect	[redacted]	[redacted]	[redacted]
Other	[redacted]	[redacted]	[redacted]
Total Equipment Costs	[redacted]	[redacted]	[redacted]
Intangible Costs			
Development/Management	[redacted]	[redacted]	[redacted]
Insurance	[redacted]	[redacted]	[redacted]
Permitting	[redacted]	[redacted]	[redacted]
Financing/Other	[redacted]	[redacted]	[redacted]
Total Intangible Costs	[redacted]	[redacted]	[redacted]
Total	[redacted]	[redacted]	[redacted]
Cost per kW	[redacted]	[redacted]	[redacted]

(2) Capital Cost Comparison

Due to the Applicant's relatively small number of similar projects, a direct cost comparison is not meaningful, however, national data is available to provide a general comparison, and a waiver has been requested (see Exhibit Y). Installed project costs compiled by the U.S. Department of Energy Lawrence Berkeley National Laboratory indicate that the capital costs of the Facility are in line with recent industry trends. The Berkeley National Laboratory compilation show an average installed cost ranged from $1,240 to $2,600 per kW, with an average of $1,710. Installation costs in 2008 were expected to rise to an average of $1,920 per kW due to increases in turbine costs (Wiser & Bolinger, 2008). Based on this trajectory, the costs presented in Table 05-2 are in line with expected national averages. However, recent industry shifts suggest that turbine prices will begin to decline. Therefore, it is likely that the values indicated in Table 05-2 could decrease by the time the Facility is financed.

(3) Present Worth and Annualized Capital Costs

Capital costs will include development costs, construction design and planning, equipment costs, and construction costs. The costs will be incurred within a year or two of start of construction. Therefore, a present worth analysis is essentially the same as the costs presented in Section 4906-13-05(B)(1) of this Application. As alternative sites and facilities were not considered in this Certificate Application (see Exhibit Y), the capital cost information in this section is limited to the Facility.

(C) OPERATION AND MAINTENANCE EXPENSES

(1) Estimated Annual Operation and Maintenance Expenses

The annual operation and maintenance costs for the Facility during the initial two years of operation are estimated to be in the range of [redacted] per year. Table 05-2 summarizes the anticipated operation and maintenance expenses.

Table 05-2. Estimated Annual Operation & Maintenance Expenses.

Description	Cost
Staffing	[redacted]
General Maintenance	[redacted]
Total	[redacted]

(2) Operation and Maintenance Cost Comparisons

Due to the Applicant's relatively small number of similar projects, a direct cost comparison is not meaningful, however, national data is available to provide a general comparison (see Exhibit Y). As technology improves, operations and maintenance costs are decreasing. The values in Table 05-2 represent an O&M cost of about [redacted]. Data compiled by the Berkeley National Laboratory indicates that these estimated O&M costs are in line with recent market trends (Wiser & Bolinger, 2008).

(3) Present Worth and Annualized Operation and Maintenance

The annual operation and maintenance costs itemized in 4906-13-05(C)(1) will be subject to real and inflationary increases. Therefore, these costs are expected to increase after the first two years with inflation. The Net Present Value of the operation and maintenance costs, using an inflation rate of 2% and arbitrary 10% discount rate, is between [redacted]. As alternative sites and facilities were not considered in this Certificate Application (see Exhibit Y), the operation and maintenance cost information in this section is limited to the Facility

(D) DELAYS

The monthly delay costs depend on various factors. If the delay occurs in the permitting stage, the losses are associated with the time value of money resulting from a delay in the timing of revenue payments. This is estimated to be about $200,000 per month. If the delay were to occur during construction, the costs would include lost construction days and the costs associated with idle crews and equipment. This is estimated to be about $4.5 million per month.

Significant costs for delays would be incurred if the delays prevented the Facility from meeting deadlines for federal incentive programs. If delays prevented the Facility from meeting those timelines, the cost would be estimated at about $25 million for loss of the opportunity to take advantage of the Investment Tax Credit or other associated credits or grants, and about $10 million for loss of rapid depreciation incentives for renewable energy production equipment. Prorating these delay costs monthly would not be meaningful, as the lost opportunity is triggered at a single deadline and does not accrue over time.

4906-13-06 ENVIRONMENTAL DATA

(A) GENERAL

This section provides environmental data regarding air, water, and solid waste in terms of current site conditions, potential impacts of the proposed facility, and proposed mitigation measures.

(B) AIR

(1) Pre-construction

(a) *Ambient Air Quality*

The State of Ohio Environmental Protection Agency (Ohio EPA) Division of Air Pollution Control publishes air quality data for the State of Ohio annually. The most recent summary of air quality data available for the state is the *Division of Air Pollution Control 2006 Annual Report* (Ohio EPA, 2006). Included in this report are a summary of 2006 air quality data, a discussion of toxics monitoring projects, and trend studies for selected pollutants. While no air monitoring sites are located in Champaign County, monitoring stations for various pollutants were located in four of the six adjacent counties. Pollutants monitored in nearby counties include particulate matter in Clark County; sulfur dioxide in Clark County; ozone in Clark, Madison, and Miami Counties; and lead in Logan County. National Ambient Air Quality Standards (NAAQS) for ozone were exceeded at monitoring stations in both Clark and Madison Counties. No other violations of NAAQSs were reported in the vicinity of the Project Area (Ohio EPA, 2006).

Air emissions in the general area are related primarily to farm operations, vehicular travel, and manufacturing. Vehicles traveling area roads and farm equipment produce exhaust emissions, along with dust from unpaved road surfaces. In addition, routine odors are associated with certain farming practices (e.g., manure-spreading). The largest sources of manufacturing emissions in the vicinity of the Project Area originate from the Honda Plant in Logan County, Trutec Industries in Clark County, and the Scotts Company in Union County, located approximately 9, 10, and 14 miles from the Project Area, respectively (EPA, 2009). Although at times an annoyance, none of these have a significant adverse effect on local air quality.

(b) *Air Pollution Control Equipment*

Because wind turbines generate electricity without releasing pollutants into the atmosphere, the use of air pollution control equipment is not proposed. Water, calcium carbonate, or temporary paving may be used to suppress dust on unpaved roads during construction, as described in 4906-13-06(B)(2) below.

(c) *Applicable Federal and/or Ohio New Source Performance Standards (NSPS) Air Quality Limitations, Applicable National Ambient Air Quality Standards (NAAQS), and Applicable Prevention of Significant Deterioration (PSD) Increments*

In accordance with Section 111 of the Clean Air Act Extension of 1970, the EPA established New Source Performance Standards (NSPS) to regulate emissions of air pollutants from new stationary sources. The OAC regulations do not contain any NSPS regulations beyond those promulgated at the federal level. These standards apply to a variety of facilities including landfills, boilers, cement plants, and electric generating units fired by fossil fuels. Because wind turbines generate electricity without releasing pollutants into the atmosphere, NSPSs do not apply to the proposed Facility.

All new sources of air emissions in Ohio are required to obtain a Permit to Install (PTI) for Title V facilities, or a Permit to Install and Operate (PTIO) for non-Title V facilities. Because wind turbines generate electricity without releasing pollutants into the atmosphere, the proposed Facility will not require a PTI or PTIO.

Administered by the US EPA, the Acid Rain Program was established by the Clean Air Act Amendments of 1990 to reduce emission of SO_2 and NO_x through regulatory and market based approaches. Because wind turbines generate electricity without releasing pollutants into the atmosphere, the proposed Facility will not require an acid rain permit.

Prevention of Significant Deterioration (PSD) applies to new major sources of pollutants, or major modifications at existing sources for pollutants, where the area the source is located is in attainment or unclassifiable with the NAAQS. The proposed Facility will not be a major source of any pollutants. Therefore, PSD does not apply.

(d) *List of all Required Permits to Install and Operation Air Pollution Sources*

Wind turbines generate electricity without releasing pollutants into the atmosphere. Therefore, air pollution permits are not required for the proposed facility.

(e) *Map of Air Monitoring Stations and Major Present and Anticipated Air Pollution Sources*

As indicated above, wind turbines generate electricity without releasing pollutants into the atmosphere. Therefore, this section is not applicable to the Facility.

(f) *Compliance with Required Permits*

As indicated above, wind turbines generate electricity without releasing pollutants into the atmosphere. Therefore, this section is not applicable to the Facility.

(2) Construction

Best management practices will be utilized and implemented to minimize the amount of dust generated by construction activities. All construction vehicles will be maintained in good working condition to minimize emissions from construction-related activities. In addition, the extent of exposed/disturbed areas on the site at any one time will be minimized and restored/stabilized as soon as possible. Water or calcium carbonate will be used to suppress dust on unpaved roads (public roads as well as Facility access roads) as needed throughout the duration of construction activities. If necessary, temporary paving (e.g., oil and stone) could be used to stabilize dusty surfaces in certain locations (e.g., staging areas). However, oil and stone dust suppression methods will not be applied within, or immediately adjacent to, sensitive areas such as streams or wetlands. Any unanticipated construction-related dust problems will be identified and immediately reported to the construction manager and contractor.

(3) Operation

Although the Facility will not require air quality monitoring plans (given that it will not release pollutants to atmosphere), Facility operation has the potential to reduce current emissions from existing power plants. Nationwide, the United States currently obtains 71% of its electricity from fossil fuels, with 49% coming from coal, the fossil fuel with the highest carbon dioxide content per unit of electricity produced (EIA, 2007a). As shown in Table 06-1, the state of Ohio relies more heavily on fossil fuels than the national average, with 86% of electricity generated from coal (PUCO, 2008).

Table 06-1. Ohio Electric Generation by Fuel Source.

Generation Resource	Percent of Fuel Mix
Coal	86
Nuclear	10
Natural Gas & Other Gases	2
Petroleum	1
Hydroelectric & Other Renewables	1

Source: PUCO, 2008.

Total annual carbon dioxide emissions in the United States currently approach 6 billion metric tons (bmt) (EIA, 2007b); these emissions are projected to rise to 7 bmt annually by 2030 (EIA, 2008). Every 10,000 MW of wind energy installed can reduce carbon dioxide emissions by approximately 33 million metric tons (MMT) annually if it replaces coal-fired generating capacity, or 21 MMT if it replaces generation from the United States average fuel mix (San Martin, 1989).

A detailed analysis by the Department of Energy's Pacific Northwest Laboratory in 1991 estimated the energy potential of the United States wind resource at 10.8 trillion kilowatt-hours (kWh) annually (Elliot *et al.*, 1991). This potential generating capacity represents more than twice the electricity generated in the U.S. today (AWEA, 2008a). Switching from fossil fuel energy generation to wind power generations contributes to cleaner and healthier air, since wind power generation has zero emissions and is not a direct source of regulated (or unregulated) pollutants such as nitrogen oxides, sulfur dioxide, and mercury.

In 2006, President Bush emphasized the nation's need for greater energy efficiency and a more diversified energy portfolio. This led to a 2008 report, produced by the Department of Energy, which explores a modeled energy scenario where wind energy provides 20% of U.S. electricity by 2030. This report concludes that obtaining 20% of the nation's electricity from wind by 2030 is ambitious, but could be feasible if significant challenges identified in the report are overcome. If the goal of obtaining 20% of national electricity from wind energy by 2030 were achieved, the country would avoid putting 825 MMT of carbon dioxide annually into the atmosphere, or a cumulative total of 7.6 billion metric tons by 2030 (USDOE, 2008). Thus, by contributing to this effort, the Facility will have an incremental and long-term beneficial impact on climate and air quality.

Specifically, the operation of this Facility is anticipated to have a positive impact on air quality by producing approximately 331,000 to 460,000 MWh of electricity annually with zero emissions (assuming a nameplate capacity of 126 to 175 MW, operating at 30% capacity). Power delivered to the grid from this Facilitywill directly offset the generation of energy at existing conventional power plants (Jacobsen & High, 2008). Table 06-2 summarizes anticipated emission displacements for the 70-turbine Facility, showing the range of air quality benefits that would be realized for the typical rated capacity of modem turbines, based on emissions rates for electricity used in Ohio.

Table 06-2. Estimated Annual Emission Displacements from the Facility.

Pollutant	Estimated Annual Displacement in Tons		
	1.8 MW Turbines (331,128 MWh)	2.0 MW Turbines (367,920 MWh)	2.5 MW Turbines (459,900 MWh)
CO_2 (carbon dioxide)	299,174	332,416	415,520
NO_x (nitrogen oxides)	1,142	1,269	1,587
SO_2 (sulfur dioxide)	2,633	2,925	3,656
Mercury Compounds	3,328	3,693	4,623
Lead Compounds	4,699	5,221	6,526

Sources: Abraxas Energy, 2009; Leonardo Academy, 2004.

(a) *Air Quality Monitoring Plans*

As indicated above, wind turbines generate electricity without releasing pollutants into the atmosphere. Therefore, this section is not applicable to the Facility.

(b) *Isopleth Map*

As indicated above, wind turbines generate electricity without releasing pollutants into the atmosphere. Therefore, this section is not applicable to the Facility.

(c) *Procedures to be Followed in the Event of Failure of Air Pollution Control Equipment, Including Consideration fo the Probability of Occurrence, Expected Duration and Resultant Emmissions*

As indicated above, wind turbines generate electricity without releasing pollutants into the atmosphere. Therefore, this section is not applicable to the Facility.

(C) WATER

As indicated on the base mapping of Figure 3, named perennial streams within the Project Area include Kings Creek, Buck Creek, Little Darby Creek, Macochee Creek, Spain Creek, and Treacle Creek. The Project Area lies within the drainage of the Upper Scioto River Basin and the Upper Great Miami River Basins, United States Geological Survey (USGS) eight-digit Hydrologic Unit Codes (HUC) 05060001 and 05080001, both of which eventually drain to the Ohio River (USGS, 2008a). These drainage basins are then divided into 11-digit sub-watersheds, which are used by the Ohio EPA when preparing Integrated Water Quality Monitoring and Assessment Reports. Table 06-3 summarizes watersheds within the Project Area.

Table 06-3. Watersheds within the Project Area.

11-digit HUC	Watershed Name	Description
05060001 210	Little Darby Creek	
05080001 150	Mad River	Headwaters to Kings Creek
05080001 160	Mad River	Kings Creek to Chapman Creek
05080001 170	Buck Creek	

The Greater Miami Sole Source Aquifer is a buried valley aquifer system underlying the Great Miami, Little Miami, and Mill Creek watersheds in the western portion of the Project Area. "Sole source" designation indicates that an aquifer supplies at least 50% of the drinking water to persons living over the aquifer, and there is no feasible alternate source of drinking water for these individuals. The Greater Miami Sole Source Aquifer provides drinking water to 1.6 million people. It occurs in bedrock valleys incised into uplifted Silurian and Ordovician bedrock by a tributary of the Teays preglacial drainage system. Depth to groundwater in most parts of the aquifer is less than 20 feet, and supply wells in sand and gravel deposits commonly yield more than 1,000 gallons per minute (USGS, 2008b). The Ohio Department of Natural Resources (ODNR) subdivides buried valley aquifers into Class I and Class II aquifers, based on hydrogeologic characteristics, including potential productivity and proximity to recharge (FR, 1988). The portion of the Greater Miami Sole Source Aquifer that underlies portions of the Project Area is designated as Class II, indicating that it has low-intermediate to low potential productivity (MVRPC, 2005).

(1) Pre-construction

(a) *List of all Permits Required to Install and Operate Water Pollution Control Equipment and Treatment Processes*

Prior to the start of construction, the Applicant will obtain the following permits:

- The Ohio National Pollutant Discharge Elimination System (NPDES) construction storm water general permit, Ohio EPA Permit No. OHC000002

- The Ohio NPDES general permit for stormwater discharges associated with construction activity within the Big Darby Creek watershed, Ohio EPA Permit No. OHCD00001
- An individual permit or nationwide permit under Section 404/401 of the Clean Water Act (if necessary)
- An Ohio Isolated Wetland Permit (if necessary)
- An Ohio Permit to Install on-site sewage treatment under OAC 3745-42 (if necessary)

(b) *Map of Monitoring and Gauging Stations*

The Facility is not anticipated to have measurable impacts on the quantity or quality of surrounding water resources; therefore, pre-construction survey data have not been collected, and water monitoring and gauging stations have not been mapped.

(c) *Ownership of Monitoring and Gauging Stations*

Not Applicable. The Facility is not anticipated to have measurable impacts on the quantity or quality of surrounding water resources; therefore, pre-construction survey data have not been collected, and water monitoring and gauging stations have not been mapped.

(d) *Existing Water Quality of the Receiving Stream Based on at Least One Year of Monitoring Data, Using Appropriate Ohio Environmental Protection Agency Reporting Requirements*

General information about existing water quality in the vicinity of the Project Area was obtained from an Ohio EPA (2008) document, *Integrated Water Quality Monitoring and Assessment Report*, compiled under Clean Water Act Sections 303(d) and 305(b). This report lists stream segments with impaired ambient water quality in the State of Ohio. All four 11-digit HUC watersheds within the Project Area are listed as impaired in both the Aquatic Life Use Assessment and Recreation Use Assessment. In addition, Fish Tissue Assessments were listed as impaired for three of the Project Area 11-digit watersheds (all except Buck Creek). High magnitude causes of impairment include direct habitat alteration, nutrients, metals, and siltation. High magnitude sources of impairment include channelization for agriculture and development, upstream impoundment, sanitary overflows, urban runoff/storm sewers, industrial and municipal point source, spills, and septage disposal. Table 06-4 summarizes causes and sources of impairment by watershed.

Table 06-4. Causes and Sources of Project Area Watershed Impairment.

Watershed HUC	Causes of Impairment	Sources of Impairment
05060001 210	• Unknown Toxicity • Siltation • Nutrients • Organic Enrichment	• Spills • Pasture Land • Channelization – Agriculture • Nonirrigated Crop Production • Minor Municipal Point Source
05080001 150	• Direct Habitat Alterations	• Channelization – Agriculture
05080001 160	• Organic Enrichment • Nutrients • Metals • Priority Organics • Direct Habitat Alterations • Siltation	• Minor Municipal Point Source • Channelization – Agriculture and Development • Sanitary Overflows • Urban Runoff/Storm Sewers • Contaminated Sediments
05080001 170	• Direct Habitat Alterations • Flow Alteration	• Upstream Impoundment

Source: Ohio EPA, 2008.

(e) *Data Necessary for Completion of any Application Required for a Water Discharge Permit for any State or Federal Agency for this Project*

As mentioned in 4906-13-06(C)(1)(a), the Facility will require a NPDES Construction Storm Water General Permit (OHC000002) from the Ohio EPA. This permit is required for all construction sites disturbing 1 acre (or more) of ground. To obtain this permit, the Applicant must develop a Stormwater Pollution Prevention Plan (SWP3), and file a Notice of Intent (NOI) letter with the Ohio EPA at least 21 days prior to the commencement of construction activities.

The SWP3 will address all minimum components of the NPDES permits, and conform to the specifications of the Rainwater and Land Development manual, which describes Ohio's standards for storm water management, land development, and urban stream protection. The SWP3 will identify potential sources of pollution that may reasonably be expected to affect the quality of storm water discharges associated with construction activities. If applicable, the SWP3 will also clearly identify all activities that will be authorized under Section 401 of the Clean Water Act and be subject to an anti-degradation review. In addition, the SWP3 will describe and ensure the implementation of best management practices that reduce the pollutants in storm water discharges during construction (ODNR, 2006).

(2) Construction

The draft rules 4906-17(C)(2)(a), Instructions for the Preparation of Certificate Applications for Wind-powered Electric Generation Facilities, request that a schedule for receipt of the NPDES be included in this section. Please refer to Section 4906-13-06(C)(3)(c) of this Application for the NPDES permit schedule.

(a) *Map of Monitoring and Gauging Stations*

Facility construction activities will be dispersed over a large area resulting in a relatively low level of soil disturbance and minimal addition of impervious surfaces within the overall Facility site. In fact, soil disturbance associated with Facility construction is a small fraction of the acreage of soil routinely exposed through plowing and other agricultural activities within the area. Additionally, impact minimization and avoidance measures described in 4906-06(C)(2)(c) will be utilized to further reduce potential impacts to receiving water bodies. For example, impacts to wetlands will be entirely avoided. Where streams must be crossed by access roads or electrical collection lines, special crossing techniques will be employed to avoid stream impacts that would require Clean Water Section 401 and 404 Permits.

For these reasons, Facility construction is not anticipated to have measurable impacts on the quality or quantity of surrounding water resources. Therefore, no monitoring and gauging stations are proposed, and none are mapped.

(b) *Quantity/Quality of Aquatic Discharges from the Site Clearing and Construction Operations, Including Runoff and Siltation from Dredging, Filling, and Construction of Shore Side Facilities*

The proposed Facility will not result in wide-scale conversion of land to built/impervious surfaces. Tower bases and associated crane pads, access roads, the substation, and the O&M facility in total will add approximately 72 acres of impervious surface to the approximately 9,000 acres of leased land (i.e., conversion of 0.8%). Consequently, no significant changes to the rate or volume of stormwater runoff are anticipated.

Construction of the proposed Facility could result in certain localized impacts to groundwater; installation of turbine foundations has the greatest potential for impacts.

Based on the preliminary turbine design information, the footing excavations will be approximately ten feet below existing ground surface. Due to the anticipated depth of bedrock in the area, blasting will probably not be necessary for construction. When required, blasting can generate seismic vibrations, fracture bedrock, and potentially impact groundwater levels. However, the site layout incorporates turbine setbacks from residences of at least 1000 feet. Since private wells are typically located within 100 feet of residences, the turbine setbacks should ensure that that private wells are not damaged and that well yields are not reduced (if blasting is necessary). In addition, responses to well surveys mailed to Project Area residents indicated that local wells encountered water at a depth of 15 to 200 feet, most commonly in the range of 30 to 60 feet. This suggests that even if blasting should be required, it would not likely encounter groundwater. Therefore, construction is not anticipated to physically damage private wells or affect well yields (Hull, 2008c).

In addition to potential impacts to groundwater due to turbine foundation installation, minor impacts could result from other Facility activities. Soil compaction from the use of construction equipment could limit the efficiency of surface water infiltration to groundwater. When soils are compressed, the pore spaces within the soil are decreased, which reduces water percolation. Construction of access roads will result in minor increases in storm water runoff that otherwise would have infiltrated into the ground at the road locations. However, areas so affected would be a tiny percentage of the ground surface within the site, and will not have a significant impact on groundwater recharge. Buried electrical interconnect lines can also facilitate near-surface groundwater migration along trench backfill in areas of shallow groundwater. However, as previously indicated, depth to groundwater is most commonly in the range of 30 to 60 feet. Therefore, near surface groundwater migration is anticipated to be minimal, and should not affect groundwater levels in the Project Area. Construction of Facility components that traverse wetlands could also have an impact on groundwater as many wetlands serve as groundwater recharge areas. However, through careful Facility design, impacts to wetlands will be avoided, thereby eliminating any potential impact to the groundwater recharge function of affected wetlands.

A final potential impact to groundwater is the possible introduction of pollutants to groundwater from accidental discharge of petroleum or other chemicals during construction. Such discharges could occur in the form of minor leaks from fuel and hydraulic systems, as well as more substantial spills that could occur during refueling or due to mechanical failures and other accidents.

(c) *Plans to Mitigate the Above Effects in Accordance with Current Federal and Ohio Regulations*

The construction process could potentially impact groundwater, should excavation or blasting occur below the water table or alter fractures in the rock that carry ground water. Although not anticipated, if any blasting is necessary for construction of wind turbine foundations, it will be designed with appropriate charge weights and delays to localize bedrock fracturing to the proposed foundation area, minimizing the already unlikely chance of impacting water levels in residential wells. The exact location of private water supply wells within the Project Area will be determined and clearly marked to avoid potential damage. As described above, groundwater is not expected to be encountered, even if blasting is required. However, should groundwater be encountered during excavation, water removal shall be conducted in accordance with the following best management practices:

- A sump pit shall be used to trap and filter water for pumping to a suitable discharge point.
- Clean pumped water shall be discharged to a vegetated and stabilized area (or to an appropriately sized level spreader or riprap energy dissipater) to prevent scouring of the receiving area.
- Sediment-laden water shall be pumped through a filter bag or into a sediment trapping device prior to discharge.
- No discharges shall occur directly to a receiving water body.

In addition to the SWP3 described in Section 4906-13-06(C)(1)(e) of this Application, Spill Prevention, Containment, and Countermeasure (SPCC) procedures will be implemented to prevent the release of hazardous substances into the environment. These procedures will not allow refueling of construction equipment within 100 feet of any stream or wetland, and all contractors will be required to keep materials on hand to control and contain a petroleum spill, including a shovel, tank patch kit, and oil-absorbent materials. Any spills will be reported in accordance with Ohio EPA Division of Emergency and Remedial Response regulations.

As described in Section 4906-13-07(F)(1)(b) of this Application, topsoil removal and de-compaction will be conducted in agricultural areas where soil restoration is necessary to accommodate future agricultural uses. These practices will also mitigate any potential impacts that soil compaction could have on infiltration of rain and snowmelt, thereby further reducing any potential impact to groundwater recharges. Furthermore, the construction footprint will be minimized by defining/delineating the work area in the field prior to construction, and adhering to work area limits during construction. These measures will limit potential impacts of soil compression on normal infiltration rates.

Impacts to wetlands will be avoided, while impacts to surface waters will be minimized by utilizing existing or narrow crossing locations whenever possible. Upgrading existing crossings that are under-maintained/undersized will have a long-term beneficial effect on water quality, as it will help to keep farm equipment and other vehicles out of surface waters. Special crossing techniques, equipment restrictions, herbicide use restrictions, and erosion and sedimentation control measures will be utilized to reduce adverse impacts to water quality, surface water hydrology, and aquatic organisms. In addition, clearing of vegetation along stream banks will be kept to an absolute minimum. For additional information on mitigation measures to protect wetlands and surface water, see 4906-13-07(B)(2)(c).

These mitigation measures will ensure that impacts to groundwater, surface waters, and wetlands are avoided or minimized to the maximum extent practicable during Facility construction.

(d) *Changes in Flow Patterns and Erosion due to Site Clearing and Grading Operations*
As a result of the mitigation measures discussed in 4906-13-06(C)(2)(c) above, changes to flow patterns are not anticipated, and impacts to surface waters and wetlands will not be significant.

(3) Operation

(a) *Map of Monitoring and Gauging Stations*
The Facility will add only small areas of impervious surface, which will be dispersed throughout the Project Area, and will have a negligible effect on surface water runoff and groundwater recharge. Facility operation will not involve the discharge of water or waste into streams or water bodies, nor will Facility operation require the use of water for

cooling or any other activities, and thus measurable impacts on the quality of surrounding water resources are not anticipated. Therefore no monitoring and gauging stations are proposed, and none are mapped.

(b) *Description of Water Pollution Control Equipment and Treatment Processes Planned for the Proposed Facility*

Not Applicable. The Facility generates electricity without the use of water.

(c) *NPDES Permit Schedule*

As described in 4906-13-06(C)(1)(a), Facility construction will require two separate NPDES permits: (1) a construction storm water general permit, Ohio EPA Permit No. OHC000002, and (2) a general permit for stormwater discharges associated with construction activity within the Big Darby Creek watershed, Ohio EPA Permit No. OHCD00001. The Applicant anticipates full and complete compliance with these permits. The NOI and associated fee for the Construction Activities General Permit will be filed at least 21 days prior to commencement of construction activities. Under the Construction Activities in the Big Darby Watershed General Permit, the Applicant anticipates that the NOI, an approvable SWPPP, and the associated fee will be filed at least 45 days prior to commencement of construction activities.

Facility operation will not discharge wastewater, effluent, or other pollutants to surface waters. Therefore, Facility operation will not require any NPDES permits.

(d) *Description of Water and Waterborne Wastes*

The O&M facility will generate sewage and wastewater comparable to a typical small business office. These waterborne wastes will be disposed of through use of a septic system or municipal sewage treatment system, and if necessary, the Applicant will obtain a permit to install on-site sewage treatment under OAC 3745-42. No other Facility components will discharge measurable quantities of wastewater. Therefore, flow diagram information is not applicable.

(e) *Water Conservation Practices*

The O&M facility will use water at a rate comparable to a typical small business office. No other Facility components will use measurable quantities of water. Therefore, water conservation practices are not applicable.

The US Department of Energy, Office of Energy Efficiency and Renewable Energy issued a report detailing the water conservation benefits of wind energy as compared to thermal power. According to that report, the Facility could conserve about 220 million gallons of water annually (NREL, 2006).

(D) SOLID WASTE

(1) Pre-construction

The Applicant is not aware of any debris or solid waste within the Project Area that would require removal for Facility development.

(2) Construction

Facility construction will generate some solid waste, primarily plastic, wood, cardboard and metal packing/packaging materials, construction scrap, and general refuse. This material will be collected from turbine sites and other Facility work areas, and disposed of in dumpsters located at the construction staging areas. A private contractor will empty the dumpsters on an as-needed basis, and dispose of the refuse at a licensed solid waste disposal facility. In addition, Facility construction will require clearing or disturbance of approximately 6.7 acres of vegetation, 4.1 acres of which is forested. Trees cleared from the work area will be cut into logs and either left for the landowner or removed, while limbs and brush will be buried, chipped, or otherwise disposed of as directed by the landowner and as allowed under federal, state, and local regulations.

(3) Operation

For the most part, Facility operation will not result in significant generation of debris or solid waste. The O&M facility will generate solid wastes comparable to a typical small business office, and will likely utilize local solid waste disposal services.

(4) Licenses and Permits

Facility operation will not require acquisition of licenses or permits for the generation, storage, treatment, transportation, and/or disposal of waste.

4906-13-07 SOCIAL AND ECOLOGICAL DATA

(A) HEALTH AND SAFETY

(1) Demographic

The Project Area occurs in Champaign County, within the Townships of Goshen, Rush, Salem, Urbana, Union, and Wayne. Additional communities that occur within five miles of the proposed Facility include the City of Urbana; the Villages of Catawba, Mechanicsburg, Mutual, North Lewisburg, and Woodstock; the census-designated place (CDP) of Northridge; the Towns of Concord, Mad River, Somerford, and Allen; and the counties of Clark, Logan, Madison, and Union. In addition, a number of hamlets (or unincorporated communities) occur within five miles, including Cable, Catawba Station, Fountain Park, Kennard, Kings Creek, Middletown, Mingo, and Powhattan. Table 07-1 provides the population of each county, town, city, and village that occurs within five miles of the proposed Facility, based on the 1990 and 2000 census, as well as 2007 and 2020 population estimates from the Ohio Department of Development, Office of Policy Research and Strategic Planning. Projected 2020 population data are only available at the state and county levels; therefore, a waiver has been requested from this requirement (see Exhibit Y) and this data is not provided for towns, cities, or villages.

Table 07-1. Populations of Communities within Five Miles of the Proposed Facility.

Governmental Unit	1990 Census Population	2000 Census Population	2007 Population Estimate	2020 Population Projection
Champaign County	36,019	38,890	39,522	44,050
Town of Goshen	3,172	3,383	3,434	-
Town of Concord	1,122	1,408	1,484	-
Town of Mad River	2,353	2,650	2,738	-
Town of Rush	2,248	2,779	2,811	-
Town of Salem	2,045	2,307	2,431	-
Town of Union	1,651	1,920	2,014	-
Town of Urbana	14,770	14,968	14,824	-
Town of Wayne	1,416	1,660	1,742	-
City of Urbana	11,353	11,613	11,408	-
Village of Mechanicsburg	1,803	1,744	1,698	-
Village of Mutual	126	132	129	-
Village of North Lewisburg	1,160	1,588	1,575	-
Village of Woodstock	296	317	309	-
Clark County	147,548	144,742	140,477	141,660

Governmental Unit	1990 Census Population	2000 Census Population	2007 Population Estimate	2020 Population Projection
CDP of Northridge	5,939	6.853	7.769	-
Town of Moorefield	9,621	11,402	11,193	-
Town of Pleasant	2,700	3,134	3,282	-
Village of Catawba	268	312	316	-
Logan County	42,310	46,005	46,279	51,340
Town of Monroe	1,274	1,503	1,595	-
Town of Zane	704	968	1,026	-
Madison County	37,068	40,213	41,499	45,190
Town of Pike	506	531	543	-
Town of Somerford	2,544	2,939	2,993	-
Union County	31,969	40,909	47,234	64,570
Town of Allen	901	1,518	1,912	-
Town of Union	1,658	1,565	1,920	-

Sources: Saratoga Associates, 2009; US Census Bureau, 1992; US Census Bureau, 2002; Ohio Department of Development, 2003; and Ohio Department of Development, 2007.

Despite recent and projected growth, the area remains quite rural in nature. The estimated population density in Champaign County is 93.4 persons per square mile, compared to 280.5 persons per square miles statewide.

(2) Atmospheric Emissions

The Facility will not utilize air pollution control equipment because wind turbines generate electricity without releasing pollutants into the atmosphere. Therefore, there will be no probable impact to the population due to failures of air pollution control equipment.

(3) Noise

To establish existing ambient sound levels and evaluate potential sound impacts from the Facility, a Noise Impact Assessment was prepared (see Exhibit K). The two primary phases of the study included a background/ambient sound level survey and a computer modeling analysis of future turbine sound levels. The study was performed by Hessler Associates, Inc. (2009), a member of the National Council of Acoustical Consultants with over 30 years of experience evaluating industrial, commercial, and residential noise issues.

(a) *Construction Noise Levels*

Noise from construction activities associated with the Facility is likely to temporarily constitute a moderate unavoidable impact at some of the homes in the Project Area. Assessing and quantifying these impacts is difficult, because construction activities will constantly be moving from place to place around the site, leading to highly variable impacts at any given point. In general, the maximum potential noise impact at any single residence might be analogous to a few days to a few weeks of repair or repaving work occurring on a nearby road, or to the sound of machinery operating on a nearby farm. More commonly (at houses that are some distance away), the sounds from Facility construction are likely to be faintly perceived as the far off noise of diesel-powered earthmoving equipment characterized by such things as irregular engine revs, back up alarms, gravel dumping and the clanking of metal tracks (Hessler, 2009).

Construction of the Facility is anticipated to consist of several principal activities:

- Access road construction and electrical interconnect line trenching,
- Site preparation and foundation installation at each turbine site (as indicated in Exhibit F, blasting is unlikely to occur),
- Material and subassembly delivery, and
- Turbine erection.

As required by rule 4906-13-07(A)(3)(a)(i) through (vi), the individual pieces of equipment likely to be used for each of these phases and their typical noise levels are summarized below in Table 07-2. Typical noise levels are as reported in the Power Plant Construction Noise Guide (Bolt et al., 1977). It should be pointed out that conservative values from a somewhat antiquated 1977 reference have been deliberately used for the equipment, to show a worst-case scenario. More recent measurements of modern construction equipment generally indicate significantly lower sound levels. Table 07-2 also shows the maximum total sound levels that might temporarily occur at a typical minimum setback distance of 1000 feet, and the distance at which construction sound levels are likely to become inconsequential (at a level of about 35 dBA). A value of 35 dBA is used here because construction noise has no dependency on wind speed, and is likely to occur during times of calm when background sound levels are minimal. A sound level of 35 dBA during the day (when construction activities will occur) is generally considered a negligible sound level, even in the almost total absence of any natural environmental background sound (Hessler, 2009).

Table 07-2. Typical Construction Equipment Sound Levels.

Equipment Description	Typical Sound Level at 50 feet (dBA)	Estimated Maximum Total Level per Phase at 50 feet (dBA)	Maximum Sound Level at 1000 feet (dBA)	Distance Until Sound Level Decreases to 35 dBA (feet)
Road Construction and Electrical Line Trenching				
Dozer, 200-700 hp	88	92	63	7,600
Front End Loader, 300-750 hp	88			
Grader, 13-16 foot Blade	85			
Excavator	86			
Foundation Work, Concrete Pouring				
Piling Auger	88	88	59	5,900
Concrete Pump, 115 cu yd/hr	84			
Material and Subassembly Delivery				
Off Highway Hauler, 115 ton	90	90	61	6,700
Flatbed Truck	87			
Erection				
Mobile Crane, 75 ton	85	85	56	4,800

Sources: (Hessler, 2009; Bolt *et al.*, 1977).

The values in Table 07-2 generally indicate that, depending on the particular activity, sounds from construction equipment are likely to be at least intermittently audible at distances of up to 7,600 feet. At the very worst, sound levels ranging from 56 to 63 dBA might temporarily occur over several weeks at the homes nearest to turbine construction sites, and sound levels ranging from 85 to 92 dBA might temporarily occur at property boundaries, assuming such boundaries are located a distance of 50 feet from construction activities. Such levels would not generally be considered acceptable on a permanent basis or outside of normal daytime working hours (when Facility construction is planned), but as a temporary, daytime occurrence construction noise of this magnitude may well go unnoticed by many in the vicinity of the Project Area. This is especially true in agricultural areas, where the sounds of tractors, trucks, and other agricultural machinery are commonplace.

Most proposed turbine sites are located a minimum of 1,000 feet away from permanent residences. However, there may be some cases where road construction or trenching operations occur closer to homes, which could result in higher sound levels if this work occurs very close to residences. For example, a short-term sound level of about 80 dBA is theoretically possible where the distance to nearby work is about 200 feet. In such cases, every effort will be made to give affected residents advanced notice about when this kind of work will be occurring and how long it is expected to last (Hessler, 2009).

(b) *Operational Noise Levels*

(i) Generating Equipment

Background Sound Level Survey

The purpose of the background sound level survey was to determine what minimum environmental sound levels are consistently present and available at the nearest potentially sensitive receptors to mask or obscure potential noise from the Facility. A number of statistical sound levels were measured in consecutive 10-minute intervals over the entire survey period. Of these, the average (Leq) and residual (L90) levels are the most meaningful.

The average, or equivalent energy sound level (Leq), is the average sound level over each measurement interval. This is the "typical" sound level most likely to be observed at any given moment. The L90 residual sound level, on the other hand, is commonly used to conservatively quantify background sound levels. The L90 is the sound level exceeded during 90% of the measurement interval and has the quality of filtering out sporadic, short-duration noise events thereby capturing the quiet lulls between such events. It is this consistently present "background" level that forms a conservative or worst-case basis for evaluating the audibility of a new source.

An additional factor that is important in establishing the minimum background sound level available to mask potential wind turbine noise is the natural sound generated by the wind itself. Wind turbines only operate and produce noise when the wind exceeds a minimum cut-in speed of about 3 m/s (measured at hub height). Turbine sound levels increase with wind speed up to about 8 to 10 m/s, when the sound produced generally reaches a maximum and no longer increases because the rotor has reached a predetermined maximum rotational speed. Consequently, at moderate to high speeds when turbine noise is most significant, the level of natural masking noise is normally also relatively high (due to tree or grass rustle) thus reducing turbine perceptibility. In order to quantify this effect wind speed was measured over the entire sound level survey period at two on-site met towers for later correlation to the sound data (Hessler, 2009).

In order to measure existing background sound levels representative of those experienced in the vicinity of the turbines, sound level monitors were set up at nine positions distributed throughout the Facility vicinity. The survey period lasted 14 days, from January 11 to January 25, 2008. Environmental sound levels are normally lowest in the winter, because wind-induced leaf rustle noise is absent and no insects are present. During the warm weather months significantly higher background sound levels can be expected due to these two principal causes. For detailed information about instrumentation and methodology, see Exhibit K.

Sound levels clearly increased with increasing wind speed, regardless of time of day. The level and behavior was remarkably consistent between the monitoring stations, given the fact that they were spread out over an area of roughly 77 square miles in a variety of settings. Because of this uniformity, it can be concluded that the average sound level would reasonably represent the sound level anywhere in the vicinity of the site, and can be used as a design level. The likelihood of the sound level being substantially different at a location between the monitoring points is extremely remote.

In general, the nighttime L90 background levels have a greater dependency on wind and reach extremely low levels (in the 20 to 25 dBA range) during calm wind conditions, while daytime levels remain relatively elevated even during low wind conditions. At higher wind speeds the daytime and nighttime sound levels are nearly the same. Table 07-3 summarizes the residual background sound levels that characterize the site environment over the range of wind speeds relevant to turbine operation.

Table 07-3. Measured L90 Worst-Case Background Sound Levels.

Wind Speed at Height of 10 m (m/s)	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Daytime L90 Sound Level (dBA)	32	34	35	37	39	40	42
Nighttime L90 Sound Level (dBA)	26	29	32	35	38	41	43

Source: Hessler, 2009.

As described above, the L90 sound levels displayed in Table 07-3 can be considered "worst-case" because these background levels represent the lowest levels that are likely to be observed. These low levels only occur during brief periods of intermittent lulls in all forms of environmental sound (both natural and man-made). By definition, the L90 sound level does not occur over long periods and does not characterize the sound level that is most commonly present. The sound level that is more likely to actually exist most of the time is the average, or Leq, sound level, which may be regarded as the "typical" sound level. Like the L90 measurements, Leq sound levels are also dependent on wind speed, with higher sound levels at higher wind speeds. Table 07-4 summarizes the average background sound levels that characterize the site environment over the range of wind speeds relevant to turbine operation.

Table 07-4. Measured Leq Typical Background Sound Levels.

Wind Speed at Height of 10 m (m/s)	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Daytime Leq Sound Level (dBA)	42	43	44	45	46	47	48
Nighttime Leq Sound Level (dBA)	35	38	40	42	44	46	48

Source: Hessler, 2009.

Assessment Criteria

No existing national or state laws specifically limit Facility noise levels. Therefore, in the absence of any specific or absolute regulatory noise level limits, potential noise from the Facility will be evaluated in terms of its likely audibility or perceptibility at residences (where people are most likely to be most of the time) relative to the background sound level. This approach is commonly used in siting analyses for various types of new infrastructure projects.

A new broadband noise source without any distinctive character (such as tonality or impulsiveness) generally must have a sound level that is about 5 dBA higher than the background before it begins to be perceptible to most people. However, for wind turbines, the threshold of perception is somewhat lower. This is because the sound sometimes has a mildly periodic quality associated with blade "swish" that makes it more readily perceptible than a steady, bland sound of the same magnitude. The sound level rises and falls slightly at about 1 second intervals: the down-coming blade briefly generates aerodynamic noise, which is followed by a very short pause until the next blade comes around. This phenomenon, referred to as amplitude modulation, makes wind turbines more readily perceptible than other sounds of comparable magnitude.

Having said that, however, setting the nominal impact threshold at a point 5 dBA above the prevailing background level represents a reasonable design target in the sense that it balances the interests of all parties. On one hand, the allowable sound level must not be so low and restrictive that, for all practical purposes, no viable wind power projects can be built. On the other hand, the Facility sound level must not be so loud that it leads to legitimate disturbance at a large number of homes. Setting a nominal threshold of 5 dBA above the prevailing background level represents a reasonable design target that strikes a sensible balance between the interests of all parties. This nominal threshold of 5 dBA over the background sound level is consistent with guidelines used for siting wind energy projects in other states, e.g., New York (NYSDEC, 2001).

The design goal described above is considered appropriate for application to existing permanent residences, where people actually are most of the time. At the property lines of adjoining non-participating land parcels, it is not practical to use an ambient-based, incremental increase design criterion, since that would effectively limit any development to a few turbines on vast tracts of land. Furthermore, a low Facility sound level at property lines is also unnecessary in most cases because no one is typically present at the fringe of a land parcel to be affected by potential noise. In the rare instances where property line noise limits have been imposed on wind energy facilities, an absolute noise limit of 50 dBA has typically been used. This limit reasonably caps Facility sound levels at property lines, and will be adopted herein as an additional design goal for operational sound levels at the nearest property boundaries.

Noise Modeling Methodology

Since the specific make and model of turbine to be installed in the Project Area has not yet been determined, Hessler (2009) evaluated two of the models under consideration:

- Nordex N90/2500 LS – 90 meter rotor, 2.5 MW power output
- Repower MM92 – 92 meter rotor, 2.0 MW power output

The sound emissions from both turbine models are similar, as might be expected since both have nearly identical rotors. The overall sound power levels of each unit are below in Table 07-5, as a function of wind speed. These levels come from field tests of operating units carried out by independent acoustical engineers in accordance with IEC 61400-11. Because the Repower values are slightly higher, the modeling studies relied exclusively on these sound levels as inputs in order to present a worst-case scenario.

Table 07-5. Sound Power Levels of Candidate Turbine Models.

Wind Speed at Height of 10 m (m/s)	Nordex N90/2500, Sound Power Level (dBA re: 1 pW)	Repower MM92, Sound Power Level (dBA re: 1 pW)
4	98	-
5	101	101.6
6	103	103.6
7	104	104.4
8	104.5	105
9	104.8	105
10	105	105

Source: Hessler, 2009.

It is important to note in this context that a sound *power* level is not the same thing as a sound *pressure* level, which is the familiar quantity measured by instruments and perceived by the ear. A power level is a specialized calculated measure, expressed in Watts, which is primarily used for acoustical modeling and in design analyses. It is a function of both the sound pressure level produced by a source at a particular distance and the effective radiating area, or physical size of the source. The ostensible magnitude of a sound power level is always considerably higher than the sound pressure level near a source. The fundamental advantage of a power level is that the sound pressure level of the source can be calculated at any distance; hence its importance to noise modeling. For more information about the mathematical relationship between power and pressure sound levels, see Exhibit K.

From the field survey, it was determined that the background sound level varies with wind speed and time of day. From Table 07-5, it can be seen that the turbine sound levels also vary with wind speed. The two values must be compared under the same wind conditions for the comparison to be meaningful. For example, it would be incorrect to compare the maximum turbine sound level, which requires high winds for it to occur, to the background sound level on a calm night. In terms of potential noise impacts, the worst-case conditions would occur at the wind speed where the background level is lowest relative to the turbine sound level or, in other words, where the differential between the background level and turbine sound power level is greatest.

Table 07-6 compares the sound power levels of the Repower MM92 design turbine to the daytime and nighttime L90 and Leq background levels measured during the survey. In the daytime, the maximum differential occurs during 6 m/s wind conditions for both Leq and L90 background levels, while at nighttime, the maximum differential occurs during 5 m/s wind conditions for both Leq and L90 background levels. At lower and higher wind speeds the differentials are lower, indicating that turbine noise is less perceptible relative to the background level.

Table 07-6. Comparison of Background and Turbine Sound Levels.

Daytime Background Sound Levels							
Wind Speed at Height of 10 m (m/s)	4	5	6	7	8	9	10
Turbine Sound Power Level (dBA re: 1 pW)	-	101.6	103.6	104.4	105	105	105
Typical Leq Background Sound Level (dBA)	42	43	**44**	45	46	47	48
Differential (dB)	-	58.6	**59.6**	59.3	58.9	57.8	56.8
Worst-case L90 Background Sound Level (dBA)	32	34	**35**	37	39	40	42
Differential (dB)	-	67.9	**68.2**	67.3	66.2	64.5	62.8
Nighttime Background Sound Levels							
Wind Speed at Height of 10 m (m/s)	4	5	6	7	8	9	10
Turbine Sound Power Level (dBA re: 1 pW)	-	101.6	103.6	104.4	105	105	105
Typical Leq Background Sound Level (dBA)	35	**38**	40	42	44	46	48
Differential (dB)	-	**64.1**	64.0	62.8	61.3	59.2	57.1
Worst-case L90 Background Sound Level (dBA)	26	**29**	32	35	38	41	43
Differential (dB)	-	**72.4**	71.6	69.6	67.3	64.5	61.6

Source: Hessler, 2009.

Cumulative Operational Noise Impact Assessment for Facility

Using the sound power level spectrum, sound level contour plots for the site were calculated using the Cadna/A® version 3.7 sound modeling program developed by DataKustik, GmbH. This software enables proposed Facility turbines and their surroundings, including terrain features, to be realistically modeled in three dimensions. The somewhat complex hill and valley topography of this site was digitized into the sound model from USGS topographic mapping. Each turbine is represented as a point sound source at a height of 80 meters above the local ground surface. The model uses conservative assumptions regarding ground absorption of sound and wind speed, and predicts downwind sound levels from all directions simultaneously, to evaluate the "worst case" sound scenario (Hessler, 2009). Sound contour plots based on typical (Leq) and residual (L90) for both daytime and nighttime conditions are included in Exhibit K, and impacts are described below.

Plots 1A and 1B of Exhibit K show the typical daytime conditions in the northern and southern halves of the Facility, respectively. They illustrate the sound emissions of the Facility during a critical 6 m/s wind, when the Facility is most likely to be audible above the background level, with a nominal impact threshold of 49 dBA (i.e., 5 dBA above ambient, based on the measured Leq background level of 44 dBA). These plots show that a sound level of 49 dBA occurs fairly close to each turbine and well short of any homes. Turbine sound levels will not be 5 dBA or more above the background sound level at any home. In fact, sound levels at homes may be comparable to the measured Leq environmental sound level of 44 dBA. Consequently, there is a very low probability of an adverse impact during daytime hours.

However, if the background sound level is based on the L90, the potential area of impact is considerably larger, as shown in Plots 1C and 1D of Exhibit K. They illustrate the sound emissions of the Facility during a critical 6 m/s wind, when the Facility is most likely to be audible above the background level, with a nominal impact threshold of 40 dBA (i.e., 5 dBA above ambient, based on the measured L90 background level of 35 dBA). In this instance, a few residences, most of which are project participants, fall inside the nominal 40 dBA. However, the vast majority of residences are outside of this nominal impact zone.

During the night, when somewhat lower background sound levels prevail, there is a greater potential that the turbines will be clearly audible at some residences. Plots 2A and 2B of Exhibit K show typical Facility sound emissions during a critical 5 m/s wind, when the Facility is most likely to be audible above the background level, with a nominal impact threshold of 43 dBA (i.e., 5 dBA above ambient, based on the measured Leq background level of 38 dBA). As with the daytime model based on typical Leq sound levels, all homes in the vicinity of the Facility lie outside of the threshold. This suggests there will not be a legitimate disturbance at a significant number of homes during daytime or nighttime hours during average or typical conditions.

When the background level momentarily decreases, it appears that the Facility may become distinctly audible, at least intermittently, over a fairly wide area (see Plots 2C and 2D in Exhibit K). The nighttime residual L90 sound level was measured at 29 dBA during the critical 5 m/s wind conditions, when the Facility is most likely to be audible above the background level, yielding a nominal impact threshold of 34 dBA. Since the predicted worst-case L90 sound levels exceed 34 dBA at a number of residences near the proposed Facility, some adverse reaction to nighttime Facility noise appears to be possible during these particular conditions. However, because these impacts were calculated using L90 sound levels, it is important to note that, by *definition*, these potential impacts could only occur 10% of the time.

Although the nighttime model using residual L90 sound levels indicates the potential for a moderate noise impact at some homes in the vicinity of the Project Area, it is important to realize that this particular case combines a number of assumptions, that taken together intentionally represent the worst possible impact during normal atmospheric conditions. These assumptions include:

- *A 5 m/s Wind Speed* – As shown above in Table 07-6, turbine audibility would be lower at all other wind speeds, both higher and lower.
- *L90 Sound Levels* – The background masking sound is based on the L90 level, which captures momentary lulls in the background level and excludes most noise-causing events, such as cars passing by on nearby roads.

- *Winter Background Levels* -- The background sound level was measured during wintertime conditions, when environmental sound levels are normally the lowest. This ensures the greatest possible differential between background sound and turbine sound is used to determine nominal impact thresholds. During summer months, rustling leaves, bird, and insects sounds mask turbine noise.
- *Observer Outside* – The noise model predicts noise levels outside. Sound levels inside homes will be 10 to 20 dBA lower.
- *Wind Direction* – The wind would need to be blowing from all the nearest turbines directly towards the point of observation.

These conservative assumptions and worst-case conditions have been consciously adopted for the analysis because the perceptibility of turbine noise varies with atmospheric conditions, such as during temperature inversions and periods of unusual wind stratification. Consequently, there may be occasions when the actual impact would approach or possibly even exceed the conservatively predicted levels in the plots. However, the majority of the time, perceptibility of Facility noise will be less than indicated by the models (Hessler, 2009).

Plots 3A and 3B in Exhibit K were prepared specifically to show the relationship between the 50 dBA sound contour and the boundaries of participating land parcels. As discussed above, no state or federal laws regulate sound levels at property lines. For purposes of this analysis, a 50 dBA design target is assumed, since it represents a reasonable limit for property line sound levels associated with wind projects. As these plots show, sound levels of 50 dBA or more are almost entirely confined to participating properties. There are only a few places where sound levels may exceed 50 dBA for a short distance into a neighboring property.

In summary, the predicted L90 sound levels exceed 34 dBA (the nominal nighttime impact threshold) at numerous residences near the proposed Facility, and also exceed 40 dBA (the nominal daytime impact threshold) at a few residences. In absolute terms, sound levels in the 35 to 45 dBA range are often considered "faint" (RSG, 2006) or "very quiet to quiet" (NYSDEC, 2001). Therefore, while the proposed turbines will be audible at many residences shown inside the nominal impact thresholds on Plots 1C, 1D, 2C, and 2D, these predicted noise levels won't necessarily constitute a nuisance. It is important to note that these nominal impact thresholds were calculated relative to the worst-case background noise level, and exceedance of these relative thresholds does not necessarily mean that the Facility will be perceived as noisy. It is also important to note that because these impacts were calculated using L90 sound levels, by definition, these potential impacts only occur 10% of the time. Based on the more typical Leq sound levels, all homes in the vicinity of the Facility lie outside the nominal threshold.

Low Frequency Noise

Although concerns are often raised with respect to low frequency or infrasonic noise emissions from wind turbines, no adverse impact of any kind related to low frequency noise is expected from this Facility. Early wind turbines were designed with the blades downwind of the support tower, and were prone to producing a periodic thumping noise each time a blade passed the tower. The widespread belief that wind turbines generate excessive or even harmful amounts of low frequency noise likely originated with this phenomenon. Modern wind turbines have been re-configured, with blades arranged upwind of the tower, and no longer produce such thumping noises.

The myth of excessive low-frequency noise may have perpetuated due to confusion of the amplitude modulation typical of wind turbines (i.e., the periodic swishing sound with a frequency of about 1 Hz) with low frequency sound. Another possible explanation is that measurements taken during windy conditions can erroneously exhibit elevated levels of low frequency noise caused by wind flowing over the microphone tip, whether a wind turbine is present or not. This self-induced, false-signal distortion is commonly mistaken for actual noise from wind turbines (Hessler, 2009).

However, recent studies conclusively demonstrate that the low frequency content in the sound spectrum of a typical modern wind turbine, like those proposed for this Facility, is no higher than that of the natural background sound level in rural areas. Sondergaard and Hoffmeyer (2007) conducted a study with the specific objective of determining whether large wind turbines produce significant low frequency noise. Multiple elaborate microphone windscreens were used to preclude low frequency self-noise contamination during extremely careful measurements, based on the IEC 61400-11 procedure. The results of this testing show that for a typical turbine, sound levels steadily taper down in magnitude towards the low end of the frequency spectrum. As shown in Figure 3.7.1 in Exhibit K, the measured sound energy below 40 Hz is comparable to or less than the sound energy in the natural rural environment where the measurements were made. Figure 3.7.2 in Exhibit K plots similar measurements taken at an operating wind energy facility in New York State, which produced almost identical results (Hessler *et al.*, 2008).

(ii) Processing Equipment

The proposed Facility will not involve any processing equipment, and therefore no associated operational noise will occur.

(iii) Associated Road Traffic

Once operational, the proposed Facility will not significantly contribute to traffic on local roads. Therefore, impacts from traffic noise are not anticipated.

(c) *Location of Noise-Sensitive Areas*

In addition to residential structures, the predicted sound contour plots in Exhibit K depict recreational areas (including golf courses and partks) and possible noise-sensitive structures (including schools, libraries, churches, hospitals and nursing homes) in the vicinity of the Project Area. Recreational areas within one mile of the Facility include two golf courses and a local park. Possible noise-sensitive areas within one mile of the Facility consist of several churches. Although schools, libraries, hospitals, and nursing homes beyond one mile are depicted on the Plots, none are located within one mile of the proposed Facility.

As shown on Plots 1A-1D, predicted daytime sound levels will not exceed nominal impact thresholds at any of the noise-sensitive sites. Plots 2A-2B portray predicted nighttime sound contours with a nominal impact threshold based on typical Leq sound levels, and as shown, sound levels will not exceed the impact thresholds at any noise-sensitive sites. When nighttime sound contours are predicted based on the worst-case L90 sound levels (Plots 2C-2D), sound levels at a few noise-sensitive sites exceed the nominal impact threshold, including the Chapel Hill Church of God on Ludlow Road, and portions of both Urbana Country Club and Woodland Golf Club. Although churches often offer evening or nighttime services, the sound level of 37 dBA predicted in Plot 2C will occur outside the structure, with indoor sound levels 10-20 dBA lower (well below any threshold of concern). Since golf is not typically played at night, the sound levels should not affect recreational use of the greens.

Therefore, adverse sound impacts to noise-sensitive areas from the proposed Facility are not anticipated.

(d) *Mitigation of Noise Emissions During Construction and Operation*

Over the last decade, the wind industry has invested heavily in reducing turbine noise through improvements in turbine technology, engineering, and insulation. According to a 2006 report prepared by the Renewable Energy Research Laboratory, sound levels emitted by wind turbines have decreased as technology has advanced. Improvements in blade airfoil efficiency have resulted in more of wind energy being converted into rotational energy, and less into acoustic energy. Vibration dampening and improved mechanical design have also significantly reduced noise from mechanical sources. Furthermore, aerodynamic sound generation is very sensitive to speed at the blade tips. Modern variable speed wind turbine, like those proposed for the Facility, rotate at slower speeds in low winds, increasing in higher winds. This results in quieter operation in low winds when compared to older, constant speed wind turbines (Rogers *et al.*, 2006). These findings are consistent with a recent Department of Energy Report (2008), which concluded, "advances in engineering and insulation ensure that modem turbines are relatively quiet; concerns about sound are primarily associated with older technology, such as the turbines of the 1980s, which were considerably louder."

In addition to general improvements in wind turbine technology, significant site-specific mitigation efforts have occurred during the design phase for the proposed Facility. The turbine locations and general site plan have been in development for quite some time, and the current layout is the result of multiple iterations and analyses designed to minimize noise impacts. At least 7 or 8 previous turbine layouts have been modeled over the last year with a view towards proactively identifying and alleviating any significant noise impacts. To reduce the potential for adverse noise impacts, many turbines have been moved further away from residences or to entirely different properties, and an even larger number have been completely removed from the Facility. The site plan presented herein is the result of this extensive noise mitigation effort.

The first noise impact assessment was completed in February 2008, when the site plan contained a much greater density of turbines than the current layout presented herein.

For example, the area bordered by the hamlet of Cable to the north, State Route 36 to the south, Ludlow Road to the west and Parkview Road to the east was originally proposed to host 48 turbines. Because of the adverse noise impacts predicted in the initial assessment, the turbine locations were shifted, with 30 of the turbines ultimately eliminated; the Facility now contains just 18 turbines in the same area where 48 had originally been proposed. This same process occurred throughout the Project Area, and involved constant interaction between Hessler and Associates, Applicant's engineers, and Facility developers. The Applicant is confident that no other project in the country has made a greater effort to mitigate potential impacts to the community. Although residential sound impacts that remain are anticipated to be minor, additional mitigation measures will include the following:

- Implementing best management practices for sound abatement during construction, including use of appropriate mufflers, proper vehicle maintenance, and limiting hours of construction to normal working hours, unless there is a compelling reason to work beyond those hours.
- Notifying landowners of certain construction sound impacts in advance, e.g., if blasting becomes necessary (as indicated in Exhibit F, blasting is unlikely to occur).
- Implementing a reasonable complaint resolution procedure to assure that any complaints regarding construction or operational sound are adequately investigated and resolved.

(4) Water

Hull & Associates, Inc. (2009b) conducted a desktop review of available hydrogeologic and groundwater information for the proposed Facility, attached as Exhibit H. Information was summarized from available on-line databases and/or documents produced by the following Federal, State and Local agencies: the USGS; the FEMA; the ODNR; the Ohio EPA; the Champaign County Engineer and Health Department; and the Ohio State University Agricultural Extension Office. In addition, Hull mailed a single-page well survey to selected landowners within the vicinity of the proposed Project Area that were under contract with the Applicant at the time of mailing in March 2008. Hull received completed well surveys from 24 of the 30 property owners to which the surveys were mailed.

(a) *Public and Private Water Supply Impact*

As shown on Figure 4 in Exhibit H, there are multiple ground water Source Water Protection Areas (SWPAs) in the eastern portion of Champaign County. However, there are no proposed turbines located within a designated Ground Water SWPA. Figure 4 in Exhibit H also depicts the Big Darby Creek surface water SWPA, which comprises the entire extent of the Big Darby Creek Watershed within the Project Area. According to information provided by Ohio EPA, this portion of the Big Darby Creek surface water SWPA is just a small fraction of the Cincinnati Public Water Supply SWPA, which also includes the entirety of the Ohio River drainage basin upstream of the City of Cincinnati, Ohio (Hull, 2009b).

Because of the rural nature of the Project Area, municipal water is generally unavailable, and residents rely upon private wells for their drinking water, as well as for agricultural uses such as watering livestock and irrigating crops. Hull mailed a single-page well survey to property owners that were under contract with the Applicant at the time of mailing. Responses were received from 80% of property owners (see Appendix A of Exhibit H). The majority of respondents indicated they have at least one well, with several landowners indicating the presence of two or three wells, in order to provide additional water for livestock. None of the responding property owners is connected to a municipal water supply (Hull, 2009b).

The majority of the owners were able to provide information regarding the total depth and diameter of their wells. However, only about half of the responding owners were able to provide information regarding the formation (sand and gravel or bedrock) in which the well was installed. Few respondents were able to provide information regarding the depth of water or yield of the completed well. However, several observations can be made based on the information received to date.

Among the wells described in the survey responses, only one well was completed at a depth less than 60 feet. Approximately 12 wells were installed at depths between 60 and 100 feet. All but one of the wells completed at depths shallower than 100 feet were installed in sand and gravel deposits, as were approximately half of the wells completed at depths between 100 and 200 feet. The other half of the wells installed to depths between 100 and 200 feet were reportedly completed in bedrock. With the exception of one well completed at a depth of 250 feet in sand and gravel, all of the wells completed below 200 feet were installed in bedrock. One of the property owners near

Mechanicsburg has two wells installed at depths of approximately 400 feet in bedrock. Flowing springs were noted at another property located near Mechanicsburg. No estimate was given of an approximate yield associated with these springs, but the property owner noted that the flow was sufficient to provide their livestock with water.

Groundwater was typically encountered at depths ranging from 15 to 50 feet in the wells completed in sand and gravel. The typical yield in these wells was reportedly between 5 and 35 gallons per minute (gpm). However, at least three of the wells reportedly installed in sand and gravel had yields in excess of 100 gpm. As would be expected, groundwater depths within the bedrock were typically deeper than those in the sand and gravel wells. Of the six bedrock wells for which depth to water information was included, none had groundwater levels less than 100 feet. Yield information for the bedrock wells was even more limited: only one of the responses included estimated yields. The reported yield for this well was approximately 15 gpm (Hull, 2009b).

One of the final questions included on the survey was whether the property owners had ever experienced any problems with their wells related to the water table being lowered or poor yield. One of the responding property owners indicated that they had to clean their well due to problems with sand entering the casing. Although this well was reportedly used for several more years, the owners eventually installed a deeper well. A second property owner indicated that they installed a new well due to damage to their former well. It does not appear that the responding property owners have experienced problems related to lowered water tables or lower yields from their wells (Hull, 2009b).

The draft rules 4906-17-08(C)(1)(ii) specify a setback from residential structures of 750 feet in horizontal distance from the turbines nearest blade, or 914 feet (half of the total rotor diameter of 328 feet is 164 feet, plus 750 feet = 914 feet). Although the exact location of each potable use well cannot be determined with the information obtained to date, it is assumed that the potable wells are located in close proximity to each property owners' residence. Due to the distance between residences and construction activities at proposed turbine sites, this setback will protect wells from any significant negative impact. Therefore, no impact to public or private water supplies is anticipated from the construction or operation of the proposed Facility (Hull, 2009b).

(b) *Pollution Control Equipment Failures*

Control of water pollution during construction will be managed under an NPDES construction storm water permit and associated storm water pollution prevention plan. An erosion and sediment control plan will be developed prior to construction that will use appropriate runoff diversion and collection devices. Potential impacts to groundwater during construction might include spills of oil or other substances that could infiltrate the soils. Although the quantities of substances on site during construction are not expected to be present in amounts that would represent a significant hazard to surface or groundwater, all contractors will be required to maintain and implement a Spill Prevention, Control, and Countermeasures Plan. Therefore, no impacts to public or private water supplies are anticipated as a result of pollution control failures.

(5) Ice Throw[26]

Ice shedding refers to the phenomena that can occur when ice accumulates on rotor blades, and subsequently breaks free and falls to the ground. Under certain weather conditions, ice may build up on the rotor blades and/or sensors, slowing the rotational speed, and potentially creating an imbalance in the weights of the individual blades. Such effects of ice accumulation can be sensed by the turbine's computer controls and would typically result in the turbine being shut down until the ice melts. As ice builds up on the blades of an operating wind turbine, it can lead to vibration, caused by both the mass of the ice and the aerodynamic imbalances. Modern commercial turbines are equipped with vibration monitors, which shut the machine down when vibrations exceed a pre-set level (Garrad Hassan, 2007).

Field observations and studies of ice shedding indicate that most ice shedding occurs as air temperatures rise and the ice on the rotor blades begins to thaw. Therefore, the tendency is for ice fragments to drop off the rotors and land near the base of the turbine (Morgan *et al.*, 1998). Although less common, ice can potentially be "thrown" when ice begins to melt and stationary turbine blades begin to rotate again (although turbines usually do not restart until the ice has largely melted and fallen straight down near the base). There has been no reported injury caused by ice being "thrown" from an operating wind turbine (Global Energy Concepts, 2005).

[26] Ice throw information is presented herein to comply with the requirements of draft rule 4906-17-08(A)(4).

The distance traveled by a piece of ice depends on a number of factors, including the position of the blade when the ice breaks off, the location of the ice on the blade when it breaks off, the rotational speed of the blade, the shape of the ice that is shed (e.g., spherical, flat, smooth), and the prevailing wind speed. The risk of ice landing at a specific location is found to drop dramatically as the distance from the turbine increases. Garrad Hassan (2007) indicates a negligible risk at distances beyond approximately 722 feet (220 meters) from a wind turbine. However, data gathered at existing wind farms have documented ice fragments on the ground at a distance of 50 to 328 feet from the base of the tower. These fragments were in the range of 0.2 to 2.2 pounds in mass (Morgan *et al.*, 1998). The European Union Wind Energy on in Cold Climates (WECO) research collaborative studied ice throw at operational wind farms throughout Europe. The data gathered shows that ice fragments typically land within 328 feet (100 meters) of the wind turbine (Morgan *et al.*, 1998). Ice throw observations are also available from a wind turbine near Kincardine, Ontario, where the operator conducted 1,000 inspections between December 1995 and March 2001. Only 13 of the 1,000 inspections noted ice, and documented ice fragments on the ground at a distance up to 328 feet (100 meters) from the base of the turbine, with most found within 164 feet (50 meters) (Garrad Hassan, 2007).

The Facility's minimum setback distance of 914 feet between proposed turbines and permanent residences, and at least 590 feet from adjacent property lines, should adequately protect the public from falling ice. In addition, unauthorized public access to the site will be limited. Based upon the results of studies/field observations at other wind power projects, modern turbine technological controls, the Facility's siting criteria, the proposed control of public access to the turbine sites, and the fact that there has been no reported injury caused by ice being "thrown" from an operating wind turbine, it is not anticipated that the Facility will result in any measurable risks to the health or safety of the general public due to ice shedding.

(6) Blade Shear[27]

Another potential public safety concern is the possibility of a rotor blade dropping or being thrown from the nacelle. While extremely rare, such incidents can be dangerous. However, there are no reported instances of a member of the public having been injured as a result of a blade failure of a wind turbine.

[27] Blade shear information is presented herein to comply with the requirements of draft rule 4906-17-08(A)(5).

The reasons for a turbine collapse or blade throw vary depending on conditions and tower type. Past occurrences of these incidents have generally been the result of design defects during manufacturing, poor maintenance, control system malfunction, or lightning strikes (AWEA, 2008b). Evidence suggests that the most common cause of blade failure is human error in interfacing with control systems. Manufacturers have reduced that risk by limiting human adjustments that can be made in the field (Garrad Hassan, 2007). Most instances of blade throw and turbine collapse were reported during the early years of the wind industry. Technological improvements and mandatory safety standards during turbine design, manufacturing, and installation have largely eliminated such occurrences. The reduction in blade failures coincides with the widespread introduction of wind turbine design certification and type approval. The certification bodies perform quality control audits of the blade manufacturing facilities and perform strength testing of construction materials. These audits typically involve a dynamic test that simulates the life loading and stress on the rotor blade. This approach has largely eliminated blade design as a root cause of blade failures (Garrad Hassan, 2007).

Modern utility-scale turbines are certified according to international engineering standards. These include ratings for withstanding different levels of hurricane-strength winds and other criteria (AWEA, 2008c). The engineering standards of the wind turbines proposed for this Facility are of the highest level and meet all federal, state, and local codes. In the design phase, state and local laws require that licensed professional engineers review and approve the structural elements of the turbines. State of the art braking systems, pitch controls, sensors, and speed controls on wind turbines have greatly reduced the risk of tower collapse and blade throw. The wind turbines proposed for the Facility will be equipped with two fully independent braking systems that allow the rotor to be brought to a halt under all foreseeable conditions. In addition, the turbines will automatically shut down at wind speeds over the manufacturers threshold (54 mph for the Repower MM92, 45 mph for the Nordex N100, and 56 mph for the Nordex N90). As described above, the turbines will also cease operation if significant vibrations or rotor blade stress is sensed by the monitoring systems. For all of these reasons, the risk of catastrophic tower collapse or blade shear is minimal. See 4906-13-04(A)(5)(b) for additional information regarding structural integrity as it relates to wind speeds.

A report by the California Wind Energy Collaborative (CWEC) provides a literature review of turbine blade failure. The range of blade throw is highly dependent on the release velocity, which is a function of the turbine tip speed. Because the blade tip speed of wind turbines tends to remain constant with turbine size, putting turbines on higher towers means the potential throw distance, and is essentially unchanged. When compared with the blade failure rates of earlier turbine models from the 1980's and 1990's, the overall blade failure rate of modern commercial turbines has declined by a factor of three. This is primarily due to the improved reliability of modern commercial wind turbines. The CWEC (2006) report concludes that there is no evidence that existing setbacks in California were created based on formal analysis of blade throw hazard, and that current setbacks are well in excess of those required to protect against blade failure.

There are no standard setback distances in the wind industry today. KPFF Consulting Engineers performed a calculation of possible throw distance for use as a reference when considering setbacks. The worst-case loss of a whole blade would occur with the blade rotating at maximum speed, when the blade is oriented at 45 degrees from the vertical and rising. According to KPFF (2006), this is the "classic maximum trajectory case from standard physics texts." The results of their calculations indicates that for the Repower MM92, the maximum calculated blade throw distance is 500 feet (152.3 meters) from the tower to tip of the fallen blade. Project setbacks between turbine sites and permanent residences (minimum of 914 feet) and property lines (minimum of 590 feet) should protect the public from the already minimal risk of blade throw.

(7) Shadow Flicker[28]

Shadow flicker from wind turbines can occur when moving turbine blades pass in front of the sun, creating alternating changes in light intensity or shadows. These flickering shadows can cause an annoyance when cast on nearby residences ("receptors"). The spatial relationship between a wind turbine and a receptor, along with weather characteristics such as wind direction and sunshine probability, are key factors related to shadow-flicker impacts. Shadow flicker becomes much less noticeable at distances beyond about 1,000 feet, except at sunrise and sunset when shadows are long (NRC, 2007).

There is some public concern that flickering light can have negative health effects, such as triggering seizures in people with epilepsy. According to the British Epilepsy Foundation (2008), approximately 5% of individuals with epilepsy have sensitivity to light. Most people with photosensitive epilepsy are sensitive to flickering around 16-25 hertz (Hz, or flashes per second), although some people may be sensitive to rates as low as 3 Hz and as high as

[28] Shadow flicker information is presented herein to comply with the requirements of draft rule 4906-17-08(A)(6).

60Hz. Because the maximum wind turbine rotor speed of 15 RPM translates to a blade pass frequency of 0.8 Hz (less than one flash per second), health effects to individuals with photosensitive epilepsy are not anticipated.

Although setback distances for turbines (914 feet from residences) will significantly reduce shadow flicker impacts to homes within the Project Area, some limited impact will occur. No state or national standards exist for frequency or duration of shadow flicker from wind turbine projects. However, international studies/guidelines from Europe and Australia have suggested 30 hours of shadow flicker per year as the threshold of significant impact, or the point at which shadow flicker is commonly perceived as an annoyance (Dobesch and Kury, 2001; Danish Wind Industry Association, 2008; Sustainable Energy Authority Victoria, 2003). Accordingly, a threshold of 30 hours of shadow flicker per year was used for this analysis.

EAPC Architects Engineers (EAPC) conducted a shadow flicker analysis for the Facility, attached hereto as Exhibit L. To calculate potential shadow flicker impacts, EAPC (2009) used WindPRO, a computer model based on the following data:

- Turbine coordinates
- Turbine specifications (height, rotor diameter, etc.)
- Shadow receptor coordinates
- Joint wind speed and direction frequency distribution
- Monthly Sunshine Probabilities
- USGS DEM (height contours)

WindPRO can calculate the theoretical number of hours per year that shadow flicker will occur at any given location. As with limits of exposure, no state or national standards define how far from turbines shadow flicker impacts should be calculated. Several government sources (U.S. Department of Interior, 2005; BERR, 2008) suggest that shadow flicker effects become relatively insignificant beyond 10 rotor diameters (maximum of 1,000 meters [3,281 feet] for this Facility). However, German codes have established guidelines that vary based on turbine specification; under these guidelines, shadow flicker should be calculated out to 1,700 meters (5,577 feet) for the turbines proposed for this Facility (EAPC, 2009). Therefore, to ensure that worst-case values are presented in this Certificate Application, residential structures within 1,700 meters of a turbine were included in the analysis[29]. See Exhibit L for more information about the German code and WindPRO methodology.

All residential structures within 1,700 meters of the nearest wind turbine were analyzed, resulting in predicted shadow flicker effects ranging from 0 hours/year to approximately 57 hours/year. Shadow flicker is anticipated to approach the 30 hours/year threshold at just 14 of the 2,087 receptors. As shown in Table 07-7, more than 99% of residences within 1,700 meters of a turbine are expected to experience shadow flicker less than 25 hours/year.

Table 07-7. Shadow Flicker at Residences within 1,700 meters of a Turbine.

Predicted Shadow Flicker (Hours/Year)	Number of Residences	Percent of Total Residences
0	1,322	63.3
0-5	158	7.6
5-10	325	15.6
10-15	170	8.1
15-20	79	3.8
20-25	19	0.9
25-30	7	0.3
30+	7	0.3
Total	**2,087**	**99.9%**

Source: EAPC, 2009.

Based on the predicted shadow flicker values shown above in Table 07-7, a more detailed greenhouse-mode analysis was subsequently performed for those seven homes predicted to receive shadow flicker in excess of 30 hours/year. This greenhouse-mode analysis has a higher resolution, and assumes that windows face in every direction. Maps 3-5 in Appendix E of Exhibit L show that just seven specific receptors will receive more than 30 hours/year, using 2006 OGRIP aerial photographs to illustrate the settings of each specific site. As shown in Table 07-8, estimated annual shadow flicker values at these homes range from 33:36 hours/year to 57:04 hours/year (EAPC, 2009). The complete WindPRO output for the shadow flicker analysis is included in Appendix F of Exhibit L.

[29] The presence of residential structures (and distinction of residences versus non-residential structures) within 1,000 meters of the turbines was confirmed through direct in-field observations. To maintain a conservative assessment and to reduce the required effort to classify each individual structure, all structures outside of 1,000 meters were assumed to be "residential."

Table 07-8. Predicted Shadow Flicker Results for Receptors to Exceed 30 Hours/Year.

Receptor ID	Project Status	Predicted Shadow Flicker (Hours: Minutes/Year)	Turbines Contributing Flicker	Distance to Nearest Turbine (Meters)
NP 834	Non-Participating	33:36	10, 11, 12, 15, 16	524
NP 532	Non-Participating	33:37	48, 49	360
P 774	Participating	41:52	18, 20, 21	511
NP 43	Non-Participating	42:16	69, 70	265
NP 22	Non-Participating	42:20	69, 70	331
NP 741	Non-Participating	50:08	20, 21, 23, 25	351
NP 23	Non-Participating	57:04	69, 70	308

Source: EAPC, 2009.

The shadow flicker model assumptions applied to this Facility are conservative, and as such, the analysis is expected to over-predict the impacts. For example, model inputs do not reflect local conditions at the receptor site that could block shadow flicker, such as trees and neighboring structures. The model also assumes that the receptor always has a window facing the direction of the sun, and that the receptor is occupied at all hours when shadow flicker may occur (i.e., from sunrise and sunset). These highly conservative assumptions over-predict potential impacts. In reality, site-specific factors such as trees, buildings, and window locations could significantly reduce real impacts from shadow flicker. In addition, many of the modeled shadow flicker hours are expected to be of very low intensity, due to the distance of the proposed turbines from the affected receptors. Therefore, the analysis presented herein is expected to be an inclusive and conservative prediction of the shadow flicker effects from the proposed Facility.

Proposed rule 4906-17-08(A)(6) requires the Applicant to "evaluate and describe the potential impact from shadow flicker at adjacent residential structures and primary roads..." With respect to primary roads[30], the shadow flicker maps (specifically Maps 1 and 2 in Appendix E of Exhibit L) depict the expected shadow flicker at all areas (including roads) within 1,700 meters of a turbine. However, the model results generated by WindPRO assume a stationary object, which remains fixed 24 hours/day, 365 days/year. Therefore,

[30] The term "primary roads" is not defined in draft rule 4906-17; however, the Interactive Electric Maps available at the PUCO website (http://www.puco.ohio.gov/PUCO/GIS/) depict "major roads" and "secondary roads", and as portrayed, "major roads" include interstates, US highways, and state highways. *Assuming primary roads and major roads are defined the same, primary roads in the vicinity of the Project* Area include US Highway 36 and State Routes 4, 29, 54, 56, 161, 296, and 814.

because primary road users are mobile (typically in a motorized vehicle traveling at a relatively high speed), any Facility-related shadow flicker experienced by such users would be a tiny fraction of that experienced by a stationary object. Furthermore, most vehicle operators are already accustomed to shadow flicker while driving, since shadows cast from nearby objects (e.g., trees, roadside/overhead signage, etc.) will "flicker" across the windows of a moving vehicle.

(B) ECOLOGICAL IMPACT

(1) Project Area Site Information

As part of the preparation of this Certificate Application, Hull & Associates, Inc. (Hull) and other environmental consultants have made numerous site visits to the Project Area beginning in 2007, with extensive on-site ecological surveys conducted during the 2008 growing season. A surface water evaluation was performed at each proposed construction site within the Project Area (see Exhibit M). The presence of wetlands and other surface waters was determined in accordance with the methods outlined in the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual (Environmental Laboratory, 1987) and subsequent regulatory guidance issued by the Corps, along with Ohio Environmental Protection Agency (Ohio EPA) guidance on evaluation of streams. Wetland functions and values were evaluated using the Ohio Rapid Assessment Method for Wetlands, with each wetland assigned to the appropriate category of the Ohio Antidegradation Policy for Wetlands (OAC 3745-1-54). Streams were evaluated using the Ohio Qualitative Habitat Evaluation Index (QHEI) or the Ohio Headwater Habitat Evaluation Index (HHEI), as applicable. An additional survey method, the Visual Encounter Survey (VES), was used to search for salamanders in a few streams thought to have physical aspects of higher-value headwaters streams.

Hull (2009d) also performed an assessment of ecological communities within a 0.25 mile distance from the Facility boundary. This evaluation involved mapping and describing plant communities, and compiling lists of animals likely to utilize each habitat. In addition, Hull screened the Project Area for major species of biota, including those of commercial or recreational value, and those designated as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) or the Ohio Department of Natural Resources (ODNR).

On-site studies of bird and bat migration activity were conducted by Stantec Consulting (Stantec) during the fall of 2007 (see Exhibit N), and in the spring/summer/fall of 2008 (see

Exhibit O). Methods of study included visual diurnal migration surveys of raptors and sandhill crane, nocturnal songbird migration radar surveys, breeding bird surveys, and acoustic bat surveys. These surveys were designed using best management practices, and were completed through extensive coordination with the ODNR and the Reynoldsburg Ohio Ecological Services Field Office of the USFWS (now located in Columbus).

(a) *Open Spaces and Facility Map*

Figure 6 shows the Facility and designated undeveloped lands within a 0.5-mile radius of the proposed Facility. This mapping was developed from the following USGS 7.5 minute, 1:24,000 topographic quadrangles, which occur within five miles of the Facility boundary: Kingscreek, Mechanicsburg, Milford Center, New Moorefield, North Lewisburg, Northville, Plumwood, Springfield, South Vienna, Urbana East, Urbana West, and Zanesfield. Due to the scale of the mapping, the edges of the map also incorporates portions of other quadrangles that do not fall within a 5-mile radius, including: Bellefontaine, Charleston, Clifton, De Graff, Donnelsville, East Liberty, Florence, Huntsville, London, Peoria, Rushsylvania, Russell's Point, Saint Paris, Thackery, Walnut Run, West Mansfield, Yellow Springs, and York Center.

(b) *Vegetation Survey*

Although agricultural row crops comprise a majority of this area, this land use is not included as an ecological community because it is assumed to have nominal ecological value. Similarly, residential lawns were not assessed. Hull (2009d) identified and mapped six plant community types within the Facility boundary and within 0.25 mile of the Facility boundary: old field, scrub-shrub, young woods, upland ridge, upland woods, and riparian woods (see Figures 1-18 in Exhibit M). Each of these communities is described below.

<u>Old Field</u>

The old field community type comprises approximately 0.71% of the area within 0.25 mile of the Facility boundary. Old field communities typically develop on abandoned agricultural land, and persist for 10 to 20 years until they succeed to scrub-shrub or forest communities, or are converted back to agriculture. This community type is dominated by upland herbaceous vegetation. Common species include goldenrods (*Solidago* spp.), Queen Anne's lace (*Daucus carota)*, teasel *(Dipsacus fullonum), Aster* spp., ragweeds (*Ambrosia* spp.), thistles (*Cirsium* spp.), and upland grasses. Old fields occur on flat to sloping terrain, but are not usually found on steep slopes, due to lack of prior agricultural impact in such areas.

Scrub-Shrub

The scrub-shrub community type comprises approximately 0.73% of the area within 0.25 mile of the Facility boundary. This community type is an intermediate successional stage between old field and forest communities, and is dominated by upland shrubs and small trees. Common species include green ash (*Fraxinus pensylvanica)*, maples *(Acer* spp.), hackberry *(Celtis occidentalis)*, raspberry and/or blackberry *(Rubus* spp.), multiflora rose (*Rosa multiflora)*, and honeysuckles (*Lonicera* spp). Scrub-shrub communities can occur on flat to sloping terrain, but like old fields, are not often found on steep slopes. Where scrub-shrub communities are in an advanced stage of ecological succession (i.e., recovery from disturbance), they approach and merge into the Young Woods community type.

Young Woods

This community type comprises approximately 0.67% of the area within 0.25 mile of the Facility boundary. Young woods are dominated by small trees and may have a dense shrub layer. Common species include maples, green ash, oaks *(Quercus* spp.), hickories (*Carya* spp.), hackberry, poplars *(Populus* spp.), beech (*Fagus grandifolia)*, cherries (*Prunus* spp.), along with shrub species found in scrub-shrub areas. Young woods are not generally limited by slope, and may occur on any terrain in the vicinity of Project Area.

Upland Ridge

This wooded community type occurs on steeply sloped ridges that are inaccessible for agricultural purposes, and comprises approximately 0.57% of the area within 0.25 mile of the facility boundary. Canopy trees observed along these forest ridges include black cherry (*Prunus serotina*), catalpa (*Catalpa speciosa*), sugar maple (*Acer saccharum*), hackberry, white oak (*Quercus alba*), red oak (*Q. rubra*), sycamore (*Platanus occidentalis*), and green ash. The shrub layer includes hop hornbeam (*Carpinus caroliniana*), paw paw (*Asimina triloba*), honeysuckles, and blackberries. Herbaceous species observed include *Geum* sp., *Aster* sp., and garlic mustard (*Alliaria petiolata*). Although the timing of field surveys did not permit assessment of spring ephemerals, upland ridges within 0.25 mile of the Facility boundary may support a diverse herbaceous spring flora.

Upland Woods

This community type comprises approximately 4.11% of the area within 0.25 mile of the facility boundary, and generally occurs on flat to gently sloping terrain on well-drained soils. Species observed within the canopy of this community type include honey locust (*Gleditsia triacanthos*), white oak, shagbark hickory (*Carya ovata*), green ash, ironwood (*Ostrya virginiana*), American elm (*Ulmus americana*), black cherry, cottonwood (*Populus deltoides*), tupelo (*Nyssa sylvatica*), white ash (*Fraxinus americana*), osage orange (*Maclura pomifera*), burr oak (*Quercus macrocarpa*), sugar maple, red oak, and post oak (*Q. stellata*). The shrub layer is dominated by bush honeysuckles. In some locations, the upland woods community includes significant components of pine species or is dominated by pines, particularly red pine (*P. resinosa*) and eastern white pine (*P. strobus*). In Figures 1-18 in Exhibit M, these mixed woods communities are mapped as "Upland Woods with Pine."

Riparian Woods

Riparian woods occur within floodplains along streams and creeks, and comprise approximately 1.34% of the area within 0.25 mile of the facility boundary. Riparian woods typically occur on moderately well-drained alluvial soils, but this community type can also include wetland areas in depressions. Species typically observed within the canopy include black cherry, honey locust, box elder (*Acer negundo*), green ash, American elm, cottonwood, burr oak, osage orange, red maple (*Acer rubrum*), swamp white oak (*Quercus bicolor*), red oak, tupelo, mockernut hickory (*Carya tomentosa*), Ohio buckeye (*Aesculus glabra*), and hackberry. The shrub layer includes honeysuckles, hawthorne (*Crataegus* spp.), spicebush (*Lindera benzoin*), and multiflora rose.

(c) *Animal Life Survey*

As part of the ecological community assessment described above in Section 4906-13-07(B)(1)(b) of this Application, Hull compiled a list of vertebrate fauna likely to occur in each habitat type identified within the facility boundary and 0.25 mile of the facility boundary, based on field observations and published data. The results of these surveys are presented below by habitat type.

Old Field

Old field plant communities provide habitat and foraging for numerous animal species. Mammals that utilize this habitat include white-tailed deer, red fox, coyote, groundhog, striped skunk, eastern cottontail rabbit, field mouse, and meadow vole. Many ground-nesting bird and songbird species utilize old field plant communities for nesting and foraging. Ground-nesting bird species most likely to frequent old field communities in the vicinity of the Project Area include ringneck pheasant, eastern wild turkey, bobwhite quail, eastern meadowlark, and bobolink. Songbirds that use old field communities in the vicinity of the Project Area include eastern bluebird, goldfinch, field sparrow, horned lark, and red-winged blackbird. Reptiles that utilize old field habitats include several garter snake species, eastern hognose snake, black rat snake and blue racer.

Scrub-Shrub

Scrub-shrub plant communities provide habitat and foraging for numerous animal species. Mammals that utilize scrub-shrub habitats include white-tailed deer, red fox, coyote, groundhog, striped skunk, eastern cottontail rabbit, field mouse, and meadow vole. A variety of songbird species utilize scrub-shrub communities for nesting and rearing young, including indigo bunting, dark-eyed junco, robin, eastern towhee, sparrows, mourning dove, cardinal, and kingbird. Reptiles are not common in scrub-shrub habitats in the vicinity of the Project Area, but a few snake species such as garter snakes or eastern hognose snake could inhabit these areas.

Young Woods

Young woods are utilized by numerous mammalian species, including white-tailed deer, red fox, gray fox, coyote, raccoon, opossum, fox squirrel, and eastern chipmunk. Bird species that would utilize young woods habitats in the vicinity of the Project Area include numerous raptor species, scarlet tanager, Baltimore oriole, black-capped chickadee, vireos, blue jay, and a variety of woodpecker species.

Upland Ridge, Upland Woods, and Riparian Woods

Mammalian species that utilize mature upland forest habitats within 0.25 mile of the Facility boundary include white-tailed deer, eastern fox squirrel, gray squirrel, raccoon, opossum, red squirrel, and eastern chipmunk. Mammals expected within the riparian woods community are similar, with the addition of species that prefer to be located in or near small streams/wetlands including muskrat, mink, long-tailed weasel, and beaver. In addition, several bat species may utilize all three wooded plant community types for roosting, foraging or as travel corridors, particularly when wetlands or streams are also present in the woods or in the immediate vicinity. Bird species that utilize forested habitats include various warbler species, wood thrush, hermit thrush, numerous woodpecker species, nuthatches, screech owl, barred owl, great-horned owl, whip-poor-will, eastern wild turkey, and various raptor species. Reptilian species that utilize forested habitats include eastern box turtle, eastern fox snake, and several garter snake species.

In addition to the ecological surveys conducted by Hull, Stantec conducted numerous avian and bat studies throughout the facility and surrounding area. Ecological resources in the vicinity of the Project Area were also identified through analysis of existing data sources, such as the North American Breeding Bird Survey, the Ohio Breeding Bird Atlas, the Audubon Christmas Bird Count, the Ohio Frog and Toad Calling Survey, the Ohio Salamander Monitoring Program, and correspondence received from the USFWS Ecological Services Office and the ODNR Division of Natural Areas and Preserves. These various sources of information have been synthesized, and are presented in the following sections on birds, mammals, reptiles/amphibians, and aquatic species.

Birds

This section summarizes available information regarding avian use of the Project Area and surrounding areas, based on review of existing data and studies conducted on-site.

Breeding Birds: The Ohio Breeding Bird Atlas (BBA) is a comprehensive, statewide survey that indicates the distribution of breeding birds in Ohio. Field data for Ohio's first BBA was collected from 1982 to 1987, while data collection for the second BBA is currently underway and is projected to extend through 2010. The Ohio BBA survey grid is based on 7.5-minute USGS topographic maps, with survey "blocks" defined by dividing topographic maps into six areas of equal size (approximately 10 square miles each). The Project Area overlaps four USGS 7.5 minute maps (Kingscreek, North Lewisburg, Urbana East, and Mechanicsburg) and includes portions of 10 BBA survey blocks.

In the first BBA, one block was randomly selected from each USGS map and assigned priority status, with breeding activity of birds documented only within the priority block. Among the six sampled priority blocks in the vicinity of the Project Area, the number of species observed per survey block ranged from 68 to 75, for a cumulative total of 84 different species. The majority of species recorded in the 1982 to 1987 BBA were common nesting birds for this region of the state. No state- or federally-listed endangered or threatened species were observed in the vicinity of the Project Area. However, two state-listed species of concern (bobolink and northern bobwhite) were recorded (Ohio BBA II, 2008). The goal of the second BBA is to survey each one of the 4,437 atlas blocks in the state of Ohio. However, because the data collection phase of the BBA is still underway, results are not yet available for any survey blocks in the vicinity of the Project Area (Ohio BBA II, 2009).

The North American Breeding Bird Survey (BBS), overseen by the Patuxent Wildlife Research Center of the USGS, is a long-term, large-scale, international avian monitoring program that tracks the status and trends of North American bird populations. Each survey route is 24.5 miles long, with 3-minute point counts conducted at 0.5-mile intervals. During the point counts, every bird seen or heard within a 0.25-mile radius is recorded. The Kings Creek survey route is approximately 1.6 miles west of the Facility boundary. Most of the species recorded were common birds of forest, forest edge, woodland, old field, grassland, and wetland habitats. However, state-listed species observed during these surveys included bobolink and northern bobwhite, both Ohio species of concern. No federally-listed endangered or threatened species were observed (Sauer *et al.*, 2007).

To provide site-specific information on nesting birds in the vicinity of the Project Area, Stantec conducted on-site breeding bird surveys during the spring and summer of 2008, attached hereto as Exhibit O. Survey timing and methods were based on recommended protocol developed by the ODNR. Surveys were conducted once during May, twice in June, and once again in July. Although surveys focused on assessing the presence or absence of state- or federally-listed species, all species of breeding birds either heard or visually detected were documented. The plots were designed to sample various habitats in proportion to their availability, with a total of 90 breeding bird survey point counts sampled during the survey. A total of 5,947 individual birds representing 97 species were observed during the point count surveys. Species with the highest relative abundance were red-winged blackbird, horned lark, American robin, song sparrow, American crow, and European starling. The species detected in the vicinity of the Project Area are generally common to the region and the habitats in which they were observed. However, the following state-listed species were documented: northern harrier (endangered); least flycatcher (threatened); and bobolink and northern bobwhite (special concern). No federally-listed endangered or threatened species were detected during the surveys (Stantec, 2009).

Migrating Raptors: In order to minimize energy expenditure, raptors typically use ridgelines or shorelines to gain altitude via thermal development or ridge-generated updrafts. Geography and topography are major factors shaping migration dynamics in the Central Continental Hawk Flyway, where the Facility is located. The orientation of the Great Lakes and inland mountain ranges influence diurnal migrants in central Canada and the mid-west to fly generally southwest to their wintering grounds in fall, and northeast in the spring, with considerable east to west movement along the Great Lake shorelines. Away from features such as the Lake Erie shore, the Alleghany and Appalachian plateaus may provide "leading lines" for hawks to follow (Stantec, 2009).

The Facility is located in the south-central portion of the state in the Bellefontaine Uplands physiographic region, a sub-region of the Central Ohio Till Plains. This region is characterized by low to moderate relief hills formed by glacial processes. The topography surrounding the Facility does not contain any outstanding features that typically concentrate raptors by providing reliable updrafts. The majority of raptor migration in Ohio (aside from along the Lake Erie shoreline) is thought to occur along the escarpments and leading lines of the Alleghany Plateau area, well to the east of the Project Area. Raptor migration through central Ohio, including the Project Area, is likely less concentrated than in other areas of the Central Flyway, because ridges and lakeshores are not prevalent (Stantec, 2009).

Stantec conducted diurnal raptor migration surveys during 2007 and 2008 to characterize raptor activity in the vicinity of the Project Area, and to document species-specific flight and behavioral patterns in the area. Surveys were conducted from a hilltop southwest of the hamlet of Mingo, at an elevation of approximately 1,450 feet. The observation site was in open and active pastureland that offered excellent views to the east, south, and west, with good views to the north. Surveys were based on methods developed by the Hawk Migration Association of North America (HMANA). Days with favorable flight conditions were targeted. Observers scanned the sky and surrounding landscape for flying raptors. Observations were recorded onto HMANA data sheets, which summarize data by hour. Detailed notes on each observation were recorded, including location and flight path, flight height, and activity of the bird.

In 2007 raptor surveys were conducted on 11 days between August 30 and October 11, for a total of 66 hours. A total of 421 raptors, representing eight different species, were observed during the survey, yielding an overall observation rate of 6.4 birds/hour.

Turkey vulture (N=380) was the most commonly observed species during the on-site raptor migration survey, and accounted for 90% of the observed birds. Red-tailed hawk was the second most commonly observed species (N=14), accounting for 3% of total observations. Other species observed at low densities include black vulture, Cooper's hawk, sharp-shinned hawk, northern goshawk, American kestrel, and northern harrier. Northern harrier is listed as endangered by the State of Ohio, while sharp-shinned hawk and black vulture are listed as a species of concern. No federally-listed endangered or threatened species were observed (Stantec, 2008a).

Birds that were repeatedly observed foraging and perching at similar locations throughout the survey period were classified as residents. However, the vast majority of raptors observed (97%) were believed to be actively migrating southward; only 3% of all observations were birds believed to be residents of the area surrounding the proposed Facility. Flight direction was generally south and southeast. Flight heights were categorized as either above or below 125 meters (412 feet). Overall, 55% of the observed raptors were estimated to be flying lower than 125 meters. However, differences in flight altitudes between species were observed. Small species, such as accipiters and falcons, were consistently observed flying below turbine height. Larger species, such as red-tailed hawks and turkey vultures, generally flew near or above 125 meters (Stantec, 2008a).

During the fall of 2007 observation rates at recognized regional hawk watch sites ranged from 6.4 to 241.6 birds/hour. The passage rate observed in the vicinity of the Project Area was one of the lowest reported from the Central Continental Flyway. There are several reasons for the observed differences in passage rates during the fall of 2007, with landscape setting probably being the most significant. As described above, geographic location can affect the magnitude of raptor migration. Sites that are located at prominent topographical points or along long ridgelines tend to concentrate migrant use. Sites along Lake Erie also see a greater magnitude of migrants due to migration routes following shorelines. The lower passage rate in the vicinity of the Project Area is likely due to the lack of prominent landscape features that would concentrate raptor migration (Stantec, 2008a).

In 2008, raptor surveys were conducted on 32 days (216 hours) between March 1 and May 15, and on 24 days (167 hours) between September 1 and November 15. In addition, surveys for sandhill cranes, state-listed as an endangered species, were conducted on 12 days (84 hours) between November 16 and December 15, using the same HMANA methodology. A total of 1,476 raptors representing 12 different species were observed in the spring, yielding an overall observation rate of 6.8 birds/hour. A total of 581 raptors representing seven different species were observed in the fall, yielding an overall observation rate of 3.5 birds/hour. Although no sandhill cranes were observed during the targeted survey period, four were observed during a spring raptor survey on March 6, 2008. During the sandhill crane survey period, 27 raptors representing six species were observed, yielding an observation rate of 0.3 bird/hour. Throughout the spring and fall, daily count totals ranged from 1 to 94 observed raptors and passage rates ranged from 0.1 to 14.3 birds/hour. The highest daily count of 94 raptors occurred on May 6, when winds were moderate and predominantly from the southwest (Stantec, 2009).

Turkey vulture was by far the most commonly observed species during both the spring (n=1,347, 91%) and fall (n=527, 91%) 2008 survey periods. Red-tailed hawk was the second most commonly observed species, accounting for 7% of the total observations in the spring (n=98), and 6% in the fall (n=32). Other species observed at low densities in 2008 include Cooper's hawk, sharp-shinned hawk, northern goshawk, broad-winged hawk, merlin, peregrine falcon, American kestrel, bald eagle, golden eagle, northern harrier, and sandhill crane. Northern harrier and sandhill crane are listed as endangered by the State of Ohio, peregrine falcon and bald eagle are listed as threatened, and sharp-shinned hawk is listed as a species of concern. No federally-listed endangered or threatened species were observed. Because they were seen repeatedly foraging and/or consistently perching at similar locations throughout the survey period, 8% of raptors observed in 2008 were believed to be residents of the area. The remaining 92% appeared to be actively migrating. The vast majority of raptors were flying at heights below 150 meters: 95% in the spring and 93% in the fall (Stantec, 2009).

The overall number of raptors observed in the vicinity of the Project Area was low relative to numbers observed at regional hawk watch sites, which ranged from 5.2 to 3082.8 birds/hour during the fall of 2008. The average passage rate of 4.5 birds/hour for the combined spring and fall Facility raptor surveys was lower than that for all HMANA hawk watch sites in the region for which both spring and fall 2008 data were available, despite having comparable or greater survey effort in most cases (see Appendix B in Exhibit O). When compared to 14 other publicly available spring raptor surveys conducted at wind energy facilities between 1999 and 2006, the passage rate observed in the vicinity of the

Project Area (6.8 birds/hour) is similar to rates observed in other agricultural settings. The average passage rate over the publicly available spring surveys evaluated was 5.2 birds/hour, with a range of 0.9 to 25.6 birds/hour. When compared to passage rates for 17 other fall surveys conducted at wind energy facilities between 1996 and 2007, the passage rate observed in the vicinity of the Project Area (3.5 birds/hour) is among the lowest. Passage rates at the publicly available fall surveys averaged 4.4 birds/hour, and ranged from 3.0 to 12.72 birds/hour (Stantec, 2009).

Migrating Songbirds: To characterize fall songbird migration, Stantec (2008a) conducted nocturnal radar surveys in the vicinity of the Project Area. The study totaled 30 nights of radar surveys between September 1 and October 15, 2007 and included data collection on passage rates, flight altitude, and flight direction. Passage rates ranged from 0 targets/kilometer/hour (t/km/hr) to 404 t/km/hr, for an overall passage rate of 74 t/km/hr for the entire survey period. While there are currently no accurate quantitative methods for directly correlating pre-construction passage rates to operational impacts to migrating songbirds, the risk of collision appears to increase as passage rates of nocturnal migrants increases. As shown in Table 07-9, the passage rates observed in the vicinity of the Project Area were lower than at other comparable agricultural and forested sites across the Mid-Atlantic and Northeast regions.

The average nightly flight altitude ranged from 252 meters (828 feet) to 506 meters (1,661 feet), for a mean flight altitude of 393 meters (1,290 feet). The seasonal average percentage of targets flying below 150 meters was 6%, with 4% flying below 125 meters. The flight height at in the vicinity was consistent with the heights observed at all other sites, regardless of landscape, and suggests that the majority of migration during the fall survey period took place well above the height of the proposed turbines. As shown in Table 07-9, the percent of targets flying below turbine height in the vicinity of the Project Area was near the low end of the range observed at other sites (to more readily compare with other publicly available heights, the percent of targets flying below 125 meters is displayed for Buckeye). Based upon the data collected, nocturnal songbird migration during the fall 2007 survey was characterized as broad front, and in general, the flight direction was to the south-southwest (Stantec, 2008a).

Table 07-9. Summary of Available Fall Avian Radar Survey Results.

Location	Survey Date	Landscape	Average Passage Rate (t/km/hr)	Average Flight Altitude (m)	% Targets Below (Turbine Height)	Citation
Westfield, NY	2003	Great Lakes Shore	238	532	4% (125 m)	Cooper *et al.*, 2004
Franklin, WV	2004	Forested Ridge	229	583	8% (125 m)	Woodlot , 2005a
Sheffield, VT	2004	Forested Ridge	114	566	1% (125 m)	Woodlot , 2006a
Searsburg, VT	2004	Forested Ridge	178	611	3% (100 m)	Woodlot , 2005b
Martindale, PA	2004	Reclaimed Minelands	187	436	8% (125 m)	Young, 2006
Casselman, PA	2004	Reclaimed Minelands	174	448	7% (125 m)	Young, 2006
Prattsburgh, NY	2004	Agricultural Plateau	200	365	9% (125 m)	Mabee, *et al.*, 2005
Prattsburgh, NY	2004	Agricultural Plateau	193	516	3% (125 m)	Woodlot 2005c
Churubusco, NY	2005	Great Lakes Plain	152	438	5% (120 m)	Woodlot , 2005d
Searsburg, VT	2005	Forested Ridge	559	395	13% (100 m)	Woodlot , 2005e
Mars Hill, ME	2005	Forested Ridge	512	424	8% (120 m)	Woodlot , 2005f
Clayton, NY	2005	Agricultural Plateau	418	475	10% (150 m)	Woodlot , 2005g
Sheldon, NY	2005	Agricultural Plateau	197	422	3% (120 m)	Woodlot , 2005h
Howard, NY	2005	Agricultural Plateau	481	491	5% (125 m)	Woodlot , 2005i
Fairfield, NY	2005	Agricultural Plateau	691	516	4% (125 m)	Woodlot , 2005j
Jordanville, NY	2005	Agricultural Plateau	380	440	6% (125 m)	Woodlot , 2005k
Munnsville, NY	2005	Agricultural Plateau	732	644	2% (118 m)	Woodlot , 2005l
Lempster, NH	2006	Forested Ridge	620	387	8% (125 m)	Woodlot , 2007a
Danforth, ME	2006	Forested Ridge	476	378	13% (125 m)	Woodlot , 2007b
Chateaugay, NY	2006	Agricultural Plateau	843	431	8% (120 m)	Woodlot , 2006b
Buckeye Project	2007	Agricultural Plateau	74	393	4% (125 m)	Stantec, 2008a

Source: Stantec, 2008a.

Wintering Birds: Data from the Audubon's Christmas Bird Count (CBC) provides an excellent overview of the birds that inhabit the region during early winter. Counts take place on a single day during a three-week period around Christmas, when dozens of birdwatchers comb a 15-mile (24 km) diameter circle in order to tally up bird species and individuals observed. Although there are no active CBC circles that overlap the Project Area, portions of both the Dayton and Columbus count circles are within 30 miles. The number of wintering species observed in these count circles ranged between 57 and 77 species/year over the last 10 years, with a total of 125 different species recorded. The most common wintering bird species observed were European starling, American robin, Canada goose, mallard, American crow, northern cardinal, house sparrow, American goldfinch, house finch, ring-billed gull, mourning dove, American black duck, rock dove, and Carolina chickadee. The following state-listed avian species were also documented: bald eagle, northern harrier, peregrine falcon, sandhill crane, and yellow-bellied sapsucker (endangered); black-crowned night-heron, dark-eyed junco, and hermit thrush (threatened); and common moorhen, northern bobwhite, and sharp-shinned hawk (species of concern). No federally-listed endangered or threatened species were recorded on either CBC route in the last ten years (National Audubon Society, 2008).

Mammals

Due to a lack of existing data regarding mammals within the proposed Facility and surrounding areas, the occurrence of mammalian species was documented primarily through evaluation of available habitat, species range, and incidental observation. This effort suggests that at least 30 species of mammal could occur in the area, including white-tailed deer, eastern cottontail, eastern chipmunk, coyote, red fox, raccoon, opossum, woodchuck, gray squirrel, fox squirrel, striped skunk, beaver, muskrat, mink, long-tailed weasel, little brown bat, Indiana bat, big brown bat, red bat, eastern pipistrelle, hoary bat, silver-haired bat, and a variety of small mammals such as mice, voles, and shrews (ASM, 2008; NatureServe, 2007; ODR, 2008c). Most of the mammal species likely to occur in the area are common and widely distributed throughout Ohio.

To characterize and document bat activity in the vicinity of the Project Area, Stantec conducted field surveys during the fall of 2007, and in the spring, summer, and fall of 2008. The spring and fall surveys were designed to document migratory bat activity patterns in the vicinity of the Project Area, while the summer survey was designed to document bat activity in the vicinity of the Project Area during the breeding season. Bat echolocation calls were recorded through the use of six stationary Anabat acoustic detectors, with three units deployed at each of two temporary meteorological towers (north and south). One detector was deployed at the following heights at each tower: 40 meters (high), 20 meters (low), and 2 meters (tree). Although the habitat surrounding the sample sites was mostly open agricultural field or pastureland with scattered hedgerows and isolated trees, stands of second-growth mixed hardwoods were generally within 200 meters.

Bat call sequences were individually marked and categorized by species group, or "guild," based on visual comparison to reference calls. A call sequence was considered of suitable quality and duration if the individual call pulses were "clean" (i.e., consisting of sharp, distinct lines) and at least five pulses were included within the sequence. Call sequences were classified to species whenever possible. However, similarity of call signatures between species prevents exact identification of many bat call sequences. Therefore, calls of suitable quality were categorized into one of the four following guilds:

- Unknown – All call sequences with too few pulses (less than five) or of poor quality, such as indistinct pulse characteristics or background static.
- Myotid – All bats of the genus *Myotis*, including little brown bat, northern long-eared bat, and Indiana bat (federally-listed as endangered). Different species in the genus *Myotis* produce similar calls that cannot always be distinguished.
- Red bat/pipistrelle – Eastern red bats and eastern pipistrelles. Like many other northeastern bats, these two species can produce calls distinctive only to each species. However, significant overlap in the call pulse shape, frequency range, and slope can also occur.
- Big brown/silver-haired/hoary bat – This guild will be referred to as the big brown guild. These species' call signatures commonly overlap and have therefore been included as one guild.

This guild grouping represents a conservative approach to bat call identification. Since most bat species do occasionally produce calls unique only to that species, all calls were identified to the lowest possible taxonomic level before being grouped into the guilds.

The 2007 survey was conducted from August 28 to October 30, for a total of 226 detector nights. During the sampling period, a total of 1,522 bat call sequences were detected and recorded, resulting in overall detection rates of 6.73 calls/detector-night. Of the calls that could be identified to species or guild, those of the big brown guild were the most common (34% of all call sequences), followed by the species within the red bat/eastern pipistrelle guild (18% of all call sequences). Less than 1% of call sequences were attributable to *Myotis* species. Bat call sequences identifiable to species were recorded for eastern pipistrelle, hoary bat, and silver-haired bat (Stantec, 2008a).

The 2008 survey was conducted from March 29 to September 2, for a total of 774 detector nights. During the sampling period, a total of 18,715 bat call sequences were detected and recorded, resulting in overall detection rates of 23.9 calls/detector-night. Of the calls that could be identified to species or guild in the 2008 survey, those of the big brown guild were the most common (61% of all call sequences), followed by the species within the red bat/eastern pipistrelle guild (4% of all call sequences). Only 3% of call sequences were attributable to *Myotis* species. Bat call sequences identifiable to species were recorded for big brown bat, eastern pipistrelle, hoary bat, red bat, and silver-haired bat (Stantec, 2009).

Because the 2008 detection rate was so much higher than that observed in 2007, it is useful to examine the distribution of recorded call sequences amongst the six detectors. Detection rates were generally higher at the north meteorological tower than at the south tower. As shown in Table 07-10, the average detection rates at the four tower detectors (1.8 calls/detector-night in the spring and 12.4 calls/detector-night in the fall) were within the range of rates observed during publicly available acoustic bat surveys at other sites in recent years. However, the average detection rates at the two tree detectors (17.7 calls/detector-night in the spring and 128 calls/detector-night in the fall) were relatively high compared to other sites, especially in the fall survey period (Stantec, 2009).

Although the fall detection rate at the south tree detector (13.1 calls/detector-night) was comparable to rates observed at other publicly available sites, the rate at the north tree detector during the fall survey period was unusually high (256.5 calls/detector-night). Approximately 74% of calls recorded at the northern tree detector were identified as members of the big brown guild, most of which appear to be big brown bats. Given the exceptionally high number of call sequences recorded, it is likely that the north tree detector was unintentionally placed in close proximity to a big brown bat maternity colony, and the detector was picking up local activity of bats foraging along the field edge where the detector was placed (Stantec, 2009).

Table 07-10. Summary of Available Bat Acoustic Survey Results.

	Location	Survey Date	Habitat	Height (meters)	Detection Rate (calls per detector-night)	Citation
Spring	**Tree or Low Tower Detectors (10 meters or less)**					
	Sheffield, VT	2005	Forest Edge	10	0	Woodlot, 2006a
	Sheffield, VT	2006	Forest Edge	8	22.1	Woodlot, 2006a
	Sheffield, VT	2006	Forest Edge	9	2.4	Woodlot, 2006a
	Sheffield, VT	2006	Forest Edge	8	5.2	Woodlot, 2006a
	Searsburg, VT	2006	Forest Edge	2	0.1	Woodlot, 2006c
	Howard, NY	2006	Field	8	0.8	Woodlot, 2006d
	Buckeye (North Tree)	2008	Field	2	12.5	Stantec, 2009
	Buckeye (South Tree)	2008	Field	2	20.4	Stantec, 2009
	Meteorological Tower Detectors					
	Sheffield, VT	2005	Forest Edge	20	0.2	Woodlot, 2006a
	Cohocton, NY	2005	Field	30	0.7	Woodlot, 2006e
	High Sheldon, NY	2005	Field	30	0.2	Woodlot, 2006f
	Sheffield, VT	2006	Forest Edge	31	0.14	Woodlot, 2006a
	Searsburg, VT	2006	Forest Edge	35	0.1	Woodlot, 2006c
	Searsburg, VT	2006	Forest Edge	15	0	Woodlot, 2006c
	Searsburg, VT	2006	Forest Edge	30	0	Woodlot, 2006c
	Searsburg, VT	2006	Forest Edge	15	0.3	Woodlot, 2006c
	Eustis, ME	2006	Forest Edge	50	0	Woodlot, 2006g
	Eustis, ME	2006	Forest Edge	50	0	Woodlot, 2006g
	Eustis, ME	2006	Forest Edge	20	0.7	Woodlot, 2006g
	Eustis, ME	2006	Forest Edge	50	0	Woodlot, 2006g

	Location	Survey Date	Habitat	Height (meters)	Detection Rate (calls per detector-night)	Citation
	Chateaugay, NY	2006	Field	40	2.2	Woodlot, 2006h
	Chateugay, NY	2006	Field	20	1.9	Woodlot, 2006h
	Howard, NY	2006	Field	50	0.1	Woodlot, 2006d
	Howard, NY	2006	Field	20	0.4	Woodlot, 2006d
	Buckeye (North High)	2008	Field	40	1.0	Stantec, 2009
	Buckeye (North Low)	2008	Field	20	2.8	Stantec, 2009
	Buckeye (South High)	2008	Field	40	0.2	Stantec, 2009
	Buckeye (South Low)	2008	Field	20	2.3	Stantec, 2009
Fall	**Tree or Low Tower Detectors (10 meters or less)**					
	Lempster, NH	2005	Forest Edge	7.5	0.8	Woodlot, 2005m
	Lempster, NH	2005	Forest Edge	2	0	Woodlot, 2005m
	Clayton, NY	2005	Forest Edge	2	4.7	Woodlot, 2005g
	Stamford, NY	2005	Forest Edge	2	4.8	Woodlot, 2005n
	Churubusco, NY	2005	Field	10	4.4	Woodlot, 2005d
	Churubusco, NY	2005	Field	2	6.3	Woodlot, 2005d
	Sheldon, NY	2005	Field	2	113	Woodlot, 2005h
	Howard, NY	2005	Field	2	51.5	Woodlot, 2005i
	Jordanville, NY	2005	Field	2	4.4	Woodlot, 2005k
	Lempster, NH	2006	Forest Edge	10	0.1	Woodlot, 2007a
	Lempster, NH	2006	Forest Edge	3	8.7	Woodlot, 2007a
	Buckeye (North Tree)	2008	Field	2	256.5	Stantec, 2009
	Buckeye (South Tree)	2008	Field	2	13.1	Stantec, 2009

Location	Survey Date	Habitat	Height (meters)	Detection Rate (calls per detector-night)	Citation
Meteorological Tower Detectors					
Loarville, MD	2005	Forest Edge	11	10.8	Roy *et.al.*, 2005
Loarville, MD	2005	Forest Edge	23	12.5	Roy *et.al.*, 2005
Stamford, NY	2005	Forest Edge	15	6.8	Woodlot, 2005n
Stamford, NY	2005	Forest Edge	30	5.3	Woodlot, 2005n
Sheldon, NY	2005	Field	15	5.2	Woodlot, 2005h
Sheldon, NY	2005	Field	30	2.4	Woodlot, 2005h
Churubusco, NY	2005	Field	20	6.2	Woodlot, 2005d
Jordanville, NY	2005	Field	15	4.2	Woodlot, 2005k
Jordanville, NY	2005	Field	30	6.2	Woodlot, 2005k
Lempster, NH	2006	Forest Edge	40	0.4	Woodlot, 2007a
Chateaugay, NY	2006	Field	40	3	Woodlot, 2006b
Chateugay, NY	2006	Field	20	7.8	Woodlot, 2006b
Buckeye (North High)	2008	Field	40	4.7	Stantec, 2009
Buckeye (North Low)	2008	Field	20	24.3	Stantec, 2009
Buckeye (South High)	2008	Field	40	6.5	Stantec, 2009
Buckeye (South Low)	2008	Field	20	13.9	Stantec, 2009

Amphibians and Reptiles

Reptile and amphibian presence in the vicinity of the Project Area was determined through review of the Ohio Frog and Toad Calling Survey, the Ohio Salamander Monitoring Program, the Ohio Gap Analysis Program, and ODNR data. Based on this information, along with documented species ranges and existing habitat conditions, it is estimated that approximately 25 reptile and amphibian species could occur in the area. Species likely to occur within the Facility boundary and within 0.25 mile of the Facility boundary include spotted salamander, southern two-lined salamander, longtail salamander, red-backed salamander, American toad, Fowler's toad, gray treefrog, spring peeper, bullfrog, green frog, northern leopard frog, painted turtle, eastern garter snake, northern water snake, brown snake, and rat snake (Davis & Lipps, 2008; ODNR, 2008b; USGS, 2008c). These species are generally common and widely distributed throughout Ohio.

Aquatic Species

The presence of aquatic species in the vicinity of the Project Area was determined through review of the Ohio Aquatic Gap Analysis Program and ODNR data. Based on this information, along with documented species ranges and existing habitat conditions, it is estimated that approximately 70 fish species and approximately 25 mollusk species could occur in the area. Fish species likely to occur within 0.25 mile of the Facility boundary include blacknose dace, blackside darter, bluntnose minnow, bluegill, brook stickleback, brown bullhead, central mudminnow, central stoneroller, creek chub, golden shiner, green sunfish, largemouth bass, mottled sculpin, northern hogsucker, pumpkinseed, rainbow darter, rock bass, silverjaw minnow, and yellow perch. Mollusk species likely to occur within 0.25 mile of the Facility boundary include creeper, fatmucket, giant floater, lilliput, paper pondshell, ridgedback peaclam, slippershell mussel, and Wabash pigtoe (Covert *et al.*, 2007). These species are generally common and widely distributed throughout Ohio.

However, according to Ohio Aquatic Gap Analysis, the following state-listed aquatic species are thought to occur in watersheds in the vicinity of the Project Area: snuffbox and rabbitsfoot (endangered); tongue-tied minnow, threehorn wartyback, and pondhorn (threatened); and least darter, wavy-rayed lampmussel, kidneyshell, and creek heelsplitter (species of concern). In addition, rayed bean mussel, a federally-listed candidate species and state-listed endangered species, has been documented in Little Darby Creek, and may inhabit its tributaries as well (Covert *et al.*, 2007).

(d) *Summary of Ecological Impact Studies*

Ecological studies of the Project Area include the Hull and Stantec studies described above. Stantec conducted on-site visual, radar, and acoustic monitoring studies of bird and bat migration during the fall of 2007 (see Exhibit N). Stantec also conducted various on-site avian and bat studies during the spring/summer/fall of 2008, including acoustic bat monitoring, diurnal raptor and sandhill crane surveys, and breeding bird surveys (see

Exhibit O). Environmental scientists from Hull assessed and delineated wetlands and streams within the Project Area, and mapped and described ecological communities within 0.25 mile of the Facility boundary (see Exhibit M). The Hull report also presents the results of a screening for potential occurrence of threatened or endangered surveys, and plans for additional field surveys in 2009 to cover areas that were/have not been surveyed due to small changes in Facility layout and seasonality considerations (see Exhibit Y).

In summary, the vegetation survey conducted by Hull identified and mapped six plant community types within the facility boundary and within 0.25 mile of the Facility boundary: old field, scrub-shrub, young woods, upland ridge, upland woods, and riparian woods. The old field community type comprises approximately 0.71% of the area within 0.25 mile of the Facility boundary. Old field communities typically develop on abandoned agricultural land, and persist for 10 to 20 years until they succeed to scrub-shrub or forest communities, or are converted back to agriculture. The scrub-shrub community type comprises approximately 0.73% of the area within 0.25 mile of the Facility boundary. This community type is an intermediate successional stage between old field and forest communities, and is dominated by upland shrubs and small trees. Young woods comprises approximately 0.67% of the area within 0.25 mile of the Facility boundary. Young woods are dominated by small trees and may have a dense shrub layer. Upland ridge occurs on steeply sloped ridges that are inaccessible for agricultural purposes, and comprises approximately 0.57% of the area within 0.25 mile of the facility boundary. Upland woods comprises approximately 4.11% of the area within 0.25 mile of the facility boundary, and generally occurs on flat to gently sloping terrain on well-drained soils. Riparian woods occur within floodplains along streams and creeks, and comprise approximately 1.34% of the area within 0.25 mile of the facility boundary. Riparian woods typically occur on moderately well-drained alluvial soils, but this community type can also include wetland areas in depressions (see 4906-13-07(B)(1)(b) above for additional detail). Based on the vegetation survey and suitable habitat, a list was compiled of vertebrate fauna likely to occur in each habitat type identified within the facility boundary and 0.25 mile of the facility boundary, based on field observations and published data (see 4906-13-07(B)(1)(c) above for additional detail).

To provide site-specific information on nesting birds in the vicinity of the Project Area, Stantec conducted on-site breeding bird surveys during the spring and summer of 2008. Survey timing and methods were based on recommended protocol developed by the

ODNR, and although surveys focused on assessing the presence or absence of state- or federally-listed species, all species of breeding birds either heard or visually detected were documented. A total of 5,947 individual birds representing 97 species were observed during the point count surveys. Species with the highest relative abundance were red-winged blackbird, horned lark, American robin, song sparrow, American crow, and European starling (see 4906-13-07(B)(1)(c) above for additional detail).

Stantec conducted diurnal raptor migration surveys during 2007 and 2008 to characterize raptor activity at the Project Site, and to document species-specific flight and behavioral patterns in the area. In 2007 raptor surveys were conducted on 11 days between August 30 and October 11, for a total of 66 hours. A total of 421 raptors, representing eight different species, were observed during the survey, yielding an overall observation rate of 6.4 birds/hour. Turkey vulture (N=380) was the most commonly observed species during the on-site raptor migration survey, and accounted for 90% of the observed birds. Red-tailed hawk was the second most commonly observed species (N=14), accounting for 3% of total observations. In 2008, raptor surveys were conducted on 32 days (216 hours) between March 1 and May 15, and on 24 days (167 hours) between September 1 and November 15. In addition, surveys for sandhill cranes, state-listed as an endangered species, were conducted on 12 days (84 hours) between November 16 and December 15, using the same HMANA methodology. A total of 1,476 raptors representing 12 different species were observed in the spring, yielding an overall observation rate of 6.8 birds/hour. A total of 581 raptors representing seven different species were observed in the fall, yielding an overall observation rate of 3.5 birds/hour. Although no sandhill cranes were observed during the targeted survey period, four were observed during a spring raptor survey on March 6, 2008. During the sandhill crane survey period, 27 raptors representing six species were observed, yielding an observation rate of 0.3 bird/hour. Turkey vulture was by far the most commonly observed species during both the spring (n=1,347, 91%) and fall (n=527, 91%) 2008 survey periods. Red-tailed hawk was the second most commonly observed species, accounting for 7% of the total observations in the spring (n=98), and 6% in the fall (n=32) (see 4906-13-07(B)(1)(c) above for additional detail).

To characterize fall songbird migration, Stantec (2008a) conducted nocturnal radar surveys in the vicinity of the Project Area. The study totaled 30 nights of radar surveys between September 1 and October 15, 2007 and included data collection on passage rates, flight altitude, and flight direction. Passage rates ranged from 0 targets/kilometer/hour (t/km/hr) to 404 t/km/hr, for an overall passage rate of 74 t/km/hr for the entire survey period. While there are currently no accurate quantitative methods for directly correlating pre-construction passage rates to operational impacts to migrating songbirds, the risk of collision appears to increase as passage rates of nocturnal migrants increases. As shown in Table 07-9 above, the passage rates observed in the vicinity of the Project Area were lower than at other comparable agricultural and forested sites across the Mid-Atlantic and Northeast regions (see 4906-13-07(B)(1)(c) above for additional detail).

To characterize and document bat activity in the vicinity of the Project Area, Stantec conducted field surveys during the fall of 2007, and in the spring, summer, and fall of 2008. The spring and fall surveys were designed to document migratory bat activity patterns in the vicinity of the Project Area, while the summer survey was designed to document bat activity in the vicinity of the Project Area during the breeding season. The 2007 survey was conducted from August 28 to October 30, for a total of 226 detector nights. During the sampling period, a total of 1,522 bat call sequences were detected and recorded, resulting in overall detection rates of 6.73 calls/detector-night. Of the calls that could be identified to species or guild, those of the big brown guild were the most common (34% of all call sequences), followed by the species within the red bat/eastern pipistrelle guild (18% of all call sequences). Less than 1% of call sequences were attributable to *Myotis* species. The 2008 survey was conducted from March 29 to September 2, for a total of 774 detector nights. During the sampling period, a total of 18,715 bat call sequences were detected and recorded, resulting in overall detection rates of 23.9 calls/detector-night. Of the calls that could be identified to species or guild in the 2008 survey, those of the big brown guild were the most common (61% of all call sequences), followed by the species within the red bat/eastern pipistrelle guild (4% of all call sequences). Only 3% of call sequences were attributable to *Myotis* species (see 4906-13-07(B)(1)(c) above for additional detail).

Anticipated impacts to ecological resources are presented below in Sections 4907-13-07(B)(2) and 4907-13-07(B)(3) of this Application.

(e) *List of Major Species*

Major species are defined by the OPSB as species of commercial or recreational value, and species designated as endangered or threatened in accordance with the U.S. and

Ohio threatened and endangered species lists. Commercial species consist of those trapped for fur, while recreational species consist of those hunted as game.

Commercial Species

The ODNR regulates the hunting and trapping of the following furbearers in Champaign County: muskrat, raccoon, red fox, gray fox, coyote, mink, opossum, striped skunk, long-tailed weasel, and beaver (ODNR, 2008d).

- Muskrat (*Ondatra zibethicus*): Muskrat are abundant throughout Ohio, and prefer habitats with slow-moving water, such as creeks and wetlands. This species is likely to occur in the vicinity of the Project Area.
- Raccoon (*Procyon lotor*): Raccoon are common statewide, occupying a wide variety of habitats, including forests, cropland, and developed land. This species is likely to occur in the vicinity of the Project Area.
- Red Fox (*Vulpes vulpes*): Red fox are common statewide, occupying a wide variety of habitats, including forests, cropland, and developed land. This species is likely to occur in the vicinity of the Project Area.
- Gray Fox (*Urocyon cinereoargenteus*): Less common in Ohio than the red fox, gray fox prefer forested and shrubland habitats, avoiding open areas. Although the Project Area is predominantly open agricultural land, this species could occur in low numbers in area woodlots and shrubland.
- Coyote (*Canis latrans*): Once extirpated in Ohio, coyotes are now common statewide, occupying a wide variety of habitats, including forests, cropland, and developed land. This species is likely to occur in the vicinity of the Project Area.
- Mink (*Mustela vison*): This semi-aquatic weasel has a statewide distribution, and favors forested wetlands with abundant cover. This species is likely to occur in low numbers in the vicinity of the Project Area.
- Opossum (*Didelphis virginiana*): Opossum are common statewide, occupying a wide variety of habitats, including forests, cropland, and developed land. This species is likely to occur in the vicinity of the Project Area.
- Striped Skunk (*Mephitis mephitis*): Skunk are common statewide, occupying a wide variety of habitats, including forests, cropland, and developed lands. This species is likely to occur in the vicinity of the Project Area.

- Long-tailed weasel (*Mustela frenata*): Found in a wide variety of habitats (including forests, cropland, and shrubland), this species is Ohio's most common weasel, and is likely to occur in the vicinity of the Project Area.
- Beaver (*Castor canadensis*): Beaver are common statewide, inhabiting and modifying permanent sources of water of almost any type, particularly low gradient streams and small lakes/ponds with outlets. This species is likely to occur in the vicinity of the Project Area.

<u>Recreational Species</u>

The ODNR (2009a) regulates the hunting of the following species in Champaign County: white-tailed deer, gray squirrel, red squirrel, fox squirrel, Eastern cottontail rabbit, woodchuck, ring-necked pheasant, northern bobwhite quail, wild turkey, mourning dove, American crow, wild boar, and various waterfowl.

- White-tailed deer (*Odocoileus virginianus*): Deer are common statewide, occupying a wide variety of habitats, including forests, shrubland, cropland, and developed land. This species was observed during fieldwork in the Project Area.
- Gray, red, and fox squirrels: The fox squirrel (*Sciurus niger*) is primarily an inhabitant of open woodlands, while the gray squirrel (*Sciurus carolinensis*) and the red squirrel (*Tamiasurius hudsonicus*) prefer more extensive forested areas. However, all three species have adapted well to landscaped suburban areas, and are often found around structures. These tree squirrels occur throughout Ohio, and are likely to occur in the vicinity of the Project Area.
- Eastern cottontail (*Sylvilagus floridanus*): Cottontails are widespread and abundant statewide. The species prefers open areas bordered by brush and open woodlands, and have adapted well to developed areas. This species is likely to occur in the vicinity of the Project Area.
- Woodchuck (*Marmota monax*): Woodchuck are common statewide, occupying a wide variety of habitats, including pastures, grasslands, and open woodlands. This species is likely to occur in the vicinity of the Project Area.
- Ring-necked pheasant (*Phasianus colchicus*): Although not native to North America, the pheasant is naturalized in northern and western Ohio, and occupies open habitats such as agricultural landscapes and old fields. This species has been documented in the vicinity of the Project Area in the Ohio BBA, the USGS BBS, and the Audubon CBC, and was observed during fieldwork on-site.

- Wild turkey (*Meleagris gallopavo*): Once extirpated in Ohio, this species has re-established populations statewide, and is especially common in the southern and eastern parts of the state. Wild turkey is an adaptable species that prefers mature forest habitats, but live successfully in areas with as little as 15% forest cover (ODNR, 2008c). This species has been documented in the vicinity of the Project Area in the USGS BBS and the Audubon CBC, and was observed during fieldwork on-site.
- Mourning dove (*Zenaida macroura*): Mourning doves are common statewide, occupying a wide variety of habitats, including cropland, shrubland, and developed land. This species has been documented in the vicinity of the Project Area in the Ohio BBA, the USGS BBS, and the Audubon CBC.
- American crow (*Corvus brachyrhyncos*): Crow are common statewide, occupying a wide variety of habitats, including forests, cropland, shrubland, and developed land. This species has been documented in the vicinity of the Project Area in the Ohio BBA, the USGS BBS, and the Audubon CBC.
- Wild boar (*Sus scrofa*): Wild boar are not native to Ohio, but have established breeding populations in several locations, occupying a wide variety of habitats, including forests, cropland, and shrubland. Distribution maps from the ODNR (2007) indicate that the feral swine have been recorded in the vicinity of the Project Area in the Town of Salem.
- Waterfowl: The following waterfowl game species have been recorded in the vicinity of the Project Area: Canada goose (*Branta canadensis*), snow goose (*Chen caerulescens*), mallard (*Anas platyrhynchos*), wood duck (*Aix sponsa*), pintail (*Anas acuta)*, black duck (*Anas rubripes*), scaup (*Aythya affinis*), coot (*Fulica americana*), and hooded merganser (*Lophodytes cucullatus*).

<u>Federally-Listed Species</u>

Correspondence with the USFWS (see Exhibit P) and review of published information indicates that the Project Area is within the range of three federally-listed species: the endangered Indiana bat, the candidate eastern massasauga, and the candidate rayed bean mussel (USFWS, 2007a).

- Indiana bat (*Myotis sodalis*): The Indiana bat is a migratory bat that hibernates in caves and mines in the winter. In spring, reproductive females emerge from their hibernaculum and migrate, forming maternity colonies in wooded areas to bear and raise their young. Trees (dead, dying, or healthy) with exfoliating or defoliating bark, or trees containing cracks or crevices, provide suitable summer roosts. Indiana bats require a mosaic of habitats for feeding, preferring to forage along streams/rivers and above waterbodies, but also utilizing upland forests, clearings with successional old field vegetation, the borders of croplands, wooded fencerows, and pastures (USFWS, 2007b). To document the presence or probable absence of Indiana bat within the Facility vicinity, the Applicant contracted Stantec to conduct bat mist-netting surveys (see Exhibit X). The scope and methodology of the study were developed in collaboration with the ODNR and the Reynoldsburg Ohio Ecological Services Field Office of the USFWS (now located in Columbus). The scope of the mist-netting survey covered an area extending from southern Logan County (directly north of Champaign County) south past the Village of Mutual. Although several Indiana bats were captured in Logan County, none were identified within the Project Area (Stantec, 2008b). Mist-net survey results and radio telemetry were used to calculate home/core ranges, which enabled the USFWS to establish a buffer from known Indiana bat locations in Logan County. The proposed Facility is in compliance with this setback, and therefore, no impacts to Indiana bats or their habitat are anticipated. As described in Section 4906-13-07(A)(3)(d) of this Application, the Facility layout has been modified since the 2008 mist-netting survey to reduce noise impacts at nearby residences. However, the USFWS has reviewed the layout of the proposed Facility as presented herein, and is in agreement with the conclusion that no impacts to Indiana bats or their habitat are anticipated. See USFWS correspondence dated April 9, 2009, included in Exhibit P.

- Eastern massasauga (*Sistrurus catenatus catenatus*): This rare rattlesnake inhabits the edges of open-canopied wetlands with adjacent early successional uplands, and moves seasonally between the upland and wetland habitats. Correspondence from the USFWS dated January 18, 2008 (see Exhibit P) indicated, "the Project, as proposed, should not impact this species or its habitat."
- Rayed bean mussel (*Villosa fabalis*): The rayed bean mussel is typically found in small, headwater creeks (usually in or near shoal or riffle areas), and in the shallow, wave-washed areas of lakes. This species has been recorded in the vicinity of the Project Area in Little Darby Creek, and is potentially present in its perennial tributaries as well. Correspondence from the ODNR (see Exhibit P) indicated, "If no in-water work is proposed, the proposed Project is not likely to

impact this species." No in-water work will be performed in perennial tributaries to Little Darby Creek, and therefore, no impacts to the rayed bean mussel are anticipated.

State-Listed Species

Correspondence with the ODNR (see Exhibit P) has indicated that there are no state nature preserves, state parks, or scenic rivers in the vicinity of the Project Area. The Division of Natural Areas and Preserves, Natural Heritage Database contains records of three state-listed species in the vicinity of the proposed Facility: lake chubsucker and tongue-tied minnow (threatened), and flat-stemmed pondweed (potentially threatened).

- Lake chubsucker (*Erimyzon sucetta*): Declining across much of its range, this species occupies ponds, lakes, impoundments, oxbows, swamps, and other clear waters with little or no flow. Lake chubsucker only rarely occurs in streams.
- Tongue-tied minnow (*Exoglossum laurae*): Limited to three disjunct populations in the upper Ohio River drainage basin, this species occurs in clear creeks and small/medium rivers, with moderate gradients and generally unsilted bottoms.
- Flat-stemmed pondweed (*Potamogeton zosteriformis*): This submersed aquatic plant is found in both shallow and deep waters of lakes, rivers, creeks, and wet swales.

Although very few records of state-listed threatened and endangered species exist for the Project Area, ODNR has not surveyed all areas of the State, and additional state-listed species could occur within the Project Area. Therefore, Hull (2009d) compiled a list of state listed threatened and endangered plant and animal species with potential to occur in the Project Area. This list was assembled by examining ODNR occurrence records for threatened and endangered species for the counties within a 5-mile buffer around the Project Area (Champaign, Logan, Clark, Madison, and Union counties). Within the five counties, there are records of 92 state-listed plant species and 30 state-listed animal species (see Tables 5 and 6 in Exhibit M).

In addition, for purposes of aquatic life use attainment assessment, the Ohio EPA considers the Big Darby watershed assessment unit to consist of four 11-digit HUCs, including the Little Darby 11-digit HUC and three Big Darby 11-digit HUCs. As described in Section 4906-13-06(C) of this Application, the Project Area includes part of the Little

Darby Creek 11-digit HUCs. Available lists of endangered aquatic species are compiled for the larger Big Darby watershed (i.e., including the Little Darby), and are not broken down by 11-digit HUC. An additional 10 state-listed fish species and 11 state-listed mussel species are known to occur within the Big Darby watershed assessment unit.

These lists were further refined by comparing habitat requirements for each listed species with the habitat types available within 0.25 mile of the Facility boundary, including active agricultural fields, old fields, dry forests, mesic forests, wet forests, floodplain forests, open wooded slopes, small streams, and marshes. Using the range of known and possible habitat types within 0.25 mile of the Facility boundary, a list was prepared of the state-listed threatened and endangered plant and animal species with the highest potential to occur within the Project Area. Threatened and endangered species specifically requiring stream or marsh habitats were excluded, as the design flexibility inherent in the Facility will likely allow for avoidance of impacts to these habitat types. In addition, because the vegetation survey described in 4906-13-07(B)(1)(b) did not reveal the presence of dry prairies, prairie remnants, fen wetlands, or seep wetlands within 0.25 mile of the Facility boundary, species requiring those habitats were also excluded (Hull, 2009d).

Based on the analysis of habitat types available within 0.25 mile of the Facility boundary, it was determined that 24 state-listed plant species, and five state-listed animal species could occur within the Project Area. Table 07-11 shows the state-listed species with potential habitat within 0.25 mile of the Facility boundary, along with general habitat requirements and Ohio state status for each species. For more information on these species, see Exhibit M.

Table 07-11. Protected Species with Potential Habitat within 0.25 mile of the Facility Boundary.

Plant Species[1]			
Scientific Name	**Common Name**	**General Habitat**	**Ohio Status[2]**
Amelanchier sanguinea	rock serviceberry	open woods, slopes	E
Anemone cylindrica	prairie thimbleweed	variety	T
Arabis hirsuta var. adpressipilis	southern hairy rock cress	variety	P
Baptisia lactea	prairie false indigo	variety	P
Botrychium biternatum	sparse-lobed grape fern	moist/shaded	T
Calamintha arkansana	limestone savory	dry open areas	T

Plant Species[1]			
Scientific Name	**Common Name**	**General Habitat**	**Ohio Status[2]**
Carex bicknellii	Bicknell's sedge	variety	T
Carex retroflexa	reflexed sedge	variety	T
Carex timida	timid sedge	dry to mesic woods/cedar	E
Delphinium exaltatum	tall larkspur	variety	P
Desmodium glabellum	hairy tick-trefoil	floodplain forest	E
Elymus trachycaulus	bearded wheat grass	variety	T
Gentiana alba	yellowish gentian	prairie/damp woods	T
Helianthus mollis	ashy sunflower	variety open	T
Juglans cinerea	butternut	mesic woods	P
Lathyrus venosus	wild pea	prairie/open woods	E
Melica nitens	three-flowered melic	dry woods/prairies	T
Nothoscordum bivalve	false garlic	variety open	T
Rosa blanda	smooth rose	variety	E
Sphenopholis obtusata var. obtusata	prairie wedge grass	variety	T
Spiranthes ovalis	lesser ladies'-tresses	moist forest, field	P
Thuja occidentalis	arbor vitae	open woods, slopes	P
Verbesina helianthoides	hairy wingstem	dry open woodlands	P
Vitis cinerea	pigeon grape	moist woods, edges	P
Animal Species[1]			
Scientific Name	**Common Name**	**General Habitat**	**Ohio Status[2]**
Bartramia longicauda	upland sandpiper	open uplands	T
Falco peregrinus	peregrine falcon	variety/nests on tall structures	E
Lanius ludovicianus	loggerhead shrike	old field/prairie	E
Myotis sodalis	Indiana bat	woodlands	E[3]
Taxidea taxus	badger	variety	SC

[1] (Hull & Associates, 2009d).
[2] E = Endangered, T = Threatened, P = Potentially Threatened, SC = Species of Concern (ODNR, 2008a).
[3] This species is also federally-listed as Endangered.

Facility components are located predominantly in agricultural land that does not provide habitat for state-listed species. However, the routes of a limited number of buried electrical interconnect lines will not fully avoid wooded plant community types (i.e., upland woods, upland ridge woods, young woods, and riparian woods). During the 2008 growing season, these habitats were the focus of a field survey for the species listed above in Table 07-11. The survey included inspection by qualified experts (including a botanist and a wildlife expert) along the proposed route of access roads and at proposed turbine locations. In the growing season of 2009, buried electrical interconnect routes (portions not paralleling access roads) will be the focus of additional survey efforts (see Exhibit Y). Re-routing will be implemented as needed to avoid any identified threatened or endangered species.

It is possible that Hull, the USFWS, or the ODNR may identify listed rare, threatened or endangered species along buried interconnect routes that may be affected by the Facility. If listed species are encountered during the field survey, their location will be noted on a map, and field notes on diagnostic characteristics will be taken along with a color photo. In the case of State-listed plant species where local abundance is moderate to high, a single specimen will be collected in a vasculum, and a mounted voucher will be prepared and preserved according to standard botanical methods. The documented occurrence of listed species may necessitate site-specific work beyond the activities described above to determine a strategy for compliance with the State or federal regulations, possibly including development of detailed site species lists, habitat mapping, animal live trapping, or other activities. If additional assessment work is necessary, the Applicant will prepare site-specific work plans and then coordinate review of those work plans with the USFWS and ODNR prior to implementation.

(2) Construction

(a) *Estimation of Impact of Construction on Undeveloped Areas*

Potential ecological impacts may occur during construction as a result of the installation of turbines, access roads, and electrical interconnects; the upgrade of local public roads or intersections, if needed; the development and use of staging areas and temporary workspaces around the turbine sites; and the construction of the substation and O&M building. Potential impacts to upland and wetland communities are discussed below.

<u>Upland Habitats</u>

Facility construction will result in temporary and permanent impacts to vegetation within the Project Area. Construction activities that will result in impacts to vegetation include site preparation, earth-moving, and excavation/backfilling activities associated with construction/installation of staging areas, access roads, foundations, and buried electrical interconnect. These activities will result in the cutting and clearing of vegetation, the removal of stumps and root systems, and increased exposure/disturbance of soil. Along with direct loss of (and damage to) vegetation, these impacts can result in a loss of wildlife food and cover, increased soil erosion and sedimentation, increased risk of colonization by non-native invasive species, and a disruption of normal nutrient cycling. However, it is not anticipated that any plant species occurring in the Project Area will be extirpated or significantly reduced in abundance as a result of construction activities.

Based on the Facility layout (i.e., wind energy Facility footprint) presented herein and the assumed area of disturbance associated with various construction activities as described in 4906-13-04(B)(1), Facility construction is anticipated to result in a total disturbance of approximately 6.7 acres of ecological communities, as described in 4906-13-07(B)(1)(b). These impacts will be comprised of 2.3 acres of old field, 0.3 acres of scrub-shrub, 0.6 acres of upland ridge, 0.9 acres of upland woods, and 2.6 acres of riparian forest. As indicated in Table 07-12, the majority of calculated impacts will be temporary. Native vegetation or agricultural crops will be reestablished following restoration of areas disturbed during construction.

Table 07-12. Impacts to Ecological Communities.

Community[1]	Total Disturbance (acres)	Temporary Disturbance (acres)	Permanent Loss (acres)
Old Field	2.3	2.3	0.0
Scrub-Shrub	0.3	0.3	0.0
Young Woods	0.0	0.0	0.0
Upland Ridge	0.6	0.4	0.2
Upland Woods	0.9	0.9	0.0
Riparian Forest	2.6	2.5	0.1
TOTAL	**6.7**	**6.4**	**0.3**

[1] Excludes wetland and open water communities. Impacts to wetlands and surface waters are discussed below.

Wetland & Surface Water Habitats

All of the proposed wind turbines are located in currently or recently active agricultural fields. Therefore, direct and indirect impacts to wetlands and surface waters in the vicinity of turbine workspaces will be negligible. The greatest potential for surface water and wetland impacts will be in the construction of turbine access roads and installation of electrical line interconnections among the turbine arrays (Hull, 2009d).

In 2007, Hull conducted a preliminary GIS screening analysis of the Project Area and surrounding areas, incorporating environmental datasets such as Ohio Wetland Inventory (OWI), National Wetland Inventory (NWI), streams and rivers, land use/land cover, and soils. This database was used to systematically screen the Project Area for environmentally sensitive areas, which were then avoided to the extent practicable during the turbine siting process. Hull and EDR then conducted a preliminary siting field study of proposed Facility component locations, to allow for layout adjustments that would further avoid impacting sensitive areas such as wetlands and streams.

Hull conducted a surface water evaluation in 2008 to delineate and evaluate potential surface water areas that may be affected by the Facility. A surface water evaluation consists of an initial surface water determination to establish the absence or potential presence of surface waters at a given site, and to make a preliminary determination of federal and/or State of Ohio surface water jurisdiction. If potential surface waters are present, the surface water determination is followed by delineation (as necessary) to establish jurisdictional boundaries of wetlands, streams, ditches and other water bodies.

The surface water evaluation was performed in accordance with the 1987 US Army Corps of Engineers (USACE) Wetland Delineation Manual and subsequent regulatory guidance issued by the USACE, Ohio Environmental Protection Agency (Ohio EPA) guidance on evaluation of streams, and established principles and practices of plant community ecology, botany and wildlife biology. Areas of mapped hydric soil, hydric soil inclusions within mapped non-hydric soil units, depressional areas, or any area that appears to contain or have contained standing water, saturated soil or hydrophytic plants were field-tested for the presence of wetland criteria. Where NWI mapping suggests the presence of wetlands within or near the Facility, these areas were examined to determine whether the NWI wetland was actually present. Upland areas were also examined to confirm the absence of wetland characteristics. Delineation activities were conducted in May, June, and November 2008 (Hull, 2009d).

If the presence of wetlands was confirmed, the edge of the wetland was flagged with surveyor's tape and confirmatory upland data points were taken. Wetland boundaries were mapped in the field using a portable mapping-grade GPS unit to capture the location of each flag. A quantitative assessment of wetland value was then conducted using the Ohio Rapid Assessment Method for Wetlands (ORAM) Version 5.0, and the wetlands were assigned to the appropriate category, as defined by the Ohio Water Quality Standards Antidegradation Policy for Wetlands (OAC 3745-1-54). There are three possible Ohio Wetland Antidegradation categories to which wetlands may be assigned:

- Category 1 – Lowest value category. Wetlands in this category are generally limited to small, low-diversity wetlands and wetlands with a predominance of non-native invasive species. The designation 'Category 1' is assigned to wetlands whose ORAM scores fall between 0 and 29.9. Wetlands whose ORAM scores fall between 30 and 34.9 fall in a scoring 'gray area', and additional testing is needed to determine whether they belong in Category 1 or the next higher Category.

- Category 2 – Middle value category. Wetlands in this category are of moderate diversity but do not contain rare, threatened or endangered species. They are generally degraded, but are capable of attaining higher value. Most wetlands in Ohio are expected to fall into this category. The designation 'Modified' is assigned to wetlands whose ORAM scores fall within the lower end (ORAM = 35-44.9) of the scoring range that defines Category 2 (ORAM = 35-59.9). Wetlands whose ORAM scores fall between 60 and 64.9 in a scoring 'gray area', and additional testing is needed to determine whether they belong in Category 2 or the next higher Category.

- Category 3 – Highest value category. Wetlands in this category may be large, diverse, represent rare plant community types, contain rare, threatened or endangered species, or any combination of these and several other factors. The designation 'Category 3' is assigned to wetlands whose ORAM scores fall between 65 and 100.

During the surface water delineation, three Ohio Category 1 Wetlands and four Modified Category 2 Wetlands were identified in the Project Area. No Ohio Category 3 wetlands were identified. Of the seven wetlands delineated, five were found to be non-isolated and under the Clean Water Act jurisdiction of federal and state government. Two wetlands were found to be isolated and under the sole jurisdiction of the Ohio Isolated Wetland Permitting Program. Delineated wetlands are mapped in Figures 1-18 in Exhibit M, which also contains detailed descriptions of each wetland, including information on dominant vegetation, soils, and hydrology. Characteristics of delineated wetlands in the vicinity of Project Area are summarized in Table 07-13 below.

Table 07-13. Delineated Wetlands with the Project Area.

Wetland ID	Figure Number[1]	NWI Community Type[2]	Wetland Size (acres)[3]	ORAM Score[4]	Ohio Category[4]	Isolation Status[3]
A	10	PUBFh	0.39	42	Modified 2	Isolated
B	10	PEMCd	2.9	41.5	Modified 2	Non-Isolated
G	7	PEMC	1.15	26	1	Non-Isolated
H	10	N/A	0.02	37.5	Modified 2	Non-Isolated
I	10	PUBGh	0.66	37	Modified 2	Non-Isolated
J	11	PEMA	0.74	7.5	1	Isolated
K	11	PEMC	1.44	17.5	1	Non-Isolated

[1] Figures are in the Surface Waters, Ecological Communities, and Threatened and Endangered Species report (Hull, 2009d), attached hereto as Exhibit M.
[2] PUBFh = Palustrine, Unconsolidated Bottom, Semi-permanently Flooded, Diked/Impounded; PEMCd = Palustrine, Emergent, Seasonally Flooded, Partially Drained/Ditched; PEMC = Palustrine, Emergent, Seasonally Flooded; PUBGh = Palustrine, Unconsolidated Bottom, Intermittently Exposed, Diked/ Impounded; PEMA = Palustrine, Emergent, Temporarily Flooded.
[3] Subject to verification by USACE.
[4] Subject to verification by Ohio EPA.

Through careful Facility design, all temporary and permanent impacts to identified wetlands will be avoided during Facility construction. However, some wetlands listed in Table 07-13 are close enough to proposed Facility components that specific avoidance steps will be taken during construction to ensure their protection. These steps may include prominently flagging or temporarily fencing the wetland edges prior to construction, and proper implementation of a SWP3 (Hull, 2009d). Additional information on proposed mitigation measures can be found in Section 4906-13-07(B)(2)(c) of this Application.

Streams with the potential to be impacted by Facility activities were mapped, and field measurements of basic stream fluvial morphological characteristics were performed. Hull evaluated streams on each site using the Ohio Qualitative Habitat Evaluation Index (QHEI) scoring method, or the Ohio Headwater Habitat Evaluation Index (HHEI), as applicable. Both methods yield a numerical score for the section of streams evaluated. Hull used these scores to estimate the probable existing aquatic life use of each stream. An additional survey method, the Visual Encounter Survey (VES), was used in a few streams thought to have physical aspects of higher-value headwaters streams.

The HHEI and the Ohio Headwaters Macroinvertebrate Field Evaluation Index (HMFEI) are used on primary headwater habitat (PHWH) streams with a drainage area less than one square mile and with maximum pool depths less than 40 centimeters. Headwater streams are the small swales, creeks, and streams that are the origin of most rivers. These small streams join together to form larger streams and rivers, or run directly into larger streams and lakes. Ohio EPA defines a headwater stream as a stream with a watershed less than or equal to 20 square miles. Many streams and drainage ways have a watershed of less than one square mile; these are referred to as primary headwater streams (Ohio EPA, 2003). There are three possible categories to which PHWH streams may be assigned:

- Class I PHWH Streams – Lowest value category. Limited to intermittent or ephemeral streams with warm water conditions. May contain ephemeral warm water communities, but are often dry for long periods of time.

- Class II PHWH Streams – Middle value category. Perennial or intermittent streams with warm water conditions. Generally contain species of animals that are adapted to warm water streams, including certain amphibians and pioneering fish species, along with invertebrates such as odonate larvae.

- Class III PHWH Streams – Highest value category. Perennial streams with cold water conditions. Groundwater fed. Contain species of animals adapted to year-round presence of cool water, including certain amphibians or fish species, along with insect larvae such as mayflies, stoneflies, and caddisflies.

In addition to natural channels, different classes of headwater streams can also have modified channels. Many primary headwater streams are being modified through channelization and/or riparian removal, as part of activities related to agricultural activities and urban/suburban development. Such modification is the origin of habitat degradation in smaller streams and a leading source of impairment to the water quality of larger streams into which they flow (Ohio EPA, 2003).

The QHEI is used for streams with drainage areas greater than about one to three square miles. This index was designed to provide a measure of habitat quality that corresponds to physical factors that affect communities of fish and aquatic invertebrates, and is based on six main metrics: substrate, instream cover, channel morphology, channel and bank condition, pool and riffle quality, and gradient (Rankin, 1989). These larger streams have sufficient amounts of water throughout the year to support fish communities. Scores from the QHEI were used to assign each stream to one or more of the following aquatic life use designations, as defined by Ohio Water Quality Standards Water Use Designations (OAC 3745-1-07):

- Warmwater Habitat (WWH) – Capable of supporting and maintaining a balanced community of warmwater aquatic organisms. This is the most widely applied use designation assigned to rivers and streams in Ohio.

- Limited Warmwater Habitat (LWWH) – Temporary aquatic life habitat use designation created in the 1978 Ohio Water Quality Standards for streams not meeting specific warmwater habitat criteria. This aquatic life use designation is being phased out.

- Exceptional Warmwater Habitat (EWH) – Capable of supporting and maintaining an exceptional or unusual community of warmwater aquatic organisms with the general characteristics of being highly intolerant of adverse water quality conditions and/or being rare, threatened, endangered, or of special status.

- Modified Warmwater Habitat (MWH) – Incapable of supporting and maintaining a balanced community of warmwater aquatic organisms because of extensive and irretrievable modifications to the physical habitat.

- Seasonal Salmonid Habitat (SSH) – Capable of supporting the passage of salmonids from October to May, and large enough to support recreational fishing.

- Coldwater Habitat (CWH) – Capable of supporting populations of coldwater aquatic organisms on an annual basis and/or put-and-take salmonid fishing. These water bodies are not necessarily capable of supporting the successful reproduction of salmonids and may be periodically stocked.

- Limited Resource Water (LRW) -- Incapable of supporting and maintaining a balanced community of aquatic organisms because of natural background conditions or irretrievable human-induced conditions.

During the surface water delineation, 13 streams were identified within the Project Area and confirmed to be under federal regulatory jurisdiction. These streams consist of five Modified Class I PHWH streams, six Modified Class II PHWH streams, one CWH stream, and one EWH/CWH stream. Assessed streams are mapped in Figures 1-18 in Exhibit M, which also contains detailed descriptions of each stream, including information on flow direction, substrate, and HHEI/HMFEI/QHEI/VES scores. Characteristics of jurisdictional streams in the Project Area are summarized below in Table 07-14.

Table 07-14. Jurisdictional Streams within the Project Area.

Stream ID	Figure Number[1]	Flow Regime	Watershed Size (square miles)	Aquatic Life Use Designation
B	4	Perennial	0.46	Modified Class II PHWH
D	6	Ephemeral	0.23	Modified Class I PHWH
E	4	Intermittent	2.73	Modified Class II PHWH
F	7	Perennial	0.24	Modified Class II PHWH
G	3	Ephemeral	0.1	Modified Class I PHWH
H	4	Intermittent	11.3	Modified Class II PHWH
I	9	Perennial	0.43	Modified Class II PHWH
J	9	Intermittent	1.05	Modified Class II PHWH
K	9	Ephemeral	0.24	Modified Class I PHWH
L	12	Perennial	1.95	EWH and CWH
M	7	Ephemeral	0.07	Modified Class I PHWH
O	16	Perennial	4.11	CWH
P	10	Ephemeral	0.07	Modified Class I PHWH

[1] Figures are in the Surface Waters, Ecological Communities, and Threatened and Endangered Species report (Hull, 2009d), attached hereto as Exhibit M.

For all identified stream crossings, effective techniques are available and will be used to avoid stream impacts that would require Clean Water Act Section 404 and 401 permits. For example, existing stream crossings will be used whenever possible. These existing crossings may need to be temporarily strengthened via placement of a steel plate to allow crossing by heavy equipment (e.g., cranes) and turbine components. After construction, the steel plate will be removed, and maintenance vehicles will use the existing crossing without modification. In situations where there is no existing crossing, in-water work will be avoided, and special crossing techniques will be utilized. Such techniques could include permanent bridge span above the ordinary high water mark for access road crossings or directional boring for buried electrical collection lines.

According to Hull (2009d), additional surface water delineation activities will be necessary prior to construction at a several locations that have not yet been surveyed. The only areas not already subject to field delineation occur along portions of buried interconnect routes that do not parallel access roads, and these areas will be investigated/delineated during the growing season of 2009 (see Exhibit Y). As summarized in Table 07-15 below, areas of particular concern include points where buried interconnect lines cross mapped streams, or where they cross woodlands with the potential to contain unmapped wetlands. These areas will be subject to a surface water evaluation prior to construction, and along with the stream/wetland impacts previously described, will be re-evaluated and quantified during the state and federal wetland permitting process.

Table 07-15. Areas Subject to Surface Water Evaluation Prior to Construction.

Figure Number[1]	Buried Interconnect Connects Turbines	Plant Community Crossed	Cross Mapped Stream?
4	2 and 3	Upland Ridge, Riparian Woods, Agriculture	Yes
6	16 and 18	Upland Woods, Riparian Woods, Agriculture	Yes
9	31 to access road between 40 and 43	Agriculture	No
10	40 to access road between 38 and 42	Agriculture	Yes
12, 17	53 and 56	Riparian Woods, Scrub-Shrub, Agriculture	Yes
13, 14	62 to overhead	Agriculture	No
13	66 and 68	Agriculture	Yes
15, 10	52 to access road to 49	Agriculture; may cross grassed waterways	Yes
15	70 to overhead	Agriculture; may cross grassed waterways	No
16	69 to substation	Agriculture; may cross grassed waterways	No

[1] Figures are in the Surface Waters, Ecological Communities, and Threatened and Endangered Species report (Hull, 2009d), attached hereto as Exhibit M.

The Facility is located entirely on leased private land. Therefore, construction-related impacts to recreational areas, parks, wildlife areas, nature preserves, or other conservation areas (as identified in proposed rule 4906-17-08(B)(1)(a)) will not occur.

(b) *Estimation of Impact of Construction on Major Species*

Siting Facility components away from sensitive habitats, such as forestland, streams and wetlands, will minimize impacts to wildlife. Construction-related impacts to wildlife are anticipated to be limited to incidental injury and mortality due to construction activity and vehicular movement, construction-related silt and sedimentation impacts on aquatic organisms, habitat disturbance/loss associated with clearing and earth-moving activities, forest fragmentation, and displacement of wildlife due to increased noise and human activities. Each of these potential impacts is described below. Based on the studies conducted to date, none of the construction-related impacts will be significant enough to affect local populations of any resident or migratory wildlife species.

Incidental Injury & Mortality

Incidental injury and mortality should be limited to sedentary/slow-moving species such as small mammals, reptiles, and amphibians that are unable to move out of the area being disturbed by construction. If construction occurs during the nesting season, wildlife subject to mortality could also include the eggs and young offspring of nesting birds, as well as immature mammalian species that are not yet fully mobile. More mobile species and mature individuals should be able to vacate areas that are being disturbed. Furthermore, because most Facility components are sited in active agricultural land that provides limited wildlife habitat, and which currently (and historically) experiences frequent agricultural-related disturbances, such impacts are anticipated to be very minor.

Siltation & Sedimentation

Earth-moving activities associated with Facility construction have the potential to cause siltation and sedimentation impacts down slope of the area of disturbance. Facility components will be sited away from wetlands and streams to the extent practicable. To prevent adverse effects to water quality and aquatic habitat during construction, runoff will be managed under an NPDES construction storm water permit and associated SWP3. An erosion and sediment control plan will be developed prior to construction that will use appropriate runoff diversion and collection devices. Also, because the majority of Facility components are being sited in active agricultural land, soil disturbance/exposure due to Facility construction will generally occur in areas already subject to regular plowing, tilling, harvesting, etc.

Habitat Loss

The majority of the Facility will be built in or adjacent to agricultural land, which generally provides habitat for a limited number of wildlife species. In addition, these areas are already subject to periodic disturbance in the form of mowing, plowing, harvesting, etc. However, hayfields and pastureland do provide habitat for open country/grassland avian species (such as bobolink, red-winged blackbird, and savannah sparrow), and will be disturbed by Facility construction. Successional old-field, scrub-shrub, and forested communities will experience less construction-related disturbance. However, based on the current Facility layout, approximately 4.1 acres of forest and 2.6 acres of successional habitat will be directly impacted by Facility construction. As discussed in Section 4906-13-07(B)(2)(a) of this Application, most of these impacts will be temporary.

Forest Fragmentation

The proposed Facility will result in permanent loss of 0.3 acres of forest habitat, and conversion of 3.8 acres of forest to successional communities. However, the forested habitat being impacted by the Facility generally occurs at the edges of relatively small blocks or woodlots. This being the case, it is not anticipated that any forests will be significantly fragmented by the proposed Facility.

Disturbance/Displacement

Some wildlife displacement will also occur due to increased noise and human activity as a result of Facility construction. The significance of this impact will vary by species and the seasonal timing of construction activities. Because most of the Facility occurs in agricultural land and early successional habitat, species utilizing those habitats (such as grassland bird species) are most likely to be disturbed/displaced by Facility construction.

(c) *Description of Short-term and Long-term Mitigation Procedures*

Various procedures will be used to reduce impacts during Facility construction, including impact minimization measures, site restoration, and mitigation. Each of these procedures is described in detail below:

Impact Minimization Measures

Mitigation measures to avoid or minimize impacts to vegetation will include identifying/delineating sensitive areas (such as wetlands) where no disturbance or vehicular activities will be allowed, limiting areas of disturbance to the smallest size practicable, siting Facility components in previously disturbed areas (e.g., existing farm lanes), educating the construction workforce on respecting and adhering to the physical boundaries of off-limit areas, employing best management practices during construction, and maintaining a clean work area within the designated construction sites. Following construction activities, temporarily disturbed areas will be seeded (and stabilized with mulch and/or straw if necessary) to reestablish vegetative cover in these areas. Native species will be allowed to re-vegetate these areas, except in active agricultural fields.

To avoid or minimize Facility -related impacts on surface waters and wetlands, preliminary and final Facility design is guided by the following criteria during the siting of wind turbines and related infrastructure:

- Large built components of the Facility, including wind turbine generators, staging areas, the O&M building, and the substation, are sited to completely avoid wetlands and surface waters.
- The number and overall impacts due to access road crossings were minimized by routing around wetlands and streams whenever possible, and by utilizing existing crossings and narrow crossing locations to the extent practicable.
- Buried electric interconnect lines will avoid crossing wetlands whenever possible, will cross streams at existing or, previously disturbed locations, and will utilize installation techniques that minimize construction-related impacts to surface waters and wetlands.
- All Facility components, including access roads and buried interconnects, are sited to completely avoid forested wetlands.

Other on-site environmental or logistical constraints, (such as stands of mature forest, landowner concerns, and other current land use), may make further avoidance of wetlands and streams unfeasible. Where crossings of surface waters and wetlands are required, the Applicant will employ best management practices associated with applicable streamside and wetland activities. Specific mitigation measures for protecting wetlands and surface water resources will include designating no equipment access areas and restricted activity areas, employing low impact wetland and stream crossing techniques, developing and implementing a sediment and siltation control plan and a storm water pollution prevention plan, and implementing spill prevention, containment and countermeasure controls. Each of these mitigation measures is described below.

No Equipment Access Areas: Except where crossed by permitted access roads, wetlands and surface waters will be designated "No Equipment Access," thus prohibiting the use of motorized equipment in these areas.

Restricted Activity Areas: A buffer zone of 50 feet, referred to as a "Restricted Activity Area", will be established wherever Facility construction traverses, or comes in proximity to, wetlands and surface waters. Restrictions within this buffer zone will include:

- No deposition of slash
- No accumulation of construction debris
- No application of herbicide
- No degradation of stream banks
- No equipment washing or refueling and
- No storage of any petroleum or chemical material

Low Impact Wetland Crossing Techniques: When constructing roads or installing buried interconnect, routing around wetland edges, utilizing previously-disturbed areas, and crossing the narrowest portion of a wetland will be the preferred crossing options. Wherever feasible, low impact crossing methods will be used such as timber mats or similar materials. Geotextile mats or corduroy may also be used to provide temporary access through wetlands. Where permanent roadways are installed and impoundment of water is possible, suitably sized culverts will be installed to maintain the natural water levels/flows on each side of the road.

Low Impact Stream Crossing Techniques: The Applicant will adhere to any permit special conditions pertaining to low impact stream crossing techniques, including seasonal restrictions and/or alternative stream crossing methods, such as temporary bridging and installation of crossings "in the dry." Open-bottomed or elliptical culverts may be utilized on certain streams to minimize loss of aquatic habitat and restriction of fish passage. Utilizing these techniques should avoid or minimize any adverse impacts on fish and other aquatic organisms.

Storm Water Pollution Prevention Plan (SWP3): To avoid and minimize impacts to aquatic resources resulting from construction-related siltation and sedimentation, an approved SWP3 will be implemented. To protect surface waters, wetlands, and groundwater, silt fencing, hay bales and other sediment and erosion control measures will be installed and maintained throughout Facility development. The location of these features will be indicated on construction drawings and reviewed by the contractor prior to construction.

Spill Prevention, Containment, and Countermeasure (SPCC): SPCC measures will be implemented to prevent the release of hazardous substances into the environment. These measures will not allow refueling of construction equipment within 100 feet of any stream or wetland, and all contractors will be required to keep materials on hand to control and contain a petroleum spill. These materials will include a shovel, tank patch kit, and oil-absorbent materials. Any spills will be reported in accordance with ODNR regulations. Contractors will be responsible for ensuring responsible action on the part of construction personnel.

<u>Site Restoration</u>

Following completion of construction, temporarily impacted areas will be restored to their pre-construction condition. Restoration activities are anticipated to include the following:

- The 200-foot radius turbine workspaces will be reduced to a permanent footprint of 0.2 acre (60-foot by 100-foot gravel crane pad, 18-foot diameter turbine pedestal, and a 6-foot wide gravel skirt around the tower base).
- The 40-foot wide access roads will be reduced to maximum width of 20 feet.
- Pre-construction contours and soil/substrate conditions will be established in all disturbed areas, to the extent practicable.
- Disturbed stream banks will be stabilized per the conditions of any formal state-issued permit.
- Buried electrical interconnect routes will be restored to pre-construction contours (as necessary) and allowed to regenerate naturally.
- Restoration of disturbed agricultural fields will be accomplished by de-compacting the soil, removing rocks, and re-spreading stockpiled topsoil.

- Disturbed soils throughout the Project Area will be re-seeded with an annual cover crop to stabilize exposed soils and control sedimentation and erosion. Seeding outside of active agricultural fields will be restricted to native seed mixes.

These actions will assure that, as much as possible, the site is returned to its pre-construction condition and that long-term impacts are minimized.

Mitigation Measures

To mitigate for unavoidable permanent wetland and stream impacts associated with the Facility, the Applicant will undertake a suitable on-site or off-site compensatory mitigation project, likely through the creation of in-kind wetland at a ratio of 1.5 to 1 (mitigation to impact). This suitable compensatory mitigation project will be developed in consultation with the USACE and Ohio EPA during the permitting process. No mitigation for indirect or temporary impacts to wetlands or surface waters is proposed, given the fact that these impacts will not result in any loss of wetland acreage, function or value. However, temporary impacts to wetlands and streams will be minimized during construction, as described above.

(3) Operation

(a) *Estimation of Impact of Operation on Undeveloped Areas*

Aside from minor disturbance associated with routine maintenance and occasional repair activities, no other disturbance to plants, vegetative communities, wetlands, or surface waters are anticipated as a result of Facility operation. As previously indicated, the Facility is located entirely on leased private land. Therefore, the built Facility will not result in physical disturbance/impacts to recreational areas, parks, wildlife areas, nature preserves, or other conservation areas (as identified in proposed rule 4906-17-08(B)(1)(a)). However, Facility visibility will extend beyond the boundaries of leased private land. The Cultural Resources analysis located at 4906-13-07(D)(5) of this Certificate Application provides an evaluation of potential impact to recreational areas within one mile of the Facility, which includes two golf courses and a local park. These recreational sites are briefly described below, along with a brief assessment of potential impacts from the proposed Facility. Additional detail is provided at 4906-13-07(D)(5) of this Certificate Application.

- Woodland Golf Club is a public, 18-hole course located along Swisher Road in Cable, OH, and includes a driving range, putting green, pro shop, and banquet facilities (Woodland Golf Club, 2009; CCC&VB, 2009). Turbines will likely be visible throughout the entire property, with the number of turbines visible ranging from 19 to 67, depending on location. The southwest corner of the golf course has views of the fewest turbines, while the vicinity of the clubhouse parking lot has views of the most turbines. However, because the viewshed analysis only includes screening provided by topography and vegetation, and not that provided by buildings, the clubhouse structure will likely block views towards some turbines, thereby reducing the total number of turbines visible from that area (EDR, 2009). As described in Section 4906-13-07(A)(3)(c) of this Application, daytime sound levels will not exceed nominal impact thresholds at Woodland Golf Club. When nighttime sound contours are modeled based on the worst-case L90 sound levels, sound levels in the extreme western portion of the course exceed the nominal impact threshold (Hessler, 2009). However, the sound levels that may occur on the two western-most fairways will not adversely affect recreational use of the golf course since golf is not typically played at night.

- Urbana Country Club is a private facility, with an 18-hole course, located along US Highway 36 in Urbana, and includes a swimming pool, tennis courts, golf shop, restaurant, and clubhouse (Urbana Country Club, 2009; CCC&VB, 2009). Turbines will likely be visible throughout much of the property, with the number of turbines visible ranging from 0 to 65, depending on location. No turbines will be visible from forested areas, including the extreme northeast and southwest corners of the property, and a large woodlot in the east-central portion of the course. The greatest number of turbines will be visible from the east-southern portion of the golf course (EDR, 2009). As described in Section 4906-13-07(A)(3)(c) of this Application, daytime sound levels will not exceed nominal impact thresholds at Urbana Country Club. When nighttime sound contours are modeled based on the worst-case L90 sound levels, the southern portion of the course exceed the nominal impact threshold (Hessler, 2009). However, since golf is not typically played at night, the nighttime sound levels that may occur on the five affected fairways will not adversely impact recreational use of the golf course.

- Goshen Memorial Park is located within the village of Mechanicsburg, along Parkview Road. Amenities include baseball, t-ball, and softball fields; tennis courts; horseshoe pits; a playground; restrooms and water fountains; picnic tables and grills; a large covered shelter; an enclosed multi-purpose building; and a stage at the foot of a natural amphitheater (Village of Mechanicsburg, 2009; CCC&VB, 2009). Turbines will likely be visible throughout much of the property, with the number of turbines visible ranging from 0 to 56, depending on location. No turbines will be visible in the forested areas in the central-south portion of the park. The greatest number of turbines will be visible only from a tiny area north of the tennis courts; 20 or fewer turbines will be visible from the majority of the park (EDR, 2009). Sound levels at Goshen Memorial Park will not exceed nominal impact thresholds during either daytime or nighttime hours (Hessler, 2009).

With respect to wildlife areas, nature preserves, and other conservation areas, the Visual Impact Assessment identifies a number of these resources within 5 miles of the Facility, and provides an analysis of potential visibility from each location. Below is a brief summary of this analysis (see Exhibit I, Appendix B for additional detail).

- Prairie Road Fen Nature Preserve (State Nature Preserve) – located approximately 3.7 miles from the nearest turbine. Topographic viewshed analysis indicates visibility from this preserve, while vegetation viewshed analysis indicates partial visibility.

- Urbana Wildlife Propagation Unit (State Wildlife Management Area) – located approximately 1.8 miles from the nearest turbine. Topographic viewshed analysis indicates partial visibility from this preserve, and vegetation viewshed analysis also indicates partial visibility.

- Cedar Bog Nature Preserve (National Natural Landmark) – located approximately 4.0 miles from the nearest turbine. Topographic viewshed analysis indicates visibility from this preserve, while vegetation viewshed analysis also indicates partial visibility.

- Darby Wetlands Reserve Program (Nature Preserve Area) – located approximately 0.6 miles from the nearest turbine. Topographic viewshed analysis indicates partial visibility from this preserve, and vegetation viewshed analysis also indicates partial visibility.

As indicated in Exhibit I (see also Section 4906-13-05(B)(3)(d) of this Certificate Application), the contrast and visual impact of the wind turbines from a given location is highly variable based on the number of turbines visible, viewer sensitivity/acceptance, and/or existing land use characteristics. The greatest impact typically occurs when numerous turbines are visible and/or where the turbines are close to the viewer (i.e., less than 1.0 mile). These conditions tend to heighten the Facility 's contrast with existing elements of the landscape in terms of, line, form, and especially scale. Visual impact can also be significant where the turbines appear incongruous or out of place in a certain landscape setting, or where aesthetic quality and/or viewer sensitivity are high. However, the analysis presented in the Visual Impact Assessment (Exhibit I) does not indicate a significant adverse impact.

(b) *Estimation of Impact of Operation on Major Species*

Operational impacts to wildlife are expected to be limited to possible displacement of wildlife due to the presence of the wind turbines, and some level of avian and bat mortality as a result of collisions with the wind turbines. Each of these potential impacts is described below.

Disturbance/Displacement

Habitat alteration and disturbance resulting from the operation of turbines and other wind farm infrastructure has the potential to make a site unsuitable or less suitable for nesting, foraging, resting, or other wildlife use. As mentioned above, the footprint of turbine pads, roads, and other Facility infrastructure represents a very small percentage of the site following construction. Therefore, overall land use is relatively unchanged by wind power development. However, due to the presence of tall structures and increased human activity, the amount of wildlife habitat altered by a wind power project can extend beyond the functional Facility footprint.

While wildlife may become habituated to the presence of wind turbines within a few years, the rate and degree of habituation is currently unknown because long-term studies have not been conducted. Forest and forest edge birds should not be significantly disturbed because the affected habitat generally consists of forest edges and small forest patches already subject to human disturbance. In addition, forest-dwelling birds are familiar with tall features (i.e., trees) in their habitat, and appear to have a greater ability to habituate to tall structures.

However, evidence indicates that some grassland species do not respond favorably to the addition of tall structures to their habitat. Studies conducted at the Buffalo Ridge Wind Power Project in southwest Minnesota and the Foote Creek Rim Project in Wyoming, revealed that grassland nesting birds are found in reduced numbers in proximity to wind turbines (Johnson *et al.*, 2000; Leddy *et al.*, 1999). In a study at the Oklahoma Wind Energy Center, killdeer, western meadowlark, and greater roadrunner occurred in higher abundance 5-10 km from turbines than in their immediate vicinity. However, overall results for the 35 species assessed, including numerous other grassland species, showed no significant differences in breeding densities in relation to turbine proximity (O'Connell & Piorkowski, 2006).

Assuming similar behavior by grassland species within the Project Area, the completed Facility may result in a reduced number of grassland species in open fields that contain wind turbines. Common grassland species that could be affected include savannah sparrow, horned lark, vesper sparrow, grasshopper sparrow, and eastern meadowlark. State-listed grassland species at risk for displacement impacts include northern harrier (endangered); and sedge wren, Henslow's sparrow, and bobolink (species of concern). The degree to which these species are affected depends of the suitability of affected habitat (i.e., are these species currently nesting in the area), nesting locations, and nesting densities relative to the wind turbine placements. If grassland songbirds are displaced, it is not known how far this displacement would extend from the turbines, or how long the displacement effect would last.

The long-term significance of this disturbance and displacement cannot be entirely understood without examining the long-term integrity and maintenance of the agricultural habitats that now comprise much of the Project Area. If fields that currently support nesting grassland bird species succeed into woodlands, as is often the case with abandoned farmland, grassland birds will be displaced from those areas with or without the Facility. If these grassland habitats are maintained over the long-term, grassland birds can be expected to continue nesting on site. It is also not known to what degree populations of grassland-nesting birds are being impacted by hay mowing and other agricultural activities on site. The significance of impacts to grassland birds in a given area would have to be considered in terms of the cumulative impacts of agricultural practices, farm conversion, and other deleterious impacts to these species, in addition to wind turbine related displacement.

The potential impacts of the Facility on waterfowl, including foraging Canada geese and snow geese, should not be significant, even though migrating waterfowl can be expected to forage in the farm fields in the vicinity of the Project Area. This conclusion is based on the results of a study conducted by the Iowa Cooperative Fish and Wildlife Research Unit at the Top of Iowa Wind Farm located in Worth County, Iowa. Due to its proximity to three state-owned Wildlife Management Areas, the Top of Iowa Wind Farm experiences very high use by waterfowl (over 1.5 million duck and goose use-days per year). Observations at that site revealed that the wind turbines did not affect the use of the fields by Canada geese or other species of waterfowl. In addition, over the two-year course of the study, no turbine-related waterfowl or shorebird mortality was documented (Koford *et al.*, 2005). Based on these study results, and observations at other wind power projects, the proposed Facility is not anticipated to have a significant, long-term displacement or mortality effect on resident or migrating waterfowl.

Landowners and recreational users are often concerned over the potential displacement effect of wind turbines on game species such as deer and wild turkey. While habituation may not be immediate, species such as deer and wild turkey generally adapt quickly to the presence of man-made features in their habitat, as evidenced by the abundance of these species in suburban settings. Specific to wind turbines, EDR personnel observed deer and wild turkey foraging at the base of wind turbines that had just been erected a few months before at the Maple Ridge Wind Farm in Lewis County, New York. Significant displacement of game species from a wind power site has not been reported.

Collision

Collision with various man-made structures has been documented as a potentially significant source of songbird mortality. Although fatalities at wind energy facilities has been minor when compared to other anthropogenic sources of avian mortality, an estimated 20,000 to 37,000 birds were killed at about 17,500 wind turbines in the United States in 2003. Fatalities ranged from zero to about 9 birds/turbine/year, yielding an average of 2.1 birds/turbine/year (Erickson *et al.*, 2005). Studies from the Eastern United States generally reveal slightly higher fatality levels than those observed farther west. A study conducted in 2003 at the Mountaineer Wind Energy Center in West Virginia found an average mortality rate of about four birds/turbine/year (Kerns & Kerlinger, 2004). At the Maple Ridge Wind Farm in Lewis County, New York, post-construction monitoring documented average fatality levels of 9 birds/turbine/year in 2006 (Jain *et al.*, 2007), and 6 birds/turbine/year in 2007 (Jain *et al.*, 2008).

Collision risk to resident waterbirds (waterfowl, long-legged waders, shorebirds, rails, etc.) in the Project Area is likely to be minimal. Because there are small wetlands in the vicinity of the Project Area, some waterbirds may be present, which could be at risk of colliding with turbines. However, research has demonstrated that very few shorebirds collide with wind turbines or other tall structures. Shorebirds are extremely rare on the lists of birds killed at wind power projects (Erickson *et al.*, 2001). Risk of collision to waterfowl and other waterbirds during migration is also likely to be minimal, because these birds typically migrate at high altitudes (Kerlinger & Moore, 1989; Bellrose, 1976), and because this group of birds has not demonstrated a propensity to collide with wind turbines or communication towers. The Canada geese and snow geese that forage on nearby agricultural fields may experience a slightly higher level of risk. However, Canada geese have never demonstrated susceptibility to colliding with turbines. As mentioned previously, a study at the Top of Iowa Wind Power Project site revealed no fatalities to waterfowl (Koford *et al.*, 2005). Therefore, waterbirds are not likely to be at significant risk of colliding with wind turbines in the Project Area.

Similarly, raptor mortality from collision with turbines has also been low at most operating wind power projects outside of California. Studies have documented high raptor collision avoidance behaviors at modern wind facilities (Whitfield & Madders, 2006; Chamberlain *et al.*, 2006). Although the mechanism of raptor turbine avoidance is unknown, most raptors are diurnal and have good eyesight, suggesting they may be able to detect turbines visually as well as acoustically. As described in Section 4906-13-07(B)(1)(c) of this Application, the passage rate of migrating raptors within the Project Area during the fall of 2007 was very low (Stantec, 2008a). Even where concentrated hawk migration does occur around wind energy sites, evidence suggests that risk to migrating raptors is not great, and not likely to be biologically significant. Reports from Tarifa, Spain, where raptor migration is highly concentrated, strongly suggest that migrating raptors rarely collide with turbines (DeLucas *et al.*, 2004).

Based on post-construction monitoring studies at other operating wind energy facilities, the species most likely to be impacted are resident birds that forage in open country, such as red-tailed hawk, as opposed to migrating raptors that pass through the area. At the Mountaineer Wind Energy Center in West Virginia, a study found that only one raptor, a red-tailed hawk, was killed during a year of study (Kerns & Kerlinger, 2004). Similarly, a 2006 post-construction mortality study at the Maple Ridge Wind Power Project in New York State found only one raptor fatality, an American kestrel (Jain *et al.*, 2007). Standardized searches at the same facility in 2007 found three raptor fatalities, all red-tailed hawks (Jain *et al.*, 2008).

As these studies illustrate, bird collisions are relatively infrequent events at wind farms. No mortalities to federally listed endangered or threatened species have been recorded, and only occasional raptor, waterfowl, or shorebird fatalities have been documented. In the Midwestern and Eastern United States, night migrating songbirds have accounted for a majority of the fatalities at wind turbines. In general, the documented level of fatalities has not been large in comparison with the source populations of these species, and has been minor when compared to other potential sources of avian mortality. Collision impacts have been studied at over 20 wind power facilities in more than 12 states. The overall number of avian fatalities, the species involved, and the fatality rate are consistently low. When scavenging and observer efficiency are factored in, studies of avian mortality suggest that wind turbines account for 1-9 avian fatalities per turbine per year (Erickson *et al.*, 2001; Jain *et al.*, 2007).

There currently is no predictive model available to quantify expected avian collision mortality as a result of wind power project operation. Therefore, risk assessments must be based on pre-construction indices and indicators of risk (e.g., breeding bird and raptor migration surveys), along with empirical data from operating facilities (e.g., avian mortality surveys). Because pre-construction surveys revealed no indicators of elevated risk (e.g., unusually high numbers, unusually low flight altitude, habitat that would act as an ecological magnet, or abundance of rare species), collision risk to night migrating songbirds in the Project Area is likely to be consistent with other wind sites in the Eastern United States. However, fatality studies have not been conducted at turbines in excess of 125 meters (410 feet), so there are no data with which to compare. The turbines proposed for the Facility are about 25% taller than many of those studied, and thus extend higher into the airspace of night migrants.

Due to the greater height of the proposed turbines, collision mortality to night migrating songbirds may be somewhat greater than the average fatality rate observed at other wind sites in the Eastern United States. Using the national average of 2.1 birds killed per turbine per year, the 70-turbine Facility would result in a total of 147 bird deaths per year

(Erickson *et al.*, 2005). Even if as many as 9 birds/turbine/year are killed (i.e., the "worst case" mortality number, observed during first year monitoring at the Maple Ridge Project in northern New York [Jain et al., 2007]), total annual collision mortality would be approximately 630 birds. Although this number may appear large, it is a tiny fraction of the population that migrates through the area, as radar data indicate, and is not considered a biologically significant impact.

Table 07-16 summarizes estimated annual avian mortality from anthropogenic causes, including wind turbines. The cumulative level of avian fatalities from wind turbines is quite minor when compared to other sources of mortality, with bird deaths caused by turbines accounted for just 0.003% of the total anthropogenic bird deaths in 2003 (NRC, 2007). As shown in Table 07-16, other sources of avian mortality that each greatly exceed that caused by wind turbines include collision with buildings/windows, collision with power lines, predation by housecats, collision with vehicles, use of agricultural pesticides, collision with communication towers, and poisoning in oil pits (USFWS, 2002; Erickson *et al.*, 2005; NRC, 2007).

Table 07-16. Estimated Annual Avian Mortality from Anthropogenic Causes.

Mortality Source	Estimated Annual Mortality	Citation
Collisions with Buildings	97 - 976 million	Klem, 1990
Collisions with Power Lines	130 – 174 million	Koops, 1987
Predation by Domestic Cats	100 million	Coleman & Temple, 1996
Automobiles	80 million	Banks, 1979; Hodson & Snow, 1965
Pesticides	67 million	Pimentel *et al.*, 1991
Communication Towers	4 - 50 million	USFWS, 2002
Oil Pits	1.5 – 2 million	USFWS, 2002
Wind Turbines	20,000 - 37,000	Erickson *et al.*, 2005

Source: Erickson *et al.*, 2005.

Relatively few studies have evaluated bat fatalities at operating wind energy facilities. However, available data suggest that the risk of collision mortality can be higher for bats than that for birds, with bat mortality rates averaging 3.4 fatalities/turbine/year across the United States (NWCC, 2004a). Like the avian data, studies of bat mortality at wind energy facilities in the eastern United States generally reveal higher fatality levels than those observed farther west. The highest bat mortality rate reported in the United States, 63.9 fatalities/turbine/year, was observed in 2005 during post-construction surveys at the

Buffalo Mountain Wind Windfarm, sited in Tennessee along forested Appalachian ridgelines (Fiedler *et al.*, 2007). This differs by an order of magnitude from the national average, and from the much lower mortality rates documented at mid-western and western sites located in open and mixed landscapes, ranging from 0.07 to 2.32 fatalities per turbine per year (Erickson *et al.* 2002).

While the mortality rates observed at Buffalo Mountain Windfarm in 2005 are high compared to those observed elsewhere, they are of a similar scale to mortality rates documented at other forested sites in the eastern U.S. For example, post-construction monitoring at the Mountaineer Wind Energy Center, located along forested ridgelines in West Virginia, documented bat mortality rates of 47.5 fatalities/turbine/year (Kerns & Kerlinger, 2004). Before a 2004 facility expansion, previous studies at the Buffalo Mountain Windfarm had documented a three-year average bat mortality rate of 20.8 fatalities/turbine/year in 2000 through 2003 (Fiedler, 2004). Estimated mortality rates at the Maple Ridge Wind Farm in Lewis County, New York ranged from 15.2 to 24.5 fatalities/turbine/year in 2006 (Jain *et al.*, 2007), and from 15.4 to 18.4 bats fatalities/turbine/year in 2007 (Jain *et al.*, 2008).

The mean detection rate in the vicinity of the Project Area was 6.73 bat calls per detector night during fall 2007 bat acoustic surveys, and 23.9 calls per detector night during 2008. As shown above in Table 07-10, these detection rates are similar to those recently observed at other proposed wind energy facilities in the northeast and mid-Atlantic (with the exception of the north tree detector, which recorded unusually high numbers of call sequences). However, it is important to note that numbers of recorded bat call sequences are not necessarily correlated with numbers of bats in an area, because acoustic detectors do not allow for differentiation between a single bat making multiple passes, and multiple bats each recorded individually (Stantec, 2008a).

As with avian risk, there are currently no predictive models available to quantify expected bat collision mortality as a result of wind energy facility operation, and risk assessments must be based on pre-construction indices and indicators of risk (e.g., acoustic surveys), along with empirical mortality data from operating facilities. Because pre-construction surveys revealed no indicators of elevated risk (e.g., landscape position, unusually high numbers, or abundance of rare species), collision risk to bats in the Project Area is likely to be consistent with other wind energy projects in the mid-west.

Mortality rates observed at the Maple Ridge Wind Farm can be used to provide a worst-case estimate of bat mortality for the Facility, as both sites are located within agricultural plateaus (although Maple Ridge differs in that it is located adjacent to a vast mosaic of forest and wetlands in excess of 100,000 acres). Using the highest mortality rates observed at the Maple Ridge facility of 24.5 fatalities/year, the 70-turbine Facility would result in a total of 1,715 bat deaths per year. Wind energy facilities located along forested ridgelines in the eastern United States have the highest documented mortality rates (Arnett *et al.*, 2007). Since the proposed Facility is located within an agricultural plateau in central Ohio, high mortality rates like those observed on forested Appalachian ridgelines are not anticipated. Using the national average of 3.4 fatalities/turbine/year, the 70-turbine Facility would result in a total of 238 bat deaths per year. Using the average mortality rate for the upper Midwest of 1.7 fatalities/turbine/year (NWCC, 2004a), the 70-turbine Facility would result in a total of 119 bat deaths per year.

(c) *Procedures to Avoid/Minimize/Mitigate Short-term and Long-term Operational Impacts*[31]

The short-term and long-term operational impacts of the Facility are essentially identical, and are consistent with the operational impacts noted above. The Facility has been designed to minimize bird and bat collision mortality. The turbines will be placed much further apart than in older wind farms where high rates of avian mortality have been documented, such as those in California. Turbines will be placed in agricultural fields, avoiding wooded areas that provide habitat for bats. Towers will be tubular structures (rather than lattice), which prevent perching and nesting by birds. Lighting of turbines and other infrastructure will be minimized to the extent allowed by the FAA, and will follow specific design guidelines to reduce collision risk (e.g., using flashing lights with the longest permissible off cycle). In addition, the turbine layout was designed to avoid impacts to the federally endangered Indiana bat, through compliance with a setback established by the USFWS to protect home/core ranges in nearby Logan County. The site plan presented herein is the result of these short-term and long-term impact minimization efforts.

With respect to short-term and long-term inspection and maintenance activities, such activities that are relatively minor (e.g., routine inspection of various components) will be carried out through use of the Facility infrastructure/access roads that are established during construction. Major repairs that require large equipment (i.e., a crane) can

[31] Information regarding procedures to avoid, minimize, and mitigate operational impacts is presented herein to comply with the requirements of draft rule 4906-17-08(B)(3)(c).

typically be trucked directly to the respective crane pad established during construction at the base of each turbine, and permanent access roads are generally wide enough to accommodate this activity.

(d) *Post-Construction Monitoring Plans*[32]

Despite the fact that significant impacts to birds and bats are not anticipated, a post-construction avian and bat fatality monitoring program will be implemented. Although this study will not directly mitigate Facility -specific impacts, it will help to advance understanding of avian and bat collision impacts. Experts have indicated that, although the impact of wind power projects on wildlife has been studied more intensively than comparable infrastructure, such as communication towers, important research gaps remain (GAO, 2005). These gaps result primarily from the limited number of post-construction monitoring studies that have been conducted and made publicly available.

The Applicant has been cooperating with the ODNR since 2007, when the Applicant first met with the ODNR and the USFWS to develop an appropriate work plan for conducting on-site avian and bat studies. This work plan was finalized in May 2008 (Stantec, 2008b). In addition, the Applicant has followed the ODNR's Terrestrial Wind Energy Voluntary Cooperation Agreement (see Exhibit Q), to the extent practicable. The Applicant is committed to following appropriate pre- and post-construction protocols. The details of the protocols have been and will be determined in cooperation with the ODNR, using a risk-based approach. The purpose of the on-site, post-construction monitoring program will be to determine if avian and/or bat collision fatalities are occurring as a result of Facility operation, and if so, the rate of mortality. This data can then be correlated with pre-construction data, and ultimately this information can help to develop models that will more precisely predict the impact of future wind power projects. Post-construction bird and bat mortality monitoring will be conducted according to standard methodologies that include searcher efficiency and carcass removal studies.

(C) ECONOMICS, LAND USE AND COMMUNITY DEVELOPMENT

Information provided in this section was obtained primarily from the Buckeye Wind Farm Socioeconomic Report prepared by Saratoga Associates (2009). This report is attached hereto as Exhibit R.

[32] Information regarding post construction monitoring is presented herein to comply with the requirements of draft rule 4906-17-08(B)(3)(d).

(1) Land Use

As seen in the socioeconomic analysis provided in Exhibit R, agricultural uses are the predominant land use as measured by percent area of each township and county within five miles of the Facility. The townships that will host the Facility have the greatest share of agricultural land, when compared to all other geographic areas under study. This predominant agricultural use emphasizes the rural character of the region, and with respect to compatibility with existing land uses, deems this part of Ohio an ideal location for a potential wind energy facility. Comprehensive plans for Champaign, Clark, and Madison Counties indicate that current rural land uses are the preferred use for future development. Each comprehensive plan, in its discussion of land use policy, places primary emphasis on the preservation and protection of agricultural lands and open space. Please see Exhibit R for more information.

(a) *Land Use Map*

Land uses within the five-mile study area of the Facility are shown on Figure 6. Indicated land uses include: residential, urban, manufacturing, commercial, mining, transport, recreational, utilities, water, wetlands, forest, woodland, pasture and cropland. Registered historic sites and recreational areas are also depicted. The land use mapping was developed from land use data and information obtained during field surveys of the areas.

Residential Structures In Relation to the Boundary of the Proposed Facility[33]

Residential structures are depicted on Figure 3 (the Proximity Maps). There are 181 residences within 100 feet of the boundary of the proposed Facility (identified on Figure 3 in hot pink). These residences are primarily located within 100 feet of the overhead collection lines that run along local roadways, and constitute part of the Facility, as defined in 4906-17-01(B)(2). There are 579 residences within 1000 feet of the boundary of the proposed Facility. Again, the vast majority of these residences are located within 1000 feet of a non-turbine component such as an electrical collection line or access road. The distance from each turbine to the nearest residential structure ranges from 873 to 4,503 feet, averaging 2,059 feet. Additional information on the distances between turbines and residential structures is provided below.

[33] Information regarding residential structures in relation to the proposed facility boundary is presented herein to comply with the requirements of draft rule 4906-17-08(C)(1)(b).

Locations of Turbines in Relation to Property Lines and Residential Structures[34]

Proposed turbines are sited in locations consistent with setbacks from property lines and residential structures, as required in 4906-17-08(C)(1)(c) and described below.

Section 4906-17-08(C)(1)(c)(i) of the proposed rule requires that "the distance from a wind turbine base to the property line of the wind farm shall be at least 1.1 times the total height of the turbine structure as measured from its tower's base (excluding the subsurface foundation) to the tip of its highest blade." In addition, an existing wind ordinance in Union Township (see Exhibit S) states that the distance from a wind turbine to the property line shall be 1.2 times the total height of the turbine structure.[35] The maximum height of turbines under consideration for the Facility is 492 feet (150 meters), which yields a property line setback of 541 feet, and 590 feet in Union Township. All turbine locations comply with the appropriate property line setbacks, except where the affected property owner has granted a waiver.

Section 4906-17-08(C)(1)(c)(ii) of the proposed rule requires that "the wind turbine shall be at least seven hundred fifty feet in horizontal distance from the tip of the turbine's nearest blade at ninety degrees to the exterior of the nearest habitable residential structure, if any, located on adjacent property at the time of Certificate Application." The maximum rotor diameter of turbine under consideration for the Facility is 328 feet (100 meters). If the turbine blade were at ninety degrees, the tip would extend from the base of the tower one-half the length of the rotor diameter, or 164 feet, which added to 750 feet, yields a total setback of 914 feet. In addition, the Union Township wind ordinance requires a 1,000-foot setback from residential structures. Turbine 70 technically falls within the setback, with one residence located approximately 873 feet from the proposed turbine site. However, advanced engineering and micro-siting is expected to remedy this situation, and the turbine will not be constructed unless the setback requirement is ultimately met or an appropriate waiver is executed. All other proposed turbine locations comply with these setbacks. The average distance from all proposed turbines to the nearest residential structure is 2,059 feet. Excluding turbine 70, which as described above will not be constructed unless the setback requirement is met, the distance from all other proposed turbine sites to the nearest residential structure ranges from 932 to 4,503 feet.

[34] Information regarding location of turbines in relation to property lines and residential structures is presented herein to comply with the requirements of draft rule 4906-17-08(C)(1)(c).

[35] Although the application references the Union Township ordinance, the Applicant does not waive the preemption by Chapter 4906, Revised Code of any local zoning ordinances as applied to the Facility.

(b) *Land Use Impacts Within 1 Mile of Facility*

As previously indicated, agriculture is the predominant land use in the Project Area, as measured by percent of total area. Likewise, agriculture is the leading land use by acreage for Champaign County and the adjacent Counties of Logan, Clark, Madison and Union. The predominantly agricultural land use in the Project Area and surrounding municipalities emphasizes the rural character for the region. The land is made up of flat and rolling terrain consisting of croplands, farmsteads, meadows, and forests. Residential development within and around the Facility consists almost entirely of single-family homesteads along rural roads. Homesteads are often comprised of large lot parcels, many in excess of 50 acres, with farms often in excess of 200 acres. The rural land use patterns and rolling landscape are typical for much of western and central Ohio, outside of urban centers (Saratoga, 2009).

The Facility is located in Champaign County, in the townships of Goshen, Rush, Salem, Union, Urbana, and Wayne. The five-mile radius includes the City of Urbana. The corporate limits of this boundary effectively demarcate the transition between town-scale development and the surrounding agricultural landscape, where residential development consists primarily of independently built farmsteads and single-family homes. The Mad River Valley and the gentle 'bluffs' and hillsides on either side of the valley are the major landscape defining features of this area. The Mad River is approximately 60 miles in length, originating in Logan County to the north and flowing south into the Great Miami River near Dayton. The length of the valley in the vicinity of the Project Area is overwhelmingly in active crop production (Saratoga, 2009).

As shown in Table 07-17, residential land is the second most abundant land use classification. Residential land comprises nearly 12,000 acres, or 8.1% of all land in the municipalities containing Facility components. Similarly, residential land comprises 10.5% of all land in the municipalities within five miles of the Facility (Saratoga, 2009). Over 4,000 acres of vacant land occurs in the municipalities containing Facility components. Land used for commercial purposes, forestry, governmental, minerals and oil, manufacturing, non-commercial, non-designated, and utilities combine to comprise only 2.4% of the total land in the municipalities that host the Facility, and 5.6% of land in the municipalities within five miles. The relatively small amount of land being used for commercial and industrial properties is consistent with the rural characteristics of the communities within the Project Area (Saratoga, 2009).

Table 07-17. Land Use in and Near the Project Area.

Land Use Classification	Townships Hosting the Facility		Townships and Communities within 5.0 miles of the Facility	
	Total Acres	Percentage	Total Acres	Percentage
Agricultural	127,243	86.8%	178,923	80.4%
Commercial	789	0.5%	1,651	0.7%
Forestry	211	0.1%	749	0.3%
Government	2,104	1.4%	6,062	2.7%
Manufacturing	93	0.1%	2,491	1.1%
Minerals and Oil	232	0.2%	0	0.0%
Non-Commercial	128	0.1%	508	0.2%
Residential	11,806	8.1%	23,298	10.5%
Utilities	0	0.0%	0	0.0%
Vacant	4,052	2.8%	7,650	3.4%
Undesignated	0	0.0%	1,267	0.6%

Source: Saratoga Associates, 2009.

Construction of the proposed Facility will involve the leasing of private land from nearly 60 landowners, collectively comprising approximately 9,000 acres. This land is overwhelmingly zoned as agricultural, and is currently being used primarily for agricultural purposes. The Facility will be compatible with the agricultural land uses that dominate the Project Area, as well as with the established long-range plans for continuation of such land uses in the surrounding local and regional communities. Nevertheless, both temporary (construction-related) impacts and permanent (operation-related) impacts to land use within the Facility could occur.

The transportation and use of construction equipment and material could impact growing crops, fences and gates, subsurface drainage systems (tile lines), and/or temporary blockage of farmers' access to agricultural fields. However, construction impacts will be temporary in nature, and confined to the properties of participating landowners. As described in the Agricultural Mitigation Provisions (see Exhibit G), the Applicant has developed standards and policies specifically for construction activities occurring partially or wholly on privately owned agricultural land. Details provided in this plan (e.g., reimbursement for construction-related damages to crops, topsoil removal and protection, and repair of damaged tiles lines) will minimize impacts to agricultural land uses in the Project Area.

Only very minor changes in land use within the Project Area are anticipated as a result of Facility operation. The presence of the turbines bases, substation, and other ancillary structures will result in the cumulative conversion of approximately 72 acres of land from its current use to built facilities (0.8% of the 9,000 acres of leased land). During Facility operation, additional impacts over the years on land use should be infrequent and minimal. Aside from occasional maintenance and repair activities, Facility operation should not interfere with on-going land use (i.e., farming activities).

(c) *Structures That Will Be Removed or Relocated*

The Applicant does not anticipate the removal or relocation of any existing structure as a result of construction or operation of the proposed Facility.

(d) *Formally Adopted Plans For Future Use of Site and Surrounding Lands*

As previously indicated, comprehensive plans for Champaign, Clark, and Madison Counties indicate that current rural land uses are the preferred use for future development. In discussions of land use policy, each comprehensive plan places primary emphasis on the preservation and protection of agricultural lands and open space. The underlying interests in taking this position is to limit development that takes agricultural land out of production (ensure viability of agricultural economy), limit costly public infrastructure (lower assessments), and to limit land-intensive sprawling development patterns (reduced quality of life). Such policies indicate compatibility with the proposed Facility (Saratoga, 2009).

(e) *Applicant's Plans for Concurrent or Secondary Uses of the Site*

The Applicant has no plans for concurrent or secondary uses of the site. However, because wind power projects are compatible with agricultural practices, and because this Facility has been sited and designed to maximize such compatibility, existing land uses will continue concurrently with Facility operation.

(2) Economics

Many economic factors are dependent on the capacity of the Facility, e.g., investment, payroll, employment, and local tax revenues. The Socioeconomic Report (see Exhibit R) was initiated before final site selection analyses were completed. Therefore, to best represent the range of potential economic benefits that could result from a wind-energy facility of various sizes, the report includes analysis of a range of project generation capacities. Specifically, the report includes detailed analysis of a project in Champaign

County with a total nameplate capacity of 131.4, 146, or 182.5 MW. Within the text of Section 4906-13-07(C)(2) of this Application, a range of economic values is presented based on that range of capacity values. Please see Exhibit R for the specific economic benefits under each scenario.

(a) *Construction and Operation Payroll*

A wind energy facility with a capacity of 131.4-182.5 MW represents approximately $313.7-431.7 million in investment. Approximately 68% of the total budget is estimated as purchase and installation of the towers, turbines, and equipment. The remaining 32% represents expenditures for business services, labor, and materials. Construction of the proposed Facility will employ a total work force of approximately 131-182 employees over an 18-month period. Facility payroll for construction workers is anticipated to be $7.24-10.05 million over the 18-month construction period (Saratoga Associates, 2009).

The Facility is expected to employ 12 full-time workers during operation, regardless of Facility capacity. These positions will consist of one operations manager/supervisor, eight operations and maintenance technicians, one parts/logistics person, and two customer service representatives. Total wages for the Facility's full-time employees are estimated to be approximately $569,000 per year. It is anticipated that these jobs will have a spin-off effect on the local economy, through local expenditures on goods and services associated with project operation and maintenance. The full-time jobs generated by operating the Facility will result in a spin-off of approximately 50 additional jobs in the local economy, bringing the total impact of the operations phase to 62 new jobs. These full-time jobs create new jobs in other sectors of the economy through expenditures derived from household wages that are spent (Saratoga Associates, 2009).

The present worth of the construction and operation payroll can be calculated using a nominal 10% discount rate and 2% increase in operations staff wages over the life of the Facility. Given a two year construction period and 20 year operations period, for a total of 22 years, this results in a net present value of $10.9 to $13.3 million dollars for construction and operation payroll over the life of the Facility.

Additionally, annual lease payments will be provided to local landowners participating in the Facility. Leases to landowners will be based on a percentage of gross revenues, and are initially expected to total approximately $1.5-2 million per year. It is important to note that these payments will be distributed among all property owners where turbines are located. Exact lease payments will vary depending on annual production and power purchase agreements (Saratoga Associates, 2009). These lease payments are a direct financial benefit to all participating landowners and will enhance the ability of those in the agricultural industry to continue farming. Russell Cary, Supervisor of the Town of Fenner, New York believes that lease payments from the wind power project in his town are preserving a rural life style and protecting family farms from being taken over by large-scale commercial farming operations (Cary, 2005). Local lease payments will also enhance the ability of participating landowners to purchase additional goods and services. To the extent that these purchases are made locally, they will have a broader positive effect on the local economy.

(b) *Construction and Operation Employment*

It is anticipated that construction of the proposed Facility will employ a total work force of approximately 131-182 employees. While it is difficult to estimate the portion of employment that will be drawn from the Southwest-Central Ohio labor market, the Applicant will employ local labor to the extent practicable, but will not exceed the anticipated total work force. Local construction employment will be primarily equipment operators, truck drivers, laborers, and electricians. Facility construction will also require workers with specialized skills, such as crane operators, turbine assemblers, specialized excavators, and high voltage electrical workers. It is anticipated that the majority of these specialized workers will originate from outside the area and will remain only for the duration of construction.

As described above, approximately 12 full-time jobs will be created once the Facility is fully operational. These will include one operations manager/supervisor, eight operations and maintenance technicians, one parts/logistics person, and two customer service representatives. These employees are expected to reside locally, which could translate into the purchase of a few homes and addition of a few families to the towns and/or the surrounding communities. Although this represents a positive economic impact, long-term employment associated with the Facility is not large enough to have a significant impact on local population or housing characteristics (Saratoga Associates, 2009).

(c) *Local Tax Revenues*

The construction and operation of the Facility is anticipated to produce numerous tax benefits to the Townships of Goshen, Rush, Salem, Union, Urbana, and Wayne in Champaign County; as well as the Mechanicsburg Exempted Village School District, the

Triad Local School District, the Urbana City School District, and the West-Liberty Salem Local School District. During construction, the Facility will not have a substantial impact on municipal budgets and taxes. Temporary construction workers will not create significant demand for municipal or school district services or facilities. These workers will also not generate significant revenue through payment of property taxes. However, sales tax revenue will increase through the purchase of local goods and services.

Local municipalities will benefit from additional tax revenues, because the Facility owner will pay taxes to all taxing jurisdictions that host the Facility. While the tax treatment of wind facilities in Ohio is unclear, the Applicant assumes that the tax payments generated from this Facility will be proportional to and competitive with those from similar facilities in neighboring states. As used in this document, "Alternative Tax" is meant to approximate the expected tax for this Facility, and is not necessarily a direct reflection of current Ohio tax code. It is anticipated that the Facility will result to a positive fiscal impact to host communities. In order for Ohio to meet AEPS goals as described in Section 4906-13-03(A)(1) of this Application, it is critical that policies be adopted that allow for a competitive rate of taxation for wind projects in Ohio as compared to rates in surrounding states. Reflective of the rates typical in surrounding states, and given Ohio leadership's expressed desire to support wind power as a viable and significant part of its energy portfolio and its future economy, it is projected that total annual payments will range from a low value of $6,000/MW to a high value of $8,000/MW.

Information compiled by the American Wind Energy Association (see Exhibit T) shows that without modification, the tax structure in Ohio will result in a severe competitive disadvantage for wind energy projects proposed for the state. Wind energy development is a competitive business that does not enjoy any sort of monopoly in customers or service area, yet Ohio's current property tax structure treats wind energy as a monopoly electric utility. This is simply not competitive with other nearby states. For example, Ohio's property taxes on wind projects are 20 times those in Pennsylvania and 16 times those in Michigan (AWEA, 2009). The Alternative Tax values presented in this Certificate Application represent a more competitive range of values that will likely need to be realized for this Facility, and other similar projects in Ohio, to become a reality.

Table 07-18 summarizes fiscal year 2005 general property (real estate) tax revenues, the number of proposed turbines, and the projected annual Alternative Tax revenues generated from the Facility.. The following table projects a range of possible annual payments, based on estimated annual payments ranging from $6,000-8000/MW and a Facility capacity ranging from 131.4-182.5 MW. As presented in the last column, alternative taxes from the proposed Facility will represent significant increases to local municipal tax levies. More detailed information is found in Exhibit R.

Table 07-18. General Property Tax Levy for Townships Within the Project Area.

Taxing Jurisdiction (Township)	Fiscal Year 2005 General Property Tax Levy	% Distribution of Proposed Turbines	Projected Annual Alternative Tax Revenues (Low)	Projected Annual Alternative Tax Revenues (High)	Percent Increase in Tax Revenue
Goshen	$161,154	6.9	$54,000	$100,000	34-62%
Rush	$81,382	6.9	$54,000	$100,000	66-123%
Salem	$130,920	19.2	$151,200	$280,000	116-214%
Union	$173,625	28.8	$226,800	$420,000	121-242%
Urbana	$199,418	16.4	$129,600	$240,000	65-120%
Wayne	$189,130	21.9	$172,000	$320,000	91-169%
TOTAL	$973,865	100	$788,400	$1,460,000	81-150%

Source: Saratoga Associates, 2009.

Depending on the township, the alternative tax revenue received by each taxing jurisdiction will be variously divided between: the County, the Township, Health Funds, 911 Funds, School District Funds, Joint Vocational School Funds, Library Funds, Fire Funds, Ambulance Funds, Cemetery Funds, and Corporation Funds (Saratoga Associates, 2009). Please refer to Exhibit R for specific information on the various allocations of funds in each township.

(d) *Economic Impact on Local Commercial and Industrial Activities*

Saratoga Associates (2009) used the Regional Input-Output Modeling System (RIMS II) to determine the economic impacts of the proposed Facility. RIMS II was developed by the U.S. Department of Commerce (1997) as a method for estimating regional multipliers for impact analysis in output, earnings, and employment associated with a program or project under study. The Facility is expected to create employment and income during the initial phase of construction, as well as throughout the life of the Facility. The economic impact study quantifies the effect of one dollar spent as it ripples through the local economy, creating additional expenditures and jobs.

Wind power development can expand the local economy through ripple effects. Ripple effects stem from subsequent expenditures for goods and services made by first-round income from the development. A direct effect or impact arises from the first round of buying and selling. Direct effects include the purchase of inputs from local sources, such as fuel; the spending of income earned by workers; annual labor revenues; and the income effect of taxes. These direct effects can be used to identify additional, subsequent rounds of buying and selling for other sectors and to identify the effect of spending by local households. The indirect effect or impact is the increase in sales of other industry sectors in the region, which include further round-by-round sales. The induced effect or impact is the expenditures generated by increased household income resulting from direct and indirect effects. The total effect or impact is the sum of the direct, indirect, and induced effects (NWCC, 2004b).

The proposed Facility would have a beneficial impact on the local economy. In addition to the jobs created during construction and the wages paid to the work force, the Facility will have a direct economic benefit from the first round of buying/selling, which includes the purchase of goods from local sources (such as fuel), the spending of income earned by workers, annual labor revenues, and the income effect of taxes. These direct effects will result in additional, subsequent rounds of buying and selling in other sectors.

Based on the RIMS II model, the 131-182 full-time jobs created during the construction phase will have an indirect and induced impact of creating an additional 1,554-2,158 jobs in other sectors of the economy. The $313.7-431.7 million in original construction investment will generate an indirect and induced output of approximately $480.9-661.8 million. Household earnings of 131-182 construction workers over an 18-month period are estimated at $7.24-10.05 million. These earnings will have a spin-off of approximately $2.9-4.1 million in earnings. Thus, the Facility will result in direct, indirect, and induced benefits to local commerce and industry (Saratoga Associates, 2009).

(3) Impact on Public Services and Facilities

The Facility is not expected to have significant growth-inducing effects on the surrounding locales. Therefore, no significant impact on local public services and facilities is expected. Workers will commute to the work site on a daily basis. Local employees would be hired to the extent possible. Hiring of non-resident workers would occur only when local residents with the required skills were not available or competitive. It is expected that these workers would commute or stay in regional transient housing or motels and not require new housing, and would not bring families that might require family healthcare or additional school facilities. The principal impact on public services in the site locale would be increases in traffic on routes leading to the site due to deliveries of equipment and materials during construction (Saratoga Associates, 2009).

(4) Impact on Regional Development

(a) *Regional Development Effects*

Housing

The population increased by approximately 16% between 1990 and 2000 in municipalities within the Project Area. This growth is projected to continue at a lesser rate, increasing another 5.1% between 2000 and 2012. The number of housing units in the Townships hosting turbines increased by 2.7% between 2000 and 2007, reflective of recent population trends. At the same time, occupancy rates of existing properties has increased, thereby decreasing the vacancy rates. It is unlikely that population or population growth within the Project Area or the greater region would be significantly effected by the Facility. Although there will be a substantial number of short-term jobs created during the construction period, only 12 long-term jobs will be created during Facility operation. As a result, the Facility is not likely to create a noticeable increase in the demand for housing (Saratoga, 2009).

Commercial and Industrial Development

The construction and operation of the Facility will have a positive impact on commercial and industrial development in Champaign County, as well as throughout southwest-central Ohio and the entire State. Although wind power projects typically require a substantial number of inputs from outside the local area, there is considerable potential for the future development of wind turbine manufacturing in the State of Ohio.

A 2004 report prepared by the Renewable Energy Policy Project assessed the location of manufacturing activity related to wind turbine development. This report measured the number of potential employees at existing companies capable of manufacturing turbine parts (i.e. rotors, nacelle, controls, gearbox, drive train, etc.). Ohio ranked second among states nationwide in terms of the number of employees (at firms with over 80,000 employees) that have the technical potential to become active manufacturers of wind turbine components. Ohio has the potential to become is the leading state in terms of production of rotors; the second largest in terms of production of nacelle, controls, gearbox, and drive train; the third largest in terms of generator and power electronics; and the fourth largest in terms of towers. These estimates were based on employment at potential active companies, average investment, and job creation potential. Manufacturers in the State of Ohio are already producing wind turbine components that include blade extenders, brakes, cooling systems, gear boxes, pitch drives, power electronics, rotor blades, tower flange and bolts, and yaw drives (Sterzinger & Svercek, 2004).

While difficult to gauge the proposed Facility's exact impact on job creation and investment, analysis suggests that every 1,000 MW of wind power developed creates a potential for 3,000 jobs in manufacturing (Sterzinger & Svercek, 2004). If this formula were applied to the proposed Facility, 378-525 manufacturing jobs would be created or maintained to produce the turbine components (Saratoga, 2009). Because Ohio already has wind turbine manufacturing infrastructure in place, the state is poised to benefit from such job creation.

Transportation System

Due to the rural nature of Project Area and surrounding areas, residents must rely heavily on automobile travel. This is accomplished through a network of interstate, state, and county highways. The highways and road network provide access to two metropolitan areas, Dayton and Columbus, and other regional and interstate destinations. In addition to the interstate, state, and county roadways, numerous local roads transverse the Project Area. Given the limited number of nearby residents and the existence of alternate routes within the Project Area, temporary road closures during the construction phase are not expected to create any significant adverse impacts on the vehicular transportation network (Saratoga, 2009).

Three CSX-operated rail lines run in the vicinity of the Project Area. The first CSX line follows Interstate Highway 75 south, running north of the site through Marysville towards Columbus. Connection to this rail exists in Bellefontaine via a CSX connecting line. This provides the area with a transit and freight link to and from various regional locations. The second CSX line follows Interstates 40 and 70 south of the site running from Columbus and points east through Springfield and Dayton before continuing west. The final CSX line runs between Bellefontaine and Urbana, providing a freight and passenger connection between the two cities. While it is likely that turbine components may be transported via rail, neither construction nor operation of the Facility is expected to create any significant adverse impacts on the rail network (Saratoga, 2009).

The Facility is located within a one-hour drive of six major primary service and reliever airports. Port Columbus International Airport is the largest of the primary service airports in the area, with a total of 44 gates in three concourses. The Columbus Regional Airport Authority currently manages the airport, while also overseeing operation of two local reliever airports, Rickenbacker International Airport and Bolton Field. Rickenbacker International Airport provides commercial services to the Columbus area, but is not considered a primary airport. While limited passenger options exist at Rickenbacker, six cargo airline services operate out of the facility. The second major airport in the area is located in Dayton. The James M. Cox Dayton International Airport is located north of the city, and is operated by the City of Dayton Department of Aviation. Nine airlines provide service within the two concourses at this airport.

In addition to the three commercial service airports (Columbus, Rickenback, and Dayton), there are also three reliever airports in vicinity of the proposed Facility. Two are located in Columbus (Bolton Field and Ohio State University Airport), and one is located in Dayton (Dayton-Wright Brothers Airport). Furthermore, many smaller municipal or private airfields are within the vicinity of the Project Area (including the Weller Airstrip in Union Township). These would primarily be used for recreational opportunities; however, the potential for other uses is available. Neither construction nor operation of the proposed Facility is expected to create any significant adverse impacts on the air travel network (Saratoga, 2009).

(b) *Regional Plan Compatibility*

As was previously mentioned in Section 4906-13-07(C)(1) of this Application, comprehensive plans for Champaign, Clark and Madison counties indicate that current rural land uses are the preferred use for future development. Each comprehensive plan, in its discussion of land use policy, places primary emphasis on the preservation and protection of agricultural lands and open space. The underlying interests in taking this position is to limit development that takes agricultural land out of production (ensure viability of agricultural economy), limit costly public infrastructure (lower assessments), and to limit land-intensive sprawling development patterns (reduced quality of life). Such policies indicate a positive disposition towards the anticipated low-impact nature of the proposed Facility (Saratoga, 2009).

(D) CULTURAL IMPACT

Data on cultural and archaeological resources was collected by ASC Group, Inc. (ASC), and compiled into a cultural resources literature review and impact assessment for the Facility, attached hereto as Exhibit U.

(1) Landmarks of Cultural Significance

Figure 6 depicts registered landmarks of historic, religious, archaeological, scenic, natural, or other cultural significance within 5 miles of the proposed Facility.

The purpose of the literature review was to identify known cultural resources in or near the Project Area that may be historically significant, so that impacts to these resources can be minimized. Cultural resources include archaeological and historical sites, such as cemeteries, buildings, structures, objects, and districts. The literature review included the following records available from the Ohio Historic Preservation Office (OHPO):

- Online Geographic Information Mapping System;
- National Register of Historic Places (NRHP);
- NRHP formal determination of eligibility list;
- NRHP preliminary and consensus determination of eligibility lists;
- Ohio Historic Inventory (OHI);
- *Ohio Cemeteries: 1803–2003* (Troutman 2003); and
- Ohio Archaeological Inventory (OAI).

The literature review identified 33 cultural resources listed in the NRHP, including four historic districts and 29 historic sites; one NRHP determination of eligibility; 839 OHIs; 397 OAIs; and 70 cemeteries (Tonetti & Terpstra, 2009). Exhibit U contains 31 pages of tables providing additional information on these cultural resources, including site name, address, and UTM coordinates, as applicable.

(2) Impact to Landmarks

The cultural resources impact assessment (see Exhibit U) evaluates anticipated impacts from the Facilityto both archaeological and historical resources. These impacts are summarized below.

Impacts to Archaeological Resources

Archaeological surveys at similar types of facilities in Ohio (e.g., telecommunications towers), rarely encounter significant archaeological sites. This is partially due to the small amount of ground disturbed during construction of such facilities, and partially due to the location of these facilities. Like wind energy facilities, telecommunication towers are often sited in uplands as opposed to stream valleys, where Native American settlements typically occurred and significant archaeological sites are more likely to be found. Upland prehistoric archaeological sites are often the result of hunting and gathering activities by Native Americans. These sites rarely contain the kind of data categories, features, or artifacts that yield important information (Tonetti & Terpstra, 2009).

In addition, Facilitydesign has minimized ground-disturbing activities by utilizing existing farm lanes, public roads, and existing utility right-of-ways to the extent possible. Minimizing ground-disturbing activities reduces the likelihood that prehistoric archaeological sites will be disturbed by construction of the facilities. Permanent ground-disturbing activities associated with construction of the proposed Facility include development of turbine foundations and crane pads, access roads, the electrical collection system, and the substation. Temporary ground-disturbing activities associated with construction of the Facility include grading and site preparation activities at staging areas and turbine workspaces, and installation of segments of buried electrical interconnect that are not parallel to access roads. Construction of the proposed Facility is anticipated to disturb a total of approximately 373 acres of soil. Approximately 301 acres of this disturbance will be temporary, while permanent impact is estimated at 72 acres.

Therefore, based on the siting of the Facility in upland areas and design criteria that minimized ground-disturbing activities to the extent possible, construction and operation of the proposed Facility is expected to have a low risk of impacting archaeological resources (Tonetti & Terpstra, 2009).

Impacts to Historical Resources

The instructions in the OPSB rules for Section 4906-13-07(D) require applicants to identify any registered landmarks of historic, archaeological, or other cultural significance within five miles of the proposed facility and to estimate the impact of the proposed facility on the preservation and continued meaningfulness of these landmarks. "Registered landmarks" is interpreted to mean properties listed in or eligible for listing in the NRHP. As mentioned in Section 4906-13-07(D)(1) of this Application, the Ohio Historic Preservation Office identified

34 such landmarks within five miles of the Facility. Twenty of these landmarks are in the village of Mechanicsburg, and nine are in the city of Urbana. The remaining five are located outside of incorporated communities.

"Preservation and continued meaningfulness" is interpreted as the concept of integrity, as used in the NRHP criteria for evaluation. The NRHP criteria for evaluation state that the quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and A) that are associated with events that have made a significant contribution to the broad patterns of our history; or B) that are associated with the lives of persons significant in our past; or C) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or D) that have yielded, or may be likely to yield, information important in prehistory or history. Integrity is the ability of a property to convey its significance. To be listed in or eligible for the NRHP, a property must not only be significant under Criteria A, B, C, and/or D, but also must retain its historic integrity.

The NRHP criteria recognize seven aspects or qualities that, in various combinations, define integrity: location, design, setting, materials, workmanship, feeling, and association. Location is the place where the historic property was constructed or the place where the historic event occurred. Design is the combination of elements that create the form, plan, space, structure, and style of a property. Setting is the physical environment of a historic property. Materials are the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property. Workmanship is the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory. Feeling is a property's expression of the aesthetic or historic sense of a particular period of time. Association is the direct link between an important historic event or person and a historic property. To retain its historic integrity a property will possess several, and usually most, of the seven aspects. Depending on the nature of the property and the areas in which it is significant, some of the aspects may be more important for the property to retain than others.

The impairment of the preservation and continued meaningfulness of a landmark would be equivalent to an adverse effect under Section 106 of the National Historic Preservation Act of

1966, as amended. An adverse effect is found when a project may alter, either directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the NRHP in a manner that would diminish the property's integrity. In other words, not only must a change occur to the property, but the change must be one that is harmful to the property's historic character. Examples of adverse effects include, but are not limited to, physical destruction of or damage to all or part of a property, moving a property from its historic location, change of the character of a property's use or of physical features within the property's setting that contribute to its historic significance, and introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features.

Because the proposed wind turbines will not physically destroy, alter, or be located immediately adjacent to any registered landmarks, impacts will be limited to indirect, i.e., visual effects. This means the proposed Facility will not impact six of the seven NRHP defined aspects of integrity for any registered landmark (location, design, materials, workmanship, feeling, and association). Setting is the aspect of integrity most likely to be impacted by visual effects of the Facility. Setting refers to the character of the place in which a historic property played its historical role, and reflects the basic physical conditions under which a property was built and the functions it was intended to serve. The physical features that constitute the setting of a historic property can be either natural or manmade, and can include such elements as topography, vegetation, and relationships between buildings and other features or open space.

However, just because wind turbines are visible from a landmark, or are visible in the background when viewing a landmark, does not mean that the turbines will impair a landmark's historic setting. Being within five miles of the Facility does not necessarily indicate that the setting of a landmark includes the rural countryside where the wind turbines are located, e.g. landmarks in cities or villages may depend on the more developed setting. Furthermore, the importance of setting may vary, depending on the nature of the landmark's significance. Visibility of a wind turbine at a distance would only constitute an adverse effect to the setting (and integrity) of a landmark in cases where the property's vista is cited as being of primary importance to its significance. However, turbines located very close to landmarks could be considered an obtrusive visual element that would adversely impact historic landmarks for which setting is an important aspect of integrity.

Even within five miles of the Facility, a wind turbine may not be visible from some landmarks due to obstructing terrain, vegetation (primarily tree lines), or other buildings. The distance between a landmark and a wind turbine will also play a role in the visibility and impact of a turbine. Figure 18 in Exhibit I shows that at a distance of miles distance, wind turbines will only be visible on the horizon, and will be small and indistinct enough not to be a significant visual presence in the viewshed of a landmark. Furthermore, existing tall elements, such as cell phone towers, are already present in the viewshed, and probably to the same or greater extent as the wind turbines. Figure 22 in Exhibit I shows that at 3.5 miles, wind turbines will be clearly visible but will not be obtrusive to any but a landmark where a vista is a primary part of its significance. In the case of this simulation, the primary characteristic visible in the photo is agricultural land. The turbines in this image are not close enough to the camera to significantly impact the view of agricultural fields or the feeling of rural agricultural countryside.

In general, the buildings and historic districts in Urbana are not located in areas where they are likely to have clear views toward any of the turbines. Located 2.27 miles from the nearest turbine, the Scioto Street Historic District is the closest NRHP-listed or eligible landmark in Urbana. Because Urbana is a city, the historic setting of the NRHP-listed or eligible resources there generally will reflect the densely developed urban character of a city. The presence of wind turbines several miles outside of the city would not likely affect their historic setting, preservation, or continued meaningfulness, even if the turbines were visible.

Similarly, the historic setting of the NRHP-listed resources in the village of Mechanicsburg generally reflect the densely developed character of a village, and most of the buildings and the historic district will not have significant views of wind turbines. The closest any NRHP-listed resource in Mechanicsburg comes to a wind turbine is approximately 5,900 feet (1.12 miles). Most of the buildings in the village are not sited to take advantage of vistas of the surrounding countryside, but are sited within the plat of the village or the additions to that plat, with no regard given to the view outside the village. Agriculture was the basis for the village's economy, but the turbines will not impede the agricultural utilization of the surrounding countryside. Most of the NRHP-listed resources in the village were listed as part of the Mechanicsburg Multiple Resource Area under Criteria A, B, and C in the areas of agriculture, commerce, ethnic/immigration, industry, religion, and society/culture. In summary, the presence of wind turbines outside of the village will not significantly affect the historic setting of the NRHP-listed resources in Mechanicsburg, and will not impact their preservation and continued meaningfulness.

The remaining five landmarks are located outside of Urbana and Mechanicsburg. Expected Impacts to each of these landmarks are summarized briefly below:

- Elmwood Place is located along State Route 161 in Union County, approximately 4.73 miles from the nearest turbine. At this distance the turbines will be visible only along the horizon, and will not have a significant presence in the setting of this property. The proposed Facility will not impact the preservation and continued meaningfulness of the landmark.
- The Fort is located in Union County north of the village of North Lewisburg, approximately 5.3 miles from the nearest turbine. At this distance the turbines will be visible only along the horizon, and will not have a significant presence in the setting of this property. The proposed Facility will not impact the preservation and continued meaningfulness of the landmark.
- The Piatt Houses are located in Logan County east of the village of East Liberty, approximately 5.3 miles from the nearest turbine. The distance, terrain, and various tree lines will mostly block views of the turbines from the houses. The proposed Facility will not impact the preservation and continued meaningfulness of the landmark.
- The Carl Potter Mound is an archaeological site located east of State Route 56 and southwest of the village of Mechanicsburg, approximately 1.2 miles from the nearest turbine. Vistas and views generally are not applicable to the significance of archaeological sites, and the wind turbines are not close enough to the mound to be a significant intrusion into the mound's setting. The proposed Facility will not impact the preservation and continued meaningfulness of the mound.
- The Mt. Tabor Church, Cemetery, and Hitching Yard are located in Salem Township north of the hamlet of Kennard and southeast of the village of East Liberty, approximately 3.4 miles from the nearest turbine. Given the church's hilltop location and the surrounding mostly flat terrain, the wind turbines will be clearly visible from this location. However, at this distance, the turbines will not be visually prominent enough to be a significant intrusion in the setting of the church and cemetery, nor will they remove the rural, agricultural character of that setting. The proposed Facility will not impact the preservation and continued meaningfulness of the landmark.