DOE/EA-1819

FINAL
ENVIRONMENTAL ASSESSMENT

FOR

KILOWATTS FOR KENSTON WIND ENERGY PROJECT

CHAGRIN FALLS
GEAUGA COUNTY, OHIO

U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Golden Field Office

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COVER SHEET

RESPONSIBLE AGENCY: U.S. Department of Energy

TITLE: Final Environmental Assessment for Kilowatts for Kenston Wind Energy Project, Chagrin Falls, Geauga County, Ohio (DOE/EA-1819)

CONTACT: For additional copies or more information on this Environmental Assessment (EA), please contact:

Melissa Rossiter
NEPA Document Manager
Golden Field Office
U.S. Department of Energy
1617 Cole Blvd.
Golden, CO 80401-3305
Desk Phone: 720-356-1566
Blackberry: 720-291-1602
Melissa.Rossiter@go.doe.gov

ABSTRACT: The U.S. Department of Energy (DOE) has provided Federal funding to the Ohio Department of Development (ODOD) under the State Energy Program (SEP). ODOD would provide $1,105,500 of its SEP funds to the Kenston Local School District. Kenston Local School District would use these Federal funds to construct a single 750-kilowatt wind turbine at the Kenston High School at 9500 Bainbridge Road, Chagrin Falls, Ohio. DOE has authorized ODOD to use a percentage of the Federal funding for preliminary activities, which include preparation of this EA, conducting analysis, and agency consultation. Such activities are associated with the proposed project and do not significantly impact the environment nor represent an irreversible or irretrievable commitment by DOE in advance of completing the EA. The wind turbine would provide 750 kilowatts of renewable energy to fulfill nearly 70 percent of the school's annual electricity demand and help to reduce greenhouse gas emissions. Kenston has selected the Aeronautica 750 model, which has a 177-foot rotor diameter and a 213-foot tower height. Overall, the turbine would stand 302 feet at its tallest blade tip. Approximately 600 feet of associated underground electrical transmission equipment would be installed to connect the wind turbine to the existing school switchgear. No new access roads or road improvements would be required for this project.

This EA analyzes the potential environmental impacts as a result of the proposed construction, operation, and decommissioning of the Kenston Local School District's wind energy project and the alternative of not implementing this project (the No-Action Alternative).

AVAILABILITY: This EA is available for review on the DOE Golden Field Office Reading Room Website, http://www.eere.energy.gov/golden/Reading_Room.aspx, and the DOE NEPA Website, http://nepa.energy.gov/DOE_NEPA_documents.htm.

ACRONYMS

APE	area of potential effect
ARRA	*American Recovery and Reinvestment Act of 2009*
BMP	best management practice
CFR	*Code of Federal Regulations*
dBA	decibel on an A-weighted scale, used to approximate the human ear's response to sound
DNL	Day Night Average Sound Level (also L_{dn})
DOE	U.S. Department of Energy
EA	environmental assessment
EMF	electromagnetic field
EPA	U.S. Environmental Protection Agency
FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact
IBA	Important Bird Area
Kenston	Kenston Local School District
L_{max}	maximum sound level
L_{min}	minimum sound level
L_{eq}	equivalent sound level
L_{xx}	percentile-exceeded sound level
MBTA	*Migratory Bird Treaty Act*
NEPA	*National Environmental Policy Act*
NHPA	*National Historic Preservation Act*
NOA	Notice of Availability
NPDES	National Pollutant Discharge Elimination System
NTIA	National Telecommunications and Information Administration
ODOD	Ohio Department of Development
ODNR	Ohio Department of Natural Resources
ODOW	Ohio Department of Natural Resources Division of Wildlife
OHPO	Ohio Historic Preservation Office
OSHA	Occupational Safety and Health Administration
PM_{10}	particulate matter with an aerodynamic diameter less than or equal to 10 micrometers
$PM_{2.5}$	particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers
SEP	State Energy Program
Stat.	United States Statutes at Large
U.S.C.	United States Code
USFWS	U.S. Fish and Wildlife Service

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1. INTRODUCTION

1.1 National Environmental Policy Act

The *National Environmental Policy Act* (42 U.S.C. 4321 *et seq*.; NEPA), the Council on Environmental Quality's NEPA regulations [40 *Code of Federal Regulations* (CFR) Parts 1500 to 1508], and the U.S. Department of Energy's (DOE's) NEPA implementing procedures (10 CFR Part 1021) require that DOE consider the potential environmental impacts of a proposed action before making a decision. This requirement applies to decisions about whether to provide different types of financial assistance to States and private entities.

This Environmental Assessment (EA):

- Examines the potential environmental impacts of the Proposed Action and the No-Action Alternative;
- Identifies unavoidable adverse environmental impacts of the Proposed Action;
- Describes the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity; and
- Characterizes any irreversible and irretrievable commitments of resources that would be involved should DOE decide to implement its Proposed Action.

This EA provides DOE and other decisionmakers the information needed to make an informed decision about the installation, operation, and eventual decommissioning of the proposed wind turbine. The EA evaluates the potential individual and cumulative impacts of the proposed project. For purposes of comparison, this EA also evaluates the impacts that could occur if DOE did not provide funding (the No-Action Alternative), under which DOE assumes the project would not proceed. The EA does not analyze other action alternatives.

1.2 Background

The Kenston Local School District (Kenston) proposes to construct, operate, and eventually decommission a single 750-kilowatt wind turbine, along with approximately 600 linear feet of associated underground electronic transmission equipment, at Kenston High School, located at 9500 Bainbridge Road, Chagrin Falls, Ohio (see Appendix A, Figure 1). The current estimated project cost is $1,875,000. The Ohio Department of Development's (ODOD's) Energy Resources Division selected this project to receive a $1,105,500 grant. This grant would come from money that the State of Ohio received from DOE under the *American Recovery and Reinvestment Act of 2009* (Pub. L. 111-5, 123 Stat. 115; ARRA) and DOE's State Energy Program (SEP). The purpose of the SEP is to promote the conservation of energy and reduce dependence on imported oil by helping states develop comprehensive energy programs and by providing them with technical and financial assistance. SEP is authorized under the *Energy Policy and Conservation Act*, as amended (42 U.S.C. 6321 *et seq*.).

States can use SEP funds for a wide variety of activities related to energy efficiency and renewable energy (42 U.S.C. 6321 *et seq*. and 10 CFR Part 420). In ARRA, Congress appropriated $3.1 billion to DOE's SEP, and the State of Ohio received $96,083,000, pursuant to a Federal statutory formula for distributing these funds. The potential use of Federal SEP funds to assist in the financing of the proposed project constitutes a Federal action subject to review under NEPA.

In compliance with NEPA regulations, this EA examines the potential environmental impacts of the DOE's Proposed Action (providing funding for the proposed project) and the No-Action Alternative, under which DOE assumes the proposed project would not proceed. This EA also describes options that the sub-recipient (Kenston) considered during development of its application to the State of Ohio, which is the recipient of Federal funding under DOE's SEP. This EA will provide DOE with the information needed to make an informed decision about whether allowing the State of Ohio to provide certain Federal funds for the proposed project might result in significant environmental impacts.

1.3 Purpose and Need

1.3.1 DOE'S PURPOSE AND NEED

DOE's purpose and need is to ensure that SEP funds are used for activities that meet congressional statutory aims to improve energy efficiency, reduce dependence on imported oil, decrease energy consumption, create and retain jobs, and promote renewable energy. Providing funding as part of the Ohio SEP grant to Kenston would partially satisfy the need of DOE's SEP to assist U.S. cities, counties, states, territories, and American Indian tribes to develop, promote, implement, and manage energy efficiency and conservation projects and programs designed to:

- Reduce fossil fuel emissions;
- Reduce the total energy use of the eligible entities;
- Improve energy efficiency in the transportation, building, and other appropriate sectors; and
- Create and retain jobs

Congress enacted ARRA to create jobs and restore economic growth through measures that, among other things, modernize the nation's infrastructure and improve energy efficiency. Provision of SEP funds for the proposed project would partially meet these goals.

1.3.2 OHIO'S PURPOSE AND NEED

Ohio's purpose and need is to grow the economy of the state by connecting companies and communities to financial and technical resources to deploy renewable energy technologies, and to support the goals of SEP and ARRA to reduce energy costs, reduce reliance on imported energy and to preserve and create jobs.

1.4 Ohio's SEP Project Selection Process

Ohio's SEP, administered by ODOD, includes five sub-programs:

- Deploying Renewable Energy in Ohio
- Making Efficiency Work
- Targeting Industry Efficiency
- Banking on New Energy Financing
- Setting the Stage for Ohio's Carbon Management Strategy

ODOD selected the proposed project to receive a grant through its sub-program, "Deploying Renewable Energy in Ohio," which provides grants to public and private entities to fund a variety of renewable energy projects, including solar, wind, fuel cell, and waste to energy technologies. ODOD issued a Request for Proposals for the "Deploying Renewable Energy in Ohio" sub-program and used the following criteria for selection: project readiness; matching capabilities, financing, and cost effectiveness; economic impact on Ohio; project characteristics and potential for innovation; and a project's ability to (1) provide emission-free energy, and (2) create jobs during the construction of the project.

A criterion of the SEP grant is that funds must be obligated to sub-recipients by September 30, 2010, and spent by March 2012; therefore, all conditions on SEP awards must be removed by March 2012. Kenston was one of eight wind energy grant applicants awarded SEP funds by ODOD in 2009. A total of $5,831,000 was awarded to these eight applicants, and Kenston was awarded $1,105,500.00 conditioned on completion of NEPA review. For this project, DOE is the Federal agency, ODOD is the recipient of Federal funding, and Kenston is the sub-recipient of this funding. The project would be implemented on Kenston High School property.

1.5 Public and Agency Involvement

1.5.1 DOE'S PUBLIC SCOPING PROCESS

When it began preparing this EA, DOE sent notices of public scoping to stakeholders and interested parties including local, State, and Federal agencies; certain organizations; the 24 tribal representatives that are regularly notified of Federal actions in northeastern Ohio; and the general public (see Appendix D, Attachment D1). The notices solicited comments from all of these parties. DOE published the scoping letter on the DOE Golden Field Office Public Reading Room Website to solicit comments. The scoping letter described the Proposed Action and requested assistance in identifying potential issues to be evaluated in this EA. These letters are contained in Appendix D, Attachment D1, of this document. On August 26, 2010, DOE sent postcards announcing the public scoping process and directing stakeholders to the DOE Golden Field Office Public Reading Room, where the scoping letter was available for review. The scoping letter described DOE's Proposed Action and the proposed project, and requested assistance in identifying potential issues the EA could evaluate. The public comment period closed on September 9, 2010.

In response to the scoping letters, DOE received a letter from the U.S. Fish and Wildlife Service (USFWS) that was part of the ongoing consultation between DOE and the USFWS (see Appendix C, Attachments C2 and C3) and is discussed in detail in Section 3.2.2.6 of this EA. To conclude the consultation, the USFWS sent a subsequent letter dated October 29, 2010 (see Appendix C, Attachment C4), indicating that the USFWS believed that the proposed project is not likely to result in the take of or adverse impact to the Indiana bat (*Myotis sodalis*).

1.5.2 KENSTON PUBLIC INVOLVEMENT

Kenston has provided opportunities for public involvement since Monday, October 17, 2005, in an attempt to educate the public about this project and to provide an opportunity for public comment. These opportunities have included public meetings (see Appendix D, Attachment D2) as well as coverage of the project in local media outlets (see Appendix D, Attachment D3). Table 1-1 is a list of the meetings that representatives from the Kenston project attended and provided information to those in attendance. A timeline of public outreach efforts is provided in Appendix D, Attachment D2.

Table 1-1. List of Meetings with Meeting Dates

Meeting Date	Documented Meeting
10/17/2005	Kenston Board of Education Meeting, Superintendent's Report
10/16/2006	Kenston Board of Education Meeting, 2006-129 Wind Study Report
02/12/2007	Kenston Board of Education Meeting, Superintendent's Report
06/18/2007	Kenston Board of Education Meeting, Superintendent's Report
09/17/2007	Kenston Board of Education Meeting, Superintendent's Report
09/17/2007	Kenston Board of Education Meeting, Educational Agreement with (CSU)
12/10/2007	Kenston Board of Education Meeting, Superintendent's Report
02/11/2008	Kenston Board of Education Meeting, Superintendent's Report
03/17/2008	Kenston Board of Education Meeting, Superintendent's Report
03/17/2008	Kenston Board of Education Meeting, Superintendent's Report
03/17/2008	Kenston Board of Education Meeting, 2008-30 Notice to Proceed
04/17/2008	Kenston Citizens Advisory Committee
04/21/2008	Kenston Board of Education Meeting, Renaissance Group
04/21/2008	Kenston Board of Education Meeting, Superintendent's Report
05/19/2008	Kenston Board of Education Meeting, Advertise for Bids
05/19/2008	Kenston Board of Education Meeting, Superintendent's Report
05/29/2008	Geauga County Renewable Energy Meeting
06/16/2009	Kenston Board of Education Meeting, Superintendent's Report
06/24/2008	Kenston Citizens Advisory Committee
07/14/2008	Kenston Board of Education Meeting, New Fund Approval
07/14/2008	Kenston Board of Education Meeting, Superintendent's Report
08/18/2008	Kenston Board of Education Meeting, Superintendent's Report
08/28/2008	Kenston Citizens Advisory Committee
09/15/2008	Kenston Board of Education Meeting, Superintendent's Report
10/15/2008	Business Advisory
10/16/2008	Kenston Board of Education Meeting, Special Rejection of Bid
10/20/2008	Kenston Board of Education Meeting, Superintendent's Report
11/05/2008	Bainbridge Civic Club
11/17/2008	Kenston Board of Education Meeting, Superintendent's Report
11/20/2008	Kenston Citizens Advisory Committee
12/04/2008	Kenston Citizens Advisory Committee
12/10/2008	Business Advisory
12/15/2008	Kenston Board of Education Meeting, Advertise for Bids
12/15/2008	Kenston Board of Education Meeting, Superintendent's Report
01/28/2009	Kenston Citizens Advisory Committee
02/11/2009	Business Advisory
03/04/2009	Kenston Citizens Advisory Committee
04/16/2009	Kenston Citizens Advisory Committee
04/29/2009	Business Advisory
06/30/2009	CAFR

Table 1-1. List of Meetings with Meeting Dates (continued)

Meeting Date	Documented Meeting
09/25/2009	PTO Council
10/14/2009	Business Advisory
11/13/2009	PTO Council
12/09/2009	Business Advisory
01/29/2009	PTO Council
020/3/2009	Business Advisory
03/18/2010	PTO Council

In addition, Kenston contacted the following agencies and organizations:

- Ohio Historic Preservation Office (OHPO)
- Ohio Department of Natural Resources (ODNR), Division of Wildlife (ODOW)
- Ohio Department of Transportation, Office of Aviation
- ODOD Energy Resources Division
- Bainbridge Board of Zoning Appeals
- Geauga County Historical Society
- Federal Aviation Administration (FAA)

1.5.3 DOE PUBLIC INVOLVEMENT

DOE has contacted the following agencies and organizations regarding the proposed project:

- USFWS
- U.S. Department of Commerce, National Telecommunications and Information Administration (NTIA)
- The 24 tribal representatives with historic ties to northeastern Ohio.

1.5.4 DRAFT ENVIRONMENTAL ASSESSMENT COMMENT AND RESPONSES

DOE issued the Draft EA for comment on January 3, 2011, and posted it on the Golden Field Office Reading Room Website (http://www.eere.energy.gov/golden/Reading_Room.aspx) and the DOE NEPA Website (http://nepa.energy.gov). DOE sent postcards to the individuals listed in Appendix D, Attachment D4 of this EA to notify them of the EA's availability on the web and to announce a 15-day public comment period on the EA. DOE published the Notice of Availability (NOA) in the local newspaper, *The Chagrin Valley Times* (see Appendix D, Attachment D5). The comment period ended on January 17, 2011.

DOE received one comment from an individual related to cumulative impacts and DOE's assessment. DOE has made changes to the cumulative impacts section and prepared a response to that comment (see Appendix F, Attachment F1).

2. PROPOSED ACTION AND ALTERNATIVES

2.1 DOE's Proposed Action

DOE is proposing to authorize ODOD's expenditure of Federal SEP funding to design construct a 750-kilowatt wind turbine to provide renewable energy to Kenston High School (proposed project).

DOE authorized ODOD and Kenston to use a percentage of the Federal funding for preliminary activities, which included EA preparation and studies. Such activities are associated with the proposed project and would not significantly impact the environment nor represent an irreversible or irretrievable commitment of resources in advance of DOE completing the NEPA process for the proposed project.

2.2 Ohio's Proposed Project

The proposed project was chosen based on the following ODOD criteria: project readiness; cost effectiveness; economic impact on Ohio; project characteristics and potential for innovation; and its ability to (1) provide emission-free energy and (2) create jobs during the construction of the project. For this proposed project, DOE is the Federal agency whose Proposed Action is to authorize funding, ODOD is the recipient of Federal funding and Kenston is the sub-recipient of this funding. The project would be implemented on the Kenston High School campus in Chagrin Falls, Ohio.

The proposed project would include the installation and operation of a single 750-kilowatt wind turbine on the school's campus. The turbine model would be an Aeronautica 750 with a 177-foot rotor diameter and a 213-foot tower height. Overall, the turbine would stand 302 feet at its tallest blade tip extension. The turbine would be designed to be mounted on a monopole made up of tubular conical steel segments. This design would eliminate the need for guy wires for support of the wind turbine. The electrical grid interconnect of the turbine would be composed of the turbine's controller (contained within the turbine tower-based section), approximately 600 linear feet of buried 4-inch electrical conduits, including the portions of the run embedded within the turbine tower foundation, a 690- to 12,480-volt transformer, an automatic disconnect switch, a UL1741-compliant monitoring and control device, and a fused disconnect within the school's electrical room's existing switchgear. The system would also have a parallel run of 2-inch conduit for data transfer and control runs. The full system would meet all local, State, and Federal codes and regulations.

Guy wires can be a challenge for birds and bats to locate and maneuver around, which can lead to injury or death, and therefore would not be used for support of the wind turbine. The proposed design also would not include the use of lattice towers for support, which have been found to be roosting sites for birds at other wind project sites.

2.2.1 PROJECT LOCATION

The turbine would be located in the center of the approximate 189-acre school campus between the southwest corner of the football field and the tennis courts. Surrounding the proposed turbine

site are Kenston's administration building, approximately 900 feet to the north, the middle school, approximately 390 feet southeast, and the new high school, approximately 1,060 feet to the east. There is also a maintenance building located approximately 365 feet northwest of the proposed turbine site (see Appendix A, Figures 1a, 1b, 2, and 3) The approximate center point of the proposed turbine is 41 degrees north Latitude and 81 degrees west Longitude at 1,557 feet above mean sea level (see Appendix C, Attachment C8). Once installed, the final ground-level footprint of the turbine base would be 256 square feet.

2.2.2 CONSTRUCTION AND INSTALLATION

Site construction would include installation of the turbine, transformer, electrical distribution wiring, and foundation systems (see Figure 2-1 and Appendix A, Figure 3). No access roads and road improvements would be required due to accessibility to the site's existing roadways.

The turbine nacelle (the enclosure around the turbine engine), blades, and tower would be staged at Buckeye Excavating directly across Washington Street to the north of the project site. Final transport of project materials and construction vehicles would occur through the north entrance of the campus.

An area equal to the possible fall zone (within a 332-foot radius) would be closed during the erection phase of the project. Crane pads would be used during erection as needed to protect the existing school roadways. The foundation for the turbine would be composed of approximately 300 cubic yards of reinforced concrete. The foundation would be placed at a depth of 10 feet (and may require a pier placement at a depth of 24 feet) and require approximately 23,000 pounds of reinforcing steel.

The electrical grid interconnect of the turbine would be composed of the turbine's controller (contained within the turbine tower-based section), approximately 600 linear feet of buried 4-inch electrical conduits, including the portions of the run embedded within the turbine tower foundation, a 690- to 12,480-volt transformer, an automatic disconnect switch, a UL1741-compliant monitoring and control device, and a fused disconnect within the school's electrical room's existing switchgear. The system would also have a parallel run of 2-inch conduit for data transfer and control runs. The full system would meet all local, State, and Federal codes and regulations.

Construction would be performed in accordance with an approved Erosion and Sedimentation Control Plan and in compliance with all other local, State, and Federal applicable requirements. Kenston would use best management practices (BMPs) and employ *Clean Water Act* National Pollutant Discharge Elimination System (NPDES) requirements during construction and operation to protect topsoil and to minimize soil erosion. Construction activities for wind turbine foundations, tower erection, turbine nacelle placement, and blade installation would be contingent on temperature and weather conditions. The turbine nacelle and blades would be installed during calm wind periods. Foundations would not be installed during cold winter months. These and similar factors would determine the final construction timeline.

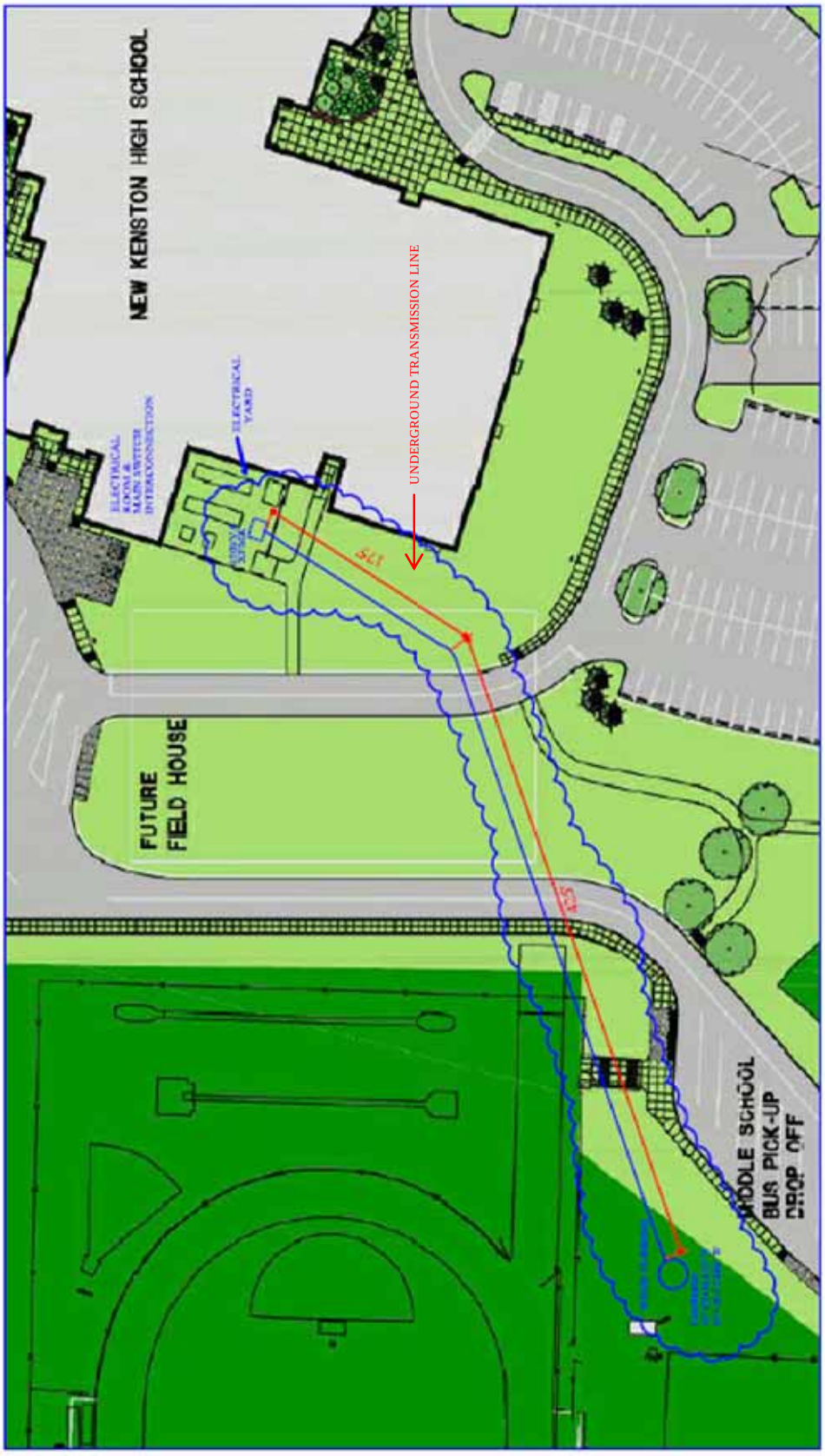

Figure 2-1. Site Plan

The proposed project, including site preparation, erection, final commissioning, generator installation, and overall systems tie-in and startup would be planned to be completed within approximately 10 months of groundbreaking.

Construction activities would occur within a 2-acre footprint that is currently used as open space and overflow parking within the school's campus. During construction and for safety measures, these areas would be closed and secured using fencing, danger signs, and locked gates to prevent unauthorized individuals from entering the work zone.

The project has been reviewed by and received a favorable aeronautical determination from the FAA on November 9, 2010 (see Appendix C, Attachment C8).

White strobe lights at the minimum number, minimum intensity, and minimum number of flashes per minute allowable by the FAA would be used at this site to ensure aviation safety.

2.2.3 OPERATIONS AND MAINTENANCE

Kenston would operate and maintain the proposed project according to operating, maintenance, and safety procedures and requirements specifically recommended by the turbine's manufacturer, Aeronautica. Routine preventive maintenance and inspection of the turbine would be necessary to maximize performance and identify potential problems or escalating maintenance issues. The turbine would be remotely monitored daily to ensure operations are proceeding efficiently. This monitoring would occur through the use of trained onsite staff and remote monitoring via a service provider contract. The turbine would have equipment installed with the ability to monitor and report faults both locally and remotely, as well as automatically shut itself down, if a fault should occur outside the normal operating parameters of the turbine per the manufacturer's specifications. The turbine would also have the ability for onsite and remote shutdown by authorized personnel. For the first 5 years of operation, the school district would contract out all formal service and maintenance functions to a nationally experienced firm. During this period, local staff and resources would be trained and gain experience in the maintenance and service procedures for the machine. A 5-year extended warranty would also be included in the initial purchase contract of the turbine from the original provider to optimize performance and safety. After this 5-year period, the service and maintenance plans and providers would be reevaluated and contracted as necessary. All routine servicing would be performed without using a crane to remove the turbine from the tower.

2.2.4 DECOMMISSIONING

Impacts evaluated with respect to the decommissioning of the turbine would be similar to those examined in the construction section of this EA. The turbine and other infrastructure would be expected to have a useful life of at least 20 years. Retrofitting the turbine with upgrades may allow the turbine to produce efficiently for many years after the original useful life. When the project is terminated, the turbine and other infrastructure would be decommissioned and all facilities would be removed to a depth of approximately 3 feet below ground surface. The aboveground area would be restored as closely as possible to its original condition. Underground facilities would either be removed or safely secured and left in place. Salvageable items (including fluids) would be sold, reused, or recycled as appropriate; unsalvageable material

would be disposed of at authorized and approved disposal sites. All decommissioning construction activities would be performed in accordance with the manufacturer's guidelines as well as all applicable Federal, State, and local regulations.

2.3 Alternatives

2.3.1 DOE ACTION ALTERNATIVE

Ohio's SEP funds are from a formula grant, in which the amount granted to the State is determined pursuant to a formula established in DOE's SEP grant procedures (10 CFR 420.11). Allocation of funds among the states is based on population and other factors. Recipients of these formula grants have broad discretion in how they use these funds.

This EA examines the potential environmental impacts of the DOE's Proposed Action (providing funding for the proposed project) and the No-Action Alternative. This EA also describes options that Kenston (sub-recipient) considered during development of its application to the State of Ohio, which is the recipient of Federal funding under the SEP. This EA provides DOE with the information necessary to make an informed decision about whether allowing the State of Ohio to provide some of its Federal funds for the proposed project might result in significant environmental impacts. Based on the analysis in this EA, DOE may issue a FONSI, which could include mitigation measures, or determine that additional study is needed in the form of a more detailed environmental impact statement.

2.3.2 DOE NO-ACTION ALTERNATIVE

Under the No-Action Alternative, DOE would not allow Ohio to use its SEP funds for the proposed project. DOE assumed for purposes of this EA that the project would not proceed without SEP funding. This assumption allows a comparison between the potential impacts of the project as proposed and the impacts of not proceeding with the project. Without the proposed project, the school's operations would continue as otherwise planned, but without the installation or operation of the proposed wind turbine.

2.3.3 SITING OPTIONS CONSIDERED BY KENSTON

Kenston considered three main sites for the location of the wind turbine at the school's campus in Chagrin Falls, Ohio. Although other sites on the campus were briefly considered, they were quickly ruled out due to their poor evaluation by almost all of the criteria listed below. All of the potential campus sites are owned by Kenston and are similar with regards to environmental considerations, such as wildlife impact avoidance, wetland and stream avoidance, and compatibility with existing zoning and land uses. Further considerations used by Kenston for siting the turbine on the school's campus are the following:

- Distance from adjacent properties
- Maximization of distances to occupied structures (no closer than 1.25 times the blade tip height)
- Ease of access and adequate room for construction, installation, and maintenance
- Proximity to existing hardened roadways (minimization of new construction)

- Minimization of disruption to the school's operations
- Availability for educational programs (school, community, and college partnerships)
- Minimization of wind turbulence due to adjacent buildings and trees
- Utilization of previously disturbed land (avoidance of natural areas)
- Soil conditions (foundation suitability)
- Maximum avoidance of potential wildlife habitats
- Topography
- Wind resource optimization
- Existing infrastructure avoidance
- Utility interconnect distances
- Architectural, visual balance and icon siting

The selected site scored the best of the three proposed sites in almost all categories. It has the most unobstructed, least turbulent wind profile; offers the best installation staging; and is the farthest away from structures occupied by students during the day (the closest building is the maintenance garage to the northwest and the stadium to the north). The project site would allow the construction area to be controlled without having to close off a portion of the student parking area to the south.

2.4 Required Agency Permits and Approval Types

Prior to construction, all required Federal, State, and local permits and approvals would be obtained. The required permits and approvals are listed in Table 2-1. All permit documentation and approval letters are contained in Appendix C and Appendix E.

Table 2-1. Federal, State, and Local Permits and Approvals

Agency	Permit Approval / Type
Federal	
FAA	FAA Aeronautical Determination (issued November 9, 2010) (Appendix C, Attachment C8)
NTIA	Radio Frequency Transmission Approval (issued October 18, 2010) (Appendix C, Attachment C9)
USFWS	Compliance with the *Endangered Species Act*, the *Migratory Bird Treaty Act*, and the *Bald and Golden Eagle Protection Act* (letter issued October 29, 2010) (Appendix C, Attachment C4)
State	
OHPO	Compliance with the *National Historic Preservation Act* (OHPO issued Determination of No Effect on June 21, 2010) (Appendix E, Attachment E1)
Ohio Department of Natural Resources, Division of Wildlife	Concurrence that the proposed project does not pose a substantial risk to State-protected species, including birds and bats (pursuant to Ohio Revised Code Chapter 1531; received August 27, 2010) (Appendix C, Attachment C1)
Local	
Bainbridge Township Planning & Zoning Commission	Height Variance Approval (issued May 4, 2010) (Appendix C, Attachment C10)

2.5 Project Proponent-Committed Practices

Kenston has committed to the following measures and procedures to minimize or avoid environmental impacts if the proposed project is implemented.

2.5.1 BIRD, BAT, AND RAPTOR AVOIDANCE AND MINIMIZATION MEASURES

Project coordination occurred with USFWS and ODNR concerning the project's location and potential impacts on birds, bats, and other wildlife; rare, threatened and endangered species; and other protected natural features. There are no nests of bald eagle or observations of Indiana bat, which are both Federally and State-listed endangered or protected species, within 5 miles of the project site. USFWS and ODNR issued letters for the proposed project on October 29, 2010 (Appendix C, Attachment C4), and August 27, 2010 (Appendix C, Attachment C1), respectively, wherein the agencies determined that the proposed project is not likely to result in adverse impacts to the Indiana bat or bald eagles.

Kenston considered the USFWS *Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines* (USFWS 2003) and would take actions to minimize any potential adverse effects on wildlife associated with the proposed project through the following actions: use of previously developed site, a smooth monopole tower (no guy wires or lattice towers), wildlife-friendly FAA obstruction lighting equipment and operation procedures, soil erosion/run-off prevention measures, proper recycling and waste management procedures; minimization of construction areas; and contractual obligation of contractors and subcontractors to all above procedures.

Kenston would voluntarily conduct post-construction avian and bat mortality surveys. Voluntary monitoring likely would consist of one initial post-construction fall migration season (approximately 8 to 12 weeks, based predominantly on Indiana bat migration habits). Kenston plans to implement the voluntary monitoring with in-kind support and/or oversight from qualified local university/college faculty/staff. This monitoring will provide data to the USFWS, DOE, and ODOW on potential avian and bat mortality associated with single wind turbines. DOE is working with USFWS Region 3 to establish an appropriate protocol for the post-construction monitoring. The final protocol is expected to include details related to timing, frequency, and reporting. Kenston would implement monitoring consistent with the final protocol.

2.5.2 HEALTH, SAFETY, AND NOISE

Kenston has prepared a Health and Safety Plan; this plan, as well as all Occupational Safety and Health Administration (OSHA) requirements, and Aeronautica 750 guidelines, would be followed. Therefore, all facilities would include high-voltage warning signs. All construction activities would occur during normal working hours (7 Am to 7 PM Monday through Saturday) in order to avoid noise disturbances to surrounding areas. The construction of the proposed project would comply with all applicable Federal, State, and local requirements.

2.5.3 SOIL

Soil disturbance would not exceed 1 acre and would not require an NPDES permit under the *Clean Water Act* (33 U.S.C. 1251 *et seq*.). Kenston would implement BMPs during construction and operation to protect topsoil and to minimize soil erosion. BMPs would include, at a minimum, the following: containing excavated material, using silt fences, protecting exposed soil, stabilizing restored material, and revegetating disturbed areas with native plant species.

2.5.4 WASTE MANAGEMENT

Any waste generated during construction, operation, and decommissioning, including used lubricants, would be handled, collected, transferred, and reused/recycled in accordance with applicable Federal, State, and local regulations.

2.5.5 CULTURAL RESOURCES

Based on the archaeological and cultural study results (see Appendix E), encountering archaeological resources during excavation activities is not anticipated. However, if archaeological resources were identified in areas that would be excavated, all ground-disturbing activities would be halted and OHPO would be consulted for resolution.

2.5.6 FLICKER EFFECTS

Based on the shadow flicker assessment (see Appendix B, Attachment B2) prepared for this project, shadow flicker is not expected to have a significant impact on any potential receptors (e.g., a private residence or business). However, if shadow flicker becomes a nuisance to spectators during sporting events, Kenston would temporarily shut down the turbine to lessen the shadow's impact on the stadium and public ball fields during periods when shadowing events would overlap scheduled sporting or other use events. Additionally, should a local resident find shadow flicker to be an annoyance, Kenston would plant screening trees or purchase window coverings acceptable to the resident.

2.5.7 ICING AND FIRE

The turbine system would have an automated system fault shut-off triggered by the following sensors: system temperature, power quality, vibration, over-speed, fire and icing (vibration caused by blade icing-induced imbalances would automatically shut down the turbine). This system would be designed to automatically send fault codes to preauthorized personnel through a web interface. The turbine's nacelle would have a cold-weather package including nacelle heaters. All icing related turbine shutdowns would require a direct inspection and an onsite manual restart. The site personnel and the system maintenance personnel would shut down the turbine in the event of icing on the blades. The site would adopt an ice safety zone that covers the blade radius around the turbine for implementation during icing events, should they occur. Section 3.2.2.7 of this EA further discusses this topic.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS

This chapter of this EA examines in detail the potential environmental impacts of the proposed project and the No-Action Alternative on the affected environmental resource areas.

3.1 No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the use of Federal funds for the design, construction, and operation of the proposed project and thus assumes, for purposes of this EA, that the project would not go forward without SEP funding. Therefore, there would not be any impacts to the resource areas analyzed in this EA; however, the school would continue to use fossil fuels to create energy and no additional jobs would be created.

If the proposed project was not implemented, the amount of the school's electrical power that the proposed project could provide (70 percent) would continue to be purchased from First Energy Solutions. In 2009, First Energy Solutions generated electricity using coal (72.8 percent), oil (0.4 percent), natural gas (2.7 percent), nuclear (22.3 percent), and renewable energy sources (1.1 percent), which is similar to the overall national composition and includes emissions of carbon dioxide, nitrogen oxides and sulfur dioxide (EPA 2010a). Thus, carbon dioxide emissions from electricity generation to serve the school would be higher under the No-Action Alternative, and ODOD would not meet its objective of deploying emission-free energy.

3.2 Ohio's Proposed Project

Consistent with NEPA implementing regulations and guidance, DOE focuses the analysis in an EA on topics with the greatest potential for significant environmental impact. For the reasons discussed below, the proposed project is not expected to have any measurable effects on certain resources; therefore, these resources are not carried forward for further analysis.

3.2.1 CONSIDERATIONS NOT CARRIED FORWARD FOR FURTHER ANALYSIS

3.2.1.1 Water Resources

Floodplains and Wetlands

Pursuant to 10 CFR Part 1022, DOE reviewed USFWS National Wetlands Inventory maps (USFWS 2010) and Federal Emergency Management Agency floodplain maps (FEMA 2009) and identified no floodplains, wetlands, or surface water sources, such as streams or drainage channels that are located on the proposed project site or that could be affected by the construction and operation of the proposed project (see Appendix A, Figures 4 and 5). The nearest surface water body is a small pond located adjacent to a residence approximately 0.25 mile to the northeast of the proposed project site.

Wild and Scenic Rivers

No Ohio scenic rivers or waterways included in the National Wild and Scenic River System occur in the project vicinity. The closest Ohio scenic river is the Chagrin River, located in Lake County, located approximately 6.5 miles east of the proposed project site. The proposed project

would not be visible from the Chagrin River (ODNR 2010). The closest national scenic river is Little Beaver Creek located mainly in Columbiana County and about 55 miles southeast of the school (USDA 2009) (see Appendix A, Figure 6). The proposed project would not affect Federal- or State-designated wild and scenic rivers.

Groundwater

Based on the review of existing Ohio Environmental Protection Agency and ODNR groundwater resource maps, the proposed project site is not located in an endorsed wellhead protection area, where certain activities are restricted within an Ohio Environmental Protection Agency-designated protection area. Additionally, the proposed project site is not located within any designated Public Water System supply areas (sole-source aquifer, community/non-community systems, or drinking water source protection areas using groundwater/surface water). No private well water supplies on or near the project site would be affected by the proposed project. The proposed project would have no adverse effect on any groundwater resources.

Surface Water

In compliance with the *Clean Water Act*, the proposed project site was investigated for surface water. The nearest stream is an unnamed ephemeral stream located about 0.25 miles to the southeast of the school, which is part of the Lake Erie drainage system. No runoff or discharges from the construction of the proposed project would directly enter neighboring bodies of water, including the ephemeral stream to the southeast. Because ground-disturbing activity would affect less than 1 acre, an NPDES permit would not be required prior to any construction-related earthwork. However, Kenston has committed to using sediment and erosion pollution control BMPs in conformance with a plan specific to the proposed project.

3.2.1.2 Waste Management

Solid wastes that are anticipated to be generated during construction include equipment packaging materials and construction-related material debris. Solid wastes generated during operation of the turbines would be minimal. Solid wastes that are anticipated to be generated during decommissioning include dismantled equipment, which would likely be recycled and construction-related material debris. Hazardous, regulated nonhazardous, and universal wastes are not anticipated to be generated during construction, operation, or decommissioning. All wastes generated over the life of the proposed project would be handled, collected, transferred, reused/recycled, and disposed of in accordance with all applicable Federal, State, and local regulations. Used oil (e.g., spent gear box oil, hydraulic fluid, and gear grease) would not be considered a waste because it can be reused and/or recycled. Used oil would be generated during operations of the proposed project and recycled utilizing a qualified recycling facility.

3.2.1.3 Intentional Destructive Acts

DOE considers intentional destructive acts (i.e., acts of sabotage or terrorism) in all its EAs and environmental impact statements (DOE 2006). Construction and operation of the proposed project would not involve the transportation, storage, or use of radioactive, explosive, or toxic materials. The proposed project would not offer any particularly attractive targets of opportunity for terrorists or saboteurs to inflict adverse impacts on human life, heath, or safety.

3.2.2 CONSIDERATIONS CARRIED FORWARD FOR FURTHER ANALYSIS

This section of this EA examines in detail the potential environmental impacts of the proposed project on the following resource areas:

- Land use
- Visual quality
- Noise
- Cultural resources
- Geology and soils
- Biological resources
- Human health and safety
- Transportation
- Socioeconomics and environmental justice
- Air Quality and climate change
- Utilities and energy

3.2.2.1 Land Use

The project site is located on the Kenston High School campus. The school is bounded in all four directions by single- or double-lane local roads. Snyder Road (Township Highway 192) is located west of the campus, East Washington Street (County Route 606) is located north and east of the campus, and Bainbridge Road (County Route 11) and U.S. Highway 422 are located south of the campus.

The majority of land in the immediate vicinity of the school is zoned as Residential. There are several communities found within a half-mile of the project site. There are no special designated zoning areas within the project site. In addition to Residential, the following zoning areas exist within 2 miles of the site: General Business (B-1), Rural Residential (R-3A), and Active Park district (AP-1) (Auburn Township Zoning Commission 2008; Geauga County Zoning Commission 2008) (see Appendix A, Figures 7 and 8). The Bainbridge Township Zoning Department reviewed and approved the zoning application (Permit Application Certification Number X4005) for the proposed project on May 4, 2010 (see Appendix C, Attachment C10).

The landscape surrounding the school is generally rural to residential interspersed with large tracts of trees, lakes, natural areas, and public lands. Tanglewood Lake, Lake Lucerne, Kenston Lake, and Lake Taylor are all located over a mile away to the west and Eastview Lake is located over a mile away to the east of the project site. The Auburn Marsh Wilderness Area is approximately 3 miles east of the project site. Tanglewood National Golf Course is located west of the project site and is adjacent to Tanglewood Lake. Auburn Springs Country Club is located approximately 1 mile to the northeast of the project site.

Direct and Indirect Impacts

Implementation of the proposed project would permanently commit 256 square feet of aboveground surface area and 600 linear feet (1,200 square feet) for the underground transmission line of previously disturbed and developed land. The aboveground area of disturbance for the transmission line would be returned to its previous state once installation was

completed. The overall use of the general area would not change as a result of construction and operation of the proposed project.

Neither direct nor indirect impacts on land use are expected to occur outside of the immediate project site. Land disturbing activities would be relegated to the area needed for construction and operation of the proposed project. No other zoned or public lands, including golf courses, natural, or residential areas, would be affected.

3.2.2.2 Visual Quality

Viewshed

The Kenston school property and turbine site is located in a somewhat rural community composed mainly of widely spaced, large lot residences with large tracts of wooded areas interspersed. There are also some scattered mowed grass tracts of land in the immediate vicinity of the proposed project. The landscape surrounding the school property is generally flat, but the large tracts of trees and scattered nature of the residences act to limit views. Existing viewer groups in the area include residents, roadway users, recreationists, and occupants of nearby commercial facilities, and educational facilities. Potential receptors in the surrounding landscape include nearby residences and the Kenston school property (Figure 3-1).

Figure 3-1. Location of the Project Site (WTG) and Nearest Receptors (blue dots)

Figure 3-2. Nearby Communication Tower

The residences that are nearest to the school have the most direct, ground level views of the project site. Trees vary in height, but tend to be mainly mature stands that are upwards of 30 to 50 feet tall. Vertical elements present in the landscape include school and other buildings, power line poles, and communication towers (Figure 3-2); however, only communication towers, some which measure over 200 feet in height, are most often seen rising above the tree line (Figures 3-3 and 3-4).

A visual analysis was conducted for the proposed project to assess potential impacts on the local viewshed (Appendix B, Attachment B1). The results of a visual analysis were intended to give a sense of how the proposed wind turbine would appear to potential nearby receptors (residences and businesses in the area) in the surrounding landscape. The actual visibility of the wind turbine in the surrounding area is affected by many factors: the size of the machine; tower and blade tip heights; turbine color; distance to the viewer; obstructions such as trees, hills, and buildings; atmospheric conditions; sun angle; and the curvature of the earth. Of these factors, the overall height of a turbine, obstructions in the sightline between the viewer and the turbine, and the distance between the machine and the viewer have the potential for the greatest impact. Visual simulations were used to illustrate the effect of the proposed project from vantages that are representative of typical views that would be affected and include the 213-foot tower and blades, for a combined total height of 302 feet to the tallest blade.

Figure 3-3. View of Nearby Communication Tower

Figure 3-4. View of Nearby Communication Tower

Visual simulations for the following properties are located in Appendix B, Attachment B1. Table 3-1 shows readings from the visualization log.

Table 3-1. Kenston Visualizations Log

Set Number	Picture Number	Distance from Turbine (miles)	Site Description	Latitude	Longitude	Direction
1	1269	0.15	Entrance near Radio Station/Tennis Courts	41° 23' 40.48" N	81° 18' 28.79" W	90°
2	1291	0.16	17446 Snyder	41° 23' 46.59" N	81° 18' 28.10" W	136°
3	1298	0.26	9490 Washington	41° 23' 53.66" N	81° 18' 14.09" W	194°
4	1302	0.43	17485 Indian Hills Drive	41° 23' 34.87" N	81° 17' 49.08" W	285°
5	1310	0.44	South Entrance of School	41° 23' 17.50" N	81° 18' 13.88" W	352°
6	1332	0.80	From 422	41° 23' 01.71" N	81° 18' 37.69" W	21°

Source: Appendix B, Attachment B1 of this EA.

As one example, Figure 3-5 depicts the results of a visual simulation of how the proposed project would look from the school's entrance near the radio station and tennis courts. As another illustration, figure 3-6 shows the results of the visual simulation from nearby Route 422. The remaining visual simulations can be found in Appendix B, Attachment B1.

Figure 3-5. Visual Simulation Depicted from the Radio Station/ Tennis Court Entrance of the Kenston Local School Campus

Figure 3-6. Visual Simulation Depicted from Nearby Route 422

Direct and Indirect Impacts to the Viewshed

The visual simulation shows that the proposed turbine would be readily seen in the foreground from vantages within the school property and would be a prominent visual element whose light-colored surface makes it stand out against its surroundings. While the turbine appears to be of similar height to the stadium and parking lot light poles and the nearby cell tower, the turbine is much wider, which creates a larger visual impact.

The results of the visual analysis indicate that the proposed project would not be clearly visible to the scattered nearby residences due to obstruction proximities and densities to typical sights such as trees and buildings (see Appendix B, Attachment B1). Residential, public facility, and commercial buildings are widely scattered with large tracts of trees interspersed. Orientation of buildings and the presence of these trees limit views to the immediate surroundings for most viewers, precluding views of the proposed project. In addition, existing vegetation within the town further acts to limit views. However, some of the surrounding residents and occupants of commercial facilities would be able to see the wind turbine, at least partially due to the proximity and the overall flat terrain surrounding the project site. The turbine would appear as a small

vertical element of the skyline from most locations, similar to the region's existing communication towers and granaries. The sites nearest the school would have the most prominent view of the turbine such as the property listed at 9490 Washington (see above Table 3-1 and Figure 3-7). The turbine would be easily viewed from this location. However, it should be noted that existing power lines are more readily viewed at this location than the turbine would be, as seen below in Figure 3-7.

In addition, views of the wind turbine would be seen by residents adjacent to the school while entering or exiting buildings or school property and most of these viewers would often focus on their immediate surroundings. FAA-required lighting, such as safety light intensity and the number of lights installed, would not be a source of light pollution such that it would distract viewers in the project vicinity. Therefore, effects on the local viewshed are anticipated to be minimal.

Figure 3-7. Visual Simulation Depicted from 9490 Washington

Shadow Flicker

Shadow flicker is the moving/flickering shadows produced when sunlight passes through the spinning rotor blades of a turbine. This phenomenon can become an annoyance to nearby residents when the shadows pass directly over their line of sight, i.e., windows or other transparent surfaces. While the adverse effects of shadows can be subjective, the shadows themselves can be precisely modeled for location and duration.

For shadow receptor sites within a turbine shadow's reach (10 rotor diameters is standard, but the model used 6,560 feet, well beyond 10 rotor diameters), not all would receive shadow due to existing obstructions that block the shadows path such as other buildings, hills or trees. While evergreen trees would fairly consistently block shadows year-round, deciduous trees would have

a lesser impact in the winter months when they have no leaves. Additionally, the farther an observer is from the wind turbine, the smaller the portion of the sun being blocked and the distance allows the shadow to diffuse (weaken). Although no official U.S. policy has been adopted, international standards appear to be in consensus that flickering shadows in excess of 30 hours per year impacting a particular location are considered a potential nuisance (Appendix B, Attachment B2).

A shadow flicker analysis (Appendix B, Attachment B2) was completed to evaluate the amount of shadow flicker that the below receptors would experience. The analysis considered several aspects affecting the casting of shadows and potential impacts on these receptors, including the distance to receptors, angle of incoming solar insolation (exposure to the sun's rays), and the amount of sunlight experienced at the project site during each of the four seasons.

The following are the closest receptors to the proposed wind turbine:

Receptor A: Elementary School to east, approximately 990 feet. Shadows would be rare, but possible in mid-April to early-May and from mid-August to late-August evenings with a total average of less than 7 hours of moving shadow per year possible.

Receptor B: 17430 Snyder Road, approximately 930 feet. Shadows would not impact this receptor.

Receptor C: 17360 Wood Acre Trail, approximately 1,830 feet. Shadows would not impact this receptor.

Receptor D: 17405 Snyder Road, approximately 1,805 feet. Shadows would be highly diffused, to completely blocked, as the receptor is substantially blocked by multiple trees, but shadow flicker is possible during portions of mid to late May and the first couple of days in August with a total average of less than 11 hours of moving morning shadow per year.

Receptor E: 17406 Snyder Road approximately 1,030 feet. Shadows would be highly diffused, to completely blocked, as the receptor is substantially blocked by multiple trees including evergreens, but shadow flicker is possible during portions of very late-January to late-February and mid-October to mid-November mornings with a total average of less than 5 hours of moving shadow per year.

Receptor F: 17446 Snyder Road, approximately 930 feet. Shadows would be highly diffused, to completely blocked, as the receptor is substantially blocked by multiple trees, but shadow flicker is possible during portions of mid-March to mid-April and middle September mornings with a total average of less than 6 hours of moving morning shadow per year.

Receptor G: 17476 Snyder Road, approximately 950 feet. Shadows would be highly diffused, to completely blocked, as the receptor is substantially blocked by multiple trees, but shadow flicker is possible during portions of mid to late May and early-August mornings with a total average of less than 17 hours of moving morning shadow per year.

Receptor H: High School Stadium, approximately 150 feet. Shadows would be distinct during most evenings of the year on some portion of the stadium field except late-May to mid-August

with a total average of less than 147 hours of moving shadow per year. This effect would be mitigated by Kenston by turning off the turbine during sporting events during those timeframes.

Because of the strobe-like effect of shadow flicker, there have been investigations into whether it might have the potential to produce epileptic seizures in individuals with photosensitivity. It has been determined that modern utility-scale wind turbines do not have the potential to cause these types of problems because of their relatively slow blade rotation. One study (Harding et al. 2008) reported that flickers with a frequency greater than 3 hertz could pose a potential for inducing photosensitive seizures (that is, a light flashing at a rate of more than 3 times per second). The American Epilepsy Foundation reports that lights flashing in the range of 5 to 30 hertz are most likely to trigger seizures and recommends that flash rates of visual alarms be kept under 2 hertz (Epilepsy Foundation 2010). A wind turbine with three blades would have to make a full revolution every second (or 60 revolutions per minute) to reach a frequency of 3 hertz. The Aeronautica 750 wind turbine proposed for this project operates at 25.3 revolutions per minute (Appendix D, Attachment D6). This would indicate a flicker frequency created by this wind turbine at less than one-half the rates identified with photosensitivity issues.

Some data suggest that shadow flicker has the potential to cause a disorienting effect on a small segment of the population. The data also suggest that rotor rotation below 2.5 hertz can avoid such effects (BLM 2005). As stated above, the rotor speeds involved with the project would be well below this level.

Direct and Indirect Impacts from Shadow Flicker

The shadow flicker study completed for the proposed project indicated that no homes or occupied business structures outside the owner's property within the turbine's shadow influence of over 10 rotor diameters would receive flickering shadows of over 30 hours per year. Two to three houses to the southwest of the site could receive less than 10 hours of moving shadows per year, but the shadows likely would be highly diffused or completely blocked due to existing trees. While part of Kenston Middle School to the northwest of the site would receive shadowing of over 30 hours per year, this portion of the school structure, which includes the maintenance garage, has no windows facing the turbine. The tennis courts to the southwest would receive moving morning shadows up to almost 50 hours per year during sunny late fall to early spring mornings. The stadium to the northeast of the project site would receive moving shadows throughout much of the year from late afternoon into the evenings. To a lesser extent, the playing fields farther to the east and northeast would receive moving shadows for 10 to 20 hours per year. For the periods when shadowing events would overlap scheduled sporting or other use events for any of these locations, Kenston has adopted a policy that would temporarily shut down the turbine during the period the shadows if they were found to have an impact on the playing fields to athletic participants or spectators. Shadow flicker impacts as a result of the proposed project would be minimal.

3.2.2.3 Noise

Noise is any unwanted, undesirable sound. It has the potential to interfere with communication, damage hearing, and, in many cases, is viewed as an annoyance. Noise can occur at different levels and frequencies, depending on the type of source and the distance away from the listener.

Sound is a result of fluctuating air pressure. The standard unit for measuring sound pressure levels is the decibel. A decibel is a unit that describes the amplitude (or difference between levels) of sound, equal to 20 times the logarithm to the base 10 of the ratio of the measured pressure to the reference pressure, which is 20 micropascals. Typically, environmental and occupational sound pressure levels are measured in decibels on an A-weighted scale (dBA). The A-weighted scale de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear [i.e., using the A-weighting filter adjusts certain frequency ranges (those that humans detect poorly)] (Colby et al. 2009). Table 3-2 shows some sound pressure levels associated with common activities measured in dBA. Table 3-3 defines commonly used frequency terms.

Table 3-2. Typical Sound Pressure Levels Measured in the Environment and Industry

Noise Source At a Given Distance	A-Weighted Sound Level in Decibels	Qualitative Description
Carrier deck jet operation	140	
	130	Pain threshold
Jet takeoff (200 feet)	120	
Auto horn (3 feet)	110	Maximum vocal effort
Jet takeoff (1000 feet) Shout (0.5 feet)	100	
N.Y. subway station Heavy truck (50 feet)	90	Very annoying Hearing damage (8-hour, continuous exposure)
Pneumatic drill (50 feet)	80	Annoying
Freight train (50 feet) Freeway traffic (50 feet)	70 to 80	
	70	Intrusive (Telephone use difficult)
Air conditioning unit (20 feet)	60	
Light auto traffic (50 feet)	50	Quiet
Living room Bedroom	40	
Library Soft whisper (5 feet)	30	Very quiet
Broadcasting/Recording studio	20	
	10	Just audible

Adapted from Table E, "Assessing and Mitigating Noise Impacts", NY DEC, February 2001.
Table 3-2 is cited in Colby et al. 2009.

For a point source such as a stationary compressor or construction equipment, sound attenuates based on geometry at rate of 6 decibels per doubling of distance. For a line source such as free flowing traffic on a freeway, sound attenuates at a rate of 3 decibels per doubling of distance. Atmospheric conditions including wind, temperature gradients, molecular absorption, and humidity can change how sound propagates over distance and can affect the level of sound received at a given location. The degree to which the ground surface absorbs acoustical energy also affects sound propagation for sources located close to the ground. Sound that travels over an

acoustically absorptive surface such as grass attenuates at a greater rate than sound that travels over a hard surface such as pavement. The increased attenuation is typically about 1.5 decibels per doubling of distance (Caltrans 2009). Barriers such as buildings and topography that block the line of sight between a source and receiver also increase the attenuation of sound over distance.

Table 3-3. Definitions of Commonly Used Acoustical Terms

Sound Measurements	Definition
Decibel	A unitless measure of sound on a logarithmic scale, which indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micropascals.
A-Weighted decibel (dBA)	An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.
Maximum Sound Level (L_{max})	The maximum sound level measured during the measurement period.
Minimum Sound Level (L_{min})	The minimum sound level measured during the measurement period.
Equivalent Sound Level (L_{eq})	The equivalent steady state sound level that in a stated period of time would contain the same acoustical energy as a time-varying sound level.
Percentile-Exceeded Sound Level (L_{xx})	The sound level exceeded "×" percent of a specific time period. L_{10} is the sound level exceeded 10 percent of the time. L_{90} is the sound level exceeded 90 percent of the time. L_{90} is often considered to be representative of the background ambient noise level in a given area.
Day Night Level (DNL or L_{dn})	The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 decibels added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.
Frequency: hertz	The number of complete pressure fluctuations per second above and below atmospheric pressure.

DNL = Day Night Average Sound Level.

Noise Guidelines and Regulations

The U.S. Environmental Protection Agency (EPA) identifies noise levels necessary to protect public health and welfare against hearing loss, annoyance, and activity interference in its document, *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (EPA 1974). This document recommends an exterior Day Night Average Sound Level (DNL) of 55 dBA for residential uses. However, this document contains recommendations only and the levels are not Federally enforceable. Furthermore, in 1981, the Federal Government concluded that noise issues were best handled at the State or local government level. As a result, EPA phased out Federal oversight of noise issues to transfer the primary responsibility of regulating noise to the State and local governments. However, EPA recommendations remain useful for assessing the affected environment.

EPA has also evaluated general public response to changes in noise levels. In general, an increase to ambient or average noise levels of 5 decibels would be noticeable to most people and may elicit widespread complaints. An increase of 20 decibels would likely result in vigorous community response. An increase of ambient noise levels of less than 3 dBA is usually considered minute.

Section 509.08 of the Codified Ordinances of Chagrin Falls is related to noise. The section does not specify limits on noise:

> No person shall cause, create, allow, or permit to be made within the Village any unreasonably loud, disturbing and unnecessary noise, or noises of such character, intensity and duration as to be detrimental to the life and health of any individual.

Background Information on Wind Turbines and Noise

Operating wind turbines can generate two types of sound: first, the mechanical sound from components such as gearboxes, generators, yaw drives, and cooling fans, and second, the aerodynamic sound from the flow of air over and past the rotor blades. Modern wind turbine design has greatly reduced mechanical sound and it generally can be ignored in comparison to the aerodynamic sound, which is often described as a "swishing" or "whooshing" sound (BLM 2005).

Wind turbines produce a broadband sound; that is, the sound occurs over a wide range of frequencies, including low-frequencies. Low-frequency sounds are in the range of 20 to 100 hertz and infrasonic sound (or infrasound) is low-frequency sound of less than 20 hertz. Compared to higher frequency sound, low-frequency sound propagates over longer distances, is transmitted through buildings more readily, and can excite structural vibrations (for example, rattling windows or doors). The threshold of perception, in decibels, also increases as the frequency decreases. For example, in the frequency range where humans hear best (in the low kilohertz), the threshold of hearing is at about 0 decibels, but at a frequency of only 10 hertz, the threshold of human hearing is at about 100 decibels (Rogers et al. 2006).

Older designs of wind turbines, particularly those in which the blades were on the downwind side of the turbine tower, produced more low frequency sound as a result of the blades passing through more turbulent air as a result of the tower blocking wind flow. Modern, upwind turbines produce a broad band sound emission that includes low-frequency sounds, but not at the levels produced by older wind turbines. A primary cause for low-frequency sounds in modern turbines is the blade passing through the change in air flow at the front of the tower and this can be aggravated by unusually turbulent wind conditions.

The University of Massachusetts at Amherst reported (Rogers et al. 2006) on noise measurements made at four different wind turbines ranging in size from 450 kilowatts to 2 megawatts. The results indicated that at distances of no more than 387 feet from the turbines, all infrasound levels were below human perception levels. The report further states that there is "no reliable evidence that infrasound below the hearing threshold produces physiological or psychological effects." This lack of effects at levels below the hearing threshold was supported by a scientific advisory panel comprised of medical doctors, audiologists, and acoustic professionals established by the American and Canadian Wind Energy Associations to review wind turbine sound and health effects (Colby et al. 2009). It was also supported by the findings from Canadian and Australian government reviews of available scientific literature (CMOH 2010; Australia NHMRC 2010).

Existing Noise Conditions

Ambient noise monitoring was conducted to establish baseline sound conditions in the area of the proposed wind turbine. Ambient noise monitoring was conducted at three locations indicated in Figure 3-8. The monitoring sites surround the proposed wind turbine site and were selected to

be representative of several residential receptor areas near the wind turbine. The measurement positions (Figure 3-8; Appendix A, Figure 9) were as follows:

- Position 1 - 17150 Indian Hills
- Position 2 - 9551 East Washington Street
- Position 3 - 17476 Snyder Road

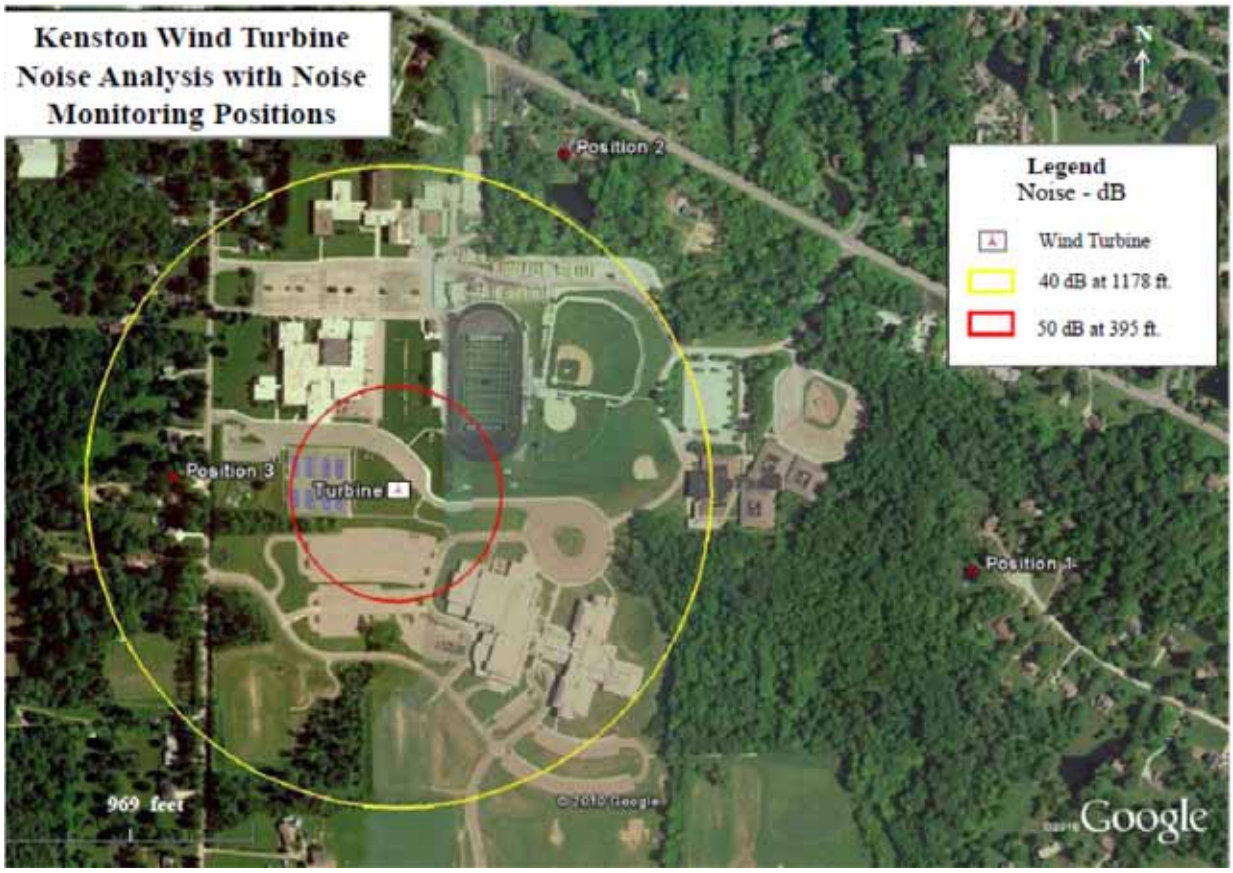

Figure 3-8. Monitoring Sites for Measuring Baseline Sound Conditions and Predicted Turbine Sound Level Contours

Measurements were conducting using Larson-Davis Model 820 Type I sound level meters. Data at each site were collected between 3 p.m. on Thursday November 11, 2010, and 3 p.m. on Thursday November 12, 2010. Table 3-4 provides a summary of the baseline sound monitoring results.

The types of sources of baseline sounds heard in and around the site during the site visits were from auto and truck traffic, air-conditioning units, insects, birds, and the activities at the school.

Table 3-4. Summary of Baseline Sound Monitoring Results (dBA)

Monitoring Site	Distance to Turbine Site (feet)	L_{eq} 24 Hours	Hourly L_{90} Range	L_{eq} Daytime	L_{eq} Nighttime	DNL
Position 1	2,160	45.8	29.1 to 48.4	47.2	41.1	49.1
Position 2	1,360	50.6	31.0 to 51.2	51.8	47.2	54.7
Position 3	840	52.7	42.4 to 51.3	53.9	49.2	56.7

Daytime: 7 a.m. to 10 p.m.
Nighttime: 10 p.m. to 7 a.m.
DNL = Day Night Average Sound Level.

Direct and Indirect Impacts

Construction of the wind turbine would temporarily result in increased noise and vibration. Operation of the wind turbine would be a permanent source of noise until the turbine is decommissioned.

Construction of the turbine would involve the use of heavy construction including the equipment listed in Table 3-5. Table 3-5 also summarizes typical noise levels produced by this equipment. L_{max} sound levels at 50 feet are shown along with the typical acoustic use factor. The acoustic use factor is the percentage of time each piece of construction equipment is assumed to be operating at full power (i.e., its noisiest condition) during construction operation and is used to estimate L_{eq} values from L_{max} values. For example the L_{eq} value for a piece of equipment that operates at full power 50 percent of the time (acoustical use factor of 50) is 3 decibels less than the L_{max} value.

Table 3-5. Typical Construction Noise Emission Levels

Equipment	Typical Noise Level (L_{max})[a]	Acoustical Use Factor	Typical Noise Level (L_{eq})[a]
Compactor (ground)	83	20	76
Dozer	82	40	78
Dump Truck	76	40	72
Excavator	81	40	77
Generator	81	50	78
Grader	85	40	81
Pickup Truck	75	40	71
Warning Horn	83	5	70
Crane	81	16	73

Source: US DOT 2006.
a. A-weighted decibel level, measured at 50 feet.

The three noisiest pieces of equipment likely to operate at the same time include a grader, a dozer, and a generator. Simultaneous operation of this equipment would result in a noise level of 84 dBA (L_{eq}) at 50 feet. Based on the assumed simple geometric attenuation of 6 decibels per doubling of distance the noise level at the nearest residences (at about 800 feet) would be 60 dBA (L_{eq}). Because construction noise would be temporary and intermittent during daytime hours, no adverse effect from construction noise is expected. With regard to vibration, no highly dynamic equipment, such as a pile driver, would be used. Given this and the fact that residences are about 800 feet from the turbine site, no adverse vibration impacts from construction activity would occur.

Kenston has selected the Aeronautica 750 wind turbine[1], which has several characteristics that reduce aerodynamic sounds levels in comparison to other and primarily older wind turbine designs. It is an upwind turbine, meaning the turbine faces into the wind and the wind encounters the rotor blades before the tower and the nacelle, which makes for quieter operations than a downwind turbine. It has relatively low rotational speeds and pitch control on the rotors, both of which reduce sound levels. Complete technical information including sound data is provided in Appendix D, Attachment D6.

Figure 3-9 shows A-weighted wind turbine sound pressure levels at 1.5 meters (5 feet) above the ground calculated by the wind turbine manufacturer at a wind speed of 8 meters (26 feet) per second.

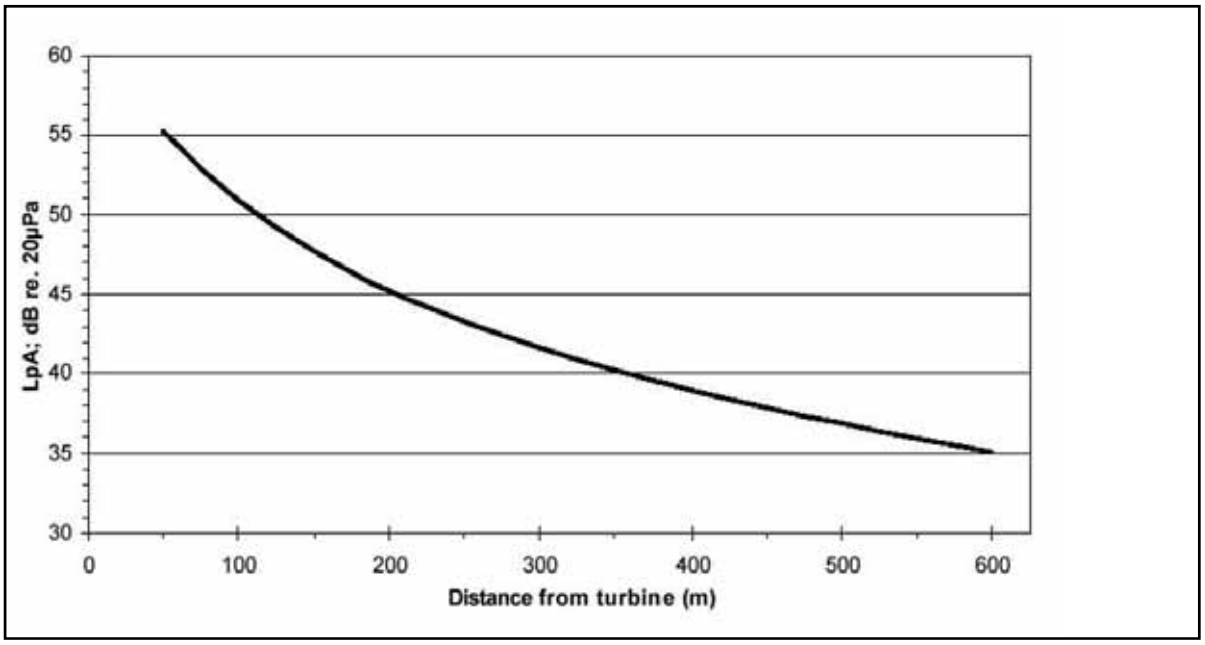

Figure 3-9. Aeronautica 54-750 Sound Pressure Level as a Function of Distance

Table 3-6 summarizes following key sound level values that have also been provided by the manufacturer.

Table 3-6. Turbine Sound Levels at Various Distances

Distance (feet)	A-Weighted Sound Level
1,992	35
1,178	40
676	45

Table 3-7 summarizes the predicted steady state turbine sound level and the corresponding DNL value at each receptor location where measurements were taken. Measured DNL values are also shown. DNL can be calculated from the steady state sound level value assuming that the turbine

1. The noise analysis presented in this EA represents data for the Aeronautica 47-750 turbine as the version for the 54-750 was not available. However, both the 54-750 and 47-750 are reported to have an A-weighted sound power level of 100.0 decibels. Accordingly, data for the Aeronautica 47-750 are considered to be representative of the Aeronautica 54-750, which is the turbine that will be used at Kenston High School.

operates continuously over a 24-hour period. The conversion between a steady state sound level and DNL is 6.4 decibels. Seven decibels has been added to the steady state sound level to estimate DNL.

Table 3-7. Predicted Turbine DNL Sound Levels

Monitoring Site	Distance to Turbine Site (feet)	Predicted Turbine Steady State Sound Level (dBA)	Predicted Turbine DNL	Measured DNL
Position 1	2,160	34	41	49.1
Position 2	1,360	39	46	54.7
Position 3	840	42	49	56.7

dBA = A-weighted decibel.
DNL = Day Night Average Sound Level.

Because the Village of Chagrin Falls does not have a specific limit on noise, the EPA-recommended sound level of 55 DNL is used here. The predicted turbine sound levels in the range of 41 to 49 DNL are below this level and the DNL values measured at each position.

Figure 3-8 (above) shows the estimated 40 dBA and 50 dBA wind turbine noise contours. These contours indicate that no receptors would be included within the 48 dBA (equivalent to 55 DNL) noise contour. Table 3-8 compares predicted steady state turbine sound levels to the range of L_{90} values measured at each site.

Table 3-8. Comparison of Predicted Turbine Noise Levels to Measured L_{90} Values

Monitoring Site	Distance to Turbine Site (feet)	Predicted Turbine Steady State Sound Level (dBA)	Hourly L_{90} Range
Position 1	2,160	34	29.1 to 48.4
Position 2	1,360	39	31.0 to 51.2
Position 3	840	42	42.4 to 51.3

dBA = A-weighted decibel.

Table 3-8 indicates that predicted wind turbine noise levels are expected to be at or above many of the hourly L_{90} values measured at each site. Therefore turbine sound may be audible at nearby residences. Audibility does not necessarily mean an adverse noise effect would occur. The magnitude of the increase in noise level relative to ambient noise conditions is evaluated to determine the severity of the noise impact.

An adverse noise impact is considered to occur if the wind turbine noise is predicted to increase the ambient daytime or nighttime L_{eq} value at residences by more than 3 dBA. Tables 3-9 and 3-10 summarize the noise impact analysis.

Table 3-9. Daytime Noise Impact Analysis

Site	Daytime Ambient L_{eq} (dBA)	Turbine Sound (dBA)	Daytime Ambient plus Turbine Sound	Increase (dBA)
1	47.2	34	47.4	0.2
2	51.8	39	52.0	0.2
3	53.9	42	54.2	0.3

dBA = A-weighted decibel.

Table 3-10. Nighttime Noise Impact Analysis

Site	Nighttime Ambient L_{eq} (dBA)	Turbine Sound (dBA)	Nighttime Ambient plus Turbine Sound	Increase (dBA)
1	41.1	34	41.9	0.8
2	47.2	39	47.8	0.6
3	49.2	42	50.0	0.8

dBA = A-weighted decibel.

The results in Tables 3-9 and 3-10 indicate that operation of the proposed wind turbine would not result in noise increases greater than 3 dBA at residences in the project vicinity. Operation of the proposed wind turbine is therefore not expected to result in an adverse noise impact.

3.2.2.4 Cultural Resources

The *National Historic Preservation Act* (16 U.S.C. 470 *et seq.*; NHPA) is the primary Federal law protecting cultural, historic, American Indian, and Native Hawaiian resources. Section 106 of the NHPA (36 CFR Part 800) requires Federal agencies to assess and determine the potential effects of their proposed undertakings on prehistoric and historic resources (e.g., sites, buildings, structures, and objects) and to develop measures to avoid or mitigate any adverse effects. Compliance with Section 106 requires consultation with a State Historic Preservation Officer (SHPO).

On August 28, 2009, DOE executed a memorandum authorizing its ARRA grant applicants under the Energy Efficiency and Conservation Block Grant, Weatherization Assistance Program, and SEP to initiate Section 106 consultations pursuant to 36 CFR 800.2(c)(4). As of that date, applicants and their authorized representatives could consult with the SHPO to initiate the review process established under 36 CFR Part 800. On May 7, 2010, the Ohio Historic Preservation Officer (OHPO) signed the Programmatic Agreement with the DOE, which further solidified a recipient's ability to initiate consultation with a SHPO. In accordance with this authorization, Kenston initiated Section 106 Consultation with the OHPO on May 25, 2010 (Appendix E, Attachment E4). In response to the May 25, 2010, submission, the OHPO requested additional information and expansion of the proposed area of potential effect (APE) from the 189-acre school campus and immediate vicinity to 1.5 miles. The OHPO response letter dated June 7, 2010 (Appendix E, Attachment E3) also requested that effects from vibration and noise be included in the subsequent analysis. Kenston submitted the analysis to the OHPO on June 16, 2010, and, after additional correspondence, the OHPO ultimately responded that there would be no adverse effects on historic resources and that the likelihood of finding archaeological remains was very low (Appendix E, Attachment E1).

In addition, pursuant to Section 106, DOE is required to consult with American Indian tribes about the potential effects of DOE's proposed undertakings on prehistoric and historic resources and to develop measures to avoid or mitigate any adverse effects. DOE uses a list maintained by the U.S. Bureau of Indian Affairs, entitled "Indian Entities Recognized and Eligible to Receive Services from the U.S. Bureau of Indian Affairs" (72 FR 13648, March 22, 2007), to determine which tribes to contact. Based on this document, DOE determined that there are no Federally-recognized tribes in the state of Ohio. Moreover, there is no Tribal Historic Preservation Officer for the state of Ohio according to the National Association of Tribal Historic Preservation Officers . However, DOE provided the notice of scoping and the NOA of the Draft EA to 24

Tribal Nation representatives that are regularly notified of Federal actions in northeastern Ohio[2]. To date, none of the tribal representatives contacted has responded to DOE's scoping letter or the Draft EA. DOE will continue its outreach to these tribal representatives by providing them with the NOA of this Final EA.

Consulting Party Participation

As part of DOE's responsibilities under NHPA, DOE will send a copy of this Final EA and appendices related to historic and cultural resources to the following consulting parties identified as part of Kenston's Section 106 consultation with OHPO:

- Geauga County Community and Economic Development
- Geauga County Planning Commission
- Western Reserve Historical Society
- Western Reserve Heritage Association

Although Kenston has conducted a great deal of public outreach for the proposed project, to ensure DOE's compliance with NHPA, the public was afforded the opportunity to comment on historic resources via the same method for commenting on the Draft EA. No comments related to historic resources were received.

Archaeological and Aboveground APEs

The direct APE is defined as the area disturbed for construction of a project. However there is no definitive rule for determining an indirect APE for a wind turbine, which can create both visual and audible effects on the adjacent properties, otherwise known as the aboveground APE.

Aboveground Historic Resources

At the request of the OHPO, on June 16, 2010, Kenston provided additional information to the OHPO regarding an expansion of the APE (Appendix E, Attachment E2). In the subsequent submission, Kenston indicated that there were a total of 21 potentially historic properties within 1.5 miles that contained the requisite features and characteristics.

Belowground Archaeological Resources

The APE established for archaeological resources focuses on the zone of direct ground disturbance associated with the construction of the proposed project. The installation of the proposed project would result in temporary ground-disturbing activities to 1,600 square feet for the turbine foundation (ultimately a 256-square-foot permanent footprint).

Direct and Indirect Impacts to Archaeological Resources

The visual historic resources associated with the above-mentioned 21 potentially historic properties would not be adversely affected by the turbine. Additionally, based on the lack of vibration associated with the proposed turbine and the fact that noise levels would be below 45 decibels at the school property line, within local zoning requirements, there would be no adverse effects to historic resources anticipated from noise.

2. List used by the U.S. Army Corps of Engineers Buffalo District for actions occurring in northeastern Ohio.

Because the installation of the wind turbine would occur entirely within the previously disturbed 189-acre campus [and specifically within the 256-square-foot footprint of the turbine foundation and 600 linear feet (1,200 square feet) for the underground transmission line], there are no direct effects to archaeological resources expected from the project. If archaeological resources were encountered during construction, ground-disturbing activities would immediately cease, and the OHPO would be contacted for resolution and further instruction regarding additional studies and/or potential avoidance, minimization, or mitigation measures in accordance with the NHPA.

Based on the information provided to the OHPO by Kenston pursuant to the Memorandum and Programmatic Agreement, DOE concurs with Kenston's assessment that the proposed project would not have an adverse effect on historic or archaeological resources. In a letter dated June 21, 2010, OHPO concurred with Kenston's assessment that no adverse impacts on historic or cultural resources would occur as a result of the construction and operation of the proposed project (Appendix E, Attachment E1).

3.2.2.5 Geology and Soils

The majority (74 percent) of the soil found within the 189-acre project site consists of Wadsworth silt loam and Loudonville silt loam (12 percent) (NRCS 2010) (see Appendix D, Attachment D7). Table 3-11 shows a complete list of soils present within the project site. No soils listed by the U.S. Department of Agriculture as prime farmlands or unique or rare soils exist within the project area (NRCS 2010).

Table 3-11. Geauga County, Ohio Project Site Soil Composition

Map Unit Symbol	Map Unit Name	Acres in Area of Interest	Percent of Area of Interest
LyB	Loudonville silt loam, 2 to 6 percent slopes	6.1	2.8
LyC	Loudonville silt loam, 6 to 12 percent slopes	25.4	11.7
RsB	Rittman silt loam, 2 to 6 percent slopes	7.2	3.3
RsC	Rittman silt loam, 6 to 12 percent slopes	5.4	2.5
RsC2	Rittman silt loam, 6 to 12 percent slopes, eroded	12.9	6.0
WbB	Wadsworth silt loam, 2 to 6 percent slopes	159.1	73.6
Totals for Area of Interest		**216.0**	**100.0**

Seismic activity in Geauga County is not considered a significant risk. Northeast Ohio has experienced approximately 80 earthquakes that were felt since 1836, most of which were small (ODNR 2007). The only earthquake to result in minor damage (cracked plaster, broken windows) was on January 31, 1986, which had a magnitude of 5.0.

Direct and Indirect Impacts

Soil disturbance would occur as a result of site preparation and project construction. As part of project construction, approximately 0.02 acre of current open space would be disturbed for the foundation and another approximately 0.04 acre of open space would be disturbed for the electrical interconnecting trench, for a total of approximately 0.06 acre. Ground-disturbing activities would be less than 1 acre and would not require an NPDES Storm Water Program

Permit. However, Kenston has committed to using sediment and erosion pollution control BMPs in conformance with a plan specific to the proposed project.

Data reviewed from the Ohio Department of Natural Resources suggest there is a low risk of seismic activity jeopardizing the structural integrity of the proposed wind turbine and foundation.

3.2.2.6 Biological Resources

Biological resources include native or naturalized plants and animals and the habitats that support their various stages of life. Species that are considered sensitive, either pursuant to Federal or State law or regulations publicized by agencies, are specifically addressed in this section.

Project Site

The proposed project site consists of a fully developed high school site on approximately 189 acres that includes various classroom, administration, and physical activity buildings and parking facilities. There are also tennis courts, ball fields, and a football stadium. All land within the school site is disturbed ground, asphalt, or mowed and maintained grass. The greater surrounding area is mainly suburban, large lot residential intermixed with wooded lots and agricultural fields. The nearest wood lot is approximately 850 feet west of the proposed turbine site, and there are no stream corridors in the vicinity of the project site. Potentially suitable roosting or maternity habitat might be located within the surrounding area beyond the nearest wooded lot, but is not present within the approximately 189-acre school site. According to the USFWS letter dated October 29, 2010, the proposed project is approximately 7 miles from several caves where small numbers of the Indiana bat have been documented swarming in the fall, but have never been documented emerging in the spring despite multiple years of survey (see Appendix C, Attachment C4).

Federally and State-listed Species

Information regarding the potential occurrence of Federally listed species was reviewed using the USFWS Endangered Species Website and a list of potentially occurring listed species for Geauga County, Ohio (USFWS 2010). The only species with a potential to occur in Geauga County according to the USFWS is the Indiana bat (*Myotis sodalis*) .

ODNR was contacted to complete a review of the proposed project. According to its letter regarding the proposed project dated August 27, 2010, ODNR conducts reviews "by an interdisciplinary team within ODNR in accordance with its authority under the *Fish and Wildlife Coordination Act* (48 Stat. 401, as amended; 16 U.S.C. 661 *et seq*.), NEPA, the *Coastal Zone Management Act*, Ohio Revised Code, and other applicable laws and regulations" (Appendix C, Attachment C1).

ODOW, a division under ODNR, provided the following information concerning the project's potential impacts on wildlife species (Appendix C, Attachment C1)[3] and stated that the ODNR Ohio Biodiversity Database did not contain data at this project site. ODOW also determined that

3. The sandhill crane (*Grus canadensis*) is also a State-listed endangered species. This species was not included in the ODOW August 27, 2010 response letter. If ODOW wishes to consult further with respect to sandhill crane, DOE will do so.

the project lies within the range of the Indiana bat (*Myotis sodalis*), a Federally and State-listed endangered species. Indiana bat habitat consists of suitable trees that include dead and dying trees of the species listed below with exfoliating bark, crevices, or cavities in upland areas or riparian corridors and living trees of the species listed below with exfoliating bark, cavities, or hollow areas formed from broken branches or tops. ODNR identified the following species of trees as having relatively high value as potential Indiana bat roost trees: shagbark hickory (*Carya ovata*), shellbark hickory (*Carya laciniosa*), bitternut hickory (*Carya cordiformis*), black ash (*Fraxinus nigra*), green ash (*Fraxinus pennsylvanica*), white ash (*Fraxinus americana*), shingle oak (*Quercus imbricaria*), northern red oak (*Quercus rubra*), slippery elm (*Ulmus rubra*), American elm (*Ulmus americana*), Eastern cottonwood (*Populus deltoides*), silver maple (*Acer saccharinum*), sassafras (*Sassafras albidum*), post oak (*Quercus stellata*), and white oak (*Quercus alba*).

In its response, the ODOW indicated that the proposed project site was within the range of several other State-listed species, including the snuffbox (*Epioblasma triquetra*) and the eastern pondmussel (*Ligumia nasuta*) – State-listed endangered mussels (which require streams or other aquatic environments); the American emerald (*Cordulia shurtleffi*), the frosted whiteface (*Leucorrhinia frigida*), and the racket-tailed emerald (*Dorocordulia libera*) – State-listed endangered dragonflies; the black bear (*Ursus americanus*), snowshoe hare (*Lepus americanus*), and the bobcat (*Lynx rufus*) – State-listed endangered species; and the yellow-bellied sapsucker (*Sphyrapicus varius*) – a State-listed endangered bird.

Migratory Birds and Bald Eagle

The *Migratory Bird Treaty Act* (16 U.S.C. 703-7012; MBTA) implements four international conventions that provide for international protection of migratory birds. The MBTA prohibits taking, killing, possessing, transporting, and importing migratory birds, their eggs, parts, and nests, except when specifically authorized by the U.S. Department of the Interior. While the MBTA has no provision for allowing unauthorized take, USFWS recognizes that some migratory birds may be taken during activities such as wind turbine operation even if all reasonable measures to avoid a take have been implemented.

Bald and golden eagles are included under the MBTA, and are afforded additional legal protection under the *Bald and Golden Eagle Protection Act* (16 U.S.C. 668-668d). In its letter dated September 18, 2009, USFWS indicated that although bald eagles are known in Geauga County, no bald eagle nests exist within 5 miles of the project site. Therefore, bald eagles are not likely to regularly occur in the project area (see Appendix C, Attachment C2). In a subsequent letter from the USFWS dated September 2, 2010, the USFWS noted that eagle nests are not known to occur within the project area or within 5 miles and that the project area does not provide suitable habitat for eagles (see Appendix C, Attachment C3).

The proposed project site is located in an area that contains predominantly medium to large scattered stands of trees interspersed with residential development. The nearest Important Bird Area (IBA) is approximately 6 miles west of the proposed turbine location. This IBA encompasses approximately 43,431 acres that run along the Chagrin River Corridor and is a relatively intact contiguous riparian corridor surrounded by developed residential areas. It consists of the riparian corridor, featuring ravines and forested areas that are mostly mature, over 75 years in age, with a mixture of beech-maple to hemlock-hardwood. It includes 19 constructed

ponds and lakes and numerous natural wetlands. Although some continuity between the IBA and the project site exists, there are also numerous residential developments and rural towns located between the main riparian corridor and the project site. The medium to large stands of trees that surround the project site have potential to provide migratory bird nesting and foraging habitat as well as stopover habitat during migration.

The USFWS indicated in its letters dated September 18, 2009, and September 2, 2010, that no bald eagle nests are known to occur in the vicinity of the proposed project site, as did ODNR in its letter of August 27, 2010.

Direct and Indirect Impacts

An initial letter sent to the recipient in September 2009 from the USFWS (Appendix C, Attachment C2) indicated that the proposed project would have no effect on Indiana bat based on lack of suitable habitat at the project site. In a subsequent letter sent to the DOE in September 2010 (Appendix C, Attachment C3), the USFWS indicated that although the project site did not provide suitable habitat for Indiana bat, the site was within 1,000 feet of a wooded lot, which, based on new information, may be considered suitable habitat for Indiana bat. Kenston provided additional information to the USFWS regarding the project site and specifics related to the residential nature of the area surrounding the project site and the lack of habitat on the approximately 189-acre school site.

Based on the additional information Kenston provided, the USFWS reviewed the proposed project and surrounding area further. In USFWS's letter dated October 29, 2010, the USFWS indicated that summer Indiana bats typically stay within 1,000 feet of stream corridors and forested areas, and although the proposed project site was located 850 feet from wooded lots, the site complex of approximately 100 acres is substantially developed and that Indiana bats would likely stay close to the forested areas and would be unlikely to fly over the 100-acre open area (Appendix C, Attachment C4).[4]

Because of this and the small rotor sweep of a single turbine, the USFWS concluded that it would be very unlikely that an Indiana bat would be exposed to the single turbine during the migratory season. In addition, although the proposed project area is approximately 7 miles from several caves where small numbers of Indiana bats have been documented swarming in the fall, none have been documented emerging in the spring despite multiple years of survey. This indicates that Indiana bats might just be swarming in the caves in the fall or they may be hibernating in very small numbers (see Appendix C, Attachment C4). Because suitable habitat is so plentiful in the surrounding landscape, including in areas near the caves, and because the Indiana bat has been detected in such low numbers, the USFWS indicated that fall-swarming Indiana bats are unlikely to be exposed to a single, small turbine 7 miles away from the caves, in a developed area (Appendix C, Attachment C4).

Although potentially suitable roosting and maternity habitat is located in the woodlands surrounding the project site, based on the foregoing, the USFWS concluded that take of Indiana bat as a result of the proposed project is extremely unlikely and the project was not likely to result in adverse impacts to this species (Appendix C, Attachment C4). Additionally, ODOW

4. Although the USFWS letter states the school site is approximately 100 acres, it is actually 189 acres.

concluded that the proposed project was not likely to adversely affect the Indiana bat unless tree removal was planned as part of the project (Appendix C, Attachment C1). No tree removal is proposed to occur; therefore, the project is not likely to adversely affect the Indiana bat.

In its letter dated August 27, 2010, the ODOW indicated that the Ohio Biodiversity Database currently has no records of bald eagle near the project site and, based on the lack of records for bald eagle near the project site, the proposed project is not anticipated to affect this species. The USFWS concluded that bald eagle nests are not known in the vicinity of the proposed project site and that adverse impacts to this species were not anticipated.

ODOW's letter also indicated that although the project site lies within the range of snuffbox and the eastern pondmussel, project activities do not include in-water work, and therefore, no impacts to these species would result from the proposed project.

The project site is also within the range of the American emerald, frosted whiteface, and the racket-tailed emerald dragonflies. However, ODOW concluded that, due to the mobility of these species, the proposed project is not likely to impact these species.

ODOW also concluded in its August 27, 2010, letter that due to the mobility of the black bear and the bobcat and due to the location of the project site and the habitat requirements of the yellow-bellied sapsucker and the snowshoe hare, the proposed project is not likely to impact these species.

The medium to large stands of trees that surround the project site have potential to provide migratory bird nesting and foraging habitat as well as stopover habitat during migration. However, a single turbine within an approximately 189-acre developed area is not likely to take large numbers of migratory birds. Based on the foregoing, impacts on migratory birds as a result of the proposed project are anticipated to be minimal.

During turbine siting, design, and installation of the proposed project, Kenston gave consideration to the recommendations contained within the *Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines* (USFWS 2003) and incorporated those recommendations, including them as applicant-committed measures as appropriate, to avoid and minimize potential impacts on migratory birds and bald and golden eagles. The proposed project is a single wind turbine located in an area that is already developed and is part of the school's property. The proposed turbine design is a monopole, no external features are proposed to the design, and all electric lines would be placed underground. The area around the turbine is mainly landscaped grass or sparsely vegetated ground and does not provide significant bird habitat. The project site is surrounded by medium to large stands of trees, interspersed with residential development, but the single turbine would not fragment highly suitable migratory bird or other wildlife habitat. The proposed project would make use of an existing 0.8-acre area that is used as overflow parking for staging and would not require temporary construction roads or additional excavation for equipment laydown. Aviation lighting would utilize the minimum required by FAA to minimize potential bird and bat impacts.

Kenston would voluntarily conduct post-construction avian and bat mortality surveys. Voluntary monitoring likely would consist of one initial post-construction fall migration season

(approximately 8 to 12 weeks, based predominantly on Indiana bat migration habits). Kenston plans to implement the voluntary monitoring with in-kind support and/or oversight from qualified local university/college faculty/staff. This monitoring will provide data to the USFWS, DOE, and ODOW on potential avian and bat mortality associated with single wind turbines. DOE is working with USFWS Region 3 to establish an appropriate protocol for the post-construction monitoring. The final protocol is expected to include details related to timing, frequency, and reporting. Kenston would implement monitoring consistent with the final protocol.

3.2.2.7 Human Health and Safety

Workers have the potential to be injured or killed during construction, operation, and decommissioning of wind turbines through industrial accidents such as falls, fires, and dropping or collapsing equipment. Such accidents are uncommon in the wind industry and are avoidable through implementation of proper safety practices and equipment maintenance.

Collapse of a turbine or breakage (and throwing) of one or more turbine blades is possible, but both are very unlikely occurrences. Debris falling from these occurrences would likely be limited to a calculated fall zone, calculated at 1.1 times the full turbine height, or 332 feet, which is defined to approximate the area around the base of the turbine that would likely receive the tower and turbine if it were to fall. The southwest corner of the football stadium is within the 332-foot fall zone (approximately 322 feet away from the turbine site) as is the eastern half of the tennis court (approximately 191 feet from the proposed turbine site). Estimates of blade throw vary, but MacQueen et al. (1983) estimate the probability of being struck outside the fall zone (i.e., within one blade diameter of the tower base) is about 10^{-7} per year for a fixed building, and substantially less for people who are mobile.

Another potential source of accidents is ice shedding and lightning. Ice shedding, or ice throw, refers to the phenomenon that can occur when ice accumulates on rotor blades and subsequently breaks free or melts and falls to the ground. Although a potential safety concern, it is important to note that, while more than 90,000 wind turbines have been installed worldwide, there has been no reported injury caused by ice thrown from a turbine (Tetra Tech EC, Inc. 2007). The proposed project would be supplied with ice sensors on the turbine blades. When ice forms, the sensors would engage and the turbine would not be permitted to rotate until the ice had melted. This technology is intended to prevent ice throws. Ice that has accumulated on the blades would fall to the foot of the turbine as it melts. To prevent accident or injury from ice that falls as it melts, the turbine requires the area directly underneath to be a clear zone.

A study conducted for the National Renewable Energy Laboratory was successful in identifying damage mechanisms due to direct and indirect effects of lightning strikes on wind turbines. Lightning strikes can cause extensive damage to the turbine blades, controllers, and power electronics (NREL 2002). However, this damage can be reduced by protection from tall nearby communication towers, integral blade protection in the form of conductors, bonding to minimize arcing, good turbine grounding, controller cable and controller shielding, and transient voltage surge suppression. The amount of lightning damage is a factor of the lightning activity in the area, the height and prominence of the turbine, the terrain, and the lightning protection system in

place. According to the National Oceanic and Atmospheric Organization Illinois has mid-range lightning activity (between 40 and 50 annual thunderstorm days).

Because no fuel is used in wind energy projects, there would be no process waste streams generated during operation of the wind turbine that could cause health and safety concerns. Some lubricants are used in wind turbines, including gearbox oil, hydraulic fluid, and gear grease, that require periodic replacement. These lubricants would be managed in accordance with Federal and State regulations.

A previous Environmental Real Estate Assessment Phase 1, which included a soils study, was conducted prior to the Kenston's purchase of the 28-acre Bainbridge property in 2003 to construct Kenston High School. The entire 28-acre parcel was cleared from environmental hazards.

Three airports are within 10 miles of the project site: Auburn Airport in Chagrin Falls, Ohio; Harper Ridge Airport in Solon, Ohio; and Rataiczak Airport in Russell Center, Ohio. All structures taller than 200 feet, as is the case with the proposed project, are required to have aircraft warning lights in accordance with requirements specified by the FAA.

The term electromagnetic field (EMF) refers to electric and magnetic fields that are present around any electrical device. Electric fields arise from the voltage or electrical charges and magnetic fields arise from the flow of electricity or current that travels along transmission lines, collector lines, substation transformers, house wiring, and electrical appliances. The intensity of the electric field is related to the voltage of the line and the intensity of the magnetic field is related to the current flow through the conductors (wire). EMFs can occur indoors and outdoors. The question of whether exposure to magnetic fields potentially can cause biological responses or even health effects continues to be the subject of research and debate. However, wind turbines are not considered a significant source of EMF exposure since emissions levels around wind farms are low (CMOH 2010).

Direct and Indirect Impacts

No adverse public security impacts are anticipated due to the proposed project. Safety signage would be posted around the tower (where necessary); transformers and other high-voltage facilities would be in conformance with applicable Federal and State regulations.

All contractors, subcontractors, and their personnel are required to comply with all Federal and State worker safety requirements, specifically all of the applicable requirements of OSHA. Safety procedures specific to the Aeronautica 750 turbine would be observed whenever work is being done on the turbine.

As described earlier, risk of turbine collapse is very rare (Klepinger 2007). The blade and tower impact area should have restricted access with very limited public use. Based on the extreme rarity of tower collapse or blade throw, the risk to public safety due to such occurrences can be mitigated by limiting access within the fall zone and areas, such as portions of the stadium or tennis courts that are within the fall zone, that are intermittently occupied during sporting events and not at all during winter months and portions of the summer. Therefore, risk of impacts to individuals in these areas as a result of tower collapse is considered very unlikely.

The same access management strategies can mitigate the risks to public safety due to ice throw or shedding conditions, which are in effect only on a limited temporal basis. The turbine system would have an automated system fault shut-off triggered at a minimum by the following sensors: system temperature, power quality, vibration, over-speed, fire and icing (vibration caused by blade icing induced imbalances would automatically shut down the turbine). This system would also automatically send fault codes to preauthorized personnel through a web interface. The turbine's nacelle would have a cold-weather package including nacelle heaters. These heaters are designed to maintain nacelle temperatures above the dew point and well above freezing. This system would automatically melt snow and ice accumulation on top of the nacelle. The turbine system would have staff-accessible emergency shut-offs. All icing-related turbine shutdowns would require a direct inspection and an onsite manual restart. The site personnel and the system maintenance personnel would shut down the turbine in the event of an icing condition. The site shall adopt an ice safety zone around the turbine for implementation during icing events, when they occur.

The FAA issued a Determination of No Hazard to Air Navigation on November 9, 2010 (Appendix C, Attachment C8), for the proposed project. Based on this determination, the proposed project is not anticipated to have a substantial effect on the safe and efficient utilization of navigable airspace by aircraft or on the operation of air navigation facilities. Aviation lighting would be in compliance with FAA standards (FAA 2007).

The turbine is not anticipated to impact public health and safety due to EMF because wind turbines are not considered a significant source of EMF.

The soil sample collected as part of the initial soil field and laboratory study exhibited concentrations of volatile organic compounds, semivolatile organic compounds, and metals well below Ohio Voluntary Action Program standards. Therefore, excavation of the soils would pose no risks to contractor health or to the environment in general (EDP 2008).

3.2.2.8 Transportation

The project site can be accessed by Snyder Road (Township Highway 192), East Washington Street (County Route 606), Bainbridge Road (County Route 11), and U.S. Highway 422. Access to the Interstate transportation system is available at the I-480/I-271 interchange, approximately 12 miles to the west of the project site. No new access or other roads would be necessary for construction and operation of the proposed project.

Direct and Indirect Impacts

During the construction phase of the project, a minor increase in vehicular traffic on the local roads surrounding the project site is anticipated. This traffic increase would occur for a period of approximately 10 months throughout the course of construction. No long-term or permanent impacts on the local transportation systems would occur as a result of the proposed project. No new access or other roads would be required for construction and operation of the proposed project.

The turbine nacelle, blades, and tower would be staged at Buckeye Excavating directly across Washington Street to the north of the project site. Final transport of project materials and construction vehicles would occur through the north entrance of the campus.

3.2.2.9 Socioeconomics and Environmental Justice

Executive Order 12898 (February 11, 1994) directs Federal agencies to identify and address "disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." The racial makeup of Geauga County in the 2000 Census was 96.8 percent white, compared with 84.7 percent for the state of Ohio as a whole, with the remainder of both populations constituting minorities. The median household income in 2000 dollars for a household in Geauga County in 2008 was $62,223, compared with $48,011 for the state of Ohio as a whole. About 6.9 percent of individuals were below the poverty level in 2008, compared with 13.3 percent for the state of Ohio as a whole (Bureau of the Census 2010).

Direct and Indirect Impacts

No potential for adverse impacts to human health or environmental effects have been identified as part of the proposed project. Therefore, there would be no disproportionately high and adverse socioeconomics- or environmental justice-related impacts on minority populations and low-income populations.

The construction of the proposed project is expected to generate short-term and small increase in employment due to temporary construction related jobs for the wind turbine. Operation of the proposed project is not anticipated to generate new jobs, as it would be maintained by the school district.

3.2.2.10 Air Quality and Climate Change

The affected air environment can be characterized in terms of concentrations of the criteria pollutants carbon monoxide, sulfur dioxide, particulate matter, nitrogen oxides, ozone, and lead. EPA has established National Ambient Air Quality affected environment and environmental impacts standards for these pollutants. There are two standards for particulate matter: one for particulates with an aerodynamic diameter less than or equal to a nominal 10 micrometers (PM_{10}) and one for particulates with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers ($PM_{2.5}$). According to the Northeast Ohio Areawide Coordinating Agency, Geauga County is in attainment for carbon monoxide, sulfur dioxide, PM_{10}, nitrogen oxides, ozone, and lead, which means that the levels of these pollutants in the air are below the EPA standards. However, in 2004 Geauga County was given moderate nonattainment status with respect to a new Federal 8-hour ozone standard (NOACA 2005). The EPA has found that the "aggregate group of the well-mixed greenhouse gases" constitutes an air pollutant that contributes to climate change. Carbon dioxide is a greenhouse gas and the Kenston wind turbine would have an indirect impact on reducing carbon dioxide emissions from fossil fuel sources.

Electricity is provided to the school by First Energy Solutions. First Energy Solutions currently has a mix of fuel sources (Table 3-12). First Energy Solutions reports an average estimated grid

line loss of 6.14 percent, resulting in higher realized grid power offsets for renewable energy generating sites than their actual onsite production (EPA 2010b).

Table 3-12. First Energy Fuel Mix and Emissions

Source Fuel Mix (percent)	
Coal	72.8
Oil	0.4
Natural Gas	2.7
Nuclear	22.3
Renewable	1.1

Direct and Indirect Impacts

The proposed project would be an emissions-free energy generation project that would not degrade air quality. Grading and construction for the proposed project would result in short-term air quality impacts, such as dust generated by clearing and grading activities, exhaust emissions from gas- and diesel-powered construction equipment, and vehicular emissions associated with the commuting of construction workers. Emissions from construction would be minimized to the extent practicable (for example, by watering dry roads), following BMPs.

First Energy Solutions generated electricity using coal (72.8 percent), oil (0.4 percent), natural gas (2.7 percent), nuclear (22.3 percent), and renewable energy sources (1.1 percent),

The information reported from the EPA's eGRID database for calendar year 2005 shows the fuel mix for the Chagrin Falls area as 72.8 percent coal, 2.7 percent natural gas, and 0.4 percent oil, which equals 75.9 percent fossil fuel use (EPA 2010a). Based on the wind turbine analysis prepared as part of the turbine siting process for the project area wind speeds and wind days were analyzed and it was determined that the turbine would supply 70 percent of the school's energy needs (1,366,305 kilowatt hours per year). Therefore, the project carbon reduction is calculated as follows:

> 75.9 percent fossil fuel use × 2.0562 pounds of carbon dioxide per kilowatt-hour × 1,336,305 kilowatt-hours per year = 2,085,512 pounds of carbon dioxide per year.

The proposed project would reduce Kenston's carbon footprint by reducing its reliance on fossil fuels.

3.2.2.11 Utilities and Energy

The school is well served by utility infrastructure, including electric power transmission and municipal potable water and sanitary sewer. No microwave communications exist in the area surrounding the project site.

The NTIA is responsible for managing the Federal spectrum and is involved in resolving technical telecommunications issues for the Federal government and private sector. This information aids in siting wind turbines, so they do not cause interference in radio, microwave, radar, and other frequencies, disrupting critical lines of communication. Upon submittal by a

wind project proponent, the NTIA provides project specific information to the members of the Administration's Interdepartment Radio Advisory Committee for review and comment on whether the proposed project could potentially interfere with Federal radio communication links.

Direct and Indirect Impacts

The electrical grid interconnect of the proposed project would be composed of the turbine's controller (contained within the turbine tower-based section), approximately 600 feet of buried 4-inch electrical conduits including the portions of the run embedded within the turbine tower foundation, a 690- to 12,480-volt transformer, an automatic disconnect switch, a UL1741-compliant monitoring and control device, and a fused disconnect within the school's existing switchgear. The system would also have a parallel run of 2-inch conduit for data transfer and control runs. The full system would meet all local, State, and Federal codes and regulations.

The proposed project would have a nameplate capacity of 750 kilowatts and generate approximately 1,336,305 kilowatt-hours per year on average, or enough electricity to supply up to 127 homes each year (DOE 2010). The wind energy generated from the proposed project would meet approximately 70 percent of the school's annual electricity needs. The proposed project is anticipated to produce a total of 26,726,100 kilowatt-hours of clean electricity for the 20-year design life of the project.

The proposed project would not result in any adverse energy impacts. Approximately 70 percent of electricity used by the school would be supplied by the proposed project and not by the burning of fossil fuels. This would reduce carbon emissions by 2,085,512 pounds of carbon dioxide per year and allow Kenston to meet its objective to reduce its carbon footprint.

On October 18, 2010, DOE received a letter from NTIA indicating that no Federal agencies identified any concerns regarding the blockage of their radio frequency transmissions (Appendix C, Attachment C9). No microwave communications exist in the areas surrounding the project site.

3.3 Irreversible and Irretrievable Commitment of Resources

A commitment of resources is irreversible when its primary or secondary impacts limit the future options for a resource or limit those factors that are renewable only over long periods of time. Examples of nonrenewable resources are minerals, including petroleum. An irretrievable commitment of resources refers to the use or consumption of a resource that is neither renewable nor recoverable for use by future generations. Examples of irretrievable resources are the loss of a recreational use of an area. While an action may result in the loss of a resource that is irretrievable, the action may be reversible. Irreversible and irretrievable commitments of resources are primarily related to construction activities.

For the proposed project, resources consumed during construction of the project, including labor, fossil fuels and construction materials, would be committed for the life of the project. Nonrenewable fossil fuels would be irretrievably lost through the use of gasoline- and diesel-powered construction equipment during construction. Approximately 256 square feet of land would be irreversibly committed during the functional life of the project. The expenditure of ARRA funding from DOE would also be irreversible.

3.4 Unavoidable Adverse Impacts

Unavoidable adverse impacts associated with the proposed project include:

- Long-term loss of approximately 256 square feet of vegetation resulting from the construction of the tower foundation;
- A minimal increase in noise levels during construction and operation;
- Introduction of an additional vertical element into the existing viewshed;
- Minimal shadow flicker impacts for the stadium and tennis courts; and
- A risk of tower collapse within 332 feet of the turbine tower.

These impacts are both temporary, in the case of the construction noise, and long-term, in regard to the loss of vegetation, visual and shadow flicker impacts, and the risk of tower collapse. Overall, impacts of the proposed project on the environment and human health would be minimal.

3.5 The Relationship Between Local Short-Term Uses of the Human Environment and the Maintenance and Enhancement of Long-Term Productivity

Short-term use of the environment, as the term is used in this document, is that used during the life of the project, whereas long-term productivity refers to the period of time after the project has been decommissioned, the equipment removed, and the land reclaimed and stabilized. The short-term use of the project area for the proposed project would not affect the long-term productivity of the area. If it is decided at some time in the future that the project has reached its useful life, the turbine, tower, and foundation could be decommissioned and the site reclaimed and revegetated to resemble the pre-disturbance conditions (mowed grass). The installation of a wind turbine at this site would not preclude using the land for purposes that were suitable prior to this project.

4. CUMULATIVE IMPACTS

Cumulative impacts are those potential environmental impacts that result "from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions". Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

4.1 Reasonably Foreseeable Projects

DOE considered other proposed wind turbine projects for which ARRA grants have been sought in Ohio, as well as the proposed 20-megawatt offshore wind turbine project in Lake Erie anticipated to begin construction in 2012, in connection with this project with respect to potential cumulative impacts. According to the Ohio Siting Board (http://www.opsb.ohio.gov/Opsb/), there are three other proposed wind turbine projects in Ohio, all located from 130 to 210 miles from the project site. The following is a list of ARRA SEP-awarded project. Specific locations are shown in Appendix A, Figure 10. NEPA documentation related to these projects is available on the DOE Golden Field Office Reading Room Website at http://www.eere.energy.gov/golden/Reading_Room.aspx.

Green City Growers Wind Development – DOE/EA-1817
(Notice of Scoping issued August 2010)
1.5-megawatt wind turbine
Inner City of Cleveland Greenhouse 55th St. and Woodland Ave, Cleveland, Ohio 44104

Archbold Area Schools Wind Energy Project – DOE/EA-1820
(Draft EA issued January 2011)
500-kilowatt wind turbine
600 Lafayette Street, Archbold, Ohio 43502

Pettisville Local Schools Wind Energy Project – DOE/EA-1818
(Draft EA to be issued February 2011)
500-kilowatt wind turbine
232 Summit Street, Pettisville, Ohio 43553

Toledo Joint Apprenticeship and Training Committee – Categorical Exclusion
(Issued February 2010)
100-kilowatt wind turbine
803 Lime City Road, Rossford, Ohio, 43460

Lincoln Electric – DOE/EA-1777
(Final EA and FONSI issued August 2010)
2.5-megawatt wind turbine
22800 St. Clair Ave, Euclid, OH

Cuyahoga County Agriculture Society – DOE/EA-1815
(Draft EA issued November 2010)
600-kilowatt wind turbine
Cuyahoga County Fairgrounds, 164 Eastland Road, Berea, Ohio 44017

City of Toledo – EA
(Project is in early design phase)
1- megawatt Wind Turbine at Collins Park Wastewater Treatment Facility
Toledo, Ohio

Each of the DOE-funded projects includes the construction and operation of a single turbine. None is located in Geauga County. The closest, the Lincoln Electric project in Cuyahoga County, is over 17 miles west of the Kenston site in a highly urbanized area that was determined to not provide habitat for Indiana bats. Further, these projects are not likely to share a known migration pathway for birds. The Cuyahoga County Agricultural Society wind turbine project is approximately 40 miles southwest of the project site and the Archbold and Pettisville wind turbine projects are over 160 miles west of the site. The Toledo Joint Apprenticeship and Training Committee and City of Toledo projects are over 100 miles west of the project site. Cuyahoga County, Lincoln Electric and the Lake Erie wind turbine projects are the nearest projects to the Kenston site, and these were reviewed for potential cumulative impacts to biological resources. The proposed offshore wind farm on Lake Erie is approximately 35 miles from the Kenston site and will be installed approximately 5 miles offshore and these projects do not likely share a migratory pathway for birds. The nearest non-prioritized[5], suspected Indiana bat hibernacula lies approximately 8 miles southwest of Kenston and 7 miles east-northeast of the Cuyahoga County Wind Turbine Project, near the city of Twinsburg, Ohio. The USFWS determined that the proposed project and the Cuyahoga County project were not likely to adversely affect the Indiana bat; however, these sites are within the overall range of migrating Indiana bats. Although impacts to migrating Indiana bats as a result of the proposed project are thought to be very unlikely, the proposed project might add to the overall small potential cumulative impact to migrating Indiana bats. The addition of the proposed project to potential cumulative impacts to migratory birds is considered very low.

4.2 Summary of Cumulative Impacts

4.2.1 GREENHOUSE GAS IMPACTS AND CLIMATE CHANGE

While the scientific understanding of climate change continues to evolve, the Intergovernmental Panel on Climate Change Fourth Assessment Report has stated that warming of the earth's climate is unequivocal, and that warming is very likely attributable to increases in atmospheric greenhouse gases caused by human activities (anthropogenic) (IPCC 2007). The Panel's Fourth Assessment Report indicates that changes in many physical and biological systems, such as increases in global temperatures, more-frequent heat waves, rising sea levels, coastal flooding,

5. *The Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision* (USFWS 2007) prioritizes hibernacula based on field surveys to determine the number of Indian bats utilizing the hibernacula. The suspected hibernacula located near Twinsburg, Ohio, has not been prioritized because it is not feasible to conduct a survey of the suspected cave due to inaccessibility.

loss of wildlife habitat, spread of infectious disease, and other potential environmental impacts are linked to changes in the climate system, and that some changes may be irreversible (IPCC 2007).

The proposed project would not have direct greenhouse gas emissions but would result in some emissions of greenhouse gases associated with electricity from sources used to power the facility. The facility would consume 1,336,305 kilowatts of electricity per year, corresponding to 2,085,512 tons per year of carbon dioxide-equivalent emissions. There would also be small amounts of greenhouse gases emitted as a result of construction and transportation activities related to the facility.

The release of anthropogenic greenhouse gases and their potential contribution to global warming are inherently cumulative phenomena. Greenhouse gas emissions from the proposed facility are relatively small compared with the 8,026 million tons of carbon dioxide-equivalent greenhouse gases emitted in the United States in 2007 (DOE 2007) and the 54 billion tons of carbon dioxide-equivalent anthropogenic greenhouse gases emitted globally in 2004 (IPCC 2007). However, emissions from the proposed project in combination with past and future emissions from all other sources would contribute incrementally to the climate change impacts described above. At present, there is no methodology that would allow DOE to estimate the specific impacts (if any) this increment of climate change would produce in the vicinity of the facility or elsewhere.

4.2.2 VISUAL RESOURCES

None of the projects listed in Section 4.1 would present significant cumulative impacts on visual resources. Because of the small scale of each DOE-funded individual project and the distance between the proposed project and those projects, no cumulative visual impacts from these projects are anticipated. Additionally, there would be limited visibility of the offshore wind farm from any upland vantage point due to its distance from the shoreline. Further, the wind farm is over 30 miles from the proposed project, which precludes cumulative visual impacts. The closest communications tower is approximately 155 feet tall and already located on Kenston property. The addition of the proposed wind turbine would provide an additional vertical structure within the viewshed. Overall, the only cumulative impact on the viewshed would be from the addition of the wind turbine at the school property, but this would be a small cumulative impact on visual resources.

4.2.3 BIOLOGICAL RESOURCES

All of the DOE-funded wind turbine projects are reasonably foreseeable single wind turbine projects and have received a letter from the USFWS and ODNR indicating that the Indiana bat is not at risk as a result of the turbines individually (with the exception of the City of Toledo project which is still in early design phase and the Toledo Joint Apprenticeship which was issued a categorical exclusion). ODOW and USFWS would require all of the above-referenced wind projects to consider or have considered the recommendations contained in the *Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines* (USFWS 2003) as part of their siting, design, and installation, thereby reducing potential impacts to migratory birds and other species. The closest wind projects (Cuyahoga County, Green City Growers, and Lincoln

Electric) do not share a known migratory bird pathway with the proposed project, and the areas between these projects consist mainly of developed and suburban land, with scattered wooded areas and agricultural fields. The potential for cumulative impacts on migratory birds is minimal. The installation of single wind turbines in this part of eastern Ohio would negligibly increase a potentially low cumulative impact on migrating Indiana bats.

Because of the small scale of each individual DOE-funded project and the sufficient distance between projects, DOE concluded that there are no reasonably foreseeable potential cumulative impacts.

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